杰美康机电
JUST MOTION CONTROL

JMC R&RC Series Drive Manual

VERSION 1.28

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Preface

This manual mainly theme is R& RC product:

JMC R-series drivers are slave drivers based on hardware with RS485 communication circuit, software with Modbus-RTU protocol and CIA402 motion control protocol. Modbus protocol is a bus protocol designed by MODICON company, permitting one master share data with one or multi-slave, motion controller use master & salve technology, i.e. master can activate data transmission & query, while other devices (slave) feedback those queries, or process the required action. Master includes master-slave processor or PLC. Slave includes servo drivers and stepper drivers.

JMC RC-series bus-based driver is based on hardware with CAN communication circuit, software with CANopen protocol, simultaneously, compatible with Modbus-RTU protocol based on RS485 and CIA402 motion control protocol. CANopen is an upper communication agreement structured by controller area network, including communication sub-agreement and device sub-agreement usually used in embedded device; it's a popular field bus in motion control industry. CANopen define communication object (e.g. SDO, PDO, NMT and etc.) to configurate and monitor the slave drivers, to realize the communication between master and slave. Application layer adopts CIA402 servo motion control protocol, by this way the compatibility between different products enhanced greatly, finally we can build automation network by configuration among different CAN slave devices.

This manual is divided into five parts: Hardware, Communication, Motion Control, Example and Appendix. Hardware section introduce each product hardware performance and operation, to facilitate users to understand our products; The Communication section will introduce CANopen and Modbus protocols in detail to help users understand these protocols and make better to use our products. The Control Motion section introduces the basic operation of position mode, velocity mode and homing mode in detail, so as to help users quickly get familiar with the operation of our products. Example section has some CANopen and Modbus communication programming examples, to give the user a reference object; the final Appendix section is the communication demos of some mainstream brands of controllers, and users can refer to these demos for use.

Revision history

date	Pre-change version number	Version number after change	change contents	redactor
2019-03-22	V1.0	V1.0	first edition	Stepper Servo Bus Division
2019-10-21	V1.0	V1.1	● Corrected description of power supply for " 2HSS458-R/RC Power Signal Port" ● Removed P21 "Power On Display" from IHSS Series Drive Parameters ● Corrected the description of 0x100C and 0x100D in "CA Stepper Servo Bus Division Nopen Communication Protocol" in the communication section ● Corrected description of error register 0x1001 ● Fixed RS232 communication interface description ● Add servo driver JASD-R/RC series	Stepper Servo Bus Division
2019-11-05	V1.1	V1.1 2	● Amendment 2HSS458-R/RC "Power Signal Port" Description ● Update cover and version number	Stepper Servo Bus Division
2019-11-11	V1.12	V1.1 4	● "Hardware"--"Communication interface and wiring"--"RS485/CAN bus RJ45 communication interface definition" add crystal head diagram ● Add the wiring instructions for the corresponding controller and JameCon drive to each routine in the Appendix	Stepper Servo Bus Division
2019-12-21	V1.14	V1.15	● Description of modified driver parameter P20	Stepper Servo Bus Division
2020-03-26	V1.15	V1.2	● Added IHSV, MCAC series drives ● Modified servo P00-24 description	Stepper Servo Bus Division
2020-06-08	V1.2	V1.21	● Amendment 2HSS458 Control Signal Port	Stepper Servo Bus Division
2020-06-24	V1.21	V1.24	● Added torque routine	Stepper Servo Bus

				Division
202 1-0 1- 01	V1.2 4	V1.2 5	● Modify 1800 Subindex Definition	Stepper Servo Bus Division
202 1-0 3- 04	V1.2 5	V1.2 6	● Delete MCAC830/850-R/RC catalog ● New MCAC610/825/845/8A0-R/RC Description	Stepper Servo Bus Division
202 3- 4- 10	V1.26	V1.27	● Fixed known error descriptions ● Added iHSS(V)42-R/RC Series Product Description	Stepper Servo Bus Division

Selection list

DM-R/RC Bus Digital Stepper Driver

model	communication	supply voltage	output current	digital quantity signal	adaptive motor
2DM52 2-R	RS485	24~48VDC	0~2.2A	Digital input: Current: 6~16mA Voltage: 12~24VDC Digital output: Current: 0~50mA Voltage: 5~24VDC	28/35/42 frame
2DM52 2-RC	RS485+CAN				
2DM556-R	RS485	24-48VDC	0~5.6A		57/60 frame
2DM556-RC	RS485+CAN				
2DM880-R	RS485	24~8 0VAC 24~110VDC	0~8.0A		86 stands
2DM880-RC	RS485+CAN				

HCS-R/RC bus hybrid stepping servo driver

model	communication	supply voltage	output current	digital quantity signal	adaptive motor
2HC S528-R	RS485	24~48VDC	0~2.8A	Digital input: Current: 6~16mA Voltage: 5~24VDC Digital output: Current: 0~50mA Voltage: 5~24VDC	28/35/42 frame
2HC S522-RC	RS485+CAN				
2HC S558-R	RS485		0~5.8A		57/60 frame
2HC S558-RC	RS485+CAN				
2HC S86 8-R	RS485	24~110VDC 24~ 80VAC	0~6.8A		60/86 frame
2HC S86 8-RC	RS485+CAN				
3HC S2208-R	RS485	220VAC	0~8.0A		86/110/130 frame
3HC S2208-RC	RS485+CAN				
Note: If you need 28/35 base closed-loop motor driver, you can contact us to order.					

IHSS-R/RC Integrated Hybrid Stepping Servo Motor

model	communication	static moment	supply voltage	digital quantity signal	adaptive motor
IHSS42-24-07-R	RS485	0.7N·M	Typical value: 24VDC	Digital input: Current: 6~16mA Voltage: 5~24VDC Digital output: Current: 0~50mA Voltage: 5~24VDC	42
IHSS42-24-07-RC	RS485+CAN				
IHSS57-36-20-R	RS485	2N·M	24~48VDC Typical: 36VDC		57
IHSS57-36-20-RC	RS485+CAN				
IHSS60-36-30-R	RS485	3N·M	24~48VDC Typical: 36VDC		60
IHSS60-36-30-RC	RS485+CAN				
IHSS86-60-45-R	RS485	4.5N·M	24~80VDC Typical: 60VDC		86
IHSS86-60-45-RC	RS485+CAN				
IHSS86-80-85-R	RS485	8.5N·M			
IHSS86-80-85-RC	RS485+CAN				
Note: If you need 28/35 base closed-loop motor driver, you can contact us to order.					

MCAC-R/RC AC Servo Bus Driver Series

model	communication	supply voltage	output current	digital quantity signal	adaptive motor
MCAC610-R	RS485	24~60VDC	10A	Digital input: Current: 6~16mA Voltage: 12~24VDC Digital output: Current: 0~50mA Voltage: 5~24VDC	40/57/60 machine base
MCAC610-RC	RS485+CAN				
MCAC808-R	RS485	24~80VDC	8A		40/57/60 machine base
MCAC808-RC	RS485+CAN				
MCAC825-R	RS485	24~80VDC	25A		57/60 machine base
MCAC825-RC	RS485+CAN				
MCAC845-R	RS485	24~80VDC	45A		80 machine base
MCAC845-RC	RS485+CAN				

IHSV-R/RC integrated bus AC servo motor					
model	communication	supply voltage	digital quantity signal	rated torque	machine base
IHSV42-40-05-24-R	RS485	Typical value: 24VDC	Digital input: Current: 6~16mA Voltage: 5~24VDC Digital output: Current: 0~50mA Voltage: 5~24VDC	0.16N*M	42
IHSV42-40-05-24-RC	RS485+CAN				
IHSV42-40-07-24-R	RS485			0.23N*M	
IHSV42-40-07-24-RC	RS485+CAN				
IHSV57-30-14-36-R	RS485	24~48VDC Typical value: 36VDC		0.44N*M	57
IHSV57-30-14-36-RC	RS485+CAN				
IHSV57-30-18-36-R	RS485			0.6N*M	
IHSV57-30-18-36-RC	RS485+CAN				
IHSV60-30-20-48-R	RS485	36~80VDC Typical value: 48VDC		0.64N*M	60
IHSV60-30-20-48-RC	RS485+CAN				
IHSV60-30-40-48-R	RS485			1.27N*M	
IHSV60-30-40-48-RC	RS485+CAN				
IHSV86-30-44-72-R	RS485	48~100VDC Typical value: 72VDC		1.4N*M	86
IHSV86-30-44-72-RC	RS485+CAN				
IHSV86-30-66-72-R	RS485			2.1N*M	
IHSV86-30-66-72-RC	RS485+CAN				

JASD/JAND-R/RC Bus High Voltage Servo Driver					
model	communication	supply voltage	output current	digital quantity signal	adaptive motor
JAND2002-20B-R	RS485	220VAC	2.1A	Digital input: Current: 6~16mA Voltage: 5~24VDC	40/60 stand
JAND2002-20B-RC	RS485+CAN				
JAND4 002-20B-R	RS485		2.8A		60 stands

JAND4 002-20B-RC	RS485+CAN			Digital output: Current: 0~50mA Voltage: 5~24VDC	
JAND7502-20B-R	RS485		5.5A		60/80 frame
JAND7502-20B-RC	RS485+CAN				
JASD15002- 20B-R	RS485		8.0A		80/110/130 frame
JASD15002-20B-RC	RS485+CAN				
JASD20002- 20B-R	RS485		14A		130 stands
JASD20002-20B-RC	RS485+CAN				
JASD30002- 20B-R	RS485		20A		130 stands
JASD30002-20B-RC	RS485+CAN				

CATALOG

Hardware

DM-R/RC Bus-based Digital Stepper Drive

➢ Product Introductions

The Series of products DM-R/RC are using CANopen and Modbus-RTU protocol, bus-based digital stepper drive which adopt advanced digital stepper motor algorithm, RS485 bus and CAN bus communication control technology.

These drives integrate CiA301standard (CANopen communication protocol), Modbus-RTU communication protocol and CiA402motion control protocol, compared with the traditional stepper drive with lower cost and more convenient installation, but also can effectively restrain the motor temperature rise, significantly to reduce the vibration of the motor and the wiring complexity of equipment.

The drive is compatible with the traditional stepping motor, convenient for customers to upgrade.These series integrate bus communication control technology, simple wiring, no losing step, lower heat, high speed, big torque, low cost.It is a cost-effective motion control product.

➢ Technical Feature

- ✧ Support standard CiA301 CANopen protocol, a maximum of 128 slaves are allowed to connect
- ✧ Support standard Modbus-RTUprotocol which can switch with CANopen protocol
- ✧ Support standard CiA402 motion control protocol
- ✧ Three control modes with Position Mode, Velocity Mode and Homing Mode
- ✧ Built-in CW, CCW, SW IO input signal with 5V or 24V for the limit switch and homing
- ✧ A BREAK and PEND signal output signal
- ✧ RJ45 standard network connection, the slave through the twisted pair cable can be connected
- ✧ The maximum transmission frequency is 1Mbps, and the maximum transmission distance is up to 1KM
- ✧ Little vibration and smooth running at low speed
- ✧ Built-in acceleration and deceleration control to improve startand stop state smoothness
- ✧ User-defined subdivisions
- ✧ No adjustment in general application
- ✧ Loss phase protection, over current protection, over voltage protection

➢ 2DM522-R/RC

1 Electrical, Mechanical and Environmental Specifications

Table 1 Performance of JMC 2DM522-R/RC Drive

<table>
<tr><td colspan="2">Input voltage</td><td>24~48VDC</td></tr>
<tr><td colspan="2">Continuous Current output</td><td>2.2A</td></tr>
<tr><td colspan="2">Communication Type</td><td>CANopen /Modbus-RTU</td></tr>
<tr><td colspan="2">Communication Distance</td><td>1KM</td></tr>
<tr><td colspan="2">Maximum Number of Slaves</td><td>128/32</td></tr>
<tr><td colspan="2">Maximum Communication rate</td><td>1000Kbps/115200bps</td></tr>
<tr><td colspan="2">Logic Input Current</td><td>7~20mA (Typical value 10mA)</td></tr>
<tr><td colspan="2" rowspan="2">Protect</td><td>The peak of over current action value is 10A±10%</td></tr>
<tr><td>Over voltage action value is 60VDC</td></tr>
<tr><td colspan="2">Shape Size(mm)</td><td>118×75.5×34</td></tr>
<tr><td colspan="2">Weight</td><td>Approximately 260g</td></tr>
<tr><td rowspan="5">Environmental Conditions</td><td>Working Occasion</td><td>Avoid dust, oil mist and corrosive gas as far as possible</td></tr>
<tr><td>Working Temperature</td><td>0~40℃</td></tr>
<tr><td>Storage Temperature</td><td>-20℃~+40℃</td></tr>
<tr><td>Working Humidity</td><td>40~90%RH</td></tr>
<tr><td>Cooling mode</td><td>Natural cooling or forced cold wind</td></tr>
</table>

2 Machine Dimension Diagrams

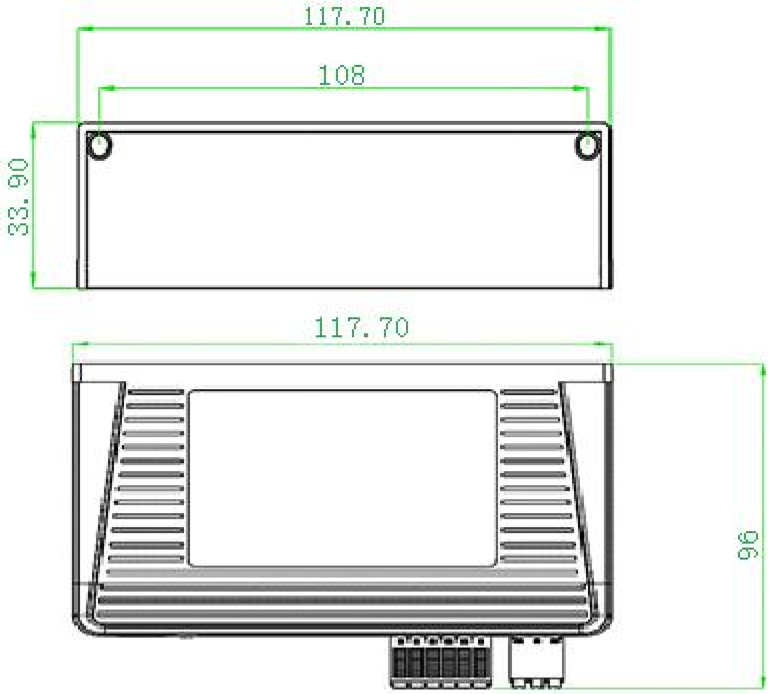


Figure 1 Machine dimension of JMC 2DM522-R/RC Drive (unit: mm)

Notice: Please take the terminal size and ventilation cooling while design the installation size.

- ✧ Drive's reliable working temperature should be <60℃, and motor working temperature should be <90℃;
- ✧ It is recommended to mount the drive vertically to maximize heat sink area. Use forced cooling method to cool the system if necessary.

3 Ports and Connections Introduction

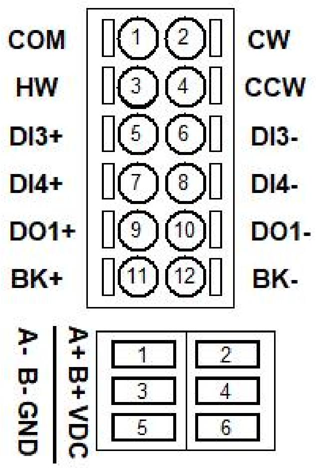


Figure 2 Cable-entry of JMC 2DM522-R/RC Drive

PS: About Communication port, please refer to "*Communication Interface and Wiring*" (Ctrl+ Mouse left or Click text to jump).

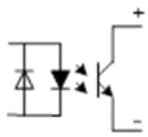
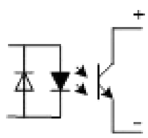
3.1 Power Interface Port

Table 2 Power Interface port of JMC 2DM522-R/RC Drive

Port	Symbol	Definition	Remark
1	A-	Motor phase A-	Motor Phase A
2	A+	Motor phase A+	
3	B-	Motor phase B-	Motor Phase B
4	B+	Motor phase B+	
5	GND	DC power -	24~48VDC
6	DC+	DC power +	
Notice: The JMC motor wiring colors of motor are red (A+), blue (A-), green (B+), and black (B-) generally. Users can connect the port of JMC drive according to this color.If the color is inconsistent with the definition of motor wiring, please call JMC technical service staff.			

3.2 Control Signal Port

Table 3 Control Signal Port of JMC 2DM522-R/RC Drive

Port	Symbol	Definition	Remark
1	COM	Common (cathode/anode)	0V or 24VDC
2	CW	Clockwise Limit	Input 12~24VDC (Compatible with 5V, but not recommended)
3	HW	Home Limit	
4	CCW	Counter Clockwise Limit	
5	Reserve	Reserve	Reserve
6	Reserve	Reserve	
7	Reserve	Reserve	Reserve
8	Reserve	Reserve	
9	DO1+ /ALM+	Position/Alarm signal output +	 The bidirectional optical coupling. Compatible with12~24VDC
10	DO1- /ALM-	Position/Alarm signal output -	
11	BRK+	Brake signal output +	 The bidirectional optical coupling. Compatiblewith 12~24VDC
12	BRK-	Brake signal output -	

3.3 Connections to Control Signal

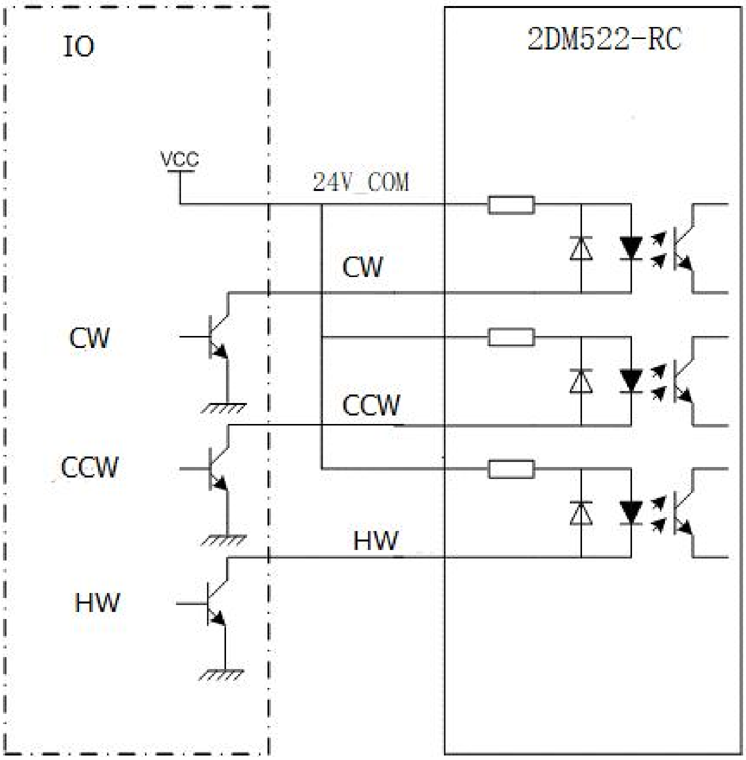


Figure 3 Connections to common anode

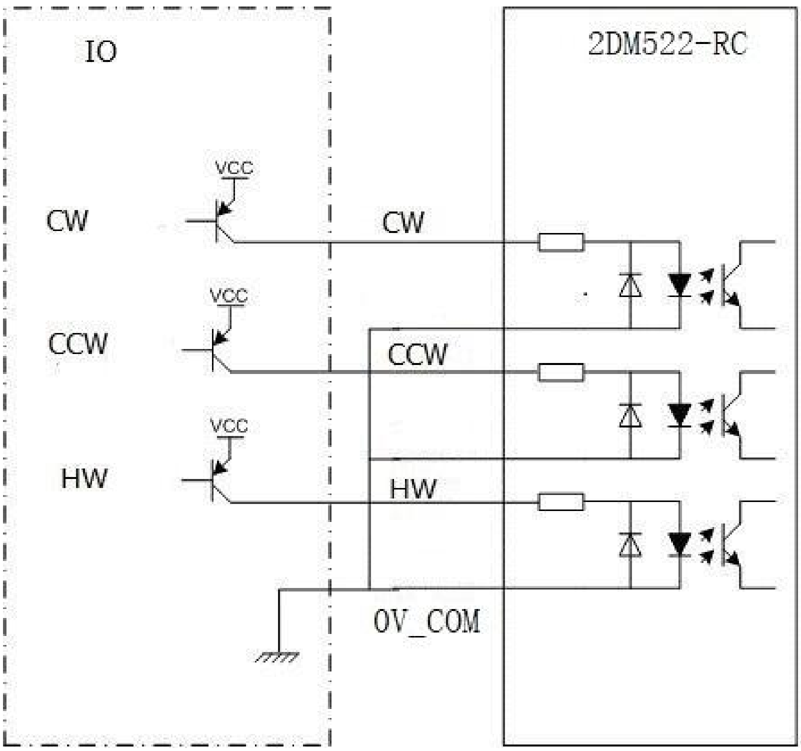


Figure 4 Connections to common cathode

Notice: The control signal can be compatible with 5V and 24V.

4 Typical application wiring diagrams

A typical connection diagram made up of the 2DM522-R/RC drive as follow. The power supply selects DC24~48V according to the voltage level of the matched motor.

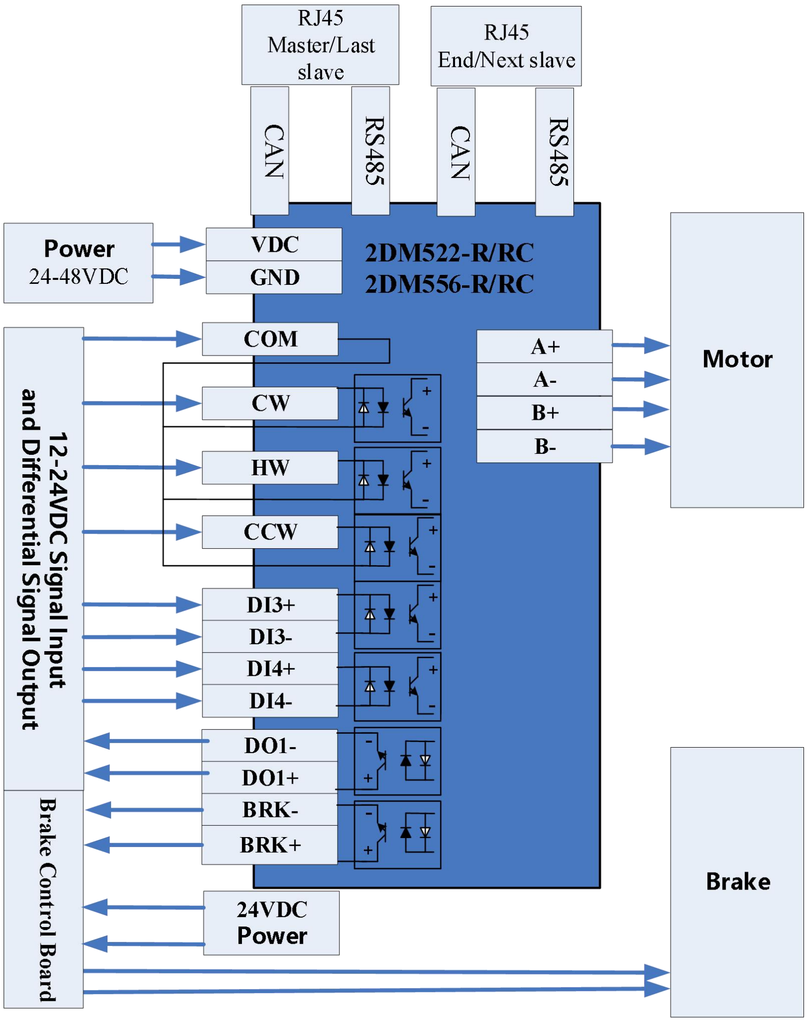


Figure 5 Typical application wiring diagram of JMC 2DM522-R/RC Drive

Notice:

- ✧ BREAK signal to control motor brake, it needs external relay, the maximum current is 50mA.
- ✧ RJ45 network interface through the standard twisted pair cable connected to the other slave, no special difference between the two network ports.

5 Parameters Configure of Drive

There two methods to configure parameters of 2DM522-R/RC. One is set the parameters through the front panel; the other way is to connect it with the HISU. A set of the best default configure parameters has already set in the drive. User need only to configure the parameter Pulses/revolution. The detail functions are as follows:

Actual value = Set value ×the corresponding dimension

Table 4 Internal parameter of JMC 2DM522-R/RC Drive

Parm	Definition	Range	Dimension	Restart Drive	Default Value
P1	Current loop Kp	0—4000	1	No	1000
P2	Current loop Ki	0—1000	1	No	100

P3	Damping coefficient	0—500	1	No	250
P4	Position loop Kp	0—3000	1	No	2000
P5	Position loop Ki	0—1000	1	No	200
P6	Speed loop Kp	0—3000	1	No	500
P7	Speed loop Ki	0—1000	1	No	1000
P8	Open-loop current	0—60	0.1	No	40
P9	Manufacturer	Reserve	Reserve	Reserve	Reserve
P10	Manufacturer	Reserve	Reserve	Reserve	Reserve
P11	Direction level	0—1	1	No	1
P12	Manufacturer	Reserve	Reserve	Reserve	Reserve
P13	Manufacturer	Reserve	Reserve	Reserve	Reserve
P14	Arrival level	0—1	1	No	0
P15	Manufacturer	Reserve	Reserve	Reserve	Reserve
P16	Manufacturer	Reserve	Reserve	Reserve	Reserve
P17	Pulses/Revolution	0—15	1	Yes	2
P18	Manufacturer	Reserve	Reserve	Reserve	Reserve
P19	Speed smoothness	0—10	0	No	2
P20	User-defined p/r	4—1000	50	Yes	8
P21	Display information	0—4	1	No	0
P22	Pulse filter	0—3	1	No	0
P23	Lock shaft	0—1	1	No	0
P24	Manufacturer	Reserve	Reserve	Reserve	Reserve
P25	Overlay proportion	0—40	1	No	10
P26	Stop damping	0—500	1	No	200
P27	Low-speed damping	0—500	1	No	50
P28	Manufacturer	Reserve	Reserve	Reserve	Reserve
P29	Manufacturer	Reserve	Reserve	Reserve	Reserve
P30	Lost phase	0—1	1	Yes	1
P31	Manufacturer	Reserve	Reserve	Reserve	Reserve
P32	Manufacturer	Reserve	Reserve	Reserve	Reserve
P33	Manufacturer	Reserve	Reserve	Reserve	Reserve
P34	Manufacturer	Reserve	Reserve	Reserve	Reserve
P35	Manufacturer	Reserve	Reserve	Reserve	Reserve
P36	Semi-flow time	0—60000	MS	No	500
P37	Semi-flow percent	0—100	1%	No	50
P38	Manufacturer	Reserve	Reserve	Reserve	Reserve
P39	Manufacturer	Reserve	Reserve	Reserve	Reserve
P40	Slave ID	1—128	1	Yes	0
P41	Slave baud rate	0—7	1	Yes	0
P42	IO signal polarity	0—1	1	Yes	1
P43	Communication mode	0—1	1	Yes	1
P44	Limit signal upload	0—1	1	No	0
P45	Target speed unit	0—1	1	No	0

Those parameters can be set by using Button Panel, can also be set by using HISU adjuster. The detail descriptions to every parameter configuration are as follows:

- ✧ **P1~7**are used to change parameters of current loop, damping, position loop and speed loop.
- ✧ **P8**, this parameter affects the static torque of the motor.
- ✧ **P10** is set to control the Alarm optocoupler. Output transistor 0 means the transistor is cut off when the system is in normal working, but when it comes to fault of the drive, the transistor becomes conductive. 1 means opposite to 0.
- ✧ **P11** is used to control direction level. By this parameter, drive's default orientation can be changed.
- ✧ **P14** is set to control the Arrival optocoupler output transistor. 0 means the transistor is cut off when the drive satisfies the arrival command, but when it comes to not, the transistor becomes conductive. 1 means opposite to 0.
- ✧ **P17** is used to select pulses.It shall restart.

Table 5 P17 of JMC 2DM522-R/RC: Pulses/Revolution

Parameter	0	1	2	3	4	5	6	7
Pulses	user-def	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
Pulses	1000	2000	4000	5000	8000	10000	20000	40000

Notice: In addition, the drive provides users with pulses that they can set up freely via parameter 20.

- ✧ **P18** is used to select single pulse or double pulse. 1 means single pulse and direction, while 0 means double pulse.
- ✧ **P19**, Speed smoothness, this parameter is set to control the smoothness of the speed of the motor while acceleration or deceleration, the larger the value, the smoother the speed in acceleration or deceleration.

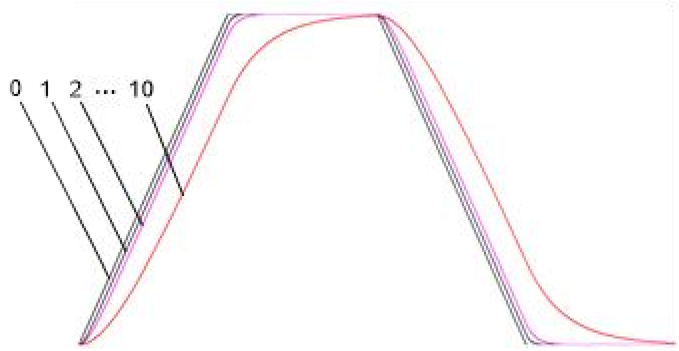


Figure 6 P19 of JMC 2DM522-R/RC Drive: Speed smoothness

- ✧ **P20** is used to set up user-defined pulses.It shall restart.
- ✧ **P21** is used to select display information.

Table 6 P21 of JMC 2DM522-R/RC Drive: Display information

Parameter	0	1	2	3	4
Display	Reference Velocity	Velocity Feedback	Position Error	Reference Position	Position Feedback

- ✧ **P22** is Pulse filter, setting 0~3. As the value increases, the frequency of the passing pulse decreases gradually. This is used to suppress the electronic interference generated in the environment.
- ✧ **P23** is Stop lock enable. This parameter is set to the drive not count external pulses and lock shaft or not.1 means enable this function while 0 means disable it.
- ✧ **P30** is used to check whether the motor is out of phase.1 means used, while 0 means not used. But this is for manufacturer only.It shall restart.
- ✧ **P36** is used to set the time after motor stops about motor current. Its default value is 1000, which means

that motor had stopped after 1000ms.

- ✧ **P37** is used to set the Semi-flow percent to control motor current. Its unit is 1%, whose default value is 50.

  [STOP STATE] Motor current = Open-loop current (P8) × Semi-flow percent (P37)
- ✧ **P40** is used to set slaves' node identifier. It shall restart.
- ✧ **P41** is used to select baud rate of CAN or RS485.It shall restart so that can be working.

Table 7 P41 of JMC 2DM522-R/RC Drive: Baud rate

Baud Rate	0	1	2	3	4	5	6	7
CAN (Kbps)	12.5	20	50	100	200	250	500	1000
485 (bps)	1200	2400	4800	9600	19200	38400	57600	115200

- ✧ **P42** is used to select IO input signal polarity. P42=0: use PNP type limit switch; P42=1: use NPN type limit switch.It shall restart.
- ✧ **P43** is used to select communication mode. P43=0: select 485 communication, P43=1: select CANopen communication. It shall restart.
- ✧ **P44** is used to select whether limit signal upload to object 60FD. 1 means enabling this function while 0 means disabling it.
- ✧ **P45** is used to set unit of target speed. 1 means that unit is 0.1RPS. 0 means that unit is 1/Revolution.

6 Parameter Adjustment Methods

6.1 Button Panel

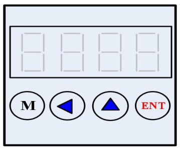


Figure 7 Button Panel of JMC 2DM522-R/RC Drive

The Button panel consists of 4 keys plus 4 LED displays. 2DM522-R/RC with LED indicating power supply and display status, panel operation as shown in the figure. Select the display mode through the key 'M' and monitor the running state of the motor through the '▲' and '◂' keys. The following table is the meaning for each monitoring code.

Table 8 Monitoring code of JMC 2DM522-R/RC Button Panel

Display	52rc	PA00	EXXX	PSΓP
Meaning	2DM522-R/RC	Parameter	Error	Reset

【1】Move Key

'◂': Shift;

'▲': Adjust parameter

【2】Function Key

'ENT': Enter or Ensure

'M': Switch mode or Cancel

Notice:Switch to parameter display function through 'M';Use 'ENT' key to view parameter value, press '▲' key switch function; Exit this function and go to the next function to press the 'M' key.

6.2 Button Panel Operation

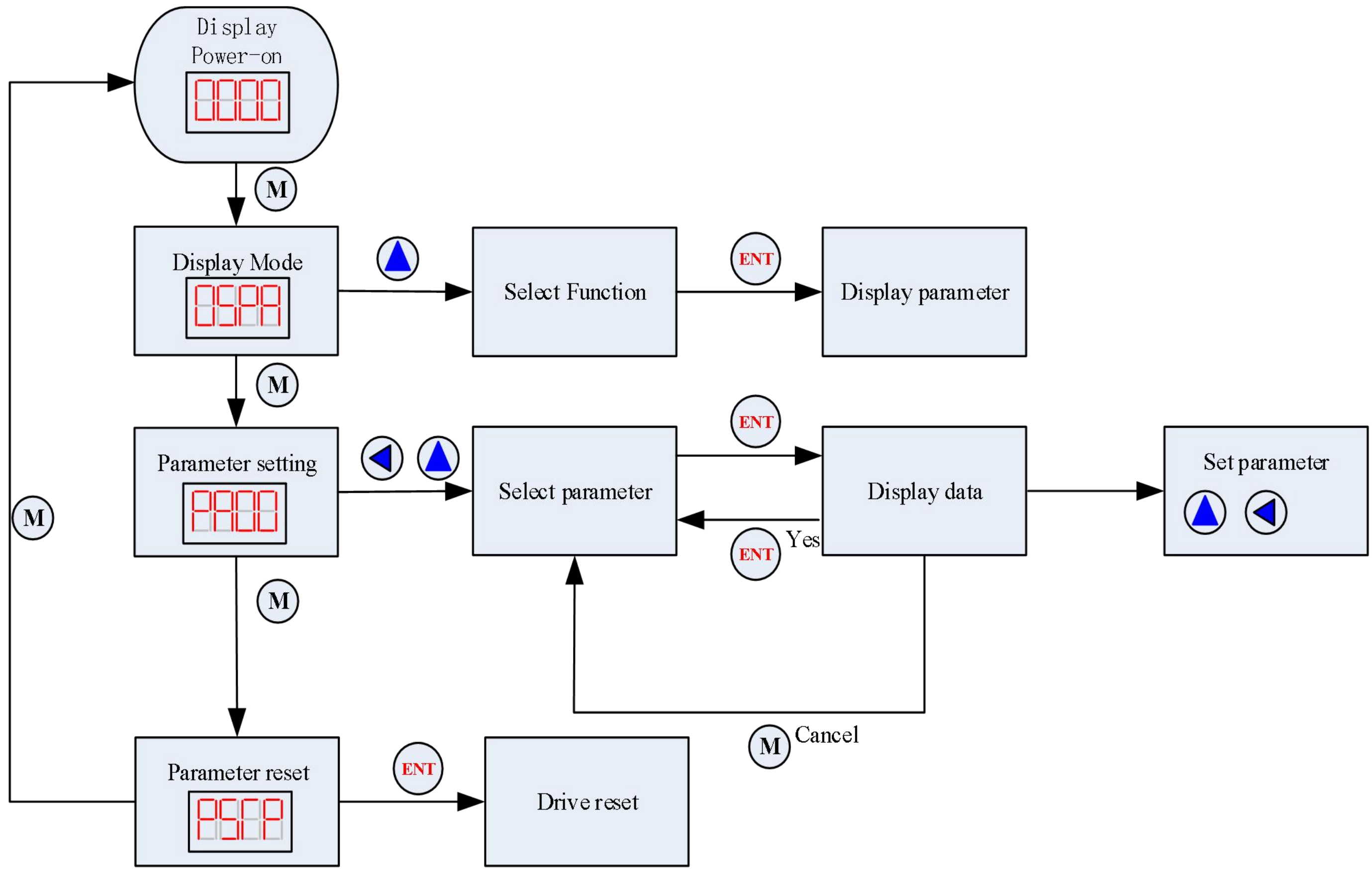


Figure 8 Operation of JMC 2DM522-R/RC Button Panel

6.3 Operation Example

1) Mode Configure Operation

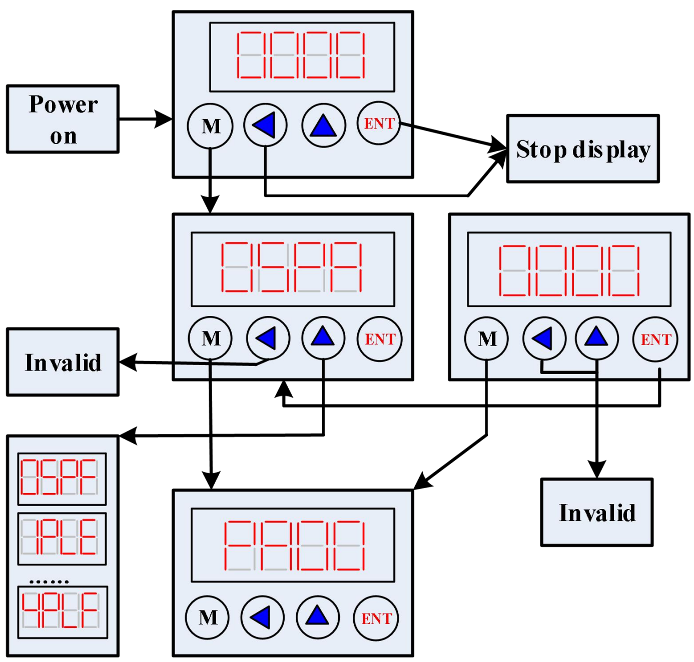


Figure 9 Mode Configure Operation of JMC 2DM522-R/RC Panel

2) **Parameter Configure Operation**

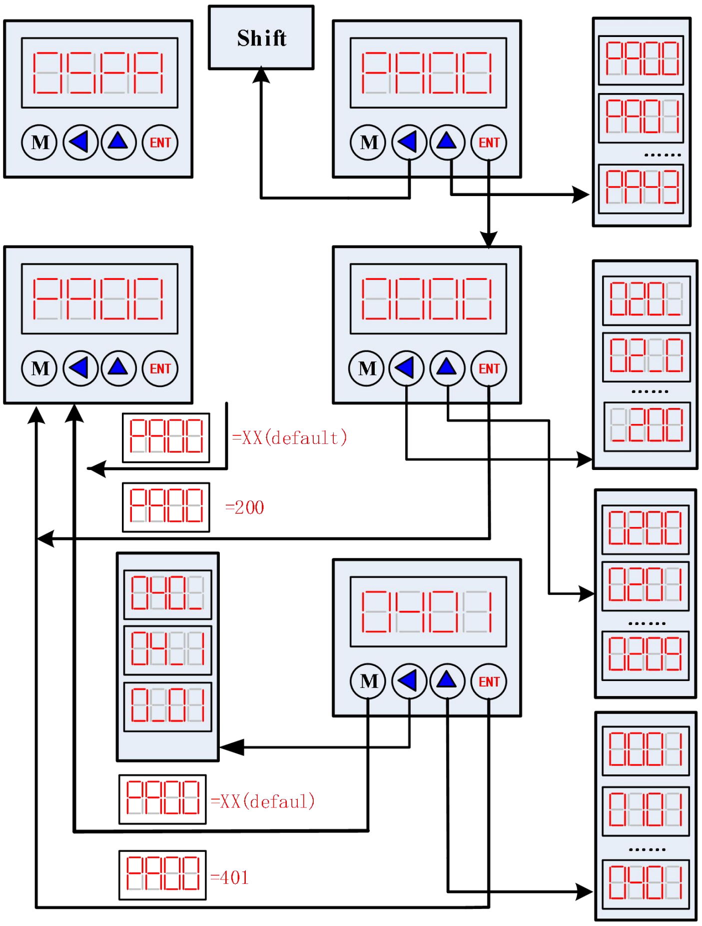


Figure 10 Parameter Configure Operation of JMC 2DM522-R/RC Panel

Notice: The default parameters of current loop, position loop and speed loop are almost the best, user no need to change them, but to configure the parameter Pulses/revolution and Open-loop/Close-loop current according to the necessity of the control system.

7 Failure Alarm

Table 9 Failure Alarm of JMC 2DM522-R/RC Drive

Display	Description	Can be Cleared
E101	Over current Error	NO
E102	Reference voltage Error	NO
E103	Parameter read\write Error	NO
E104	Over voltage Error	NO
E105	Loss phase Error	NO
E106	Over position error	YES
E107	Motor enable	YES

8 RS485 Communication Parameter Setting

When RS485 communication mode is used by the drive, communication parameters of the upper computer or other communication stations shall be set in advance. The default configuration parameters of the driver are as follows:

Table 10 RS485 Communication Parameter Setting of JMC 2DM522-R/RC Drive

Parameter	Baud Rate	Start	Data	Stop	Check
Value	0~115200bps	1Bit	8Bit	1Bit	None

9 Match Motor

Table 11 Match Motor of JMC 2DM522-R/RC Drive

Match Motor of JMC 2DM522-R/RC Drive								
Bedplate		Model	Step Angle (deg)	Static Moment (N • m)	Rated Current (A)	Phase Resistance (ohms)	Phase Inductance (mh)	Location Torque (g·cm)
Two-phase	28	28J1834-408	1.8	0.06	0.8	2.5	4.8	
		28J1845-410	1.8	0.095	1	2.2	14	
		28J1851-407	1.8	0.1	0.7	8.5	7.5	
		28J1851-410	1.8	0.12	1	1.45	1.1	
	35	35J1834-407	1.8	0.11	0.7	2.5	4.8	120
	39	39J1834-403	1.8	0.13	0.3	4	2.5	120
		39J1834-406	1.8	0.22	0.6	1.6	1.2	120
		39J1844-403	1.8	0.29	0.3	4	10	130
	42	42J1825-404	1.8	0.35	0.4	2.1	1.3	150
		42J1834-408	1.8	0.38	0.8	2.1	3.2	160
		42J1840-408	1.8	0.4	0.8	7.5	8.1	220
		42J1848-810	1.8	0.48	1	4.6	4	260
		42J1848-425	1.8	0.48	2.5	1.25	2.5	260
		42J1860-417	1.8	0.7	1.7	3	6.2	360

Table 12 Match Motor of JMC 2DM522-R/RC Drive (Continued table)

Match Motor of JMC 2DM522-R/RC Drive							
Bedplate		Model	Rotor Inertia (g-cm²)	Insulation Class	Leading wire	Weight (kg)	Length (mm)
Two-phase	28	28J1834-408	8	B	4	0.11	34
		28J1845-410	11	B	4	0.14	45
		28J1851-407	18	B	4	0.18	51
		28J1851-410	13	B	4	0.18	51
	35	35J1834-407	14	B	4	0.18	34
	39	39J1834-403	20	B	4	0.18	34
		39J1834-406	20	B	4	0.18	34
		39J1844-403	40	B	4	0.25	44
	42	42J1825-404	20	B	4	0.15	25
		42J1834-408	54	B	4	0.3	34
		42J1840-408	57	B	4	0.32	40
		42J1848-810	82	B	8	0.35	48

	42J1848-425	82	B	4	0.35	48
	42J1860-417	117	B	4	0.5	60

10 Quick Guides

10.1 Hardware Wiring

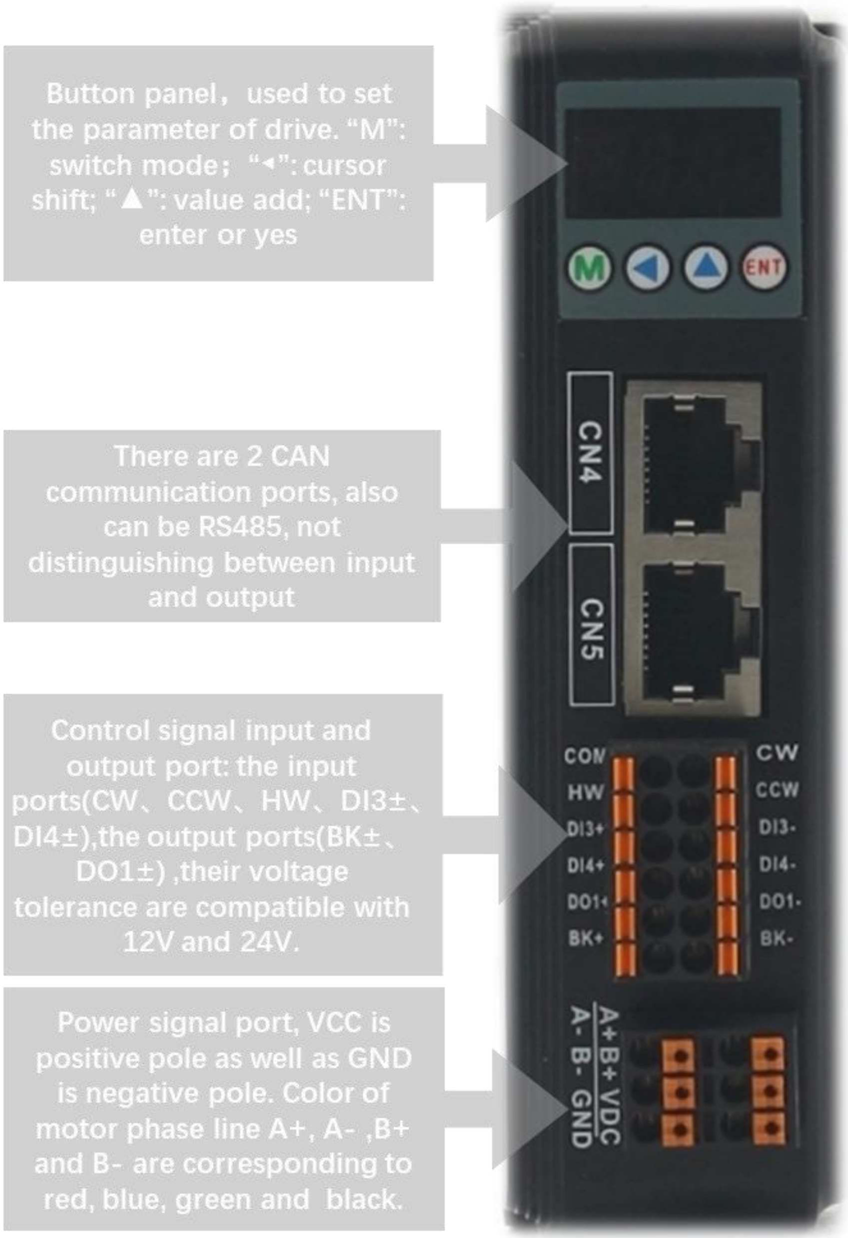


Figure 11 JMC 2DM522-R/RC Practicality

See “*Ports and Connections Introduction*” in this section for the specific definition of each port (Ctrl+ Mouse left or Click text to jump).

10.2 Parameter Setting

The use of the panel of 2DM522-R/RC is basically the same as 2DM556-R/RC. User can go to “*Setting P43 in JMC 2DM556-R/RC Button Panel*” (Ctrl+ Mouse left or Click text to jump) for viewing.

➢ 2DM556-R/RC

1 Electrical, Mechanical and Environmental Specifications

Table 13 Performance of JMC 2DM556-R/RC Drive

Input voltage		24~48VDC
Continuous Current output		6.0A
Communication Type		CANopen /Modbus-RTU
Communication Distance		1KM
Maximum Number of Slaves		128/32
Maximum Communication rate		1000Kbps/115200bps
Logic Input Current		7~20mA (Typical value 10mA)
Protect		The peak of over current action value is 10A±10%
		Over voltage action value is 60VDC
Shape Size(mm)		118×75.5×34
Weight		Approximately 260g
Environmental Conditions	Working Occasion	Avoid dust, oil mist and corrosive gas as far as possible
	Working Temperature	0~40℃
	Storage Temperature	-20℃~+40℃
	Working Humidity	40~90%RH
	Cooling mode	Natural cooling or forced cold wind

2 Machine Dimension Diagrams

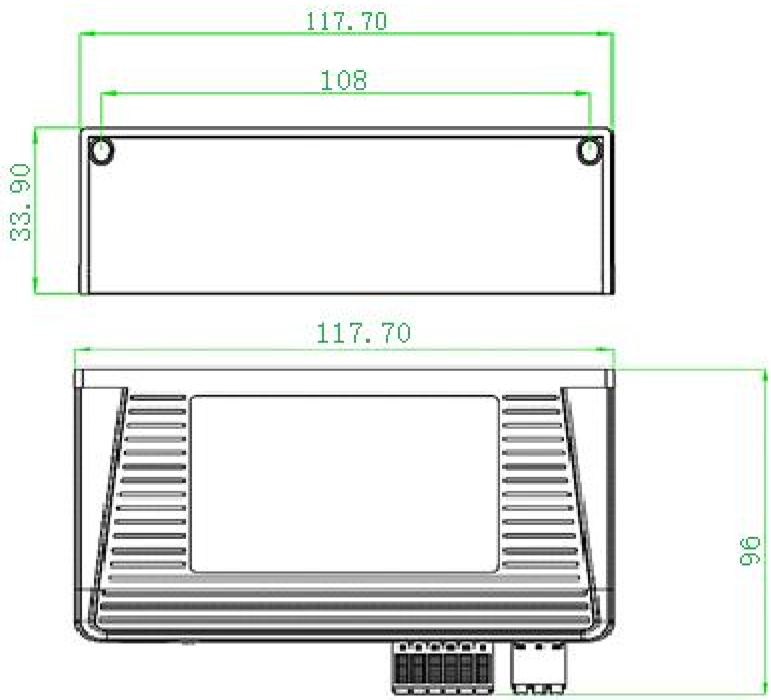


Figure 12 Machine dimension of JMC 2DM556-R/RC Drive (unit: mm)

Notice: Please take the terminal size and ventilation cooling while design the installation size.

- ✧ Drive's reliable working temperature should be <60℃, and motor working temperature should be <90℃;
- ✧ It is recommended to mount the drive vertically to maximize heat sink area. Use forced cooling method to cool the system if necessary.

3 Ports and Connections Introduction

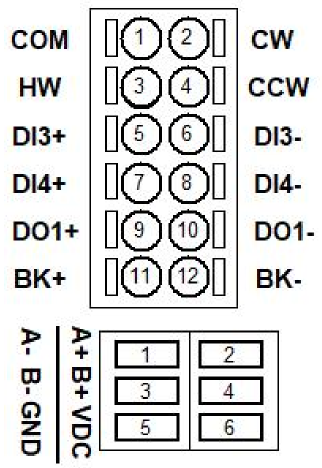


Figure 13 Cable-entry of JMC 2DM556-R/RC Drive

PS: About Communication port, please refer to "*Communication Interface and Wiring*" (Ctrl+ Mouse left or Click text to jump).

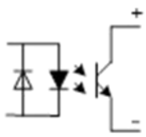
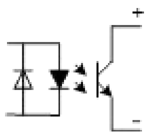
3.1 Power Interface Port

Table 14 Power Interface port of JMC 2DM556-R/RC Drive

Port	Symbol	Definition	Remark
1	A-	Motor phase A-	Motor Phase A
2	A+	Motor phase A+	
3	B-	Motor phase B-	Motor Phase B
4	B+	Motor phase B+	
5	GND	DC power -	24~48VDC
6	DC+	DC power +	
Notice: The JMC motor wiring colors of motor are red (A+), blue (A-), green (B+), and black (B-) generally. Users can connect the port of JMC drive according to this color.If the color is inconsistent with the definition of motor wiring, please call JMC technical service staff.			

3.2 Control Signal Port

Table 15 Control Signal Port of JMC 2DM556-R/RC Drive

Port	Symbol	Definition	Remark
1	COM	Common (cathode/anode)	0V or 24VDC
2	CW	Clockwise Limit	Input 12~24VDC (Compatible with 5V, but not recommended)
3	HW	Home Limit	
4	CCW	Counter Clockwise Limit	
5	Reserve	Reserve	Reserve
6	Reserve	Reserve	
7	Reserve	Reserve	Reserve
8	Reserve	Reserve	
9	DO1+ /ALM+	Position/Alarm signal output +	 The bidirectional optical coupling. Compatible with12~24VDC
10	DO1- /ALM-	Position/Alarm signal output -	
11	BRK+	Brake signal output +	 The bidirectional optical coupling. Compatiblewith 12~24VDC
12	BRK-	Brake signal output -	

3.3 Connections to Control Signal

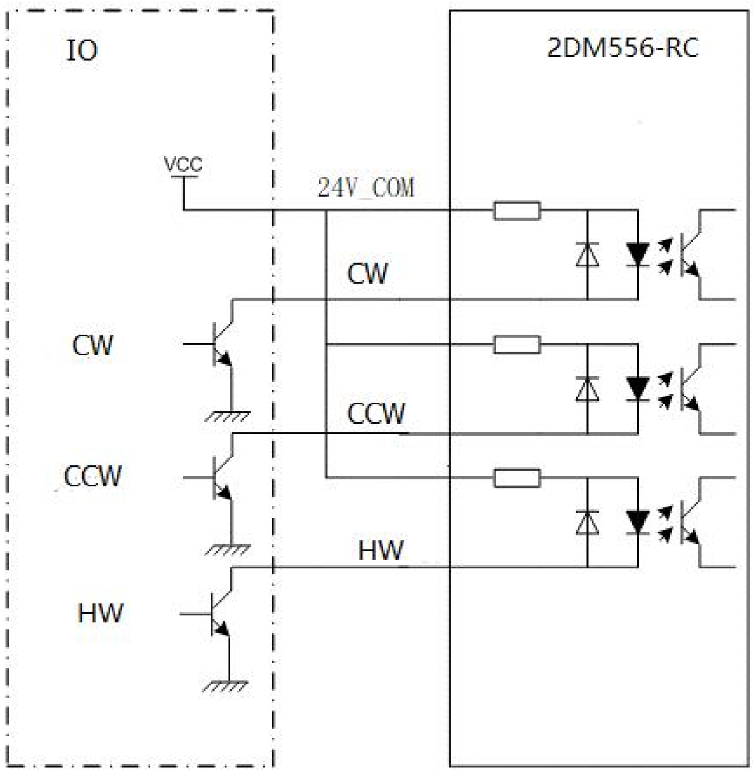


Figure 14 Connections to common anode

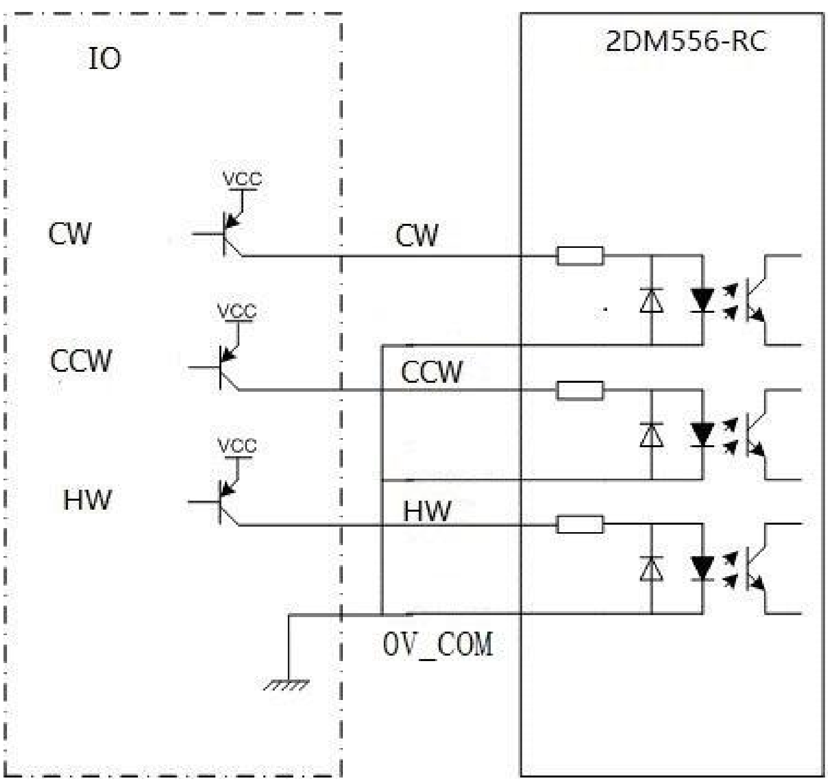


Figure 15 Connections to common cathode

Notice: The control signal can be compatible with 5V and 24V.

4 Typical application wiring diagrams

A typical connection diagram made up of the 2DM556-R/RC drive as follow. The power supply selects DC24~48V according to the voltage level of the matched motor.

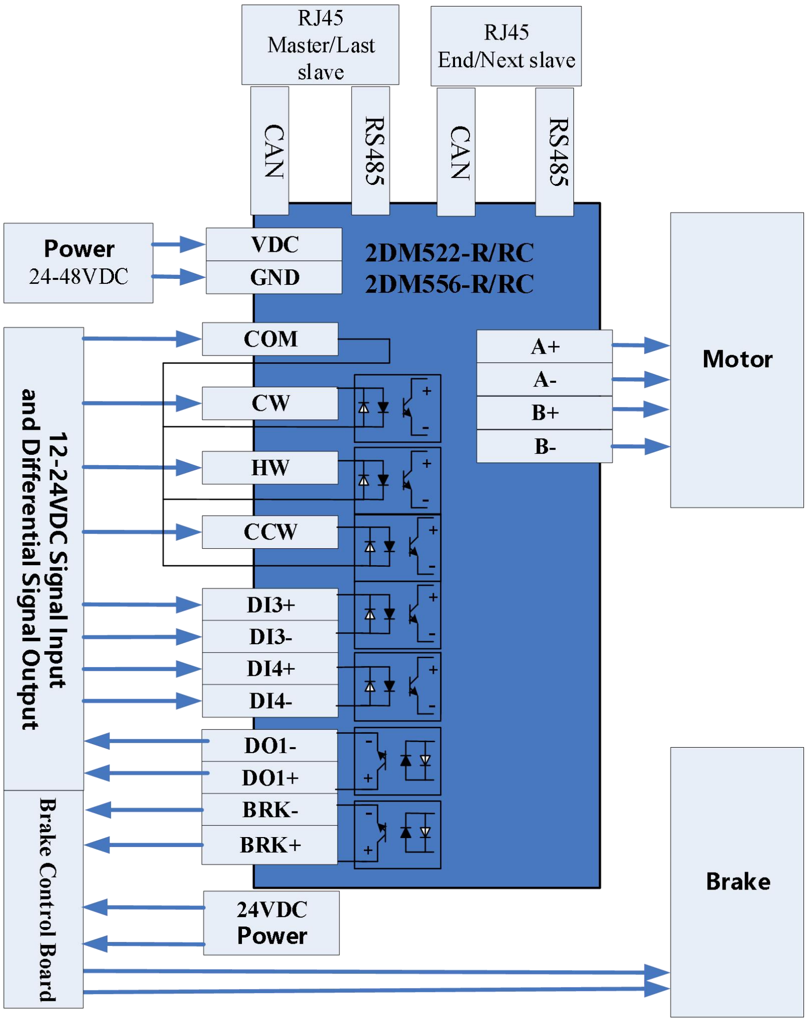


Figure 16 Typical application wiring diagram of JMC 2DM556-R/RC Drive

Notice:

- ✧ BREAK signal to control motor brake, it needs external relay, the maximum current is 50mA.
- ✧ RJ45 network interface through the standard twisted pair cable connected to the other slave, no special difference between the two network ports.

5 Parameters Configure of Drive

There two methods to configure parameters of 2DM556-R/RC. One is set the parameters through the front panel; the other way is to connect it with the HISU. A set of the best default configure parameters has already set in the drive. User need only to configure the parameter Pulses/revolution. The detail functions are as follows:

Actual value = Set value ×the corresponding dimension

Table 16 Internal parameter of JMC 2DM556-R/RC Drive

Parm	Definition	Range	Dimension	Restart Drive	Default Value
P1	Current loop Kp	0—4000	1	No	1000

P2	Current loop Ki	0—1000	1	No	100
P3	Damping coefficient	0—500	1	No	250
P4	Position loop Kp	0—3000	1	No	2000
P5	Position loop Ki	0—1000	1	No	200
P6	Speed loop Kp	0—3000	1	No	500
P7	Speed loop Ki	0—1000	1	No	1000
P8	Open-loop current	0—60	0.1	No	40
P9	Manufacturer	Reserve	Reserve	Reserve	Reserve
P10	Manufacturer	Reserve	Reserve	Reserve	Reserve
P11	Direction level	0—1	1	No	1
P12	Manufacturer	Reserve	Reserve	Reserve	Reserve
P13	Manufacturer	Reserve	Reserve	Reserve	Reserve
P14	Arrival level	0—1	1	No	0
P15	Manufacturer	Reserve	Reserve	Reserve	Reserve
P16	Manufacturer	Reserve	Reserve	Reserve	Reserve
P17	Pulses/Revolution	0—15	1	Yes	2
P18	Manufacturer	Reserve	Reserve	Reserve	Reserve
P19	Speed smoothness	0—10	0	No	2
P20	User-defined p/r	4—1000	50	Yes	8
P21	Display information	0—4	1	No	0
P22	Pulse filter	0—3	1	No	0
P23	Lock shaft	0—1	1	No	0
P24	Manufacturer	Reserve	Reserve	Reserve	Reserve
P25	Overlay proportion	0—40	1	No	10
P26	Stop damping	0—500	1	No	200
P27	Low-speed damping	0—500	1	No	50
P28	Manufacturer	Reserve	Reserve	Reserve	Reserve
P29	Manufacturer	Reserve	Reserve	Reserve	Reserve
P30	Lost phase	0—1	1	Yes	1
P31	Manufacturer	Reserve	Reserve	Reserve	Reserve
P32	Manufacturer	Reserve	Reserve	Reserve	Reserve
P33	Manufacturer	Reserve	Reserve	Reserve	Reserve
P34	Manufacturer	Reserve	Reserve	Reserve	Reserve
P35	Manufacturer	Reserve	Reserve	Reserve	Reserve
P36	Semi-flow time	0—60000	MS	No	500
P37	Semi-flow percent	0—100	1%	No	50
P38	Manufacturer	Reserve	Reserve	Reserve	Reserve
P39	Manufacturer	Reserve	Reserve	Reserve	Reserve
P40	Slave ID	1—128	1	Yes	0
P41	Slave baud rate	0—7	1	Yes	0
P42	IO signal polarity	0—1	1	Yes	1
P43	Communication mode	0—1	1	Yes	1
P44	Limit signal upload	0—1	1	No	0
P45	Target speed unit	0—1	1	No	0

Those parameters can be set by using Button Panel, can also be set by using HISU adjuster. The detail descriptions to every parameter configuration are as follows:

- ✧ **P1~7**are used to change parameters of current loop, damping, position loop and speed loop.
- ✧ **P8**, this parameter affects the static torque of the motor.
- ✧ **P10** is set to control the Alarm optocoupler. Output transistor 0 means the transistor is cut off when the system is in normal working, but when it comes to fault of the drive, the transistor becomes conductive. 1 means opposite to 0.
- ✧ **P11** is used to control direction level. By this parameter, drive's default orientation can be changed.
- ✧ **P14** is set to control the Arrival optocoupler output transistor. 0 means the transistor is cut off when the drive satisfies the arrival command, but when it comes to not, the transistor becomes conductive. 1 means opposite to 0.
- ✧ **P17** is used to select pulses.It shall restart.

Table 17 P17 of JMC 2DM556-R/RC: Pulses/Revolution

Parameter	0	1	2	3	4	5	6	7
Pulses	user-def	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
Pulses	1000	2000	4000	5000	8000	10000	20000	40000

Notice: In addition, the drive provides users with pulses that they can set up freely via parameter 20.

- ✧ **P18** is used to select single pulse or double pulse. 1 means single pulse and direction, while 0 means double pulse.
- ✧ **P19**, Speed smoothness, this parameter is set to control the smoothness of the speed of the motor while acceleration or deceleration, the larger the value, the smoother the speed in acceleration or deceleration.

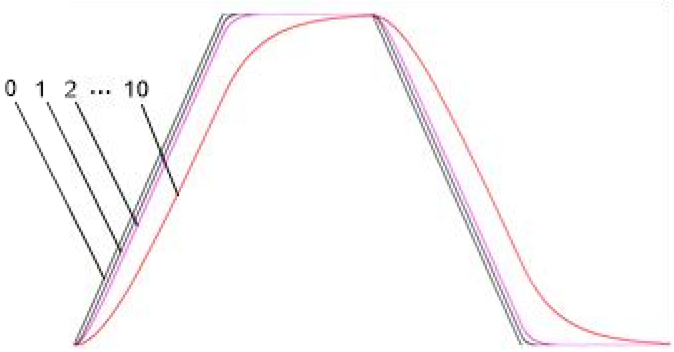


Figure 17 P19 of JMC 2DM556-R/RC Drive: Speed smoothness

- ✧ **P20** is used to set up user-defined pulses.It shall restart.
- ✧ **P21** is used to select display information.

Table 18 P21 of JMC 2DM556-R/RC Drive: Display information

Parameter	0	1	2	3	4
Display	Reference Velocity	Velocity Feedback	Position Error	Reference Position	Position Feedback

- ✧ **P22** is Pulse filter, setting 0~3. As the value increases, the frequency of the passing pulse decreases gradually. This is used to suppress the electronic interference generated in the environment.
- ✧ **P23** is Stop lock enable. This parameter is set to the drive not count external pulses and lock shaft or not.1 means enable this function while 0 means disable it.
- ✧ **P30** is used to check whether the motor is out of phase.1 means used, while 0 means not used. But this is for manufacturer only.It shall restart.
- ✧ **P36** is used to set the time after motor stops about motor current. Its default value is 1000,which means

that motor had stopped after 1000ms.

✧ **P37** is used to set the Semi-flow percent to control motor current. Its unit is 1%, whose default value is 50.

[STOP STATE] Motor current = Open-loop current (P8) × Semi-flow percent (P37)

✧ **P40** is used to set slaves ’node identifier. It shall restart.

✧ **P41** is used to select baud rate of CAN or RS485.It shall restart so that can be working.

Table 19 P41 of JMC 2DM556-R/RC Drive: Baud rate

Baud Rate	0	1	2	3	4	5	6	7
CAN (Kbps)	12.5	20	50	100	200	250	500	1000
485 (bps)	1200	2400	4800	9600	19200	38400	57600	115200

✧ **P42** is used to select IO input signal polarity. P42=0: use PNP type limit switch; P42=1: use NPN type limit switch.It shall restart.

✧ **P43** is used to select communication mode. P43=0: select 485 communication, P43=1: select CANopen communication. It shall restart.

✧ **P44** is used to select whether limit signal upload to object 60FD. 1 means enabling this function while 0 means disabling it.

✧ **P45** is used to set unit of target speed. 1 means that unit is 0.1RPS. 0 means that unit is 1/Revolution.

6 Parameter Adjustment Methods

6.1 Button Panel

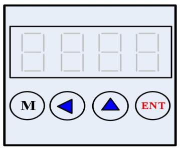


Figure 18 Button Panel of JMC 2DM556-R/RC Drive

The Button panel consists of 4 keys plus 4 LED displays. 2DM556-R/RC with LED indicating power supply and display status, panel operation as shown in the figure. Select the display mode through the key ‘M’ and monitor the running state of the motor through the ‘▲’ and ‘◂’ keys. The following table is the meaning for each monitoring code.

Table 20 Monitoring code of JMC 2DM556-R/RC Button Panel

Display	55rc	PA00	EXXX	PSГP
Meaning	2DM556-R/RC	Parameter	Error	Reset

【1】Move Key

‘◂’: Shift;

‘▲’: Adjust parameter

【2】Function Key

‘ENT’: Enter or Ensure

‘M’: Switch mode or Cancel

Notice:Switch to parameter display function through ‘M’;Use ‘ENT’ key to view parameter value, press ‘▲’ key switch function; Exit this function and go to the next function to press the ‘M’ key.

6.2 Button Panel Operation

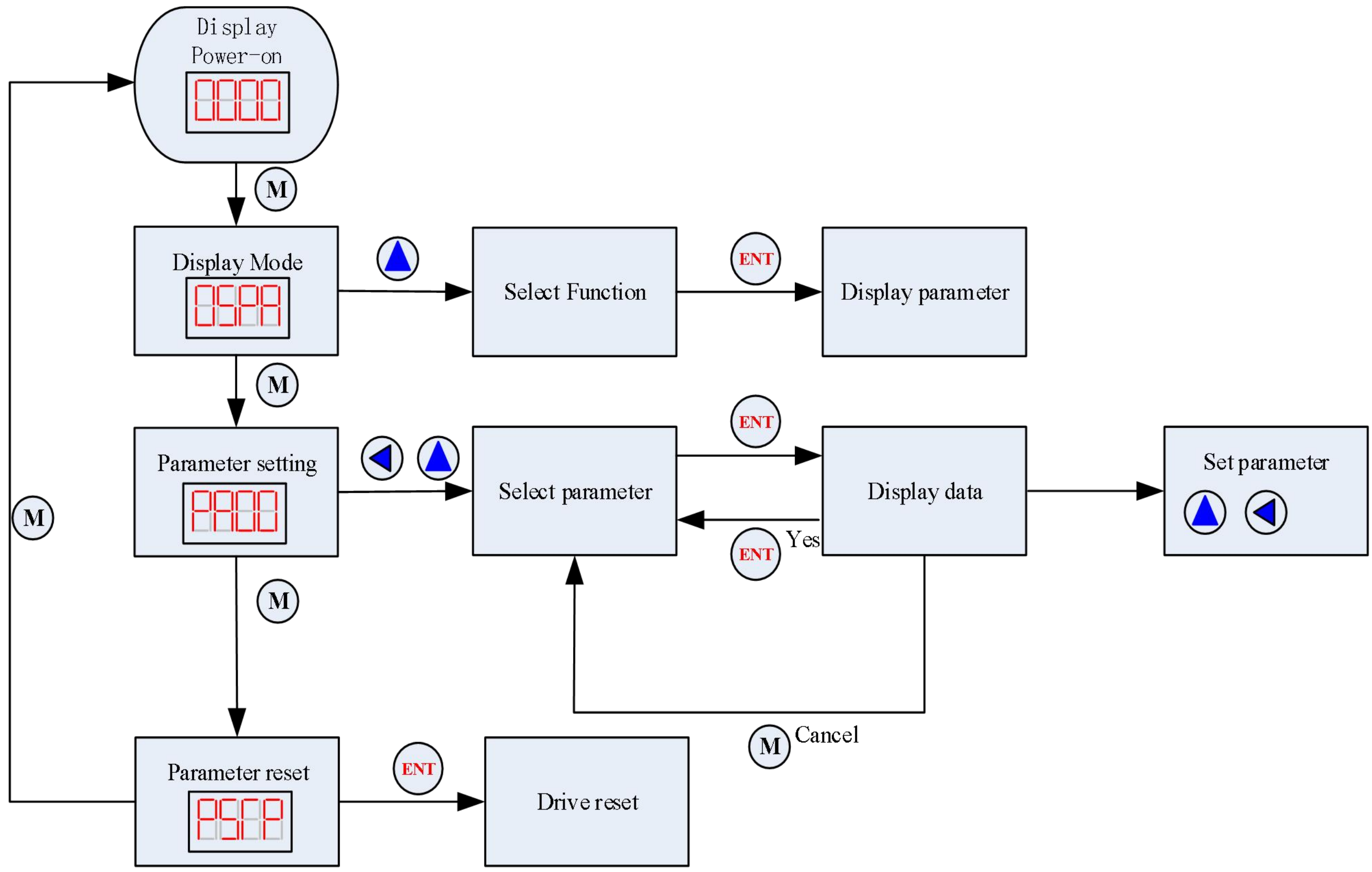


Figure 19 Operation of JMC 2DM556-R/RC Button Panel

6.3 Operation Example

1) Mode Configure Operation

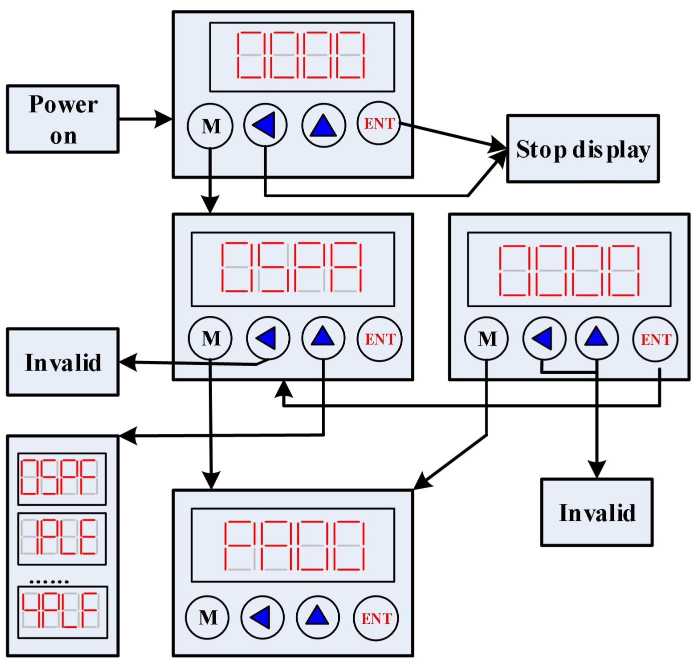


Figure 20Mode Configure Operation of JMC 2DM556-R/RC Panel

2) **Parameter Configure Operation**

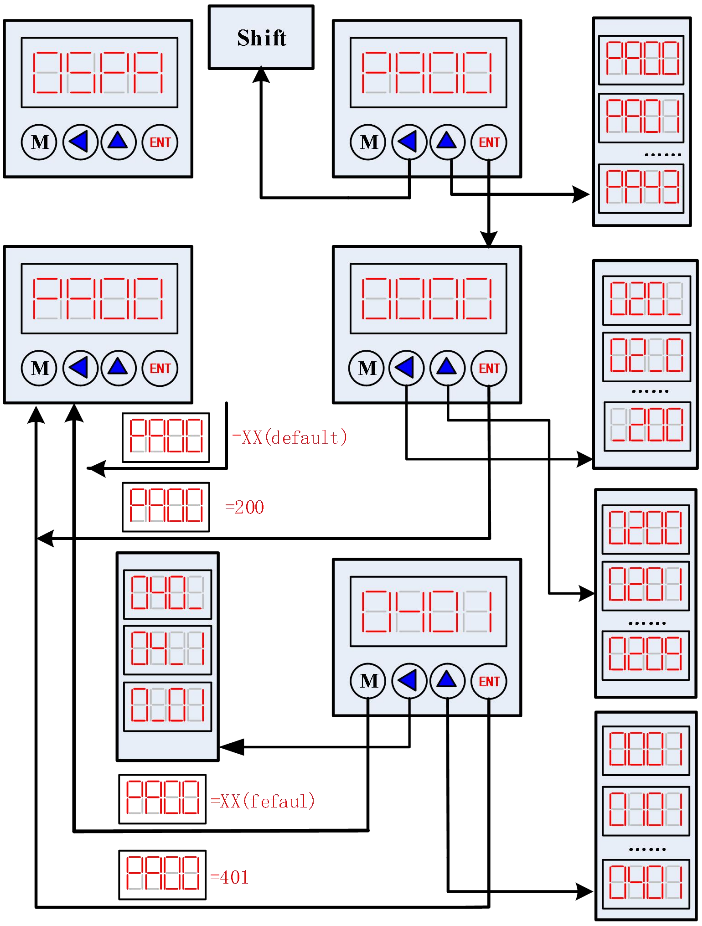


Figure 21Parameter Configure Operation of JMC 2DM556-R/RC Panel

Notice: The default parameters of current loop, position loop and speed loop are almost the best, user no need to change them, but to configure the parameter Pulses/revolution and Open-loop/Close-loop current according to the necessity of the control system.

7 Failure Alarm

Table 21Failure Alarm of JMC 2DM556-R/RC Drive

Display	Description	Can be Cleared
E101	Over current Error	NO
E102	Reference voltage Error	NO
E103	Parameter read\write Error	NO
E104	Over voltage Error	NO
E105	Loss phase Error	NO
E106	Over position error	YES
E107	Motor enable	YES

8 RS485 Communication Parameter Setting

When RS485 communication mode is used by the drive, communication parameters of the upper computer or other communication stations shall be set in advance. The default configuration parameters of the driver are as follows:

Table 22 RS485 Communication Parameter Setting of JMC 2DM556-R/RC Drive

Parameter	Baud Rate	Start	Data	Stop	Check
Value	0~115200bps	1Bit	8Bit	1Bit	None

9 Match Motor

Table 23Match Motor of JMC 2DM556-R/RC Drive

Match Motor of JMC 2DM556-R/RC Drive								
Bedplate		Model	Step Angle (deg)	Static Moment (N・m)	Rated Current (A)	Phase Resistance (ohms)	Phase Inductance (mh)	Location Torque (g·cm)
Two-phase	57	57J1841-420	1.8	0.75	2	1.3	3.2	250
		57J1854-828	1.8	0.85	2.8	0.95	1.2	350
		57J1856-440	1.8	1.2	4	0.43	1.35	350
		57J1876-828	1.8	1.6	2.8	0.95	1.85	700
		57J1876-447	1.8	2	4.7	0.37	1.75	700
		57J1880-450	1.8	2.2	5	0.4	1.8	700
		57J1880-830	1.8	2	3	0.95	1.8	700
		57J18100-840	1.8	2.8	4	0.95	3.4	1000
		57J18112-435	1.8	3	3.5	0.65	2	1200
	60	60J1887-440	1.8	3.3	4	0.7	2.5	1200
		60J18100-440	1.8	3.3	4	0.8	3	1500

Table 24Match Motor of JMC 2DM556-R/RC Drive (Continued table)

Match Motor of JMC 2DM556-R/RC Drive							
Bedplate		Model	Rotor Inertia (g-cm²)	Insulation Class	Leading wire	Weight (kg)	Length (mm)
Two-phase	57	57J1841-420	157	B	4	0.4	41
		57J1854-828	280	B	8	0.6	54
		57J1856-440	280	B	4	0.6	56
		57J1876-828	460	B	8	1	76
		57J1876-447	480	B	4	1.05	76
		57J1880-450	520	B	4	1.15	80
		57J1880-830	480	B	8	1.1	80
		57J18100-840	700	B	8	1.45	100
		57J18112-435	780	B	4	1.7	112
	60	60J1887-440	900	B	4	1.4	87
		60J18100-440	950	B	4	1.7	100

10 Quick Guides

This part is the hardware operation to help users quickly building the platform, mainly including the wiring between the motor and the driver and the driver parameter setting operation.

10.1 Hardware Wiring

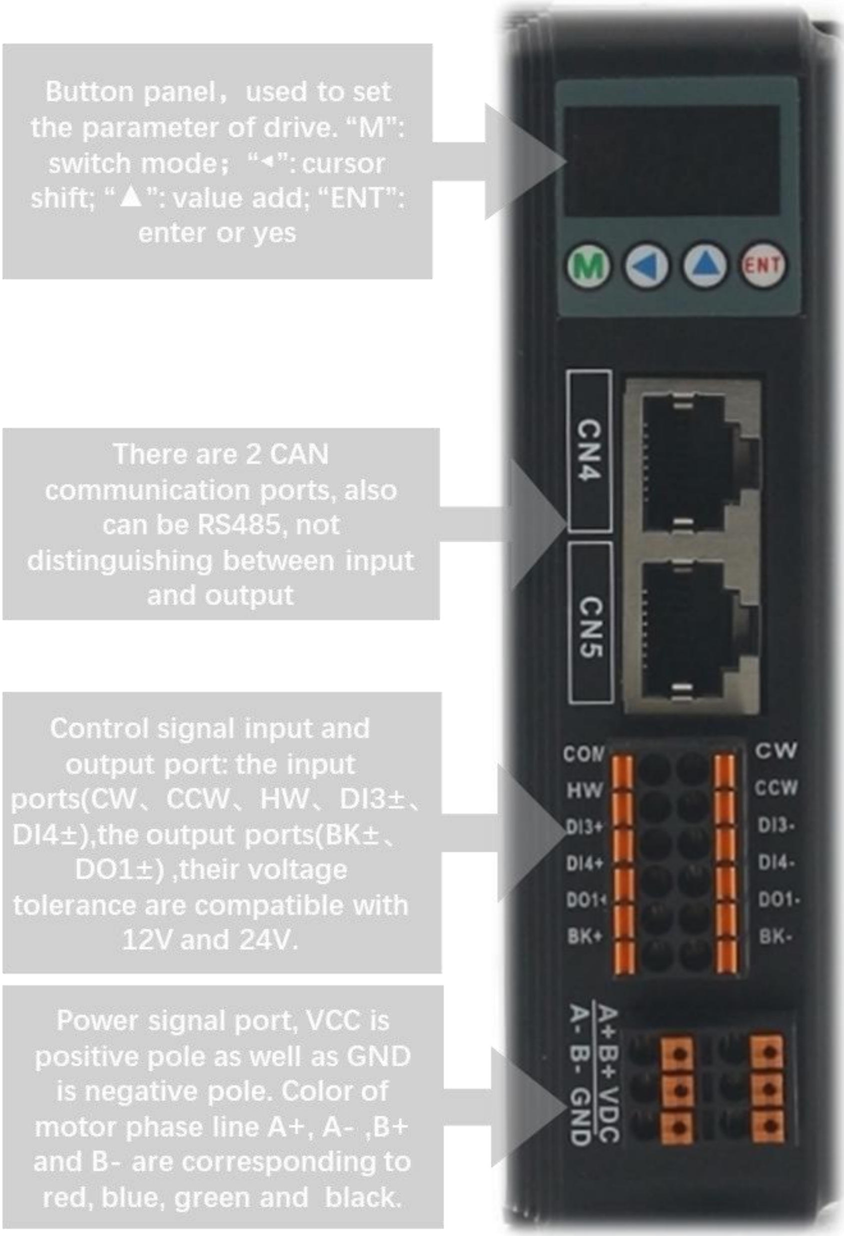


Figure 22JMC 2DM556-R/RC Practicality

User can go to “*Ports and Connections Introduction*”(Ctrl+ Mouse left or Click text to jump) for viewing.

10.2 Parameter Setting

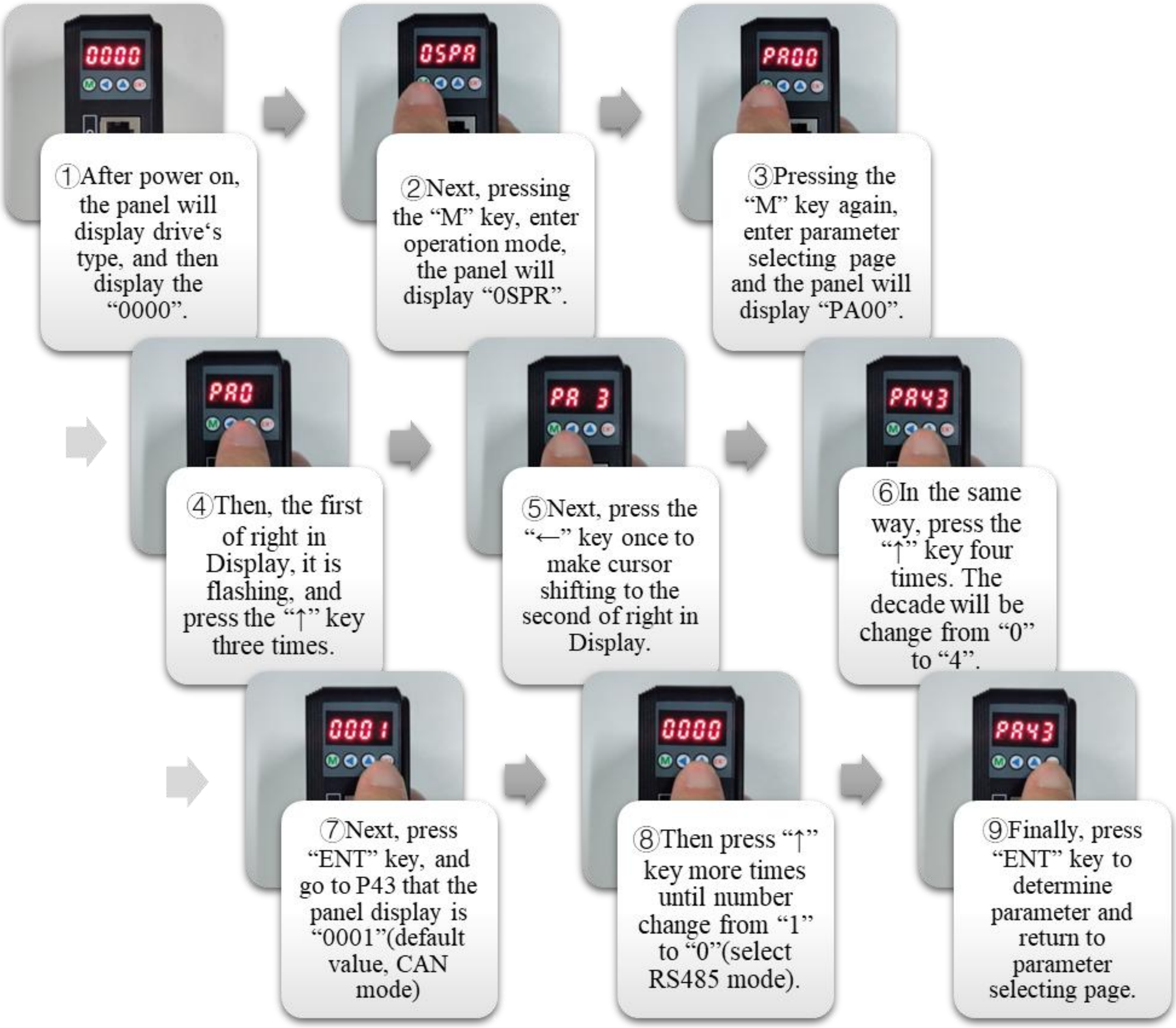


Figure 23 Setting P43 in JMC 2DM556-R/RC Button Panel

In addition to the Communication mode (P43), the Slave ID (P40) and Baud rate (P41) must be set when using the drive.

The setting of parameter P40 is basically the same as the operation of P43. Use the Button panel to "PA40" to enter and set the Slave ID. Similarly, the parameter P41 is the same operation, but it should be noted that the parameter can only be set to 0~7. The value "6" means that Baud rate of CAN communication is 500Kbps, or Baud rate of RS485 communication is 57600bps. For other parameter, please see "Parameters Configure of Drive".

The above figure takes the setting of communication mode of drive as an example to change the communication mode from CAN to 485, that is, to set the parameter P43 of drive. Other operations are much the same. According to the above flow chart, user can grasp method of operation of Button panel.

➢ 2DM880-R/RC

1 Electrical, Mechanical and Environmental Specifications

Table 25Performance of JMC 2DM880-R/RC Drive

Input voltage		24~80VDC, 20~70VAC
Continuous Current output		0~8.0A
Communication Type		CANopen /Modbus-RTU
Communication Distance		1KM
Maximum Number of Slaves		128/32
Maximum Communication rate		1000Kbps/115200bps
Logic Input Current		6~16mA (Typical value 10mA)
Protect		The peak of over current action value is 10A±10%
		Over voltage action value is 60VDC
Shape Size(mm)		150.4×115.86×36.90
Weight		Approximately 260g
Environmental Conditions	Working Occasion	Avoid dust, oil mist and corrosive gas as far as possible
	Working Temperature	0~40℃
	Storage Temperature	-20℃~+40℃
	Working Humidity	40~90%RH
	Cooling mode	Natural cooling or forced cold wind

2 Machine Dimension Diagrams

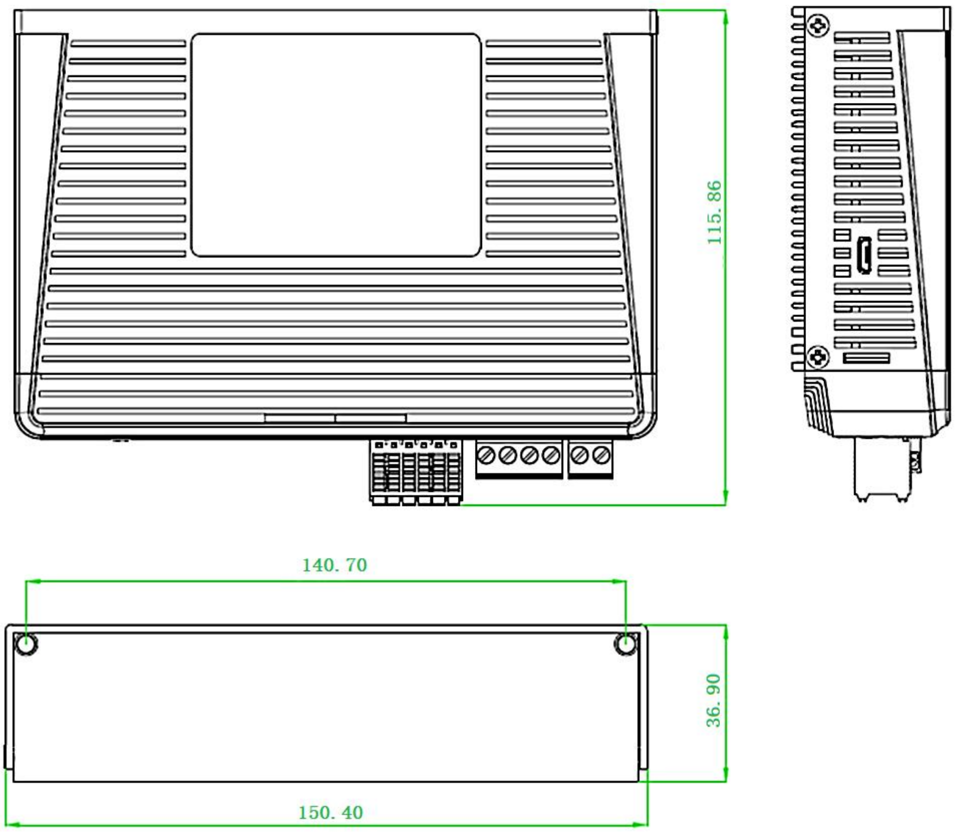


Figure 24Machine dimension of JMC 2DM880-R/RC Drive (unit: mm)

3 Ports and Connections Introduction

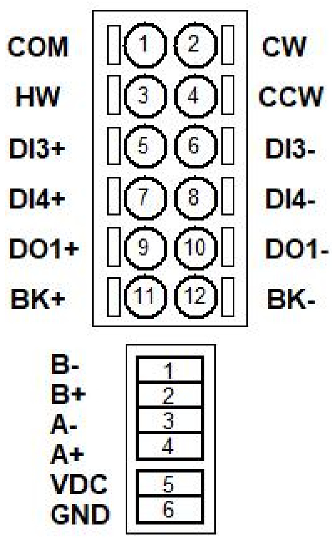


Figure 25Cable-entry of JMC 2DM880-R/RC Drive

PS: About Communication port, please refer to "*Communication Interface and Wiring*" (Ctrl+ Mouse left or Click text to jump).

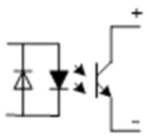
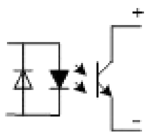
3.1 Power Interface Port

Table 26Power Interface port of JMC 2DM880-R/RC Drive

Port	Symbol	Definition	Remark
1	B-	Motor phase B-	Motor Phase B
2	B+	Motor phase B+	
3	A-	Motor phase A-	Motor Phase A
4	A+	Motor phase A+	
5	DC+	DC power +	24~80VDC or 20~70VAC
6	GND	DC power -	
Notice: The JMC motor wiring colors of motor are red (A+), blue (A-), green (B+), and black (B-) generally. Users can connect the port of JMC drive according to this color.If the color is inconsistent with the definition of motor wiring, please call JMC technical service staff.			

3.2 Control Signal Port

Table 27Control Signal Port of JMC 2DM880-R/RC Drive

Port	Symbol	Definition	Remark
1	COM	Common (cathode/anode)	0V or 24VDC
2	CW	Clockwise Limit	Input 12~24VDC (Compatible with 5V, but not recommended)
3	HW	Home Limit	
4	CCW	Counter Clockwise Limit	
5	Reserve	Reserve	Reserve
6	Reserve	Reserve	
7	Reserve	Reserve	Reserve
8	Reserve	Reserve	
9	DO1+ /ALM+	Position/Alarm signal output +	 The bidirectional optical coupling. Compatible with12~24VDC
10	DO1- /ALM-	Position/Alarm signal output -	
11	BRK+	Brake signal output +	 The bidirectional optical coupling. Compatiblewith 12~24VDC
12	BRK-	Brake signal output -	

3.3 Connections to Control Signal

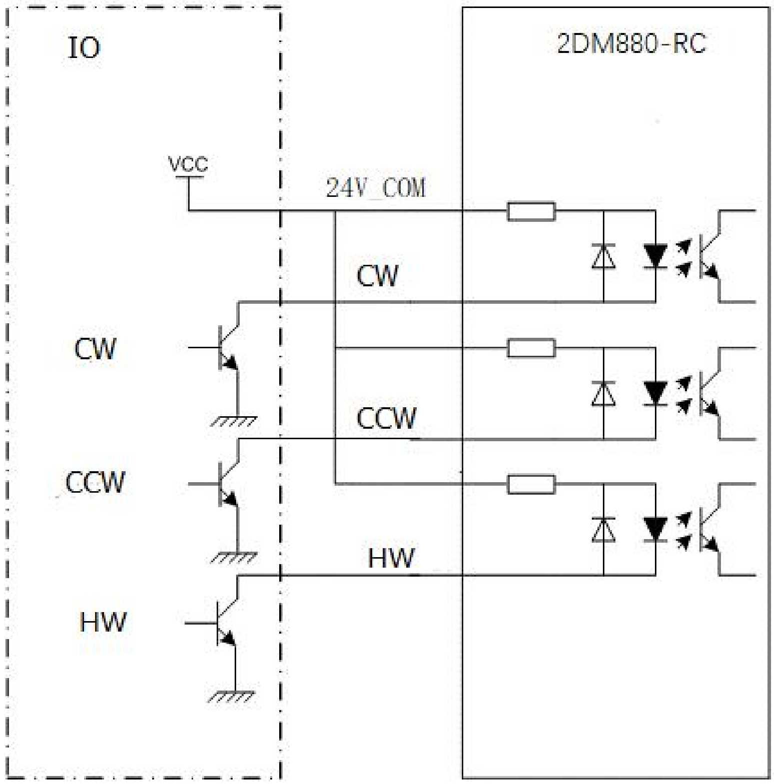


Figure 26 Connections to common anode

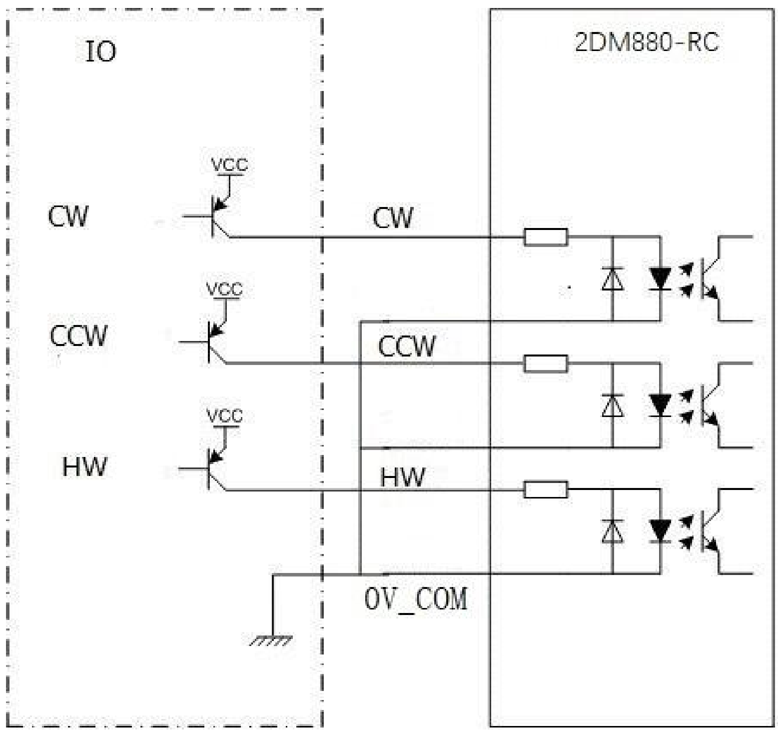


Figure 27Connections to common cathode

Notice: The control signal can be compatible with 5V and 24V.

4 Typical application wiring diagrams

A typical connection diagram made up of the 2DM880-R/RC drive as follow. The power supply selects DC24~80V or AC24~70V according to the voltage level of the matched motor.

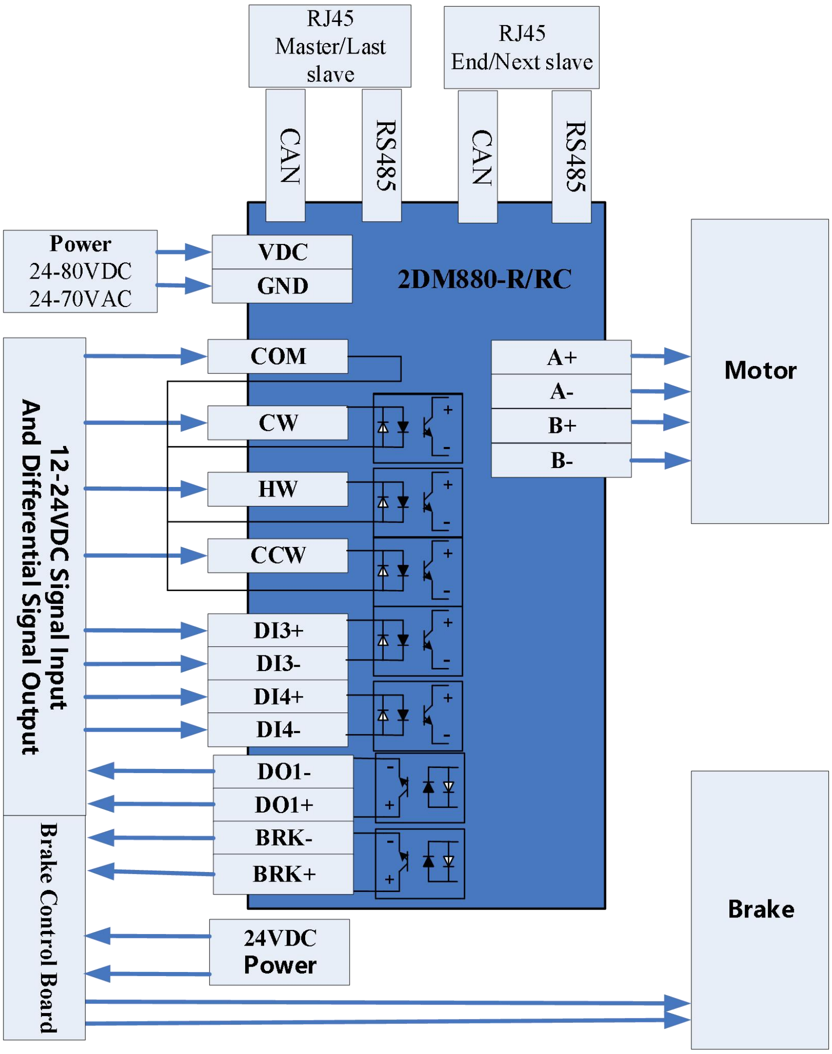


Figure 28Typical application wiring diagram of JMC 2DM880-R/RC Drive

Notice:

- ✧ BREAK signal to control motor brake, it needs external relay, the maximum current is 50mA.
- ✧ RJ45 network interface through the standard twisted pair cable connected to the other slave, no special difference between the two network ports.

5 Parameters Configure of Drive

There two methods to configure parameters of 2DM5880-R/RC. One is set the parameters through the front panel; the other way is to connect it with the HISU. A set of the best default configure parameters has already set in the drive. User need only to configure the parameter Pulses/revolution. The detail functions are as follows:

Actual value = Set value ×the corresponding dimension

Table 28 Internal parameter of JMC 2DM880-R/RC Drive

Parm	Definition	Range	Dimension	Restart Drive	Default Value

P1	Current loop Kp	0—4000	1	No	1000
P2	Current loop Ki	0—1000	1	No	100
P3	Damping coefficient	0—500	1	No	250
P4	Position loop Kp	0—3000	1	No	2000
P5	Position loop Ki	0—1000	1	No	200
P6	Speed loop Kp	0—3000	1	No	500
P7	Speed loop Ki	0—1000	1	No	1000
P8	Open-loop current	0—60	0.1	No	40
P9	Manufacturer	Reserve	Reserve	Reserve	Reserve
P10	Manufacturer	Reserve	Reserve	Reserve	Reserve
P11	Direction level	0—1	1	No	1
P12	Manufacturer	Reserve	Reserve	Reserve	Reserve
P13	Manufacturer	Reserve	Reserve	Reserve	Reserve
P14	Arrival level	0—1	1	No	0
P15	Manufacturer	Reserve	Reserve	Reserve	Reserve
P16	Manufacturer	Reserve	Reserve	Reserve	Reserve
P17	Pulses/Revolution	0—15	1	Yes	2
P18	Manufacturer	Reserve	Reserve	Reserve	Reserve
P19	Speed smoothness	0—10	0	No	2
P20	User-defined p/r	4—1000	50	Yes	8
P21	Display information	0—4	1	No	0
P22	Pulse filter	0—3	1	No	0
P23	Lock shaft	0—1	1	No	0
P24	Manufacturer	Reserve	Reserve	Reserve	Reserve
P25	Overlay proportion	0—40	1	No	10
P26	Stop damping	0—500	1	No	200
P27	Low-speed damping	0—500	1	No	50
P28	Manufacturer	Reserve	Reserve	Reserve	Reserve
P29	Manufacturer	Reserve	Reserve	Reserve	Reserve
P30	Lost phase	0—1	1	Yes	1
P31	Manufacturer	Reserve	Reserve	Reserve	Reserve
P32	Manufacturer	Reserve	Reserve	Reserve	Reserve
P33	Manufacturer	Reserve	Reserve	Reserve	Reserve
P34	Manufacturer	Reserve	Reserve	Reserve	Reserve
P35	Manufacturer	Reserve	Reserve	Reserve	Reserve
P36	Semi-flow time	0—60000	MS	No	500
P37	Semi-flow percent	0—100	1%	No	50
P38	Manufacturer	Reserve	Reserve	Reserve	Reserve
P39	Manufacturer	Reserve	Reserve	Reserve	Reserve
P40	Slave ID	1—128	1	Yes	0
P41	Slave baud rate	0—7	1	Yes	0
P42	IO signal polarity	0—1	1	Yes	1
P43	Communication mode	0—1	1	Yes	1
P44	Limit signal upload	0—1	1	No	0
P45	Target speed unit	0—1	1	No	0

Those parameters can be set by using Button Panel, can also be set by using HISU adjuster. The detail descriptions to every parameter configuration are as follows:

- ✧ **P1~7**are used to change parameters of current loop, damping, position loop and speed loop.
- ✧ **P8**, this parameter affects the static torque of the motor.
- ✧ **P10** is set to control the Alarm optocoupler. Output transistor 0 means the transistor is cut off when the system is in normal working, but when it comes to fault of the drive, the transistor becomes conductive. 1 means opposite to 0.
- ✧ **P11** is used to control direction level. By this parameter, drive's default orientation can be changed.
- ✧ **P14** is set to control the Arrival optocoupler output transistor. 0 means the transistor is cut off when the drive satisfies the arrival command, but when it comes to not, the transistor becomes conductive. 1 means opposite to 0.
- ✧ **P17** is used to select pulses.It shall restart.

Table 29 P17 of JMC 2DM880-R/RC: Pulses/Revolution

Parameter	0	1	2	3	4	5	6	7
Pulses	user-def	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
Pulses	1000	2000	4000	5000	8000	10000	20000	40000

Notice: In addition, the drive provides users with pulses that they can set up freely via parameter 20.

- ✧ **P18** is used to select single pulse or double pulse. 1 means single pulse and direction, while 0 means double pulse.
- ✧ **P19**, Speed smoothness, this parameter is set to control the smoothness of the speed of the motor while acceleration or deceleration, the larger the value, the smoother the speed in acceleration or deceleration.

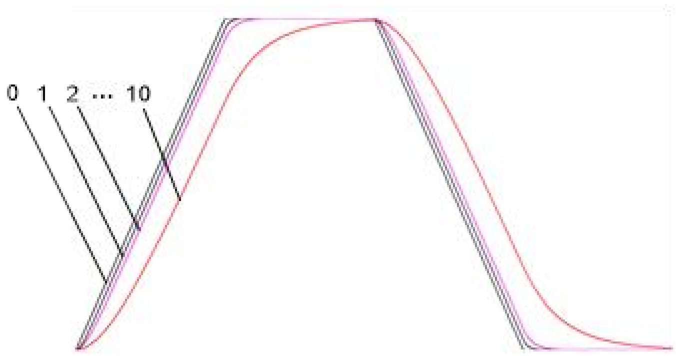


Figure 29 P19 of JMC 2DM880-R/RC Drive: Speed smoothness

- ✧ **P20** is used to set up user-defined pulses.It shall restart.
- ✧ **P21** is used to select display information.

Table 30 P21 of JMC 2DM880-R/RC Drive: Display information

Parameter	0	1	2	3	4
Display	Reference Velocity	Velocity Feedback	Position Error	Reference Position	Position Feedback

- ✧ **P22** is Pulse filter, setting 0~3. As the value increases, the frequency of the passing pulse decreases gradually. This is used to suppress the electronic interference generated in the environment.
- ✧ **P23** is Stop lock enable. This parameter is set to the drive not count external pulses and lock shaft or not.1 means enable this function while 0 means disable it.
- ✧ **P30** is used to check whether the motor is out of phase.1 means used, while 0 means not used. But this is for manufacturer only.It shall restart.

✧ **P36** is used to set the time after motor stops about motor current. Its default value is 1000, which means that motor had stopped after 1000ms.

✧ **P37** is used to set the Semi-flow percent to control motor current. Its unit is 1%, whose default value is 50.

[STOP STATE] Motor current = Open-loop current (P8) × Semi-flow percent (P37)

✧ **P40** is used to set slaves' node identifier. It shall restart.

✧ **P41** is used to select baud rate of CAN or RS485.It shall restart so that can be working.

Table 31 P41 of JMC 2DM880-R/RC Drive: Baud rate

Baud Rate	0	1	2	3	4	5	6	7
CAN (Kbps)	12.5	20	50	100	200	250	500	1000
485 (bps)	1200	2400	4800	9600	19200	38400	57600	115200

✧ **P42** is used to select IO input signal polarity. P42=0: use PNP type limit switch; P42=1: use NPN type limit switch.It shall restart.

✧ **P43** is used to select communication mode. P43=0: select 485 communication, P43=1: select CANopen communication. It shall restart.

✧ **P44** is used to select whether limit signal upload to object 60FD. 1 means enabling this function while 0 means disabling it.

✧ **P45** is used to set unit of target speed. 1 means that unit is 0.1RPS. 0 means that unit is 1/Revolution.

6 Parameter Adjustment Methods

6.1 Button Panel

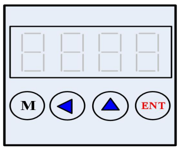


Figure 30Button Panel of JMC 2DM880-R/RC Drive

The Button panel consists of 4 keys and 4 LED displays. 2DM880-R/RC with LED indicating power supply and display status, panel operation as shown in the figure. Select the display mode through the key 'M' and monitor the running state of the motor through the '▲' and '◂' keys. The following table is the meaning for each monitoring code.

Table 32Monitoring code of JMC 2DM880-R/RC Button Panel

Display	88rc	PA00	EXXX	PSГP
Meaning	2DM880-R/RC	Parameter	Error	Reset

【1】Move Key

'◂': Shift;

'▲': Adjust parameter

【2】Function Key

'ENT': Enter or Ensure

'M': Switch mode or Cancel

Notice:Switch to parameter display function through 'M';Use 'ENT' key to view parameter value, press '▲' key switch function; Exit this function and go to the next function to press the 'M' key.

6.2 Button Panel Operation

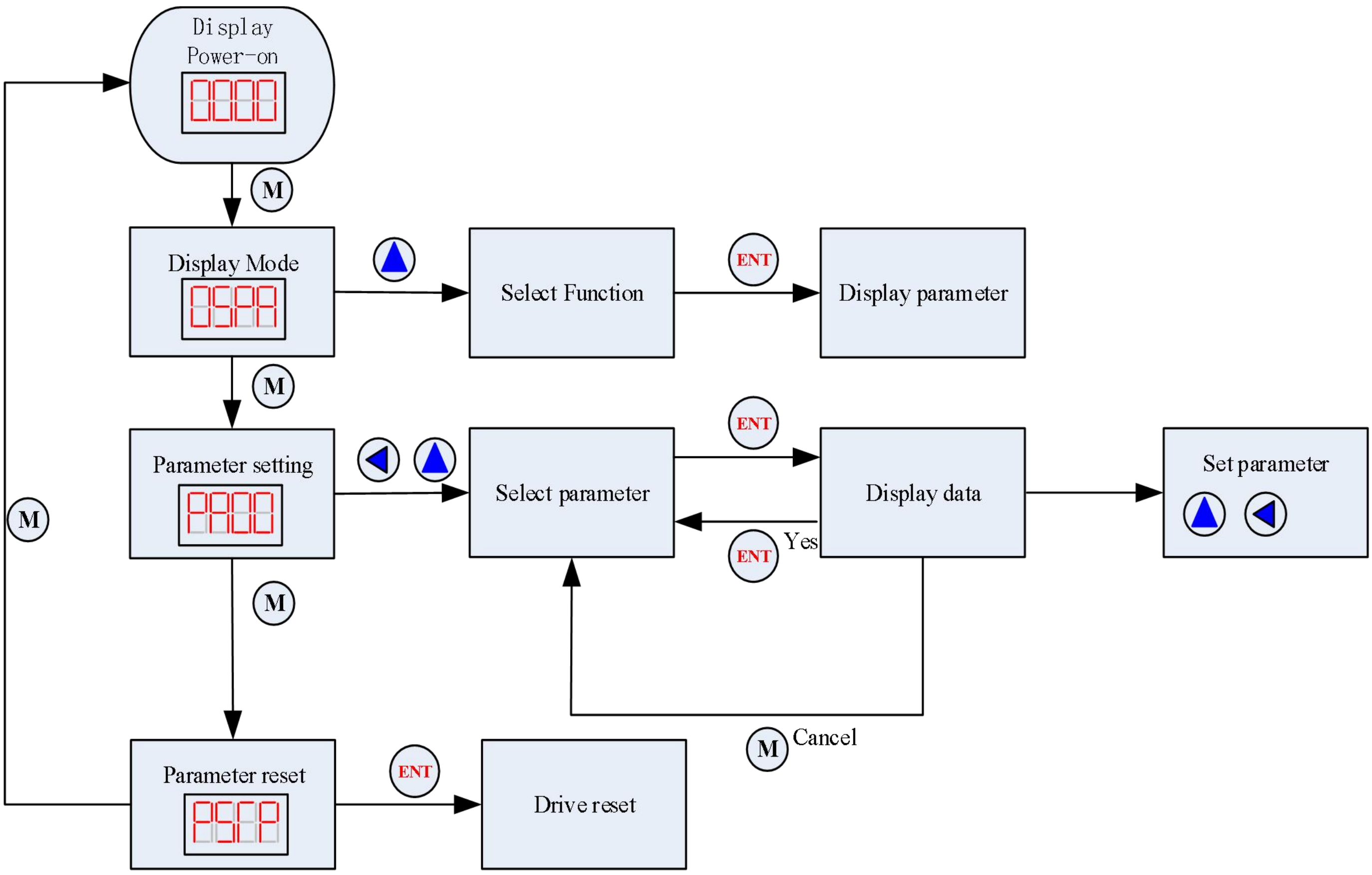


Figure 31Operation of JMC 2DM880-R/RC Button Panel

6.3 Operation Example

1) Mode Configure Operation

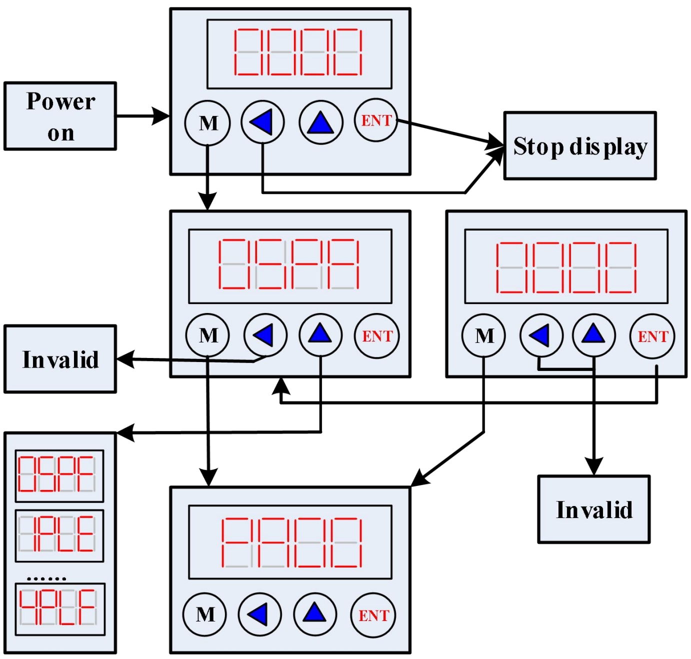


Figure 32Mode Configure Operation of JMC 2DM880-R/RC Panel

2) Parameter Configure Operation

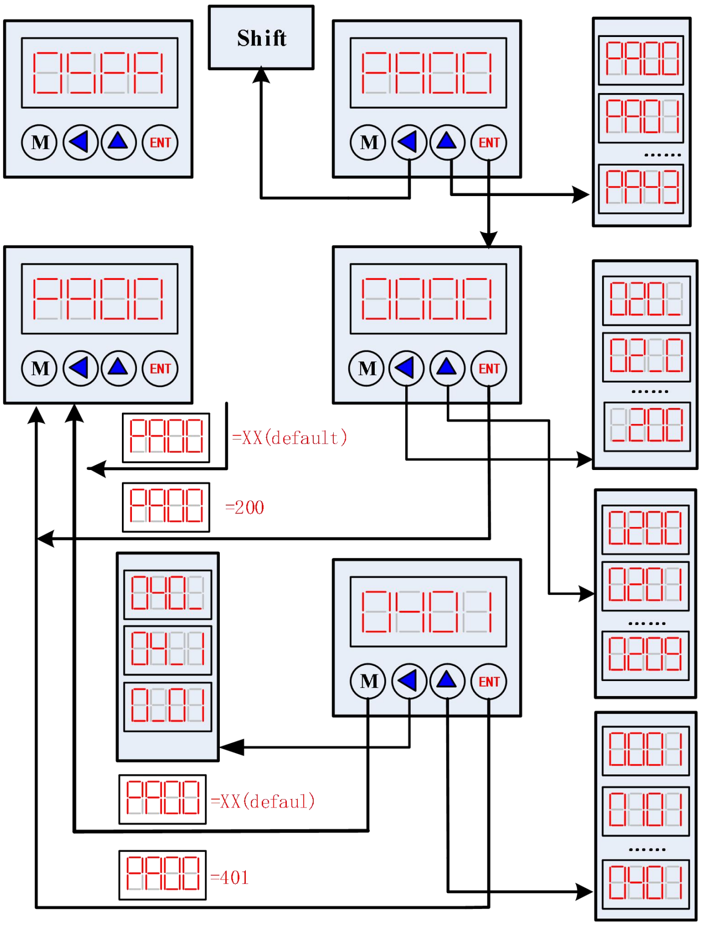


Figure 33 Parameter Configure Operation of JMC 2DM880-R/RC Panel

Notice: The default parameters of current loop, position loop and speed loop are almost the best, user no need to change them, but to configure the parameter Pulses/revolution and Open-loop/Close-loop current according to the necessity of the control system.

7 Failure Alarm

Table 33 Failure Alarm of JMC 2DM880-R/RC Drive

Display	Description	Can be Cleared
E101	Over current Error	NO
E102	Reference voltage Error	NO
E103	Parameter read\write Error	NO
E104	Over voltage Error	NO
E105	Loss phase Error	NO
E106	Over position error	YES
E107	Motor enable	YES

8 RS485 Communication Parameter Setting

When RS485 communication mode is used by the drive, communication parameters of the upper computer or other communication stations shall be set in advance. The default configuration parameters of the driver are as follows:

Table 34 RS485 Communication Parameter Setting of JMC 2DM880-R/RC Drive

Parameter	Baud Rate	Start	Data	Stop	Check
Value	0~115200bps	1Bit	8Bit	1Bit	None

9 Match Motor

Table 35 Match Motor of JMC 2DM880-R/RC Drive

Match Motor of JMC 2DM880-R/RC Drive								
Bedplate		Model	Step Angle (deg)	Static Moment (N • m)	Rated Current (A)	Phase Resistance (ohms)	Phase Inductance (mh)	Location Torque (g·cm)
Two-phase	86	86J1865-828	1.8	3.5	2.8	0.24	1.7	550
		86J1880-842	1.8	4.5	4.2	0.58	4	650
		86J1880-460	1.8	4.5	6	0.29	4	650
		86J18101-450	1.8	6	5	0.58	4.2	950
		86J18118-842	1.8	8.5	4.2	0.56	3	1250
		86J18118-460	1.8	8.5	6	0.28	3	1250
		86J18156-845	1.8	12	4.5	0.82	5.2	2500
		86J18156-460	1.8	12	6	0.41	5.2	2500

Table 36 Match Motor of JMC 2DM880-R/RC Drive (Continued table)

Match Motor of JMC 2DM880-R/RC Drive							
Bedplate		Model	Rotor Inertia (g-cm²)	Insulation Class	Leading wire	Weight (kg)	Length (mm)
Two-phase	86	86J1865-828	950	B	8	2	65
		86J1880-842	1400	B	8	2.3	80
		86J1880-460	1400	B	4	2.3	80
		86J18101-450	2300	B	4	3.25	101
		86J18118-842	2700	B	8	3.8	118
		86J18118-460	2700	B	4	3.8	118
		86J18156-845	4000	B	8	5.4	156
		86J18156-460	4000	B	4	5.4	156

10 Quick Guides

10.1 Hardware Wiring

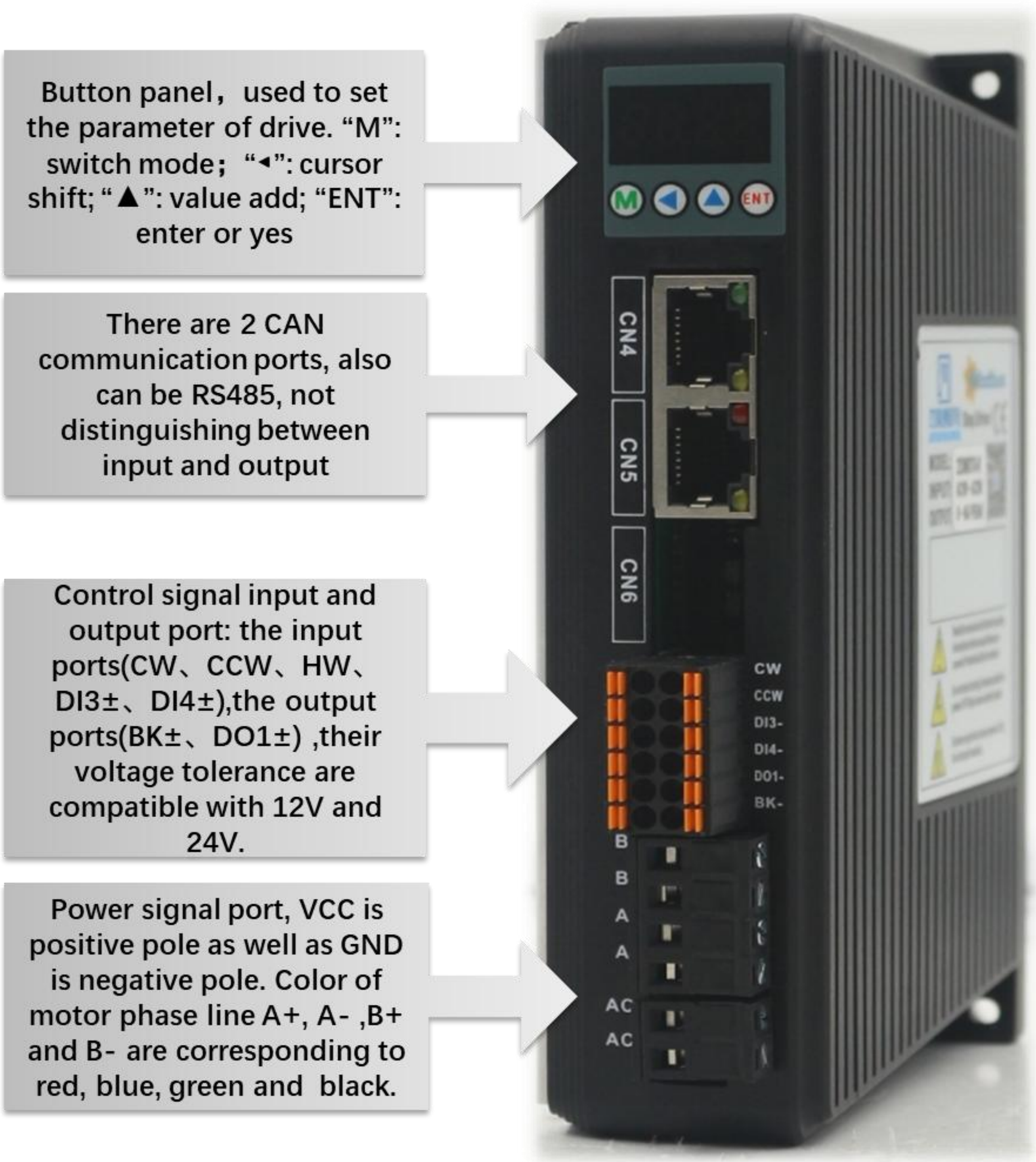


Figure 34 JMC 2DM880-R/RC Practicality

See “*Ports and Connections Introduction*” in this section for the specific definition of each port (Ctrl+ Mouse left or Click text to jump).

10.2 Parameter Setting

The use of the panel of 2DM880-R/RC is basically the same as 2DM556-R/RC. User can go to “*Setting P43 in JMC 2DM556-R/RC Button Panel*” (Ctrl+ Mouse left or Click text to jump) for viewing.

➢ Common Problems and Faults

When the driver fails, the key panel will display an error message, and the user can confirm the problem according to the Failure Alarm code in the panel. For example, after power on, the panel shows "E107", that is, the motor is not enabled, and the error can be cleared after sending enable instructions. At the same time, the user can look up the error by read the object dictionary 0x1001, or read the statusword 0x6041 to see the status of the drive.

1 Power lights don't light

- ✧ Input power failure, please check the power line. Whether the voltage is too low.

2 Power on or run a small angle of rotation alarm

- ✧ Check whether the power line is in good contact;
- ✧ Check whether the power supply voltage is correct;
- ✧ Check whether the phase sequence of the motor is correctly connected.

3 Display an error after power on

- ✧ Check whether the master and slave are communicating normally. If not, check the Slave ID and Baud rate;
- ✧ After baud rate and Slave ID are confirmed, if the communication cannot be established,please check whether the terminal resistor is connected to the network;
- ✧ Check if the statusword has an error alarm. If so, check object dictionary 0x1001 or 0x1003 sub-index 1 to see the error

4 Motor doesn't run after each parameter is given

- ✧ Check whether the given parameters meet requirements;
- ✧ Check if motor is in CCW or CW.

HCS-R/RC bus hybrid stepper servo drive series

➢ Product Introductions

The HCS-R/RC bus hybrid stepper servo drive series is a new CANopen, Modbus-RTU bus simple stepper servo drive that perfectly integrates servo technology, CAN bus and 485 communication control technology. The stepper servo drive adopts the latest 32-bit DSP, integrates the advanced power angle closed-loop control algorithm, CIA301 standard CANOPEN bus communication protocol, Modbus-RTU bus communication protocol and CIA402 control protocol control algorithm, compared with the traditional stepper drive, can effectively avoid the stepper motor step loss problem, and effectively inhibit the motor temperature rise, significantly reduce the motor vibration, greatly enhance the high-speed performance of the motor. The drive cost is 50% of the AC servo system, and the size of the adapted motor is compatible with traditional stepper motors, which is convenient for customers to replace and upgrade. In short, this stepper servo drive integrates the advantages of bus communication control, simple wiring, no step loss, low temperature rise, high speed, high torque, low cost, convenient maintenance and so on, and is a very cost-effective motion control product.

➢ Technical Feature

- Support standard CiA301 CANopen protocol, a maximum of 128 slaves are allowed to connect
- Support standard Modbus-RTUprotocol which can switch with CANopen protocol
- Support standard CiA402 motion control protocol
- Three control modes with Position Mode, Velocity Mode and Homing Mode
- Built-in CW, CCW, SW IO input signal with 5V or 24V for the limit switch and homing
- A BREAK and PEND signal output signal
- RJ45 standard network connection, the slave through the twisted pair cable can be connected
- The maximum transmission frequency is 1Mbps, and the maximum transmission distance is up to 1KM
- Little vibration and smooth running at low speed
- Built-in acceleration and deceleration control to improve startand stop state smoothness
- User-defined subdivisions
- No adjustment in general application
- Loss phase protection, over current protection, over voltage protection

➢ 2HCS-R/RC

1 Electrical, Mechanical and Environmental Specifications

Table 36 Performance of JMC 2HCS-R/RC Drive

Drive model	2HCS528-R/RC	2HCS558-R/RC	2HCS868-R/RC

Input voltage		24~48VDC	24~48VDC	24~110VDC 或 24~70VAC
Continuous Current Input		2.8A	5.8A	6.8A
Communication Type		CANopen /Modbus-RTU（P43 Parameter switching）		
Communication Distance		RS-485 communication：1KM/CAN communication：1KM		
Maximum Number of Slaves		CAN:128/RS485:32		
Maximum Communication rate		RS-485 communication：115200bps/CAN communication：1Mbps		
Logic input current		7~20mA（10mATypical value）		
protection		over current action value is 10A±10%		over current action value is 10A±10%
		Over voltage action value is 60VDC		Over voltage action value is 110VDC
Form factor（mm）		118×75.5×34	118×75.5×34	150.4×115.86×36.90
weight		约 260g	约 260g	约 500g
应用环境	occasion	Avoid dust, oil mist and corrosive gas as far as possible		
	Operating temperature	0~40℃		
	Storage temperature	-20℃~+40℃		
	humidity	40~90%RH		
	Cooling method	Natural cooling or forced cold wind		

2 Machine Dimension Diagrams

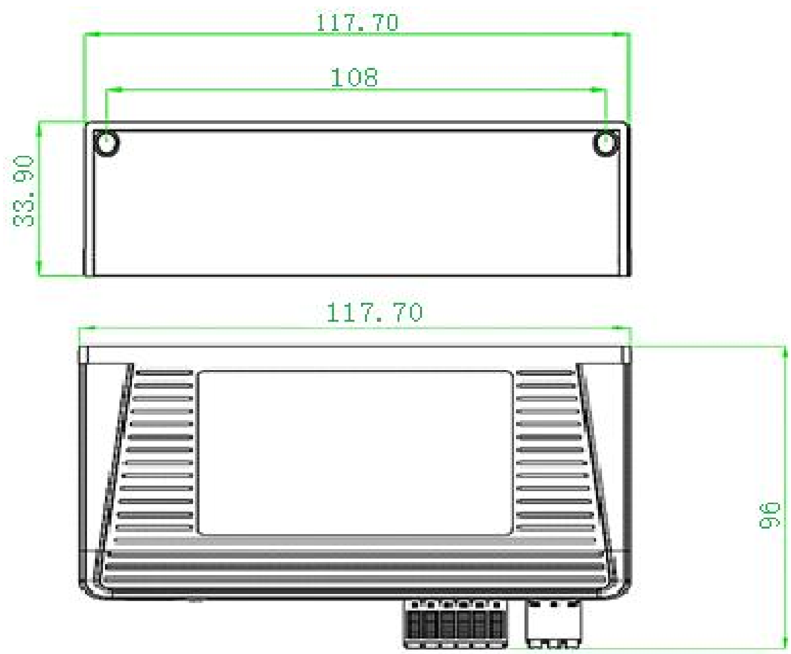


Figure 36 Machine dimension of JMC 2HCS528/558-R/RC Drive (unit: mm)

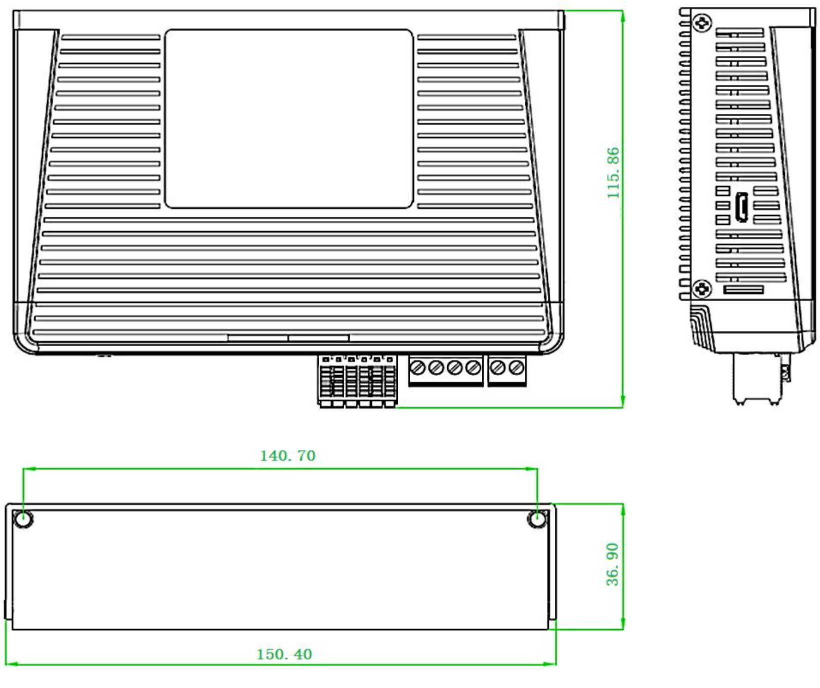


Figure 37 Machine dimension of JMC 2HCS868-R/RC Drive (unit: mm)

When designing the installation size, consider the size of the terminal block and ventilation and heat dissipation.

1) The reliable working temperature of the drive is usually within 60 ° C, and the working temperature of the motor is within 90 ° C;

2) When installing the driver, please use upright side installation to form strong air convection on the surface of the radiator; If necessary, install a fan close to the drive to force heat dissipation to ensure that the drive operates within a reliable operating temperature range.

3 Ports and Connections Introduction

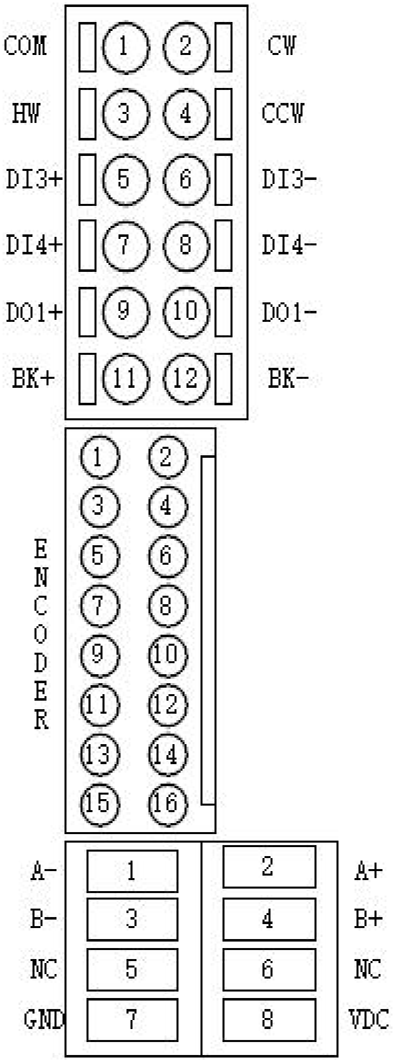


Figure 38Cable-entry of JMC 2HCS525/558-R/RC Drive

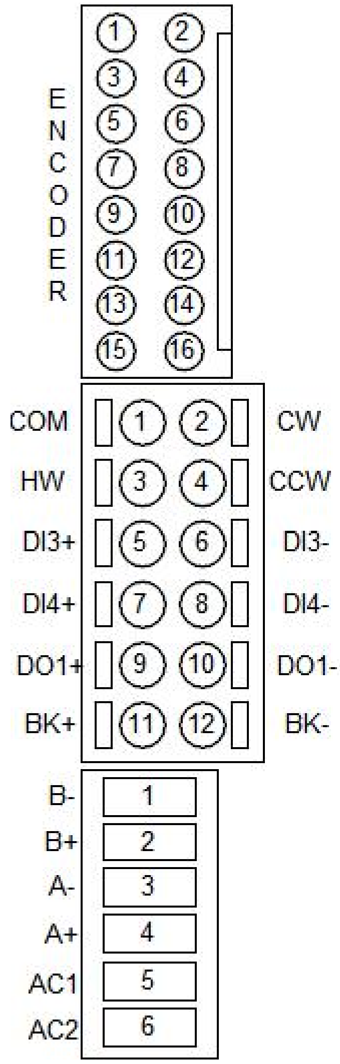


Figure 39 Cable-entry of JMC 2HCS868-R/RC Drive

Note: For communication ports, see "Communication Interface and Wiring" in this article (Ctrl + left mouse button or click text to jump).

3.1 Power Interface port

Table 37 Power Interface port of JMC 2HCS528/558-R/RC Drive

Port	Symbol	Definition	Remark
1	A-	Motor phase A-	Motor Phase A
2	A+	Motor phase A+	
3	B-	Motor phase B-	Motor Phase B
4	B+	Motor phase B+	
7	GND	DC power -	24~48VDC
8	VDC	DC power +	
Notice: The JMC motor wiring colors of motor are red (A+), blue (A-), green (B+), and black (B-) generally. Users can connect the port of JMC drive according to			

this color.If the color is inconsistent with the definition of motor wiring, please call JMC technical service staff.

Table 38 Power Interface port of JMC 2HCS868-R/RC Drive

Port	Symbol	Definition	Remark
1	B-	Motor phase B-	Motor Phase B
2	B+	Motor phase B+	
3	A-	Motor phase A-	Motor Phase A
4	A+	Motor phase A+	
5	DC+	DC power +	24~110VDC or 20~70VAC
6	GND	DC power -	
Notice: The JMC motor wiring colors of motor are red (A+), blue (A-), green (B+), and black (B-) generally. Users can connect the port of JMC drive according to this color.If the color is inconsistent with the definition of motor wiring, please call JMC technical service staff.			

3.2 Encoder signal port

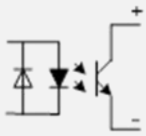
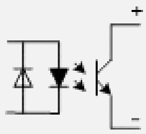
Table 39 2HCS-R/RC encoder signal ports

Pin number	Signal	description
1	EA+	Encoder A+
2	EA-	Encoder A-
3	EB+	Encoder B+
4	EB-	Encoder B-
5	EZ+	Encoder Z+
6	EZ-	Encoder Z-
7	VCC	Encoder Power +5V
8	GND	Encoder GND

3.3 IO signal port

Table 40 2HCS-R/RC IO signal ports

Port	Symbol	Definition	description
1	COM	Common (cathode/anode)	0V/24VDC
2	CW	Clockwise Limit	Input 12~24VDC (Compatible with 5V, but not recommended)
3	HW	Home Limit	
4	CCW	Counter Clockwise Limit	
5	DI3+	keep	
6	DI3-	keep	
7	DI4+	keep	
8	DI4-	keep	

9	DO1+ /ALM+	Position/Alarm signal output +	 The bidirectional optical coupling. Compatible with12~24VDC
10	DO1- /ALM-	Position/Alarm signal output —	
11	BK+	Brake signal output +	 The bidirectional optical coupling. Compatiblewith 12~24VDC
12	BK-	Brake signal output -	

3.4 IO signal wiring circuit diagram

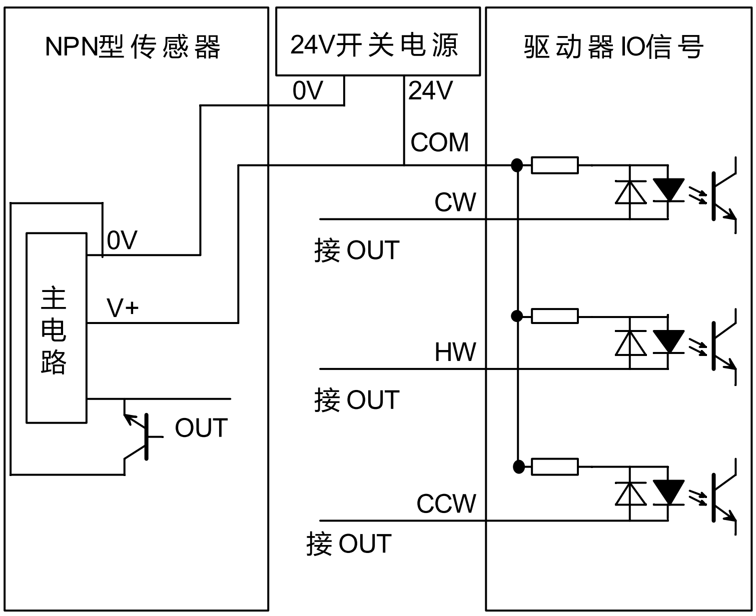


Figure 40 2HCS-R/RC input signal common anode connection

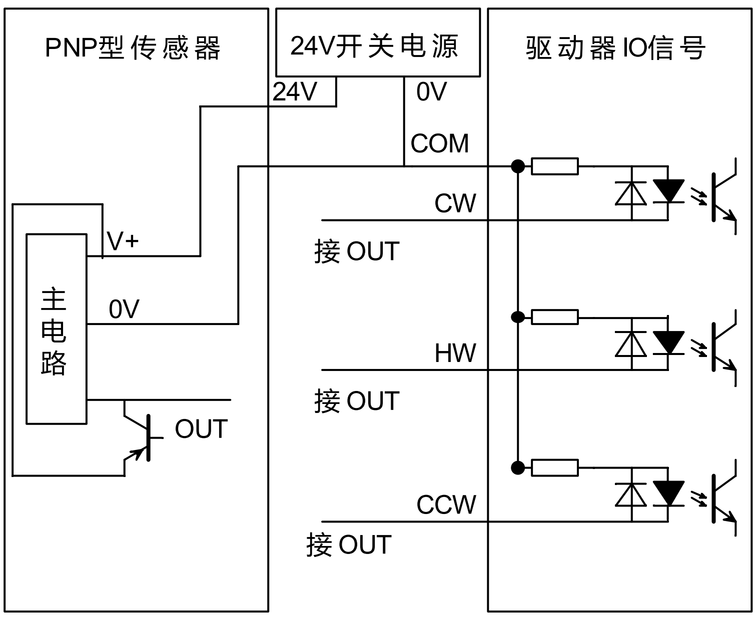


Figure 41 2HCS-R/RC input signal common cathode connection

Note: 1. As shown in the figure, there is only one OUT for one sensor, and if CW, HW, and CCW are all used, 3 sensors are required.

2. The control signal level can be compatible with 0V ground or 24V.

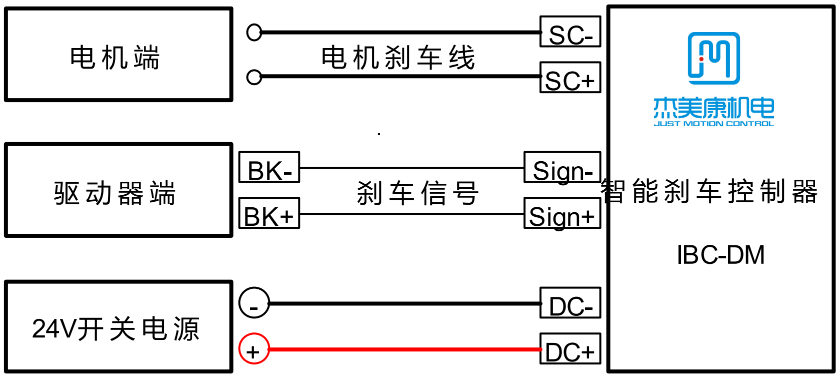


Figure 42 2HCS-R/RC brake wiring (JMECOM intelligent brake controller connection)

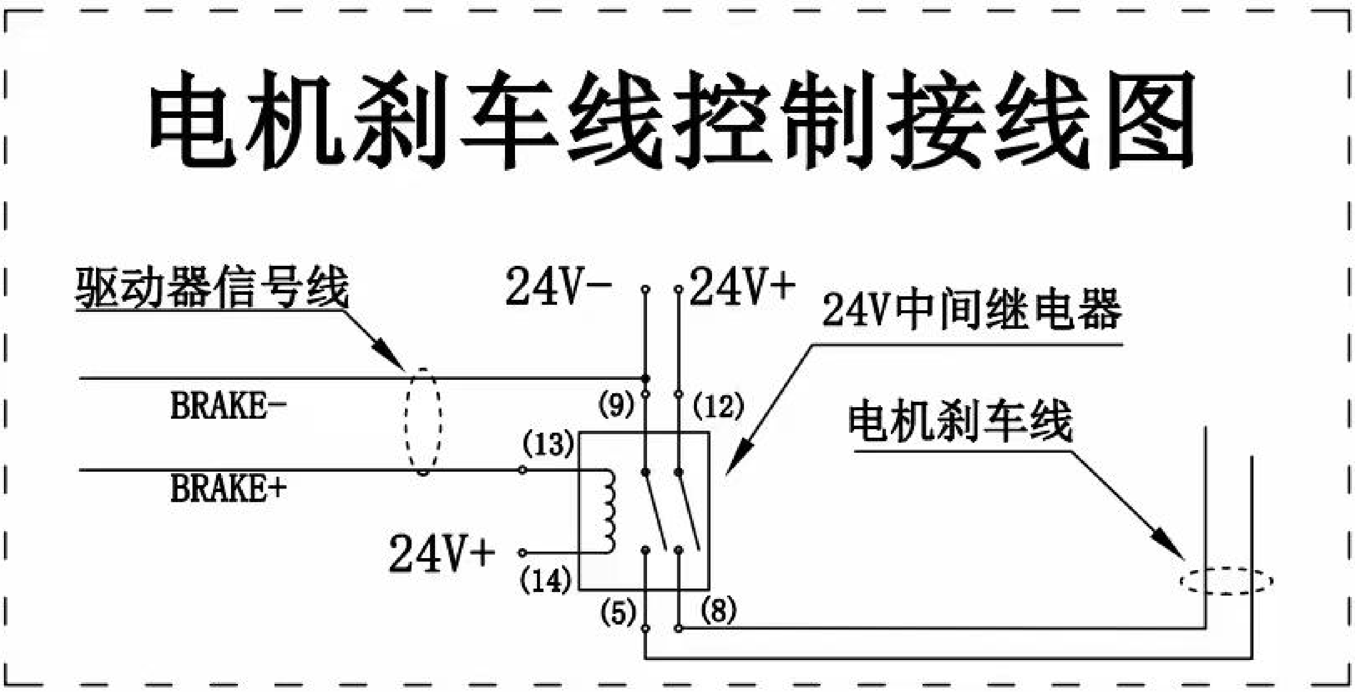
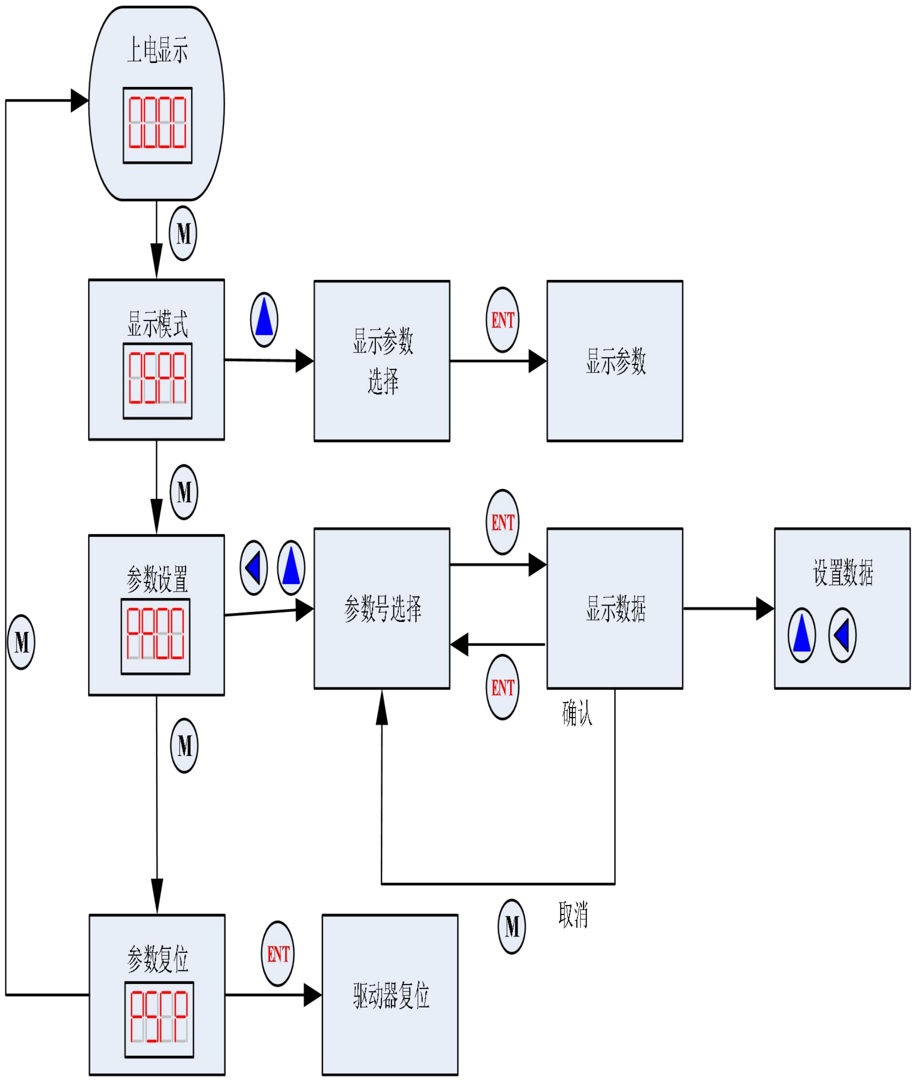


Figure 43 2HCS-R/RC brake wiring (relay connection)

4 Typical application wiring diagrams

A typical wiring diagram consisting of a 2HCS-R/RC driver, etc., is shown



below.

Figure 44 Typical application wiring diagram of JMC 2HCS528/558-R/RC Drive

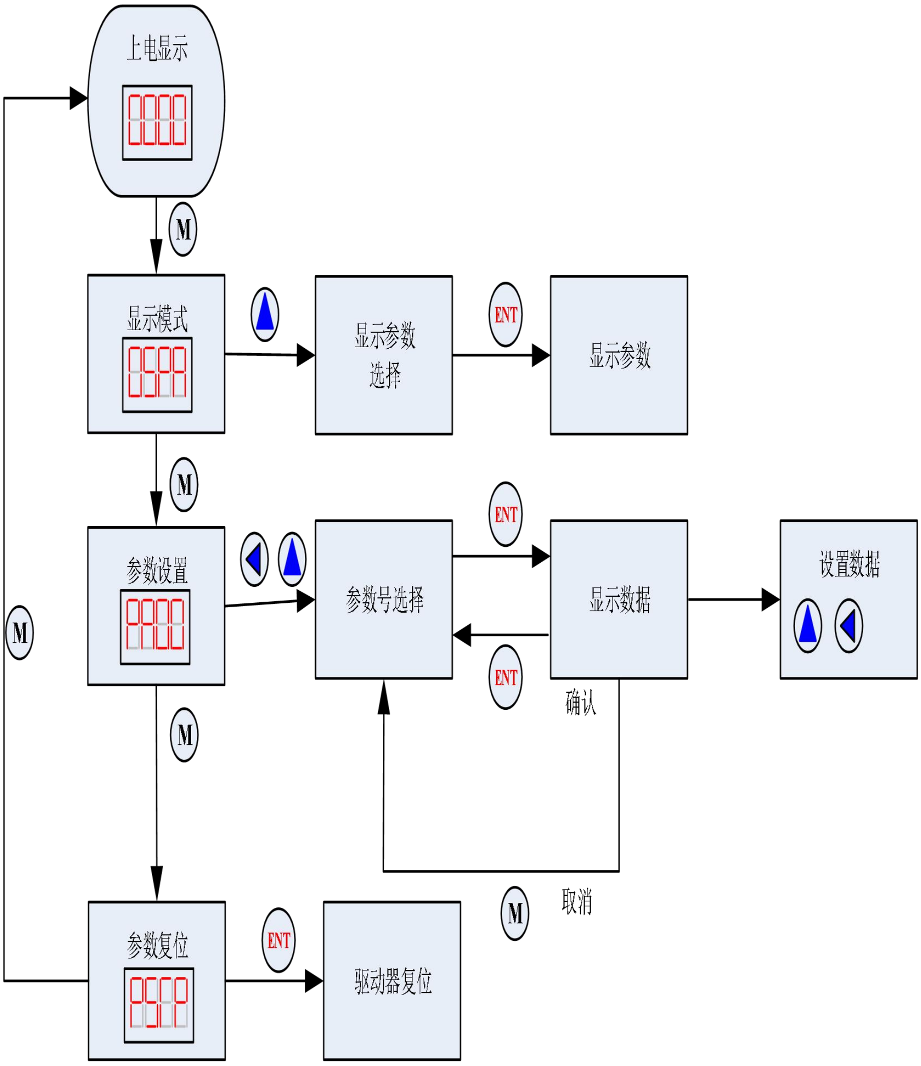


Figure 44 Typical application wiring diagram of JMC 2HCS868-R/RC Drive

Note:

1) The brake signal for motor brake control requires external relay control, and the maximum passing current is 50mA.

2) RJ45 network interface is connected to other slaves through standard twisted pair network cable, and there is no special difference between the two network ports.

3) CANopen communication CANH and CALL access 120 ohm resistance.

5 Parameters Configure of Drive

There two methods to configure parameters of 2HCS-R/RC. One is set the parameters through the front panel; the other way is to connect it with the HISU. A set of the best default configure parameters has already set in the drive. User need only to configure the parameter Pulses/revolution. The detail functions are as follows:

Actual value = Set value ×the corresponding dimension

Table 41 Internal parameter of JMC 2HCS-R/RC Drive

Parm	Definition	Range	Dimension	Restart Drive	Default Value
P1	Current loop Kp	0—4000	1	NO	1000
P2	Current loop Ki	0—1000	1	NO	100

P3	**Damping coefficient**	0—500	1	NO	30
P4	**Position loop Kp**	0—3000	1	NO	2000
P5	**Position loop Ki**	0—1000	1	NO	200
P6	**Speed loop Kp**	0—3000	1	NO	500
P7	**Speed loop Ki**	0—1000	1	NO	1000
P8	**Open-loop current**	0—60	0.1	NO	30
P9	Closed-loop current	0—40	0.1	NO	20
P10	Alarm level	0—1	1	YES	0
P11	Direction level	0—1	1	YES	1
P12	Manufacturer	keep	keep	keep	keep
P13	Manufacturer	keep	keep	keep	keep
P14	Levels in place	0—1	1	YES	0
P15	Manufacturer	keep	keep	keep	keep
P16	Location out-of-tolerance value	0-3000	10	YES	400
P17	Segmentation selection	0—15	1	YES	10
P19	Instruction smoothing	0—10	0	NO	7
P20	User-defined segments	4—1000	50	YES	0
P21	Manufacturer	keep	keep	keep	keep
P22	Manufacturer	keep	keep	keep	keep
P23	Manufacturer	keep	keep	keep	keep
P24	Manufacturer	keep	keep	keep	keep
P25	Open-loop overlay ratio	0—40	1	NO	10
P26	Stop damping	0—500	1	NO	200
P27	Drive open/closed loop	0—1	1	YES	1
P28	Manufacturer	keep	keep	keep	keep
P29	Manufacturer	keep	keep	keep	keep
P30	Phase loss detection	0—1	1	YES	1
P31	Manufacturer	keep	keep	keep	keep
P32	Manufacturer	keep	keep	keep	keep
P33	Manufacturer	keep	keep	keep	keep
P34	Manufacturer	keep	keep	keep	keep
P35	Manufacturer	keep	keep	keep	keep
P36	**Semi-flow time**	0—60000	ms	NO	1000
P37	**Semi-flow percent**	0—100	1%	NO	50

P38	Alarm history 1				
P39	Alarm history 2				
P40	Drive letter settings	1—127	1	YES	1
P41	Slave baud rate setting	0—7	1	YES	6
P42	IO signal polarity selection	0—1	1	YES	1
P43	Communication method selection	0—1	1	YES	1
P44	Limit signal upload	0—1	1	YES	0
P45	Enter the speed unit	0—1	1	YES	0

the following parameters can be modified by the user through the front panel of the drive or downloaded to the drive via HISU. The settings for each parameter are described below:

- ✧ Parameter P1 is used to set the current loop proportional gain parameter.
- ✧ Parameter P2 is used to set the current loop integral gain parameter.
- ✧ Parameter P3 is used to set the drive damping coefficient parameter.
- ✧ Parameter P4 is used to set the position loop proportional gain parameter.
- ✧ Parameter P5 is used to set the positional ring integral gain parameter.
- ✧ Parameter P6 is used to set the speed loop proportional gain parameter.
- ✧ Parameter P7 is used to set the speed loop integral gain parameter.
- ✧ Parameter P8 is used to set the open-loop current.
- ✧ Parameter P9 is used to set the closed-loop current.
  Closed-loop control current (actual current = open-loop current + closed-loop current).
- ✧ Parameter P10, for alarm output level selection, parameter 0 indicates normal working time coupling output transistor cut-off; Driver alarm time-coupling output transistor on. Vice versa.
- ✧ Parameter P11, used for direction level selection, through the setting of this parameter, the control direction of the control terminal level can be changed.
- ✧ Parameter P14, select the output level in place, 0 means that the driver meets the time coupling output transistor cutoff when it meets the position condition; The time-coupling output transistor is on when the conditions in place are not met. Vice versa.
- ✧ Parameter P16, which sets the threshold for position out-of-tolerance (actual value = setpoint ×10).
- ✧ Parameter P17, subdivision settings of the drive.

Table 42 2HCS-R/RC driver parameters P17: Subdivision parameters

parameter	0	1	2	3	4	5	6	7
Number of segments	Custom segments	800	1600	3200	6400	12800	25600	51200
parameter	8	9	10	11	12	13	14	15
Number of segments	1000	2000	4000	5000	8000	10000	20000	40000

Tip: In addition, the driver also provides the user with any subdivision that can be freely set, and the specific parameters are set by mode P20.

✧ Parameter P19, instruction smoothing coefficient

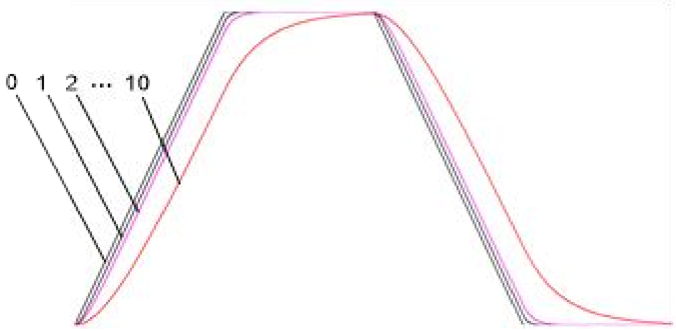


Figure 46 2HCS-R/RC driver parameter P19: Instruction smoothing coefficient

✧ Parameter P20 for user-defined number of segments. (Number of subdivisions = setpoint * 50, P17 needs to be set to 0 first).

✧ Parameter P30, driver phase loss detection, 1 means on, 0 means off. Limited to factory maintenance and use.

✧ Parameter P36, half-flow time, in ms. The default 1000 means that after the motor stops for 1000ms. Parameter P37, percentage of half stream, unit 1%. The default is 50, which means that the stop current is 50% of the set current.

Current when the motor is stopped = set current (P8) * percentage of half current (P37).Parameters 38, 39 for viewing drive alarm records.

✧ Parameter P40, slave station number setting, can set the station number from 1-127 station numbers. After setting, it needs to be powered back on before this parameter is used.

✧ Parameter P41, slave baud rate setting, can set the station number from 0-7 and other 8 gears, each gear corresponds to a different baud rate. After setting, it needs to be powered back on before this parameter is used.

Table 43 2HCS-R/RC Drive Parameter P41: Baud Rate Settings

P41 baud rate	0	1	2	3	4	5	6	7
CAN（Kbps）	12.5	20	50	100	200	250	500	1000
485（bps）	1200	2400	4800	9600	19200	38400	57600	115200

✧ Parameter P42, IO signal input polarity, P42=0: signal input is normally closed type; P43=1: The signal input is normally open. After setting, it needs to be powered back on before this parameter is used.

✧ Parameter P43, communication mode selection, P43=0: select 485 communication, P43=1: select CANopen communication.

✧ Parameter P44, limit signal upload, P44=0: limit signal is not written to 60FD, P44=1: limit signal is written to 60FD.

✧ Parameter P45, input speed unit, P45=0: unit is 0.1 (RPS),

P45=1: The unit is 1/number of subdivisions (RPS).

6 Button panel and parameter adjustment method

6.1 Button Panel

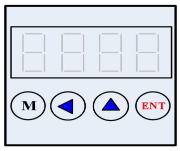


Figure 47 Button Panel of JMC 2HCS-R/RC Drive

The Button panel consists of 4 keys and 4 LED displays. 2DM880-R/RC with LED indicating power supply and display status, panel operation as shown in the figure. Select the display mode through the key ‘M’ and monitor the running state of the motor through the ‘▲’ and ‘◂’ keys. The following table is the meaning for each monitoring code.

Table 44 Monitoring code of JMC 2DM880-R/RC Button Panel

Display	88rc	PA00	EXXX	PSΓP
Meaning	2DM880-R/RC	Parameter	Error	Reset

【1】Move Key

‘◂’: Shift;

‘▲’: Adjust parameter

【2】Function Key

‘ENT’: Enter or Ensure

‘M’: Switch mode or Cancel

Notice:Switch to parameter display function through ‘M’;Use ‘ENT’ key to view parameter value, press ‘▲’ key switch function; Exit this function and go to the next function to press the ‘M’ key.

6.2 Button Panel Operation

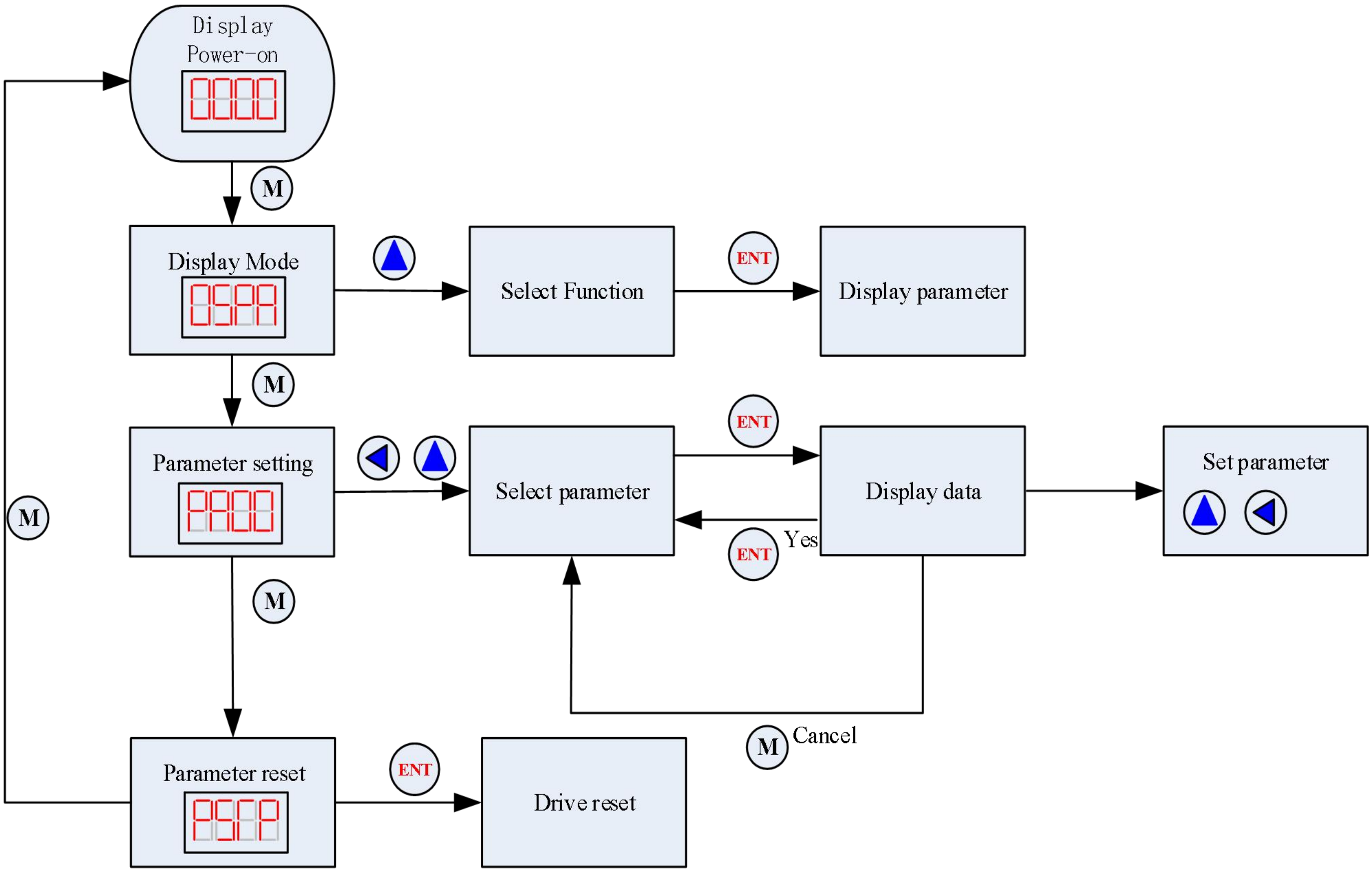


Figure 48 Operation of JMC 2HCS-R/RC Button Panel

6.3 Operation Example

1) Mode Configure Operation

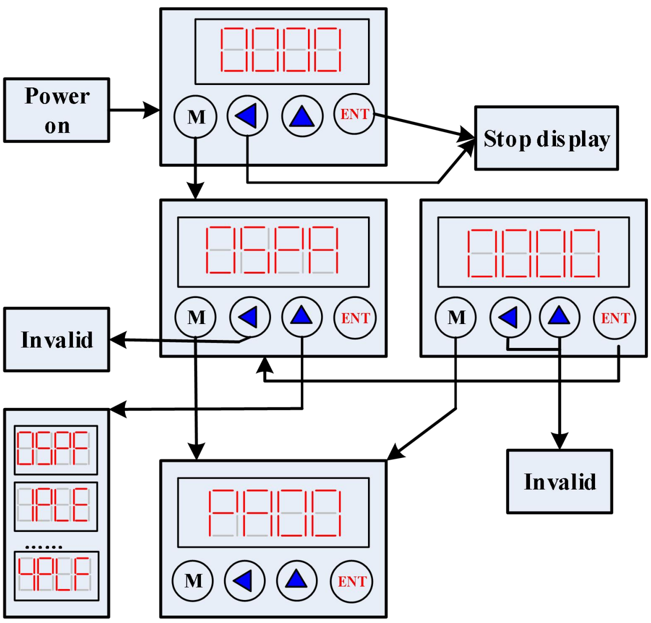


Figure 49 Mode Configure Operation of JMC 2HCS-R/RC Panel

7 Fault alarm

Table 45 Failure Alarm of JMC 2HCS-R/RC Drive

Display	Description	Can be Cleared
E101	Over current Error	NO
E102	Reference voltage Error	NO
E103	Parameter read\write Error	NO
E104	Over voltage Error	NO
E105	Loss phase Error	NO
E106	Over position error	YES
E107	Motor enable	YES

8 RS485 communication parameter setting

When RS485 communication mode is used by the drive, communication parameters of the upper computer or other communication stations shall be set in advance. The default configuration parameters of the driver are as follows:

Table 46 RS485 Communication Parameter Setting of JMC 2HCS-R/RC Drive

Parameter	Baud Rate	Start	Data	Stop	Check
Value	0~115200bps	1Bit	8Bit	1Bit	None

The baud rate is determined based on the user's settings for the setup drive.

Table 47 2HCS-R/RC Drive Parameter P41: Baud Rate Settings

P41 baud rate	0	1	2	3	4	5	6	7
CAN（Kbps）	12.5	20	50	100	200	250	500	1000
RS485（bps）	1200	2400	4800	9600	19200	38400	57600	115200

9 Adapt the motor

Table 48 Match Motor of JMC 2HCS528-R/RC Drive

Bedplate		Model	Step Angle（deg）	Static Moment（N·m）	Rated Current（A）	Rotor inertia（g-cm²）	weight（kg）	length（mm）
Two phases	42	42J1848EC-1000(*)	1.8	0.48	1.5	80	0.45	48
		42J1860EC-1000	1.8	0.7	2.5	110	0.55	60

Table 49 Match Motor of JMC 2HCS558-R/RC Drive

Bedplate		Model	Step Angle（deg）	Static Moment（N·m）	Rated Current（A）	Rotor inertia（g-cm²）	weight（kg）	length（mm）
	57	57J1854EC-1000(*)	1.8	0.9	4	280	38.1	54

		57J1880EC-1000(*)	1.8	2	5	480	38.1	80
		57J18100EC-1000	1.8	2.8	5			100
	60	60J1856EC-1000	1.8	1.5	3.5	340	0.9	56
		60J1887EC-1000(*)	1.8	3	5	690	1.45	87
		60J18100EC-1000	1.8	3.5	5	1200	1.9	100

Table 50 Match Motor of JMC 2HCS868-R/RC Drive

Bedplate		**Model**	**Step Angle（deg）**	**Static Moment（N·m）**	**Rated Current（A）**	**Rotor inertia（g-cm²）**	**weight（kg）**	**length（mm）**
Two phases	86	86J1880EC-1000(*)	1.8	4.5	6	1400	2.4	80
		86J1895EC-1000(*)	1.8	6.5	6	2200	3.4	95
		86J18118EC-1000(*)	1.8	8.5	6	2700	3.9	118
		86J18156EC-1000(*)	1.8	12	6	4000	5.3	156

HSS-R/RC Bus-based Hybrid Digital Stepper Servo Drive

➢ Product Introductions

The HSS-R/RC hybrid stepper servo drive system integrates the servo control technology, CAN and 485 Bus into the digital stepper drive perfectly.

The drive adopts latest 32bit DSP, advanced power angle closed-loop control, CANopen and Modbus-RTU communication control technologyand CIA402 motion control protocol, compared with the traditional stepper drive with lower cost and more convenient installation, but also can effectively restrain the motor temperature rise, greatly enhance the performance of high speed, significantly to reduce the vibration of the motor and the wiring complexity of equipment.

Its cost is 50% of AC Servo System and fit motor size, compatible with traditional stepper motor to convenient for customers to upgrade equipment.

It integrates bus communication control technology, simple wiring, no losing step, lower heat, high speed, big torque and low cost. These are cost-effective motion control products.

➢ Technical Feature

- ✧ No lost step,accurate positioning
- ✧ Support standard CiA301 CANopen protocol, a maximum of 128 slaves are allowed to connect
- ✧ Support standard Modbus-RTU protocol which can switch with CANopen protocol
- ✧ Support standard CiA402 motion control protocol
- ✧ Three control modes with Position Mode, Velocity Mode and Homing Mode
- ✧ Built-in CW, CCW, SW IO input signal with 5V or 24V for the limit switch and homing
- ✧ A BREAK and PEND signal output signal
- ✧ RJ45 standard network connection, the slave through the twisted pair cable can be connected
- ✧ The maximum transmission frequency is 1Mbps, and the maximum transmission distance is up to 1KM
- ✧ 100% rated torque drive motor
- ✧ Electro-rheology control technology, high efficiency
- ✧ Little vibration and smooth running at low speed
- ✧ User-defined subdivisions
- ✧ Compatible 1000 and 2500 pulses encoders
- ✧ No adjustment in general application
- ✧ Loss phase protection, over current protection, over voltage protection and over position error protection
- ✧ 6 LED digital display, it is convenient to set parameters and monitor the running state of motor

➢ 2HSS458-R/RC

1 Electrical, Mechanical and Environmental Specifications

Table 37 Performance of JMC 2HSS458-R/RC Drive

Input voltage		24~48VDC
Continuous Current output		0~6.0A
Communication Type		CANopen /Modbus-RTU
Communication Distance		1KM
Maximum Number of Slaves		128/32
Maximum Communication rate		1000Kbps/115200bps
Logic Input Current		7~20mA (Typical value 10mA)
Protect		The peak of over current action value is 10A±10%
		Over voltage action value is70VDC
Shape Size(mm)		125×101×48
Weight		Approximately 280g
Environmental Conditions	Working Occasion	Avoid dust, oil mist and corrosive gas as far as possible
	Working Temperature	0~40℃
	Storage Temperature	-20℃~+40℃
	Working Humidity	40~90%RH
	Cooling mode	Natural cooling or forced cold wind

2 Machine Dimension Diagrams

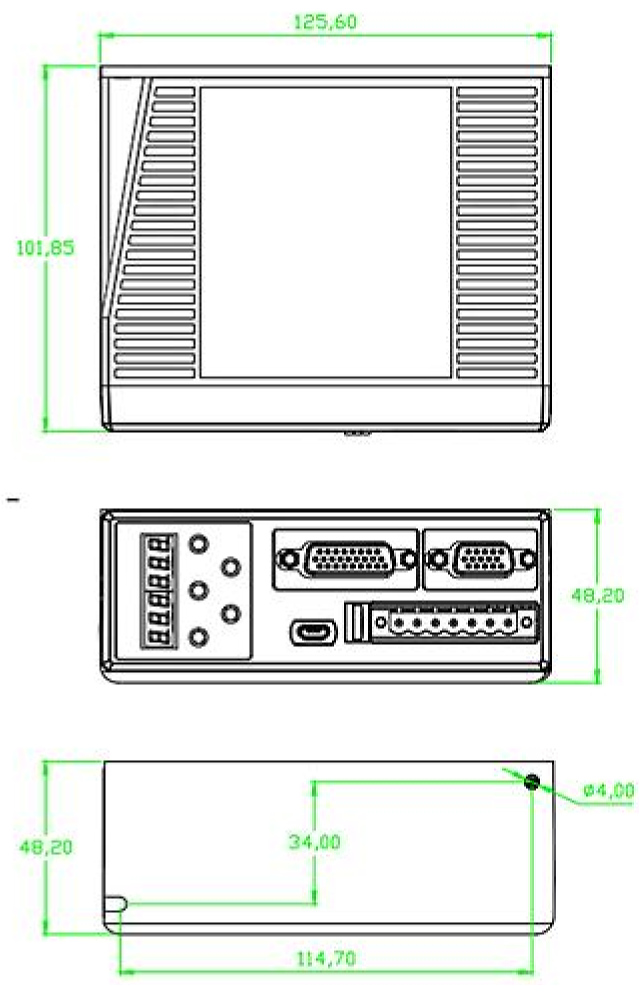


Figure 35 Machine dimension of JMC 2HSS458-R/RC Drive (unit: mm)

Notice: Please take the terminal size and ventilation cooling while design the installation size.

- ✧ Drive's reliable working temperature should be <60°C, and motor working temperature should be <90°C;
- ✧ It is recommended to mount the drive vertically to maximize heat sink area. Use forced cooling method to cool the system if necessary.

3 Ports and Connections Introduction

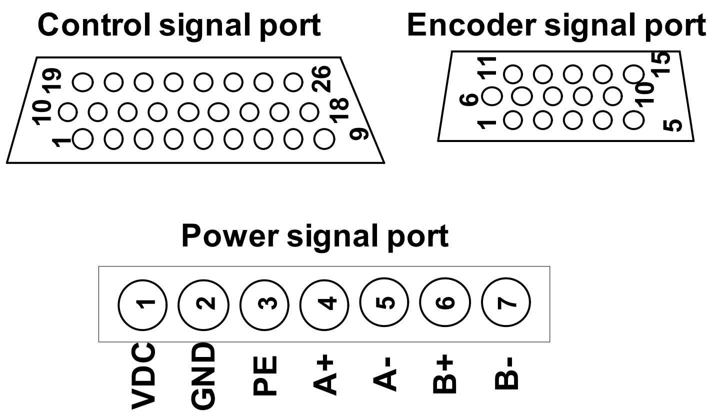


Figure 36 Cable-entry of JMC 2HSS458-R/RC Drive

PS: About Communication port, please refer to "*Communication Interface and Wiring*" (Ctrl+ Mouse left or Click text to jump).

3.1 Power Interface Port

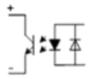
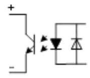
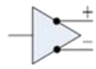
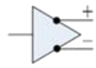
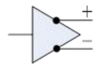
Table 38 Power Interface port of JMC 2HSS458-R/RC Drive

Port	Symbol	Definition	Remark
1	VDC	DC power +	24~48VDC
2	GND	DC power -	
3	PE	Protecting earthing	-
4	A+	Motor phase A+	Motor Phase A
5	A-	Motor phase A-	
6	B+	Motor phase B+	Motor Phase B
7	B-	Motor phase B-	
Notice: The JMC motor wiring colors of motor are red (A+), blue (A-), green (B+), and black (B-) generally. Users can connect the port of JMC drive according to this color.If the color is inconsistent with the definition of motor wiring, please call JMC technical service staff.			

3.2 Control Signal Port

Table 39 Control Signal Port of JMC 2DM522-R/RC Drive

Port	Symbol	Definition	Remark
1	EN+	-	Reserve
2	EN-	-	Reserve
3	DI3+	-	Reserve
4	DI3-	-	
5	DI4+	-	Reserve
6	DI4-	-	
7	CCW+	Counter Clockwise Limit+	Input 12~24VDC

8	CCW-	Counter Clockwise Limit-	(Compatible with 5V, but not recommended)
9	HW+	Home Limit	
10	HW-	Home Limit	
11	CW+	Clockwise Limit+	
12	CW-	Clockwise Limit-	
13	NC	Not Connect	-
14	ALM+/BRK+	Alarm/Brake signal output +	 5V~24VDC
15	ALM-/BRK-	Alarm/Brake signal output -	
16	PEND+	Position signal output +	 5V~24VDC
17	PEND-	Position signal output -	
18	SGND	Signal ground	-
19	+5V	Signal power	-
20	OUTA+	Encoder channel A output+	
21	OUTA-	Encoder channel A output-	
22	OUTB+	Encoder channel B output+	
23	OUTB-	Encoder channel B output-	
24	OUTZ+	Encoder channel Z output+	
25	OUTZ-	Encoder channel Z output-	
26	SGND	Signal ground	-

3.3 Encoder Signal Port

Table 40 Encoder Signal Port of JMC 2HSS458-R/RC Drive

PIN	Symbol	Definition
1	EA+	Encoder channel A input+
2	EB+	Encoder channel Binput+
3	GND	Ground
11	EA-	Encoder channel A input-
12	EB-	Encoder channel A input-
13	VCC	+5V

3.4 Connections to Control Signal

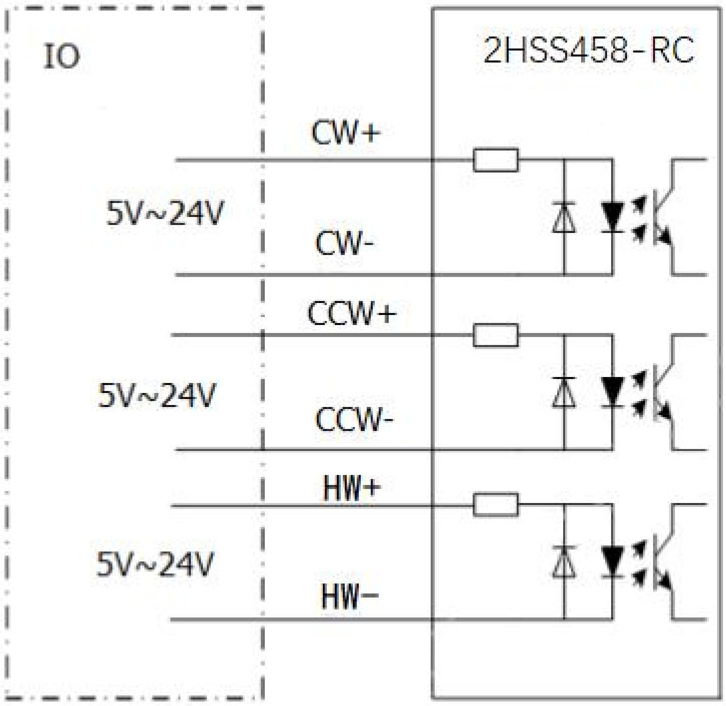


Figure 37 Connections to differential signals

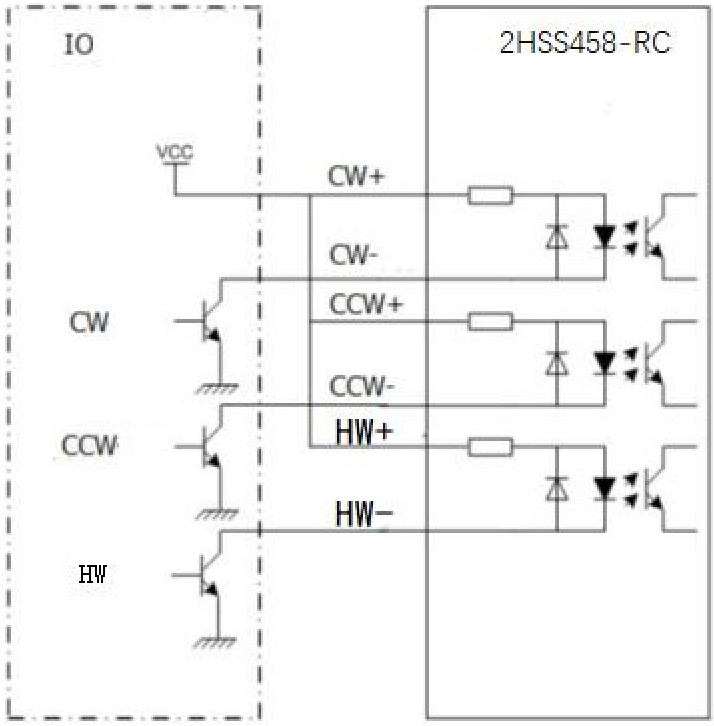


Figure 38 Connections to common anode

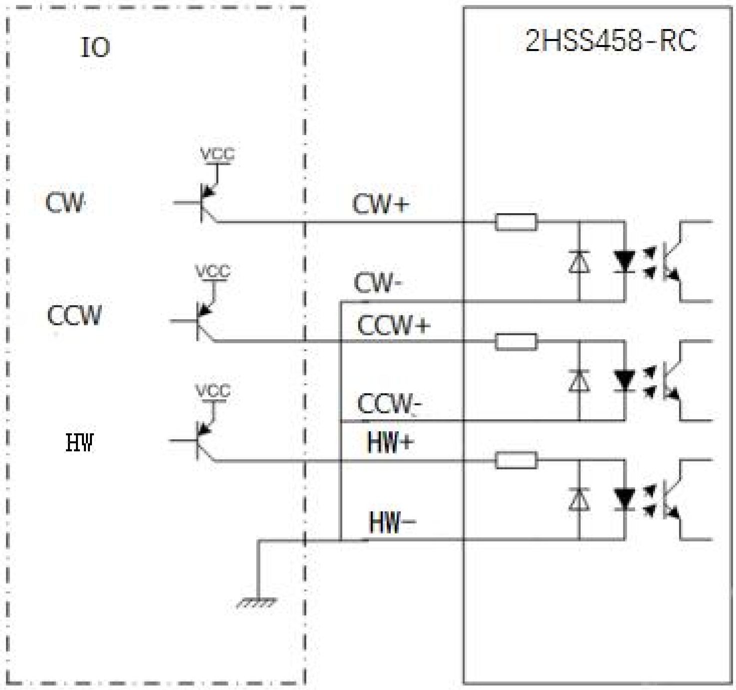


Figure 39 Connections to common cathode

4 Typical application wiring diagrams

A typical connection diagram made up of the 2HSS458-R/RC drive as follow. The power supply selects DC24~48V according to the voltage level of the matched motor.

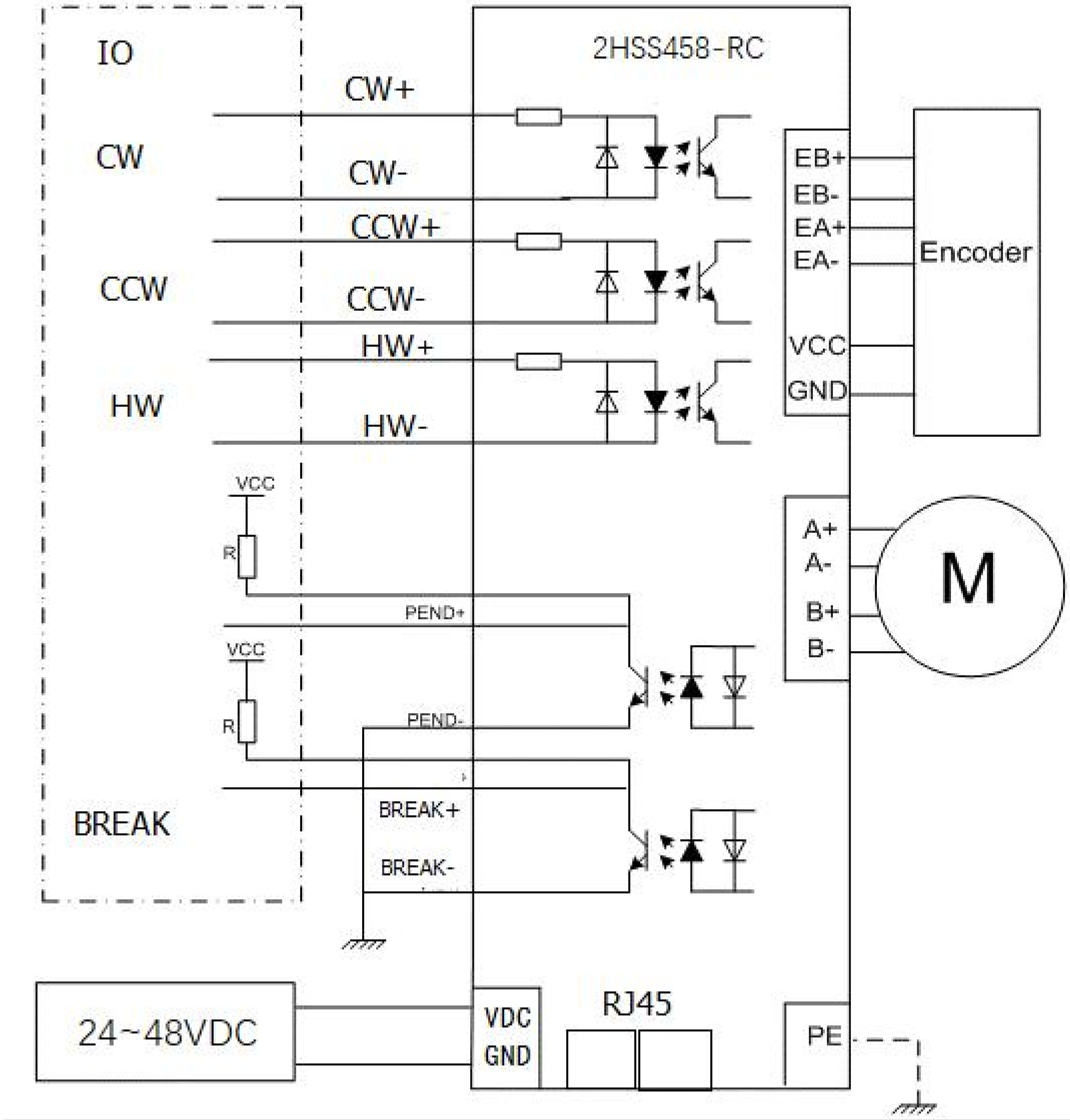


Figure 40 Typical application wiring diagram of JMC 2HSS458-R/RC Drive

Notice:

- ✧ BREAK signal to control motor brake, it needs external relay, the maximum current is 50mA.
- ✧ RJ45 network interface through the standard twisted pair cable connected to the other slave, no special difference between the two network ports.

5 Parameters Configure of Drive

There two methods to configure parameters of 2HSS458-R/RC. One is set the parameters through the front panel; the other way is to connect it with the HISU. A set of the best default configure parameters has already set in the drive. User need only to configure the parameter Pulses/revolution. The detail functions are as follows:

Actual value = Set value × the corresponding dimension

Table 41 Internal parameter of JMC 2HSS458-R/RC Drive

Parm	Definition	Range	Dimension	Restart Drive	Default Value
P1	Current loop Kp	0—4000	1	No	1000
P2	Current loop Ki	0—1000	1	No	100

P3	Damping coefficient	0—500	1	No	250
P4	Position loop Kp	0—3000	1	No	2000
P5	Position loop Ki	0—1000	1	No	200
P6	Speed loop Kp	0—3000	1	No	500
P7	Speed loop Ki	0—1000	1	No	1000
P8	Open-loop current	0—60	0.1	No	40
P9	Close-loop current	0—40	0.1	No	20
P10	Manufacturer	Reserve	Reserve	Reserve	Reserve
P11	Direction level	0—1	1	No	1
P12	Manufacturer	Reserve	Reserve	Reserve	Reserve
P13	Manufacturer	Reserve	Reserve	Reserve	Reserve
P14	Arrival level	0—1	1	No	0
P15	Manufacturer	Reserve	Reserve	Reserve	Reserve
P16	Position error limit	0—3000	10	No	400
P17	Pulses/Revolution	0—15	1	Yes	2
P18	Manufacturer	Reserve	Reserve	Reserve	Reserve
P19	Speed smoothness	0—10	0	No	2
P20	User-defined p/r	4—1000	50	Yes	8
P21	Display information	0—4	1	No	0
P22	Pulse filter	0—3	1	No	0
P23	Lock shaft	0—1	1	No	0
P24	Manufacturer	Reserve	Reserve	Reserve	Reserve
P25	Overlay proportion	0—40	1	No	10
P26	Stop damping	0—500	1	No	200
P27	Low-speed damping	0—500	1	No	50
P28	Manufacturer	Reserve	Reserve	Reserve	Reserve
P29	Manufacturer	Reserve	Reserve	Reserve	Reserve
P30	Lost phase	0—1	1	Yes	1
P31	Manufacturer	Reserve	Reserve	Reserve	Reserve
P32	Manufacturer	Reserve	Reserve	Reserve	Reserve
P33	Manufacturer	Reserve	Reserve	Reserve	Reserve
P34	Manufacturer	Reserve	Reserve	Reserve	Reserve
P35	Manufacturer	Reserve	Reserve	Reserve	Reserve
P36	Semi-flow time	0—60000	MS	No	500
P37	Semi-flow percent	0—100	1%	No	50
P38	Manufacturer	Reserve	Reserve	Reserve	Reserve
P39	Manufacturer	Reserve	Reserve	Reserve	Reserve
P40	Slave ID	1—128	1	Yes	0
P41	Slave baud rate	0—7	1	Yes	0
P42	IO signal polarity	0—1	1	Yes	1
P43	Communication mode	0—1	1	Yes	1
P44	Limit signal upload	0—1	1	No	0
P45	Target speed unit	0—1	1	No	0

Those parameters can be set by using Button Panel, can also be set by using HISU adjuster. The detail descriptions to every parameter configuration are as follows:

- ✧ **P1~7**are used to change parameters of current loop, damping, position loop and speed loop.
- ✧ **P8**,this parameter affects the static torque of the motor.
  P9, this parameter affects the dynamic torque of the motor.
  (The actual current = open loop current + close loop current)
- ✧ **P10** is set to control the Alarm optocoupler. Output transistor 0 means the transistor is cut off when the system is in normal working, but when it comes to fault of the drive, the transistor becomes conductive. 1 means opposite to 0.
- ✧ **P11** is used to control direction level. By this parameter, drive's default orientation can be changed.
- ✧ **P14** is set to control the Arrival optocoupler output transistor. 0 means the transistor is cut off when the drive satisfies the arrival command, but when it comes to not, the transistor becomes conductive. 1 means opposite to 0.
- ✧ **P16,**the limit of the position following error. When the actual position error exceeds this value, the drive will go into error mode and the fault output will be activated (The actual value = the set value× 10).
- ✧ **P17** is used to select pulses.It shall restart.

Table 42 P17 of JMC 2HSS458-R/RC: Pulses/Revolution

Parameter	0	1	2	3	4	5	6	7
Pulses	user-def	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
Pulses	1000	2000	4000	5000	8000	10000	20000	40000

Notice: In addition, the drive provides users with pulses that they can set up freely via parameter 20.

- ✧ **P18** is used to select single pulse or double pulse. 1 means single pulse and direction, while 0 means double pulse.
- ✧ **P19**, Speed smoothness, this parameter is set to control the smoothness of the speed of the motor while acceleration or deceleration, the larger the value, the smoother the speed in acceleration or deceleration.

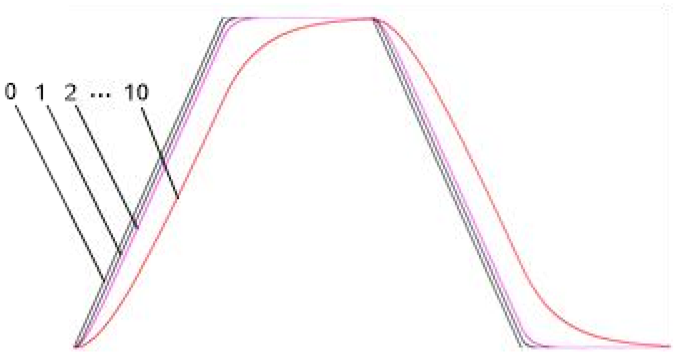


Figure 41 P19 of JMC 2HSS458-R/RC Drive: Speed smoothness

- ✧ **P20** is used to set up user-defined pulses.It shall restart.
- ✧ **P21** is used to select display information.

Table 43 P21 of JMC 2HSS458-R/RC Drive: Display information

Parameter	0	1	2	3	4
Display	Reference Velocity	Velocity Feedback	Position Error	Reference Position	Position Feedback

- ✧ **P22** is Pulse filter, setting 0~3. As the value increases, the frequency of the passing pulse decreases gradually. This is used to suppress the electronic interference generated in the environment.
- ✧ **P23** is Stop lock enable. This parameter is set to the drive not count external pulses and lock shaft or not.1 means enable this function while 0 means disable it.

✧ **P30** is used to check whether the motor is out of phase.1 means used, while 0 means not used. But this is for manufacturer only.It shall restart.

✧ **P36** is used to set the time after motor stops about motor current. Its default value is 1000, which means that motor had stopped after 1000ms.

✧ **P37** is used to set the Semi-flow percent to control motor current. Its unit is 1%, whose default value is 50.

[STOP STATE] Motor current = Open-loop current (P8) × Semi-flow percent (P37)

✧ **P40** is used to set slaves' node identifier. It shall restart.

✧ **P41** is used to select baud rate of CAN or RS485.It shall restart so that can be working.

Table 44 P41 of JMC 2HSS458-R/RC Drive: Baud rate

Baud Rate	0	1	2	3	4	5	6	7
CAN (Kbps)	12.5	20	50	100	200	250	500	1000
485 (bps)	1200	2400	4800	9600	19200	38400	57600	115200

✧ **P42** is used to select IO input signal polarity. P42=0: use PNP type limit switch; P42=1: use NPN type limit switch.It shall restart.

✧ **P43** is used to select communication mode. P43=0: select 485 communication, P43=1: select CANopen communication. It shall restart.

✧ **P44** is used to select whether limit signal upload to object 60FD. 1 means enabling this function while 0 means disabling it.

P45 is used to set unit of target speed. 1 means that unit is 0.1RPS. 0 means that unit is 1/Revolution

6 Parameter Adjustment Methods

6.1 Button Panel

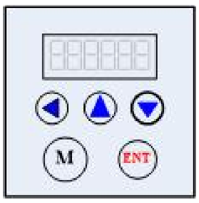


Figure 42 Button Panel of JMC 2HSS458-R/RC Drive

The Button panel consists of 5 buttons and 6 LED displays. 2HSS458-R/RC with LED indicating power supply and display status, panel operation as shown in the figure. Select the display mode through the key 'M' and monitor the running state of the motor through the '▲' and '◄' keys. The following table is the meaning for each monitoring code.

Table 45 Monitoring code of JMC 2HSS458-R/RC Button Panel

Display	d00SPR	d01SPF	d02PLE	d03PLR	d04PLF	XX_Err	En_0FF
Meaning	Reference Velocity	Velocity Feedback	Position Error	Target Position	Position Feedback	Error Code	Drive Not Enable

【1】Move Key

'◄': Shift;

'▲': Adjust parameter, ADD

‘▼’: Adjust parameter, SUB

【2】Function Key

‘ENT’: Enter or Ensure

‘M’: Switch mode or Cancel

Notice:Switch to parameter display function through ‘M’;Use ‘ENT’ key to view parameter value, press ‘▲’ or ‘▼’ key switch function; Exit this function and go to the next function to press the ‘M’ key.

6.2 Button Panel Operation

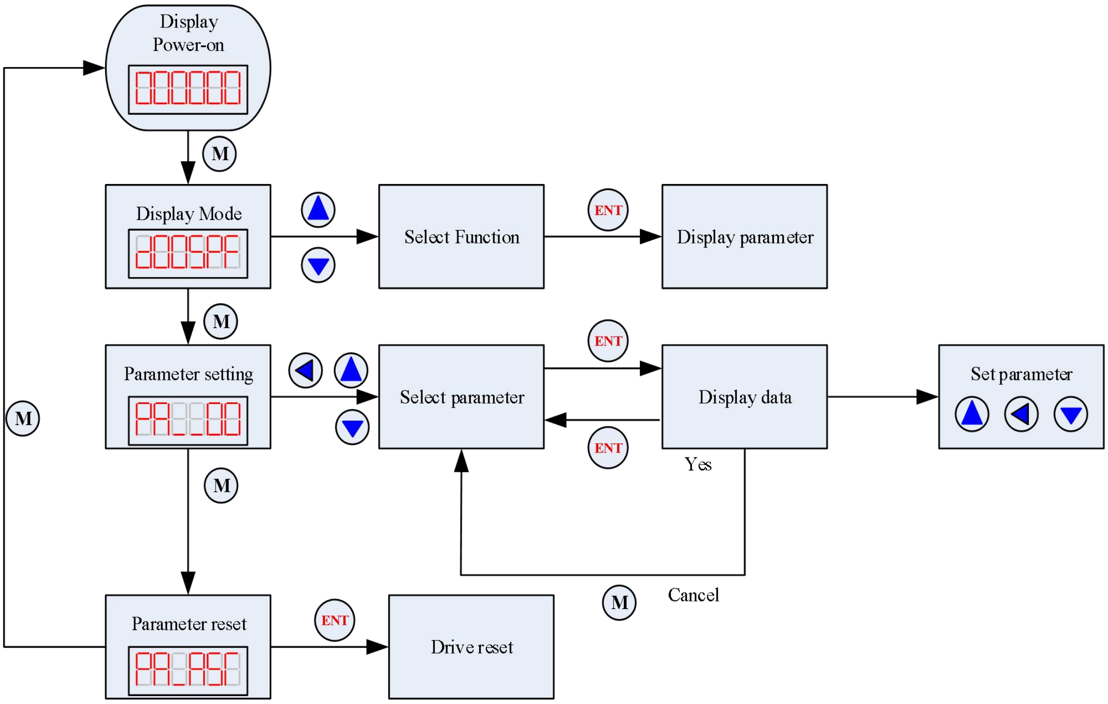


Figure 43 Operation of JMC 2HSS458-R/RC Button Panel

6.3 Operation Example

【1】Mode Configure Operation

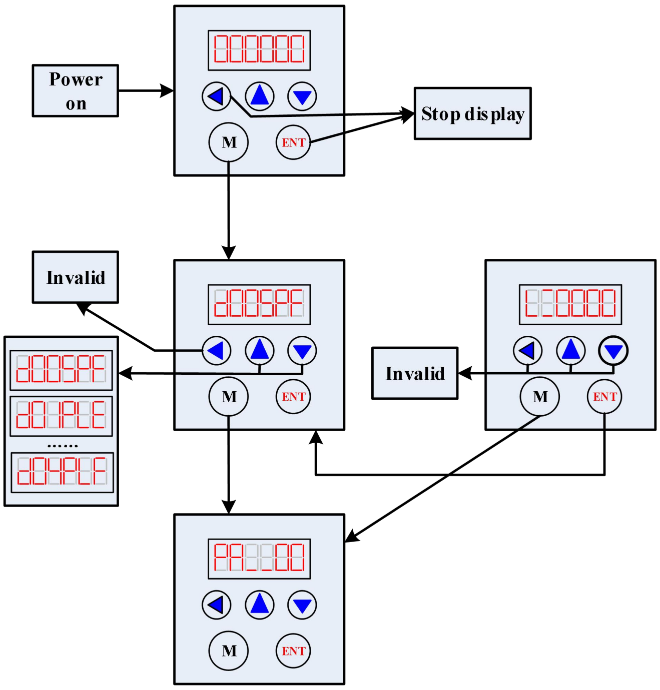


Figure 44 Mode Configure Operation of JMC 2HSS458-R/RC Panel

【2】Parameter Configure Operation

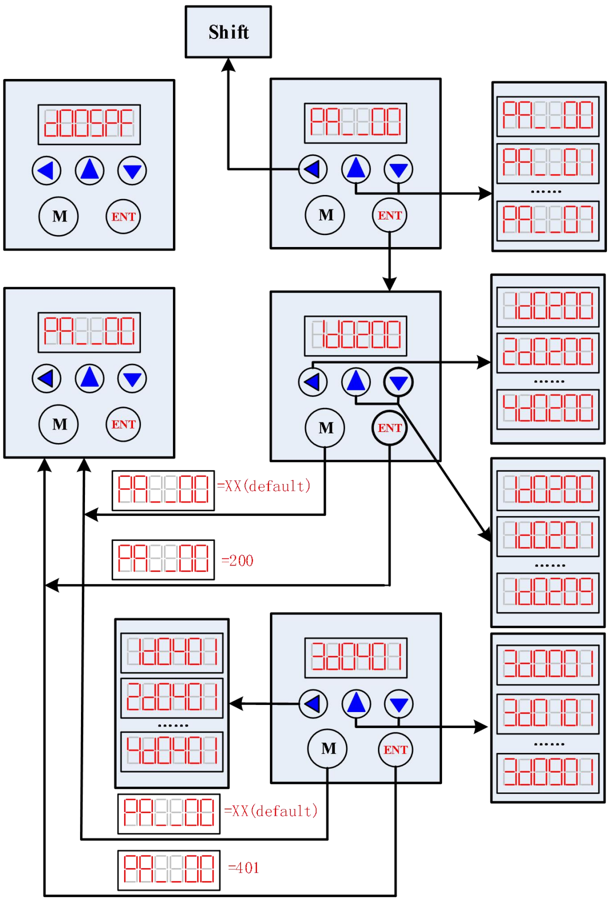


Figure 45 Parameter Configure Operation of JMC 2HSS458-R/RC Panel

Notice: The default parameters of current loop, position loop and speed loop are almost the best, user no need to change them, but to configure the parameter Pulses/revolution and Open-loop/Close-loop current according to the necessity of the control system.

7 Failure Alarm

Table 46 Failure Alarm of JMC 2HSS458-R/RC Drive

Error Code	Description
00_Err	Over current Error
11_Err	Reference voltage Error
22_Err	Parameter upload Error
33_Err	Over voltage Error
44_Err	Over position error
55_Err	Loss phase Error
66_Err	Off-line
En_OFF	Motor enable

8 RS485 Communication Parameter Setting

When RS485 communication mode is used by the drive, communication parameters of the upper computer or other communication stations shall be set in advance. The default configuration parameters of the driver are as follows:

Table 47 RS485 Communication Parameter Setting of JMC 2HSS458-R/RC Drive

Parameter	Baud Rate	Start	Data	Stop	Check
Value	0~115200bps	1Bit	8Bit	1Bit	None

9 Match Motor

Table 48 Match Motor of JMC 2DM522-R/RC Drive

Bedplate		Model	Step Angle (deg)	Static Moment (N • m)	Rated Current (A)	Rotor Inertia (g-cm²)	Weight (kg)	Length (mm)
Two-phase	42	42J1848EC-1000(*)	1.8	0.48	1.5	80	0.45	48
		42J1860EC-1000	1.8	0.7	2.5	110	0.55	60
	57	57J1854EC-1000(*)	1.8	0.9	4	280	38.1	54
		57J1880EC-1000(*)	1.8	2	5	480	38.1	80
		57J18100EC-1000	1.8	2.8	5			100

	60	60J1856EC-1000	1.8	1.5	3.5	340	0.9	56
		60J1887EC-1000(*)	1.8	3	5	690	1.45	87
		60J18100EC-1000	1.8	3.5	5	1200	1.9	100

10 Quick Guides

10.1 Hardware Wiring

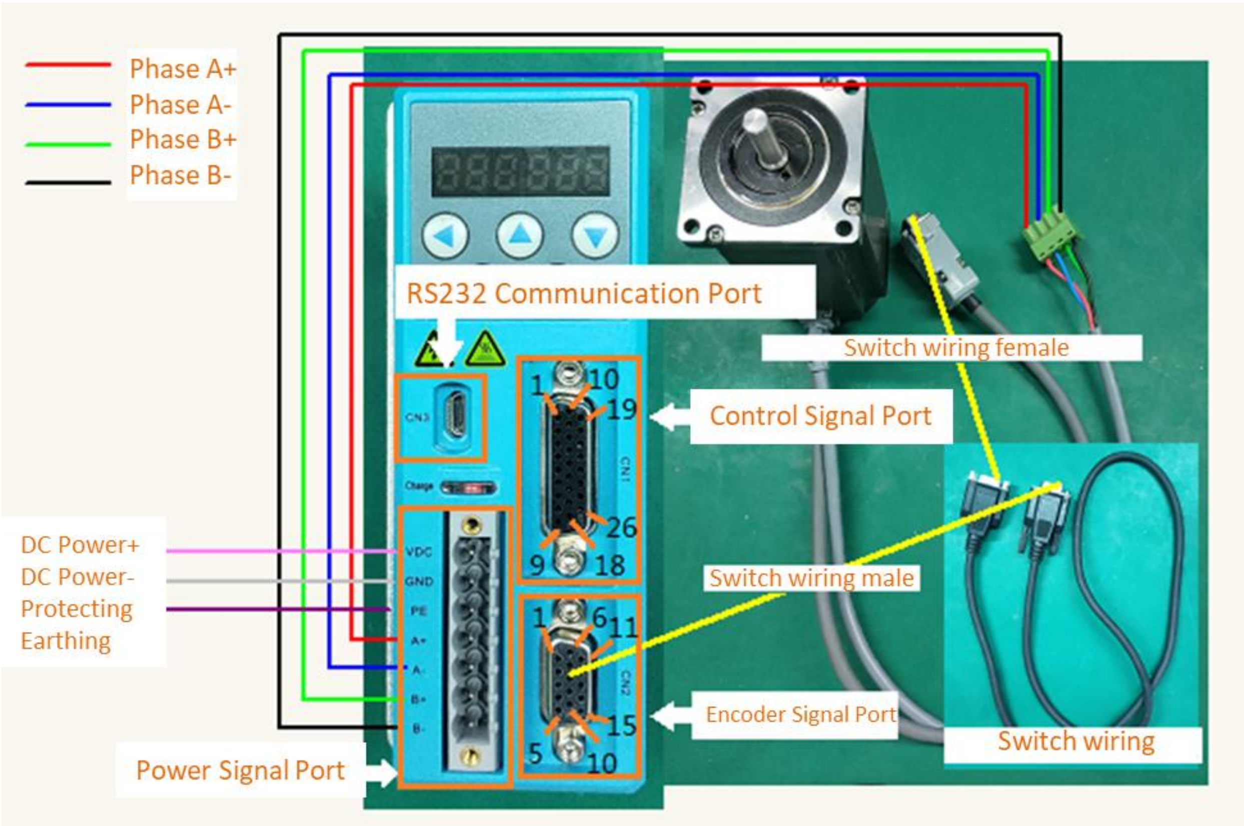


Figure 46 JMC 2HSS458-R/RC Practicality

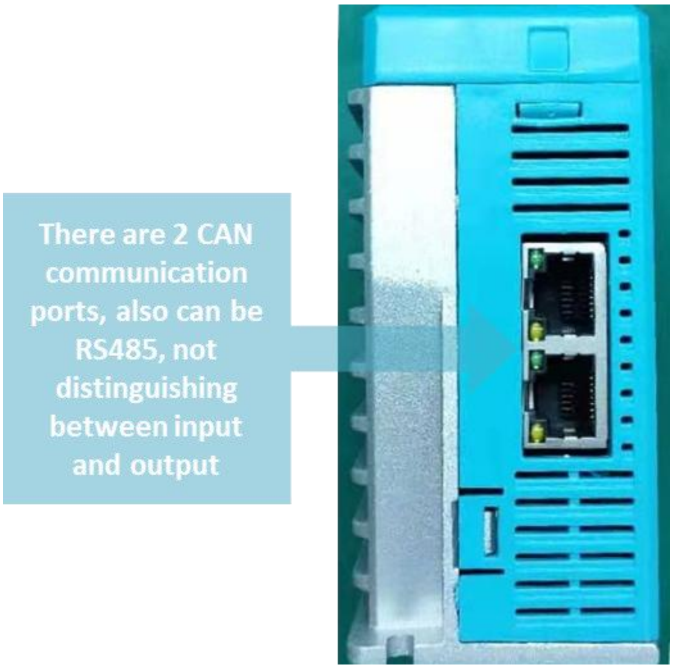


Figure 47 Side View of JMC 2HSS458-R/RC Practicality

See “*Ports and Connections Introduction*” in this section for the specific definition of each port (Ctrl+ Mouse left or Click text to jump).

10.2 Parameter Setting

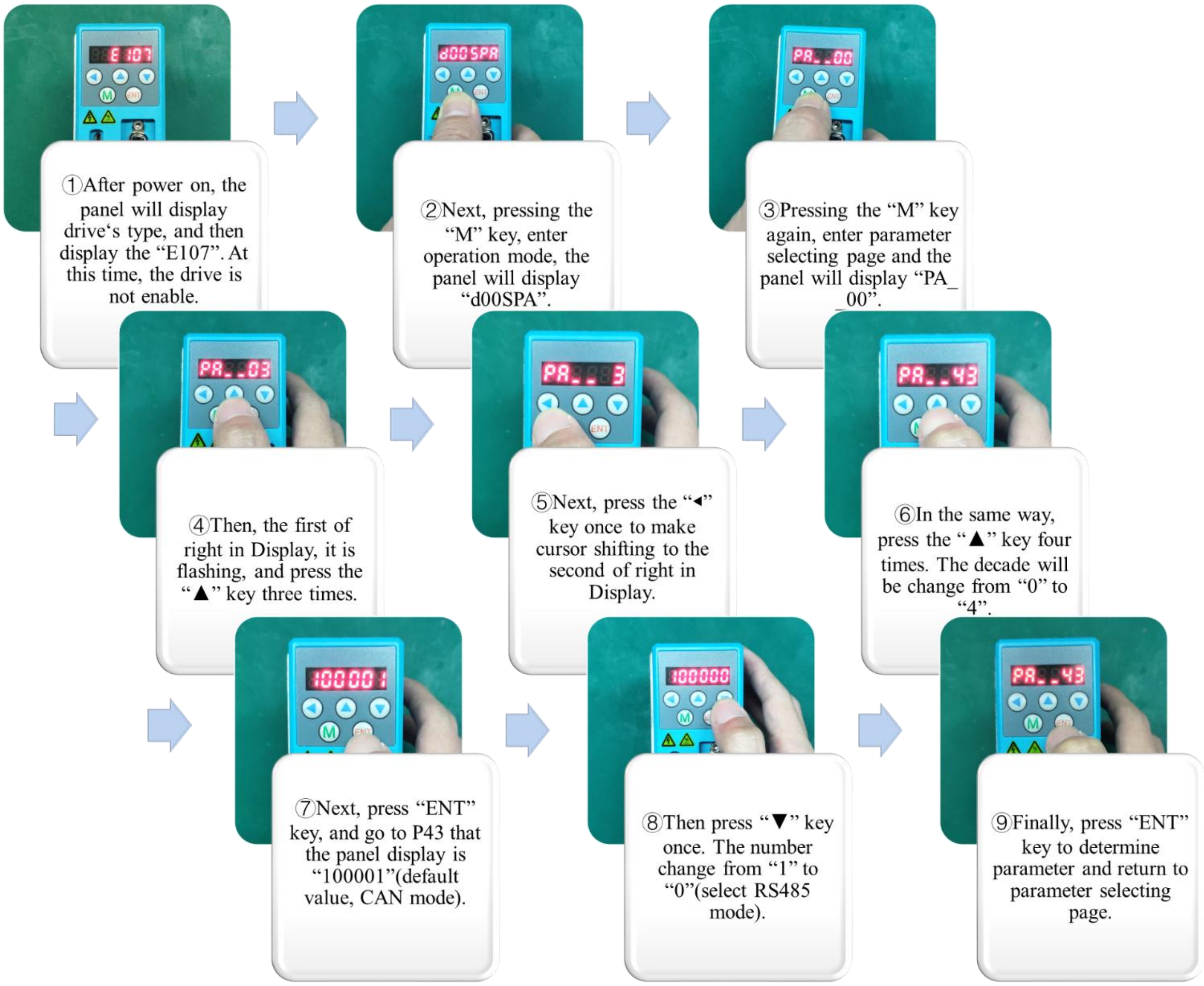


Figure 48 Setting P43 in JMC 2HSS458-R/RC Button Panel

In addition to the Communication mode (P43), the Slave ID (P40) and Baud rate (P41) must be set when using the drive.

The setting of parameter P40 is basically the same as the operation of P43. Use the Button panel to "PA0040" to enter and set the Slave ID. Similarly, the parameter P41 is the same operation, but it should be noted that the parameter can only be set to 0~7. The value "6" means that Baud rate of CAN communication is 500Kbps, or Baud rate of RS485 communication is 57600bps. For other parameter, please see "Parameters Configure of Drive".

The above figure takes the setting of communication mode of drive as an example to change the communication mode from CAN to 485, that is, to set the parameter P43 of drive. Other operations are much the same. According to the above flow chart, user can grasp method of operation of Button panel.

➢ 2HSS858-R/RC

1 Electrical, Mechanical and Environmental Specifications

Table 49 Performance of JMC 2HSS858-R/RC Drive

Input voltage		60~90VDC
Continuous Current output		0~6.0A
Communication Type		CANopen /Modbus-RTU
Communication Distance		1KM
Maximum Number of Slaves		128/32
Maximum Communication rate		1000Kbps/115200bps
Logic Input Current		7~20mA (Typical value 10mA)
Protect		The peak of over current action value is 10A±10%
		Over voltage action value is70VDC
Shape Size(mm)		140×70×56
Weight		Approximately 1500g
Environmental Conditions	Working Occasion	Avoid dust, oil mist and corrosive gas as far as possible
	Working Temperature	0~40℃
	Storage Temperature	-20℃~+40℃
	Working Humidity	40~90%RH
	Cooling mode	Natural cooling or forced cold wind

2 Machine Dimension Diagrams

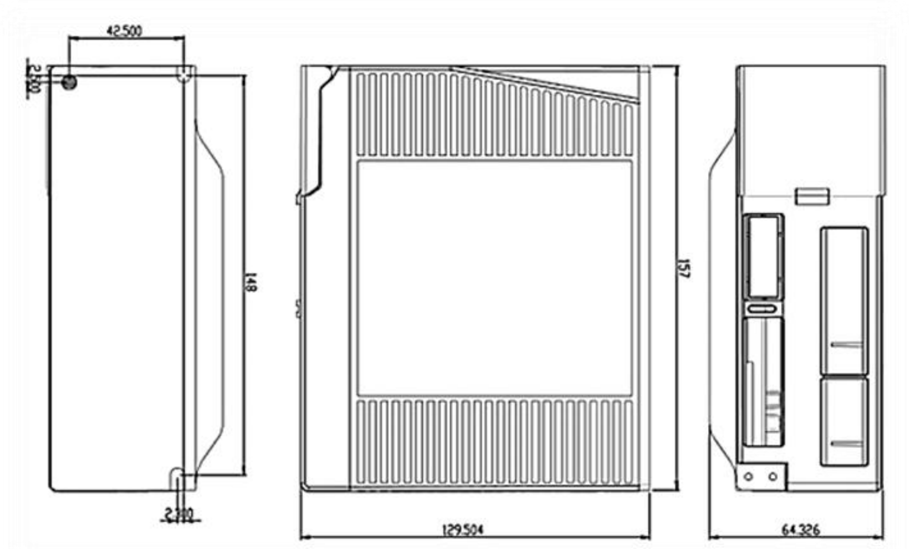


Figure 49 Machine dimension of JMC 2HSS858-R/RC Drive (unit: mm)

Notice: Please take the terminal size and ventilation cooling while design the installation size.

✧ Drive's reliable working temperature should be <60℃, and motor working temperature should be <90℃;

✧ It is recommended to mount the drive vertically to maximize heat sink area. Use forced cooling method to cool the system if necessary.

3 Ports and Connections Introduction

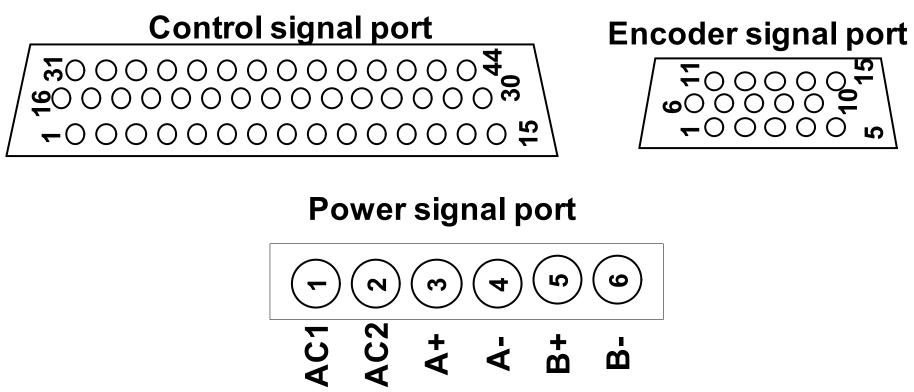


Figure 50 Cable-entry of JMC 2HSS858-R/RC Drive

PS: About Communication port, please refer to "*Communication Interface and Wiring*" (Ctrl+ Mouse left or Click text to jump).

3.1 Power Interface Port

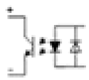
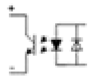
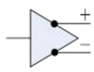
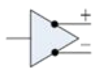
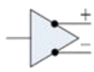
Table 50 Power Interface port of JMC 2HSS858-R/RC Drive

Port	Symbol	Definition	Remark

1	AC1	Power L	50~90VAC
2	AC2	Power N	
3	A+	Motor phase A+	Motor Phase A
4	A-	Motor phase A-	
5	B+	Motor phase B+	Motor Phase B
6	B-	Motor phase B-	

3.2 Control Signal Port

Table 512HSS858-R/RC Control Signal Port

Port	Symbol	Definition	Remark
1	HW+	Home Limit +	Input 12~24VDC (Compatible with 5V, but not recommended)
2	HW-	Home Limit -	
23	CW+	Clockwise Limit +	
24	CW-	Clockwise Limit -	
25	CCW+	Counter Clockwise Limit +	
26	CCW-	Counter Clockwise Limit -	
9	PEND+	Position signal output +	 5~24VDC 0~50mA
10	PEND-	Position signal output -	
32	BK+	Brake signal output +	 5~24VDC 0~50mA
31	BK-	Brake signal output -	
30	OUTA-	Encoder channel A output+	
44	OUTA+	Encoder channel A output-	
14	OUTB+	Encoder channel B output+	
15	OUTB-	Encoder channel B output-	
13	OUTZ+	Encoder channel Z output+	
29	OUTZ+	Encoder channel Z output-	

3.3 Encoder Signal Port

Table 52 Encoder Signal Port of JMC 2HSS858-R/RC Drive

PIN	Symbol	Definition
1	EA+	Encoder channel A input+
2	EB+	Encoder channel Binput+
3	GND	Ground
11	EA-	Encoder channel A input-
12	EB-	Encoder channel A input-
13	VCC	+5V

3.4 Connections to Control Signal

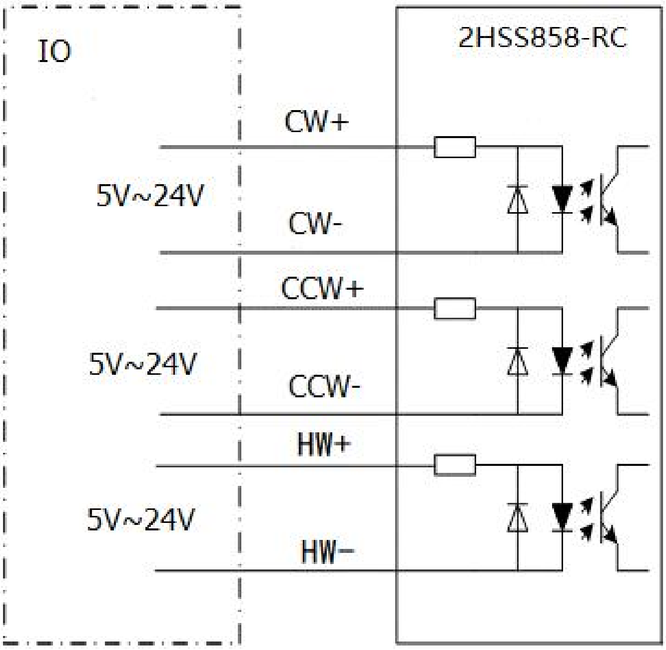


Figure 51 Connections to differential signals

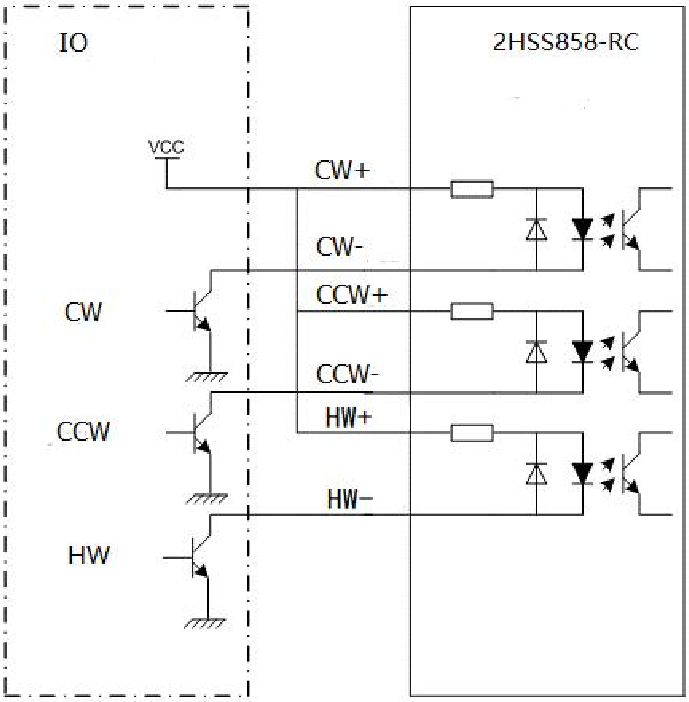


Figure 52 Connections to common anode

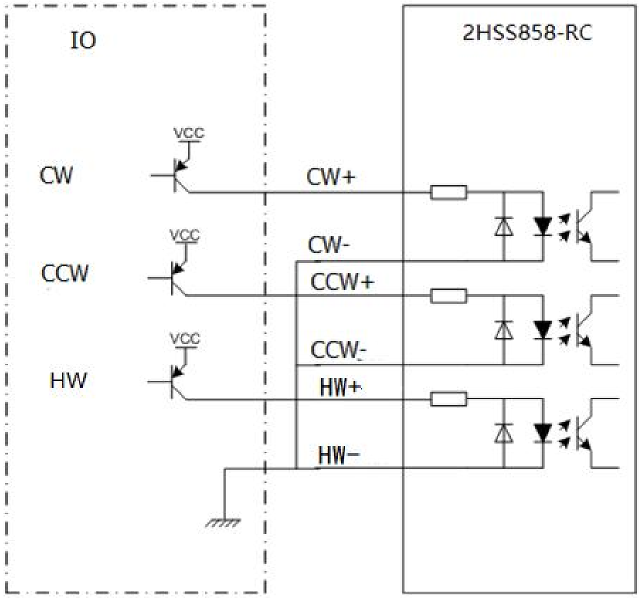


Figure 53 Connections to common cathode

4 Typical application wiring diagrams

A typical connection diagram made up of the 2HSS858-R/RC drive as follow. The power supply selects AC50~90V according to the voltage level of the matched motor.

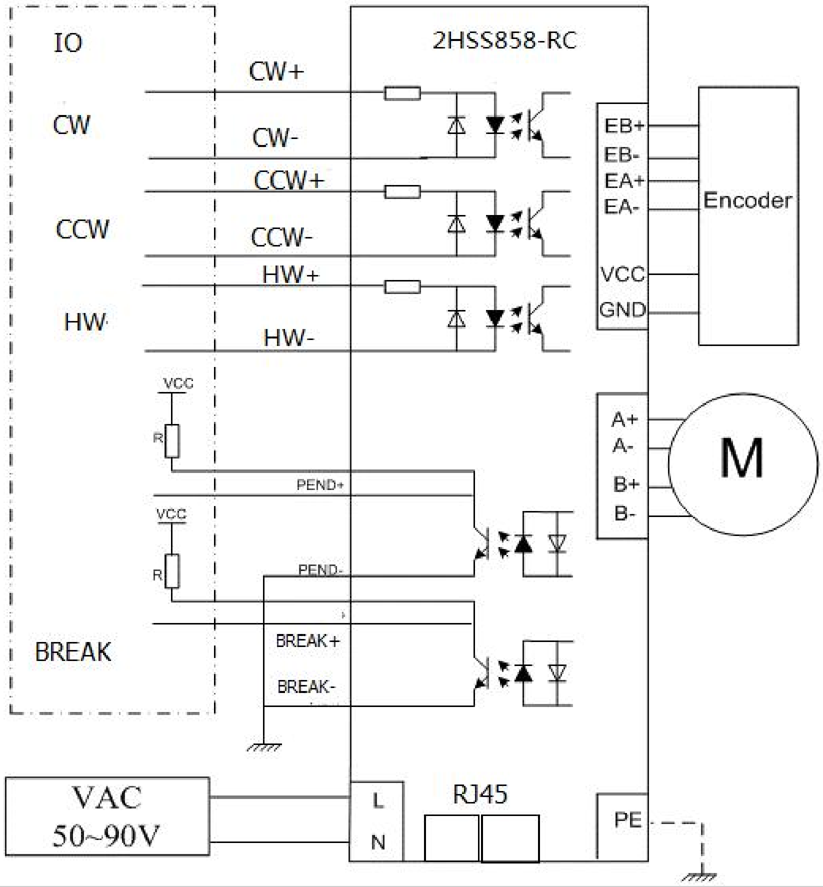


Figure 54 Typical application wiring diagram of JMC 2HSS458-R/RC Drive

Notice:

- ✧ BREAK signal to control motor brake, it needs external relay, the maximum current is 50mA.
- ✧ RJ45 network interface through the standard twisted pair cable connected to the other slave, no

special difference between the two network ports.

5 Parameters Configure of Drive

There two methods to configure parameters of 2HSS858-R/RC. One is set the parameters through the front panel; the other way is to connect it with the HISU. A set of the best default configure parameters has already set in the drive. User need only to configure the parameter Pulses/revolution. The detail functions are as follows:

Actual value = Set value × the corresponding dimension

Table 53 Internal parameter of JMC 2HSS858-R/RC Drive

Parm	Definition	Range	Dimension	Restart Drive	Default Value
P1	Current loop Kp	0—4000	1	No	1000
P2	Current loop Ki	0—1000	1	No	100
P3	Damping coefficient	0—500	1	No	250
P4	Position loop Kp	0—3000	1	No	2000
P5	Position loop Ki	0—1000	1	No	200
P6	Speed loop Kp	0—3000	1	No	500
P7	Speed loop Ki	0—1000	1	No	1000
P8	Open-loop current	0—60	0.1	No	40
P9	Close-loop current	0—40	0.1	No	20
P10	Manufacturer	Reserve	Reserve	Reserve	Reserve
P11	Direction level	0—1	1	No	1
P12	Manufacturer	Reserve	Reserve	Reserve	Reserve
P13	Manufacturer	Reserve	Reserve	Reserve	Reserve
P14	Arrival level	0—1	1	No	0
P15	Manufacturer	Reserve	Reserve	Reserve	Reserve
P16	Position error limit	0—3000	10	No	400
P17	Pulses/Revolution	0—15	1	Yes	2
P18	Manufacturer	Reserve	Reserve	Reserve	Reserve
P19	Speed smoothness	0—10	0	No	2
P20	User-defined p/r	4—1000	50	Yes	8
P21	Display information	0—4	1	No	0
P22	Pulse filter	0—3	1	No	0
P23	Lock shaft	0—1	1	No	0
P24	Manufacturer	Reserve	Reserve	Reserve	Reserve
P25	Overlay proportion	0—40	1	No	10
P26	Stop damping	0—500	1	No	200
P27	Low-speed damping	0—500	1	No	50
P28	Manufacturer	Reserve	Reserve	Reserve	Reserve
P29	Manufacturer	Reserve	Reserve	Reserve	Reserve
P30	Lost phase	0—1	1	Yes	1
P31	Manufacturer	Reserve	Reserve	Reserve	Reserve
P32	Manufacturer	Reserve	Reserve	Reserve	Reserve
P33	Manufacturer	Reserve	Reserve	Reserve	Reserve
P34	Manufacturer	Reserve	Reserve	Reserve	Reserve

P35	Manufacturer	Reserve	Reserve	Reserve	Reserve
P36	Semi-flow time	0—60000	MS	No	500
P37	Semi-flow percent	0—100	1%	No	50
P38	Manufacturer	Reserve	Reserve	Reserve	Reserve
P39	Manufacturer	Reserve	Reserve	Reserve	Reserve
P40	Slave ID	1—128	1	Yes	0
P41	Slave baud rate	0—7	1	Yes	0
P42	IO signal polarity	0—1	1	Yes	1
P43	Communication mode	0—1	1	Yes	1
P44	Limit signal upload	0—1	1	No	0
P45	Target speed unit	0—1	1	No	0

Those parameters can be set by using Button Panel, can also be set by using HISU adjuster. The detail descriptions to every parameter configuration are as follows:

- **P1~7**are used to change parameters of current loop, damping, position loop and speed loop.
- **P8**,this parameter affects the static torque of the motor.
  P9, this parameter affects the dynamic torque of the motor.
  (The actual current = open loop current + close loop current)
- **P10** is set to control the Alarm optocoupler. Output transistor 0 means the transistor is cut off when the system is in normal working, but when it comes to fault of the drive, the transistor becomes conductive. 1 means opposite to 0.
- **P11** is used to control direction level. By this parameter, drive's default orientation can be changed.
- **P14** is set to control the Arrival optocoupler output transistor. 0 means the transistor is cut off when the drive satisfies the arrival command, but when it comes to not, the transistor becomes conductive. 1 means opposite to 0.
- **P16,**the limit of the position following error. When the actual position error exceeds this value, the drive will go into error mode and the fault output will be activated (The actual value = the set value× 10).
- **P17** is used to select pulses.It shall restart.

Table 54 P17 of JMC 2HSS858-R/RC: Pulses/Revolution

Parameter	0	1	2	3	4	5	6	7
Pulses	user-def	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
Pulses	1000	2000	4000	5000	8000	10000	20000	40000

Notice: In addition, the drive provides users with pulses that they can set up freely via parameter 20.

- **P18** is used to select single pulse or double pulse. 1 means single pulse and direction, while 0 means double pulse.
- **P19**, Speed smoothness, this parameter is set to control the smoothness of the speed of the motor while acceleration or deceleration, the larger the value, the smoother the speed in acceleration or deceleration.

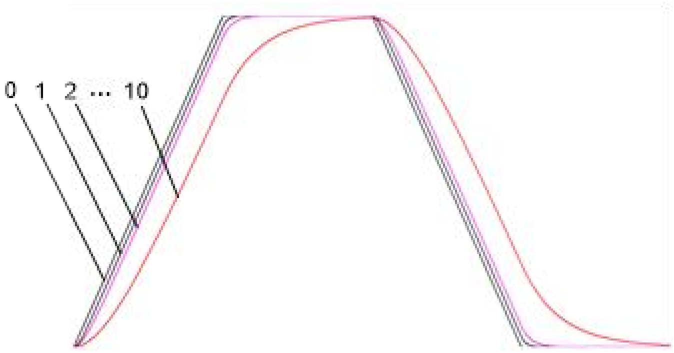


Figure 55 P19 of JMC 2HSS858-R/RC Drive: Speed smoothness

- **P20** is used to set up user-defined pulses.It shall restart.
- **P21** is used to select display information.

Table 55 P21 of JMC 2HSS858-R/RC Drive: Display information

Parameter	0	1	2	3	4
Display	Reference Velocity	Velocity Feedback	Position Error	Reference Position	Position Feedback

- **P22** is Pulse filter, setting 0~3. As the value increases, the frequency of the passing pulse decreases gradually. This is used to suppress the electronic interference generated in the environment.
- **P23** is Stop lock enable. This parameter is set to the drive not count external pulses and lock shaft or not.1 means enable this function while 0 means disable it.
- **P30** is used to check whether the motor is out of phase.1 means used, while 0 means not used. But this is for manufacturer only.It shall restart.
- **P36** is used to set the time after motor stops about motor current. Its default value is 1000, which means that motor had stopped after 1000ms.
- **P37** is used to set the Semi-flow percent to control motor current. Its unit is 1%, whose default value is 50.

  [STOP STATE] Motor current = Open-loop current (P8) × Semi-flow percent (P37)
- **P40** is used to set slaves 'node identifier. It shall restart.
- **P41** is used to select baud rate of CAN or RS485.It shall restart so that can be working.

Table 56 P41 of JMC 2HSS858-R/RC Drive: Baud rate

Baud Rate	0	1	2	3	4	5	6	7
CAN (Kbps)	12.5	20	50	100	200	250	500	1000
485 (bps)	1200	2400	4800	9600	19200	38400	57600	115200

- **P42** is used to select IO input signal polarity. P42=0: use PNP type limit switch; P42=1: use NPN type limit switch.It shall restart.
- **P43** is used to select communication mode. P43=0: select 485 communication, P43=1: select CANopen communication. It shall restart.
- **P44** is used to select whether limit signal upload to object 60FD. 1 means enabling this function while 0 means disabling it.
- **P45** is used to set unit of target speed. 1 means that unit is 0.1RPS. 0 means that unit is 1/Revolution.

6 Parameter Adjustment Methods

6.1 Button Panel

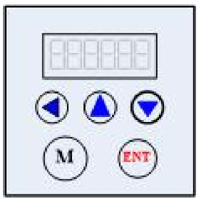


Figure 56 Button Panel of JMC 2HSS858-R/RC Drive

The Button panel consists of 5 buttons and 6 LED displays. 2HSS858-R/RC with LED indicating power supply and display status, panel operation as shown in the figure. Select the display mode through the key 'M' and monitor the running state of the motor through the '▲' and '◂' keys. The following table is the meaning for each monitoring code.

Table 57 Monitoring code of JMC 2HSS858-R/RC Button Panel

Display	d00SPR	d01SPF	d02PLE	d03PLR	d04PLF	XX_Err	En_OFF
Meaning	Reference Velocity	Velocity Feedback	Position Error	Target Position	Position Feedback	Error Code	Drive Not Enable

【1】Move Key

'◂': Shift;

'▲': Adjust parameter, ADD

'▼': Adjust parameter, SUB

【2】Function Key

'ENT': Enter or Ensure

'M': Switch mode or Cancel

Notice:Switch to parameter display function through 'M';Use 'ENT' key to view parameter value, press '▲' or '▼' key switch function; Exit this function and go to the next function to press the 'M' key.

6.2 Button Panel Operation

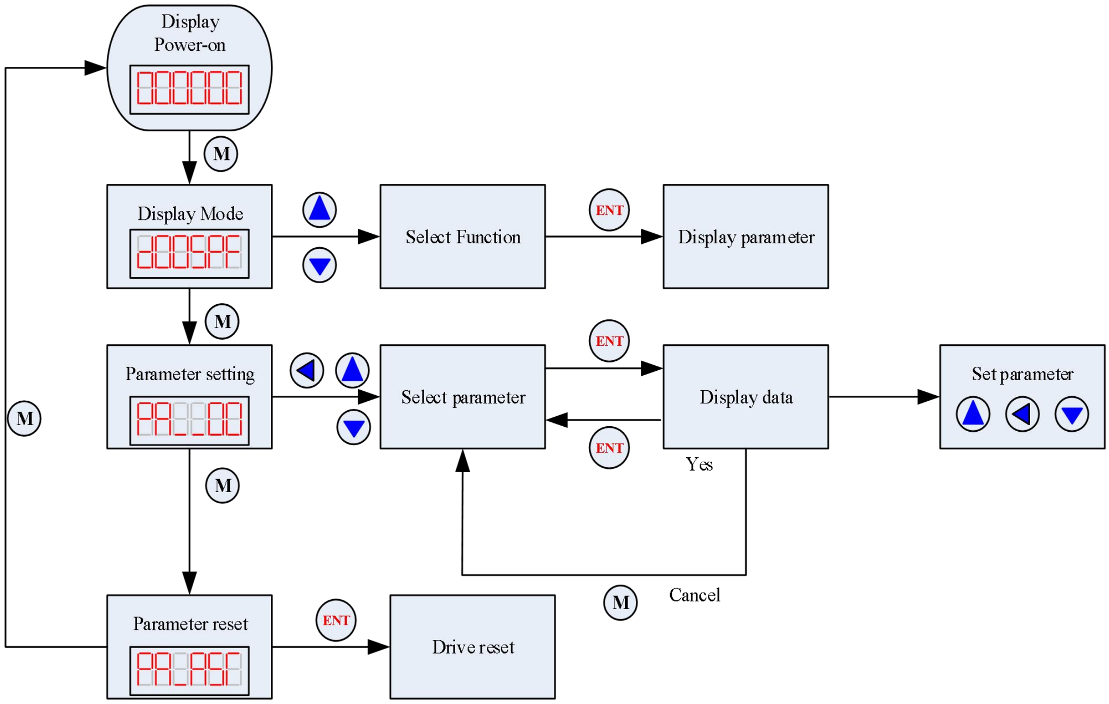


Figure 57 Operation of JMC 2HSS858-R/RC Button Panel

6.3 Operation Example

【1】Mode Configure Operation

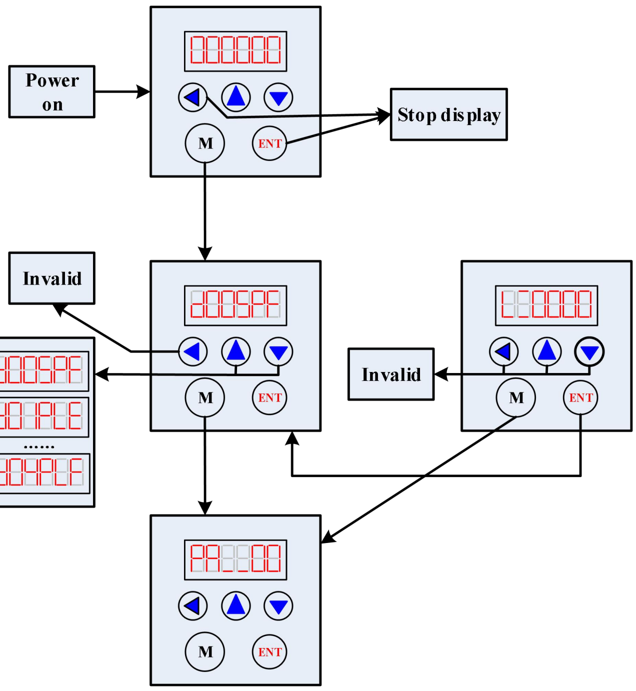


Figure 58 Mode Configure Operation of JMC 2HSS858-R/RC Panel

【2】Parameter Configure Operation

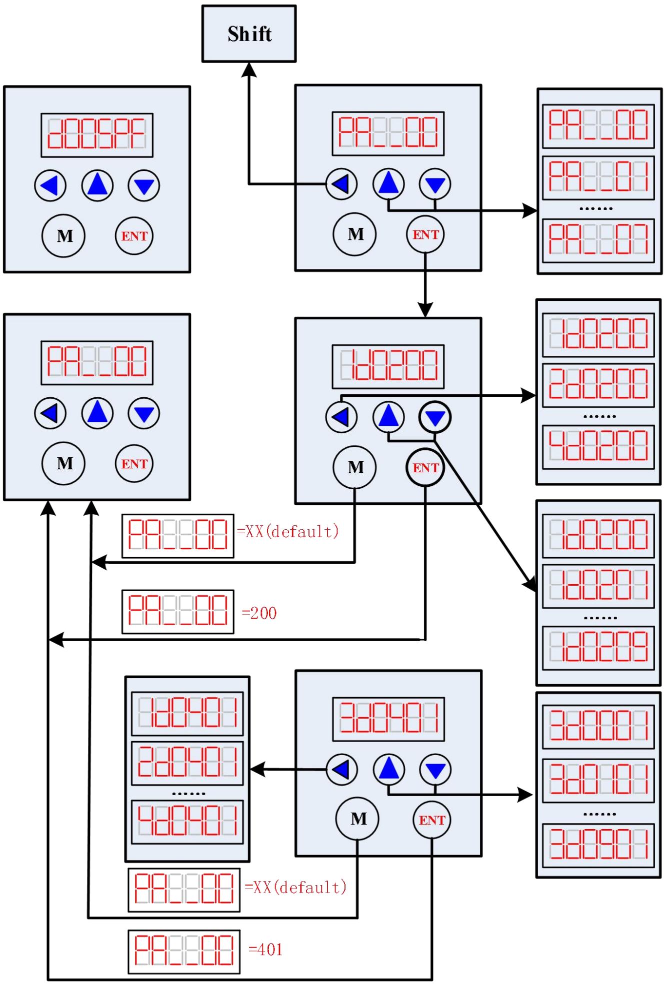


Figure 59 Parameter Configure Operation of JMC 2HSS858-R/RC Panel

Notice: The default parameters of current loop, position loop and speed loop are almost the best, user no need to change them, but to configure the parameter Pulses/revolution and Open-loop/Close-loop current according to the necessity of the control system.

7 Failure Alarm

Table 58 Failure Alarm of JMC 2HSS858-R/RC Drive

Error Code	Description
00_Err	Over current Error
11_Err	Reference voltage Error
22_Err	Parameter upload Error
33_Err	Over voltage Error
44_Err	Over position error
55_Err	Loss phase Error

66_Err	Off-line
En_OFF	Motor enable

8 RS485 Communication Parameter Setting

When RS485 communication mode is used by the drive, communication parameters of the upper computer or other communication stations shall be set in advance. The default configuration parameters of the driver are as follows:

Table 59 RS485 Communication Parameter Setting of JMC 2HSS858-R/RC Drive

Parameter	Baud Rate	Start	Data	Stop	Check
Value	0~115200bps	1Bit	8Bit	1Bit	None

9 Match Motor

Table 60 Match Motor of JMC 2HSS858-R/RC Drive

Bedplate		Model	Step Angle (deg)	Static Moment (N • m)	Rated Current (A)	Rotor Inertia (g-cm²)	Weight (kg)	Length (mm)
Two-phase	86	86J1880EC-1000(*)	1.8	4.5	6	1400	2.4	80
		86J1895EC-1000(*)	1.8	6.5	6	2200	3.4	95
		86J18118EC-1000(*)	1.8	8.5	6	2700	3.9	118
		86J18156EC-1000(*)	1.8	12	6	4000	5.3	156

10 Quick Guides

10.1 Hardware Wiring

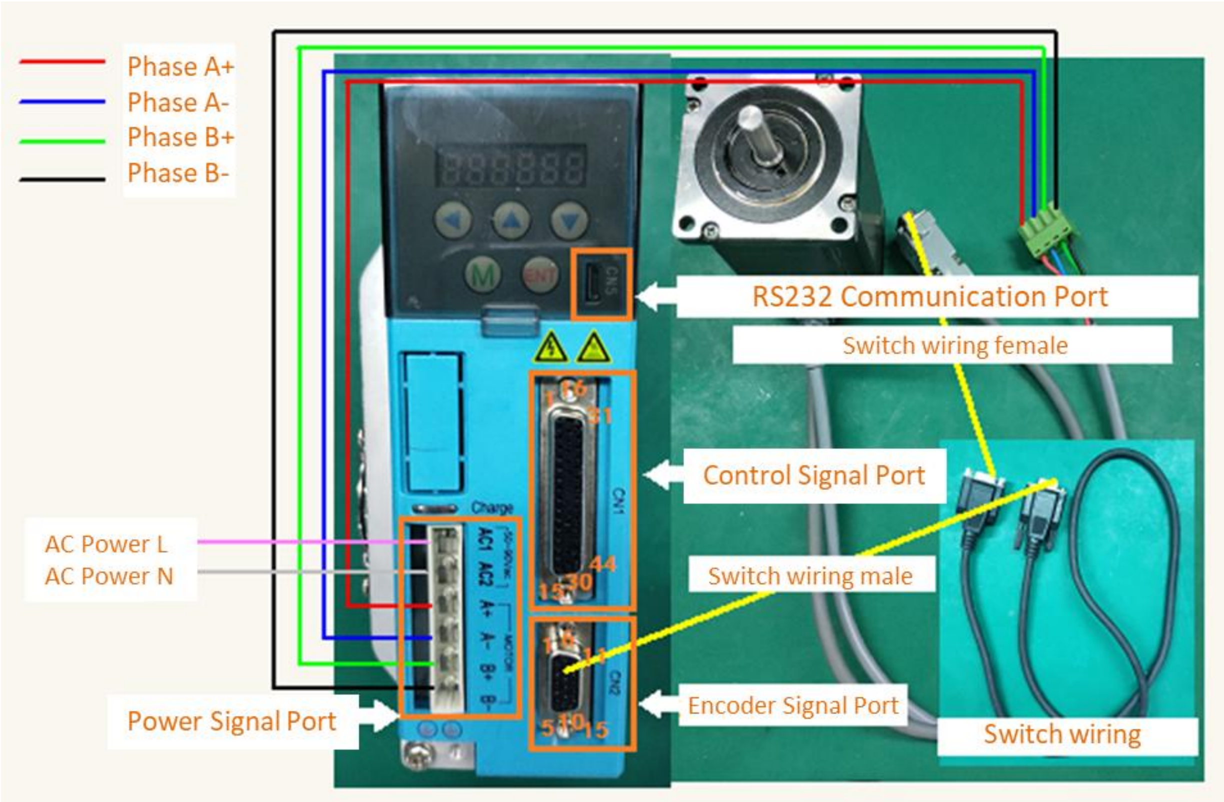


Figure 60 JMC 2HSS458-R/RC Practicality

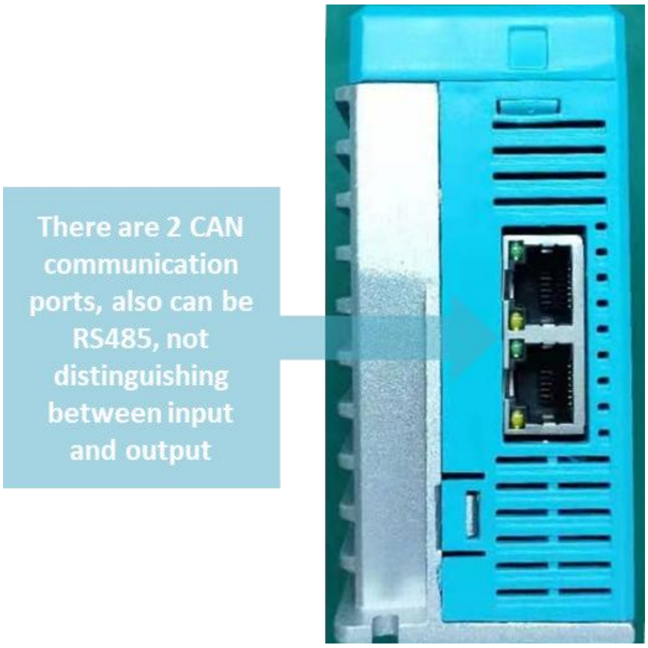


Figure 61 Side View of JMC 2HSS858-R/RC Practicality

See "*Ports and Connections Introduction*" in this section for the specific definition of each port (Ctrl+ Mouse left or Click text to jump).

10.2 Parameter Setting

The use of the panel of 2HSS858-R/RC is basically the same as 2HSS458-R/RC. User can go to "*Setting P43 in JMC 2HSS458-R/RC Button Panel*" (Ctrl+ Mouse left or Click text to jump) for viewing.

➢ Common Problems and Faults

When the driver fails, the panel will display an error message, and the user can confirm the problem according to the Failure Alarm code in the panel. For example, after power on, the panel shows “44_Err”, that is, the alarm is over position.The position of the motor is out of tolerance. Check whether the load is too large, or the encoder feedback wire is loose, after the completion of the treatment, do a power-on reset. At the same time, the user can look up the error by read the object dictionary 0x1001, or read the statusword 0x6041 to see the status of the drive.

1 Power lights don't light

- ✧ Input power failure, please check the power line. Whether the voltage is too low.

2 Power on or run a small angle of rotation alarm

- ✧ Check whether the power line is in good contact;
- ✧ Check whether the power supply voltage is correct;
- ✧ Check whether the phase sequence of the motor is correctly connected.

3 Display an error after power on

- ✧ Check whether the master and slave are communicating normally. If not, check the Slave ID and Baud rate;
- ✧ After baud rate and Slave ID are confirmed, if the communication cannot be established,please check whether the terminal resistor is connected to the network;
- ✧ Check if the statusword has an error alarm. If so, check object dictionary 0x1001 or 0x1003 sub-index 1 to see the error

4 Motor doesn’t run after each parameter is given

- ✧ Check whether the given parameters meet requirements;
- ✧ Check if motor is in CCW or CW.

IHSS-R/RC Integrate Stepper Servo Motor

➢ Product Introductions

The Series of products IHSS-R/RC are using CANopen and Modbus-RTU protocol, integrate stepper servo motor which integrates advanced digital stepper motor algorithm, RS485 bus and CAN bus communication control technology.

These drives integrate CiA301 standard (CANopen communication protocol), Modbus-RTU communication protocol and CiA402 motion control protocol, compared with the traditional stepper drive with lower cost and more convenient installation, but also can effectively restrain the motor temperature rise, significantly to reduce the vibration of the motor and the wiring complexity of equipment.

The drive is compatible with the traditional stepping motor, convenient for customers to upgrade. These series integrate bus communication control technology, simple wiring, no losing step, lower heat, high speed, big torque, low cost. It is a cost-effective motion control product.

➢ Technical Feature

- ✧ No lost step, accurate positioning
- ✧ Support standard RS-485 and CAN bus
- ✧ Support standard Modbus-RTU protocol which can switch with CANopen protocol
- ✧ Support standard CiA402 motion control protocol
- ✧ Three control modes with Position Mode, Velocity Mode and Homing Mode
- ✧ Built-in CW, CCW, SW IO input signal with 5V or 24V for the limit switch and homing
- ✧ A BREAK and PEND signal output signal
- ✧ RJ45 standard network connection, the slave through the twisted pair cable can be connected
- ✧ The maximum transmission frequency is 1Mbps, and the maximum transmission distance is up to 1KM
- ✧ 100% rated torque drive motor
- ✧ Electro-rheology control technology, high efficiency
- ✧ Little vibration and smooth running at low speed
- ✧ User-defined subdivisions
- ✧ Compatible 1000 and 2500 pulses encoders
- ✧ No adjustment in general application
- ✧ Loss phase protection, over current protection, over voltage protection and over position error protection

➢ IHSS42-R/RC

1 Electrical, Mechanical and Environmental Specifications

Table 60 Performance of JMC IHSS42-R/RC Drive

Input voltage		24VDC
Continuous Current output		1.2A
Communication Type		CANopen /Modbus-RTU（P43 Parameter switching）
Communication Distance		1KM
Maximum Number of Slaves		128/32
Maximum Communication rate		1000Kbps/115200bps
Logic Input Current		7~20mA (Typical value 10mA)
Protect		The peak of over current action value is 12A±10%
		Over voltage action value is200VDC
Shape Size(mm)		128×91×56
Weight		Approximately 1500g
Environmental Conditions	Working Occasion	Avoid dust, oil mist and corrosive gas as far as possible
	Working Temperature	0~40℃
	Storage Temperature	-20℃~+40℃
	Working Humidity	40~90%RH
	Cooling mode	Natural cooling or forced cold wind

2 Machine Dimension Diagrams

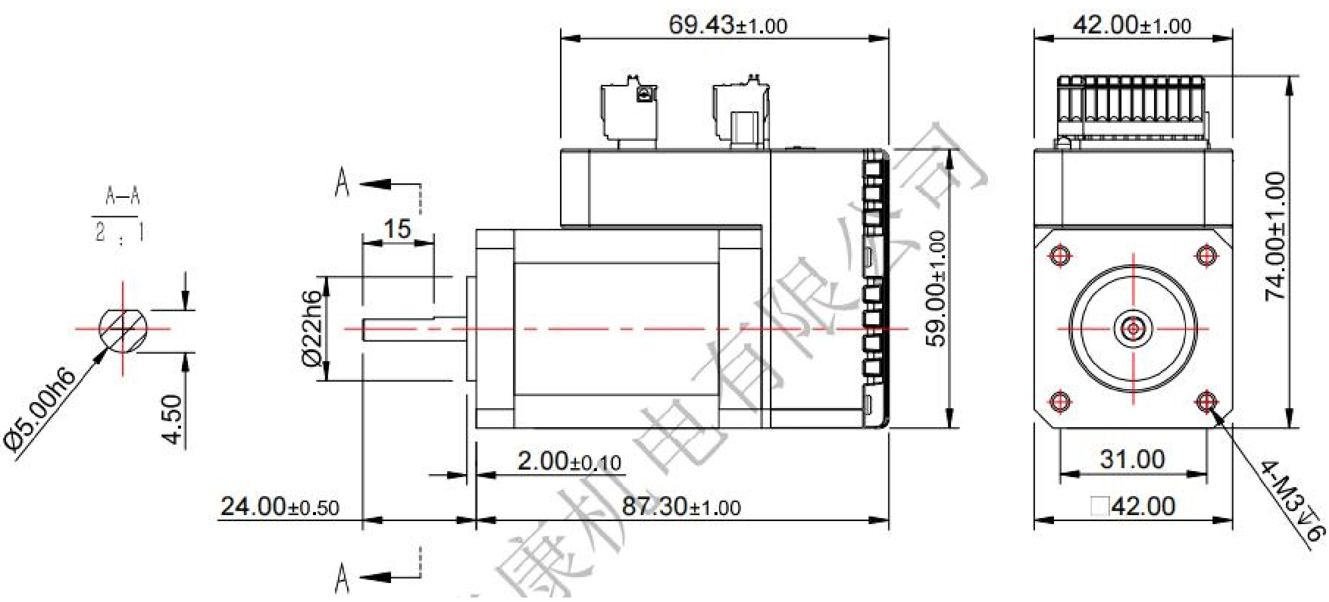


Figure 51 Machine dimension of JMC 2IHSS42-R/RC Drive (unit: mm)

3 Ports and Connections Introduction

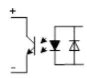
3.1 Power Signal Port

Table 52 Power Interface port of JMC IHSS57-R/RC Drive

Port	Symbol	Definition	Remark
1	DC+	DC power +	24~48VDC
2	GND	DC power -	

3.2 Control Signal Port

Table 53 Control Signal Port of JMC IHSS42-R/RC Drive

Port	Symbol	Definition	Remark
1	CW+	Clockwise Limit +	5V
2	CW-	Clockwise Limit -	
3	SW+	Home Limit +	5V
4	SW-	Home Limit -	
5	CCW+	Counter Clockwise Limit +	5V
6	CCW-	Counter Clockwise Limit -	
7	BK+	External brake of input power +	External brake of input power
8	BK-	External brake of input power -	
9	PE+	Position signal output +	
10	PE-	Position signal output -	

3.3 Connections to Control Signal

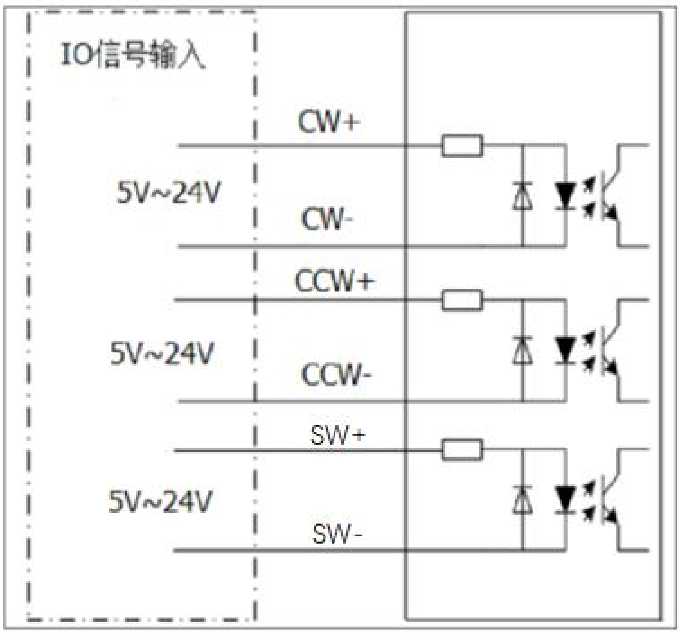


Figure 56 Connections to differential signals

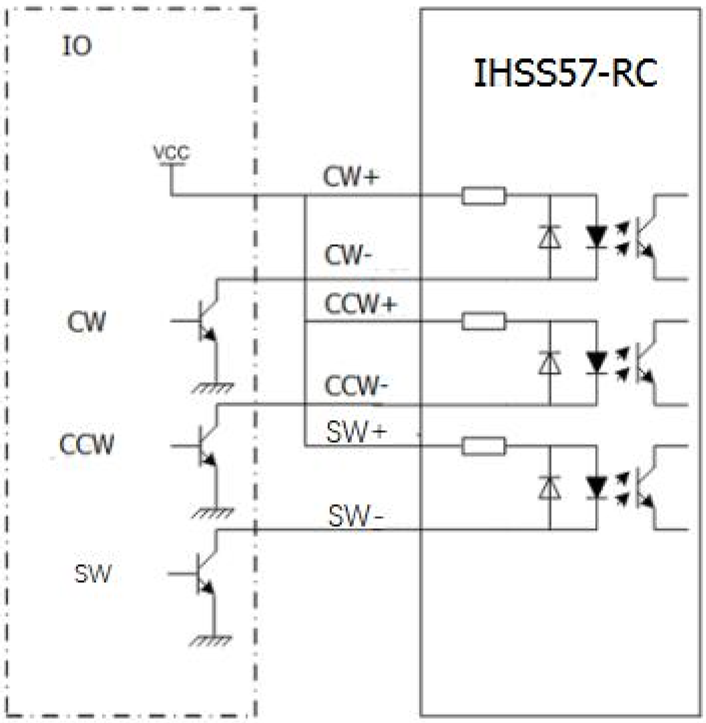


Figure 54 Connections to common anode

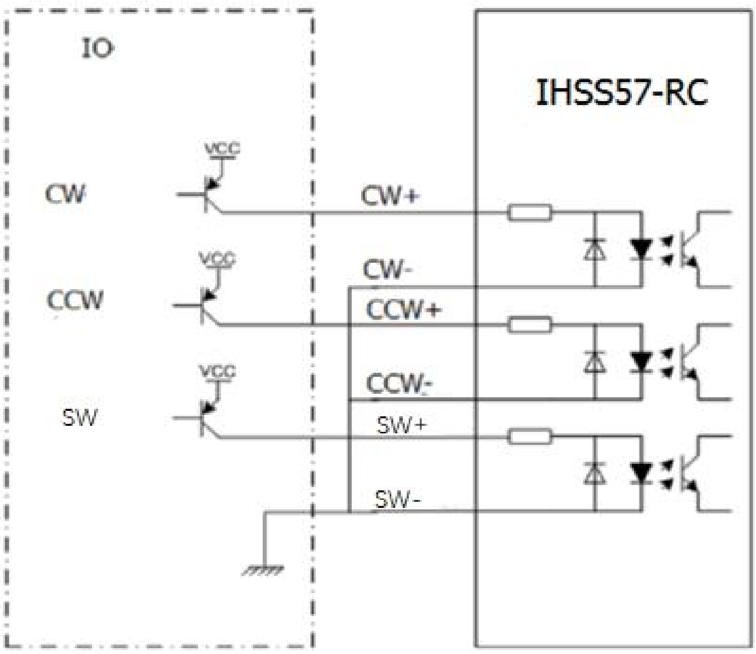


Figure 55 Connections to common cathode

Note: The control signal level is directly connected to 5V, and a 2K resistor needs to be connected in series if 24V is connected.

4 Typical application wiring diagrams

A typical connection diagram made up of the IHSS57-R/RC drive as follow. The power supply selects DC24~48V according to the voltage level of the matched motor.

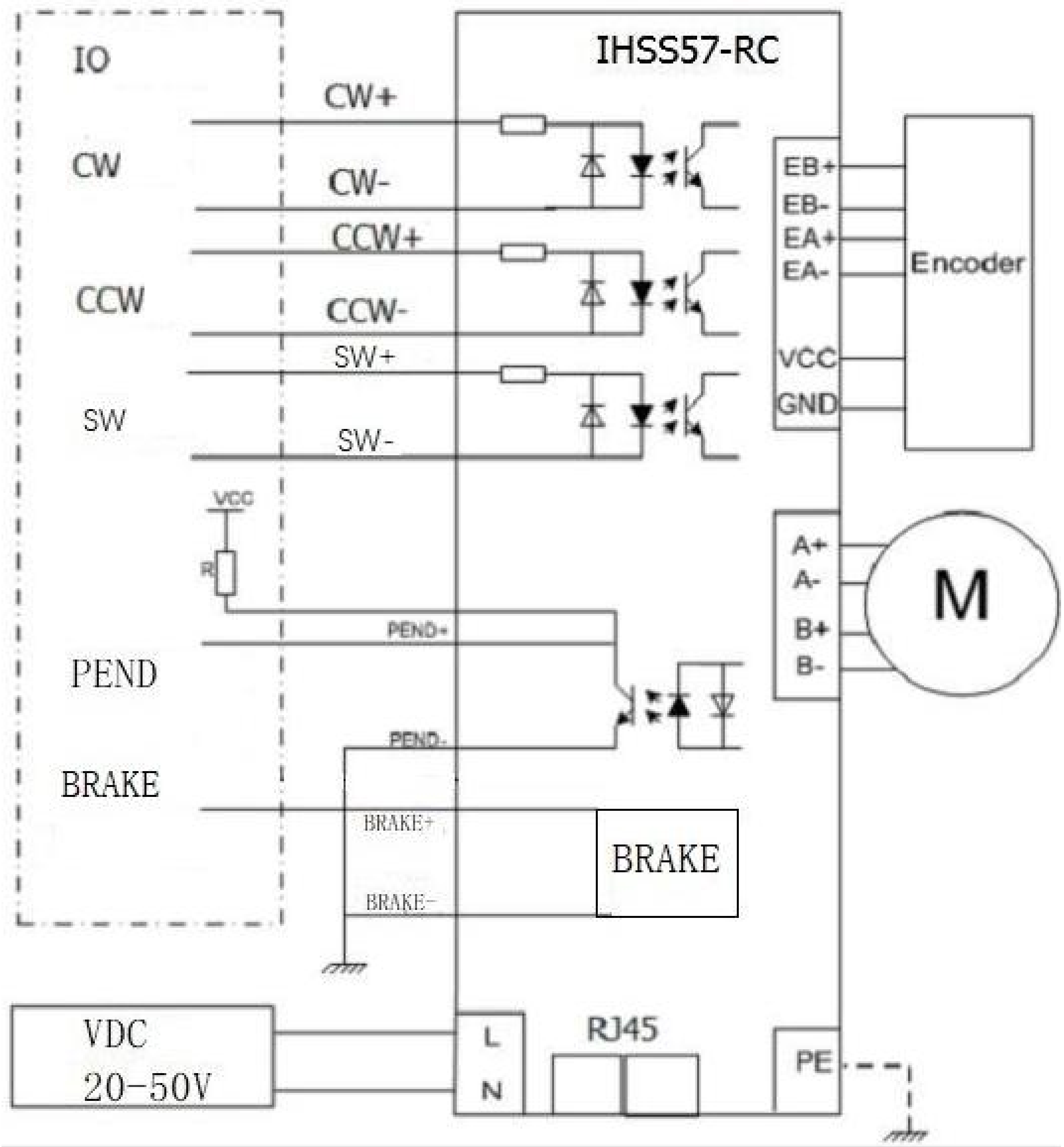


Figure 56 Typical application wiring diagram of JMC IHSS42-R/RC Drive

Notice:

- ✧ BREAK signal to control motor brake, it needs external relay, the maximum current is 50mA.
- ✧ RJ45 network interface through the standard twisted pair cable connected to the other slave, no special difference between the two network ports.

5 Parameters Configure of Drive

6 Rotary DIP Switch

6.1 Baud Rate Setting

The baud rate set for the CANopen communication and the RS-485 communication are set by the spin switch BD, which is set as follows:

Table 57 Baud Rate Setting of JMC IHSS57-R/RC Drive

Encoded value	Baud Rate of CAN (bps)	Baud Rate of RS-485 (bps)
0	12.5K	1200
1	20K	2400
2	50K	4800
3	100K	9600
4	125K	19200
5	250K	38400
6	500K	57600
7	1M	115200

7 Parameter Adjustment Methods

7.1 Connect to HISU

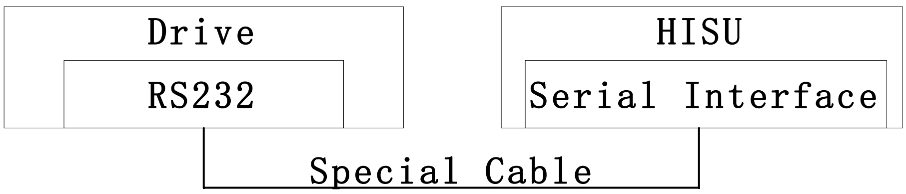


Figure 68 Connect to HISU

Notice:In case of causing any damage, please confirm the connection cables between Drive and HISU before using it.

7.2 Drive Parameter Setting

【1】Display and Operation

The rEAdy_ diagram is shown as follows:

Figure 69 Display after power-on

The connection success is shown as follows (if the connection is not connected, the LED digital tube will always flicker):

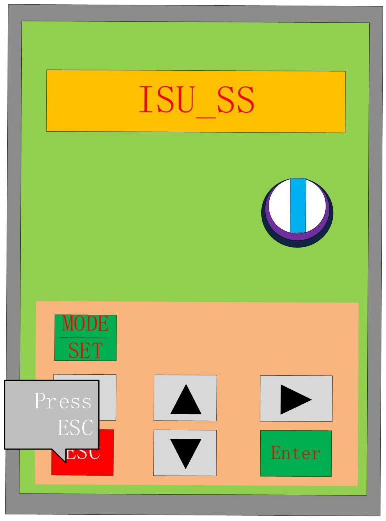


Figure 70 Connect successfully

After the connection is successful, press the MODE key to enter the various mode functions; the following figure is the parameter reset function:

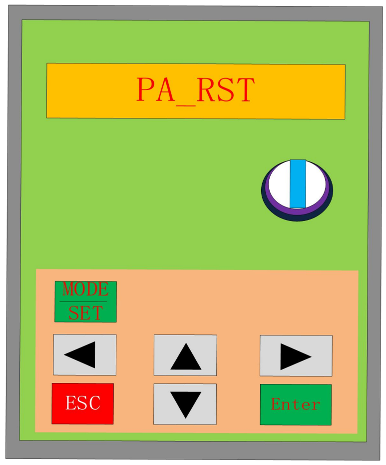


Figure 71 Mode function switching

The function description is as follows:

Table 58 Function description about HISU

Display	Function	Description
PR_RST	Reset parameter	Initializeparameter
PA_ _01	Parameter adjustment	Adjust parameter value
dA_ _UP	Parameter upload/download	Sets of parameters uploaded / downloaded

【2】Operating instructions

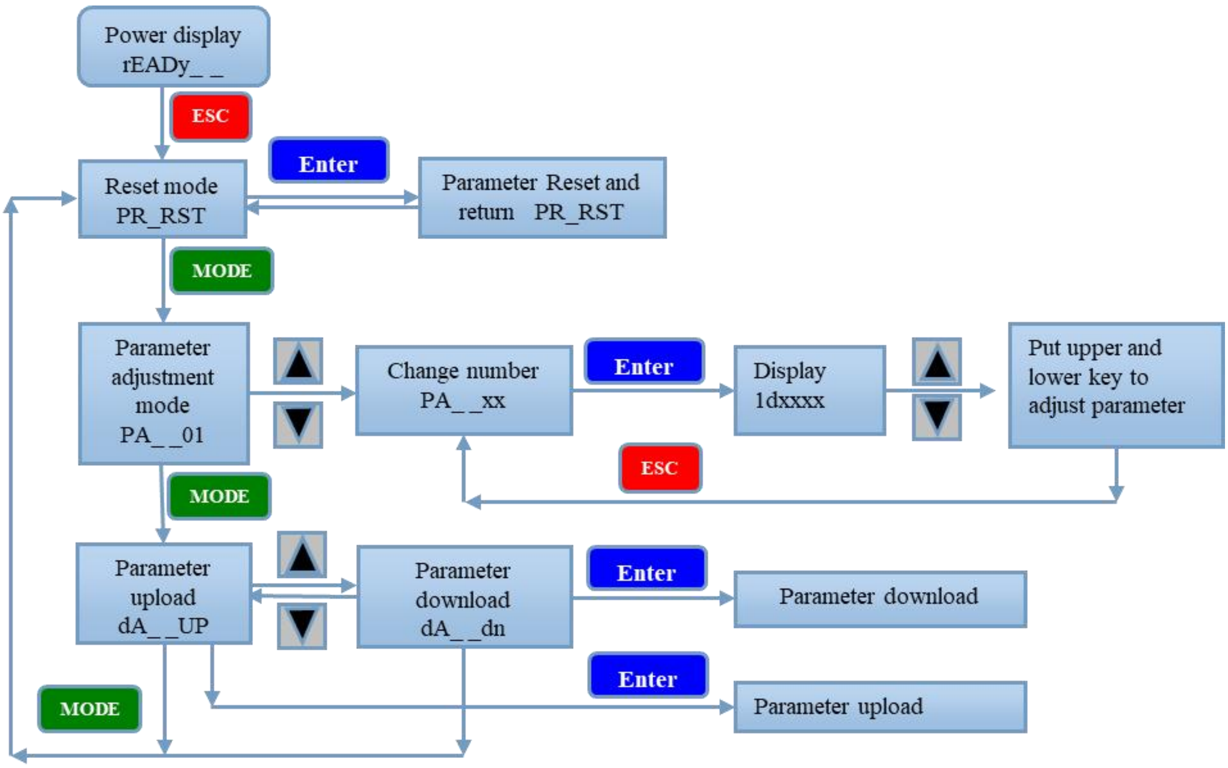


Figure 72 Operation flow chart

Description: Press each function key to adjust the mode or parameter, the arrow indicates the effect after pressing the key.

【3】Example of parameter mode operation

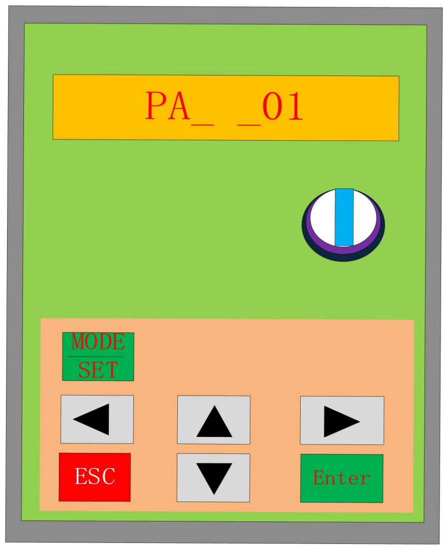


Figure 73 Display chart of parameter adjustment

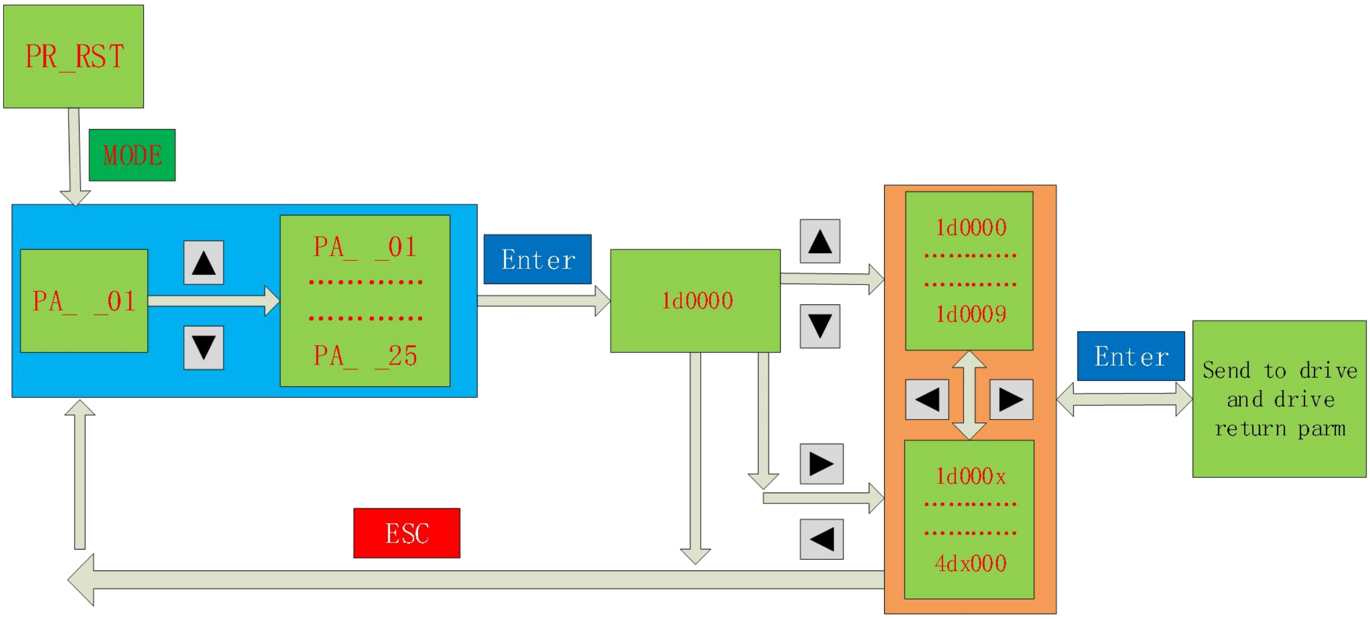


Figure 74 Flow chart of parameter adjustment

Description: When we press the Enter key to enter the parameters, we can see the initial value of the parameter. After changing the parameters, it shows the actual value of the drive parameter (for example, send that value is 9, but the actual return that is 1, then display 1).

8 Failure Alarm

8.1 Alarm Signal Sequence

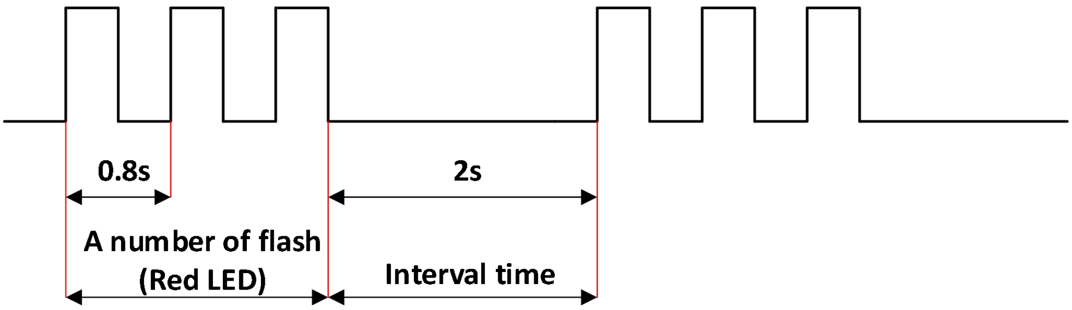


Figure 75 Alarm Signal Sequence

8.2Failure Alarm Table

Table 59 Failure Alarm Table for JMC IHSS57-R/RC

A number of flash		Description
Red	Green	
Off	Flicker	Drive CAN communication is unlinked
Off	On	Drive power up normally
1	On	Over current
2	On	Parameter upload Error
3	On	Power supply under maximum

4	On	Over position
5	On	Communication Error
6	On	CCWdirection limit
7	On	CWdirection limit
8	On	SWdirection limit
9	On	Drive overheating
10	On	Loss phase

9 RS485 Communication Parameter Setting

When RS485 communication mode is used by the drive, communication parameters of the upper computer or other communication stations shall be set in advance. The default configuration parameters of the driver are as follows:

Table 60 RS485 Communication Parameter Setting of JMC IHSS57-R/RC Drive

Parameter	Baud Rate	Start	Data	Stop	Check
Value	0~115200bps	1Bit	8Bit	1Bit	None

10 Quick Guides

10.1 Hardware Wiring

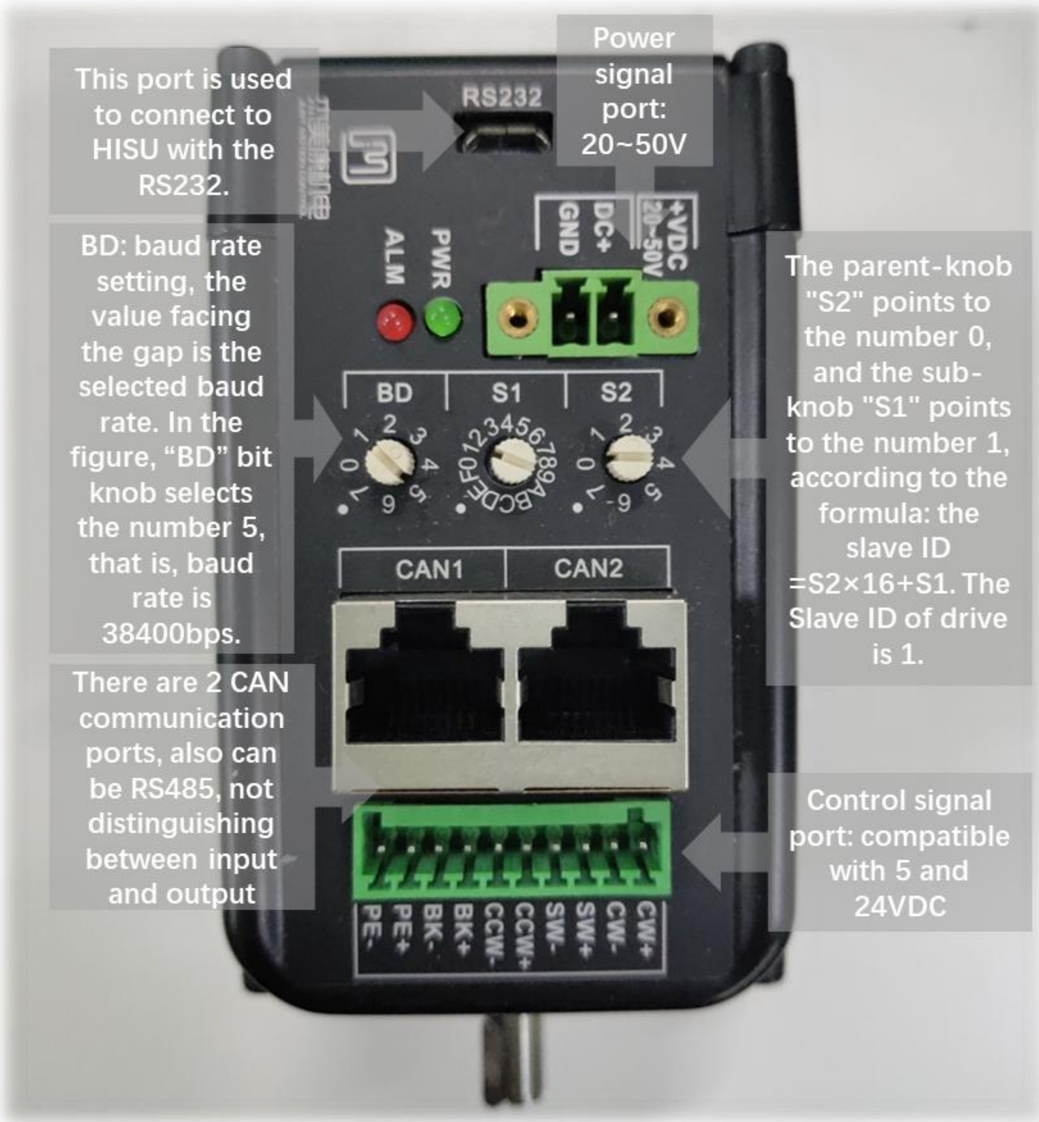


Figure 76 JMC IHSS57-R/RC Practicality

See "*Ports and Connections Introduction*" in this section for the specific definition of each port (Ctrl+ Mouse left or Click text to jump).

10.2 Parameter Setting

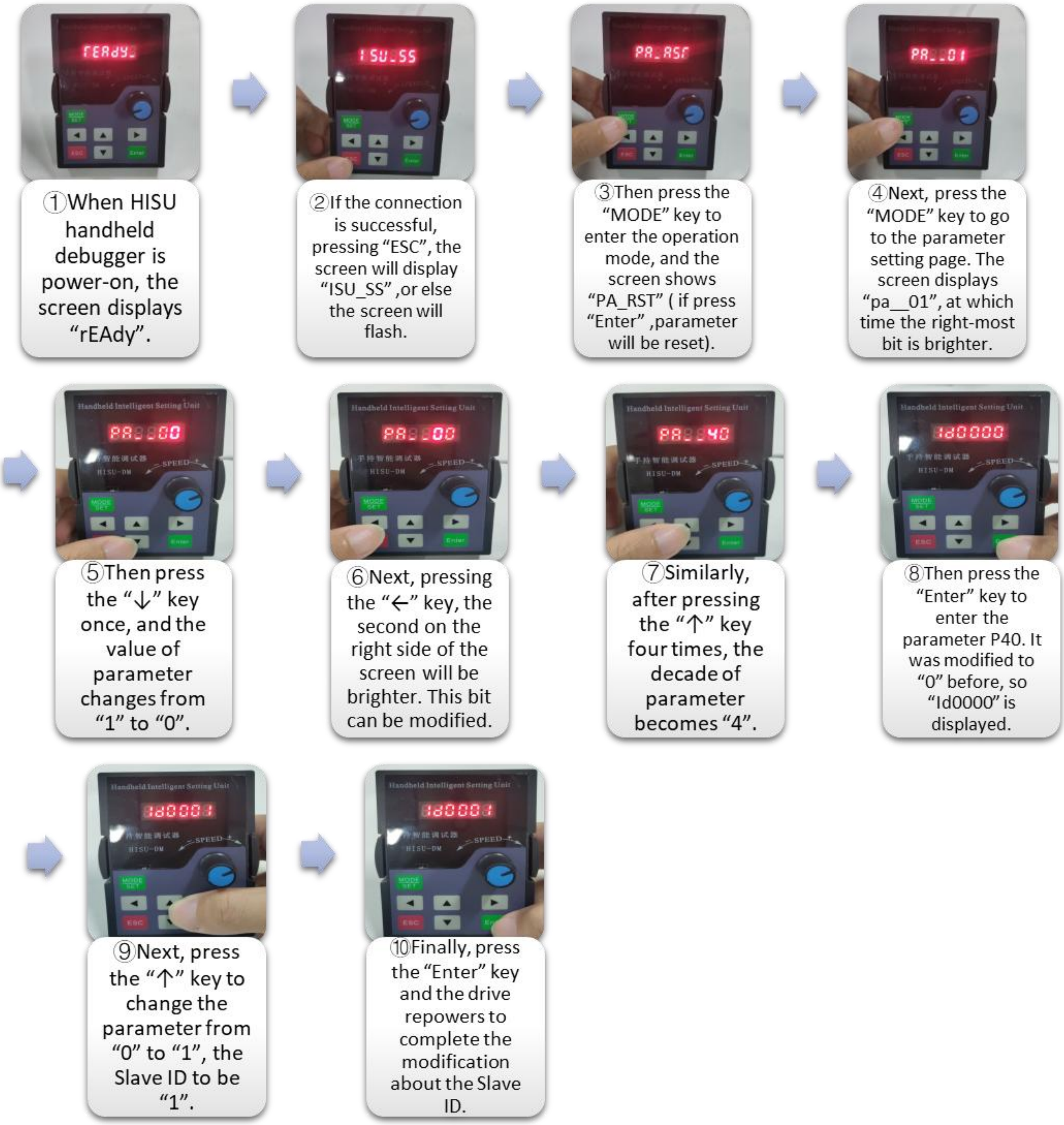


Figure 77 Setting P43 in HISU

The above figure takes the setting of communication mode of drive as an example to change the communication mode from CAN to 485, that is, to set the parameter P43 of drive. Other operations are much the same. According to the above flow chart, user can grasp method of operation of Button panel.

➢ IHSS57-R/RC

1 Electrical, Mechanical and Environmental Specifications

Table 61 Performance of JMC IHSS57-R/RC Drive

<table>
<tr><td colspan="2">Input voltage</td><td>24~48VDC</td></tr>
<tr><td colspan="2">Continuous Current output</td><td>4.0A</td></tr>
<tr><td colspan="2">Communication Type</td><td>CANopen /Modbus-RTU</td></tr>
<tr><td colspan="2">Communication Distance</td><td>1KM</td></tr>
<tr><td colspan="2">Maximum Number of Slaves</td><td>128/32</td></tr>
<tr><td colspan="2">Maximum Communication rate</td><td>1000Kbps/115200bps</td></tr>
<tr><td colspan="2">Logic Input Current</td><td>7~20mA (Typical value 10mA)</td></tr>
<tr><td colspan="2" rowspan="2">Protect</td><td>The peak of over current action value is 12A±10%</td></tr>
<tr><td>Over voltage action value is200VDC</td></tr>
<tr><td colspan="2">Shape Size(mm)</td><td>128×91×56</td></tr>
<tr><td colspan="2">Weight</td><td>Approximately 1500g</td></tr>
<tr><td rowspan="5">Environmental Conditions</td><td>Working Occasion</td><td>Avoid dust, oil mist and corrosive gas as far as possible</td></tr>
<tr><td>Working Temperature</td><td>0~40℃</td></tr>
<tr><td>Storage Temperature</td><td>-20℃~+40℃</td></tr>
<tr><td>Working Humidity</td><td>40~90%RH</td></tr>
<tr><td>Cooling mode</td><td>Natural cooling or forced cold wind</td></tr>
</table>

2 Machine Dimension Diagrams

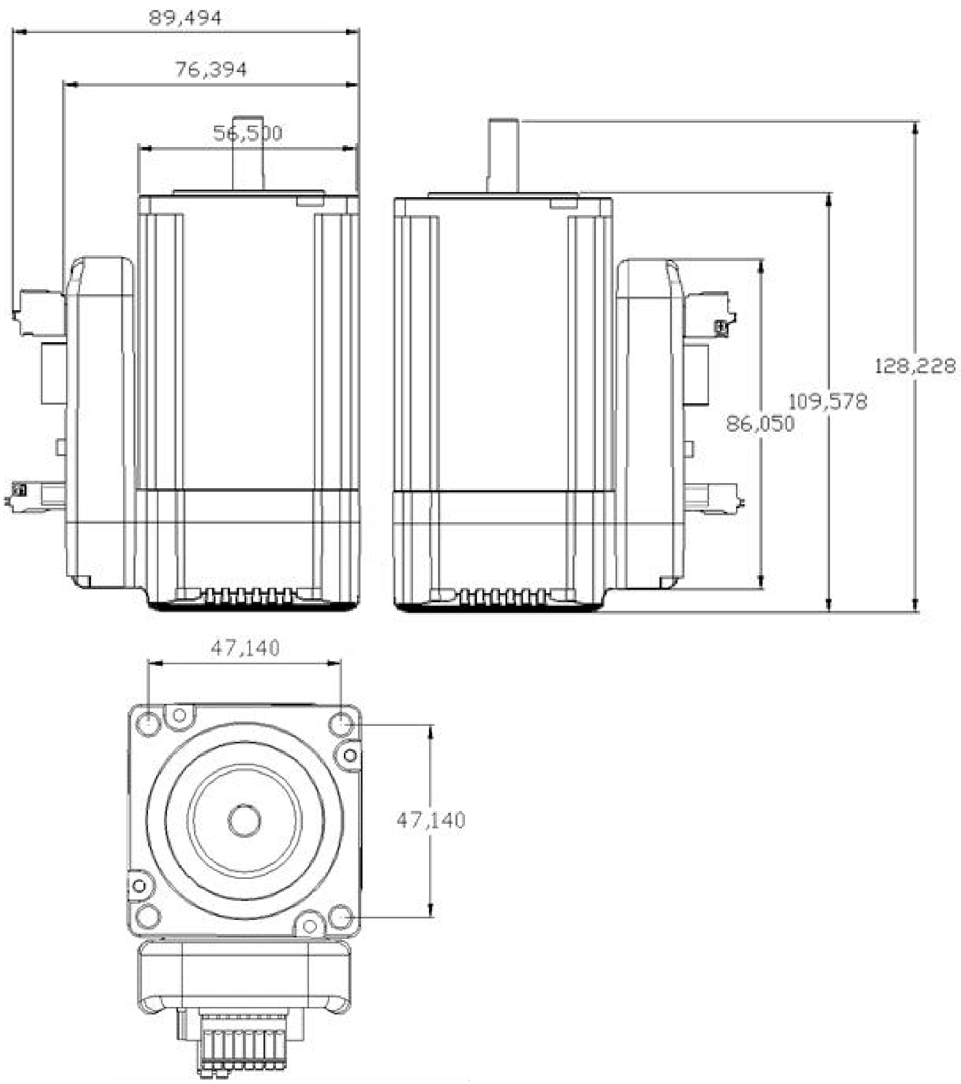


Figure 62 Machine dimension of JMC IHSS57-R/RC Drive (unit: mm)

3 Ports and Connections Introduction

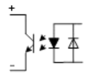
3.1 Power Signal Port

Table 62 Power Interface port of JMC IHSS57-R/RC Drive

Port	Symbol	Definition	Remark
1	DC+	DC power +	24~48VDC
2	GND	DC power -	

3.2 Control Signal Port

Table 63 Control Signal Port of JMC IHSS57-R/RC Drive

Port	Symbol	Definition	Remark
1	CW+	Clockwise Limit +	5V
2	CW-	Clockwise Limit -	
3	SW+	Home Limit +	5V
4	SW-	Home Limit -	
5	CCW+	Counter Clockwise Limit +	5V
6	CCW-	Counter Clockwise Limit -	
7	BK+	External brake of input power +	External brake of input power
8	BK-	External brake of input power -	
9	PE+	Position signal output +	
10	PE-	Position signal output -	

3.3 Connections to Control Signal

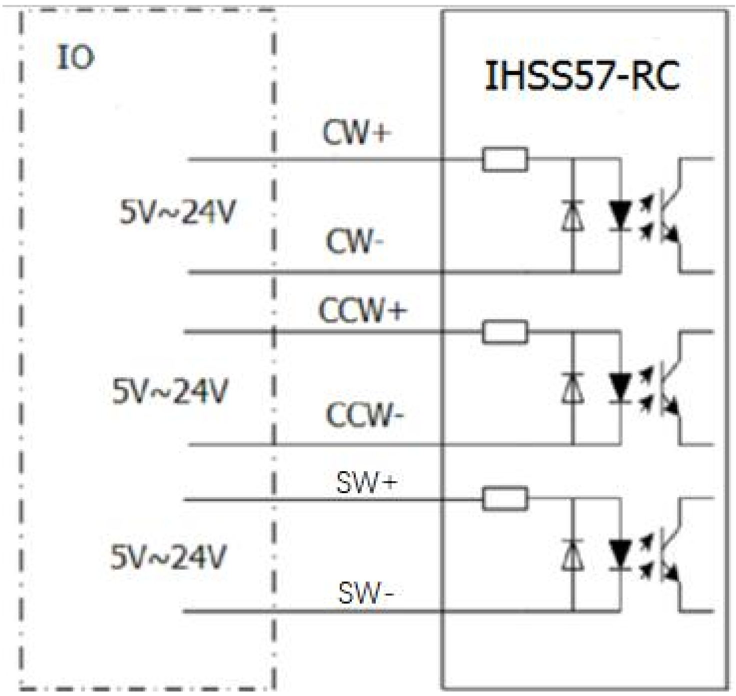


Figure 63 Connections to differential signals

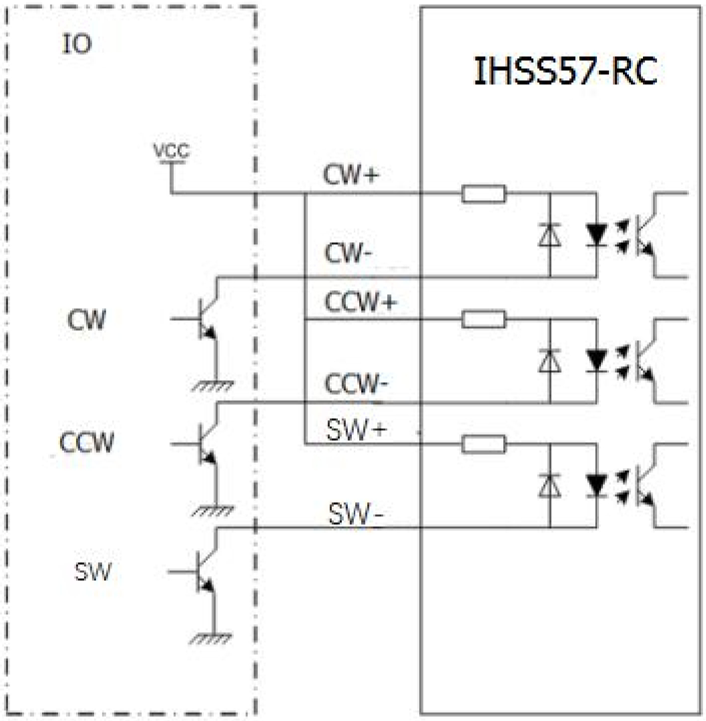


Figure 64 Connections to common anode

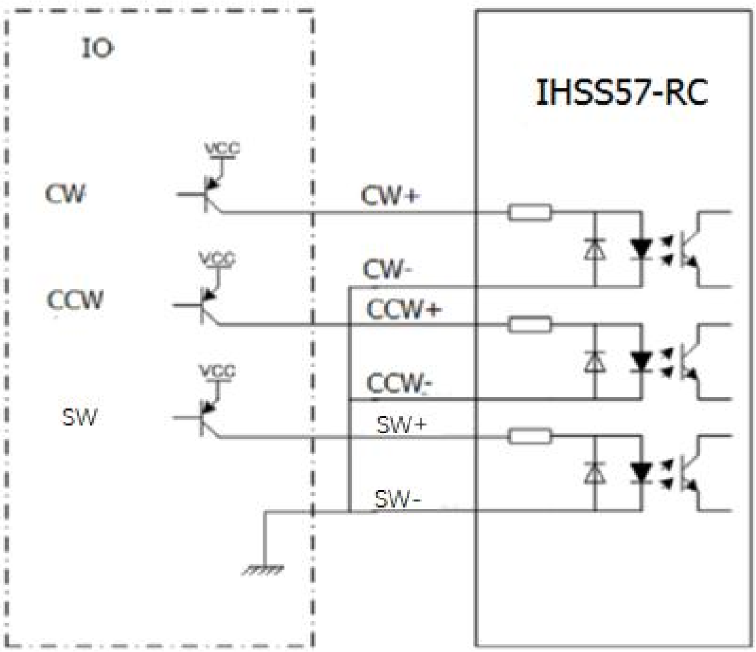


Figure 65 Connections to common cathode

Note: The control signal level is directly connected to 5V, and a 2K resistor needs to be connected in series if 24V is connected.

4 Typical application wiring diagrams

A typical connection diagram made up of the IHSS57-R/RC drive as follow. The power supply selects DC24~48V according to the voltage level of the matched motor.

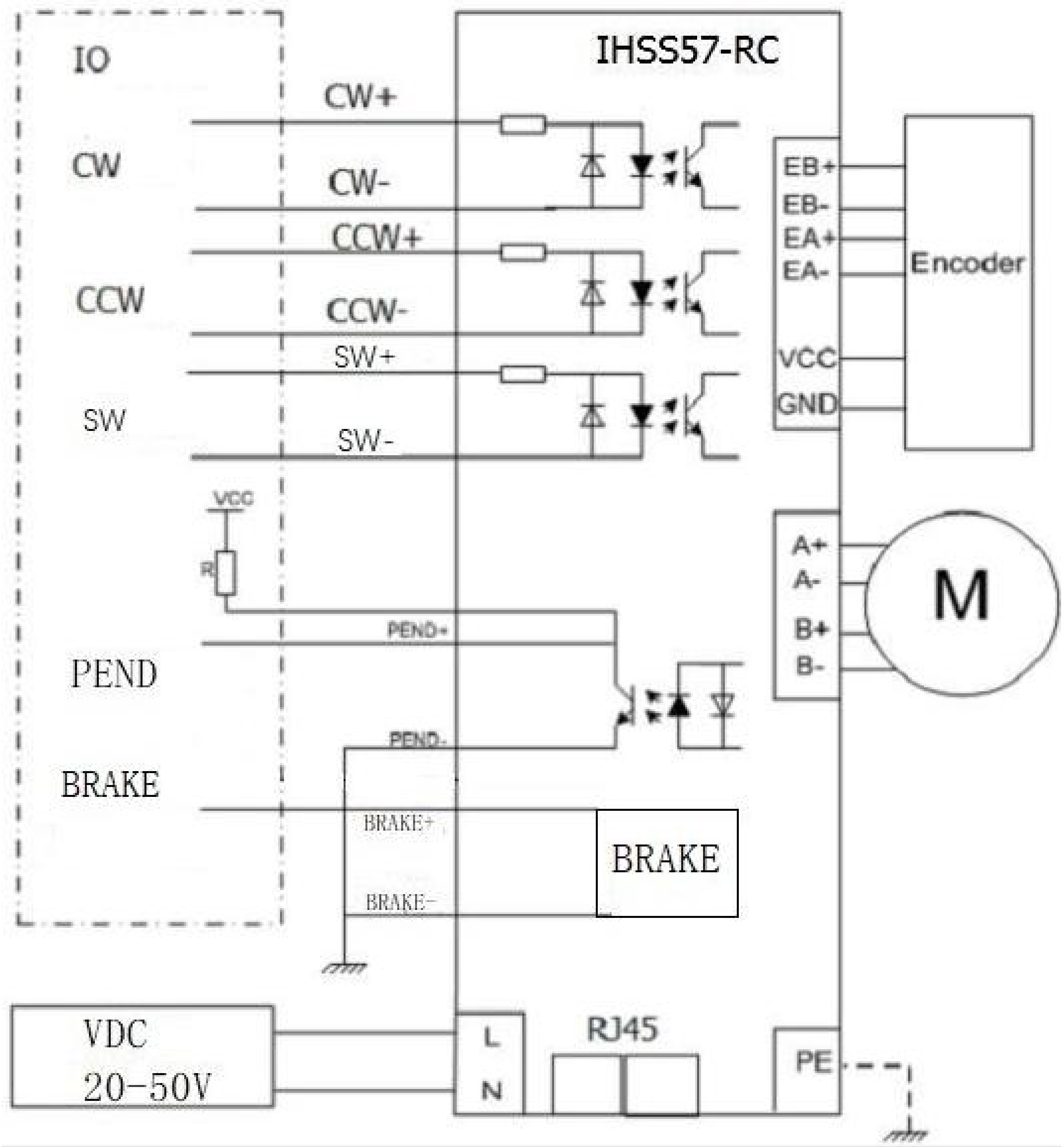


Figure 66 Typical application wiring diagram of JMC IHSS57-R/RC Drive

Notice:

- ✧ BREAK signal to control motor brake, it needs external relay, the maximum current is 50mA.
- ✧ RJ45 network interface through the standard twisted pair cable connected to the other slave, no special difference between the two network ports.

5 Parameters Configure of Drive

There two methods to configure parameters of IHSS57-R/RC. One is set the parameters through the front panel; the other way is to connect it with the HISU. A set of the best default configure parameters has already set in the drive. User need only to configure the parameter Pulses/revolution. The detail functions are as follows:

Actual value = Set value ×the corresponding dimension

Table 64 Internal parameter of JMC IHSS57-R/RC Drive

Parm	Definition	Range	Dimension	Restart Drive	Default Value
P1	Current loop Kp	0—4000	1	No	1000
P2	Current loop Ki	0—1000	1	No	100
P3	Damping coefficient	0—500	1	No	250
P4	Position loop Kp	0—3000	1	No	2000

P5	Position loop Ki	0—1000	1	No	200
P6	Speed loop Kp	0—3000	1	No	500
P7	Speed loop Ki	0—1000	1	No	1000
P8	Open-loop current	0—60	0.1	No	40
P9	Manufacturer	Reserve	Reserve	Reserve	Reserve
P10	Manufacturer	Reserve	Reserve	Reserve	Reserve
P11	Direction level	0—1	1	No	1
P12	Manufacturer	Reserve	Reserve	Reserve	Reserve
P13	Manufacturer	Reserve	Reserve	Reserve	Reserve
P14	Arrival level	0—1	1	No	0
P15	Manufacturer	Reserve	Reserve	Reserve	Reserve
P16	Manufacturer	Reserve	Reserve	Reserve	Reserve
P17	Pulses/Revolution	0—15	1	Yes	2
P18	Manufacturer	Reserve	Reserve	Reserve	Reserve
P19	Speed smoothness	0—10	0	No	2
P20	User-defined p/r	4—1000	50	Yes	8
P21	Manufacturer	Reserve	Reserve	Reserve	Reserve
P22	Pulse filter	0—3	1	No	0
P23	Lock shaft	0—1	1	No	0
P24	Manufacturer	Reserve	Reserve	Reserve	Reserve
P25	Overlay proportion	0—40	1	No	10
P26	Stop damping	0—500	1	No	200
P27	Low-speed damping	0—500	1	No	50
P28	Manufacturer	Reserve	Reserve	Reserve	Reserve
P29	Manufacturer	Reserve	Reserve	Reserve	Reserve
P30	Lost phase	0—1	1	Yes	1
P31	Manufacturer	Reserve	Reserve	Reserve	Reserve
P32	Manufacturer	Reserve	Reserve	Reserve	Reserve
P33	Manufacturer	Reserve	Reserve	Reserve	Reserve
P34	Manufacturer	Reserve	Reserve	Reserve	Reserve
P35	Manufacturer	Reserve	Reserve	Reserve	Reserve
P36	Semi-flow time	0—60000	MS	No	500
P37	Semi-flow percent	0—100	1%	No	50
P38	Manufacturer	Reserve	Reserve	Reserve	Reserve
P39	Manufacturer	Reserve	Reserve	Reserve	Reserve
P40	Slave ID	1—128	1	Yes	0
P41	Slave baud rate	0—7	1	Yes	0
P42	IO signal polarity	0—1	1	Yes	1
P43	Communication mode	0—1	1	Yes	1
P44	Limit signal upload	0—1	1	No	0
P45	Target speed unit	0—1	1	No	0

Those parameters can be set by using Button Panel, can also be set by using HISU adjuster. The detail descriptions to every parameter configuration are as follows:

- ✧ **P1~7**are used to change parameters of current loop, damping, position loop and speed loop.
- ✧ **P8**, this parameter affects the static torque of the motor.

✧ **P10** is set to control the Alarm optocoupler. Output transistor 0 means the transistor is cut off when the system is in normal working, but when it comes to fault of the drive, the transistor becomes conductive. 1 means opposite to 0.

✧ **P11** is used to control direction level. By this parameter, drive's default orientation can be changed.

✧ **P14** is set to control the Arrival optocoupler output transistor. 0 means the transistor is cut off when the drive satisfies the arrival command, but when it comes to not, the transistor becomes conductive. 1 means opposite to 0.

✧ **P17** is used to select pulses.It shall restart.

Table 65 P17 of JMC IHSS57-R/RC: Pulses/Revolution

Parameter	0	1	2	3	4	5	6	7
Pulses	user-def	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
Pulses	1000	2000	4000	5000	8000	10000	20000	40000

Notice: In addition, the drive provides users with pulses that they can set up freely via parameter 20.

✧ **P18** is used to select single pulse or double pulse. 1 means single pulse and direction, while 0 means double pulse.

✧ **P19**, Speed smoothness, this parameter is set to control the smoothness of the speed of the motor while acceleration or deceleration, the larger the value, the smoother the speed in acceleration or deceleration.

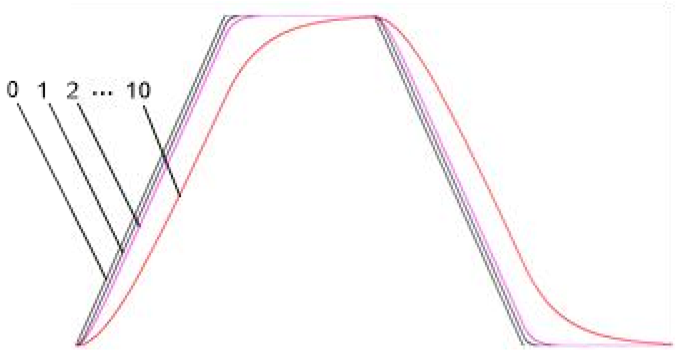


Figure 67 P19 of JMC IHSS57-R/RC Drive: Speed smoothness

✧ **P20** is used to set up user-defined pulses.It shall restart.

✧ **P22** is Pulse filter, setting 0~3. As the value increases, the frequency of the passing pulse decreases gradually. This is used to suppress the electronic interference generated in the environment.

✧ **P23** is Stop lock enable. This parameter is set to the drive not count external pulses and lock shaft or not.1 means enable this function while 0 means disable it.

✧ **P30** is used to check whether the motor is out of phase.1 means used, while 0 means not used. But this is for manufacturer only.It shall restart.

✧ **P36** is used to set the time after motor stops about motor current. Its default value is 1000, which means that motor had stopped after 1000ms.

✧ **P37** is used to set the Semi-flow percent to control motor current. Its unit is 1%, whose default value is 50.

[STOP STATE] Motor current = Open-loop current (P8) × Semi-flow percent (P37)

✧ **P40** is used to set slaves 'node identifier. It shall restart.

✧ **P41** is used to select baud rate of CAN or RS485.It shall restart so that can be working.

Table 66 P41 of JMC IHSS57-R/RC Drive: Baud rate

Baud Rate	0	1	2	3	4	5	6	7
CAN (Kbps)	12.5	20	50	100	200	250	500	1000
485 (bps)	1200	2400	4800	9600	19200	38400	57600	115200

- ✧ **P42** is used to select IO input signal polarity. P42=0: use PNP type limit switch; P42=1: use NPN type limit switch.It shall restart.
- ✧ **P43** is used to select communication mode. P43=0: select 485 communication, P43=1: select CANopen communication. It shall restart.
- ✧ **P44** is used to select whether limit signal upload to object 60FD. 1 means enabling this function while 0 means disabling it.
- ✧ **P45** is used to set unit of target speed. 1 means that unit is 0.1RPS. 0 means that unit is 1/Revolution.

6 Rotary DIP Switch

6.1 Baud Rate Setting

The baud rate set for the CANopen communication and the RS-485 communication are set by the spin switch BD, which is set as follows:

Table 67 Baud Rate Setting of JMC IHSS57-R/RC Drive

Encoded value	Baud Rate of CAN (bps)	Baud Rate of RS-485 (bps)
0	12.5K	1200
1	20K	2400
2	50K	4800
3	100K	9600
4	125K	19200
5	250K	38400
6	500K	57600
7	1M	115200

6.2 SlaveID setting

The Slave ID is set up by the combination of a sub and parent switch, in which the S1 is a sub-switch, range of encoded value between 0x00~0x0f and the S2 is the parent-switch, range of encoded value between 0x00~0x07.The encoded value of S2 is the second in hexadecimal number(such as 7 at 0x7A). The encoded value of S1 is the first in hexadecimal number (such as A at 0x7A).

Slave ID = S2*16 + S1

The specific setting method can be seen in the "Quick Guides" in this section (Ctrl+ Mouse left or Click text to jump).

7 Parameter Adjustment Methods

7.1 Connect to HISU

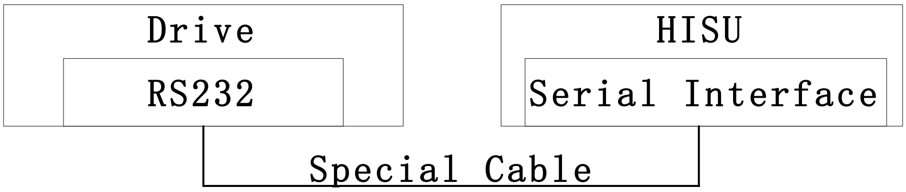


Figure 68 Connect to HISU

Notice:In case of causing any damage, please confirm the connection cables between Drive and HISU before using it.

7.2 Drive Parameter Setting

【1】Display and Operation

The rEAdy_ diagram is shown as follows:

Figure 69 Display after power-on

The connection success is shown as follows (if the connection is not connected, the LED digital tube will always flicker):

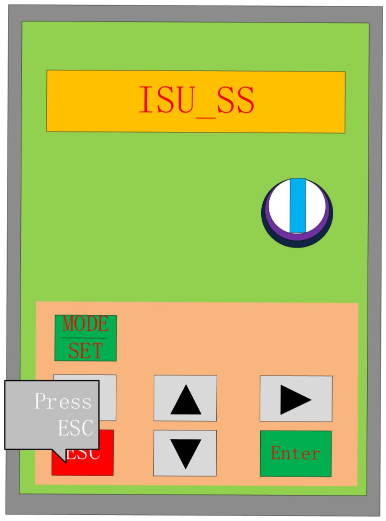


Figure 70 Connect successfully

After the connection is successful, press the MODE key to enter the various mode functions; the following figure is the parameter reset function:

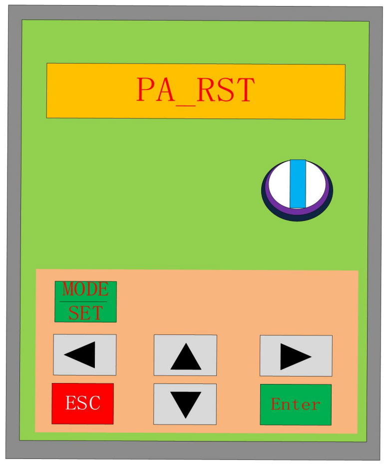


Figure 71 Mode function switching

The function description is as follows:

Table 68 Function description about HISU

Display	Function	Description
PR_RST	Reset parameter	Initializeparameter
PA_ _01	Parameter adjustment	Adjust parameter value
dA_ _UP	Parameter upload/download	Sets of parameters uploaded / downloaded

【2】Operating instructions

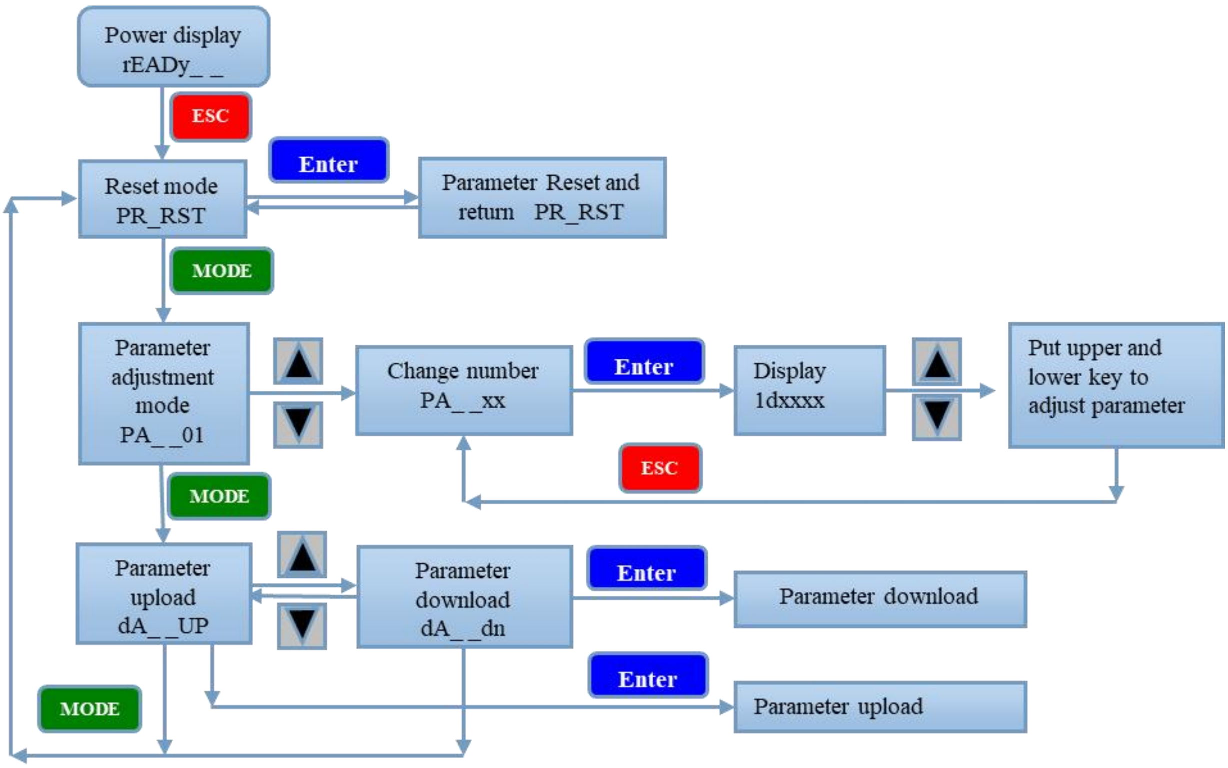


Figure 72 Operation flow chart

Description: Press each function key to adjust the mode or parameter, the arrow indicates the effect after pressing the key.

【3】Example of parameter mode operation

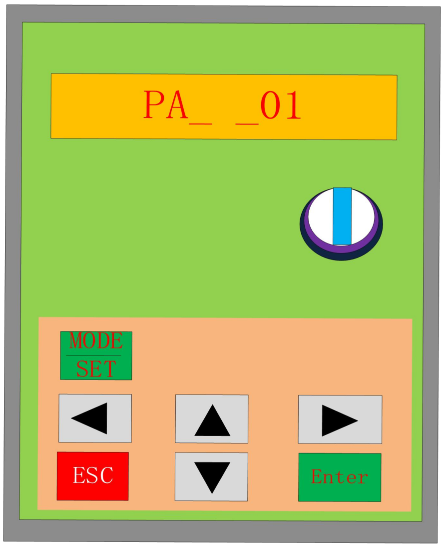


Figure 73 Display chart of parameter adjustment

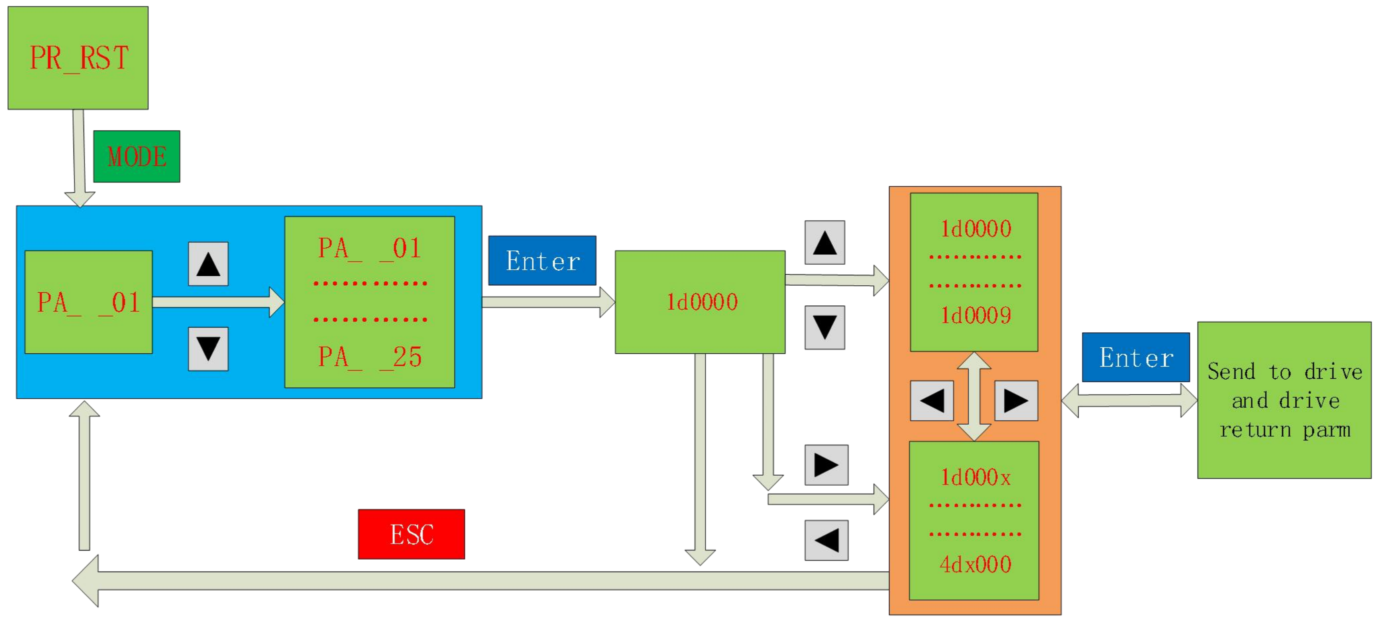


Figure 74 Flow chart of parameter adjustment

Description: When we press the Enter key to enter the parameters, we can see the initial value of the parameter. After changing the parameters, it shows the actual value of the drive parameter (for example, send that value is 9, but the actual return that is 1, then display 1).

8 Failure Alarm

8.1 Alarm Signal Sequence

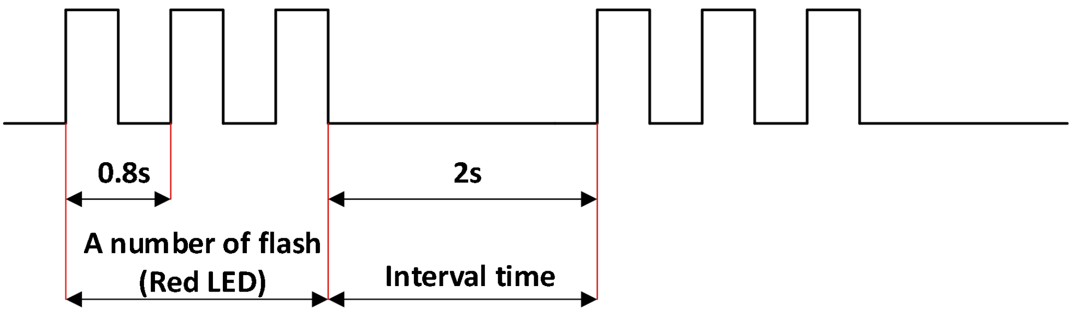


Figure 75 Alarm Signal Sequence

8.2Failure Alarm Table

Table 69 Failure Alarm Table for JMC IHSS57-R/RC

A number of flash		Description
Red	Green	
Off	Flicker	Drive CAN communication is unlinked
Off	On	Drive power up normally
1	On	Over current
2	On	Parameter upload Error
3	On	Power supply under maximum

4	On	Over position
5	On	Communication Error
6	On	CCWdirection limit
7	On	CWdirection limit
8	On	SWdirection limit
9	On	Drive overheating
10	On	Loss phase

9 RS485 Communication Parameter Setting

When RS485 communication mode is used by the drive, communication parameters of the upper computer or other communication stations shall be set in advance. The default configuration parameters of the driver are as follows:

Table 70 RS485 Communication Parameter Setting of JMC IHSS57-R/RC Drive

Parameter	Baud Rate	Start	Data	Stop	Check
Value	0~115200bps	1Bit	8Bit	1Bit	None

10 Quick Guides

10.1 Hardware Wiring

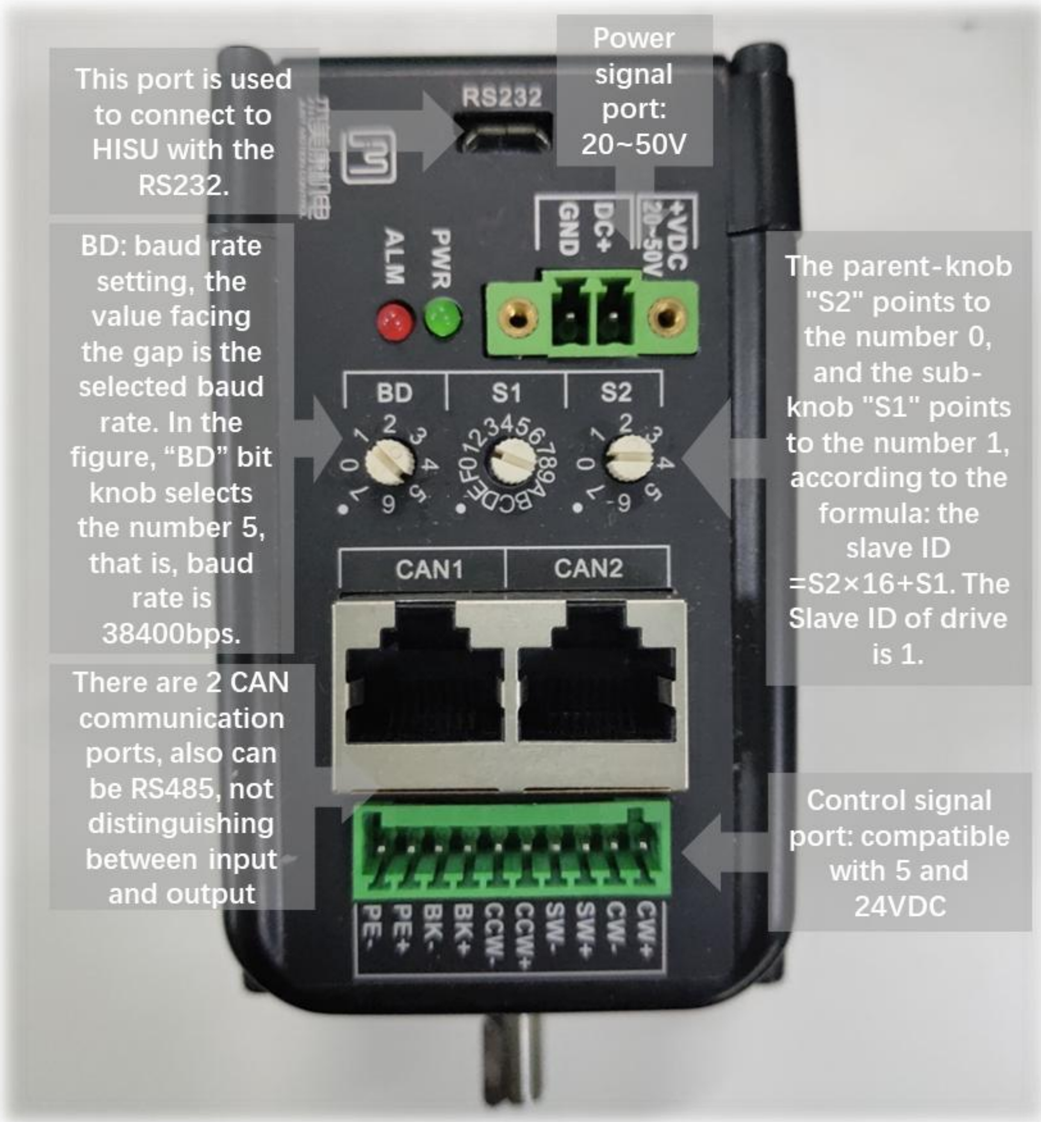


Figure 76 JMC IHSS57-R/RC Practicality

See "*Ports and Connections Introduction*" in this section for the specific definition of each port (Ctrl+ Mouse left or Click text to jump).

10.2 Parameter Setting

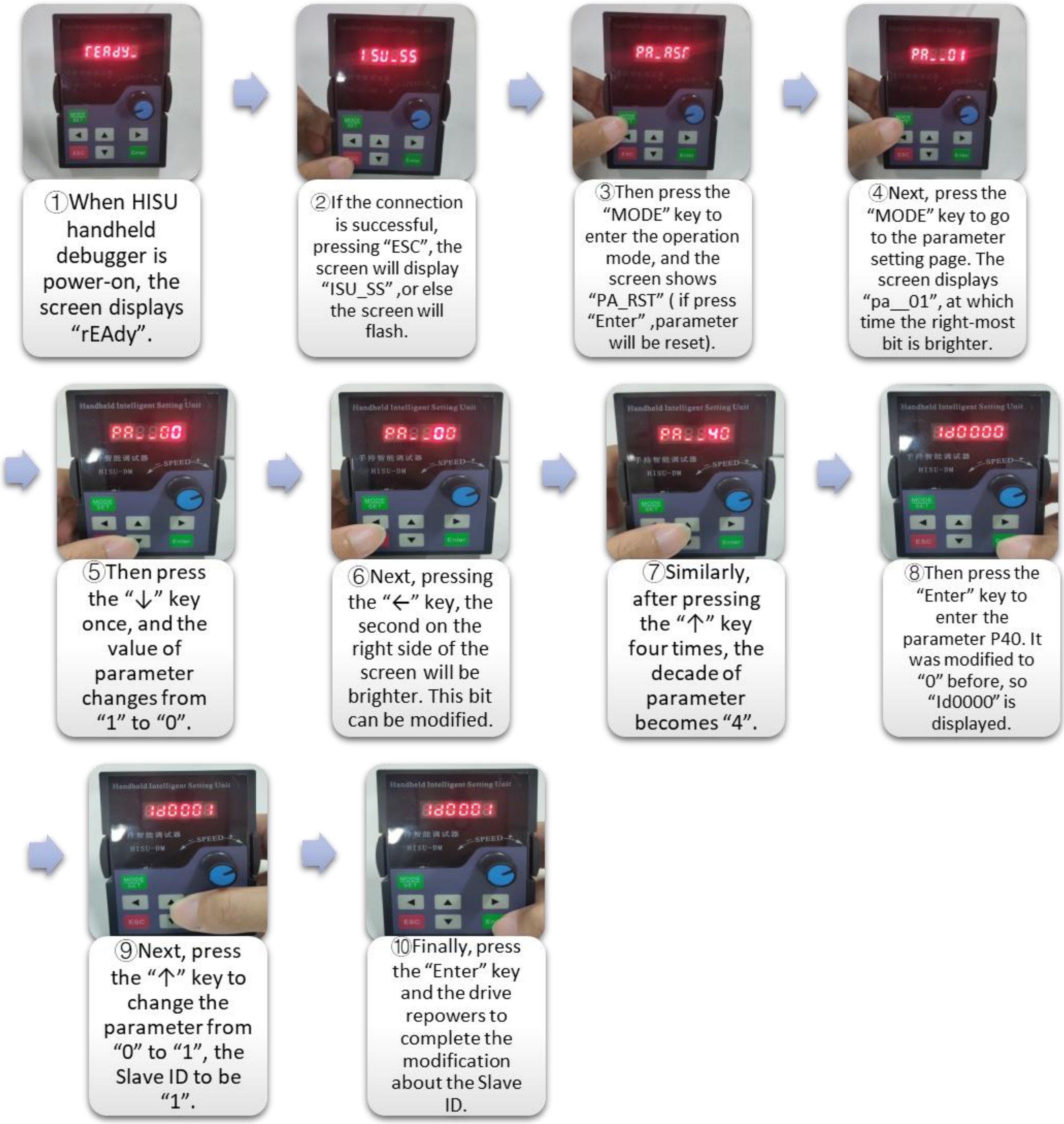


Figure 77 Setting P43 in HISU

The above figure takes the setting of communication mode of drive as an example to change the communication mode from CAN to 485, that is, to set the parameter P43 of drive. Other operations are much the same. According to the above flow chart, user can grasp method of operation of Button panel.

➢ IHSS60-R/RC

1 Electrical, Mechanical and Environmental Specifications

Table 71 Performance of JMC IHSS60-R/RC Drive

<table>
<tr><td colspan="2">Input voltage</td><td>24~48VDC</td></tr>
<tr><td colspan="2">Continuous Current output</td><td>4.0A</td></tr>
<tr><td colspan="2">Communication Type</td><td>CANopen /Modbus-RTU</td></tr>
<tr><td colspan="2">Communication Distance</td><td>1KM</td></tr>
<tr><td colspan="2">Maximum Number of Slaves</td><td>128/32</td></tr>
<tr><td colspan="2">Maximum Communication rate</td><td>1000Kbps/115200bps</td></tr>
<tr><td colspan="2">Logic Input Current</td><td>7~20mA (Typical value 10mA)</td></tr>
<tr><td colspan="2" rowspan="2">Protect</td><td>The peak of over current action value is 12A±10%</td></tr>
<tr><td>Over voltage action value is200VDC</td></tr>
<tr><td colspan="2">Shape Size(mm)</td><td>151×96×60</td></tr>
<tr><td colspan="2">Weight</td><td>Approximately 1500g</td></tr>
<tr><td rowspan="5">Environmental Conditions</td><td>Working Occasion</td><td>Avoid dust, oil mist and corrosive gas as far as possible</td></tr>
<tr><td>Working Temperature</td><td>0~40℃</td></tr>
<tr><td>Storage Temperature</td><td>-20℃~+40℃</td></tr>
<tr><td>Working Humidity</td><td>40~90%RH</td></tr>
<tr><td>Cooling mode</td><td>Natural cooling or forced cold wind</td></tr>
</table>

2 Machine Dimension Diagrams

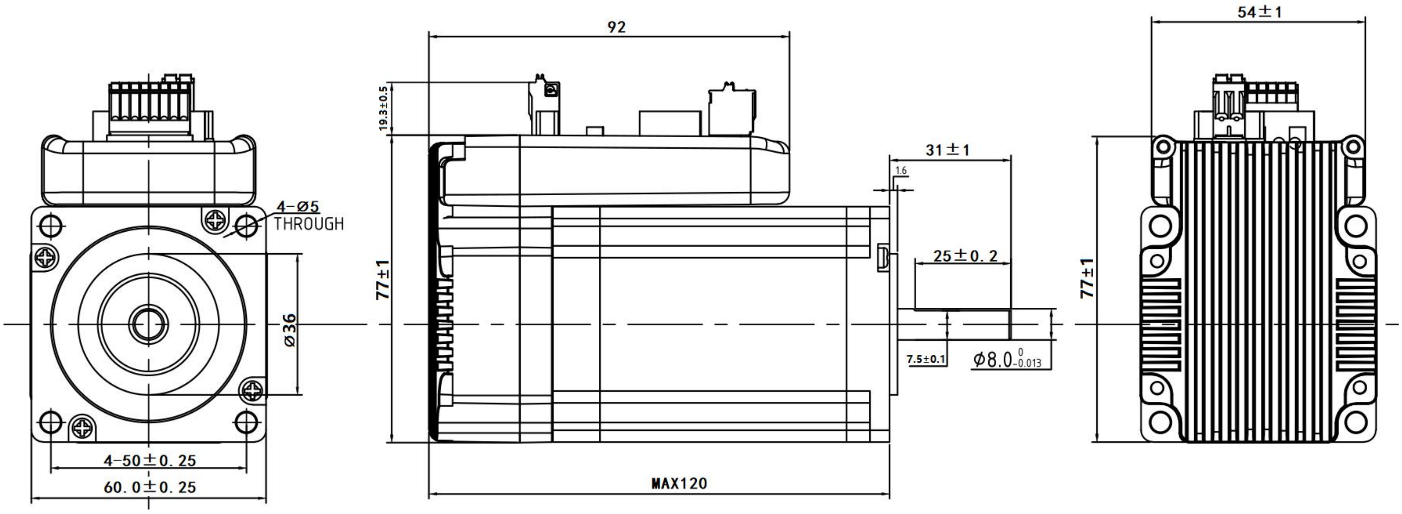


Figure 78 Machine dimension of JMC IHSS60-R/RC Drive (unit: mm)

3 Ports and Connections Introduction

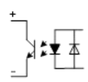
3.1 Power Signal Port

Table 72 Power Interface port of JMC IHSS60-R/RC Drive

Port	Symbol	Definition	Remark
1	DC+	DC power +	24~48VDC
2	GND	DC power -	

3.2 Control Signal Port

Table 73 Control Signal Port of JMC IHSS60-R/RC Drive

Port	Symbol	Definition	Remark
1	CW+	Clockwise Limit +	5V
2	CW-	Clockwise Limit -	
3	SW+	Home Limit +	5V
4	SW-	Home Limit -	
5	CCW+	Counter Clockwise Limit +	5V
6	CCW-	Counter Clockwise Limit -	
7	BK+	External brake of input power +	External brake of input power
8	BK-	External brake of input power -	
9	PE+	Position signal output +	
10	PE-	Position signal output -	

3.3 Connections to Control Signal

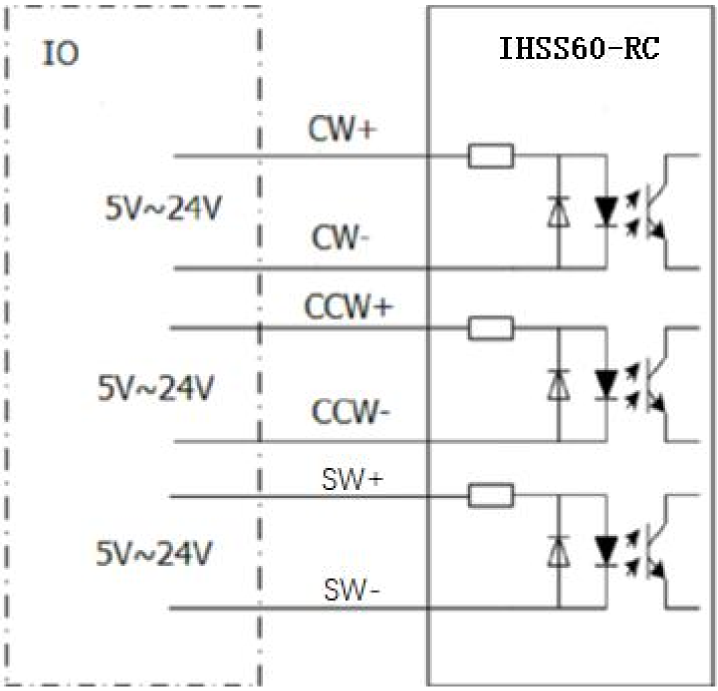


Figure 79 Connections to differential signals

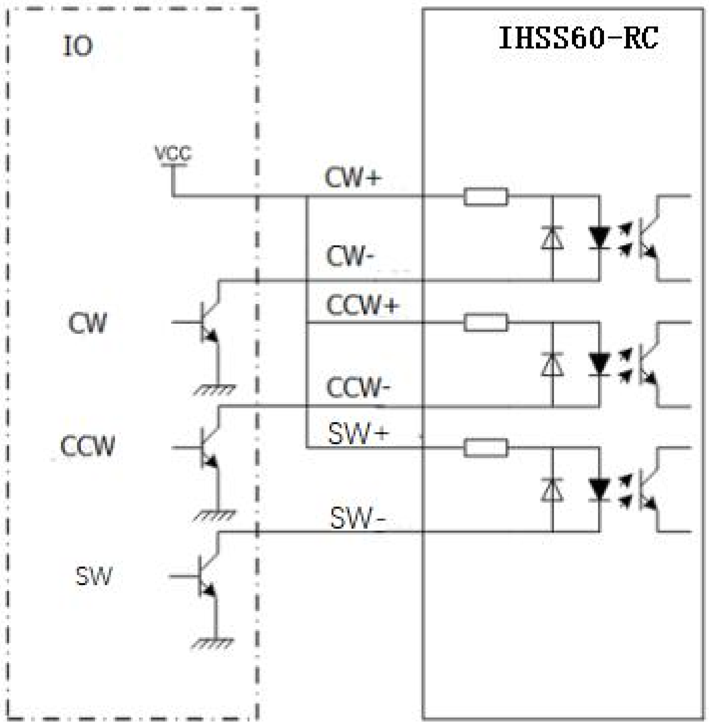


Figure 80 Connections to common anode

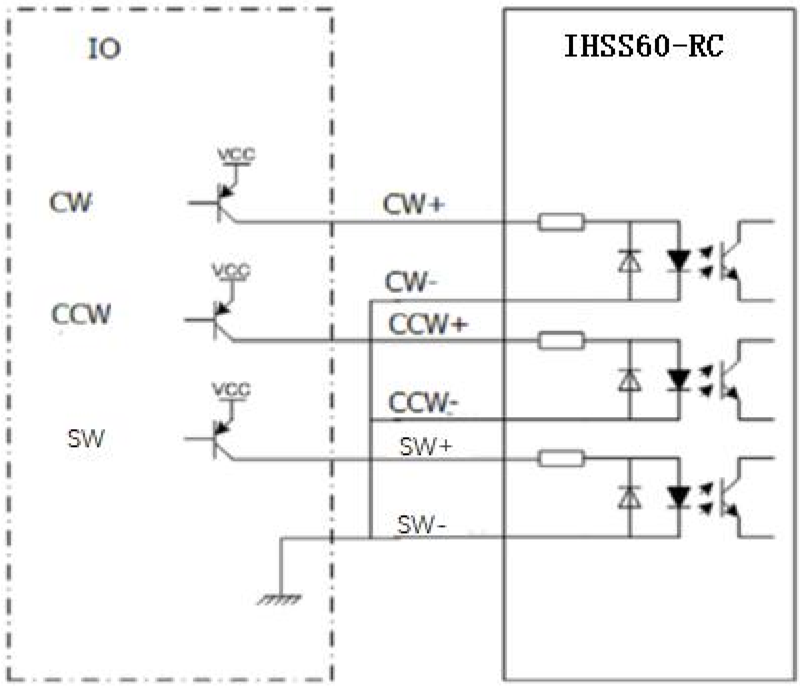


Figure 81 Connections to common cathode

Note: The control signal level is directly connected to 5V, and a 2K resistor needs to be connected in series if 24V is connected.

4 Typical application wiring diagrams

A typical connection diagram made up of the IHSS60-R/RC drive as follow. The power supply selects DC24~50V according to the voltage level of the matched motor.

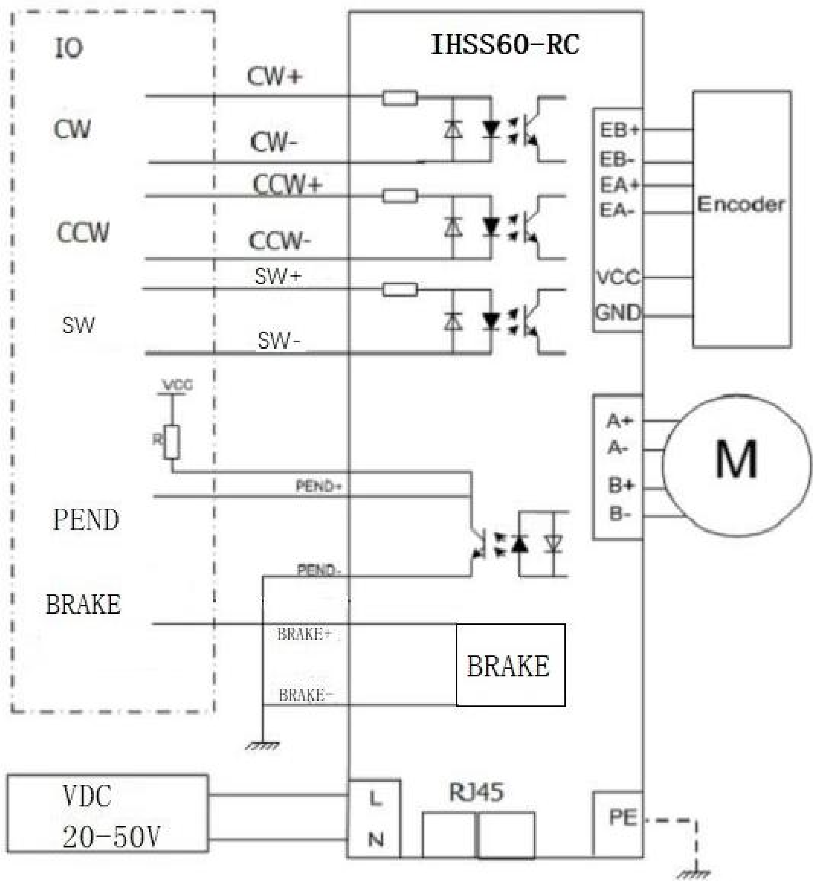


Figure 82 Typical application wiring diagram of JMC IHSS60-R/RC Drive

Notice:

- ✧ BREAK signal to control motor brake, it needs external relay, the maximum current is 50mA.
- ✧ RJ45 network interface through the standard twisted pair cable connected to the other slave, no special difference between the two network ports.

5 Parameters Configure of Drive

There two methods to configure parameters of IHSS60-R/RC. One is set the parameters through the front panel; the other way is to connect it with the HISU. A set of the best default configure parameters has already set in the drive. User need only to configure the parameter Pulses/revolution. The detail functions are as follows:

Actual value = Set value ×the corresponding dimension

Table 74 Internal parameter of JMC IHSS60-R/RC Drive

Parm	Definition	Range	Dimension	Restart Drive	Default Value
P1	Current loop Kp	0—4000	1	No	1000
P2	Current loop Ki	0—1000	1	No	100
P3	Damping coefficient	0—500	1	No	250
P4	Position loop Kp	0—3000	1	No	2000
P5	Position loop Ki	0—1000	1	No	200
P6	Speed loop Kp	0—3000	1	No	500
P7	Speed loop Ki	0—1000	1	No	1000
P8	Open-loop current	0—60	0.1	No	40
P9	Manufacturer	Reserve	Reserve	Reserve	Reserve
P10	Manufacturer	Reserve	Reserve	Reserve	Reserve
P11	Direction level	0—1	1	No	1
P12	Manufacturer	Reserve	Reserve	Reserve	Reserve
P13	Manufacturer	Reserve	Reserve	Reserve	Reserve
P14	Arrival level	0—1	1	No	0
P15	Manufacturer	Reserve	Reserve	Reserve	Reserve
P16	Manufacturer	Reserve	Reserve	Reserve	Reserve
P17	Pulses/Revolution	0—15	1	Yes	2
P18	Manufacturer	Reserve	Reserve	Reserve	Reserve
P19	Speed smoothness	0—10	0	No	2
P20	User-defined p/r	4—1000	50	Yes	8
P21	Manufacturer	Reserve	Reserve	Reserve	Reserve
P22	Pulse filter	0—3	1	No	0
P23	Lock shaft	0—1	1	No	0
P24	Manufacturer	Reserve	Reserve	Reserve	Reserve
P25	Overlay proportion	0—40	1	No	10
P26	Stop damping	0—500	1	No	200
P27	Low-speed damping	0—500	1	No	50
P28	Manufacturer	Reserve	Reserve	Reserve	Reserve
P29	Manufacturer	Reserve	Reserve	Reserve	Reserve
P30	Lost phase	0—1	1	Yes	1

P31	Manufacturer	Reserve	Reserve	Reserve	Reserve
P32	Manufacturer	Reserve	Reserve	Reserve	Reserve
P33	Manufacturer	Reserve	Reserve	Reserve	Reserve
P34	Manufacturer	Reserve	Reserve	Reserve	Reserve
P35	Manufacturer	Reserve	Reserve	Reserve	Reserve
P36	Semi-flow time	0—60000	MS	No	500
P37	Semi-flow percent	0—100	1%	No	50
P38	Manufacturer	Reserve	Reserve	Reserve	Reserve
P39	Manufacturer	Reserve	Reserve	Reserve	Reserve
P40	Slave ID	1—128	1	Yes	0
P41	Slave baud rate	0—7	1	Yes	0
P42	IO signal polarity	0—1	1	Yes	1
P43	Communication mode	0—1	1	Yes	1
P44	Limit signal upload	0—1	1	No	0
P45	Target speed unit	0—1	1	No	0

Those parameters can be set by using Button Panel, can also be set by using HISU adjuster. The detail descriptions to every parameter configuration are as follows:

- **P1~7**are used to change parameters of current loop, damping, position loop and speed loop.
- **P8**, this parameter affects the static torque of the motor.
- **P10** is set to control the Alarm optocoupler. Output transistor 0 means the transistor is cut off when the system is in normal working, but when it comes to fault of the drive, the transistor becomes conductive. 1 means opposite to 0.
- **P11** is used to control direction level. By this parameter, drive's default orientation can be changed.
- **P14** is set to control the Arrival optocoupler output transistor. 0 means the transistor is cut off when the drive satisfies the arrival command, but when it comes to not, the transistor becomes conductive. 1 means opposite to 0.
- **P17** is used to select pulses.It shall restart.

Table 75 P17 of JMC IHSS60-R/RC: Pulses/Revolution

Parameter	0	1	2	3	4	5	6	7
Pulses	user-def	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
Pulses	1000	2000	4000	5000	8000	10000	20000	40000

Notice: In addition, the drive provides users with pulses that they can set up freely via parameter 20.

- **P18** is used to select single pulse or double pulse. 1 means single pulse and direction, while 0 means double pulse.
- **P19**, Speed smoothness, this parameter is set to control the smoothness of the speed of the motor while acceleration or deceleration, the larger the value, the smoother the speed in acceleration or deceleration.

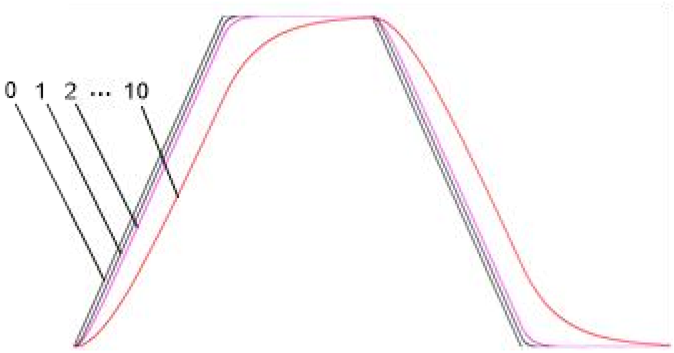


Figure 83 P19 of JMC IHSS60-R/RC Drive: Speed smoothness

- ✧ **P20** is used to set up user-defined pulses.It shall restart.
- ✧ **P22** is Pulse filter, setting 0~3. As the value increases, the frequency of the passing pulse decreases gradually. This is used to suppress the electronic interference generated in the environment.
- ✧ **P23** is Stop lock enable. This parameter is set to the drive not count external pulses and lock shaft or not.1 means enable this function while 0 means disable it.
- ✧ **P30** is used to check whether the motor is out of phase.1 means used, while 0 means not used. But this is for manufacturer only.It shall restart.
- ✧ **P36** is used to set the time after motor stops about motor current. Its default value is 1000, which means that motor had stopped after 1000ms.
- ✧ **P37** is used to set the Semi-flow percent to control motor current. Its unit is 1%, whose default value is 50.

  [STOP STATE] Motor current = Open-loop current (P8) × Semi-flow percent (P37)
- ✧ **P40** is used to set slaves' node identifier. It shall restart.
- ✧ **P41** is used to select baud rate of CAN or RS485.It shall restart so that can be working.

Table 76 P41 of JMC IHSS60-R/RC Drive: Baud rate

Baud Rate	0	1	2	3	4	5	6	7
CAN (Kbps)	12.5	20	50	100	200	250	500	1000
485 (bps)	1200	2400	4800	9600	19200	38400	57600	115200

- ✧ **P42** is used to select IO input signal polarity. P42=0: use PNP type limit switch; P42=1: use NPN type limit switch.It shall restart.
- ✧ **P43** is used to select communication mode. P43=0: select 485 communication, P43=1: select CANopen communication. It shall restart.
- ✧ **P44** is used to select whether limit signal upload to object 60FD. 1 means enabling this function while 0 means disabling it.
- ✧ **P45** is used to set unit of target speed. 1 means that unit is 0.1RPS. 0 means that unit is 1/Revolution.

6 Rotary DIP Switch

6.1 Baud Rate Setting

The baud rate set for the CANopen communication and the RS-485 communication are set by the spin switch BD, which is set as follows:

Table 77 Baud Rate Setting of JMC IHSS60-R/RC Drive

Encoded value	Baud Rate of CAN (bps)	Baud Rate of RS-485 (bps)

0	12.5K	1200
1	20K	2400
2	50K	4800
3	100K	9600
4	125K	19200
5	250K	38400
6	500K	57600
7	1M	115200

6.2 Slave ID setting

The Slave ID is set up by the combination of a sub and parent switch, in which the S1 is a sub-switch, range of encoded value between 0x00~0x0f and the S2 is the parent-switch, range of encoded value between 0x00~0x07.The encoded value of S2 is the second in hexadecimal number(such as 7 at 0x7A). The encoded value of S1 is the first in hexadecimal number (such as A at 0x7A).

Slave ID = S2*16 + S1

The specific setting method can be seen in the "Quick Guides" in this section (Ctrl+ Mouse left or Click text to jump).

7 Parameter Adjustment Methods

7.1 Connect to HISU

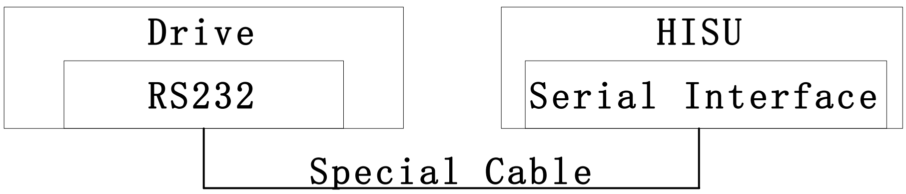


Figure 84 Connect to HISU

Notice:In case of causing any damage, please confirm the connection cables between Drive and HISU before using it.

7.2 Drive Parameter Setting

【1】Display and Operation

The rEAdy_ diagram is shown as follows:

Figure 85 Display after power-on

The connection success is shown as follows (if the connection is not connected, the LED digital tube will always flicker):

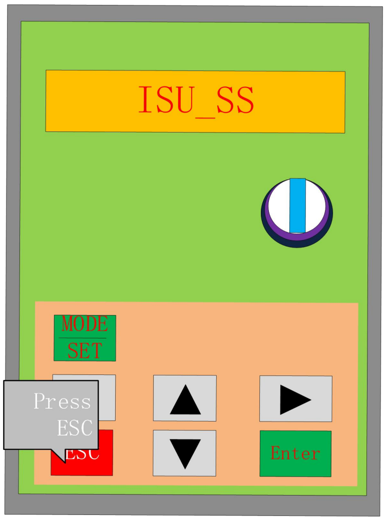


Figure 86 Connect successfully

After the connection is successful, press the MODE key to enter the various mode functions; the following figure is the parameter reset function:

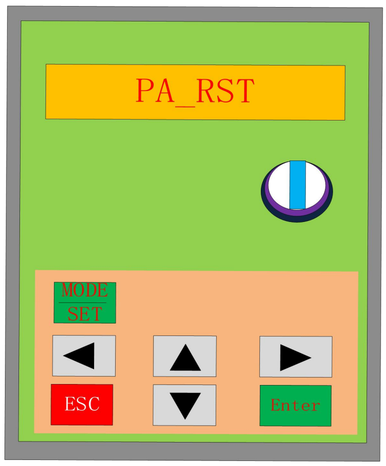


Figure 87 Mode function switching

The function description is as follows:

Table 78 Function description about HISU

Display	Function	Description

PR_RST	Reset parameter	Initializeparameter
PA_ _01	Parameter adjustment	Adjust parameter value
dA_ _UP	Parameter upload/download	Sets of parameters uploaded / downloaded

【2】Operating instructions

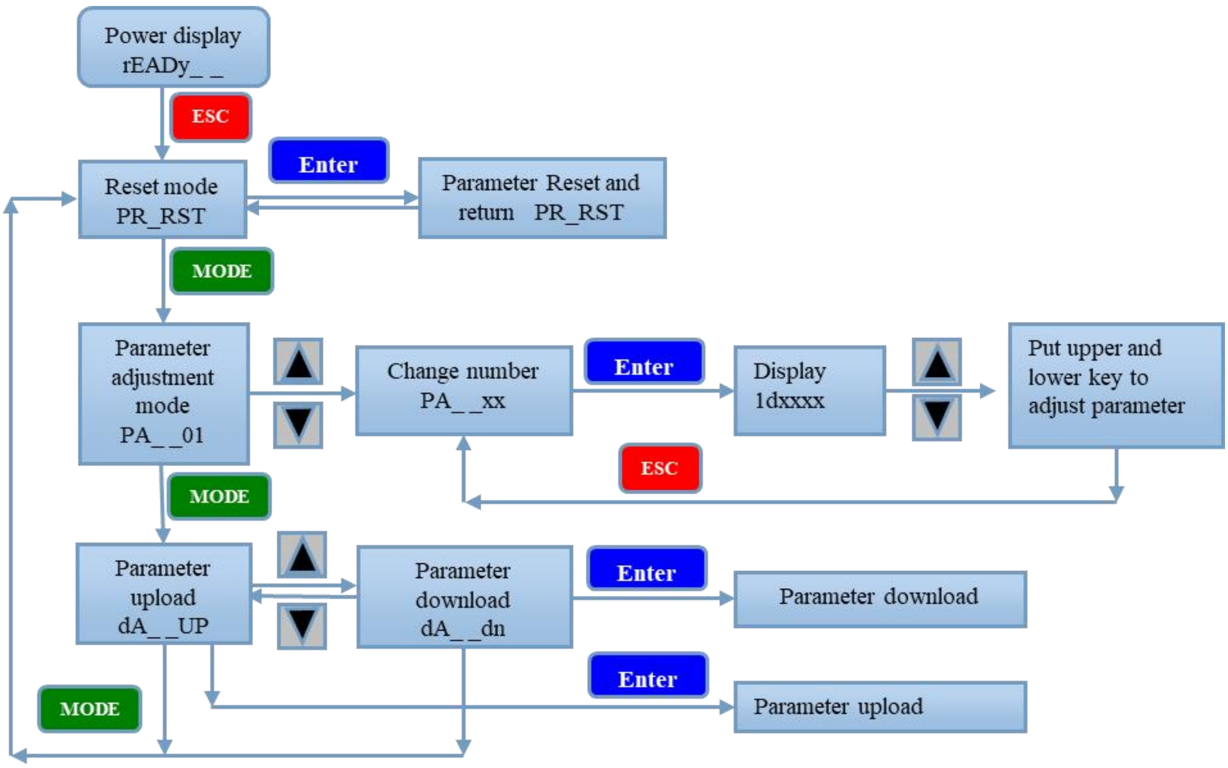


Figure 88 Operation flow chart

Description: Press each function key to adjust the mode or parameter, the arrow indicates the effect after pressing the key.

【3】Example of parameter mode operation

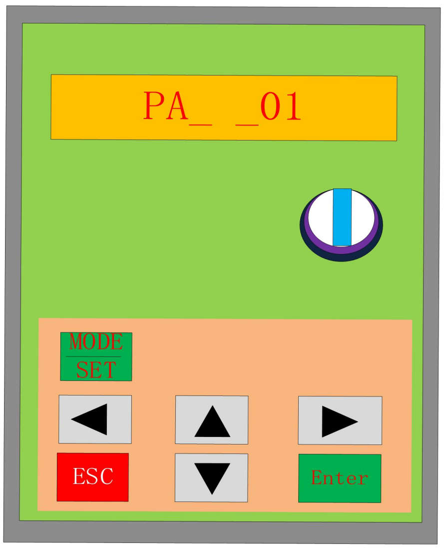


Figure 89 Display chart of parameter adjustment

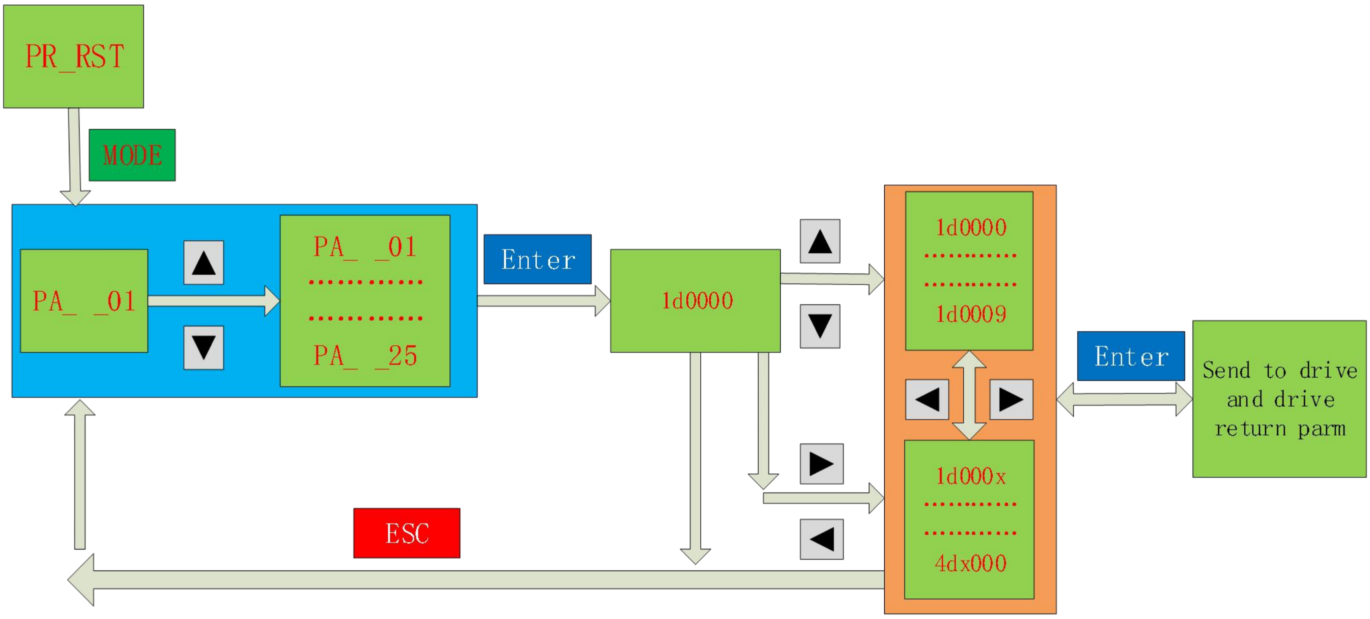


Figure 90 Flow chart of parameter adjustment

Description: When we press the Enter key to enter the parameters, we can see the initial value of the parameter. After changing the parameters, it shows the actual value of the drive parameter (for example, send that value is 9, but the actual return that is 1, then display 1).

8 Failure Alarm

8.1 Alarm Signal Sequence

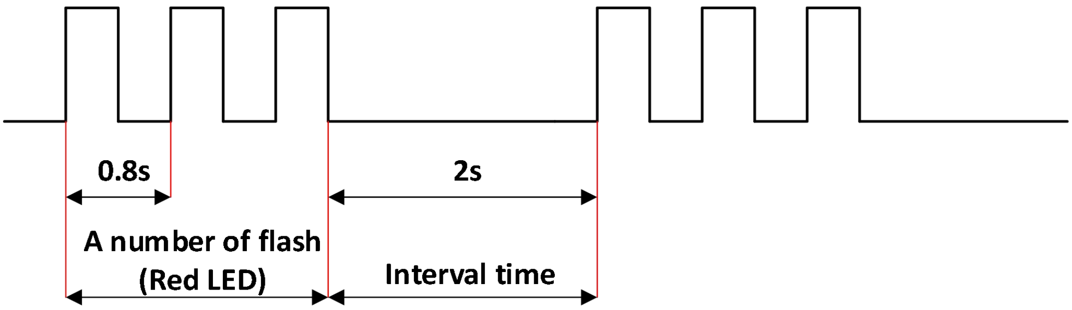


Figure 91 Alarm Signal Sequence

8.2 Failure Alarm Table

Table 79 Failure Alarm Table for JMC IHSS57-R/RC

A number of flash		Description
Red	Green	
Off	Flicker	Drive CAN communication is unlinked
Off	On	Drive power up normally
1	On	Over current
2	On	Parameter upload Error
3	On	Power supply under maximum

4	On	Over position
5	On	Communication Error
6	On	CCWdirection limit
7	On	CWdirection limit
8	On	SWdirection limit
9	On	Drive overheating
10	On	Loss phase

9 RS485 Communication Parameter Setting

When RS485 communication mode is used by the drive, communication parameters of the upper computer or other communication stations shall be set in advance. The default configuration parameters of the driver are as follows:

Table 80 RS485 Communication Parameter Setting of JMC IHSS60-R/RC Drive

Parameter	Baud Rate	Start	Data	Stop	Check
Value	0~115200bps	1Bit	8Bit	1Bit	None

10 Quick Guides

The use of IHSS60-R/RC is basically the same as IHSS57-R/RC. User can go to *Quick Guides* of IHSS57-R/RC for viewing.

➢ Common Problems and Faults

When the driver fails, the signal light will blink, and the user can find the problem according to the "Failure Alarm Table". For example, after starting the power supply, the red signal light is off and green light flashes, that is, the CAN communication of drive is not connected. Because this drive chooses the CAN communication mode, but the other slave or master station communicating with it may be in other mode. The problem can be solved as long as the communication mode is matched again and then reset.At the same time, the user can look up the error by read the object dictionary 0x1001, or read the statusword 0x6041 to see the status of the drive.

1 Power lights don't light

- ✧ Input power failure, please check the power line whether the voltage is too low.

2 Power on or run a small angle of rotation alarm

- ✧ Check whether the power line is in good contact;
- ✧ Check the power supply voltage is correct;
- ✧ Check whether the P8 and P9 parameters are correct.

3 The communication was normal, but failed to run

- ✧ Check the instructions sent by the master and whether the order is correct;
- ✧ Check the correctness of the corresponding parameters;
- ✧ Check whether the type of communication and connection is correct.

4 CAN communication anomaly

- ✧ Check whether the communication line is in good condition;
- ✧ Check whether the motor driver is set up as a CAN bus communication protocol. If the motor communication protocol is not a CAN bus communication protocol, it is reset by the debugger;
- ✧ Check the correctness of the communication baud rate.

5 Over position Errors

- ✧ Check whether the P16 parameters are correct.

6 Parameter upload Error

- ✧ Reset the parameters;

7 Input over voltage

- ✧ Check whether the input voltage exceeds 50V, and if more than 50V, reduce the input voltage.

8 Communication Error

- ✧ Check whether the baud rate is correct, and if it is incorrect, reconfigure it through a spin switch;
- ✧ Check whether the master and slave communication protocols are consistent, and if they do not agree, the protocol is reset by the debugger;

9 CW, SW, CCW directional limit

- ✧ Check whether the corresponding limit switch is activated, if not be activated,check whether the P42 parameter is the corresponding PNP or NPN limit switch connection value.

MCAC-R/RC AC Servo Bus Driver

➢ Product Introduction

MCAC-R/ RC AC servo bus driver is a High-Performance AC servo unit developed by gemicom. The servo driver of this series adopts advanced DSP chip for motor control and large-scale programmable gate array (FPGA), which has the characteristics of small volume, high integration, stable performance and reliable protection. It has rich digital and analog I / O interfaces, can be used with a variety of upper computer devices, and supports ModbusRTU and CANopen communication protocols to facilitate networking. Through the optimized PID control algorithm, the full digital control of position, velocity and torque accuracy is realized, which has the advantages of high precision and fast response. At the same time, it supports 1000, 1250, 2500-line incremental encoder to meet the different requirements of customer performance. Widely used in CNC machine tools, printing and packaging machinery, textile machinery, robots, automatic production lines and other automation fields.

➢ Technical Characteristics

- ✧ Using DSP + FPGA dual chip platform and optimized current loop design, the driver has the characteristics of high dynamic response, very short setting time, stable operation and small vibration at stop.
- ✧ With automatic gain adjustment module, users can choose rigidity according to demand.
- ✧ Built in FIR filter and multiple notch filter can automatically identify and suppress mechanical vibration.
- ✧ The built-in disturbance torque observer makes the driver have a strong ability of resisting external disturbance.
- ✧ It has a variety of control modes for selection, position control, velocity control, torque control, and can switch various control modes.
- ✧ The input frequency of position pulse is up to 500K, which supports pulse + direction, orthogonal pulse, double pulse and other position command modes.
- ✧ It has RS485 interface and supports Modbus communication.
- ✧ There are programmable 5-way INPUT and 3-way OUTPUT ports, users can customize input and output through parameter settings, and the application is flexible.
- ✧ It has perfect protection functions such as over-voltage, under voltage, over velocity, overload, position deviation, encoder error, etc., and can memorize 8 groups of historical fault information.
- ✧ There are rich monitoring projects, users can choose the desired monitoring project to monitor the operation status in the process of use.
- ✧ The driver can communicate with PC through RS232 interface to realize simple and quick debugging of servo drive system.
- ✧ Support standard RS485 bus and CAN bus.
- ✧ Support standard Modbus-RTU protocol and CANopen protocol.
- ✧ Built in CW, CCW, SW three 5V or 24V IO signal inputs for limit and zero return reference.
- ✧ RJ45 standard network connection, the slave stations can be connected through twisted pair cable.
- ✧ The transmission frequency can support up to 1Mbps, and the transmission distance can reach up to 1KM.

✧ General application parameters do not need to be adjusted.

➢ Application Area

It is suitable for point-to-point control automation equipment and instruments with large torque requirements, such as wire stripper, marking machine, cutting machine, laser Imagesetter, plotter, CNC machine tool, logistics storage equipment, new energy lithium battery equipment, automatic assembly equipment, etc. The application effect is very good in the equipment with bus control, low noise and high velocity.

➢ MCAC830/850-R/RC

1 Safety Precautions

In order to prevent harm to personal and property safety, please observe the following precautions, and make the following marks to distinguish:

⚠ Danger	Indicates a high risk of death or serious injury
⚠ Notice	Indicates that it is likely to cause minor injury or endanger property safety
🚫	Indicates prohibited items

1.1 Precautions for Receiving and Installation

⚠ Danger：1、Please use it with the driver and motor according to the specified way, otherwise it will cause equipment damage or fire.

2、It is forbidden to use in places with serious water vapor, combustible gas, corrosive gas, etc., otherwise electric shock, fire, equipment damage, etc. will be caused.

1.2 Precautions for Wiring

⚠ Danger：1、Do not connect the power supply of the driver to the output terminals of U, V and W motors, otherwise the driver will be damaged, which may cause personal injury or fire.

2、Please make sure the connection wire of power supply and motor output terminal is locked, otherwise it may cause sparking and fire.

3、Please select the power cord and motor power extension cord correctly to avoid fire caused by insufficient current bearing capacity of the wire.

4、Please make sure that the enclosure of the driver and the motor are grounded. Poor grounding may cause electric shock to personnel.

⚠ Notice：1、Please do not tie the motor power line and signal line together or pass through the same pipe to prevent interference to the signal.

2、For signal line and encoder feedback extension line, please use multi stranded shielded wire to enhance anti-interference ability.

3、Before power on, please confirm whether the wiring is connected correctly.

After the power of the driver is turned off, there is still high voltage inside. Please do not touch the power terminal within 5 minutes, and confirm that the discharge indicator is off before operation.

1.3 Precautions for Operation and Operation

⚠ Danger: 1、Before installing the equipment, please conduct no-load test run to avoid accidents.

2、Do not allow untrained personnel to operate, to prevent equipment damage and personnel injury caused by misoperation.

3、During normal operation, please do not touch the radiator and its interior of the driver with your hands to prevent high temperature scalding or electric shock.

⚠ Notice: 1、Please adjust the parameters of the driver before long-term test to prevent the poor use of the driver and equipment.

2、Please confirm that the equipment start, emergency stop, shutdown and other switches are effective before operating the equipment.

3、Please do not switch on and off the power supply frequently.

1.4 Precautions for Maintenance and Inspection

🛇: 1、During operation, it is forbidden to touch the inside of the driver and motor to prevent electric shock.

2、Do not change the connecting wire when it is powered on to prevent electric shock or personal injury.

3、Must be operated and maintained by trained professionals.

4、Please do not disassemble or repair except for the company's personnel.

5、Within 5 minutes after the power is turned off, do not touch the power supply and power terminal to prevent electric shock.

2 Product Introduction

2.1 Technical Index

Table 81 Electrical specifications of MCAC-R/RC series products

Model	MCAC708-R/RC	MCAC830-R/RC	MCAC850-R/RC
Input Voltage	DC24~70V	DC24~80V	DC24~80V
Peak Current Arms	8A	30A	50A

Table 82 Basic specification

Project		Describe
control mode		IGBT PWM control, Sine wave current driving mode
feedback		Incremental encoder
Conditions of use	temperature	Work：0～55℃storage：-25～85℃
	humidity	Work：10%～90%
	Altitude	<1000m， When it is higher than 1000M, it shall be derated according to GB/T 3859.2-93
	Protection level	Protection level：IP10，Cleanliness：2 No corrosive gas, combustible gas, oil, water splash, dust, salt and less metal powder
performance	Velocity adjustment range	1:5000
	Steady velocity accuracy	±0.01%：External load variation 0-100% ±0.1% ： Ambient temperature ± 25 ℃ (25 ℃)
	Velocity response frequency	1200Hz
I / O signal	Encoder frequency division pulse output	Phase A, phase B, phase C: linear drive output Frequency division pulse number: can be set arbitrarily
	Input signal	Point：5 Functions: servo ON, alarm clearing, forward overtravel signal input, reverse overtravel signal input, control mode switching, P action command input, gain switching input, zero fixed input, command

		pulse prohibition input, internal set velocity switching input 1. Internal set velocity switching input 2. Internal set velocity switching input 3. Position command clear input, command pulse input multiple switching input
	output signal	Point：3 Functions: alarm output, holding brake open output, servo ready output, positioning completion output, positioning approach output, velocity limit detection output, warning output, command pulse input multiple rate switching output
Communication function	RS485	Support Modbus protocol. Axis address: set by parameters
	RS232	Connect PC for debugging
	CAN	Support CAN bus communication
Protection function		Overvoltage, undervoltage, overcurrent, overload, etc

2.2 Naming Rules

MCAC830 – 1024 – 4 – 200 – RC – XXX

①②③④⑤⑥⑦⑧⑨

①Series Name: JMC MC series AC servo driver
②Servo driver category：AC：alternating current servo driver, DC：direct current servo driver
③Driver supply voltage：* 10 is the supply voltage level，7：70VDC, 8：80VDC
④Driver output current：08：8A, 30：30A, 50：50A, A0：100A
⑤Matching motor encoder：1024C：Magnetic braided 1024 wire, 2500C：Magnetic braided 2500 wire,
17BC：17-bit absolute magnetic knitting, 2500：Optical braided 2500 wire,
M23B: Multicycle absolute value optical knitting
⑥Matched motor pole pairs：4：Four pairs of poles, 5：Five pairs of poles
⑦Matching motor pole power：400：400W, 750：750W, 1000：1000W
⑧Bus communication mode： R：RS485, RC：RS485+CAN, EC：EtherCAT
⑨Product design No.: special function module, default to standard model

3 Drive Port Description

3.1 Drive Port Schematic

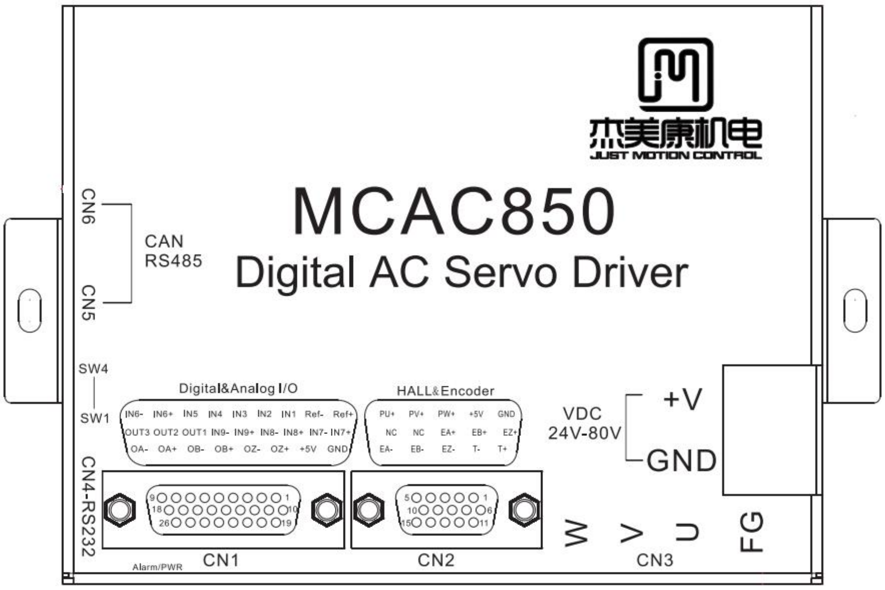


Figure 92 Drive port schematic

3.2 Drive Control Port Description

3.2.1 CN1 Control port definition

The interface between upper control and driver is used for upper control driver and driver feedback output.

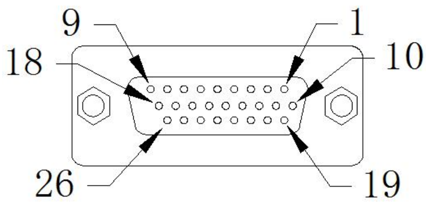


Figure 93 CN1 control port

Table 83 CN1 control port definition

Pin number	Label	Definition	Explain
1	REF+	Analog quantity control +	(Reserved)
2	REF-	Analog quantity control -	(Reserved)
3	IN1	Input I/O 1	Custom port function and effective level
4	IN 2	Input I/O 2	Custom port function and effective level
5	IN 3	Input I/O 3	Custom port function and effective level
6	IN 4	Input I/O 4	Custom port function and effective level
7	IN 5	Input I/O 5	Custom port function and effective level
8	IN 6+	Input I/O 6 +	High velocity input terminal +(Reserved)
9	IN 6-	Input I/O 6 -	High velocity input terminal -(Reserved)

10	IN 7+	Input I/O 7 +	High velocity input terminal +(Reserved)
11	IN 7-	Input I/O 7 -	High velocity input terminal -(Reserved)
12	IN 8+	Pulse positive input	Pulse signal compatible voltage 3.3-24VDC(Reserved)
13	IN 8-	Pulse negative input	Pulse signal compatible voltage 3.3-24VDC(Reserved)
14	IN 9+	Direction positive input	Pulse signal compatible voltage 3.3-24VDC(Reserved)
15	IN 9-	Direction negative input	Pulse signal compatible voltage 3.3-24VDC(Reserved)
16	DO 1	Output port 1	Custom port function and effective level
17	DO 2	Output port 2	Custom port function and effective level
18	DO 3	Output port 3	Custom port function and effective level
19	GND	Power ground	Power ground
20	+5V	+5V output	Maximum allowable output current：120 mA
21	OZ+	Encoder Z-phase positive output	Encoder Z-phase positive output
22	OZ-	Encoder Z-phase negative output	Encoder Z-phase negative output
23	OB+	Encoder B-phase positive output	Encoder B-phase positive output
24	OB-	Encoder B-phase negative output	Encoder B-phase negative output
25	OA+	Encoder A-phase positive output	Encoder A-phase positive output
26	OA-	Encoder A-phase negative output	Encoder A-phase negative output

3.2.2 CN1 Control port connection description

Digital input DI (DI1-DI5/DI6-DI9) can be connected by switch, relay and collector open circuit transistor circuit. (refer to P06 XX I / O parameter description for function setting of input I / O port)

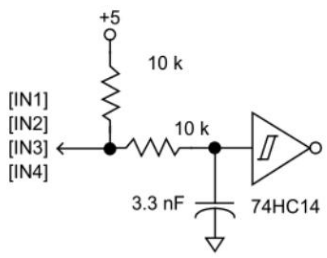


Figure 94 General input signal terminal

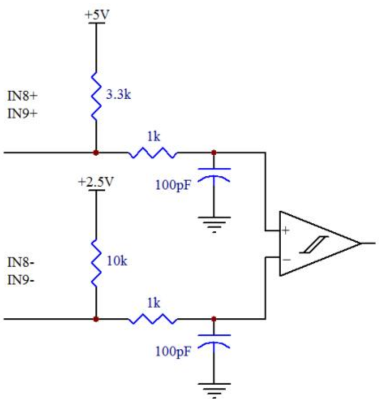
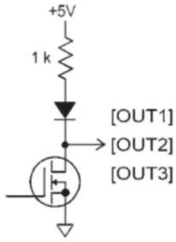


Figure 95 High velocity input signal terminal

Digital output DO(DO1-DO3) output can be connected with relay, optocoupler, etc. (see P06 XX I / O parameter description for function setting of output I / O port)



3.2.3 CN2 Encoder port description

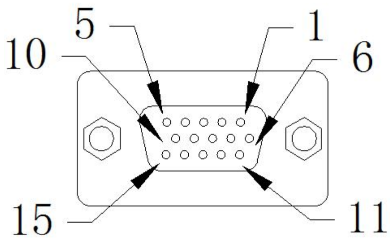


Figure 96 CN2 Encoder port

Table 84 CN2 Encoder connector description

Pin number	Label	Definition	Explain
1	GND	Output + 5V power ground	
2	VCC	Output + 5V power supply	Current limiting 120mA
3	PW+	Pole W phase positive input	Single ended connection
4	PV+	Pole V phase positive input	Single ended connection
5	PU+	Pole U phase positive input	Single ended connection
6	EZ+	Encoder Z-phase positive input	
7	EB+	Encoder B-phase positive input	
8	EA+	Encoder A-phase positive input	
9	NC		
10	NC		
11	T+	NC	
12	T-	NC	
13	EZ-	Encoder Z-phase negative input	
14	EB-	Encoder B-phase negative input	
15	EA-	Encoder A-phase negative input	

3.2.4 CN3 Power line terminal and power supply description

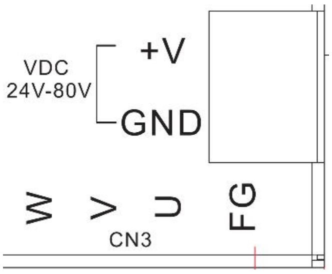


Figure 97 CN3 power line terminal

Table 85 CN3 power line terminal description

Label	Definition	Explain
FG	Power line ground	Power line ground
U	Power line U phase	Motor power line U phase
V	Power line V phase	Motor power line V phase
W	Power line W phase	Motor power line W phase
+V	Power input positive terminal	Power input range 24-80V DC
GND	GND	Power input range 24-80V DC

3.2.5 CN4 RS232 port specification

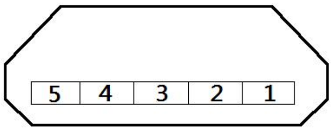


Figure 98 Face Cn5 port

Table 86 CN4 RS232 port description

Foot position	Label	Definition specification
1	3.3V	RS232Power Supply 3.3V
2	TX232	RS232Receive
3	RX232	RS232Send
4	Reserve	No connection
5	GND	RS232 GND

Notice: for 485 and CAN communication ports, please refer to"Communication Interface and Wiring" (Ctrl + left mouse button or click the text to jump).

3.2.6 SW1-SW4 switch indication

Table 87 SW1-SW4 Switch indication

Pull out code switch	ON	OFF
SW1	Reserve	Reserve
SW2	Reserve	Reserve
SW3	Built in 120 Ω for	Communication does not use built-in

	communication	120 Ω
SW4	Reserve	Reserve

3.3 Serial Interface 232 Wiring Diagram

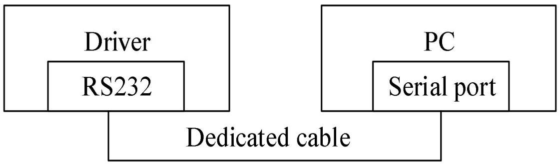


Figure 99 Schematic diagram of parameter debugging wiring

Notice:the cable between MCAC-R / RC and PC must be a special cable, the special cable model is JMC-RS232-HL340 + JMC-RS232-USB; please confirm before use to avoid damage.

3.4 Typical Application Wiring Diagram

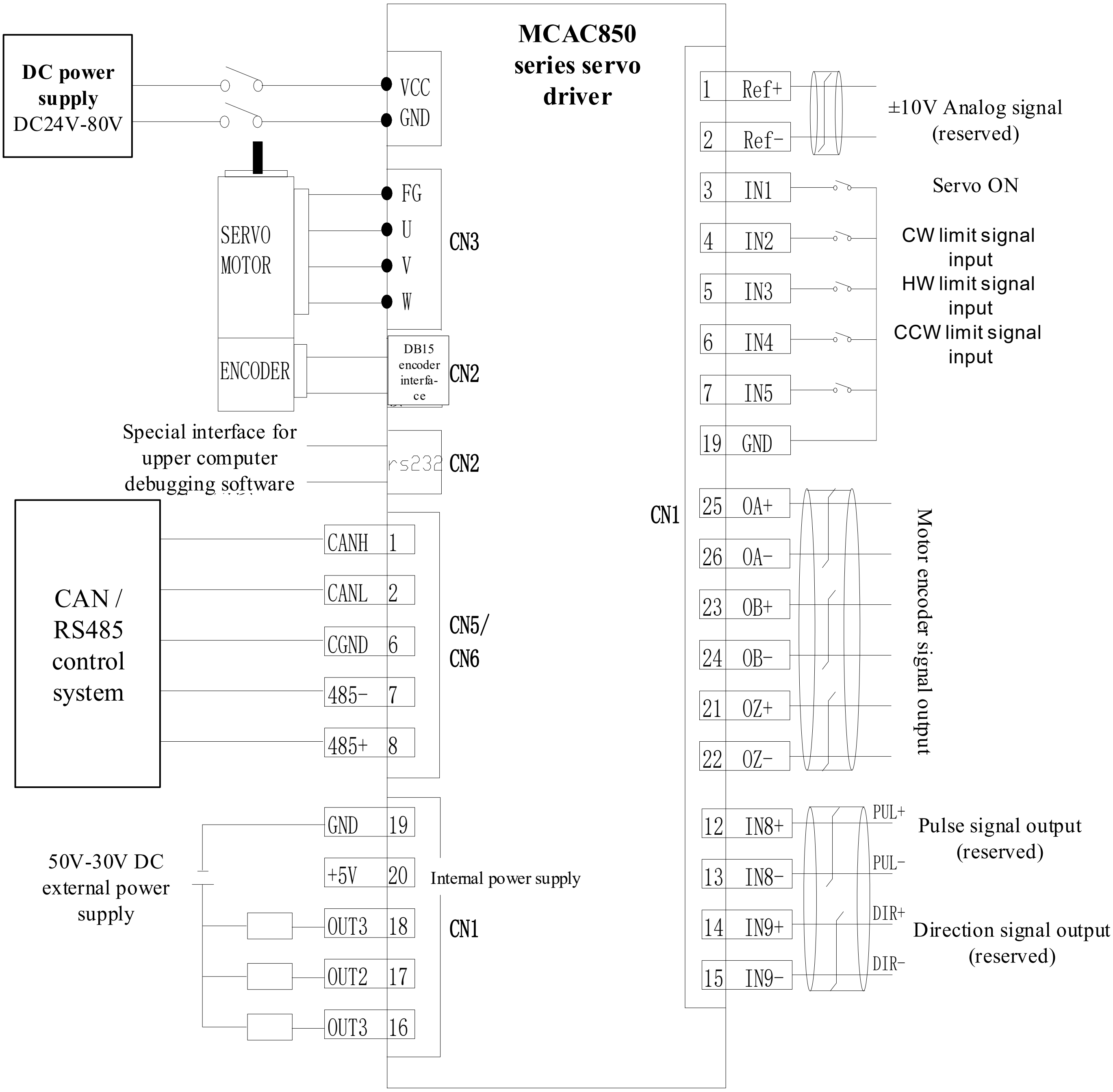


Figure 100 MCAC-R/RC Typical Connection Diagram

Typical wiring diagrams consisting of MCAC-R / RC drives, etc. are shown. The power supply is selected according to the matching motor voltage level.

Notice: 1. The resistance R is connected to the control signal terminal, with a resistance value of 3 ~ 5K.

2. RJ45 network interface is connected to other slave stations through standard twisted pair network cable, and there is no special difference between the two network ports.

4 Installation Instructions

4.1 Installation Dimension

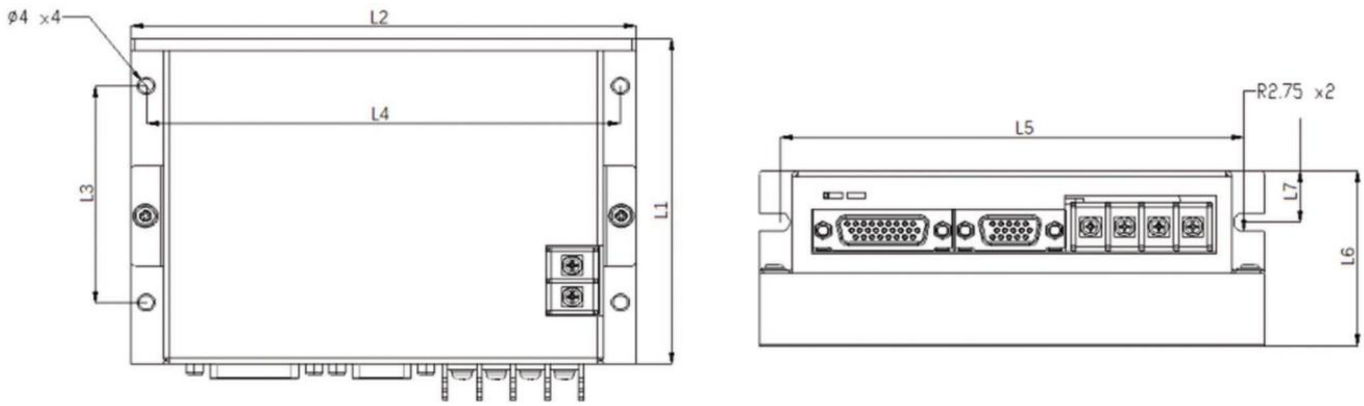


Figure 101 Installation dimension

Table 88 MCAC Dimension drawing

Model	L1（mm）	L2（mm）	L3（mm）	L4（mm）	L5（mm）	L6（mm）	L7（mm）
MCAC708-R/RC	75.50	118.10	29.60	113.20	114.15	36.00	12.65
MCAC830-R/RC	97.50	140.50	65.00	132.00	129.00	52.60	15.50
MCAC850-R/RC	97.50	140.50	65.00	132.00	129.00	52.60	15.50

Notice: please contact us for detailed specifications.

4.2 Installation and Use Environment

The installation and use environment have a direct impact on the normal operation and service life of the product, so the following conditions must be met:

1. Working environment temperature: 0-55 ℃; working environment humidity: below 10% - 90% (no condensation).
2. Storage environment: - 20 ℃ ~ + 85 ℃; storage environment humidity: below 90% (no condensation).
3. Vibration: below 0.5g.
4. Prevent rain drips or wet environment.
5. Avoid exposure to the sun.
6. Prevent oil mist and salt erosion.
7. Prevent corrosive liquid, gas, etc.
8. Prevent the invasion of dust, cotton and metal filings.
9. Keep away from radioactive materials and combustibles.
10. Space shall be reserved around the place where the drives are placed in the cabinet to facilitate loading, unloading and maintenance.
11. Pay attention to the air flow in the cabinet. If necessary, install an external fan to enhance the air flow and reduce the ambient temperature of the driver to facilitate heat dissipation. The long-term working temperature is below 55 ℃.
12. Try to avoid vibration source nearby, and install damping device such as vibration absorber or anti vibration rubber gasket.

13. If there is an electromagnetic interference source nearby, the power supply and control circuit of the driver are easy to be interfered and lead to misoperation, the noise filter can be added or various effective anti-interference measures can be adopted to ensure the normal operation of the driver (the noise filter will increase the leakage current, and the input end of the driver power supply needs to be loaded with an isolation transformer).

5 Control Mode Description

5.1 Description of Position Control (pulse not used)

5.1.1 Wiring description of position control mode

Description of controller end direction + pulse input mode: direction + pulse input is divided into 3.3V, 5V, 24V signal input mode. The use of twisted pair connection can improve the anti-interference ability. In general, this kind of position control wiring method is often used in MCU system. The maximum input pulse frequency of this control mode is 500KHz.

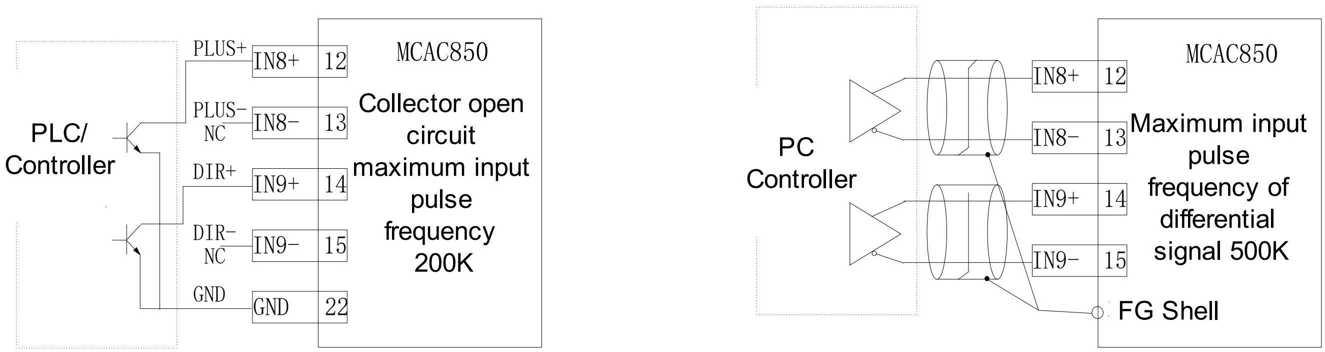


Figure 102 Position control mode wiring

5.1.2 Description of position control mode parameters

Table 89 Motor and driver control parameters

Parameter code	Name	Set scope	Set up	Explain
P01-01	Control mode setting	0-6	0	0：positional mode 1：Velocity mode 2：Torque mode 3：Velocity，Torque 4：positional，Velocity 5：positional，Torque
P03-00	Location command source	0-1	0	0：Pulse command 1：Number given
P03-01	Command pulse mode	0-3	1	0：Quadrature pulse instruction 1：Direction + pulse command 2 or 3：Double pulse command
P03-02	Command pulse input terminal	0-1	0	0：Low velocity pulse 1：High velocity pulse
P03-03	Command pulse	0-1	0	Set the initial direction of

	reversal			motor rotation
P03-09	The number of command pulses for one revolution of motor	0-65535	0	Set according to user requirements
P03-10	Molecule of electronic gear 1	1-65535	1	Set according to user requirements
P03-11	Denominator of electronic gear 1	1-65535	1	

5.2 Velocity / Torque Control Description

5.2.1 Velocity / Torque control mode wiring instructions

The effective voltage range (- 10V ~ 10V) of velocity and torque control analog input can be set by the following parameters: velocity analog command input gain of P06-40 and torque analog command input gain of P06-43. Please read the detailed description of parameters for specific setting methods.

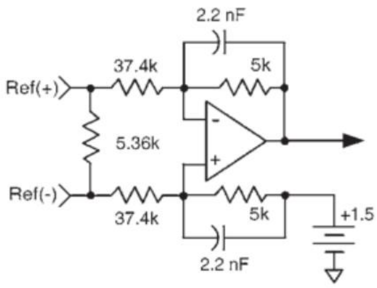


Figure 103 Velocity / Torque control mode wiring instructions

5.2.2 Description of velocity control parameters

Table 90 Description of velocity control parameters

Parameter code	Name	Set scope	Set up	Explain
P01-01	Control mode setting	0-6	1	0：positional mode 1：Velocity mode 2：Torque mode 3：Velocity，Torque 4：positional，Velocity 5：positional，Torque
P04-00	Velocity command source	0-3	0	0: external analog command 1: Digital command (parameter setting) 2: Digital command (Communication) 3: Internal multiple groups of instructions
P04-01	Reverse velocity command analog quantity	0-1	0	Set the initial direction of motor rotation

P04-02	Given value of digital velocity	-6000~6000	0	Set the velocity command value, the velocity mode is valid when P04-00 is 1.
P04-06	Forward velocity limit	0-6000		Limit forward velocity
P04-07	Reverse velocity limit	0-6000		Limit reverse velocity
P06-40	Velocity analog command input gain	10-2000		Set according to user requirements

5.3 Communication Mode Description

The user does not need to manually set the communication mode, and the driver will automatically identify the communication mode. When using CAN communication, the customer needs to set P00-22 and P00-27, while when conducting 485 communication, they need to set P00-23 and P00-24 (generally, P00-25 does not need to be set, and there is no verification by default when 485 communication is used).

When the customer carries out 485 communication, P00-23 can be set to set the address of the slave station, and P00-24 can be set to set the communication rate;

When the customer carries out CAN communication, P00-22 can be set to set the address of the slave station, and P00-27 can be set to set the communication rate.

Table 91 Communication parameter description

Parameter code	Name	Range	Set up	Explain
P00-22	CAN node ID number	0-31	0	Set the ID of the current machine on the CAN bus
P00-23	Modbus slave address	0-255	1	Set according to equipment requirements
P00-24	Modbus communication baud rate	0-7	2	Setting range 0-7, default 2 0:1200 1: 2400 2:4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200
P00-25	Verification mode	0-3	3	Setting range 0-3, default 3 0: no check, 2 stop bits 1: Even check, 1 stop bit 2: Odd check, 1 stop bit 3: No check, 1 stop bit
P00-27	CAN communication baud rate	0-7	6	Set the baud rate of CAN bus 0：12.5KH 1：120KHz 2：20KHz 3：100KHz

				4：125KHz 5：250KHz 6：500KHz 7: 1000Hz

6 Use of Servo Debugging Software

- Select JmcServoPcControl servo debugging software, double-click to open the following figure：

Figure 104 Servo debugging software

- In the pop-up dialog box, set the corresponding options and open at the point, as shown in the following figure：

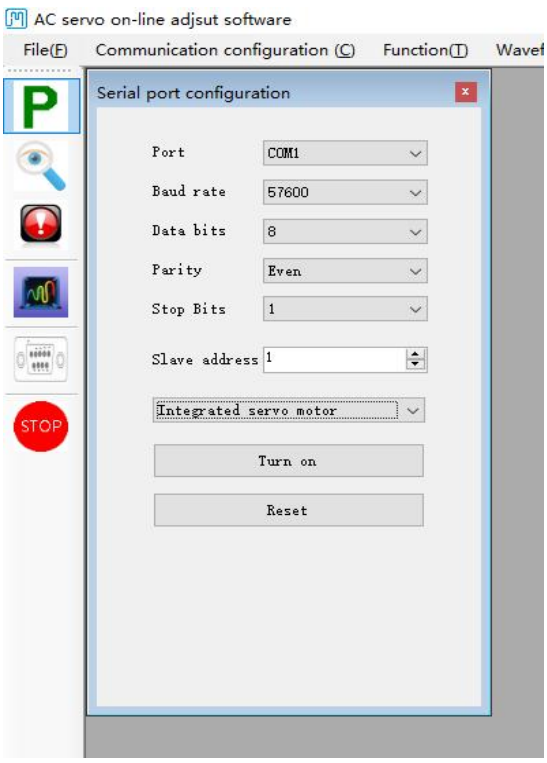


Figure 105 Serial port setting of servo debugging software

- After clicking open, if the communication is successful, it is shown as follows：

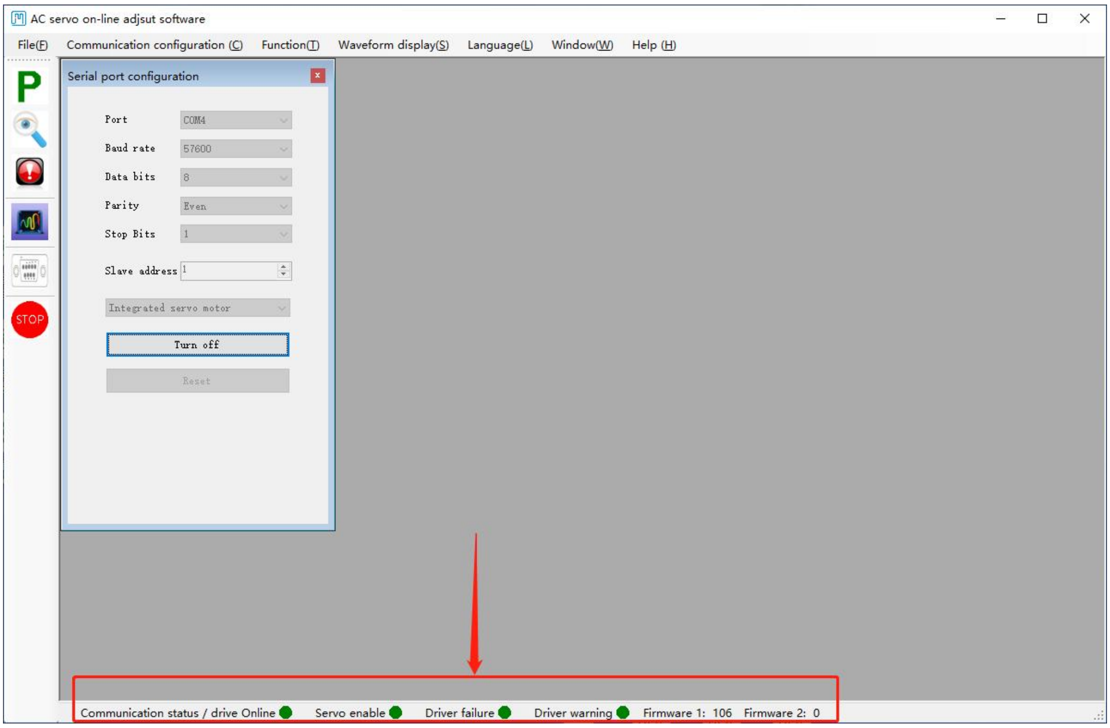


Figure 106 Software communication successful

Notice: if the connection fails, please confirm whether the COM port is selected correctly and whether the communication line is connected properly. After confirmation, reconnect according to the above steps.

Click on the top left option【 P 】, the following window will pop up. At this time, the internal parameters of the drive will be uploaded automatically. After uploading, the customer can change the parameters as required.

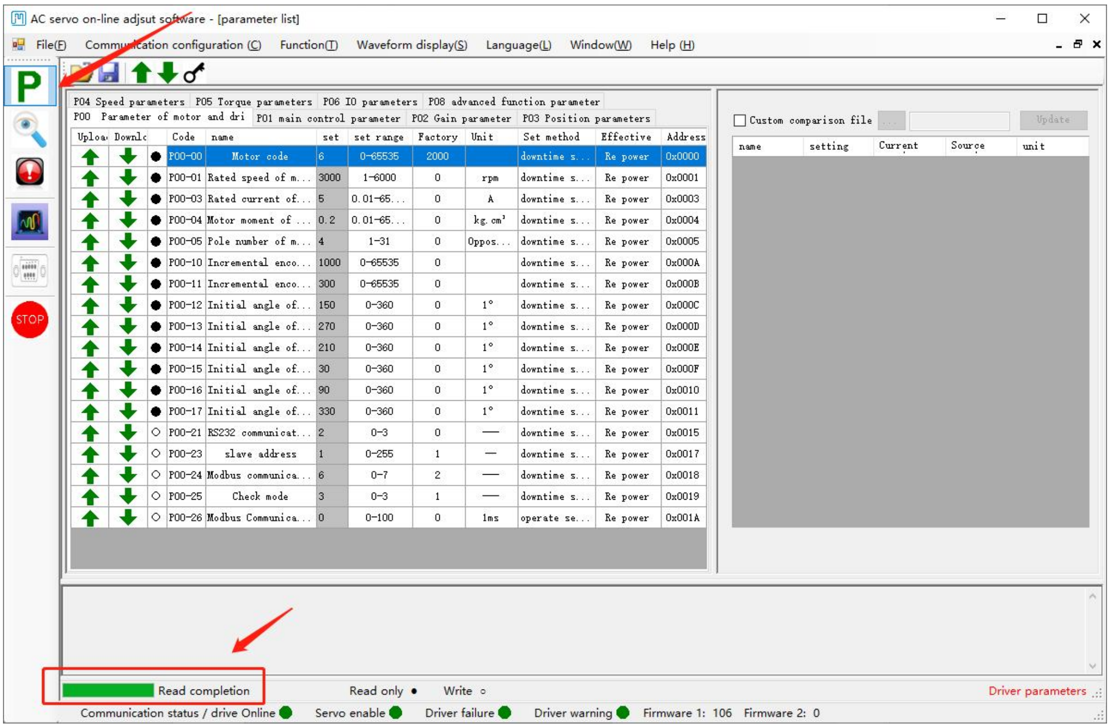
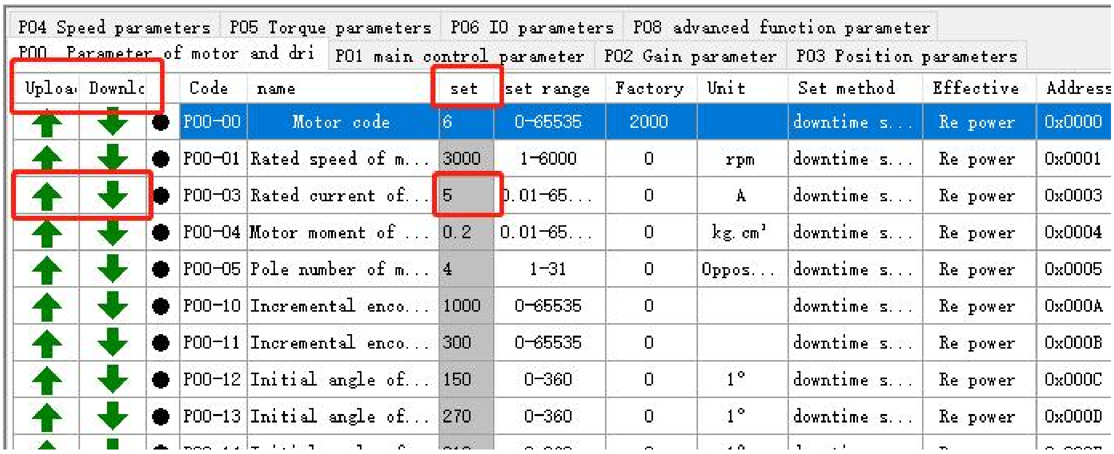


Figure 107Parameter reading completed

Note: P00-xx is the motor and driver parameters, which have been set in the factory, and will not be provided to the customer for change.

- The parameter settings are as follows: modify → download → upload, as shown in the following figure：



Uploa	Downlc		Code	name	set	set range	Factory	Unit	Set method	Effective	Address
		●	P00-00	Motor code	6	0-65535	2000		downtime s...	Re power	0x0000
		●	P00-01	Rated speed of m...	3000	1-6000	0	rpm	downtime s...	Re power	0x0001
		●	P00-03	Rated current of...	5	0.01-65...	0	A	downtime s...	Re power	0x0003
		●	P00-04	Motor moment of ...	0.2	0.01-65...	0	kg.cm²	downtime s...	Re power	0x0004
		●	P00-05	Pole number of m...	4	1-31	0	Oppos...	downtime s...	Re power	0x0005
		●	P00-10	Incremental enco...	1000	0-65535	0		downtime s...	Re power	0x000A
		●	P00-11	Incremental enco...	300	0-65535	0		downtime s...	Re power	0x000B
		●	P00-12	Initial angle of...	150	0-360	0	1°	downtime s...	Re power	0x000C
		●	P00-13	Initial angle of...	270	0-360	0	1°	downtime s...	Re power	0x000D

Figure 108Parameter setting process

Note: after setting the corresponding parameters in the setting, press the download option to download the changed parameters to the drive, and then press the upload option to upload the parameters to the interface to verify whether the parameters have been changed.

7 Manual Gain Adjustment

When the automatic gain adjustment fails to achieve the desired effect, you can manually fine tune the gain to optimize the effect. The servo system consists of three control loops. The basic control block diagram is as follows:

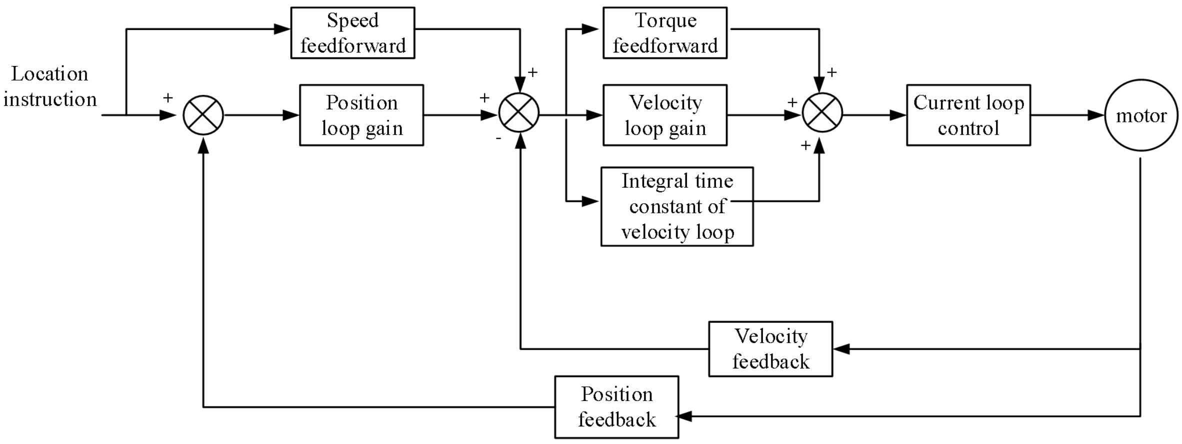


Figure 109 Control block diagram of servo system

The gain adjustment needs to set the load inertia ratio P01-04 first, then adjust the velocity loop gain, and finally adjust the position loop gain according to the order of the inner loop and the outer ring.

Velocity loop gain: increase the setting value as much as possible without vibration and noise, which can improve the velocity following performance and velocity up the positioning time.

Velocity integral constant: the smaller the setting value is, the faster the integration velocity is, and the stronger the integration effect is. If it is too small, it is easy to produce vibration and noise.

Table 92 Basic gain parameters

Parameter code	Name	Set scope	Set up	Explain
P01-02	Real time automatic adjustment mode	0-2	2	0: adjust the rigidity manually. 1: Standard mode automatically adjusts rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and

				P08-20 will be set automatically according to the rigidity level set by P01-03, and manual adjustment of these parameters will not work. The following parameters are set by the user: P02-03 (velocity feedforward gain), P02-04 (velocity feedforward smoothing constant). 2: The positioning mode automatically adjusts the rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03, and manual adjustment of these parameters will not work. The following parameters will be fixed and cannot be changed: P02-03 (velocity feedforward gain): 30.0% P02-04 (velocity feedforward smoothing constant): 0.50
P01-03	Real time automatic adjustment of rigidity setting	0-31	13	32 kinds of gain parameters are built in, which will work when P01-02 is set to 1 or 2. It can be called directly according to the actual situation. The larger the setting value is, the stronger the rigidity is.
P02-00	Position control gain 1	0-3000．0	80.0	▸The larger the setting value is, the higher the gain is, the greater the rigidity is, and the smaller the position lag is. However, if the value is too large, the system will oscillate and overshoot. ▸Increase the value as much as possible without shock. ▸For gain at rest.
P02-01	Position control gain 2	0-3000.0	80.0	▸the larger the setting value is, the higher the gain is, the greater the rigidity is, and the smaller the position lag is. However, if the value is too large, the system will oscillate and overshoot. ▸increase the value as much as possible without shock. ▸for gain in motion.
P02-03	Velocity feedforward gain	0-100.0	30.0	The larger the feedforward gain of the velocity loop, the smaller the position tracking error and the faster the response. However, if the feedforward gain is too large, the position loop of the system will be unstable and prone to

				overshoot and oscillation.
P02-04	Velocity feedforward smoothing constant	0-64.00	0	This parameter is used to set the feedforward filter time constant of velocity loop. The larger the value, the larger the filtering effect, but the larger the phase lag.
P02-10	Velocity proportional gain 1	1-2000.0	40.0	▸the larger the setting value, the greater the gain and rigidity, and the parameter value is set according to the motor and load conditions. ▸increase the value as much as possible without shock. ▸for gain at rest.
P02-11	Velocity integral constant 1	0.1-1000.0	10.0	▸the integration time constant of velocity regulator, the smaller the setting value is, the faster the integration velocity is, the greater the rigidity is, and it is easy to produce vibration and noise if it is too small. ▸ try to reduce the parameter value as much as possible when there is no vibration in the system. ▸ this parameter is for steady-state response.
P02-12	Pseudo differential feedforward control coefficient 1	0-100.0	100.0	▸when it is set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast; when it is set to 0, the integral effect of the velocity loop is obvious, which can filter the low-frequency interference, but the dynamic response is slow. ▸by adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low-frequency interference.
P02-13	Velocity proportional gain 2	1-2000.0	45.0	▸the larger the setting value, the greater the gain and rigidity, and the parameter value is set according to the motor and load conditions. ▸increase the value as much as possible without shock. ▸for gain in motion.
P02-14	Velocity integral constant 2	0.1-1000.0	1000.0	▸the integration time constant of velocity regulator, the smaller the setting value is, the faster the integration velocity is, the

				greater the rigidity is, and it is easy to produce vibration and noise if it is too small. ▸ try to reduce the parameter value as much as possible when there is no vibration in the system. ▸ this parameter is for steady-state response.
P02-15	Pseudo differential feedforward control coefficient 2	0-100.0	100.0	▸when it is set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast; when it is set to 0, the integral effect of the velocity loop is obvious, which can filter the low-frequency interference, but the dynamic response is slow. ▸by adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low-frequency interference.

8 Parameters and Functions

8.1 Parameter List

P00-xx indicates motor and driver parameters
P01-xx main control parameters
P02-xx indicates gain type parameter
P03-xx indicates position parameter
P04-xx represents velocity parameter
P05-xx represents torque parameter
P06-xx indicates I / O parameters
P08-xx indicates advanced function parameters

Table 93 Parameter list

type	Param-eter	Name	setting range	Facto-ry Defau-lt	unit	Plcether-net	time of taking effect
Motor and driver param-eters	P00-00	Motor number	0-65535	2000		Downtime setting	Power up again
	P00-01	Motor rated rotating velocity	1-6000	---	rpm	Downtime setting	Power up again
	P00-02	rated motor toroue	0.01-655.35	---	N.M	Downtime setting	Power up again
	P00-0	motor rated	0.01-655.35	---	A	Downtim	Power up

	3	current				e setting	again
	P00-04	Moment of inertia of motor	0.01-655.35	---	kg.cm²	Downtime setting	Power up again
	P00-05	Log of motor pole	1-31	---	P	Downtime setting	Power up again
	P00-07	Encoder selection	0-3	---	---	Downtime setting	Power up again
	P00-08	Save line incremental encoder	0-1	---	---	Downtime setting	Power up again
	P00-09	Absolute encoder type	0-1	---	---	Downtime setting	Power up again
	P00-10	Incremental encoder line count	0-65535	---		Downtime setting	Power up again
	P00-11	Incremental encoder Z pulse electrical Angle	0-65535	---		Downtime setting	Power up again
	P00-12	Initial angle of rotor 1	0-360	---	1°	Downtime setting	Power up again
	P00-13	Initial angle of rotor 2	0-360	---	1°	Downtime setting	Power up again
	P00-14	Initial angle of rotor 3	0-360	---	1°	Downtime setting	Power up again
	P00-15	Initial angle of rotor 4	0-360	---	1°	Downtime setting	Power up again
	P00-16	Initial angle of rotor 5	0-360	---	1°	Downtime setting	Power up again
	P00-17	Initial angle of rotor 6	0-360	---	1°	Downtime setting	Power up again
	P00-20	Power on interface display setting	0-100	100	---	Operation settings	Power up again
	P00-21	RS232 Communication baud rate	0-3	0	---	Downtime setting	Power up again
	P00-23	From the station address	0-255	1	---	Downtime setting	Power up again
	P00-24	Modbus Communication baud rate	0-7	2	---	Downtime setting	Power up again
	P00-25	verification mode	0-3	1	---	Downtime setting	Power up again
	P00-27	CANopen communication baud rate	0-7	6	---	Downtime setting	Power up again
	P00-28	485 protocol selection	0-2	0	---	Downtime setting	Power up again

	P00-30	Brake resistance setting	0-2	---	---	Downtime setting	Power up again
	P00-31	External brake resistance power	0-65535	---	10W	Operation settings	Power up again
	P00-32	External brake resistance	0-1000	---	1Ohm	Downtime setting	Power up again
	P00-40	Over temperature protection settings	0-1	1	---	Downtime setting	Power up again
	P00-41	Control power failure protection settings	0-1	1	---	Downtime setting	Power up again
Main control param-eter	P01-01	Control mode setting	0-6	0	---	Downtime setting	Immediate effect
	P01-02	Adjust the mode automatically in real time	0-2	2	---	Operation settings	Immediate effect
	P01-03	Real-time automatic adjustment of rigid Settings	0-31	13	---	Operation settings	Immediate effect
	P01-04	Moment of inertia ratio	0-100.00	1	multiple	Operation settings	Immediate effect
	P01-10	Control mode after overtravel	0-1	1	---	Operation settings	Immediate effect
	P01-20	Dynamic brake delay	0-250	50	1ms	Operation settings	Immediate effect
	P01-21	Disable dynamic brake when main power is OFF	0-1	1	---	Operation settings	Immediate effect
	P01-22	Disable dynamic brake when servo is OFF	0-1	1	---	Operation settings	Immediate effect
	P01-23	Disable dynamic brake in case of fault alarm	0-1	1	---	Operation settings	Immediate effect
	P01-24	No dynamic brake during overtravel	0-1	1	---	Operation settings	Immediate effect
	P01-30	The brake instruction - servo OFF delay time (Brake open delay)	0-255	50	1ms	Operation settings	Immediate effect
	P01-31	The velocity limit of the output of the brake command	0-3000	100	1rpm	Operation settings	Immediate effect
	P01-32	Wait time of servo OFF brake	0-255	50	1ms	Operation settings	Immediate effect

		instruction					
	P01-40	Out of control detection enable	0-1	1	---	Operation settings	Immediate effect
Gain type param-eters	P02-00	Position control gain 1	0-3000.0	48.0	1/S	Operation settings	Immediate effect
	P02-01	Position control gain 2	0-3000.0	57.0	1/S	Operation settings	Immediate effect
	P02-03	Velocity feedforward gain	0-100.0	30.0	1.0%	Operation settings	Immediate effect
	P02-04	Velocity feedforward smoothing constant	0-64.00	0.5	1ms	Operation settings	Immediate effect
	P02-10	Velocity proportional gain 1	1.0-2000.0	27.0	1Hz	Operation settings	Immediate effect
	P02-11	Velocity integral constant 1	0.1-1000.0	10.0	1ms	Operation settings	Immediate effect
	P02-12	Pseudo differential feedforward control coefficient 1	0-100.0	100.0	1.0%	Operation settings	Immediate effect
	P02-13	Velocity proportional gain 2	1.0-2000.0	27.0	1Hz	Operation settings	Immediate effect
	P02-14	Velocity integral constant 2	0.1-1000.0	1000.0	1ms	Operation settings	Immediate effect
	P02-15	Pseudo differential feedforward control coefficient 2	0-100.0	100.0	1.0%	Operation settings	Immediate effect
	P02-16	Limit amplitude of velocity integral error	0-32767	25000	---	Downtime setting	Immediate effect
	P02-19	Torque feedforward gain	0-30000	0	1.0%	Operation settings	Immediate effect
	P02-20	Torque feedforward smoothing constant	0-64.00	0.8	1ms	Operation settings	Immediate effect
	P02-30	Gain switching mode	0-10	7	---	Operation settings	Immediate effect
	P02-31	Gain switching level	0-20000	800	---	Operation settings	Immediate effect
	P02-32	Gain switching hysteresis	0-20000	100	---	Operation settings	Immediate effect
	P02-33	Gain switching delay	0-1000.0	10.0	1ms	Operation settings	Immediate effect

	P02-34	Position gain switching time	0-1000.0	10.0	1ms	Operation settings	Immediate effect
	P02-40	Mode switch selection	0-4	0	---	Operation settings	Immediate effect
	P02-41	Mode switch level	0-20000	10000	---	Operation settings	Immediate effect
	P02-50	Added value of torque command	-100.0-100.0	0	1.0%	Operation settings	Immediate effect
	P02-51	Forward torque compensation	-100.0-100.0	0	1.0%	Operation settings	Immediate effect
	P02-52	Reverse torque compensation	-100.0-100.0	0	1.0%	Operation settings	Immediate effect
location param-eter	P03-00	Location command source	0-1	0	---	Downtime setting	Immediate effect
	P03-01	Command pulse mode	0-3	1	---	Downtime setting	Immediate effect
	P03-02	Command pulse input terminal	0-1	0	---	Downtime setting	Immediate effect
	P03-03	Command pulse reversal	0-1	0	---	Downtime setting	Immediate effect
	P03-04	Position pulse filtering	0-3	2	---	Operation settings	Immediate effect
	P03-05	Judgment conditions for positioning completion	0-2	1	---	Operation settings	Immediate effect
	P03-06	Positioning complete range	0-65535	100	Encoder unit	Operation settings	Immediate effect
	P03-07	Position feedback format	0-1	0	---	Downtime setting	Immediate effect
	P03-09	The number of instruction pulses per turn of the motor	0-65535	0	Pulse	Operation settings	Power up again
	P03-10	Molecule of electronic gear 1	1-65535	8192	---	Operation settings	Power up again
	P03-11	Denominator of electronic gear 1	1-65535	625	---	Operation settings	Power up again
	P03-12	Molecular high position of electronic gear 1	0-32767	0	---	Operation settings	Power up again
	P03-15	Excessive position deviation setting	0-65535	30000	command unit *10	Operation settings	Immediate effect
	P03-16	Position command smoothing filter	0-1000.0	0	1ms	Operation settings	Immediate effect

		time					
	P03-20	Position feedback source	0-1	0	---	Operation settings	Immediate effect
	P03-21	Encoder frequency division output enable	0-1	1	---	Downtime setting	Immediate effect
	P03-22	Numerator of the output pulse division ratio of the incremental encoder	1-65535	1	---	Operation settings	Immediate effect
	P03-23	Output pulse division ratio denominator of incremental encoder	1-65535	1	---	Operation settings	Immediate effect
	P03-25	Output pulse number of one revolution of absolute motor	0-60000	2500	---	Operation settings	Immediate effect
	P03-30	Linear encoder inverting	0-1	0	---	Downtime setting	Immediate effect
	P03-31	Polarity of Z pulse of linear encoder	0-1	1	---	Downtime setting	Immediate effect
	P03-40	Output pulse source	0-1	0	---	Downtime setting	Immediate effect
	P03-42	Output Z-pulse polarity	0-1	1	---	Downtime setting	Immediate effect
	P03-45	Digital instruction caching	0-1	0	---	Downtime setting	Immediate effect
	P03-46	Maximum velocity of motor when digital position command is running	0-6000	1000	---	Operation settings	Immediate effect
	P03-50	Gantry function enable	0-1	0	---	Downtime setting	Immediate effect
	P03-51	Gantry function input signal reversal	0-1	0	---	Downtime setting	Immediate effect
	P03-52	The number of feedback pulses for one revolution of gantry function motor	0-65535	10000	---	Downtime setting	Immediate effect
	P03-5	Too large deviation	0-65535	10000	---	Operation	Immediat

	3	setting of gantry function position				settings	e effect
	P03-55	Proportional gain of gantry synchronous position	0-200	10	---	Operation settings	Immediate effect
	P03-60	Origin regression enable control	0-6	0	---	Downtime setting	Immediate effect
	P03-61	Origin regression model	0-9	0	---	Downtime setting	Immediate effect
	P03-65	High velocity when searching the origin switch	0-3000	100	---	Operation settings	Immediate effect
	P03-66	Velocity when searching the origin switch	0-1000	10	---	Operation settings	Immediate effect
	P03-67	Acceleration and deceleration time of search origin switch	0-5000	0	---	Operation settings	Immediate effect
	P03-68	Search origin maximum time limit	0-10000	0	---	Operation settings	Immediate effect
	P03-69	Mechanical origin offset H	0-65535	0	---	Operation settings	Immediate effect
	P03-70	Mechanical origin offset L	0-65535	1000	---	Operation settings	Immediate effect
Velocity param-eter	P04-00	Velocity command source	0-3	0	---	Downtime setting	Immediate effect
	P04-01	Reverse velocity command analog quantity	0-1	0	---	Downtime setting	Immediate effect
	P04-02	Given value of digital velocity	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-03	Zero velocity position clamping function	0-1	0	---	Operation settings	Immediate effect
	P04-04	Zero velocity position clamping velocity threshold	0-6000	30	1rpm	Operation settings	Immediate effect
	P04-05	Overvelocity alarm value	0-6500	6400	1rpm	Operation settings	Immediate effect
	P04-06	Forward velocity limit	0-6000	5000	1rpm	Operation settings	Immediate effect
	P04-07	Reverse velocity limit	0-6000	5000	1rpm	Operation settings	Immediate effect

	P04-10	Zero velocity detection value	0-200.0	2	1rpm	Operation settings	Immediate effect
	P04-11	Rotate check out value	0-200.0	30	1rpm	Operation settings	Immediate effect
	P04-12	Velocity consistent amplitude	0-200.0	30	1rpm	Operation settings	Immediate effect
	P04-14	Acceleration time	0-10000	0	1ms/1000rpm	Operation settings	Immediate effect
	P04-15	Deceleration time	0-10000	0		Operation settings	Immediate effect
	P04-30	Internal velocity setting 1	0-6000	0	1rpm	Operation settings	Immediate effect
	P04-31	Internal velocity setting 2	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-32	Internal velocity setting 3	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-33	Internal velocity setting 4	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-34	Internal velocity setting 5	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-35	Internal velocity setting 6	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-36	Internal velocity setting 7	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-37	Internal velocity setting 8	-6000—6000	0	1rpm	Operation settings	Immediate effect
Torque param-eter	P05-00	Torque command source	0-3	0	---	Downtime setting	Immediate effect
	P05-01	Reverse torque command analog quantity	0-1	0	---	Downtime setting	Immediate effect
	P05-02	Torque mode velocity limit given value	0-6000	1000	1rpm	Operation settings	Immediate effect
	P05-05	Torque limiting setting source	0-1	0	---	Downtime setting	Immediate effect
	P05-06	Torque limit detection output delay	0-10000	0	ms	Operation settings	Immediate effect
	P05-10	Internal forward torque limiting amplitude	0-300.0	200.0	1.0％	Operation settings	Immediate effect
	P05-11	Internal reverse torque limiting amplitude	0-300.0	200.0	1.0％	Operation settings	Immediate effect
	P05-12	External positive	0-300.0	100.0	1.0％	Operation	Immediat

		torque limiting amplitude				settings	e effect
	P05-13	Limit amplitude of external reverse torque	0-300.0	100.0	1.0％	Operation settings	Immediat e effect
I/O param -eter	P06-0 0	DI1 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-01	Function selection of DI1 input port (servo ON)	0-18	1	---	Operation settings	Power up again
	P06-0 2	DI2 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-0 3	Function selection of DI2 input port	0-18	13	---	Operation settings	Power up again
	P06-0 4	DI3 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-0 5	Function selection of DI3 input port	0-18	14	---	Operation settings	Power up again
	P06-0 6	DI4 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-0 7	Function selection of DI4 input port	0-18	15	---	Operation settings	Power up again
	P06-0 8	DI5 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-0 9	Function selection of DI5 input port (positive side external torque limit)	0-18	7	---	Operation settings	Power up again
	P06-10	DI6 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-11	Function selection of DI6 input port (external torque limit on reverse side)	0-18	8	---	Operation settings	Power up again
	P06-12	DI7 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-13	Function selection of DI7 input port (control mode switching)	0-18	5	---	Operation settings	Power up again
	P06-16	DI8 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-17	Function selection of DI8 input port	0-18	16	---	Operation settings	Power up again

		(position command clear)					
	P06-20	DO1 output port effective level	0-1	1	---	Operation settings	Power up again
	P06-21	Function selection of DO1 output port (servo ready)	0-11	3	---	Operation settings	Power up again
	P06-22	DO2 output port effective level	0/1	1	---	Operation settings	Power up again
	P06-23	Function selection of DO2 output port (holding brake open)	0-11	2	---	Operation settings	Power up again
	P06-24	DO3 output port effective level	0/1	1	---	Operation settings	Power up again
	P06-25	DI1 input port effective level (alarm output)	0-11	1	---	Operation settings	Power up again
	P06-26	Function selection of DI1 input port	0/1	1	---	Operation settings	Power up again
	P06-27	DI2 input port effective level (positioning complete)	0-11	4	---	Operation settings	Power up again
	P06-28	Function selection of DI2 input port	0/1	1	---	Operation settings	Power up again
	P06-29	DI3 input port effective level (torque limit detection)	0-11	8	---	Operation settings	Power up again
	P06-40	Function selection of DI3 input port	10-2000	500	1rpm/V	Operation settings	Immediate effect
	P06-41	DI4 input port effective level	0-65535	0.8	1ms	Operation settings	Immediate effect
	P06-42	Function selection of DI4 input port	-10.000 — 10.000	0	1V	Operation settings	Immediate effect
	P06-43	DI5 input port effective level	0.0-100.0	10	%	Operation settings	Immediate effect
	P06-44	Function selection of DI5 input port	0-64.00	0.8	1ms	Operation settings	Immediate effect
	P06-45	DI6 input port effective level	-10.000 — 10.000	0	1V	Operation settings	Immediate effect
	P06-46	Function selection of DI6 input port	0-10.000	0	1V	Operation settings	Immediate effect
	P06-47	DI7 input port effective level	0-10.000	0	1V	Operation settings	Immediate effect

Advan-ced function param-eters	P08-01	Load rotation convention identification mode	0-1	0	---	Operation settings	Immediate effect
	P08-02	Maximum velocity of inertia identification	100-2000	800	1rpm	Operation settings	Immediate effect
	P08-03	Acceleration and deceleration time of inertia identification	20-800	100	1ms	Operation settings	Immediate effect
	P08-04	Waiting time after single inertia identification	50-10000	1000	1ms	Operation settings	Immediate effect
	P08-05	Motor turns required to complete a single inertia		1.33	circle	Operation settings	RO
	P08-11	Mode selection of adaptive notch filter	0-4	0	---	Operation settings	Immediate effect
	P08-20	Torque command filter constant	0-25.00	0.8	1ms	Operation settings	Immediate effect
	P08-25	Disturbance torque compensation gain	0-100.0	0	%	Operation settings	Immediate effect
	P08-26	Time constant of disturbance torque filtering	0-25.00	0.8	1ms	Operation settings	Immediate effect
	P08-30	Notch filter 1 frequency	50-5000	5000	HZ	Operation settings	Immediate effect
	P08-31	Notch filter 1 width	0-20	2	---	Operation settings	Immediate effect
	P08-32	Notch filter 1 depth	0-99	0	---	Operation settings	Immediate effect
	P08-33	Notch filter 2 frequency	50-5000	5000	HZ	Operation settings	Immediate effect
	P08-34	Notch filter 2 width	0-20	2	---	Operation settings	Immediate effect
	P08-35	Notch filter 2 depth	0-99	0	---	Operation settings	Immediate effect
	P08-36	Notch filter 3 frequency	50-5000	5000	HZ	Operation settings	Immediate effect
	P08-37	Notch filter 3 width	0-20	2	---	Operation settings	Immediate effect
	P08-38	Notch filter 3 depth	0-99	0	---	Operation settings	Immediate effect

	P08-39	Notch filter 4 frequency	50-5000	5000	HZ	Operation settings	Immediate effect
	P08-40	Notch filter 4 width	0-20	2	---	Operation settings	Immediate effect
	P08-41	Notch filter 4 depth	0-99	0	---	Operation settings	Immediate effect

8.2 Parameter Analysis Description

8.2.1 P00-xx Motor and driver parameters

Table 94 P00-xx Motor and driver parameters

Parameter code	Name	Explain
P00-00	Motor number	Factory has been set, there is no need to set 0：P0-01 to P0-17 works
P00-01	Motor rated rotating velocity	Setting range：1-6000，unit：rpm Factory has been set, there is no need to set
P00-02	rated motor toroue	Setting range：0.01-655.35，unit：N.M Factory has been set, there is no need to set
P00-03	motor rated current	Setting range：0.01-655.35，unit：A Factory has been set, there is no need to set
P00-04	Moment of inertia of motor	Setting range：0.01-655.35，unit：kg.cm² Factory has been set, there is no need to set
P00-05	Log of motor pole	Setting range：1-31，unit：P Factory has been set, there is no need to set
P00-07	Encoder selection	Setting range: 0-3 0, 1: incremental encoder; 2: Single turn absolute value encoder; 3: Multi turn absolute encoder
P00-08	Save line incremental encoder	Setting range: 0-1 0: non provincia 1: Dart type
P00-09	Absolute encoder type	Setting range: 0-1 0: tamakawa encoder; 1: Nikon encoder
P00-10	Incremental encoder line count	According to the setting of the matched motor, it has been set in the factory
P00-11	Incremental encoder Z pulse electrical Angle	According to the setting of the matched motor, it has been set in the factory
P00-12	Initial angle of rotor 1	According to the setting of the matched motor, it has been set in the factory
P00-13	Initial angle of rotor 2	According to the setting of the matched motor, it has been set in the factory

P00-14	Initial angle of rotor 3	According to the setting of the matched motor, it has been set in the factory
P00-15	Initial angle of rotor 4	According to the setting of the matched motor, it has been set in the factory
P00-16	Initial angle of rotor 5	According to the setting of the matched motor, it has been set in the factory
P00-17	Initial angle of rotor 6	According to the setting of the matched motor, it has been set in the factory
P00-20	Power on interface display setting	Setting range: 0-100, default 100 Set according to customer display requirements When setting 100, the operation status will be displayed when the driver is powered on Other parameter settings correspond to the serial number of the list of monitoring items (Chapter 8.3) For example: when the customer needs to drive and display the motor velocity d08. F.SP the parameter is set to 8
P00-21	RS232 Communication baud rate	Setting range：0-3 Select the baud rate when communicating with PC 0：9600 1：19200 2：57600 3：115200
P00-23	From the station address	Setting range：0—255，default 1 Set according to equipment requirements
P00-24	Modbus Communication baud rate	Setting range：0-7，default 2 0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200
P00-25	verification mode	Setting range：0-3，default 1 0：NONE，2 stop bit 1：even parity check，1 stop bit 2：odd parity check，1 stop bit 3：NONE，1 stop bit
P00-27	CANopen communication baud rate	Set the baud rate of CAN bus 0：12.5KHz 1：120KHz 2：20KHz 3：100KHz 4：125KHz 5：250KHz 6：500KHz

		7：1000KHz
P00-28	485 protocol selection	0: Reserve 1: acquiescence 2: Compatible with RS485 communication
P00-30	Brake resistance setting	Setting range: 0-2 0: use built-in resistance 1: Use external resistance 2: Do not use brake resistor
P00-31	External brake resistance power	Setting range: 0-65535, unit: 10W Set correctly according to the external braking resistance. For example, if the setting value is 4, the resistance power is 40W
P00-32	External brake resistance	Setting range: 0-1000, unit: Ohm Set correctly according to the external braking resistance
P00-40	Over temperature protection settings	Setting range: 0-1 0: turn off the over temperature protection function 1: Turn on the over temperature protection function
P00-41	Control power failure protection settings	Setting range: 0-1 0: turn off the power-off protection function of the control power supply 1: Turn on the power-off protection function of the control power supply

8.2.2 P01-xx Main control parameter

Table 95 P01-xx Main control parameter

<table>
<tr><th>Parameter code</th><th>Name</th><th>Explain</th></tr>
<tr><td>P01-01</td><td>Control mode setting</td><td>Setting range：0-6
0：Position control mode
1：Velocity control mode
2：Torque control mode
3：Velocity, torque control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to switch the control mode.
<table>
<tr><td>Terminal logic</td><td>Control mode</td></tr>
<tr><td>Effective</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Torque mode</td></tr>
</table>
4：Position and velocity control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to</td></tr>
</table>

<table>
<tr><td></td><td></td><td>switch the control mode.
<table><tr><td>Terminal logic</td><td>Control mode</td></tr><tr><td>Effective</td><td>Position mode</td></tr><tr><td>Invalid</td><td>Velocity mode</td></tr></table>5：Position, torque control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to switch the control mode.
<table><tr><td>Terminal logic</td><td>Control mode</td></tr><tr><td>Effective</td><td>Position mode</td></tr><tr><td>Invalid</td><td>Torque mode</td></tr></table>6：whole-close-loop</td></tr>
<tr><td>P01-02</td><td>Adjust the mode automatically in real time</td><td>Setting range：0-2
0：Manual adjustment。
1：Standard mode automatic adjustment。In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03. Manual adjustment of these parameters will not work. The following parameters are set by the user:
P02-03 (velocity feedforward gain), P02-04 (velocity feedforward smoothing constant).
2：Positioning mode automatically adjusts rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03. Manual adjustment of these parameters will not work. The following parameters will be fixed and cannot be changed:
P02-03 (velocity feedforward gain): 30.0%
P02-04 (velocity feedforward smoothing constant): 0.50</td></tr>
<tr><td>P01-03</td><td>Real-time automatic adjustment of rigid Settings</td><td>Setting range：0-31
Built-in 32 gain class parameters that work when P01-02 is set to 1 or 2. It Can be directly called according to the actual situation, the greater the set value, the stronger the rigidity.</td></tr>
<tr><td>P01-04</td><td>Moment of inertia ratio</td><td>Setting range：0-100，unit：Multiple
Set the load inertia ratio of the corresponding motor as follows:
P01-04= load P01-04= load inertia/motor inertia
This inertia ratio can use the value identified by AF-J-L automatic inertia to write the identified value into the parameter</td></tr>
<tr><td>P01-10</td><td>Control mode</td><td>Setting range: 0-1</td></tr>
</table>

	after overtravel	0: after overtravel, the motor is in free state and only receives the reverse direction signal for operation 1: After overtravel, the motor is locked and only receives the reverse direction signal to run
P01-20	Dynamic brake delay	Setting range: 0-150, unit: ms Dynamic brake action delay time when braking conditions are met
P01-21	Disable dynamic brake when main power is OFF	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-22	Disable dynamic brake when servo is OFF	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-23	Disable dynamic brake in case of fault alarm	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-24	No dynamic brake during overtravel	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-30	The brake instruction - servo OFF delay time (Brake open delay)	Setting range：0-255，unit：ms When enabling: after the enabling command is executed, the driver will receive the position command after the time of P01-30. When closing enabling: when the motor is in the static state, the time from the closing enabling command to the time when the motor becomes non energized after the holding brake is closed.
P01-31	The velocity limit of the output of the brake command	Setting range：0-3000，unit：rpm Motor velocity threshold when the holding brake output is valid when the motor is in rotation state. Below this threshold, the holding brake output command is valid, otherwise, the holding brake output command will be valid after waiting for P01-32 time.
P01-32	Wait time of servo OFF brake instruction	Setting range：0-255，unit：ms The maximum waiting time of holding brake output when the motor is in rotation state.
P01-40	Out of control detection enable	Prevent the motor from out of control and abnormal rotation. 0: off enable 1: On enable

8.2.3 P02-xx Gain type parameter

Table 96 P02-xx Gain type parameter

Parameter code	Name	Explain

P02-00	Position control gain 1	Setting range：0-3000.0，unit：1/S ‣ For the proportional gain of the position ring regulator, the larger the parameter value, the higher the gain ratio, the larger the stiffness, the smaller the position tracking error, and the faster the response. However, if the parameters are too large, vibration and overshoot are easily caused. ‣ This parameter is for steady-state response.
P02-01	Position control gain 2	Setting range：0-3000.0，unit：1/S ‣ For the proportional gain of the position ring regulator, the larger the parameter value, the higher the gain ratio, the larger the stiffness, the smaller the position tracking error, and the faster the response. However, if the parameters are too large, vibration and overshoot are easily caused. ‣ This parameter is for dynamic response.
P02-03	Velocity feedforward gain	Setting range：0-100.0，unit：1.0% The larger the parameter value, the smaller the tracking error and the faster the response. However, if the feedforward gain is too large, the position loop of the system will be unstable and prone to overshoot and shock.
P02-04	Velocity feedforward smoothing constant	Setting range：0-64.00，unit：ms This parameter is used to set the velocity loop feedforward filter time constant. The larger the value, the greater the filtering effect, but at the same time the phase lag increases.
P02-10	Velocity proportional gain 1	Setting range：1.0-2000.0，unit：Hz ▸The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load. ▸Make the value as large as possible without oscillating. ▸For the gain at rest.
P02-11	Velocity integral constant 1	Setting range：1.0-1000.0，unit：ms ▸The velocity regulator integration time constant, the smaller the set value, the faster the integration velocity, the greater the stiffness, too small is easy to produce vibration, noise. ▸Reduce this parameter as far as possible under the condition that the system does not oscillate. ▸This parameter is for steady-state response.
P02-12	Pseudo differential feedforward control coefficient 1	Setting range： 0-100.0，unit：1.0% ▸When set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast.When set to 0, the velocity ring integral plays an obvious role in filtering low-frequency interference, but the dynamic response is slow. ▸By adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low frequency interference.
P02-13	Velocity proportional gain 2	Setting range：1.0-2000.0，unit：Hz ▸The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load.

<table>
<tr><td></td><td></td><td>▸Make the value as large as possible without oscillating.
▸For the gain in motion.。</td></tr>
<tr><td>P02-14</td><td>Velocity integral constant 2</td><td>Setting range：1.0-1000.0，unit：ms
▸The velocity regulator integration time constant, the smaller the set value, the faster the integration velocity, the greater the stiffness, too small is easy to produce vibration, noise.
▸Reduce this parameter as far as possible under the condition that the system does not oscillate.
▸This parameter is for steady-state response.</td></tr>
<tr><td>P02-15</td><td>Pseudo differential feedforward control coefficient 2</td><td>Setting range：0-100.0，unit：1.0%
▸When set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast.When set to 0, the velocity ring integral plays an obvious role in filtering low-frequency interference, but the dynamic response is slow.
▸By adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low frequency interference.</td></tr>
<tr><td>P02-16</td><td>Limit amplitude of velocity integral error</td><td>Setting range: 0-32767
Limit amplitude of velocity integral error</td></tr>
<tr><td>P02-19</td><td>Torque feedforward gain</td><td>Setting range：0-30000，unit：1.0%
Set the weighted value of current loop feedforward. This parameter weighted the differential of the velocity instruction and added the current loop.</td></tr>
<tr><td>P02-20</td><td>Torque feedforward smoothing constant</td><td>Setting range：0-64.00，unit：ms
This parameter is used to set the torque feedforward filter time constant.</td></tr>
<tr><td>P02-30</td><td>Gain switching mode</td><td>Setting range：0-10
Set the conditions for the first and second gain switching
<table>
<tr><td>value</td><td>Switching conditions</td><td>Remarks</td></tr>
<tr><td>0</td><td>Fixed as first gain</td><td>P02-00、P02-10、P02-11、P02-12</td></tr>
<tr><td>1</td><td>Fixed as second gain</td><td>P02-01、P02-13、P02-14、P02-15</td></tr>
<tr><td>2</td><td>Switch with DI input</td><td>DI port should be set to 9 (gain switching input)
Invalid: first gain
Effective: second gain</td></tr>
<tr><td>3</td><td>Large torque command</td><td>Switch to second gain when torque command is greater than threshold (determined by P02-31 and P02-32). When less</td></tr>
</table></td></tr>
</table>

				than the threshold and more than the P02-33 delay setting, switch to the first gain.
		4	Velocity command changes a lot	When the velocity instruction change is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.
		5	High velocity command	When the velocity command is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.
		6	Large position deviation	Switch to the second gain when the position deviation is greater than the threshold (determined by P02-31 and P02-32). When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.
		7	Location instruction	Switch to the second gain when there is a position command. When the position command ends and the delay setting of P02-33 is exceeded at the same time, switch to the first gain.
		8	Positioning incomplete	Switch to the second gain when the positioning is not completed. When the positioning is completed and the delay setting of P02-33 is exceeded, switch to the first gain.
		9	High actual velocity	When the actual velocity is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch

<table>
<tr><td></td><td></td><td>
<table>
<tr><td></td><td></td><td>to the first gain.</td></tr>
<tr><td>10</td><td>Position command + actual velocity</td><td>Switch to the second gain when there is a position command. When there is no position command and the actual velocity is less than the threshold (determined by P02-31 and P02-32), and the delay setting of P02-33 is exceeded at the same time, switch to the first gain.</td></tr>
</table>
</td></tr>
<tr><td>P02-31</td><td>Gain switching level</td><td>Setting range：0-20000
Judging threshold value in gain switching.
Torque unit：1000bit=25%Rated torque
Velocity unit：1000bit=200 rpm/min
Position unit：131072biteach circle</td></tr>
<tr><td>P02-32</td><td>Gain switching hysteresis</td><td>Setting range：0-20000
Hysteresis level in gain switching
Torque unit：1000bit=25%Rated torque
Velocity unit：1000bit=200 rpm/min
Position unit：131072biteach circle</td></tr>
<tr><td>P02-33</td><td>Gain switching delay</td><td>Setting range：0-1000.0，unit：ms
When switching from the second gain to the first gain, the time from the trigger condition to the actual switching.</td></tr>
<tr><td>P02-34</td><td>Position gain switching time</td><td>Setting range：0-1000.0，unit：ms
Time for position control gain 1 to smoothly switch to position control gain 2.</td></tr>
<tr><td>P02-40</td><td>Mode switch selection</td><td>Setting range: 0-4
Set the conditions of PI control and P control of velocity loop
<table>
<tr><td>value</td><td>Judgement condition</td><td>Remarks</td></tr>
<tr><td>0</td><td>Torque command</td><td>When the torque command is less than the threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control</td></tr>
<tr><td>1</td><td>Velocity command</td><td>When the velocity command is less than the threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control</td></tr>
<tr><td>2</td><td>acceleration</td><td>When the acceleration is less than the threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control</td></tr>
<tr><td>3</td><td>Positional</td><td>When the positional deviation is less</td></tr>
</table>
</td></tr>
</table>

			deviation	than the threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control
		4	No mode switch	PI control for velocity environmental protection, no switching
P02-41	Mode switch level	Setting range：0-20000 Set the threshold value of switching. Torque unit：1000bit=25%Rated torque Velocity unit：1000bit=200 rpm/min Position unit：131072biteach circle		
P02-50	Added value of torque command	Setting range：-100.0-100，unit：1.0% Valid in position control mode. This value is added to the torque given value for static torque compensation of vertical axis.		
P02-51	Forward torque compensation	Setting range：-100.0-100.0，unit：1.0% Valid in position control mode. Used to compensate for positive static friction.		
P02-52	Reverse torque compensation	Setting range：-100.0-100.0，unit：1.0% Valid in position control mode. Used to compensate for negative static friction.		

8.2.4 P03-xx Position parameter

Table 97 P03-xx Position parameter

Parameter code	Name	Explain
P03-00	Location command source	0：impulsbefehl 1：Number given,Used for communication control.
P03-01	Command pulse mode	0: orthogonal pulse command 1: Direction + pulse command 2 or 3: dual pulse command
P03-02	Command pulse input terminal	Used to specify pulse input port in CN1 port 0: low velocity pulse port 1: High velocity pulse port
P03-03	Command pulse reversal	Used to adjust the counting direction of pulse command. 0：normal. 1：Direction reversal.
P03-04	Position pulse filtering	Setting range：0-3，unit：us 0：0.1us。 1：0.4us 2：0.8us。 3：1.6us
P03-05	Judgment conditions for	0：Output when the position deviation is less than the set value of P03-06.

	positioning completion	1: Output when the position setting is completed and the position deviation is less than the set value of P03-06. 2：Output when the position setting is completed (after filtering) and the position deviation is less than the set value of P03-06.
P03-06	Positioning complete range	Setting range：0-65535，unit：Encoder unit Use to set the threshold value for locating the completion output. If the incremental encoder motor is used, the number of encoder lines *4 shall be calculated for each turn.
P03-07	Position feedback format	Setting range: 0-1 0: incremental format. 1: Multicycle absolute value format
P03-09	The number of instruction pulses per turn of the motor	Setting range：0-65535 Used to set the number of command pulses for one revolution of motor. When this parameter is set to 0, parameters P03-10 and P03-11 are valid.
P03-10	Molecule of electronic gear 1	When absolute value motor is used, see the example of electronic gear ratio calculation method Calculation formula of electronic gear ratio of incremental motor： *G=member/denominator=C*4/P* *C: Number of encoder lines;* *P: Input the number of pulses per revolution* *For example: the number of encoder lines is 2500;* *the number of input pulses per revolution is 3200;* *calculate the electronic gear ratio?* *G=C*4/P=2500*4/3200=10000/3200=25/8* Note: the numerator of 20b encoder is 131072 The numerator of 17Z encoder is 160000
P03-11	Denominator of electronic gear 1	
P03-12	Molecular high position of electronic gear 1	Setting range: 0-32767 Using this parameter, the electronic gear ratio can be enlarged: molecular value = P03-12 * 10000 + P03-10
P03-15	Excessive position deviation setting	Setting range：0-65535，unit：Command unit *10 Set the pulse number of allowable deviations, and an alarm will be given if it exceeds the set value. Example: set value 20, when the following deviation exceeds 20 * 10, the driver will alarm **AL.501** (position deviation is too large)
P03-16	Position command smoothing filter time	Setting range：1000，unit：ms Set the time constant of the position command smoothing filter.
P03-20	Position feedback source	Set the source of position feedback 0: encoder 1: Grating ruler
P03-21	Encoder frequency division output	Set whether CN1 port has encoder frequency division output 0: off enable 1: On enable

	enable	
P03-22	Numerator of the output pulse division ratio of the incremental encoder	When using incremental encoder, set the number of output pulses of CN1 port. P03-23 should be less than or equal to P03-22, calculation formula: $G = \frac{\text{molecule}}{\text{denominator}} = \frac{C \times 4}{P \times 4}$ C: Number of encoder lines P: Desired output A, B pulses per revolution Example: The number of encoder lines is 2500 ; The number of A and B pulses per revolution is 500 ; $G = \frac{C \times 4}{P \times 4} = \frac{2500 \times 4}{500 \times 4} = \frac{5}{1}$
P03-23	Output pulse division ratio denominator of incremental encoder	
P03-25	Output pulse number of one revolution of absolute motor	Setting range: 0-60000 Set the absolute value to rotate the motor for one turn, and output the number of A and B frequency pulses respectively. For example, if the set value is 2048, 2048 pulses will be output for signal A and signal B for each revolution of the motor
P03-30	Linear encoder inverting	Set whether the phase sequence of grating ruler input A and B is reversed 0: do not reverse 1: take the opposite
P03-31	Polarity of Z pulse of linear encoder	Set the effective level of grating ruler input Z signal 0: low level 1: High level
P03-40	Output pulse source	Set the source of frequency division output signal in CN1 terminal 0: motor encoder 1: Grating ruler
P03-42	Output Z-pulse polarity	Set the effective level of Z signal of frequency division output signal of CN1 terminal 0: low level 1: High level
P03-45	Digital instruction caching	Setting range: 0-1 0: do not cache (execute now) 1: Cache (execute new data after last data execution)
P03-46	Maximum velocity of motor when digital position command is running	Setting range: 0-6000 Set the maximum velocity of the motor when the digital position command is running

8.2.5 P04-xx Velocity parameter

Table 98 P04-xx Velocity parameter

Parameter	Name	Explain

code		
P04-00	Velocity command source	0: external analog command 1: Digital command (parameter setting) 2: Digital command (Communication) 3: Internal multiple groups of instructions
P04-01	Reverse velocity command analog quantity	Used to adjust the polarity relationship of analog quantity 0: normal 1: Polarity reversal
P04-02	Given value of digital velocity	Setting range：-6000—6000，unit：rpm When P04-00 is set to 1, P04-02 is the velocity control setting value
P04-03	Zero velocity position clamping function	0: no position clamping function 1: With position clamping function When the velocity control mode meets the following conditions at the same time, enter the position locking mode A: P04-03 is set to 1 B: The absolute value of velocity command is less than the set threshold of P04-04 C: The function of the external input port is set to 10 (fixed zero position), and it is in the valid input state
P04-04	Zero velocity position clamping velocity threshold	Setting range: 0-6000, unit: rpm Set the velocity command threshold to trigger the zero-velocity position clamping function
P04-05	Overvelocity alarm value	Setting range：0-6500，unit：rpm Set the allowable maximum velocity value. If it exceeds the set value, **AL.420** overvelocity alarm will be given
P04-06	Forward velocity limit	Setting range：0-6000，unit：rpm Limit motor forward velocity value
P04-07	Reverse velocity limit	Setting range：0-6000，unit：rpm Limit motor reverse velocity value
P04-10	Zero velocity detection value	Setting range：0-200.0，unit：rpm Set the threshold value of zero velocity detection, when the motor velocity is lower than the threshold value, "**motor zero velocity output**" signal can be output through the output port
P04-11	Rotate check out value	Setting range: 0-200.0, unit: rpm Set the detection threshold of motor rotation. If the motor velocity is higher than this value, the status can be displayed through the LED panel
P04-12	Velocity consistent amplitude	Setting range: 0-200.0, unit: rpm Set the threshold value of the velocity consistent signal. When the difference between the motor velocity and the command velocity is within the threshold value, the "**velocity consistent**

<table>
<tr><td></td><td></td><td>output" signal can be output through the output port</td></tr>
<tr><td>P04-14</td><td>Acceleration time</td><td>Setting range：0-10000，unit：1ms/1000rpm
Set acceleration for velocity control</td></tr>
<tr><td>P04-15</td><td>Deceleration time</td><td>Setting range：0-10000，unit：1ms/1000rpm
Set deceleration at velocity control</td></tr>
<tr><td>P04-30

P04-37</td><td>Internal velocity setting 1-8</td><td>Setting range: - 6000-6000, unit: rpm
Parameters P04-30 to P04-37 set the internal velocity 1 to internal velocity 8 respectively
The internal velocity switching method is as follows:
When the velocity loop is controlled, P04-00 is set to 3,
The corresponding input port functions are defined as 13, 14, 15
The switching of internal velocity is realized by setting the input port function to the combination of on-off states of 13, 14 and 15. The switching relationship is shown in the table below
<table>
<tr><th>DI13</th><th>DI14</th><th>DI15</th><th>Interaction parameter</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>P04-30</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>P04-31</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>P04-32</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>P04-33</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>P04-34</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>P04-35</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>P04-36</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>P04-37</td></tr>
</table></td></tr>
</table>

8.2.6 P05-xx Torque parameter

Table 99 P05-xx Torque parameter

Parameter code	Name	Explain
P05-00	Torque command source	0: external analog command (velocity limit amplitude is set by P05-02) 1: Digital command (velocity limit amplitude is set by P05-02) 2: External simulation command (velocity limit amplitude is determined by velocity simulation command) 3: Digital command (velocity limit amplitude is determined by velocity analog command)
P05-01	Reverse torque command analog quantity	Used to adjust torque direction 0: normal 1: Reverse direction
P05-02	Torque mode velocity limit given value	Setting range: 0 - maximum velocity, unit: rpm Set the maximum velocity value of the motor in the torque mode to prevent the mechanical damage caused by the high velocity of the motor in no-load condition Effective torque control mode

<table>
<tr><td>P05-05</td><td>Torque limiting setting source</td><td>Source for adjusting torque limiting amplitude
0: internal digital quantity (set by P05-10, P05-11 or P05-12, P05-13)
1: External analog quantity (given by external analog quantity input t-ref. In this mode, the positive and negative limiting amplitudes are the same.)</td></tr>
<tr><td>P05-06</td><td>Torque limit detection output delay</td><td>Setting range: 0-10000, unit: ms
Set the output torque limit of DO port to detect the output signal delay time</td></tr>
<tr><td>P05-10</td><td>Internal forward torque limiting amplitude</td><td>Setting range：0-300.0，unit：1.0%
Limit the forward output of the motor, 100 represents 1 time of torque, 300 represents 3 times of torque.
When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit.</td></tr>
<tr><td>P05-11</td><td>Internal reverse torque limiting amplitude</td><td>Setting range：0-300.0，unit：1.0%
Limit the reverse output of the motor, 100 represents 1 time of torque, 300 represents 3 times of torque.
When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit.</td></tr>
<tr><td>P05-12</td><td>External positive torque limiting amplitude</td><td>Setting range: 0-300.0, unit: 1.0%
For this function, one of the external input ports in CN1 is required to switch, and the function selection of the selected DI port input port is set to 7 (external torque limit on the positive side). Control the logical state of the port to switch the control mode.<table><tr><td>Terminal logic</td><td>Torque limiting amplitude</td></tr><tr><td>Effective</td><td>External limiting amplitude P05-12</td></tr><tr><td>Invalid</td><td>Internal limiting amplitude P05-10</td></tr></table>If the DI function is not assigned, the default torque limit amplitude of the system is P05-10
When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit</td></tr>
<tr><td>P05-13</td><td>Limit amplitude of external reverse torque</td><td>Setting range: 0-300.0, unit: 1.0%
This function needs to use an external input port in CN1 to switch, and set the function selection of the selected DI port input port to 8 (external torque limit on the reverse side). Control the logic state of the port to switch the control mode.<table><tr><td>Terminal logic</td><td>Torque limiting amplitude</td></tr><tr><td>Effective</td><td>External limiting amplitude P05-13</td></tr><tr><td>Invalid</td><td>Internal limiting amplitude P05-11</td></tr></table></td></tr>
</table>

		If the DI function is not assigned, the default torque limit amplitude of the system is P05-11 When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit

8.2.7 P06-xx I/O parameter

Table 100 P06-xx I/O parameter

Parameter code	Name	Explain
P06-00	DI1 input port effective level	Setting range: 0-4, factory setting: 0 Set valid input of DI1 input port of CN1 0: valid for low level (optocoupler on) 1: Valid for high level (optocoupler off) 2: Rising edge effective 3: Falling edge effective 4: Both rising and falling edge are effective
P06-01	Function selection of DI1 input port	Setting range: 0-18, factory setting: 1 Set the function of DI1 input port of CN1 0: invalid pin 1: servo ON 2: Alarm clear 3: Reserve 4: Reserve 5: Control mode switching 6: P action command input 7: Positive side external torque limit 8: Reverse side external torque limit 9: Gain switching input 10: Zero fixed input 11: Command pulse inhibit input 12: Encoder absolute value data required input 13: CW limit signal input 14: HW limit signal input 15: CCW limit signal input 16: Position command clear input 17: Pole detection input 18: Command pulse input rate switching input 19: Gantry simultaneous movement enable 20: Gantry alignment clear signal 21: origin switch signal 22: origin reset start signal
P06-02	DI2 input port effective level	See to P06-00
P06-03	Function	See to P06-01，Factory settings：13

	selection of DI2 input port	
P06-04	DI3 input port effective level	See to P06-00
P06-05	Function selection of DI3 input port	See to P06-01，Factory settings：14
P06-06	DI4 input port effective level	See to P06-00
P06-07	Function selection of DI4 input port	See to P06-01，Factory settings：15
P06-08	DI5 input port effective level	See to P06-00
P06-09	Function selection of DI5 input port	See to P06-01，Factory settings：7
P06-10	DI6 input port effective level	See to P06-00
P06-11	Function selection of DI6 input port	See to P06-01，Factory settings：8
P06-12	DI7 input port effective level	See to P06-00
P06-13	Function selection of DI7 input port	See to P06-01，Factory settings：5
P06-16	DI8 input port effective	See to P06-00

	level	
P06-17	Function selection of DI8 input port	See to P06-01，Factory settings：16
P06-20	DO1 output port effective level	Setting range: 0-1, factory setting: 1 0: when the status is valid, the optocoupler is cut off 1: When the representative state is valid, the optocoupler is on
P06-21	Function selection of DO1 output port	Setting range: 0-11, factory setting: 3 0: invalid pin 1: Alarm output 2: Holding brake open output 3: Servo ready for output 4: Positioning complete output 5: Positioning approach output 6: Velocity consistent output 7: Motor zero velocity output 8: Torque limit detection output 9: Velocity limit check out output 10: Warning output 11: Command pulse input rate switching output 12: Origin regression complete output 13: Electrical origin regression complete output
P06-22	DO2 output port effective level	See to P06-20
P06-23	Function selection of DO2 output port	See to P06-21，Factory settings：2
P06-24	DO3 output port effective level	See to P06-20
P06-25	Function selection of DO3 output port	See to P06-21，Factory settings：1
P06-26	DO4 output port effective level	See to P06-20
P06-27	Function selection of	See to P06-21，Factory settings：4

	DO4 output port	
P06-28	DO5 output port effective level	See to P06-20
P06-29	Function selection of DO5 output port	See to P06-21，Factory settings：8
P06-40	Velocity analog command input gain	Setting range: 10-2000, unit: 1rpm / V Set the coefficient between the analog command input by CN1 and the velocity control command For example, 500 represents 500 rpm per V
P06-41	Velocity analog command filter constant	Setting range: 0-64.00, unit: ms Set the filtering time coefficient of the analog command input by CN1
P06-42	Velocity analog instruction offset	Setting range: - 10.000-10.000, unit: V Set zero offset of analog command input by CN1
P06-43	Torque analog command gain	Setting range: 0-100.0, unit: 1% Set the coefficient between the analog command input by CN1 and the velocity control command For example, 30.0 represents 30% of rated torque per V
P06-44	torque analog command filter constant	Setting range: 0-64.00, unit: ms Set the filtering time coefficient of the analog command input by CN1
P06-45	Torque analog command offset	Setting range: - 10.000-10.000, unit: V Set zero offset of analog command input by VN1
P06-46	Velocity analog command deadband	Setting range: 0-10.000, unit: V Set the dead time voltage value of the velocity analog command. When the analog quantity is set within the range of the positive and negative values, the system will default to zero
P06-47	Torque analog command deadband	Setting range: 0-10.000, unit: V Set the dead time voltage value of torque simulation command. When the analog value is within the range of the positive and negative values, the system default value is zero

8.2.8 P08-xx Advanced function parameters

Table 101 P08-xx Advanced function parameters

Parameter code	Name	Explain
P08-01	Load rotation convention identification mode	Setting range: 0-1 0: effective 1: invalid
P08-02	Maximum velocity of inertia identification	Setting range: 100-2000, unit: RPM The highest velocity of the motor in off-line inertia identification
P08-03	Acceleration and deceleration time of inertia identification	Setting range: 20-800, unit: ms Acceleration and deceleration time of motor in off-line inertia identification
P08-04	Waiting time after single inertia identification	Setting range: 50-10000, unit: ms Waiting time after single inertia identification is completed
P08-05	Motor turns required to complete a single inertia	This parameter is the rotation circle value automatically generated according to the set conditions of P08-02, P08-03 and P08-04
P08-11	Mode selection of adaptive notch filter	Setting range: 0-4 Setting range: 0-4 The parameters of the third and fourth traps are no longer updated automatically, but are saved as the current values. But manual input is allowed 1: One adaptive notch filter is effective, the parameters of the third notch filter are updated automatically and cannot be input manually 2: Two adaptive notch filters are effective. The parameters of the third and fourth notch filters are updated automatically and cannot be input manually 3: Resonance frequency only 4: Clear the third and fourth notch filter parameters and restore them to the factory settings
P08-20	Torque command filter constant	Setting range：0-25.00， unit：ms The filtering time constant of torque command can be properly set to a large value when the motor is howling during operation.
P08-25	Disturbance torque compensatio	Setting range：0-100.0 Gain coefficient of disturbance torque observation value. The larger the value is, the stronger the anti disturbance torque

	n gain	ability is, but the action noise may also increase.
P08-26	Time constant of disturbance torque filtering	Setting range：0-25.00，unit：ms The larger the value is, the stronger the filtering effect is, and the action noise can be suppressed. However, excessive phase delay will affect the restraining effect of disturbance torque.
P08-30	Notch filter 1 frequency	Setting range: 50-5000, unit: Hz Center frequency of Notch 1 When it is set to 5000, the notch filter is invalid
P08-31	Notch filter 1 width	Setting range: 0-20 Notch width class of Notch 1 Is the ratio of width to center frequency
P08-32	Notch filter 1 depth	Setting range: 0-99 Notch depth level of Notch 1 The ratio relationship between output and input for the center frequency of the notch filter The larger the parameter, the smaller the depth of the notch and the weaker the effect
P08-33	Notch filter 2 frequency	Same P08-30
P08-34	Notch filter 2 width	Same P08-31
P08-35	Notch filter 2 depth	Same P08-32
P08-36	Notch filter 3 frequency	Same P08-30
P08-37	Notch filter 3 width	Same P08-31
P08-38	Notch filter 3 depth	Same P08-32
P08-39	Notch filter 4 frequency	Same P08-30
P08-40	Notch filter 4 width	Same P08-31
P08-41	Notch filter 4 depth	Same P08-32

8.3 List of Monitoring Items

Table 102 List of monitoring items

Displaying Serial Number	Display Item	Explain	Unit
d00.C. PU	Sum of position command pulses	This parameter can monitor the number of pulses sent by the user to	Instruction unit

		the servo driver to confirm whether there is pulse loss.	
d01.F. PU	Describe the sum of position feedback pulses	This parameter can monitor the number of pulses fed back by the servo motor. The unit is the same as the unit of user input instruction.	Instruction unit
d02.E. PU	Number of position deviation pulses	This parameter can monitor the pulse number of position lag during servo system operation. The unit is the same as the unit of user input instruction.	Instruction unit
d03.C. PE	Position given pulse sum / Gantry machine feedback pulse	This parameter can monitor the number of pulses sent by the user to the servo driver. Unit: when absolute motor is used, it is calculated as 131072bit per turn. If incremental encoder motor is used, the number of encoder lines * 4 shall be calculated for each turn.	Encoder unit/ Instruction unit
d04.F. PE	Position feedback pulse sum / Gantry machine feedback pulse	This parameter can monitor the number of pulses fed back by the servo motor. Unit: when absolute motor is used, it is calculated as 131072bit per turn. If incremental encoder motor is used, the number of encoder lines * 4 shall be calculated for each turn.	Encoder unit/ Instruction unit
d05.E. PE	Position deviation pulse number/Gantry pulse deviation	This parameter can monitor the pulse number of position lag during the operation of the servo system. Unit: when using absolute value motor, calculate by 131072bit per lap. If the incremental encoder motor is used, the number of encoder lines *4 shall be calculated for each turn.	Encoder unit/ Instruction unit
d06.C. Fr	Pulse command input frequency	This parameter monitors the input frequency of the external pulse command	KPPS
d07.C. SP	Velocity control command		rpm
d08.F. SP	Motor velocity	This parameter can monitor the velocity of the servo motor when it is running	rpm
d09.C. tQ	Torque command	This parameter can monitor the torque when the servo motor is running	%
d10.F. tQ	Torque feedback value	This parameter can monitor the feedback torque when the servo motor	%

		is running	
d11.AG. L	Average torque	This parameter can monitor the average torque of the servo motor in the past 10 seconds	%
d12.PE. L	Peak torque	This parameter can monitor the peak torque of servo motor after power on	%
d13.oL	Overload rate	This parameter can monitor the load occupancy rate of the servo motor in the past 10 seconds	%
d14.rG	Regeneration load rate	This parameter monitors the load rate of the regeneration resistor	%
d16.I. Io	Input IO status	This parameter can monitor the input port status of CN1. The upper vertical bar represents high level (optocoupler cutoff), and the lower vertical bar represents low level optocoupler conduction). The corresponding relationship with the input port is that the vertical bars of the operation panel from right to left correspond to di1-di4 respectively	Binary
d17.o. Io	Output IO status	This parameter can monitor the output port status of CN1. The upper vertical bar represents the conduction of optocoupler, the lower vertical bar represents the cutoff of optocoupler, and the corresponding relationship with the output port is that the vertical bar of the operation panel from right to left corresponds to do1-do3 respectively	Binary
d18.AnG	Mechanical angle of motor	This parameter can monitor the mechanical angle of the motor, and the rotation of 1 turn is 360 degrees	0.1°
d19.HAL	Motor UVW phase sequence	This parameter can monitor the phase sequence position of the incremental encoder motor	
d20.ASS	Absolute value encoder single turn value	This parameter can monitor the feedback value of absolute encoder, and the rotation is 0xFFFF	0-0xFFFF
d21.ASH	Absolute value encoder multi turn value	This parameter can monitor the number of turns of the absolute encoder motor	
d22.J-L	Inertia ratio	This parameter can monitor the real-time inertia of the load of the motor	%

d23.dcp	Main circuit voltage (AC value)	This parameter can monitor the voltage value of the main circuit	V
d24.Ath	Driver temperature	This parameter can monitor the drive temperature	℃
d25.tiE	Cumulative running time	This parameter can monitor the running time of the drive, unit is second	Sec
d26.1. Fr	Resonance frequency 1	This parameter can monitor resonance frequency 1	Hz
d28.2. Fr	Resonance frequency 2	This parameter can monitor resonance frequency 2	Hz
d30.Ai1	Input voltage of analog quantity command 1（V_REF）	This parameter can monitor the input voltage value of the analog command (V_REF) of the velocity loop.	0.01V
d31.Ai2	Input voltage of analog quantity command 2（T_REF）	This parameter can monitor the input voltage value of the analog command (T_REF) of the torque ring.	0.01V

9 Fault Analysis and Treatment

9.1 Fault Alarm Information Table

Table 103 Fault alarm information table

Alarm type	Serial number code	Alarm content
Hardware failure	AL.051	EEPROM Parameter exception
	AL.052	PLC configuration failure
	AL.053	Initialization failed
	AL.054	System exception
	AL.060	Product model selection failure
	AL.061	Product matching failure
	AL.062	Parameter storage failure
	AL.063	Overcurrent detection
	AL.064	Servo power on self check finds output short circuit to ground
	AL.066	Servo unit control power supply voltage low
	AL.070	AD sampling fault 1
	AL.071	Current sampling fault
	AL.101	AI Set fault
	AL.102	DI Allocation failure
	AL.103	DO Allocation failure
	AL.105	Electronic gear setting error
	AL.106	Abnormal setting of frequency division pulse output
	AL.110	Power on again after parameter setting

	AL.110	Power on again after parameter setting
	AL.401	Undervoltage
	AL.402	Overvoltage
	AL.410	Overload (instantaneous maximum load)
	AL.411	Driver overload
	AL.412	Motor overload (continuous maximum load)
	AL.420	Over velocity
	AL.421	Out of control detection
	AL.422	Runaway fault
	AL.425	AI sampling voltage too high
	AL.435	Impulse current limit resistor overload
	AL.436	DB overload
	AL.440	heatsink OT
	AL.441	Motor overheat fault
	AL.500	Frequency division pulse output over velocity
	AL.501	Excessive position deviation
	AL.502	The position deviation between the full closed-loop encoder and the motor is too large
	AL.505	P command input pulse abnormal
	AL.550	Inertia identification failure
Encoder Warning	AL.600	Encoder output power short circuit fault
	AL.610	Incremental encoder off line
	AL.611	Z signal loss of incremental encoder
	AL.941	Parameter change to be switched on again

9.2 Cause and Treatment of Fault Alarm

AL.051：EEPROM Parameter exception

Cause of fault alarm	Fault alarm check	Disposal measures
Servo unit EEPROM data abnormal	Check wiring	Correct wiring,power up again If it always appears, replace the drive

AL.052：PLC configuration failure

Cause of fault alarm	Fault alarm check	Disposal measures
Main control MCU power on initialization abnormal Serial port baud rate set too high	Check wiring Check the baud rate parameter P00-21 of serial communication	Reduce the baud rate of serial communication If it always appears, replace the drive

AL.053：Initialization failed

Cause of fault alarm	Fault alarm check	Disposal measures
Main control MCU	Check wiring	If it always appears, replace the

power on initialization failed	Power up again	drive

AL.054: System exception

Cause of fault alarm	Fault alarm check	Disposal measures
Abnormal operation of main control MCU	Check wiring Power up again	If it always appears, replace the drive

AL.060: Product model selection failure

Cause of fault alarm	Fault alarm check	Disposal measures
Product parameter setting does not match the actual hardware	Check product parameter setting and hardware model The rated current of the selected motor is greater than the output current of the driver	Set product parameters correctly If it always appears, contact the manufacturer

AL.061: Product matching failure

Cause of fault alarm	Fault alarm check	Disposal measures
Servo unit and servo motor model do not match	Check whether the servo unit supports the motor	Replace the servo unit matching the motor

AL.063: Overcurrent detection

Cause of fault alarm	Fault alarm check	Disposal measures
Servo unit power module current too high	U, V, W wiring for short circuit Is there a short circuit between B1 and B3	Correct wiring If it always appears, replace the drive

AL.071: Current sampling fault

Cause of fault alarm	Fault alarm check	Disposal measures
Abnormal sampling data of current sensor	Check wiring	Correct wiring If it always appears, replace the drive

AL.100: Parameter combination exception

Cause of fault alarm	Fault alarm check	Disposal measures
Parameter setting error	Check the set (P03-07) parameter	Set parameters correctly If it always appears, please initialize the parameters

AL.102 DI Allocation failure

Cause of fault alarm	Fault alarm check	Disposal measures
At least 2 input ports have the same function selection	Check port input function selection parameters	Set parameters correctly Power on the drive again

AL.103：DO Allocation failure

Cause of fault alarm	Fault alarm check	Disposal measures
At least 2 output ports have the same function selection parameters	Check port output function selection parameters	Set parameters correctly Power on the drive again

AL.105：Electronic gear setting error

Cause of fault alarm	Fault alarm check	Disposal measures
Electronic gear ratio setting error	Check the electronic gear ratio setting parameters. P03-10, P03-11	Set the electronic gear ratio correctly
Gantry output pulse setting too small	Check the number of feedback pulses of the gantry function motor for one revolution: P03-52 must be greater than 128	Correctly set the number of feedback pulses for one revolution of gantry function motor

AL.106：Abnormal setting of frequency division pulse output

Cause of fault alarm	Fault alarm check	Disposal measures
Frequency division pulse output parameter setting out of range	Check the frequency division pulse output setting parameters. P03-22，P03-23，P03-25	Correctly set the output parameters of frequency division pulse Incremental encoderP03-22≤ P03-23 Bus encoderP03-25<65535 Power on the drive again

AL.110：Power on again after parameter setting

Cause of fault alarm	Fault alarm check	Disposal measures
After the servo parameter is set, it can take effect only after power on again	Power on the drive again	Power on the drive again

AL.401：Undervoltage

Cause of fault alarm	Fault alarm check	Disposal measures
The input voltage of the main circuit is lower than the rated voltage or there is no input voltage	Check whether the main circuit input R, S, T wiring is correct and what is the voltage value	Make sure the wiring is correct and use the correct voltage source or series voltage regulator

AL.402：Overvoltage

Cause of fault alarm	Fault alarm check	Disposal measures
Main circuit input voltage is higher than rated voltage	Use a voltmeter to test whether the input voltage of the main circuit is correct	Use correct voltage source or series voltage regulator

Drive hardware failure	When it is confirmed that the input voltage is correct, the over-voltage alarm still occurs	Please return it to the dealer or the original factory for maintenance
The regeneration resistance is not connected or the selection of regeneration resistance is wrong	Verify that P00-30 is set to 0 or 1	Correct setting and external regeneration resistance

AL.410：Overload (instantaneous maximum load)

Cause of fault alarm	Fault alarm check	Disposal measures
The machine is stuck when the motor starts	Check if the mechanical connection is blocked	Adjust the mechanical structure
Drive hardware failure	Confirm that the mechanical part is normal and still alarm	Please return it to the dealer or the original factory for maintenance

AL.412：Motor overload (continuous maximum load)

Cause of fault alarm	Fault alarm check	Disposal measures
Continuous use beyond the rated load of the drive	It can be monitored through d13. oL.	Change the motor or reduce the load
Improper setting of control system parameters	1. Whether the mechanical system is installed 2. Acceleration setting constant is too fast 3. Whether gain parameters are set correctly	1. Adjust control loop gain 2. Acceleration and deceleration setting time slows down
Motor wiring error	Check U、V、W wiring	Correct wiring

AL.420：Over velocity

Cause of fault alarm	Fault alarm check	Disposal measures
Input velocity command too high	Check whether the input signal is normal with the signal detector	Adjust the frequency of the input signal
Over velocity determination parameter setting is incorrect	Check whether P04-05 (overvelocity alarm value) is set reasonably	Set P04-05 (overvelocity alarm value) correctly

AL.440：heatsink OT

Cause of fault alarm	Fault alarm check	Disposal measures
The internal temperature of the driver is higher than 95 ℃	Check whether the cooling condition of the drive is good	Improve the cooling condition of the drive. If there is any alarm again, please send the drive back to the original factory for

		maintenance

AL.501: Excessive position deviation

Cause of fault alarm	Fault alarm check	Disposal measures
Too large position deviation, too small parameter setting	Confirm the parameter setting of P03-15 (excessive position deviation setting)	Increase the setting value of P03-15 (position deviation is too large)
Gain value set too small	Confirm whether the gain parameters are set properly	Adjust the parameters of gain class correctly
Internal torque limit set too small	Confirm internal torque limiting amplitude	Correct internal torque limiter readjustment
Excessive external load	Check external load	Load reduction or high-power motor replacemen

AL.505: P command input pulse abnormal

Cause of fault alarm	Fault alarm check	Disposal measures
Pulse command frequency higher than rated input frequency	Check whether the input frequency is higher than the rated input frequency with pulse frequency detector	Set the input pulse frequency correctly

AL.551: Home Return timeout fault

Cause of fault alarm	Fault alarm check	Disposal measures
Time out for home operation	Confirm whether the parameter P03-68 (maximum time limit for searching the origin) is reasonable	Set P03-68 correctly

AL.600: Encoder output power short circuit fault

Cause of fault alarm	Fault alarm check	Disposal measures
Encoder power wiring error	Check whether the encoder power supply + 5V and GND are connected reversely	Correct wiring

AL.610: Incremental encoder off line

Cause of fault alarm	Fault alarm check	Disposal measures
Incremental encoder HallU, HallV, HallW signal abnormal	Check encoder wiring	Correct wiring

➢ MCAC808-R/RC

1 Safety Precautions

In order to prevent harm to personal and property safety, please observe the following precautions, and make the following marks to distinguish:

⚠ Danger	Indicates a high risk of death or serious injury
⚠ Notice	Indicates that it is likely to cause minor injury or endanger property safety
🚫	Indicates prohibited items

1.1 Precautions for Receiving and Installation

⚠ Danger： 1、Please use it with the driver and motor according to the specified way, otherwise it will cause equipment damage or fire.

2、It is forbidden to use in places with serious water vapor, combustible gas, corrosive gas, etc., otherwise electric shock, fire, equipment damage, etc. will be caused.

1.2 Precautions for Wiring

⚠ Danger： 1、Do not connect the power supply of the driver to the output terminals of U, V and W motors, otherwise the driver will be damaged, which may cause personal injury or fire.

2、Please make sure the connection wire of power supply and motor output terminal is locked, otherwise it may cause sparking and fire.

3、Please select the power cord and motor power extension cord correctly to avoid fire caused by insufficient current bearing capacity of the wire.

4、Please make sure that the enclosure of the driver and the motor are grounded. Poor grounding may cause electric shock to personnel.

⚠ Notice：1、Please do not tie the motor power line and signal line together or pass through the same pipe to prevent interference to the signal.

2、For signal line and encoder feedback extension line, please use multi stranded shielded wire to enhance anti-interference ability.

3、Before power on, please confirm whether the wiring is connected correctly.

After the power of the driver is turned off, there is still high voltage inside. Please do not touch the power terminal within 5 minutes, and confirm that the discharge indicator is off before operation.

1.3 Precautions for Operation and Operation

Danger: 1、Before installing the equipment, please conduct no-load test run to avoid accidents.

2、Do not allow untrained personnel to operate, to prevent equipment damage and personnel injury caused by misoperation.

3、During normal operation, please do not touch the radiator and its interior of the driver with your hands to prevent high temperature scalding or electric shock.

Notice: 1、Please adjust the parameters of the driver before long-term test to prevent the poor use of the driver and equipment.

2、Please confirm that the equipment start, emergency stop, shutdown and other switches are effective before operating the equipment.

3、Please do not switch on and off the power supply frequently.

1.4 Precautions for Maintenance and Inspection

: 1、During operation, it is forbidden to touch the inside of the driver and motor to prevent electric shock.

6、Do not change the connecting wire when it is powered on to prevent electric shock or personal injury.

7、Must be operated and maintained by trained professionals.

8、Please do not disassemble or repair except for the company's personnel.

9、Within 5 minutes after the power is turned off, do not touch the power supply and power terminal to prevent electric shock.

2 Product Introduction

2.1 Technical Index

Table 104 Electrical specifications of MCAC-R/RC series products

Model	MCAC808
Input Voltage	DC24~80V
Continuous input current Arms	10A
Continuous output current Arms	8A
Maximum output current Arms	20A

Table 105 Basic specification

Project		Describe
control mode		IGBT PWM control, Sine wave current driving mode
feedback		Incremental encoder
Conditions of use	temperature	Work: 0～55℃storage: -25～85℃
	humidity	Work: 10%～90%
	Altitude	<1000m， When it is higher than 1000M, it shall be derated according to GB/T 3859.2-93
	Protection level	Protection level: IP10，Cleanliness: 2 No corrosive gas, combustible gas, oil, water splash, dust, salt and less metal powder
Performance	Velocity adjustment range	1:5000
	Steady velocity accuracy	±0.01%: External load variation 0-100% ± 0.01%: power input variation ± 10% (220V) ±0.1%: Ambient temperature ± 25 ℃ (25 ℃)
	Velocity response frequency	1200Hz
	Torque control accuracy	±2%
I / O signal	Encoder frequency division pulse output	Phase A, phase B, phase C: linear drive output Frequency division pulse number: can be set arbitrarily

	Input signal	Point: 5 Functions: servo ON, alarm clearing, forward overtravel signal input, reverse overtravel signal input, control mode switching, P action command input, gain switching input, zero fixed input, command pulse prohibition input, internal set velocity switching input 1. Internal set velocity switching input 2. Internal set velocity switching input 3. Position command clear input, command pulse input multiple switching input
	output signal	Point: 3 Functions: alarm output, holding brake open output, servo ready output, positioning completion output, positioning approach output, velocity limit detection output, warning output, command pulse input multiple rate switching output
Communication function	RS485	Support Modbus protocol. Axis address: set by parameters
	RS232	Connect PC for debugging
	CAN	Support CAN bus communication
Protection function		Overvoltage, undervoltage, overcurrent, overload, etc

2.2 Naming Rules

<u>MCAC808</u> – <u>1024</u> – <u>4</u> – <u>200</u> – <u>RC</u> – <u>XXX</u>

①②③④⑤⑥⑦⑧⑨

①Series Name: JMC MC series AC servo driver
②Servo driver category：AC：alternating current servo driver；DC：direct current servo driver
③Driver supply voltage：* 10 is the supply voltage level，7：70VDC　8：80VDC
④Driver output current：08：8A；30：30A；50：50A；A0：100A
⑤Matching motor encoder：1024C：Magnetic braided 1024 wire　2500C：Magnetic braided 2500 wire
17BC：17 bit absolute magnetic knitting　2500：Optical braided 2500 wire
M23B: Multicycle absolute value optical knitting
⑥Matched motor pole pairs：4：Four pairs of poles　5：Five pairs of poles
⑦Matching motor pole power：400：400W　750：750W　1000：1000W
⑧Bus communication mode：　R：RS485　RC：RS485+CAN　EC：EtherCAT
⑨Product design No.: special function module, default to standard model

3 Drive Port Description

3.1 Drive Port Schematic

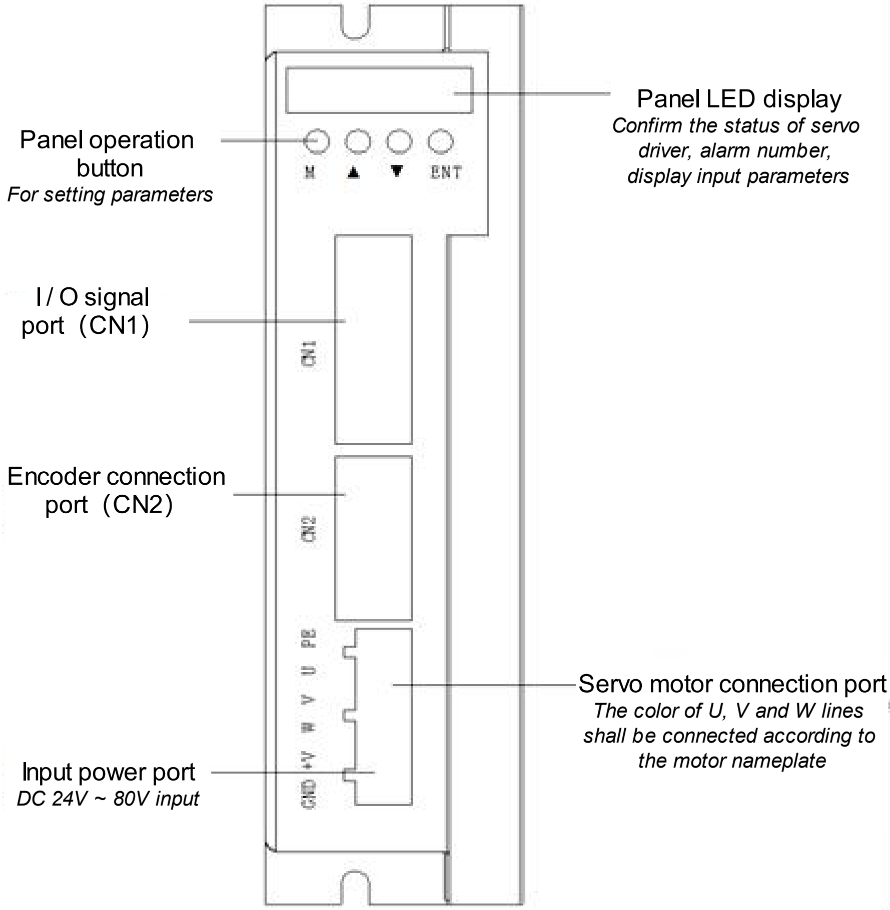


Figure 110 Drive port schematic

Notice:

1. CN3 / CN4 / CN5 port at the top of the drive
2. CN3 port is used for RS232 communication
3. CN4 / CN5 port is used for 485 and CAN bus communication

3.2 Drive Control Port Description

3.2.1 CN1 control port definition

The interface between upper control and driver is used for upper control driver and driver feedback output.

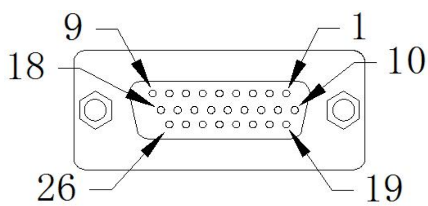


Figure 111 CN1 control port

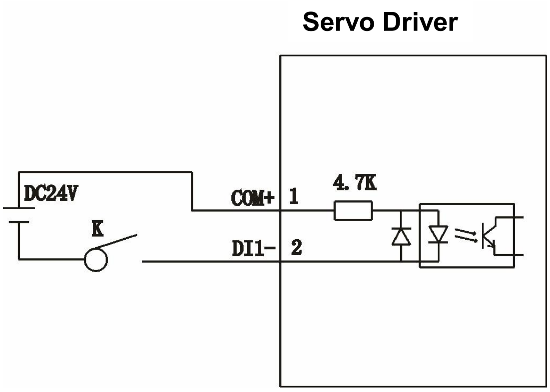
Table 106 CN1 control port definition

Pin	Label	Definition	Explain

number			
1	COM+	Common input	High level 24V effective
2	DI1-	Digital input -	Custom input port
3	PUL+	Pulse + (not used temporarily)	High level 3.6V ~ 24V effective
4	PUL-	Pulse - (not used temporarily)	Low level 0V effective
5	DIR+	Direction + (not used temporarily)	High level 3.6V ~ 24V effective
6	DIR-	Direction - (not used temporarily)	Low level 0V effective
7	DI2-	Digital input −	Custom port function and effective level
8	DO1+	Digital output +	Custom port function and effective level
9	DO1-	Digital output -	Custom port function and effective level
10	DO2+	Digital output +	Custom port function and effective level
11	DO2-	Digital output -	Custom port function and effective level
12	DO3+	Digital output +	Custom port function and effective level
13	DO3-	Digital output -	Custom port function and effective level
14	DI3-	Digital input -	Custom port function and effective level
15	DI4-	Digital input -	Custom port function and effective level
16	T_REF	Reserved	
17	V_REF	Reserved	
18	OCZ	Encoder z-phase open collector output	
19	+15V	+12V output (for analog command)	Maximum allowable output current: 50 mA
20	OA+	Encoder A-phase positive output	
21	OA-	Encoder A-phase negative output	
22	OB+	Encoder B-phase positive output	
23	OB-	Encoder B-phase negative output	
24	OZ+	Encoder Z-phase positive output	
25	OZ-	Encoder Z-phase negative output	
26	GND	Power ground	

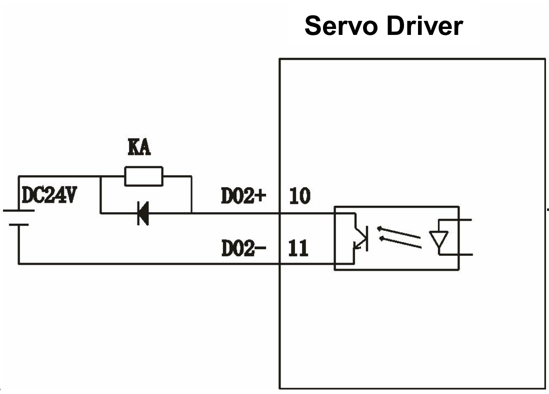
3.2.2 CN1 Control port connection description

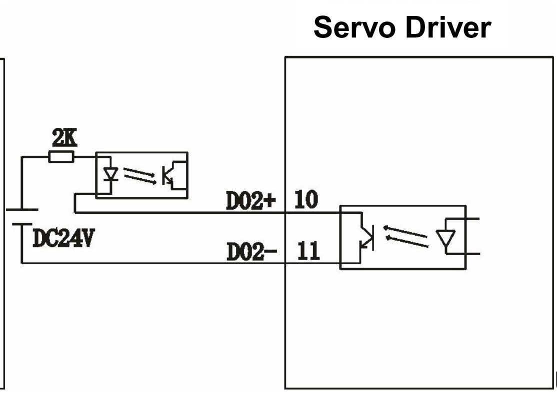
Digital input DI (DI1-DI5/DI6-DI9) can be connected by switch, relay and collector open circuit transistor circuit.



Use external power input

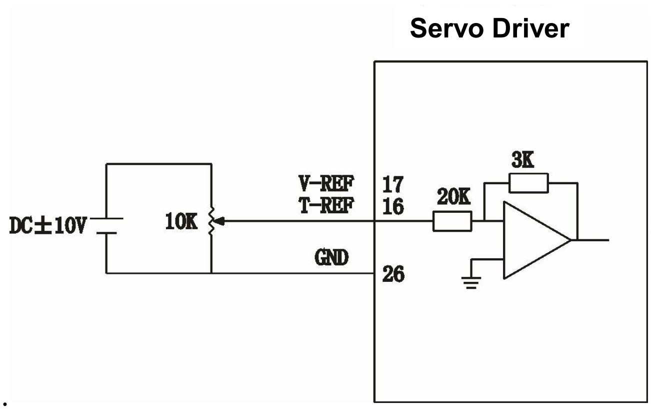
Digital output DO(DO1-DO3) output can be connected with relay, optocoupler,

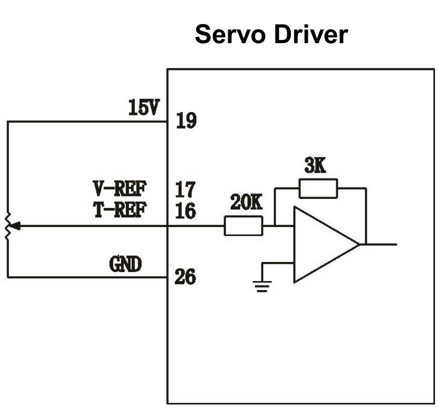




etc. Use external power supply (relay)Use external power supply (optocoupler)

The effective voltage range (- 10V ~ 10V) of velocity and torque control analog input can be set by the following parameters: velocity analog command input gain of P06-40 and torque analog command input gain of P06-43. Please read the detailed description of parameters for specific setting





methods. External power analog signal setting Internal 15V power supply, velocity / torque regulated by potentiometer

3.2.3 CN2 Encoder port description

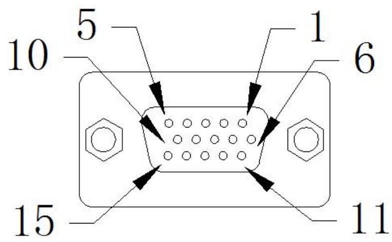


Figure 113 CN2 Encoder Port

Table 107 Connector description of CN2 encoder

Pin number	Label	Definition	Explain
1	EA+	Encoder A -phase positive input	
2	EB+	Encoder B -phase positive input	
3	GND	Output power ground	
4	Hallw+	Pole W phase positive input	
5	Hallu+	Pole U phase positive input	
6	FG		
7	EZ+	Encoder Z-phase positive input	
8	EZ-	Encoder Z-phase negative input	
9	Hallv+	Pole V phase positive input	
10	NC	NC	
11	EA-	Encoder A -phase negative input	
12	EB-	Encoder B -phase negative input	
13	+5V	Output + 5V power supply	
14	T+	Bus encoder T+	Special for bus drive
15	T-	Bus encoder T-	Special for bus drive

3.2.4 CN3 RS232port description

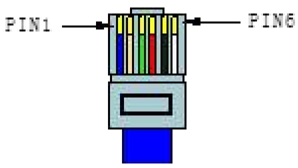


Figure 114 CN3 RS232 port

Table 108 CN3 RS232 port description

Foot position	Label	Definition specification
PIN1	TX232	RS232Receive
PIN2	RX232	RS232Send
PIN3	Reserve	No connection
PIN4	Reserve	No connection
PIN5	Reserve	No connection
PIN6	GND	RS232 GND

3.2.5 CN4/CN5 RS232 port description

Notice: for 485 and CAN communication ports, please refer to"Communication Interface and Wiring" (Ctrl + left mouse button or click the text to jump).

3.2.6Power signal port description

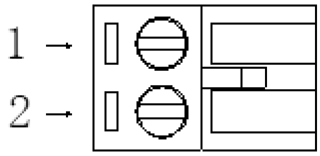


Figure 115 Power port

Table 109 Description of the power port

Terminal number	Label	Definition	Explain
1	GND	Input GND	0V
2	VDC	Input DC power +	DC24~80V

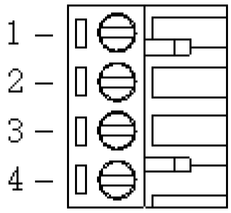


Figure 116 motor power line port

Table 110 Description of motor power line port

Terminal number	Label	Definition	Explain
1	W	W terminal of motor	
2	V	V terminal of motor	
3	U	U terminal of motor	
4	PE	GND	Ground wire of motor

4 Installation Instructions

4.1 Installation Dimension

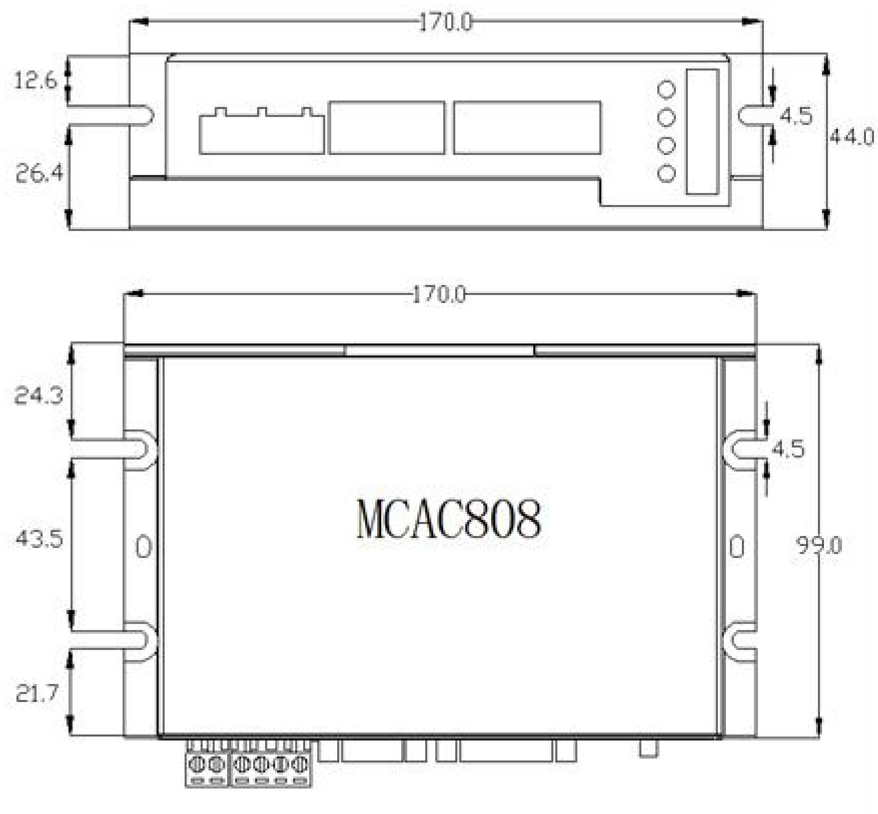


Figure 2 Installation dimension(uint:mm)

Table 111 MCACD imension drawing

Model	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	L7 (mm)
MCAC708-R/RC	75.50	118.10	29.60	113.20	114.15	36.00	12.65
MCAC808-R/RC	99.0	170.0	43.5			44.0	12.6

Notice: please contact us for detailed specifications.

4.2 Installation and Use Environment

The installation and use environment have a direct impact on the normal operation and service life of the product, so the following conditions must be met:

1. Working environment temperature: 0-55 ℃; working environment humidity: below 10% - 90% (no condensation).
2. Storage environment: - 20 ℃ ~ + 85 ℃; storage environment humidity: below 90% (no condensation).
3. Vibration: below 0.5G.
4. Prevent rain drips or wet environment.
5. Avoid exposure to sunlight.
6. Prevent oil mist and salt erosion.
7. Prevent corrosive liquid, gas, etc.
8. Prevent the invasion of dust, cotton and metal filings.

9. Keep away from radioactive materials and combustibles.
10. Space shall be reserved around the place where the drives are placed in the cabinet to facilitate loading, unloading and maintenance.
11. Pay attention to the air flow in the cabinet. If necessary, install an external fan to enhance the air flow and reduce the ambient temperature of the driver to facilitate heat dissipation. The long-term working temperature is below 55 ℃.
12. Try to avoid vibration source nearby, and install damping device such as vibration absorber or anti vibration rubber gasket.
13. If there is an electromagnetic interference source nearby, the power supply and control circuit of the driver are easy to be interfered and lead to misoperation, the noise filter can be added or various effective anti-interference measures can be adopted to ensure the normal operation of the driver (the noise filter will increase the leakage current, and the input end of the driver power supply needs to be loaded with an isolation transformer).

5 Panel Display Description and Settings

5.1 Function Introduction of Each Part of The Panel

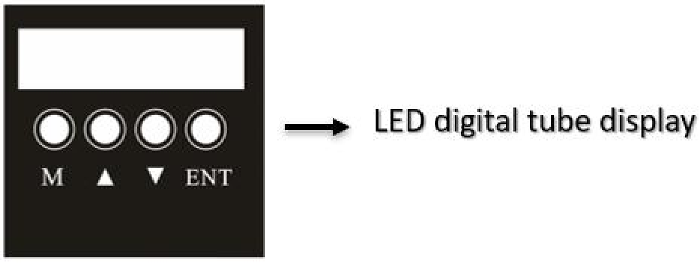


Figure 38 Key panel

MCAC808 series AC servo panel uses six LED nixie tubes to display the status; four key input instructions, with specific key functions as follows:

Table 112 Key function description

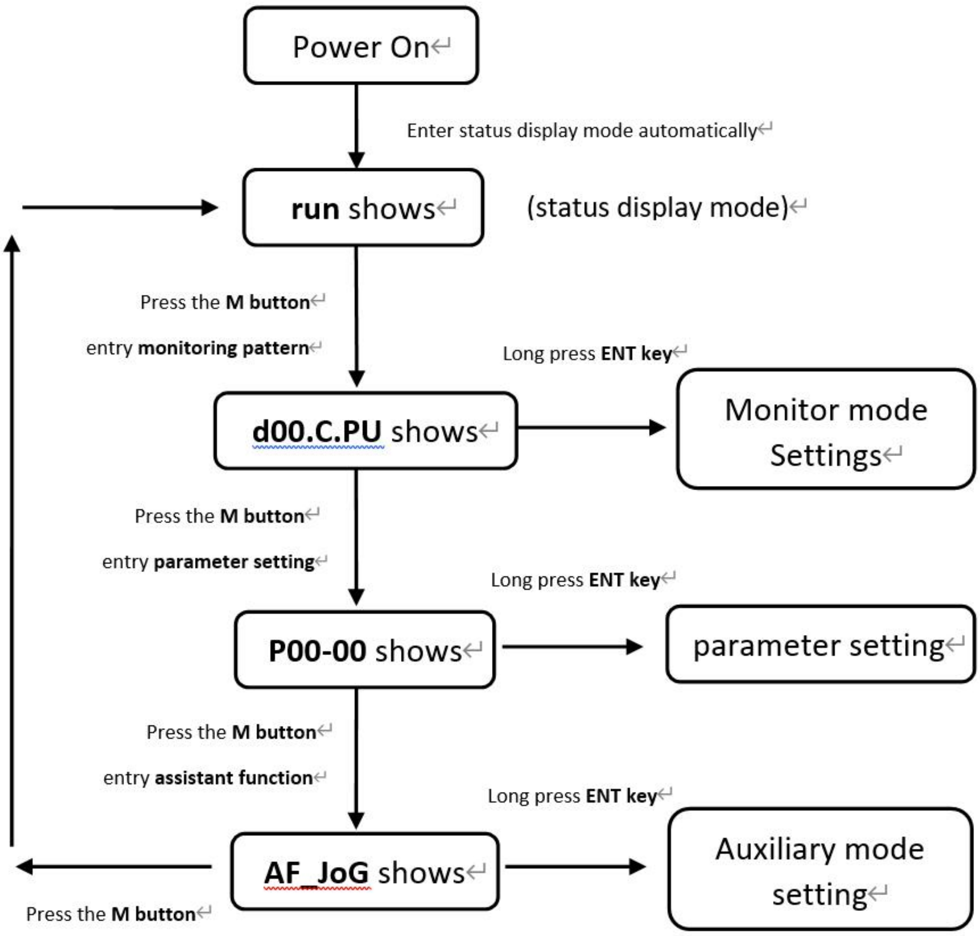
Panel key label	Definition	Explain
△	UP key	Display change, value adding function
▽	DOWN key	Display change, value reduction function
M	M key	Function switching and withdrawal
ENT	ENTkey	a. Long press to confirm or save the function b. Short press for shift function (used to switch high / low display in parameter mode)

Remarks：

a、Press and hold **ENT key** for 3 seconds to confirm or save the function.
b、In the monitoring and parameter interface, long press the **UP key** or **DOWN key** to flip quickly.

5.2 Operation Mode Switching Flow

MCAC808 series ac servo has four functional modes, which are status display mode, monitoring mode, parameter setting mode and auxiliary mode. The switching process between them is as follows：



Notice： After pressing **ENT key** to enter the mode setting, you can exit the mode selection by pressing **M key**

5.3 Status Display

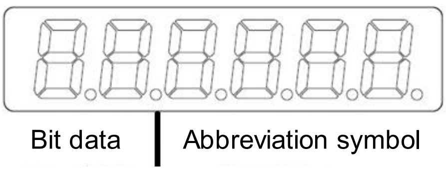


Figure 4 LED Shows

Table 113 Status display bit data meaning

Show	Meaning	Show	Meaning

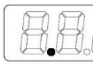
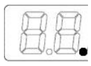
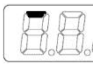
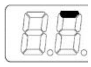
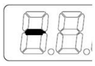
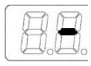
	Power on display of control circuit power supply		Main circuit power supply ready display
	Velocity and torque control: velocity consistent display Position control: positioning complete display		Rotate checkout display
	Base blocking display Servo OFF status lights up, ON status lights out		Velocity and torque control: velocity command input Position control: display in command pulse input

Table 114 Status display abbreviation meaning

Show	Meaning
nrdy	Servo not ready (power supply not powered on)
rdy	Servo ready (servo motor is not powered)
run	Servo enable state (servo motor energized state)
Pot	Indicates that the forward over travel signal input port is in a valid state, and the motor forward rotation command is invalid
not	Indicates that the input port of reverse overtravel signal is in a valid state, and the motor reverse command is invalid
FinSh	Servo related operation completed correctly
SY_on	The servo is in the enable state and cannot operate. It must be closed to enable operation
no_oP	Invalid value entered; servo does not perform current operation
LocKd	Relevant parameters of servo are locked and can only be operated after unlocking
AL-501	Servo fault display, please refer to Chapter 9 for fault definition

5.4Parameter Setting Writing and Saving Method

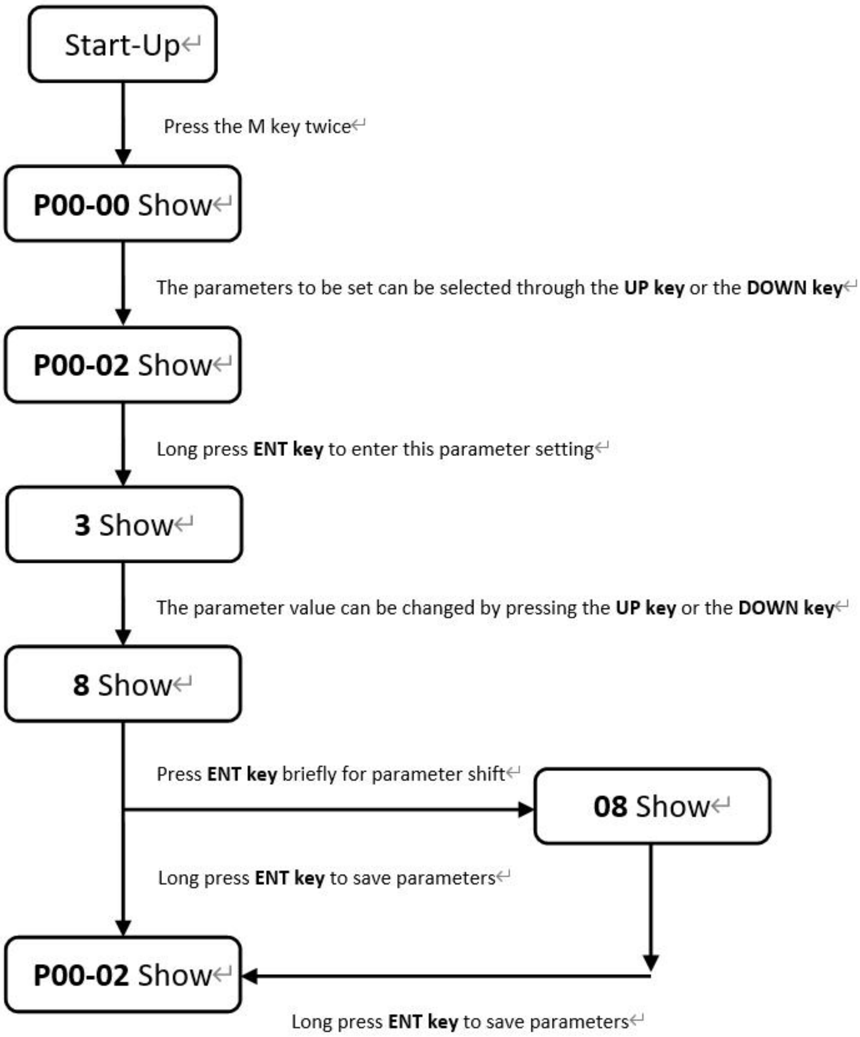


Figure 5 Parameter setting writing and saving process

6 Control Mode and Setting

6.1 Position Control (pulse not used)

6.1.1Location control wiring diagram

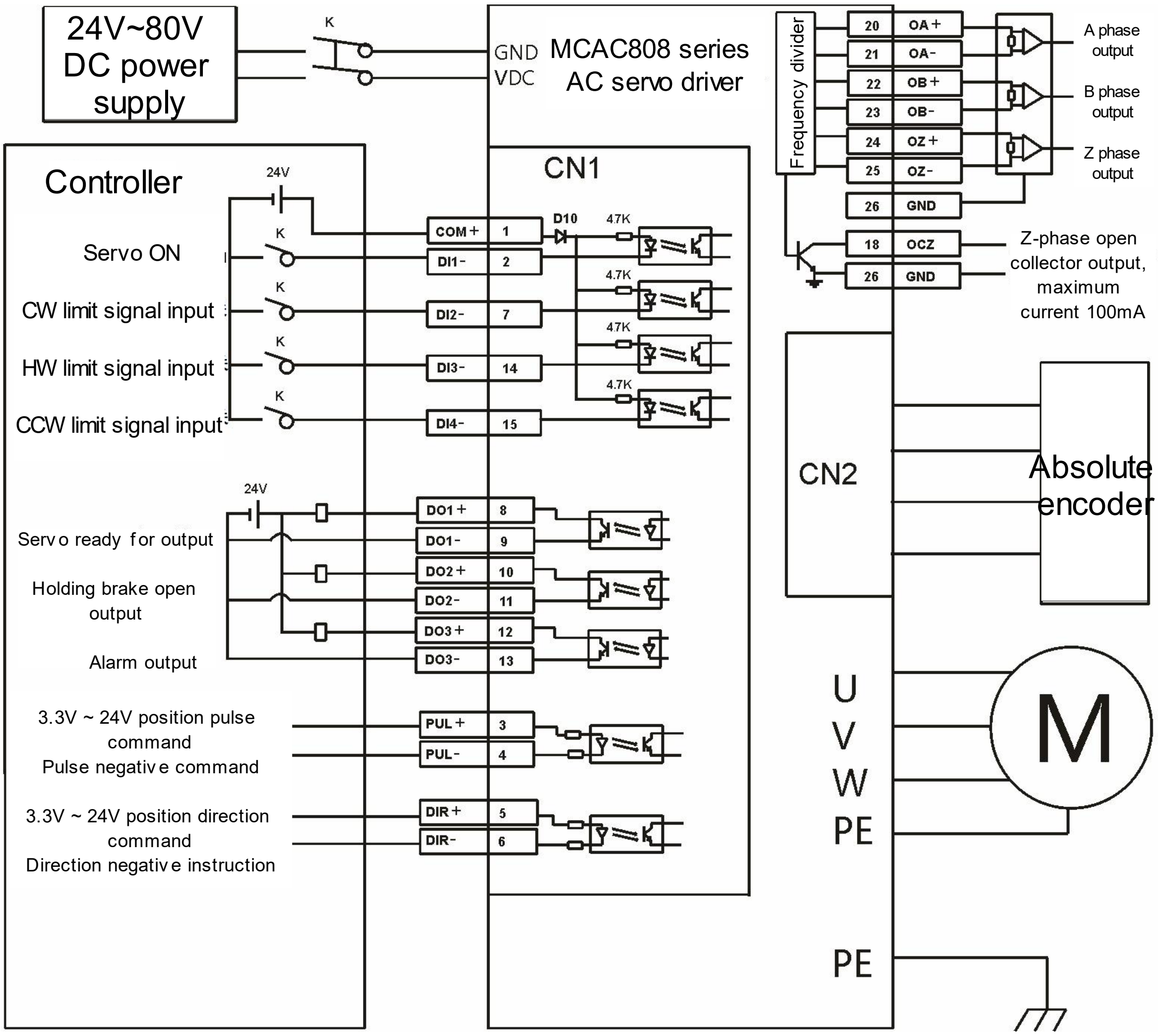


Figure 121 Location control wiring diagram

6.1.2Wiring diagram of position control

Description of controller end direction + pulse input mode: direction + pulse input is divided into 3.3V, 5V, 24V signal input mode. The use of twisted pair connection can improve the anti-interference ability. In general, this kind of position control wiring method is often used in MCU system. The maximum input pulse frequency of this control mode is 500KHz.

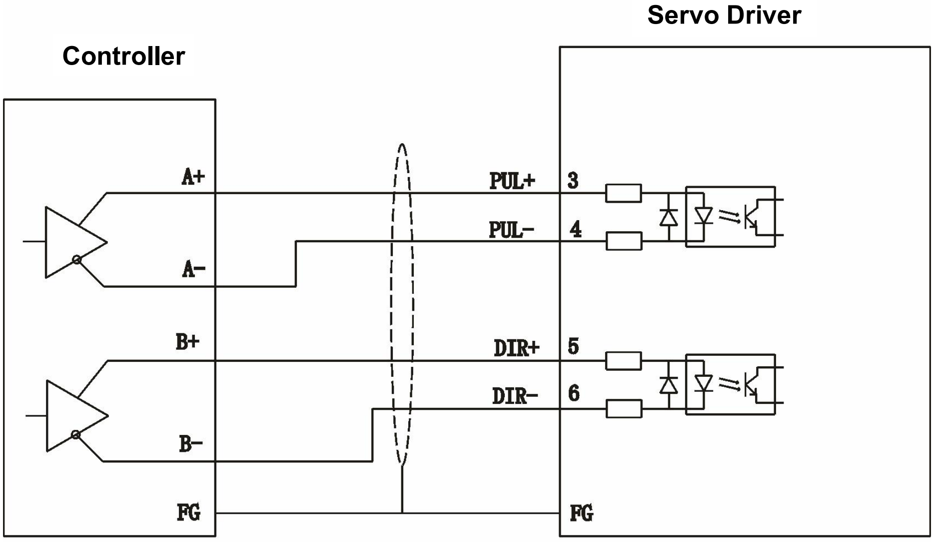


Figure 122 Brake end direction + pulse input mode

Open circuit input mode description of collector at controller end: single end input mode can use the power supply provided inside the driver or external power supply. However, the dual power input cannot be used to avoid damage to the drive. In general, this kind of position control wiring method is often used in

PLC controller system。

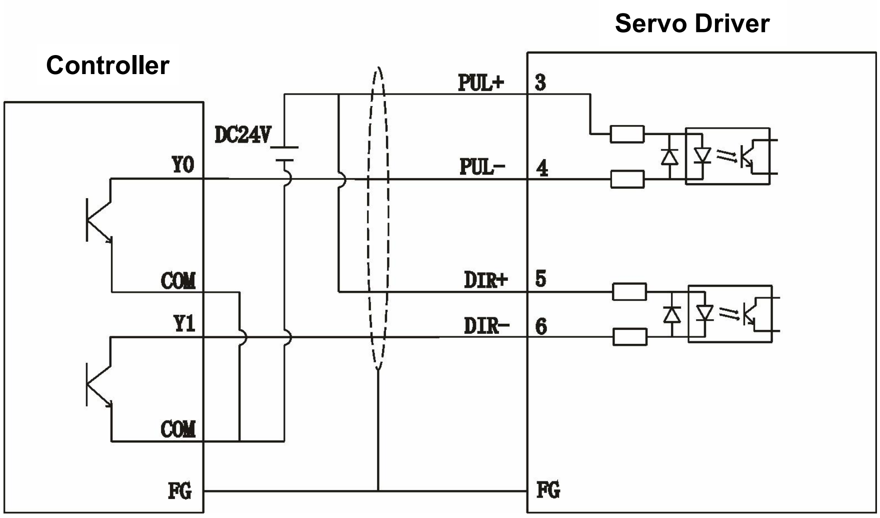


Figure 123 Open circuit input mode of collector at controller end

6.1.3Description of position control mode parameters

Table 115 Control parameters of motor and driver

Parameter code	Name	Set scope	Set up	Explain
P01-01	Control mode setting	0-6	0	0：Location mode 1：Velocity mode 2：Torque mode 3：Velocity，Torque 4：Position，Velocity 5：Position，Torque 6：Full closed loop
P00-05	Pole pairs of motor	1-31	---	Specific parameter setting depends on the motor
P0-07	Encoder selection	0-3	---	
P00-10	Number of incremental encoder lines	0-65535	---	
P03-00	Location command source	0-1	0	0：Pulse command 1：Number given
P03-01	Command pulse mode	0-3	1	0：Quadrature pulse instruction 1：Direction + pulse command 2 or 3： Double pulse command
P03-02	Command pulse input terminal	0-1	0	0：Low velocity pulse 1：High velocity pulse
P03-03	Command pulse reversal	0-1	0	Set the initial direction of motor rotation
P03-09	The number of command pulses for one revolution of motor	0-65535	0	Set according to user requirements See **8.2 parameter analysis for details**
P03-10	Molecule of electronic gear 1	1-65535	1	Set according to user requirements See **8.2 parameter**
P03-11	Denominator of	1-65535	1	

	electronic gear 1			analysis for details

6.1.4 Example of electronic gear ratio calculation

1、 Ball screw drive

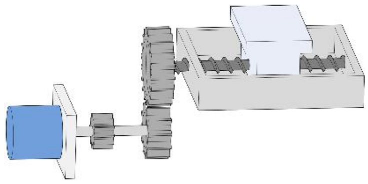


Figure 6 Ball screw drive

If：

（1）Mechanical parameters： Reduction ratio R is 2 / 1, lead of lead screw is 10 mm

（2）Absolute Encoder position ring resolution per turn： 17bit=131072

（3）Load displacement corresponding to 1 position instruction (instruction unit) is required： 0.001mm

Then：

From (1) and (3), the position command (command unit) value required for the lead screw to rotate for 1 turn (the workbench moves for 10 mm)：

$$\frac{10}{0.001}=10000$$

The ratio of electronic gear is: (B is molecule, A is denominator)

$$\frac{B}{A}=\frac{131072}{10000}\times\frac{2}{1}=\frac{16384}{625}$$

Finally, parameter P03-10 is set to 16384, and P03-11 is set to 625

2、 Pulley drive

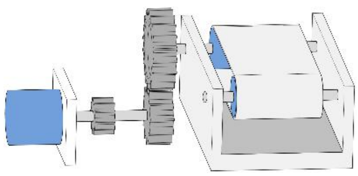


Figure 7 Pulley drive

If：

（1）Mechanical parameters: reduction ratio R: 5 / 1, pulley diameter: 0.2m (pulley circumference: 0.628m)

（2）Absolute Encoder position ring resolution per turn： 17bit=131072

（3）Load displacement corresponding to 1 position instruction (instruction unit) is required： 0.000005m

Then：

From (1) and (3), the position command (command unit) value required for the lead screw to rotate for 1 turn：

$$\frac{0.628}{0.000005}=125600$$

The ratio of electronic gear is: (B is molecule, A is denominator)

$$\frac{B}{A}=\frac{131072}{125600}\times\frac{5}{1}=\frac{4096}{785}$$

Finally, parameter P03-10 is set to 4096, and P03-11 is set to 785

3、 Rotating load

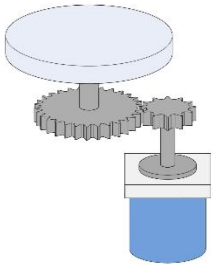


Figure 8 Rotating load

If：

（1）Mechanical parameters: the reduction ratio R is 10 / 1, and the rotation angle of the load shaft is 360 °

（2）Absolute encoder position ring resolution per revolution：17bit=131072

（3）Load displacement corresponding to 1 position instruction (instruction unit)：0.01°

Then：

From (1) and (3), the position command (command unit) value required for the lead screw to rotate for 1 turn：

$$\frac{360}{0.01} = 36000$$

The ratio of electronic gear is: (B is molecule, A is denominator)

$$\frac{B}{A} = \frac{131072}{36000} \times \frac{10}{1} = \frac{8192}{225}$$

Finally, parameter P03-10 is set to 8192, and P03-11 is set to 225

6.2 Velocity / Torque Control Description

6.2.1Velocity control wiring diagram

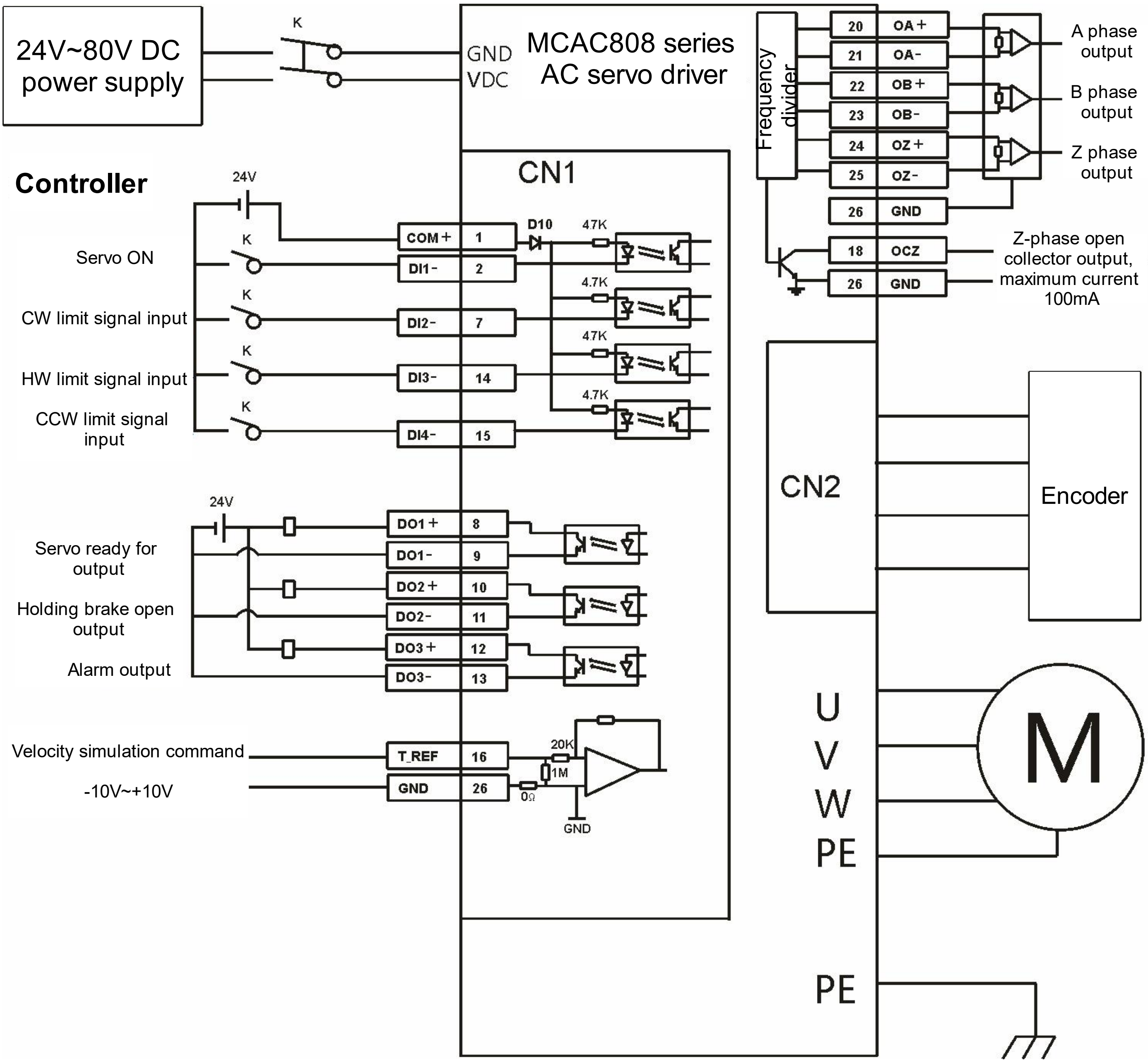


Figure 9 Velocity control wiring diagram

6.2.2Description of velocity control parameters

Table 116 Control parameters of motor and driver

Parameter	Name	Setting range	Set up	Explain
P01-01	Control mode setting	0-6	1	0：Position control mode 1：Velocity control mode 2：Torque control mode 3：Velocity，Torque 4：Position，Velocity 5：Position，Torque 6：Full closed loop
P00-05	Log of motor pole	1-31	---	Specific parameter setting depends on the motor
P00-07	Encoder selection	0-3	---	
P00-10	Incremental encoder line count	0-65535	---	

P04-00	Velocity command source	0-3	0	0: external analog command 1: Digital command (parameter setting) 2: Digital command (Communication) 3: Internal multiple groups of instructions
P04-01	Reverse velocity command analog quantity	0-1	0	Set the initial direction of motor rotation
P04-02	Given value of digital velocity	-6000—6000	0	Set the velocity command value, the velocity mode is valid when P04-00 is 1.
P04-06	Forward velocity limit	0-6000		Limit forward velocity
P04-07	Reverse velocity limit	0-6000		Limit reverse velocity
P06-40	Velocity analog command input gain	10-2000		Set according to user requirements

6.3 Torque Control

6.3.1Torque control wiring diagram

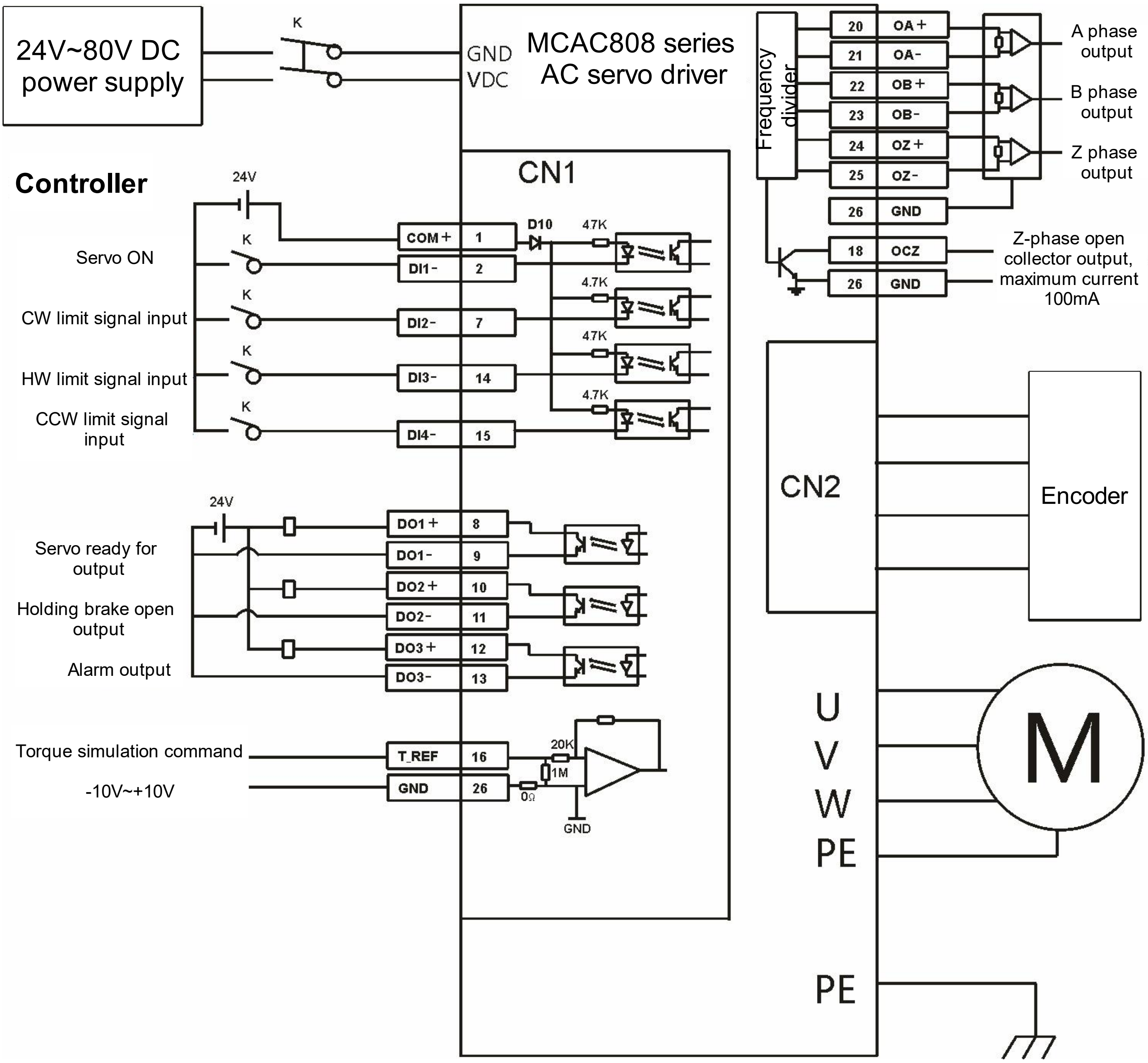


Figure 10 Torque control wiring diagram

6.3.2Parameter description of torque control mode

Table 117 Parameter description of torque control mode

Parameter code	Name	Set scope	Set up	Explain
P01-01	Control mode setting	0-6	2	0：Position control mode 1：Velocity control mode 2：Torque control mode 3：Velocity，Torque 4：Position，Velocity 5：Position，Torque 6：Full closed loop
P00-05	Pole pairs of motor	1-31	---	Specific parameter setting depends on the motor
P00-07	Encoder selection	0-3	---	
P00-10	Number of incremental encoder lines	0-65535	---	

P05-00	Torque command source	0-3	0	0: external analog command (velocity limit amplitude is set by P05-02) 1: Digital command (velocity limit amplitude is set by P05-02) 2: External simulation command (velocity limit amplitude is determined by velocity simulation command) 3: Digital command (velocity limit amplitude is determined by velocity analog command)
P05-01	Reverse torque command analog quantity	0-1	0	Set the initial direction of motor rotation
P05-02	Torque mode velocity limit given value	0-6000	1000	Sets the maximum velocity of the motor in torque mode. Valid when P05-00 is 0,1
P05-05	Torque limiting setting source	0-1	0	Source for adjusting torque limits
P05-10	Internal forward torque limiting amplitude	0-300.0	200.0	Limit forward torque value
P05-11	Internal reverse torque limiting amplitude	0-300.0	200.0	Limit reverse torque value
P06-43	Torque analog command input gain	0-100	10	Set according to user requirements

6.4 Communication Mode Description

The user does not need to manually set the communication mode, and the driver will automatically identify the communication mode. When using CAN communication, the customer needs to set P00-22 and P00-27, while when conducting 485 communication, they need to set P00-23 and P00-24 (generally, P00-25 does not need to be set, and there is no verification by default when 485 communication is used).

When the customer carries out 485 communication, P00-23 can be set to set the address of the slave station, and P00-24 can be set to set the communication rate;

When the customer carries out CAN communication, P00-22 can be set to set the address of the slave station, and P00-27 can be set to set the communication rate.

Table 118 Communication parameter description

Parameter code	Name	Set scope	Set up	Explain
P00-22	CANnode ID	0-31	0	Set the ID of the current machine on

	number			the CAN bus
P00-23	Modbus slave address	0-255	1	Set according to equipment requirements
P00-24	Modbus communication baud rate	0-7	2	Setting range: 0-7, default 2 0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200
P00-25	Verification mode	0-3	3	Setting range 0-3, default 3 0: No check, 2 bits stop bit. 1: Even-parity check, 1 stop bit 2: Odd check, 1 bit stop bit. 3: No check, 1 stop bit
P00-27	CAN communication baud rate	0-7	6	Set the baud rate of CAN bus 0：12.5KH 1：120KHz 2：20KHz 3：100KHz 4：125KHz 5：250KHz 6：500KHz 7：1000KHz

7 Commissioning and Parameter Adjustment

7.1 Test Run

7.1.1Pre operation detection

In order to avoid injury to the servo driver or mechanism, please remove all loads of the servo motor before operation, carefully check whether the following precautions are normal, and then power on for no-load test; after the no-load test is normal, connect the load of the servo motor for the next test.

Table 119 Matters needing attention

Detection before power on	1、Check the servo driver for obvious appearance damage 2、Please insulate the connecting part of wiring terminal 3、Look inside the drive for foreign material 4、Servo driver, motor and external regeneration resistance shall not be placed on combustible objects 5、To avoid failure of electromagnetic brake, please check whether the power circuit can be stopped and cut off immediately 6、Confirm whether the external power supply voltage of servo driver meets the requirements 7、Confirm whether the U, V, W power lines, encoder lines and signal lines of the motor are connected correctly (confirm according to the motor label and instructions)
Detection when power on	1、Whether the LED display of servo driver is normal 2、Confirm whether all parameters are set correctly, and unexpected actions may occur according to different mechanical characteristics, do not adjust the parameters excessively 3、Servo motor self-locking 4、Please contact the manufacturer if the servo motor has excessive vibration and sound during operation

7.1.2 No load test run

JoG mode no-load trial run test, users do not need to connect additional wiring, for safety reasons, before the JoG no-load velocity test, please fix the motor frame, to prevent the motor velocity change caused by the reaction force to cause danger.The following is a simple wiring diagram in JoG mode：

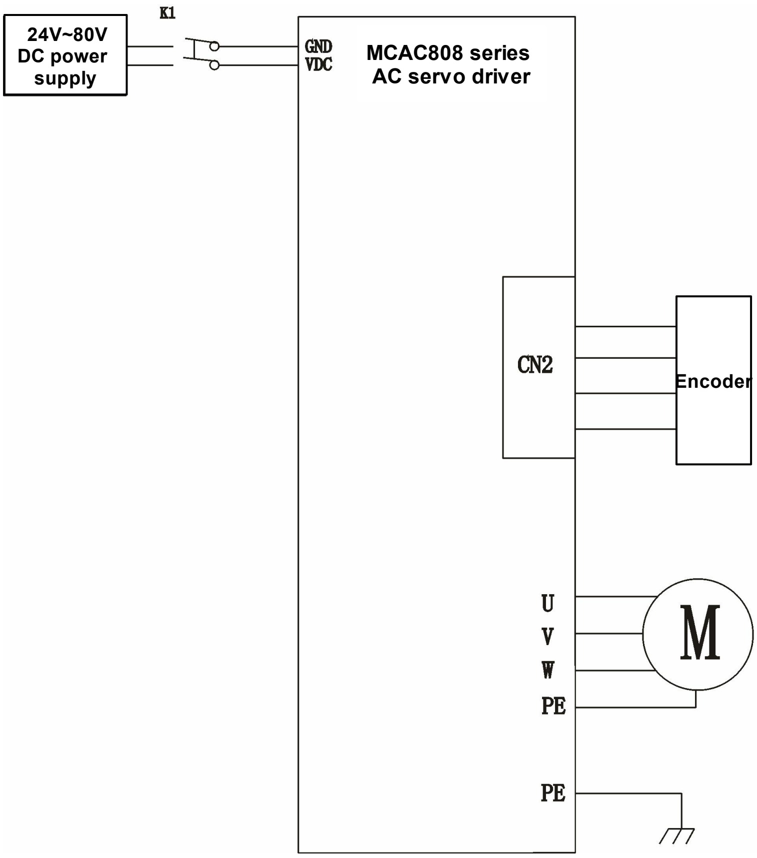


Figure 11 Simple wiring diagram in JoG mode

Select JoG mode for trial operation according to the following flow chart:

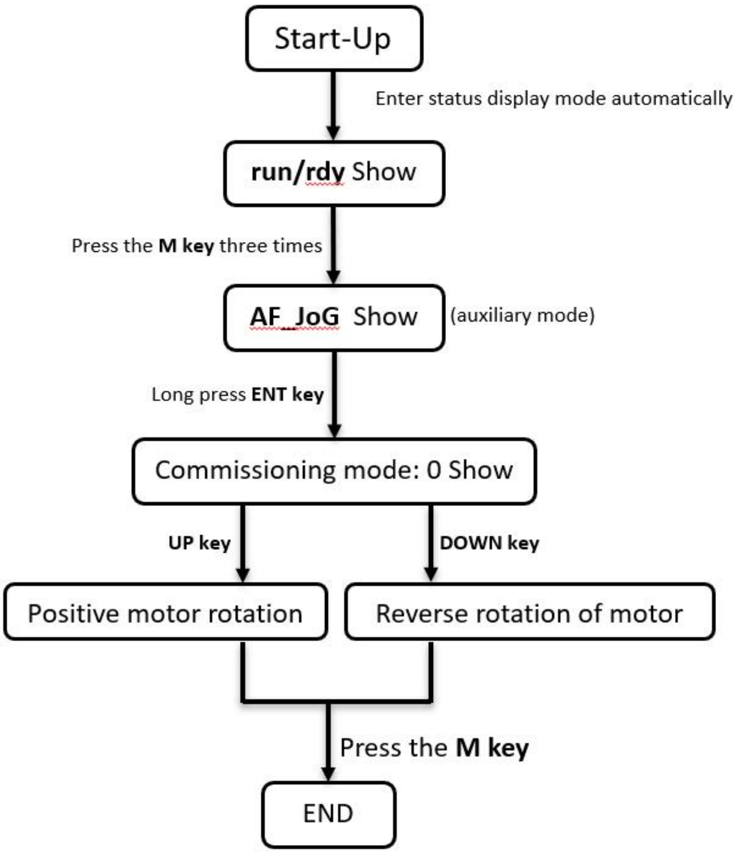


Figure 130 JoG mode flow chart

7.2 Parameter Adjustment

According to the requirements of the equipment, after choosing the appropriate control mode, the servo gain parameters need to be adjusted reasonably. So that the servo driver can drive the motor quickly and accurately, and maximize the mechanical performance.

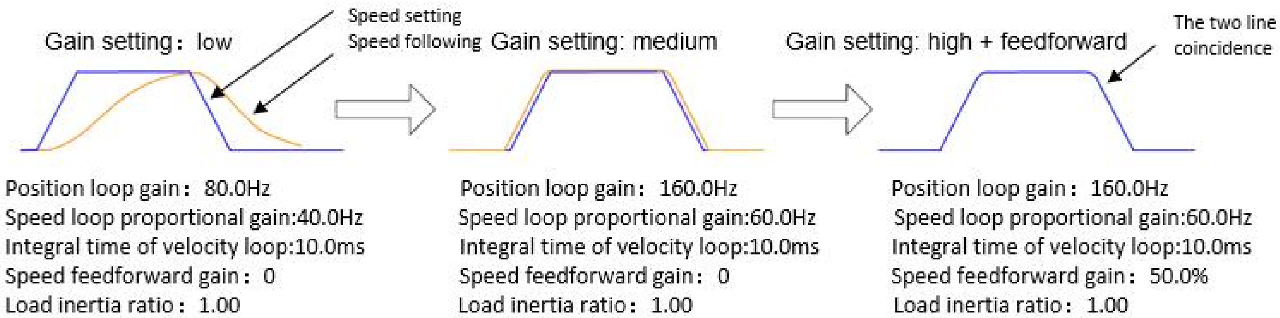


Figure 131 Curve under different gain

The servo gain is adjusted by several loop parameters (position loop, velocity loop, filter, etc.), which will affect each other. Therefore, the gain setting needs to be balanced and adjusted according to certain rules.

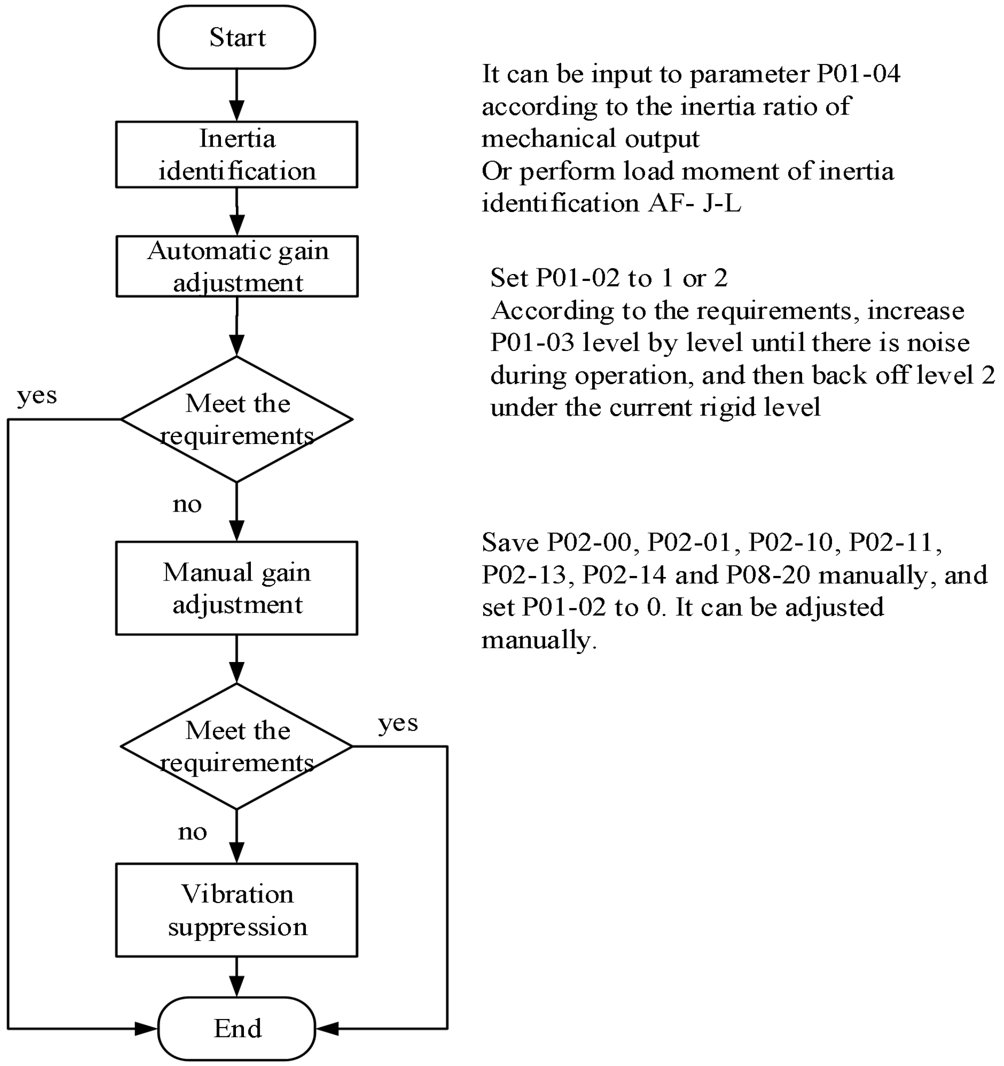


Figure 132 Gain adjustment flow chart

7.3 Manual Gain Adjustment

7.3.1Basic parameters

When the automatic gain adjustment fails to achieve the desired effect, you can manually fine tune the gain to optimize the effect. The servo system consists of three control loops. The basic control block diagram is as follows：

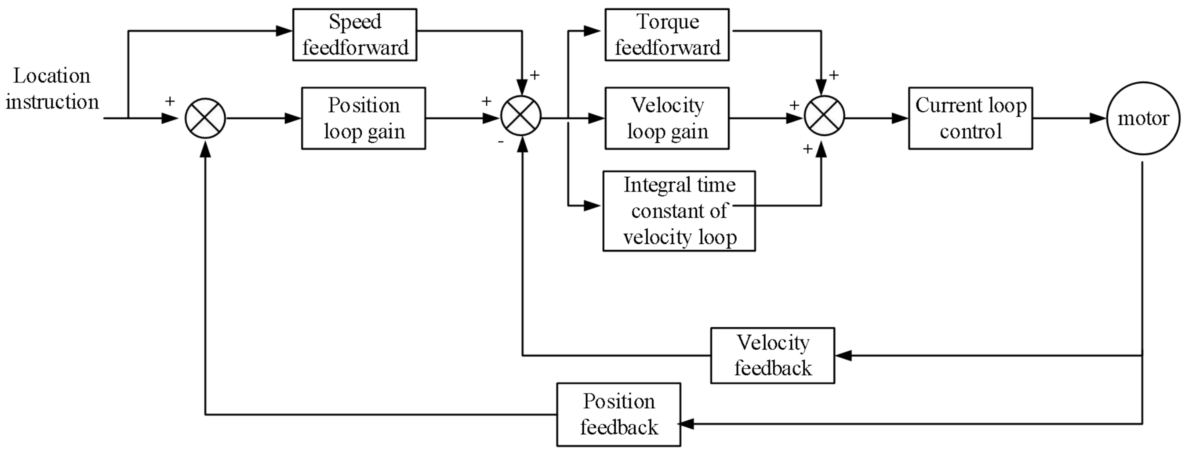


Figure 133 Control block diagram of servo system

The gain adjustment needs to set the load inertia ratio P01-04 first, then adjust the velocity loop gain, and finally adjust the position loop gain according to the order of the inner loop and the outer ring.

Velocity loop gain: increase the setting value as much as possible without vibration and noise, which can improve the velocity following performance and velocity up the positioning time.

Velocity integral constant: the smaller the setting value is, the faster the integration velocity is, and the stronger the integration effect is. If it is too small, it is easy to produce vibration and noise.

Table 120 Basic gain parameters

Parameter code	Name	Set scope	Set up	Explain
P01-02	Real time automatic adjustment mode	0-2	2	0: adjust the rigidity manually. 1: Standard mode automatically adjusts rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03, and manual adjustment of these parameters will not work. The following parameters are set by the user: P02-03 (velocity feedforward gain), P02-04 (velocity feedforward smoothing constant). 2: The positioning mode automatically adjusts the rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03, and manual adjustment of these parameters will not work. The following parameters will be fixed and cannot be changed: P02-03 (velocity feedforward gain): 30.0% P02-04 (velocity feedforward smoothing constant): 0.50
P01-03	Real time automatic adjustment of rigidity setting	0-31	13	32 kinds of gain parameters are built in, which will work when P01-02 is set to 1 or 2. It can be called directly according to the actual situation. The larger the setting value is, the stronger the rigidity is.
P02-00	Position control gain 1	0-3000．0	80.0	▸The larger the setting value is, the higher the gain is, the greater the rigidity is, and the smaller the position lag is. However, if the value is too large, the system will oscillate and overshoot. ▸ Increase the value as much as possible without shock. ▸For gain at rest.
P02-01	Position	0-3000.0	80.0	▸the larger the setting value is, the higher the

	control gain 2			gain is, the greater the rigidity is, and the smaller the position lag is. However, if the value is too large, the system will oscillate and overshoot. ▸ increase the value as much as possible without shock. ▸for gain in motion.
P02-03	Velocity feedforward gain	0-100.0	30.0	The larger the feedforward gain of the velocity loop, the smaller the position tracking error and the faster the response. However, if the feedforward gain is too large, the position loop of the system will be unstable and prone to overshoot and oscillation.
P02-04	Velocity feedforward smoothing constant	0-64.00	0	This parameter is used to set the feedforward filter time constant of velocity loop. The larger the value, the larger the filtering effect, but the larger the phase lag.
P02-10	Velocity proportional gain 1	1-2000.0	40.0	▸the larger the setting value, the greater the gain and rigidity, and the parameter value is set according to the motor and load conditions. ▸ increase the value as much as possible without shock. ▸for gain at rest.
P02-11	Velocity integral constant 1	0.1-1000.0	10.0	▸ the integration time constant of velocity regulator, the smaller the setting value is, the faster the integration velocity is, the greater the rigidity is, and it is easy to produce vibration and noise if it is too small. ▸try to reduce the parameter value as much as possible when there is no vibration in the system. ▸this parameter is for steady-state response.
P02-12	Pseudo differential feedforward control coefficient 1	0-100.0	100.0	▸ when it is set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast; when it is set to 0, the integral effect of the velocity loop is obvious, which can filter the low-frequency interference, but the dynamic response is slow. ▸by adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low-frequency interference.

P02-13	Velocity proportional gain 2	1-2000.0	45.0	▸the larger the setting value, the greater the gain and rigidity, and the parameter value is set according to the motor and load conditions. ▸ increase the value as much as possible without shock. ▸for gain in motion.
P02-14	Velocity integral constant 2	0.1-1000.0	1000.0	▸ the integration time constant of velocity regulator, the smaller the setting value is, the faster the integration velocity is, the greater the rigidity is, and it is easy to produce vibration and noise if it is too small. ▸try to reduce the parameter value as much as possible when there is no vibration in the system. ▸this parameter is for steady-state response.
P02-15	Pseudo differential feedforward control coefficient 2	0-100.0	100.0	▸when it is set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast; when it is set to 0, the integral effect of the velocity loop is obvious, which can filter the low-frequency interference, but the dynamic response is slow. ▸by adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low-frequency interference.

7.3.2Gain switching

The gain switching function can be triggered by the servo internal state or external DI Port, and is only effective in the position control and velocity control modes. With gain switching, you can:

Switch to a lower gain when the motor is stationary (servo enabled) to suppress vibration;

Switch to a higher gain when the motor is at rest (servo enable), so as to shorten the positioning time;

In order to obtain better command following performance, switch to higher gain in the motor running state;

According to the usage, different gain settings are switched with external signals.

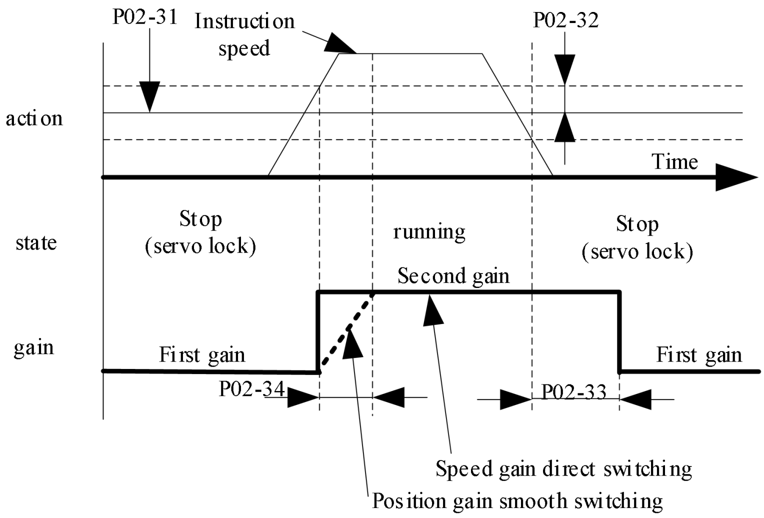


Figure 134 Gain switching

Table 121 Gain switching parameters

Parameter	Name	setting range	Factory Default	unit	time of taking effect
P02-30	Gain switching mode	0-10	7	---	Immediate effect
P02-31	Gain switching level	0-20000	800	---	Immediate effect
P02-32	Gain switching hysteresis	0-20000	100	---	Immediate effect
P02-33	Gain switching delay	0-1000.0	10.0	1ms	Immediate effect
P02-34	Position gain switching time	0-1000.0	10.0	1ms	Immediate effect

7.3.3Feedforward function

Velocity feedforward: in position control, the velocity control command required by the calculation of position command is added to the output of position regulator to reduce the position deviation and improve the response of position control.

Torque feedforward: the torque command required by the velocity control command calculation is added to the velocity regulator output to improve the velocity control response.

1、Velocity feedforward operation

When the smooth constant of velocity feedforward is set to 50 (0.5ms), the feedforward gain of velocity is gradually increased to meet the system requirements. But too large velocity feedforward gain will cause position overshoot, which will make the setting time longer.

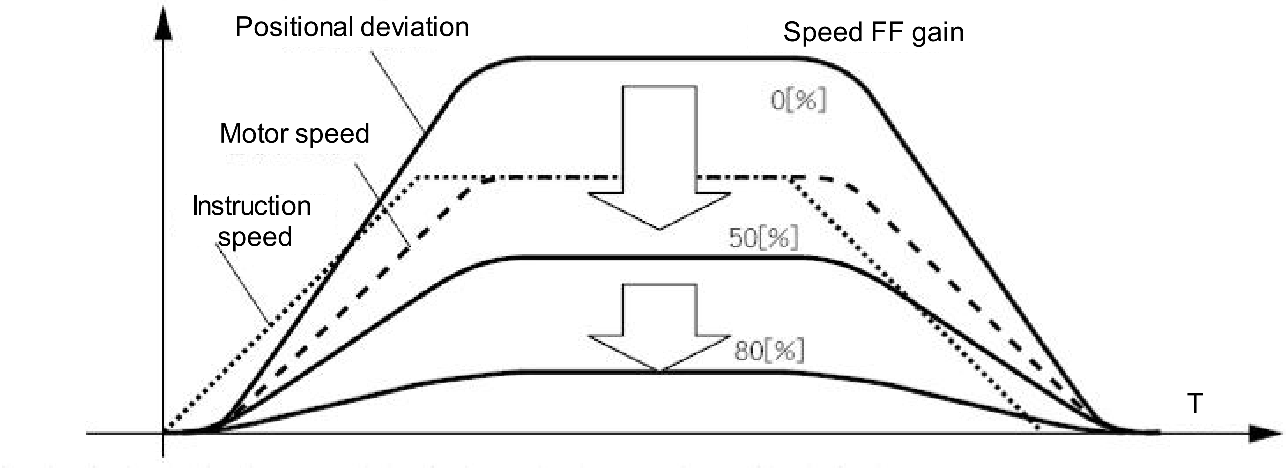


Figure 135 Velocity feedforward function

2、Torque feedforward operation

When the smooth constant of torque feedforward is set to 50 (0.5ms), the gain of torque feedforward is gradually increased to meet the system requirements.

Table 122 Feedforward function related parameters

Parameter	Name	setting range	Factory Default	unit	time of taking effect
P02-03	Velocity feedforward gain	0-100.0	30.0	1.0%	Immediate effect
P02-04	Velocity feedforward smoothing constant	0-64.00	0.5	1ms	Immediate effect
P02-19	Torque feedforward gain	0-30000	0	1.0%	Immediate effect
P02-20	Torque feedforward smoothing constant	0-64.00	0.8	1ms	Immediate effect

7.3.4Disturbance observer

The disturbance torque can be reduced and the vibration can be reduced by using disturbance observer to deduce the disturbance torque value and compensate on the torque command. In position mode and velocity mode, the observation function is effective.

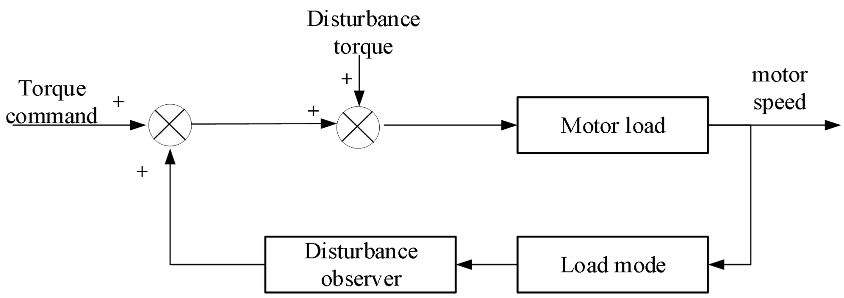


Figure 136 Disturbance observer

usage method:

1、Set P08-26 (filter constant) to a large value, and then gradually increase P08-25 (compensation gain), at this time, the action sound may become larger; after confirming that the current compensation gain is effective, gradually reduce P08-26.

2、Increasing the gain can improve the effect of disturbance torque suppression, but the action sound becomes larger.

3、When the time constant of the filter is reduced, the disturbance torque with less delay can be estimated, and the effect of restraining the disturbance can be improved, but the action sound will become larger.

4、Please look for a balanced setting.

Table 123 Related parameters of disturbance observer

Parameter	Name	setting range	Factory Default	unit	time of taking effect
P08-25	Disturbance torque compensation gain	0-100.0	0	%	Immediate effect
P08-26	Time constant of disturbance torque filtering	0-25.00	0.8	1ms	Immediate effect

7.3.5Resonance suppression

If the servo system is too large and the response is too fast, it may cause resonance of the mechanical system, which can be improved by reducing the gain of the control loop. Without reducing the gain, the resonance can also be suppressed by using a low-pass filter and a notch filter.

1、Resonance frequency detection

The resonance frequency of the mechanical system can be observed by monitoring item d26.1. Fr

2、Torque command low pass filter (P08-20)

The low-pass filter can be used in the case of vibration frequency deviation, and it can be used in the case of high-frequency vibration. By setting the filter time constant, the resonance can be attenuated near the resonance frequency. However, the low-pass filter will make the system phase lag, reduce the bandwidth, and reduce the phase margin, which is easy to cause loop oscillation. So, it can only be used in high frequency vibration.

Filter cut off frequency（Hz）= 1/(2*pi*P08-20(ms)*0.001)

Table 124 Torque command filter constant

Parameter	Name	setting range	Factory Default	unit	time of taking effect
P08-20	Torque command filter constant	0-25.00	0.8	1ms	Immediate effect

3、Notch filter

The notch filter is used when the resonance frequency of the system is fixed. By reducing the gain at a specific frequency, the notch filter can suppress the mechanical resonance. When the notch filter is set correctly, the vibration can be restrained effectively, and the servo gain can be increased continuously. There are 4 groups of traps in the servo. When P-8-11 is set to 0, 4 groups of traps can be started at the same time, and parameters can be input manually.

A. Adaptive notch mode

Through the Adaptive Notch function module, the servo system will automatically identify the current resonance frequency and automatically configure the notch parameters. Use steps:

a) Set P08-11 to 1 or 2 according to the number of resonance points. When resonance occurs, first set P08-11 to 1, open an adaptive notch filter. After gain adjustment, if a new resonance occurs, then set P08-11 to 2, open two adaptive notch filters.

b) During servo operation, the third and fourth group of notch filter parameters will be automatically updated, and the corresponding function code will be automatically stored every 30min. After storage, the notch filter parameters will be maintained after power failure.

c) If resonance is suppressed, the adaptive notch filter is effective. After waiting for the servo to run stably for a period of time, set P08-11 to 0, and the notch filter parameter will be fixed to the last updated value. This operation can prevent the parameter of the wave trap from being updated to the wrong value due to the misoperation in the servo operation, which will aggravate the vibration.

d) If the vibration cannot be eliminated for a long time, please turn off the servo enable in time.

If there are more than two resonance frequency points, the adaptive notch filter can not meet the demand, and the manual notch filter can be used at the same time.

Table 125 Mode selection of adaptive notch filter

Parameter code	Name	Explain
P08-11	Mode selection of adaptive notch filter	Setting range: 0-4 0: the third and fourth trapper parameters are no longer automatically updated, but saved as the current value. But manual input is allowed 1: One adaptive notch filter is effective, the parameters of the third notch filter are updated automatically and cannot be input manually 2: Two adaptive notch filters are effective. The parameters of the third and fourth notch filters are updated automatically and cannot be input manually 3: Resonance frequency only 4: Clear the third and fourth notch filter parameters and restore them to the factory settings

B. Manual setting of trap parameters

a) The resonance frequency of the mechanical system can be observed by monitoring items d26.1.Fr and d28.2.Fr.

b) Input the resonant frequency observed in the previous step into the parameters of the notch filter, and input the width level and depth level of the notch filter.

c) If the vibration is suppressed, the notch filter will work. Increase the gain continuously. Repeat the previous 2 steps after new vibration.

d) If the vibration cannot be eliminated for a long time, please turn off the servo enable in time.

C. Notch width class

$$\text{Notch width class} = \frac{\text{Notch width}}{\text{Center frequency of notch}}$$

The notch width represents the frequency bandwidth with an amplitude attenuation rate of - 3dB relative to the notch center frequency

D. Notch depth class

$$\text{Notch depth class} = \frac{\text{Output value}}{\text{Input value}}$$

When the depth level of the notch is 0, the input is completely suppressed at the center frequency; when the depth level is 100, the input can pass completely at the center frequency.

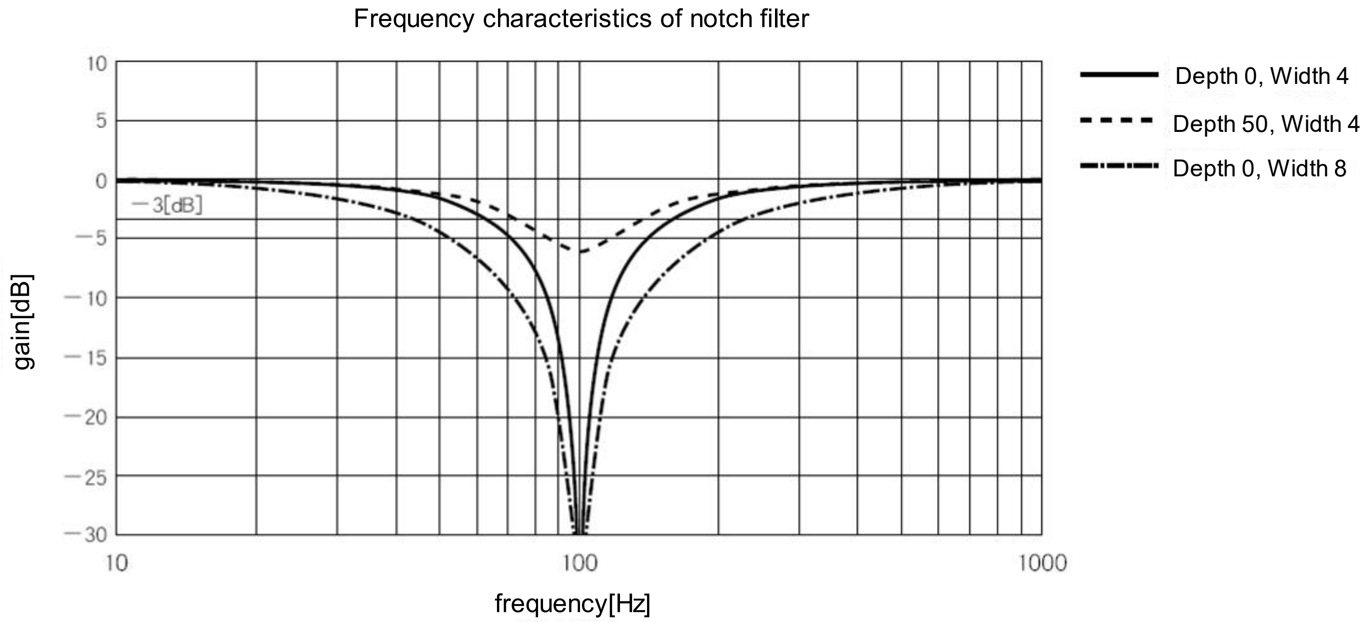


Figure 137 Frequency characteristics of notch filter

Relevant parameters of notch filter are shown in the table below:

Table 126 Relevant parameters of notch filter

Parameter code	Name	Explain
P08-30	Notch filter 1 frequency	Setting range: 50-5000, unit: Hz Center frequency of Notch 1 When it is set to 5000, the notch filter is invalid
P08-31	Notch filter 1 width	Setting range: 0-20 Notch width class of Notch 1 Is the ratio of width to center frequency
P08-32	Notch filter 1 depth	Setting range: 0-99 Notch depth level of Notch 1 The ratio relationship between output and input for the center frequency of the notch filter The larger the parameter, the smaller the depth of the notch and the weaker the effect

The relevant parameters of the notch filter are shown in the table below:

Table 127 Relevant parameters of notch filter

Parameter	Name	setting range	Factory Default	unit	time of taking effect
P08-11	Mode selection of adaptive notch filter	0-4	0	---	Immediate effect
P08-30	Notch filter 1 frequency	50-5000	5000	HZ	Immediate effect
P08-31	Notch filter 1 width	0-20	2	---	Immediate effect
P08-32	Notch filter 1 depth	0-99	0	---	Immediate

					effect
P08-33	Notch filter 2 frequency	50-5000	5000	HZ	Immediate effect
P08-34	Notch filter 2 width	0-20	2	---	Immediate effect
P08-35	Notch filter 2 depth	0-99	0	---	Immediate effect
P08-36	Notch filter 3 frequency	50-5000	5000	HZ	Immediate effect
P08-37	Notch filter 3 width	0-20	2	---	Immediate effect
P08-38	Notch filter 3 depth	0-99	0	---	Immediate effect
P08-39	Notch filter 4 frequency	50-5000	5000	HZ	Immediate effect
P08-40	Notch filter 4 width	0-20	2	---	Immediate effect
P08-41	Notch filter 4 depth	0-99	0	---	Immediate effect

8 Parameters and Functions

8.1 Parameter List

P00-xx indicates motor and driver parameters
P01-xx main control parameters
P02-xx indicates gain type parameter
P03-xx indicates position parameter
P04-xx represents velocity parameter
P05-xx represents torque parameter
P06-xx indicates I / O parameters
P08-xx indicates advanced function parameters

Table 128 Parameter list

type	Param-eter	Name	setting range	Facto-ry Defau-lt	unit	Plcether-net	time of taking effect
Motor and driver param-eters	P00-00	Motor number	0-65535	2000		Downtime setting	Power up again
	P00-01	Motor rated rotating velocity	1-6000	---	rpm	Downtime setting	Power up again
	P00-02	rated motor toroue	0.01-655.35	---	N.M	Downtime setting	Power up again
	P00-0	motor rated current	0.01-655.3	---	A	Downtim	Power up

	3		5			e setting	again
	P00-04	Moment of inertia of motor	0.01-655.35	---	kg.cm²	Downtime setting	Power up again
	P00-05	Log of motor pole	1-31	---	P	Downtime setting	Power up again
	P00-07	Encoder selection	0-3	---	---	Downtime setting	Power up again
	P00-08	Save line incremental encoder	0-1	---	---	Downtime setting	Power up again
	P00-09	Absolute encoder type	0-1	---	---	Downtime setting	Power up again
	P00-10	Incremental encoder line count	0-65535	---		Downtime setting	Power up again
	P00-11	Incremental encoder Z pulse electrical Angle	0-65535	---		Downtime setting	Power up again
	P00-12	Initial angle of rotor 1	0-360	---	1°	Downtime setting	Power up again
	P00-13	Initial angle of rotor 2	0-360	---	1°	Downtime setting	Power up again
	P00-14	Initial angle of rotor 3	0-360	---	1°	Downtime setting	Power up again
	P00-15	Initial angle of rotor 4	0-360	---	1°	Downtime setting	Power up again
	P00-16	Initial angle of rotor 5	0-360	---	1°	Downtime setting	Power up again
	P00-17	Initial angle of rotor 6	0-360	---	1°	Downtime setting	Power up again
	P00-20	Power on interface display setting	0-100	100	---	Operation settings	Power up again
	P00-21	RS232 Communication baud rate	0-3	0	---	Downtime setting	Power up again
	P00-23	From the station address	0-255	1	---	Downtime setting	Power up again
	P00-24	Modbus Communication baud rate	0-7	2	---	Downtime setting	Power up again
	P00-25	verification mode	0-3	1	---	Downtime setting	Power up again
	P00-27	CANopen communication baud rate	0-7	6	---	Downtime setting	Power up again
	P00-28	485 protocol selection	0-2	0	---	Downtime setting	Power up again

	P00-30	Brake resistance setting	0-2	---	---	Downtime setting	Power up again
	P00-31	External brake resistance power	0-65535	---	10W	Operation settings	Power up again
	P00-32	External brake resistance	0-1000	---	1Ohm	Downtime setting	Power up again
	P00-40	Over temperature protection settings	0-1	1	---	Downtime setting	Power up again
	P00-41	Control power failure protection settings	0-1	1	---	Downtime setting	Power up again
Main control param-eter	P01-01	Control mode setting	0-6	0	---	Downtime setting	Immediate effect
	P01-02	Adjust the mode automatically in real time	0-2	2	---	Operation settings	Immediate effect
	P01-03	Real-time automatic adjustment of rigid Settings	0-31	13	---	Operation settings	Immediate effect
	P01-04	Moment of inertia ratio	0-100.00	1	multiple	Operation settings	Immediate effect
	P01-10	Control mode after overtravel	0-1	1	---	Operation settings	Immediate effect
	P01-20	Dynamic brake delay	0-250	50	1ms	Operation settings	Immediate effect
	P01-21	Disable dynamic brake when main power is OFF	0-1	1	---	Operation settings	Immediate effect
	P01-22	Disable dynamic brake when servo is OFF	0-1	1	---	Operation settings	Immediate effect
	P01-23	Disable dynamic brake in case of fault alarm	0-1	1	---	Operation settings	Immediate effect
	P01-24	No dynamic brake during overtravel	0-1	1	---	Operation settings	Immediate effect
	P01-30	The brake instruction - servo OFF delay time (Brake open delay)	0-255	50	1ms	Operation settings	Immediate effect
	P01-31	The velocity limit of the output of the brake command	0-3000	100	1rpm	Operation settings	Immediate effect
	P01-32	Wait time of servo OFF brake instruction	0-255	50	1ms	Operation settings	Immediate effect

	P01-40	Out of control detection enable	0-1	1	---	Operation settings	Immediate effect
Gain type param-eters	P02-00	Position control gain 1	0-3000.0	48.0	1/S	Operation settings	Immediate effect
	P02-01	Position control gain 2	0-3000.0	57.0	1/S	Operation settings	Immediate effect
	P02-03	Velocity feedforward gain	0-100.0	30.0	1.0%	Operation settings	Immediate effect
	P02-04	Velocity feedforward smoothing constant	0-64.00	0.5	1ms	Operation settings	Immediate effect
	P02-10	Velocity proportional gain 1	1.0-2000.0	27.0	1Hz	Operation settings	Immediate effect
	P02-11	Velocity integral constant 1	0.1-1000.0	10.0	1ms	Operation settings	Immediate effect
	P02-12	Pseudo differential feedforward control coefficient 1	0-100.0	100.0	1.0%	Operation settings	Immediate effect
	P02-13	Velocity proportional gain 2	1.0-2000.0	27.0	1Hz	Operation settings	Immediate effect
	P02-14	Velocity integral constant 2	0.1-1000.0	1000.0	1ms	Operation settings	Immediate effect
	P02-15	Pseudo differential feedforward control coefficient 2	0-100.0	100.0	1.0%	Operation settings	Immediate effect
	P02-16	Limit amplitude of velocity integral error	0-32767	25000	---	Downtime setting	Immediate effect
	P02-19	Torque feedforward gain	0-30000	0	1.0%	Operation settings	Immediate effect
	P02-20	Torque feedforward smoothing constant	0-64.00	0.8	1ms	Operation settings	Immediate effect
	P02-30	Gain switching mode	0-10	7	---	Operation settings	Immediate effect
	P02-31	Gain switching level	0-20000	800	---	Operation settings	Immediate effect
	P02-32	Gain switching hysteresis	0-20000	100	---	Operation settings	Immediate effect
	P02-33	Gain switching delay	0-1000.0	10.0	1ms	Operation settings	Immediate effect
	P02-34	Position gain switching time	0-1000.0	10.0	1ms	Operation settings	Immediate effect
	P02-40	Mode switch selection	0-4	0	---	Operation settings	Immediate effect
	P02-41	Mode switch level	0-20000	10000	---	Operation settings	Immediate effect

	P02-50	Added value of torque command	-100.0-100.0	0	1.0%	Operation settings	Immediate effect
	P02-51	Forward torque compensation	-100.0-100.0	0	1.0%	Operation settings	Immediate effect
	P02-52	Reverse torque compensation	-100.0-100.0	0	1.0%	Operation settings	Immediate effect
location param-eter	P03-00	Location command source	0-1	0	---	Downtime setting	Immediate effect
	P03-01	Command pulse mode	0-3	1	---	Downtime setting	Immediate effect
	P03-02	Command pulse input terminal	0-1	0	---	Downtime setting	Immediate effect
	P03-03	Command pulse reversal	0-1	0	---	Downtime setting	Immediate effect
	P03-04	Position pulse filtering	0-3	2	---	Operation settings	Immediate effect
	P03-05	Judgment conditions for positioning completion	0-2	1	---	Operation settings	Immediate effect
	P03-06	Positioning complete range	0-65535	100	Encoder unit	Operation settings	Immediate effect
	P03-07	Position feedback format	0-1	0	---	Downtime setting	Immediate effect
	P03-09	The number of instruction pulses per turn of the motor	0-65535	0	Pulse	Operation settings	Power up again
	P03-10	Molecule of electronic gear 1	1-65535	8192	---	Operation settings	Power up again
	P03-11	Denominator of electronic gear 1	1-65535	625	---	Operation settings	Power up again
	P03-12	Molecular high position of electronic gear 1	0-32767	0	---	Operation settings	Power up again
	P03-15	Excessive position deviation setting	0-65535	30000	command unit *10	Operation settings	Immediate effect
	P03-16	Position command smoothing filter time	0-1000.0	0	1ms	Operation settings	Immediate effect
	P03-20	Position feedback source	0-1	0	---	Operation settings	Immediate effect
	P03-21	Encoder frequency division output enable	0-1	1	---	Downtime setting	Immediate effect

	P03-22	Numerator of the output pulse division ratio of the incremental encoder	1-65535	1	---	Operation settings	Immediate effect
	P03-23	Output pulse division ratio denominator of incremental encoder	1-65535	1	---	Operation settings	Immediate effect
	P03-25	Output pulse number of one revolution of absolute motor	0-60000	2500	---	Operation settings	Immediate effect
	P03-30	Linear encoder inverting	0-1	0	---	Downtime setting	Immediate effect
	P03-31	Polarity of Z pulse of linear encoder	0-1	1	---	Downtime setting	Immediate effect
	P03-40	Output pulse source	0-1	0	---	Downtime setting	Immediate effect
	P03-42	Output Z-pulse polarity	0-1	1	---	Downtime setting	Immediate effect
	P03-45	Digital instruction caching	0-1	0	---	Downtime setting	Immediate effect
	P03-46	Maximum velocity of motor when digital position command is running	0-6000	1000	---	Operation settings	Immediate effect
	P03-50	Gantry function enable	0-1	0	---	Downtime setting	Immediate effect
	P03-51	Gantry function input signal reversal	0-1	0	---	Downtime setting	Immediate effect
	P03-52	The number of feedback pulses for one revolution of gantry function motor	0-65535	10000	---	Downtime setting	Immediate effect
	P03-53	Too large deviation setting of gantry function position	0-65535	10000	---	Operation settings	Immediate effect
	P03-55	Proportional gain of gantry synchronous position	0-200	10	---	Operation settings	Immediate effect
	P03-60	Origin regression enable control	0-6	0	---	Downtime setting	Immediate effect

	P03-61	Origin regression model	0-9	0	---	Downtime setting	Immediate effect
	P03-65	High velocity when searching the origin switch	0-3000	100	---	Operation settings	Immediate effect
	P03-66	Velocity when searching the origin switch	0-1000	10	---	Operation settings	Immediate effect
	P03-67	Acceleration and deceleration time of search origin switch	0-5000	0	---	Operation settings	Immediate effect
	P03-68	Search origin maximum time limit	0-10000	0	---	Operation settings	Immediate effect
	P03-69	Mechanical origin offset H	0-65535	0	---	Operation settings	Immediate effect
	P03-70	Mechanical origin offset L	0-65535	1000	---	Operation settings	Immediate effect
Velocity param-eter	P04-00	Velocity command source	0-3	0	---	Downtime setting	Immediate effect
	P04-01	Reverse velocity command analog quantity	0-1	0	---	Downtime setting	Immediate effect
	P04-02	Given value of digital velocity	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-03	Zero velocity position clamping function	0-1	0	---	Operation settings	Immediate effect
	P04-04	Zero velocity position clamping velocity threshold	0-6000	30	1rpm	Operation settings	Immediate effect
	P04-05	Overvelocity alarm value	0-6500	6400	1rpm	Operation settings	Immediate effect
	P04-06	Forward velocity limit	0-6000	5000	1rpm	Operation settings	Immediate effect
	P04-07	Reverse velocity limit	0-6000	5000	1rpm	Operation settings	Immediate effect
	P04-10	Zero velocity detection value	0-200.0	2	1rpm	Operation settings	Immediate effect
	P04-11	Rotate check out value	0-200.0	30	1rpm	Operation settings	Immediate effect
	P04-12	Velocity consistent amplitude	0-200.0	30	1rpm	Operation settings	Immediate effect
	P04-14	Acceleration time	0-10000	0	1ms/1000rpm	Operation settings	Immediate effect
	P04-15	Deceleration time	0-10000	0		Operation settings	Immediate effect

	P04-30	Internal velocity setting 1	0-6000	0	1rpm	Operation settings	Immediate effect
	P04-31	Internal velocity setting 2	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-32	Internal velocity setting 3	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-33	Internal velocity setting 4	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-34	Internal velocity setting 5	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-35	Internal velocity setting 6	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-36	Internal velocity setting 7	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-37	Internal velocity setting 8	-6000—6000	0	1rpm	Operation settings	Immediate effect
Torque param-eter	P05-00	Torque command source	0-3	0	---	Downtime setting	Immediate effect
	P05-01	Reverse torque command analog quantity	0-1	0	---	Downtime setting	Immediate effect
	P05-02	Torque mode velocity limit given value	0-6000	1000	1rpm	Operation settings	Immediate effect
	P05-05	Torque limiting setting source	0-1	0	---	Downtime setting	Immediate effect
	P05-06	Torque limit detection output delay	0-10000	0	ms	Operation settings	Immediate effect
	P05-10	Internal forward torque limiting amplitude	0-300.0	200.0	1.0％	Operation settings	Immediate effect
	P05-11	Internal reverse torque limiting amplitude	0-300.0	200.0	1.0％	Operation settings	Immediate effect
	P05-12	External positive torque limiting amplitude	0-300.0	100.0	1.0％	Operation settings	Immediate effect
	P05-13	Limit amplitude of external reverse torque	0-300.0	100.0	1.0％	Operation settings	Immediate effect
I/O param-eter	P06-00	DI1 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-01	Function selection of DI1 input port(servo ON)	0-18	1	---	Operation settings	Power up again

	P06-02	DI2 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-03	Function selection of DI2 input port	0-18	13	---	Operation settings	Power up again
	P06-04	DI3 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-05	Function selection of DI3 input port	0-18	14	---	Operation settings	Power up again
	P06-06	DI4 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-07	Function selection of DI4 input port	0-18	15	---	Operation settings	Power up again
	P06-08	DI5 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-09	Function selection of DI5 input port(positive side external torque limit)	0-18	7	---	Operation settings	Power up again
	P06-10	DI6 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-11	Function selection of DI6 input port(external torque limit on reverse side)	0-18	8	---	Operation settings	Power up again
	P06-12	DI7 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-13	Function selection of DI7 input port(control mode switching)	0-18	5	---	Operation settings	Power up again
	P06-16	DI8 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-17	Function selection of DI8 input port(position command clear)	0-18	16	---	Operation settings	Power up again
	P06-20	DO1 output port effective level	0-1	1	---	Operation settings	Power up again
	P06-21	Function selection of DO1 output port(servo ready)	0-11	3	---	Operation settings	Power up again
	P06-22	DO2 output port effective level	0/1	1	---	Operation settings	Power up again
	P06-23	Function selection	0-11	2	---	Operation	Power up

		of DO2 output port(holding brake open)				settings	again
Advan-ced function param-eters	P06-24	DO3 output port effective level	0/1	1	---	Operation settings	Power up again
	P06-25	DI1 input port effective level(alarm output)	0-11	1	---	Operation settings	Power up again
	P06-26	Function selection of DI1 input port	0/1	1	---	Operation settings	Power up again
	P06-27	DI2 input port effective level(positioning complete)	0-11	4	---	Operation settings	Power up again
	P06-28	Function selection of DI2 input port	0/1	1	---	Operation settings	Power up again
	P06-29	DI3 input port effective level(torque limit detection)	0-11	8	---	Operation settings	Power up again
	P06-40	Function selection of DI3 input port	10-2000	500	1rpm/V	Operation settings	Immediate effect
	P06-41	DI4 input port effective level	0-65535	0.8	1ms	Operation settings	Immediate effect
	P06-42	Function selection of DI4 input port	-10.000 — 10.000	0	1V	Operation settings	Immediate effect
	P06-43	DI5 input port effective level	0.0-100.0	10	%	Operation settings	Immediate effect
	P06-44	Function selection of DI5 input port	0-64.00	0.8	1ms	Operation settings	Immediate effect
	P06-45	DI6 input port effective level	-10.000 — 10.000	0	1V	Operation settings	Immediate effect
	P06-46	Function selection of DI6 input port	0-10.000	0	1V	Operation settings	Immediate effect
	P06-47	DI7 input port effective level	0-10.000	0	1V	Operation settings	Immediate effect
	P08-01	Load rotation convention identification mode	0-1	0	---	Operation settings	Immediate effect
	P08-02	Maximum velocity of inertia identification	100-2000	800	1rpm	Operation settings	Immediate effect
	P08-03	Acceleration and deceleration time of inertia identification	20-800	100	1ms	Operation settings	Immediate effect
	P08-04	Waiting time after single inertia	50-10000	1000	1ms	Operation settings	Immediate effect

		identification					
	P08-05	Motor turns required to complete a single inertia		1.33	circle	Operation settings	RO
	P08-11	Mode selection of adaptive notch filter	0-4	0	---	Operation settings	Immediate effect
	P08-20	Torque command filter constant	0-25.00	0.8	1ms	Operation settings	Immediate effect
	P08-25	Disturbance torque compensation gain	0-100.0	0	%	Operation settings	Immediate effect

8.2 Parameter Analysis Description

8.2.1 P00-xx Motor and driver arameters

Table 129 P00-xx Motor and driver parameters

Parameter code	Name	Explain
P00-00	Motor number	Factory has been set, there is no need to set 0：P0-01 to P0-17 works
P00-01	Motor rated rotating velocity	Setting range：1-6000，unit：rpm Factory has been set, there is no need to set
P00-02	rated motor toroue	Setting range：0.01-655.35，unit：N.M Factory has been set, there is no need to set
P00-03	motor rated current	Setting range：0.01-655.35，unit：A Factory has been set, there is no need to set
P00-04	Moment of inertia of motor	Setting range：0.01-655.35，unit：kg.cm² Factory has been set, there is no need to set
P00-05	Log of motor pole	Setting range：1-31，unit：P Factory has been set, there is no need to set
P00-07	Encoder selection	Setting range: 0-3 0, 1: incremental encoder; 2: Single turn absolute value encoder; 3: Multi turn absolute encoder
P00-08	Save line incremental encoder	Setting range: 0-1 0: non provincia 1: Dart type
P00-09	Absolute encoder type	Setting range: 0-1 0: tamakawa encoder; 1: Nikon encoder
P00-10	Incremental encoder line count	According to the setting of the matched motor, it has been set in the factory
P00-11	Incremental encoder Z pulse	According to the setting of the matched motor, it has been set in the factory

	electrical Angle	
P00-12	Initial angle of rotor 1	According to the setting of the matched motor, it has been set in the factory
P00-13	Initial angle of rotor 2	According to the setting of the matched motor, it has been set in the factory
P00-14	Initial angle of rotor 3	According to the setting of the matched motor, it has been set in the factory
P00-15	Initial angle of rotor 4	According to the setting of the matched motor, it has been set in the factory
P00-16	Initial angle of rotor 5	According to the setting of the matched motor, it has been set in the factory
P00-17	Initial angle of rotor 6	According to the setting of the matched motor, it has been set in the factory
P00-20	Power on interface display setting	Setting range: 0-100, default 100 Set according to customer display requirements When setting 100, the operation status will be displayed when the driver is powered on Other parameter settings correspond to the serial number of the list of monitoring items (Chapter 8.3) For example: when the customer needs to drive and display the motor velocity d08. F. SP the parameter is set to 8
P00-21	RS232 Communication baud rate	Setting range：0-3 Select the baud rate when communicating with PC 0：9600 1：19200 2：57600 3：115200
P00-23	From the station address	Setting range：0—255，default 1 Set according to equipment requirements
P00-24	Modbus Communication baud rate	Setting range：0-7，default 2 0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200
P00-25	verification mode	Setting range：0-3，default 1 0：NONE，2 stop bit 1：even parity check，1 stop bit 2：odd parity check，1 stop bit 3：NONE，1 stop bit
P00-27	CANopen communication baud rate	Set the baud rate of CAN bus 0：12.5KHz 1：120KHz

		2：20KHz 3：100KHz 4：125KHz 5：250KHz 6：500KHz 7：1000KHz
P00-28	485 protocol selection	0: Reserve 1: acquiescence 2: Compatible with RS485 communication
P00-30	Brake resistance setting	Setting range: 0-2 0: use built-in resistance 1: Use external resistance 2: Do not use brake resistor
P00-31	External brake resistance power	Setting range: 0-65535, unit: 10W Set correctly according to the external braking resistance. For example, if the setting value is 4, the resistance power is 40W
P00-32	External brake resistance	Setting range: 0-1000, unit: Ohm Set correctly according to the external braking resistance
P00-40	Over temperature protection settings	Setting range: 0-1 0: turn off the over temperature protection function 1: Turn on the over temperature protection function
P00-41	Control power failure protection settings	Setting range: 0-1 0: turn off the power-off protection function of the control power supply 1: Turn on the power-off protection function of the control power supply

8.2.2 P01-xx Main control parameter

Table 130 P01-xx Main control parameter

<table>
<tr><th>Parameter code</th><th>Name</th><th>Explain</th></tr>
<tr><td>P01-01</td><td>Control mode setting</td><td>Setting range：0-6
0：Position control mode
1：Velocity control mode
2：Torque control mode
3：Velocity, torque control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to switch the control mode.
<table>
<tr><td>Terminal logic</td><td>Control mode</td></tr>
<tr><td>Effective</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Torque mode</td></tr>
</table>
</td></tr>
</table>

<table>
<tr>
<td></td>
<td></td>
<td>4：Position and Velocity control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to switch the control mode.
<table>
<tr><td>Terminal logic</td><td>Control mode</td></tr>
<tr><td>Effective</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Velocity mode</td></tr>
</table>
5：Position, torque control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to switch the control mode.
<table>
<tr><td>Terminal logic</td><td>Control mode</td></tr>
<tr><td>Effective</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Torque mode</td></tr>
</table>
6：whole-close-loop</td>
</tr>
<tr>
<td>P01-02</td>
<td>Adjust the mode automatically in real time</td>
<td>Setting range：0-2
0：Manual adjustment。
1：Standard mode automatic adjustment。In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03. Manual adjustment of these parameters will not work. The following parameters are set by the user:
P02-03 (velocity feedforward gain), P02-04 (velocity feedforward smoothing constant).
2：Positioning mode automatically adjusts rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03. Manual adjustment of these parameters will not work. The following parameters will be fixed and cannot be changed:
P02-03 (velocity feedforward gain): 30.0%
P02-04 (velocity feedforward smoothing constant): 0.50</td>
</tr>
<tr>
<td>P01-03</td>
<td>Real-time automatic adjustment of rigid Settings</td>
<td>Setting range：0-31
Built-in 32 gain class parameters that work when P01-02 is set to 1 or 2. It Can be directly called according to the actual situation, the greater the set value, the stronger the rigidity.</td>
</tr>
<tr>
<td>P01-04</td>
<td>Moment of inertia ratio</td>
<td>Setting range：0-100，unit：Multiple
Set the load inertia ratio of the corresponding motor as follows:</td>
</tr>
</table>

		P01-04= load P01-04= load inertia/motor inertia This inertia ratio can use the value identified by AF-J-L automatic inertia to write the identified value into the parameter
P01-10	Control mode after overtravel	Setting range: 0-1 0: after overtravel, the motor is in free state and only receives the reverse direction signal for operation 1: After overtravel, the motor is locked and only receives the reverse direction signal to run
P01-20	Dynamic brake delay	Setting range: 0-150, unit: ms Dynamic brake action delay time when braking conditions are met
P01-21	Disable dynamic brake when main power is OFF	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-22	Disable dynamic brake when servo is OFF	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-23	Disable dynamic brake in case of fault alarm	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-24	No dynamic brake during overtravel	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-30	The brake instruction - servo OFF delay time (Brake open delay)	Setting range：0-255，unit：ms When enabling: after the enabling command is executed, the driver will receive the position command after the time of P01-30. When closing enabling: when the motor is in the static state, the time from the closing enabling command to the time when the motor becomes non energized after the holding brake is closed.
P01-31	The velocity limit of the output of the brake command	Setting range：0-3000，unit：rpm Motor velocity threshold when the holding brake output is valid when the motor is in rotation state. Below this threshold, the holding brake output command is valid, otherwise, the holding brake output command will be valid after waiting for P01-32 time.
P01-32	Wait time of servo OFF brake instruction	Setting range：0-255，unit：ms The maximum waiting time of holding brake output when the motor is in rotation state.
P01-40	Out of control detection enable	Prevent the motor from out of control and abnormal rotation. 0: off enable 1: On enable

8.2.3 P02-xx Gain type parameter

Table 131 P02-xx Gain type parameter

Parameter code	Name	Explain
P02-00	Position control gain 1	Setting range：0-3000.0，unit：1/S ‣ For the proportional gain of the position ring regulator, the larger the parameter value, the higher the gain ratio, the larger the stiffness, the smaller the position tracking error, and the faster the response. However, if the parameters are too large, vibration and overshoot are easily caused. ‣ This parameter is for steady-state response.
P02-01	Position control gain 2	Setting range：0-3000.0，unit：1/S ‣ For the proportional gain of the position ring regulator, the larger the parameter value, the higher the gain ratio, the larger the stiffness, the smaller the position tracking error, and the faster the response. However, if the parameters are too large, vibration and overshoot are easily caused. ‣ This parameter is for dynamic response.
P02-03	Velocity feedforward gain	Setting range：0-100.0，unit：1.0% The larger the parameter value, the smaller the tracking error and the faster the response. However, if the feedforward gain is too large, the position loop of the system will be unstable and prone to overshoot and shock.
P02-04	Velocity feedforward smoothing constant	Setting range：0-64.00，unit：ms This parameter is used to set the velocity loop feedforward filter time constant. The larger the value, the greater the filtering effect, but at the same time the phase lag increases.
P02-10	Velocity proportional gain 1	Setting range：1.0-2000.0，unit：Hz ‣The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load. ‣Make the value as large as possible without oscillating. ‣For the gain at rest.
P02-11	Velocity integral constant 1	Setting range：1.0-1000.0，unit：ms ‣The velocity regulator integration time constant, the smaller the set value, the faster the integration velocity, the greater the stiffness, too small is easy to produce vibration, noise. ‣Reduce this parameter as far as possible under the condition that the system does not oscillate. ‣This parameter is for steady-state response.
P02-12	Pseudo differential feedforward control coefficient 1	Setting range： 0-100.0，unit：1.0% ‣When set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast.When set to 0, the velocity ring integral plays an obvious role in filtering low-frequency interference, but the dynamic response is slow. ‣By adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low

<table>
<tr><td></td><td></td><td>frequency interference.</td></tr>
<tr><td>P02-13</td><td>Velocity proportional gain 2</td><td>Setting range：1.0-2000.0，unit：Hz
▸The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load.
▸Make the value as large as possible without oscillating.
▸For the gain in motion.。</td></tr>
<tr><td>P02-14</td><td>Velocity integral constant 2</td><td>Setting range：1.0-1000.0，unit：ms
▸The velocity regulator integration time constant, the smaller the set value, the faster the integration velocity, the greater the stiffness, too small is easy to produce vibration, noise.
▸Reduce this parameter as far as possible under the condition that the system does not oscillate.
▸This parameter is for steady-state response.</td></tr>
<tr><td>P02-15</td><td>Pseudo differential feedforward control coefficient 2</td><td>Setting range：0-100.0，unit：1.0%
▸When set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast.When set to 0, the velocity ring integral plays an obvious role in filtering low-frequency interference, but the dynamic response is slow.
▸By adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low frequency interference.</td></tr>
<tr><td>P02-16</td><td>Limit amplitude of velocity integral error</td><td>Setting range: 0-32767
Limit amplitude of velocity integral error</td></tr>
<tr><td>P02-19</td><td>Torque feedforward gain</td><td>Setting range：0-30000，unit：1.0%
Set the weighted value of current loop feedforward. This parameter weighted the differential of the velocity instruction and added the current loop.</td></tr>
<tr><td>P02-20</td><td>Torque feedforward smoothing constant</td><td>Setting range：0-64.00，unit：ms
This parameter is used to set the torque feedforward filter time constant.</td></tr>
<tr><td>P02-30</td><td>Gain switching mode</td><td>Setting range：0-10
Set the conditions for the first and second gain switching
<table>
<tr><td>value</td><td>Switching conditions</td><td>Remarks</td></tr>
<tr><td>0</td><td>Fixed as first gain</td><td>P02-00、P02-10、P02-11、P02-12</td></tr>
<tr><td>1</td><td>Fixed as second gain</td><td>P02-01、P02-13、P02-14、P02-15</td></tr>
<tr><td>2</td><td>Switch with DI input</td><td>DI port should be set to 9 (gain switching input)
Invalid: first gain
Effective: second gain</td></tr>
</table></td></tr>
</table>

		3	Large torque command	Switch to second gain when torque command is greater than threshold (determined by P02-31 and P02-32). When less than the threshold and more than the P02-33 delay setting, switch to the first gain.	
		4	Velocity command changes a lot	When the velocity instruction change is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.	
		5	High velocity command	When the velocity command is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.	
		6	Large position deviation	Switch to the second gain when the position deviation is greater than the threshold (determined by P02-31 and P02-32). When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.	
		7	Location instruction	Switch to the second gain when there is a position command. When the position command ends and the delay setting of P02-33 is exceeded at the same time, switch to the first gain.	
		8	Positioning incomplete	Switch to the second gain when the positioning is not completed. When the positioning is completed and the delay setting of P02-33 is exceeded, switch to the first gain.	
		9	High actual velocity	When the actual velocity is greater than the threshold (determined by P02-31 and	

<table>
<tr><td></td><td></td><td><table>
<tr><td></td><td></td><td>P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.</td></tr>
<tr><td>10</td><td>Position command + actual velocity</td><td>Switch to the second gain when there is a position command. When there is no position command and the actual velocity is less than the threshold (determined by P02-31 and P02-32), and the delay setting of P02-33 is exceeded at the same time, switch to the first gain.</td></tr>
</table></td></tr>
<tr><td>P02-31</td><td>Gain switching level</td><td>Setting range：0-20000
Judging threshold value in gain switching.
Torque unit：1000bit=25%Rated torque
Velocity unit：1000bit=200 rpm/min
Position unit：131072biteach circle</td></tr>
<tr><td>P02-32</td><td>Gain switching hysteresis</td><td>Setting range：0-20000
Hysteresis level in gain switching
Torque unit：1000bit=25%Rated torque
Velocity unit：1000bit=200 rpm/min
Position unit：131072biteach circle</td></tr>
<tr><td>P02-33</td><td>Gain switching delay</td><td>Setting range：0-1000.0，unit：ms
When switching from the second gain to the first gain, the time from the trigger condition to the actual switching.</td></tr>
<tr><td>P02-34</td><td>Position gain switching time</td><td>Setting range：0-1000.0，unit：ms
Time for position control gain 1 to smoothly switch to position control gain 2.</td></tr>
<tr><td>P02-40</td><td>Mode switch selection</td><td>Setting range: 0-4
Set the conditions of PI control and P control of velocity loop<table>
<tr><td>value</td><td>Judgement condition</td><td>Remarks</td></tr>
<tr><td>0</td><td>Torque command</td><td>When the torque command is less than the threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control</td></tr>
<tr><td>1</td><td>Velocity command</td><td>When the velocity command is less than the threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control</td></tr>
<tr><td>2</td><td>acceleratio</td><td>When the acceleration is less than the</td></tr>
</table></td></tr>
</table>

			n	threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control
		3	Positional deviation	When the positional deviation is less than the threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control
		4	No mode switch	PI control for velocity environmental protection, no switching
P02-41	Mode switch level	Setting range：0-20000 Set the threshold value of switching. Torque unit：1000bit=25%Rated torque Velocity unit：1000bit=200 rpm/min Position unit：131072biteach circle		
P02-50	Added value of torque command	Setting range：-100.0-100，unit：1.0% Valid in position control mode. This value is added to the torque given value for static torque compensation of vertical axis.		
P02-51	Forward torque compensation	Setting range：-100.0-100.0，unit：1.0% Valid in position control mode. Used to compensate for positive static friction.		
P02-52	Reverse torque compensation	Setting range：-100.0-100.0，unit：1.0% Valid in position control mode. Used to compensate for negative static friction.		

8.2.4 P03-xx Position parameter

Table 132 P03-xx Position parameter

Parameter code	Name	Explain
P03-00	Location command source	0：impulsbefehl 1：Number given,Used for communication control.
P03-01	Command pulse mode	0: orthogonal pulse command 1: Direction + pulse command 2 or 3: dual pulse command
P03-02	Command pulse input terminal	Used to specify pulse input port in CN1 port 0: low velocity pulse port 1: High velocity pulse port
P03-03	Command pulse reversal	Used to adjust the counting direction of pulse command. 0：normal. 1：Direction reversal.
P03-04	Position pulse filtering	Setting range：0-3，unit：us 0：0.1us。 1：0.4us

		2：0.8us。 3：1.6us
P03-05	Judgment conditions for positioning completion	0：Output when the position deviation is less than the set value of P03-06. 1: Output when the position setting is completed and the position deviation is less than the set value of P03-06. 2：Output when the position setting is completed (after filtering) and the position deviation is less than the set value of P03-06.
P03-06	Positioning complete range	Setting range：0-65535，unit：Encoder unit Use to set the threshold value for locating the completion output. If the incremental encoder motor is used, the number of encoder lines *4 shall be calculated for each turn.
P03-07	Position feedback format	Setting range: 0-1 0: incremental format. 1: Multicycle absolute value format
P03-09	The number of instruction pulses per turn of the motor	Setting range：0-65535 Used to set the number of command pulses for one revolution of motor. When this parameter is set to 0, parameters P03-10 and P03-11 are valid.
P03-10	Molecule of electronic gear 1	When absolute value motor is used, see the example of electronic gear ratio calculation method Calculation formula of electronic gear ratio of incremental motor： *G=member/denominator=C*4/P* *C: Number of encoder lines;* *P: Input the number of pulses per revolution* *For example: the number of encoder lines is 2500;* *the number of input pulses per revolution is 3200;* *calculate the electronic gear ratio?* *G=C*4/P=2500*4/3200=10000/3200=25/8* Note: the numerator of 20b encoder is 131072 The numerator of 17Z encoder is 160000
P03-11	Denominator of electronic gear 1	
P03-12	Molecular high position of electronic gear 1	Setting range: 0-32767 Using this parameter, the electronic gear ratio can be enlarged: molecular value = P03-12 * 10000 + P03-10
P03-15	Excessive position deviation setting	Setting range：0-65535，unit：Command unit *10 Set the pulse number of allowable deviations, and an alarm will be given if it exceeds the set value. Example: set value 20, when the following deviation exceeds 20 * 10, the driver will alarm **AL.501** (position deviation is too large)
P03-16	Position command smoothing filter time	Setting range：1000，unit：ms Set the time constant of the position command smoothing filter.
P03-20	Position feedback	Set the source of position feedback 0: encoder

<table>
<tr><td></td><td>source</td><td>1: Grating ruler</td></tr>
<tr><td>P03-21</td><td>Encoder frequency division output enable</td><td>Set whether CN1 port has encoder frequency division output
0: off enable
1: On enable</td></tr>
<tr><td>P03-22</td><td>Numerator of the output pulse division ratio of the incremental encoder</td><td rowspan="2">When using incremental encoder, set the number of output pulses of CN1 port.
P03-23 should be less than or equal to P03-22, calculation formula:
$G = \frac{\text{molecule}}{\text{denominator}} = \frac{C \times 4}{P \times 4}$
C: Number of encoder lines
P: Desired output A, B pulses per revolution
Example: The number of encoder lines is 2500;
The number of A and B pulses per revolution is 500;
$G = \frac{C \times 4}{P \times 4} = \frac{2500 \times 4}{500 \times 4} = \frac{5}{1}$</td></tr>
<tr><td>P03-23</td><td>Output pulse division ratio denominator of incremental encoder</td></tr>
<tr><td>P03-25</td><td>Output pulse number of one revolution of absolute motor</td><td>Setting range: 0-60000
Set the absolute value to rotate the motor for one turn, and output the number of A and B frequency pulses respectively.
For example, if the set value is 2048, 2048 pulses will be output for signal A and signal B for each revolution of the motor</td></tr>
<tr><td>P03-30</td><td>Linear encoder inverting</td><td>Set whether the phase sequence of grating ruler input A and B is reversed
0: do not reverse
1: take the opposite</td></tr>
<tr><td>P03-31</td><td>Polarity of Z pulse of linear encoder</td><td>Set the effective level of grating ruler input Z signal
0: low level
1: High level</td></tr>
<tr><td>P03-40</td><td>Output pulse source</td><td>Set the source of frequency division output signal in CN1 terminal
0: motor encoder
1: Grating ruler</td></tr>
<tr><td>P03-42</td><td>Output Z-pulse polarity</td><td>Set the effective level of Z signal of frequency division output signal of CN1 terminal
0: low level
1: High level</td></tr>
<tr><td>P03-45</td><td>Digital instruction caching</td><td>Setting range: 0-1
0: do not cache (execute now)
1: Cache (execute new data after last data execution)</td></tr>
<tr><td>P03-46</td><td>Maximum velocity of motor when digital position command is running</td><td>Setting range: 0-6000
Set the maximum velocity of the motor when the digital position command is running</td></tr>
</table>

8.2.5 P04-xx Velocity parameter

Table 133 P04-xx Velocity parameter

Parameter code	Name	Explain
P04-00	Velocity command source	0: external analog command 1: Digital command (parameter setting) 2: Digital command (Communication) 3: Internal multiple groups of instructions
P04-01	Reverse velocity command analog quantity	Used to adjust the polarity relationship of analog quantity 0: normal 1: Polarity reversal
P04-02	Given value of digital velocity	Setting range：-6000—6000，unit：rpm When P04-00 is set to 1, P04-02 is the velocity control setting value
P04-03	Zero velocity position clamping function	0: no position clamping function 1: With position clamping function When the velocity control mode meets the following conditions at the same time, enter the position locking mode A: P04-03 is set to 1 B: The absolute value of velocity command is less than the set threshold of P04-04 C: The function of the external input port is set to 10 (fixed zero position), and it is in the valid input state
P04-04	Zero velocity position clamping velocity threshold	Setting range: 0-6000, unit: rpm Set the velocity command threshold to trigger the zero-velocity position clamping function
P04-05	Overvelocity alarm value	Setting range：0-6500，unit：rpm Set the allowable maximum velocity value. If it exceeds the set value, **AL.420** overvelocity alarm will be given
P04-06	Forward velocity limit	Setting range：0-6000，unit：rpm Limit motor forward velocity value
P04-07	Reverse velocity limit	Setting range：0-6000，unit：rpm Limit motor reverse velocity value
P04-10	Zero velocity detection value	Setting range：0-200.0，unit：rpm Set the threshold value of zero velocity detection, when the motor velocity is lower than the threshold value, **"motor zero velocity output"** signal can be output through the output port
P04-11	Rotate check out value	Setting range: 0-200.0, unit: rpm Set the detection threshold of motor rotation. If the motor velocity is higher than this value, the status can be displayed through the LED panel
P04-12	Velocity	Setting range: 0-200.0, unit: rpm

<table>
<tr><td></td><td>consistent amplitude</td><td>Set the threshold value of the velocity consistent signal. When the difference between the motor velocity and the command velocity is within the threshold value, the "velocity consistent output" signal can be output through the output port</td></tr>
<tr><td>P04-14</td><td>Acceleration time</td><td>Setting range：0-10000，unit：1ms/1000rpm
Set acceleration for velocity control</td></tr>
<tr><td>P04-15</td><td>Deceleration time</td><td>Setting range：0-10000，unit：1ms/1000rpm
Set deceleration at velocity control</td></tr>
<tr><td>P04-30

P04-37</td><td>Internal velocity setting 1-8</td><td>Setting range: - 6000-6000, unit: rpm
Parameters P04-30 to P04-37 set the internal velocity 1 to internal velocity 8 respectively
The internal velocity switching method is as follows:
When the velocity loop is controlled, P04-00 is set to 3,
The corresponding input port functions are defined as 13, 14, 15
The switching of internal velocity is realized by setting the input port function to the combination of on-off states of 13, 14 and 15. The switching relationship is shown in the table below
<table>
<tr><th>DI13</th><th>DI14</th><th>DI15</th><th>Interaction parameter</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>P04-30</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>P04-31</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>P04-32</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>P04-33</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>P04-34</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>P04-35</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>P04-36</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>P04-37</td></tr>
</table>
</td></tr>
</table>

8.2.6 P05-xx Torque parameter

Table 134 P05-xx Torque parameter

Parameter code	Name	Explain
P05-00	Torque command source	0: external analog command (velocity limit amplitude is set by P05-02) 1: Digital command (velocity limit amplitude is set by P05-02) 2: External simulation command (velocity limit amplitude is determined by velocity simulation command) 3: Digital command (velocity limit amplitude is determined by velocity analog command)
P05-01	Reverse torque command analog quantity	Used to adjust torque direction 0: normal 1: Reverse direction
P05-02	Torque mode velocity limit	Setting range: 0 - maximum velocity, unit: rpm Set the maximum velocity value of the motor in the torque

<table>
<tr><td></td><td>given value</td><td>mode to prevent the mechanical damage caused by the high velocity of the motor in no-load condition
Effective torque control mode</td></tr>
<tr><td>P05-05</td><td>Torque limiting setting source</td><td>Source for adjusting torque limiting amplitude
0: internal digital quantity (set by P05-10, P05-11 or P05-12, P05-13)
1: External analog quantity (given by external analog quantity input t-ref. In this mode, the positive and negative limiting amplitudes are the same.)</td></tr>
<tr><td>P05-06</td><td>Torque limit detection output delay</td><td>Setting range: 0-10000, unit: ms
Set the output torque limit of DO port to detect the output signal delay time</td></tr>
<tr><td>P05-10</td><td>Internal forward torque limiting amplitude</td><td>Setting range：0-300.0，unit：1.0%
Limit the forward output of the motor, 100 represents 1 time of torque, 300 represents 3 times of torque.
When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit.</td></tr>
<tr><td>P05-11</td><td>Internal reverse torque limiting amplitude</td><td>Setting range：0-300.0，unit：1.0%
Limit the reverse output of the motor, 100 represents 1 time of torque, 300 represents 3 times of torque.
When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit.</td></tr>
<tr><td>P05-12</td><td>External positive torque limiting amplitude</td><td>Setting range: 0-300.0, unit: 1.0%
For this function, one of the external input ports in CN1 is required to switch, and the function selection of the selected DI port input port is set to 7 (external torque limit on the positive side). Control the logical state of the port to switch the control mode.<table><tr><td>Terminal logic</td><td>Torque limiting amplitude</td></tr><tr><td>Effective</td><td>External limiting amplitude P05-12</td></tr><tr><td>Invalid</td><td>Internal limiting amplitude P05-10</td></tr></table>If the DI function is not assigned, the default torque limit amplitude of the system is P05-10
When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit</td></tr>
<tr><td>P05-13</td><td>Limit amplitude of external reverse torque</td><td>Setting range: 0-300.0, unit: 1.0%
This function needs to use an external input port in CN1 to switch, and set the function selection of the selected DI port input port to 8 (external torque limit on the reverse side). Control the logic state of the port to switch the control mode.<table><tr><td>Terminal logic</td><td>Torque limiting amplitude</td></tr><tr><td>Effective</td><td>External limiting</td></tr></table></td></tr>
</table>

<table>
<tr><td></td><td></td><td><table><tr><td></td><td>amplitude P05-13</td></tr><tr><td>Invalid</td><td>Internal limiting amplitude P05-11</td></tr></table>If the DI function is not assigned, the default torque limit amplitude of the system is P05-11
When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit</td></tr>
</table>

8.2.7 P06-xx I/O parameter

Table 135 P06-xx I/O parameter

Parameter code	Name	Explain
P06-00	DI1 input port effective level	Setting range: 0-4, factory setting: 0 Set valid input of DI1 input port of CN1 0: valid for low level (optocoupler on) 1: Valid for high level (optocoupler off) 2: Rising edge effective 3: Falling edge effective 4: Both rising and falling edge are effective
P06-01	Function selection of DI1 input port	Setting range: 0-18, factory setting: 1 Set the function of DI1 input port of CN1 0: invalid pin 1: servo ON 2: Alarm clear 3: Reserve 4: Reserve 5: Control mode switching 6: P action command input 7: Positive side external torque limit 8: Reverse side external torque limit 9: Gain switching input 10: Zero fixed input 11: Command pulse inhibit input 12: Encoder absolute value data required input 13: CW limit signal input 14: HW limit signal input 15: CCW limit signal input 16: Position command clear input 17: Pole detection input 18: Command pulse input rate switching input 19: Gantry simultaneous movement enable 20: Gantry alignment clear signal 21: origin switch signal 22: origin reset start signal
P06-02	DI2 input port	See to P06-00

	effective level	
P06-03	Function selection of DI2 input port	See to P06-01，Factory settings：13
P06-04	DI3 input port effective level	See to P06-00
P06-05	Function selection of DI3 input port	See to P06-01，Factory settings：14
P06-06	DI4 input port effective level	See to P06-00
P06-07	Function selection of DI4 input port	See to P06-01，Factory settings：15
P06-08	DI5 input port effective level	See to P06-00
P06-09	Function selection of DI5 input port	See to P06-01，Factory settings：7
P06-10	DI6 input port effective level	See to P06-00
P06-11	Function selection of DI6 input port	See to P06-01，Factory settings：8
P06-12	DI7 input port effective level	See to P06-00
P06-13	Function selection of DI7 input port	See to P06-01，Factory settings：5

P06-16	DI8 input port effective level	See to P06-00
P06-17	Function selection of DI8 input port	See to P06-01，Factory settings：16
P06-20	DO1 output port effective level	Setting range: 0-1, factory setting: 1 0: when the status is valid, the optocoupler is cut off 1: When the representative state is valid, the optocoupler is on
P06-21	Function selection of DO1 output port	Setting range: 0-11, factory setting: 3 0: invalid pin 1: Alarm output 2: Holding brake open output 3: Servo ready for output 4: Positioning complete output 5: Positioning approach output 6: Velocity consistent output 7: Motor zero velocity output 8: Torque limit detection output 9: Velocity limit check out output 10: Warning output 11: Command pulse input rate switching output 12: Origin regression complete output 13: Electrical origin regression complete output
P06-22	DO2 output port effective level	See to P06-20
P06-23	Function selection of DO2 output port	See to P06-21，Factory settings：2
P06-24	DO3 output port effective level	See to P06-20
P06-25	Function selection of DO3 output port	See to P06-21，Factory settings：1
P06-26	DO4 output port effective	See to P06-20

	level	
P06-27	Function selection of DO4 output port	See to P06-21，Factory settings：4
P06-28	DO5 output port effective level	See to P06-20
P06-29	Function selection of DO5 output port	See to P06-21，Factory settings：8
P06-40	Velocity analog command input gain	Setting range: 10-2000, unit: 1rpm / V Set the coefficient between the analog command input by CN1 and the velocity control command For example, 500 represents 500 rpm per V
P06-41	Velocity analog command filter constant	Setting range: 0-64.00, unit: ms Set the filtering time coefficient of the analog command input by CN1
P06-42	Velocity analog instruction offset	Setting range: - 10.000-10.000, unit: V Set zero offset of analog command input by CN1
P06-43	Torque analog command gain	Setting range: 0-100.0, unit: 1% Set the coefficient between the analog command input by CN1 and the velocity control command For example, 30.0 represents 30% of rated torque per V
P06-44	torque analog command filter constant	Setting range: 0-64.00, unit: ms Set the filtering time coefficient of the analog command input by CN1
P06-45	Torque analog command offset	Setting range: - 10.000-10.000, unit: V Set zero offset of analog command input by VN1
P06-46	Velocity analog command deadband	Setting range: 0-10.000, unit: V Set the dead time voltage value of the velocity analog command. When the analog quantity is set within the range of the positive and negative values, the system will default to zero
P06-47	Torque analog command	Setting range: 0-10.000, unit: V Set the dead time voltage value of torque simulation command. When the analog value is within the range of the positive and

	deadband	negative values, the system default value is zero

8.2.8 P08-xx Advanced function parameters

Table 136 P08-xx Advanced function parameters

Parameter code	Name	Explain
P08-01	Load rotation convention identification mode	Setting range: 0-1 0: effective 1: invalid
P08-02	Maximum velocity of inertia identification	Setting range: 100-2000, unit: RPM The highest velocity of the motor in off-line inertia identification
P08-03	Acceleration and deceleration time of inertia identification	Setting range: 20-800, unit: ms Acceleration and deceleration time of motor in off-line inertia identification
P08-04	Waiting time after single inertia identification	Setting range: 50-10000, unit: ms Waiting time after single inertia identification is completed
P08-05	Motor turns required to complete a single inertia	This parameter is the rotation circle value automatically generated according to the set conditions of P08-02, P08-03 and P08-04
P08-11	Mode selection of adaptive notch filter	Setting range: 0-4 Setting range: 0-4 The parameters of the third and fourth traps are no longer updated automatically, but are saved as the current values. But manual input is allowed 1: One adaptive notch filter is effective, the parameters of the third notch filter are updated automatically and cannot be input manually 2: Two adaptive notch filters are effective. The parameters of the third and fourth notch filters are updated automatically and cannot be input manually 3: Resonance frequency only 4: Clear the third and fourth notch filter parameters and restore them to the factory settings
P08-20	Torque command filter constant	Setting range：0-25.00，unit：ms The filtering time constant of torque command can be properly set to a large value when the motor is howling during operation.

P08-25	Disturbance torque compensation gain	Setting range：0-100.0 Gain coefficient of disturbance torque observation value. The larger the value is, the stronger the anti disturbance torque ability is, but the action noise may also increase.
P08-26	Time constant of disturbance torque filtering	Setting range：0-25.00，unit：ms The larger the value is, the stronger the filtering effect is, and the action noise can be suppressed. However, excessive phase delay will affect the restraining effect of disturbance torque.
P08-30	Notch filter 1 frequency	Setting range: 50-5000, unit: Hz Center frequency of Notch 1 When it is set to 5000, the notch filter is invalid
P08-31	Notch filter 1 width	Setting range: 0-20 Notch width class of Notch 1 Is the ratio of width to center frequency
P08-32	Notch filter 1 depth	Setting range: 0-99 Notch depth level of Notch 1 The ratio relationship between output and input for the center frequency of the notch filter The larger the parameter, the smaller the depth of the notch and the weaker the effect
P08-33	Notch filter 2 frequency	Same P08-30
P08-34	Notch filter 2 width	Same P08-31
P08-35	Notch filter 2 depth	Same P08-32
P08-36	Notch filter 3 frequency	Same P08-30
P08-37	Notch filter 3 width	Same P08-31
P08-38	Notch filter 3 depth	Same P08-32
P08-39	Notch filter 4 frequency	Same P08-30
P08-40	Notch filter 4 width	Same P08-31
P08-41	Notch filter 4 depth	Same P08-32

8.3 List of Monitoring Items

Table 137 List of monitoring items

Displaying Serial	Display Item	Explain	Unit

Number			
d00.C. PU	Sum of position command pulses	This parameter can monitor the number of pulses sent by the user to the servo driver to confirm whether there is pulse loss.	Instruction unit
d01.F. PU	Describe the sum of position feedback pulses	This parameter can monitor the number of pulses fed back by the servo motor. The unit is the same as the unit of user input instruction.	Instruction unit
d02.E. PU	Number of position deviation pulses	This parameter can monitor the pulse number of position lag during servo system operation. The unit is the same as the unit of user input instruction.	Instruction unit
d03.C.PE	Position given pulse sum / Gantry machine feedback pulse	This parameter can monitor the number of pulses sent by the user to the servo driver. Unit: when absolute motor is used, it is calculated as 131072bit per turn. If incremental encoder motor is used, the number of encoder lines * 4 shall be calculated for each turn.	Encoder unit/ Instruction unit
d04.F.PE	Position feedback pulse sum / Gantry machine feedback pulse	This parameter can monitor the number of pulses fed back by the servo motor. Unit: when absolute motor is used, it is calculated as 131072bit per turn. If incremental encoder motor is used, the number of encoder lines * 4 shall be calculated for each turn.	Encoder unit/ Instruction unit
d05.E.PE	Position deviation pulse number/Gantry pulse deviation	This parameter can monitor the pulse number of position lag during the operation of the servo system. Unit: when using absolute value motor, calculate by 131072bit per lap. If the incremental encoder motor is used, the number of encoder lines *4 shall be calculated for each turn.	Encoder unit/ Instruction unit
d06.C. Fr	Pulse command input frequency	This parameter monitors the input frequency of the external pulse command	KPPS
d07.C. SP	Velocity control command		rpm
d08.F. SP	Motor velocity	This parameter can monitor the velocity of the servo motor when it is running	rpm
d09. C.tQ	Torque command	This parameter can monitor the torque	%

		when the servo motor is running	
d10. F. tQ	Torque feedback value	This parameter can monitor the feedback torque when the servo motor is running	%
d11.AG.L	Average torque	This parameter can monitor the average torque of the servo motor in the past 10 seconds	%
d12.PE.L	Peak torque	This parameter can monitor the peak torque of servo motor after power on	%
d13.oL	Overload rate	This parameter can monitor the load occupancy rate of the servo motor in the past 10 seconds	%
d14.rG	Regeneration load rate	This parameter monitors the load rate of the regeneration resistor	%
d16.I. Io	Input IO status	This parameter can monitor the input port status of CN1. The upper vertical bar represents high level (optocoupler cutoff), and the lower vertical bar represents low level optocoupler conduction). The corresponding relationship with the input port is that the vertical bars of the operation panel from right to left correspond to di1-di4 respectively	Binary
d17.o. Io	Output IO status	This parameter can monitor the output port status of CN1. The upper vertical bar represents the conduction of optocoupler, the lower vertical bar represents the cutoff of optocoupler, and the corresponding relationship with the output port is that the vertical bar of the operation panel from right to left corresponds to do1-do3 respectively	Binary
d18.AnG	Mechanical angle of motor	This parameter can monitor the mechanical angle of the motor, and the rotation of 1 turn is 360 degrees	0.1°
d19.HAL	Motor UVW phase sequence	This parameter can monitor the phase sequence position of the incremental encoder motor	
d20.ASS	Absolute value encoder single turn value	This parameter can monitor the feedback value of absolute encoder, and the rotation is 0xFFFF	0-0xFFFF
d21.ASH	Absolute value encoder multi turn value	This parameter can monitor the number of turns of the absolute encoder motor	

d22.J-L	Inertia ratio	This parameter can monitor the real-time inertia of the load of the motor	%
d23.dcp	Main circuit voltage (AC value)	This parameter can monitor the voltage value of the main circuit	V
d24.Ath	Driver temperature	This parameter can monitor the drive temperature	℃
d25.tiE	Cumulative running time	This parameter can monitor the running time of the drive, unit is second	Sec
d26.1. Fr	Resonance frequency 1	This parameter can monitor resonance frequency 1	Hz
d28.2. Fr	Resonance frequency 2	This parameter can monitor resonance frequency 2	Hz
d30.Ai1	Input voltage of analog quantity command 1（V_REF）	This parameter can monitor the input voltage value of the analog command (V_REF) of the velocity loop.	0.01V
d31.Ai2	Input voltage of analog quantity command 2（T_REF）	This parameter can monitor the input voltage value of the analog command (T_REF) of the torque ring.	0.01V

8.4 Auxiliary Function

Table 138 Auxiliary function

Serial number	Display item	Function	Operation
1	AF_JoG	JOG trial run	1. Press the **M key** on the operation panel to switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_JoG**, and press the **ENT key** to enter the JoG working mode. The default JoG velocity is 30 rpm. 2. Press the **Up key**, the motor will rotate forward at the velocity of 30R / min; press the **Down key**, the motor will reverse at the velocity of 30R / min 3. Press **ENT key** for a long time to enter the velocity Edit menu. Edit the velocity through the combination of **Up**, **Down** and **LEFT keys**. After editing, press **ENT key** for a long time to enter JoG mode again. The set velocity will not be saved after exiting jog mode. 4. Press the **M key** to exit JoG mode.
2	AF_run	Forced enable operation velocity mode	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_run**, and press the **ENT key** to enter the working mode. 2. Press **Up key**, the motor will rotate forward, and press **Up key** for a long time, the motor velocity will continue to

			increase; press **Down key,** the motor will reverse, press **Up key** for a long time, the motor velocity will continue to increase. 3. Press the **M key** to exit the mode.
3	AF_oF1	Analog input 1 automatic zero drift calibration（VCMD）	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF － of1**, and press the **ENT key**, **clr.Ai1** will be displayed. 2. Long press **ENT key** until **finsh** flashes, i.e. automatic zero drift calibration of analog input 1 (velocity analog) is completed. 3. Press the **M key** to exit the mode.
4	AF_oF2	Analog input 2 automatic zero drift calibration（TCMD）	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF － of2**, and press the **ENT key**, **clr.Ai2**will be displayed. 2. Long press **ENT key** until **finsh** flashes, i.e. automatic zero drift calibration of analog input 1 (torque analog) is completed. 3. Press the **M key** to exit the mode.
5	AF_oF3	U, W current automatic zero drift calibration	Same AF_oF1 Note: when performing this function, the servo must be in the off enable state, otherwise the **finsh** flashing page will not appear, and the automatic calibration cannot be completed
6	AF_En0	Absolute encoder fault clearing	The auxiliary function must be operated in the non enabled state. The operation steps are as follows 1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_En0**, and press the **ENT key**, **clr. Err** will be displayed. 2. Long press **ENT** until **finsh** flashes, i.e. the absolute encoder fault is cleared. 3. Press the **M key** to exit the mode.
7	AF_En1	Absolute value encoder multi turn value clear	The auxiliary function must be operated in the non enabled state. The operation steps are as follows 1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_En1**, and press the **ENT key**, **clr.ASH** will be displayed. 2. Long press **ENT** until **finsh** flashes, that is to say, the absolute value encoder multi turn value is cleared. 3. Press the **M key** to exit the mode.
8	AF_ini	Restore factory parameters	Contact the manufacturer
9	AF_Err	Fault record display	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_Err**, and press the **ENT key** to display the past 8 times of historical fault information. A left digit of 0 indicates

			the last fault 2. Press **Up** to display the past faults one by one. Press and hold **ENT key** for a long time to display the time of fault occurrence. Refer to **d25.tiE** for time coordinate. 3. Press the **M key** to exit the mode. Note: there may be a deviation of 30 minutes in the recording time of the faults generated during multiple power on and power off within 30 minutes.
10	AF_uEr	Version display	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_uEr**, and press the **ENT key** to display the servo information. 2. Press the **M key** to exit the mode.
11	AF_unL	Operation permission setting	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_unL**, and press the **ENT key** to edit the operation authority. 0: all parameters are locked and cannot be changed; 1: P00-xx parameters are locked and other parameters can be changed; 2: not locked and can be changed. Set the value of 0,1, which can be saved after power failure. When setting 2, power off is not saved. 2. Press the **M key** to exit the mode.
12	AF_ Io	Forced output port level	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_Io**, and press the **ENT key** to edit. The corresponding relationship with the output port is that the vertical bars of the operation panel from right to left correspond to DO1-DO5 respectively 2. Press the **M key** to exit the mode. The output port returns to the original output state.
13	AF_J-L	Load inertia ratio measurement	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_J-L**, and press the **ENT key** to measure the inertia ratio. 2. Long press the **Up key** or **Down key**, the motor will run back and forth according to the maximum velocity set by P08-02, acceleration and deceleration time set by P08-03, waiting time of P08-04, and turns set by P08-05 until the load inertia ratio appears. 3. Press the **M key** to exit the mode. 4. Record the measured value and write it into P01-04 (moment of inertia ratio) parameter

9 Fault Analysis and Treatment

9.1 Fault Alarm Information Table

Table 139 Fault alarm information table

Alarm type	Serial number code	Alarm content
Hardware failure	AL.051	EEPROM Parameter exception
	AL.052	PLC configuration failure
	AL.053	Initialization failed
	AL.054	System exception
	AL.060	Product model selection failure
	AL.061	Product matching failure
	AL.062	Parameter storage failure
	AL.063	Overcurrent detection
	AL.064	Servo power on self check finds output short circuit to ground
	AL.066	Servo unit control power supply voltage low
	AL.070	AD sampling fault 1
	AL.071	Current sampling fault
	AL.101	AI Set fault
	AL.102	DI Allocation failure
	AL.103	DO Allocation failure
	AL.105	Electronic gear setting error
	AL.106	Abnormal setting of frequency division pulse output
	AL.110	Power on again after parameter setting
	AL.110	Power on again after parameter setting
	AL.401	Undervoltage
	AL.402	Overvoltage
	AL.410	Overload (instantaneous maximum load)
	AL.411	Driver overload
	AL.412	Motor overload (continuous maximum load)
	AL.420	Over velocity
	AL.421	Out of control detection
	AL.422	Runaway fault
	AL.425	AI sampling voltage too high
	AL.435	Impulse current limit resistor overload
	AL.436	DB overload
	AL.440	heatsink OT
	AL.441	Motor overheat fault
	AL.500	Frequency division pulse output over velocity
	AL.501	Excessive position deviation
	AL.502	The position deviation between the full closed-loop encoder

		and the motor is too large
	AL.505	P command input pulse abnormal
	AL.550	Inertia identification failure
Encoder Warning	AL.600	Encoder output power short circuit fault
	AL.610	Incremental encoder off line
	AL.611	Z signal loss of incremental encoder
	AL.941	Parameter change to be switched on again

9.2 Cause and Treatment of Fault Alarm

AL.051：EEPROM Parameter exception

Cause of fault alarm	Fault alarm check	Disposal measures
Servo unit EEPROM data abnormal	Check wiring	Correct wiring,power up again If it always appears, replace the drive

AL.052：PLC configuration failure

Cause of fault alarm	Fault alarm check	Disposal measures
Main control MCU power on initialization abnormal Serial port baud rate set too high	Check wiring Check the baud rate parameter P00-21 of serial communication	Reduce the baud rate of serial communication If it always appears, replace the drive

AL.053：Initialization failed

Cause of fault alarm	Fault alarm check	Disposal measures
Main control MCU power on initialization failed	Check wiring Power up again	If it always appears, replace the drive

AL.054：System exception

Cause of fault alarm	Fault alarm check	Disposal measures
Abnormal operation of main control MCU	Check wiring Power up again	If it always appears, replace the drive

AL.060：Product model selection failure

Cause of fault alarm	Fault alarm check	Disposal measures
Product parameter setting does not match the actual hardware	Check product parameter setting and hardware model The rated current of the selected motor is greater than the output current of the driver	Set product parameters correctly If it always appears, contact the manufacturer

AL.061：Product matching failure

Cause of fault alarm	Fault alarm check	Disposal measures

Servo unit and servo motor model do not match	Check whether the servo unit supports the motor	Replace the servo unit matching the motor

AL.063：Overcurrent detection

Cause of fault alarm	Fault alarm check	Disposal measures
Servo unit power module current too high	U, V, W wiring for short circuit Is there a short circuit between B1 and B3	Correct wiring If it always appears, replace the drive

AL.071：Current sampling fault

Cause of fault alarm	Fault alarm check	Disposal measures
Abnormal sampling data of current sensor	Check wiring	Correct wiring If it always appears, replace the drive

AL.100：Parameter combination exception

Cause of fault alarm	Fault alarm check	Disposal measures
Parameter setting error	Check the set (P03-07) parameter	Set parameters correctly If it always appears, please initialize the parameters

AL.102 DI Allocation failure

Cause of fault alarm	Fault alarm check	Disposal measures
At least 2 input ports have the same function selection	Check port input function selection parameters	Set parameters correctly Power on the drive again

AL.103：DO Allocation failure

Cause of fault alarm	Fault alarm check	Disposal measures
At least 2 output ports have the same function selection parameters	Check port output function selection parameters	Set parameters correctly Power on the drive again

AL.105：Electronic gear setting error

Cause of fault alarm	Fault alarm check	Disposal measures
Electronic gear ratio setting error	Check the electronic gear ratio setting parameters. P03-10, P03-11	Set the electronic gear ratio correctly
Gantry output pulse setting too small	Check the number of feedback pulses of the gantry function motor for one revolution: P03-52 must be greater than 128	Correctly set the number of feedback pulses for one revolution of gantry function motor

AL.106：Abnormal setting of frequency division pulse output

Cause of fault alarm	Fault alarm check	Disposal measures

Frequency division pulse output parameter setting out of range	Check the frequency division pulse output setting parameters. P03-22，P03-23，P03-25	Correctly set the output parameters of frequency division pulse Incremental encoderP03-22≤P03-23 Bus encoderP03-25<65535 Power on the drive again

AL.110：Power on again after parameter setting

Cause of fault alarm	Fault alarm check	Disposal measures
After the servo parameter is set, it can take effect only after power on again	Power on the drive again	Power on the drive again

AL.401：Undervoltage

Cause of fault alarm	Fault alarm check	Disposal measures
The input voltage of the main circuit is lower than the rated voltage or there is no input voltage	Check whether the main circuit input R, S, T wiring is correct and what is the voltage value	Make sure the wiring is correct and use the correct voltage source or series voltage regulator

AL.402：Overvoltage

Cause of fault alarm	Fault alarm check	Disposal measures
Main circuit input voltage is higher than rated voltage	Use a voltmeter to test whether the input voltage of the main circuit is correct	Use correct voltage source or series voltage regulator
Drive hardware failure	When it is confirmed that the input voltage is correct, the over-voltage alarm still occurs	Please return it to the dealer or the original factory for maintenance
The regeneration resistance is not connected or the selection of regeneration resistance is wrong	Verify that P00-30 is set to 0 or 1	Correct setting and external regeneration resistance

AL.410：Overload (instantaneous maximum load)

Cause of fault alarm	Fault alarm check	Disposal measures
The machine is stuck when the motor starts	Check if the mechanical connection is blocked	Adjust the mechanical structure
Drive hardware failure	Confirm that the mechanical part is normal and still alarm	Please return it to the dealer or the original factory for maintenance

AL.412: Motor overload (continuous maximum load)

Cause of fault alarm	Fault alarm check	Disposal measures
Continuous use beyond the rated load of the drive	It can be monitored through d13. oL.	Change the motor or reduce the load
Improper setting of control system parameters	1. Whether the mechanical system is installed 2. Acceleration setting constant is too fast 3. Whether gain parameters are set correctly	1. Adjust control loop gain 2. Acceleration and deceleration setting time slows down
Motor wiring error	Check U, V, W wiring	Correct wiring

AL.420: Over velocity

Cause of fault alarm	Fault alarm check	Disposal measures
Input velocity command too high	Check whether the input signal is normal with the signal detector	Adjust the frequency of the input signal
Over velocity determination parameter setting is incorrect	Check whether P04-05 (overvelocity alarm value) is set reasonably	Set P04-05 (overvelocity alarm value) correctly

AL.440: heatsink OT

Cause of fault alarm	Fault alarm check	Disposal measures
The internal temperature of the driver is higher than 95 ℃	Check whether the cooling condition of the drive is good	Improve the cooling condition of the drive. If there is any alarm again, please send the drive back to the original factory for maintenance

AL.501: Excessive position deviation

Cause of fault alarm	Fault alarm check	Disposal measures
Too large position deviation, too small parameter setting	Confirm the parameter setting of P03-15 (excessive position deviation setting)	Increase the setting value of P03-15 (position deviation is too large)
Gain value set too small	Confirm whether the gain parameters are set properly	Adjust the parameters of gain class correctly
Internal torque limit set too small	Confirm internal torque limiting amplitude	Correct internal torque limiter readjustment
Excessive external load	Check external load	Load reduction or high-power motor replacemen

AL.505: P command input pulse abnormal

Cause of fault alarm	Fault alarm check	Disposal measures
Pulse command frequency higher than	Check whether the input frequency is higher than the	Set the input pulse frequency correctly

rated input frequency	rated input frequency with pulse frequency detector	

AL.551：Home Return timeout fault

Cause of fault alarm	Fault alarm check	Disposal measures
Time out for home operation	Confirm whether the parameter P03-68 (maximum time limit for searching the origin) is reasonable	Set P03-68 correctly

AL.600：Encoder output power short circuit fault

Cause of fault alarm	Fault alarm check	Disposal measures
Encoder power wiring error	Check whether the encoder power supply + 5V and GND are connected reversely	Correct wiring

AL.610：Incremental encoder off line

Cause of fault alarm	Fault alarm check	Disposal measures
Incremental encoder HallU, HallV, HallW signal abnormal	Check encoder wiring	Correct wiring

iHSV-R/RC Integrated AC Servo Driving Motor

➢ Product Introductions

iHSV57/60-R/RC Integrated AC Servo Driving Motor is perfectly integrated AC servo drive into servo motor, adopts vector control in DSP chip, features in low cost, full closed loop, all digital, low heat, small vibration, and high response, as well as includes three adjustable feedback loop control modes(postition loop, velocity loop, and current loop).

The products are using CANopen and Modbus-RTU protocol, integrate AC servo motor which integrates advanced motor control algorithm, RS485 bus and CAN bus communication control technology.

This motor integrates CiA301 standard (CANopen communication protocol), Modbus-RTU communication protocol and CiA402 motion control protocol, compared with the traditional servo integrated motor with lower cost and more convenient installation, but also can effectively restrain the motor temperature rise, significantly to reduce the vibration of the motor and the wiring complexity of equipment.

The drive is compatible with the traditional stepping motor, convenient for customers to upgrade. These series integrate bus communication control technology, simple wiring, no losing step, lower heat, high velocity, big torque, low cost. It is a cost-effective motion control product.

➢ Technical Feature

- ✧ No lost step, accurate positioning
- ✧ 100% rated torque to drive the motor
- ✧ The built-in brake circuit can be connected with 24VDC power supply
- ✧ Download parameters via RS232C from PC or Text Display
- ✧ Support standard RS-485 and CAN bus
- ✧ Support standard Modbus-RTU protocol which can switch with CANopen protocol
- ✧ Follow the CSP/CSV/CST/PP/PV/PT/HM mode of CIA402 motion control protocol, easy to develop
- ✧ Built-in CW, CCW, SW IO input signal with 5V or 24V for the limit switch and homing
- ✧ A BREAK and PEND signal output signal
- ✧ RJ45 standard network connection, the slave through the twisted pair cable can be connected
- ✧ The maximum transmission frequency is 1Mbps, and the maximum transmission distance is up to 1KM
- ✧ Electro-rheology control technology, high efficiency
- ✧ User-defined subdivisions
- ✧ Compatible 1000 and 2500 pulses encoders
- ✧ No adjustment in general application
- ✧ Overcurrent, I2T, Over-voltage, Undervoltage, Overheat, Overvelocity, Overerror Protections.

➢ iHSV57/60/86-R/RC

1 Product introduction

1.1 Technical Index

Table 140 Performance of JMC IHSV57/60/86-R/RC Drive

IHSV57/60/86-R/RC Technical Index							
Input Voltage（VDC）		57mm		60mm		86mm	
		140W	180W	200W	400W	440W	660W
		36V		48V		72V	
Communication Type		CANopen /Modbus-RTU					
Communication Distance		RS485：1.2KM CAN：1KM					
Maximum Number of Slaves		RS485:32, CAN:128					
Maximum Communication rate		RS-485：115200bps CAN：1Mbps					
Protect		Overload I2t current action value of 300% 3S					
Environmental Conditions	Working Occasion	As far as possible to avoid dust, oil mist and corrosive gases					
	Working Temperature	0~+70℃					
	Storage Temperature	-20℃~+80℃					
	Working Humidity	40~90%RH					
	Cooling mode	Natural cooling or forced cold wind					

1.2 Naming Rules

<u>IHSV57</u> – <u>30</u> - <u>14</u> - <u>36</u> - <u>RC</u> - <u>XXX</u>

① ②③④⑤⑥⑦

① Series Name: IHSV：Integrated AC servo motor

② Motor frame: 57:57mm, 60:60mm, 86:86mm

③ Rated speed: 30:3000RPM

④ Rated power: 14:140W, 18:180W, 20:200W, 40:400W, 44:440W, 66:660W

⑤ Power supply voltage: 36:36VDC, 48:48VDC, 72:72VDC

⑥ Bus communication mode: R:RS485, RC:RS485+CAN, EC:EtherCAT

⑦ Product design No.: Special function module, default to standard model

2 Machine Dimension Diagrams

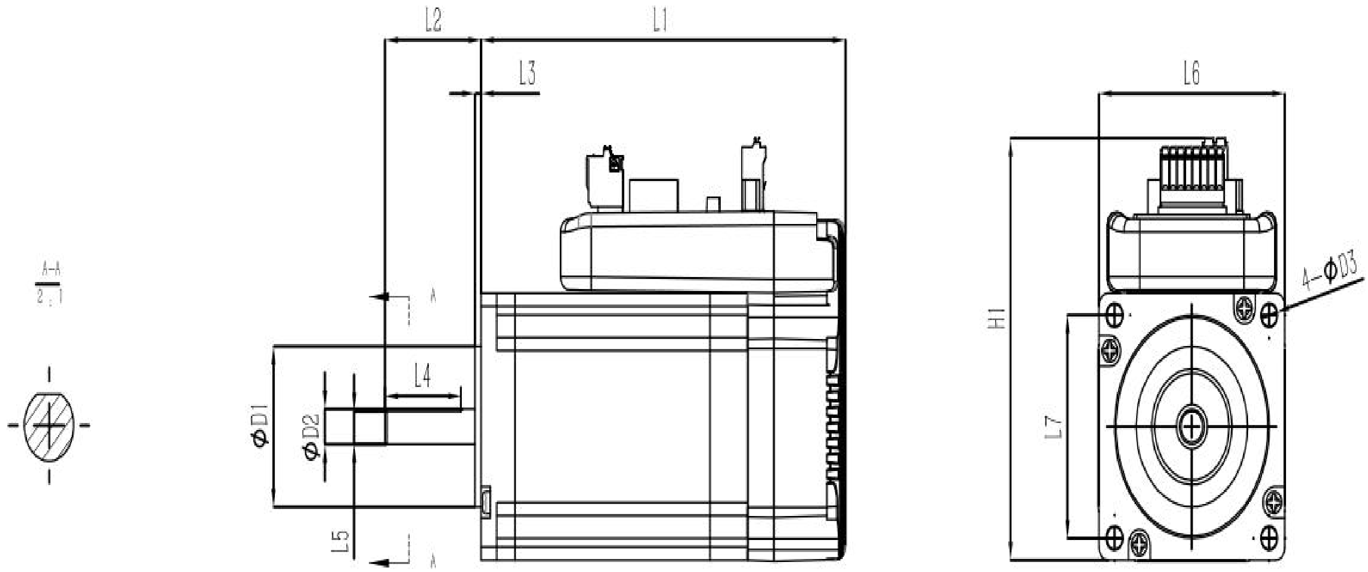


Figure 138 Machine dimension (unit: mm)

Table 141 Machine dimension of iHSV57/60-R/RC series

Model	L1 (mm)	L2 (mm)	L6 (mm)	L7 (mm)	D1 (mm)	D2 (mm)	H1 (mm)
IHSV57-30-14-36-R/RC	130	33	57	47	38	8	90
IHSV57-30-18-36-R/RC	150	33	57	47	38	8	90
IHSV60-30-20-48-R/RC	112	27	60	49.5	50	14	94
IHSV60-30-40-48-R/RC	142	27	60	49.5	50	14	94

Notice: the output shaft of standard 57/60 frame motor is flat with no key.

3 Ports and Connections Introduction

3.1 Power Signal Port

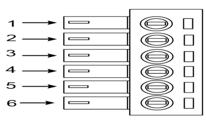


Figure 139 Power Interface port

Table 142 Power Interface port definition

Port	Symbol	Definition	Remark
1	DC+	DC power +	24~48VDC
2	GND	DC power -	

3.2 Control Signal Port

Table 143 Control Signal Port of JMC iHSV57/60-R/RC Drive

Port	Symbol	Definition	Remark

1	CW+	Clockwise Limit +	5V~24V
2	CW-	Clockwise Limit -	
3	HW+	Home Limit +	5V ~ 24V
4	HW-	Home Limit -	
5	CCW+	Counter Clockwise Limit +	5V ~ 24V
6	CCW-	Counter Clockwise Limit -	
7	BK+	External brake of input power +	24VDC
8	BK-	External brake of input power -	24VGND
9	PE+	Position signal output +	0~30VDC
10	PE-	Position signal output -	

3.3 Connections to Control Signal

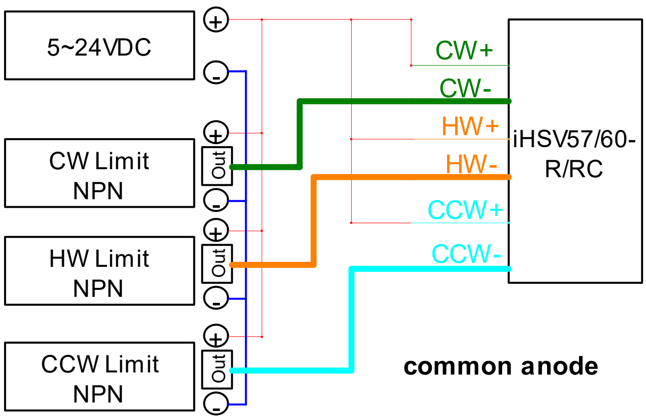


Figure 140 Connections to common anode

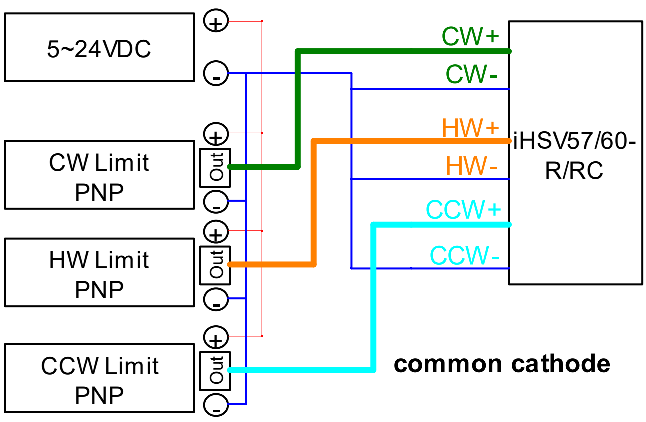


Figure 141 Connections to common cathode

Notice:The control signal level can be compatible with 5V and 24V.

3.4 Typical application wiring diagrams

A typical connection diagram made up of the IHSV57/60-R/RC drive as follow. The power supply selects DC24~48V according to the voltage level of the matched motor.

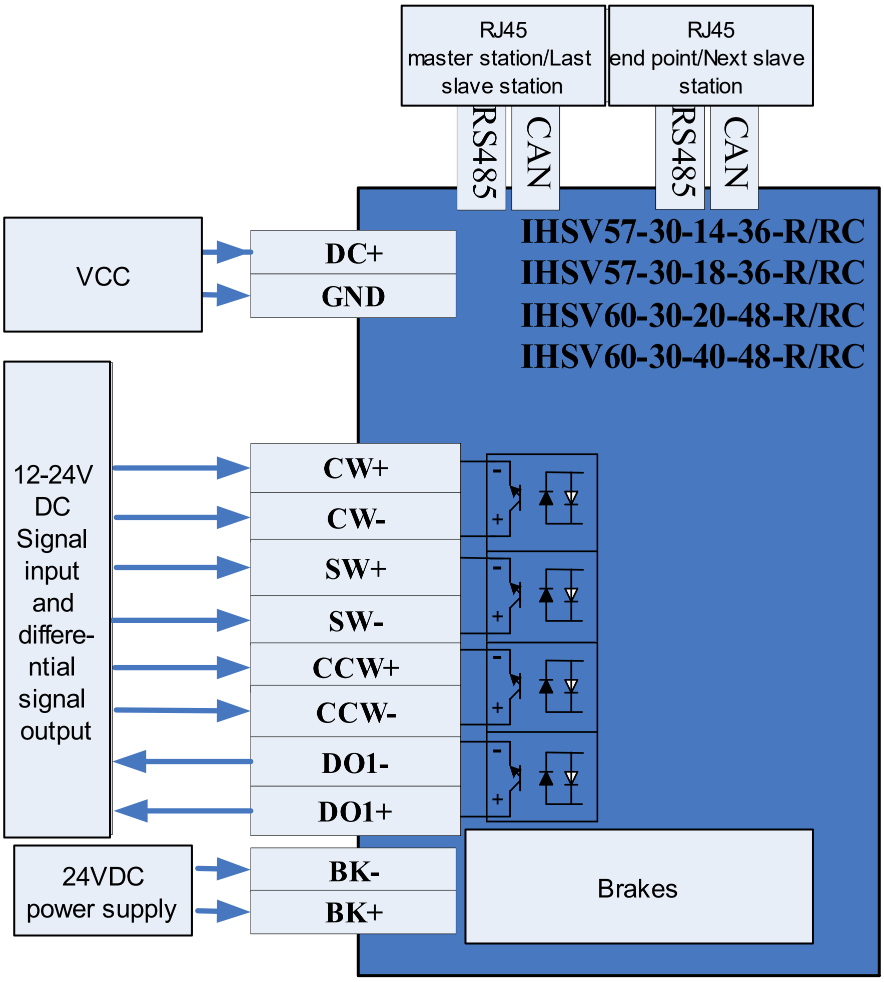


Figure 142 Typical application wiring diagram of JMC iHSV57/60-R/RC Drive

4 Rotary DIP Switch

4.1 Baud Rate Setting

The baud rate set for the CANopen communication and the RS-485 communication are set by the spin switch BD, which is set as follows:

Table 144 Baud Rate Setting of JMC iHSV57/60-R/RC Drive

Encoded value	Baud Rate of CAN (bps)	Baud Rate of RS-485 (bps)
0	12.5K	1200
1	20K	2400
2	50K	4800
3	100K	9600
4	125K	19200
5	250K	38400
6	500K	57600
7	1M	115200

4.2 Slave ID setting

The Slave ID is set up by the combination of a sub and parent switch, in which the S1 is a sub-switch, range of encoded value between 0x00~0x0f and the S2 is the parent-switch, range of encoded value between 0x00~0x07.The encoded value of S2 is the second in hexadecimal number(such as 7 at 0x7A). The encoded value of S1 is the first in hexadecimal number (such as A at 0x7A).

Slave ID = S2*16 + S1

The specific setting method can be seen in the "Quick Guides" in this section (Ctrl+ Mouse left or Click text to jump).

5 Adjustment Software

5.1 Connect To PC

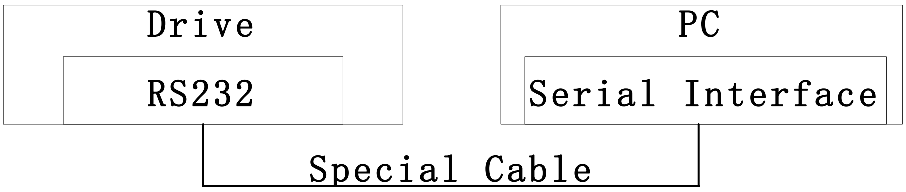


Figure 143 Connect to HISU

Notice:In case of causing any damage, please confirm the connection cables between Drive and PC before using it.

6 Failure Alarm

6.1 Alarm Signal Sequence

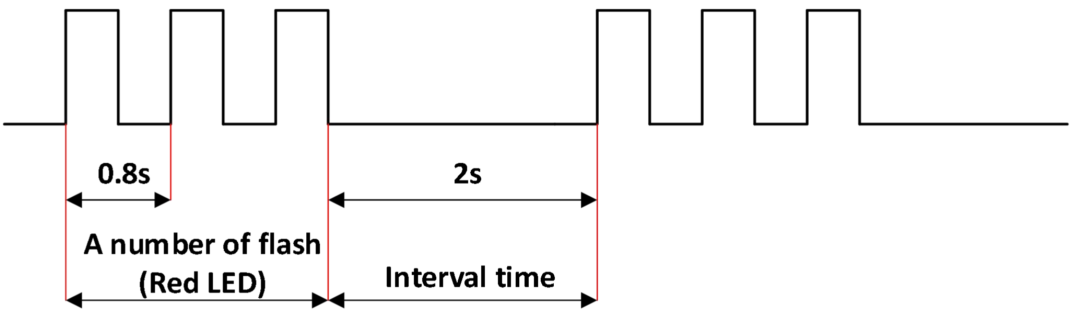


Figure 144 Alarm Signal Sequence

6.2 Failure Alarm Table

Table 145 Failure Alarm Table for JMC iHSV57/60-R/RC

A number of flashes		Description
Red	Green	
Off	Flicker	Drive CAN communication is unlinked

Off	On	Drive power up normally
1	On	Over current
2	On	Power supply under minimum
3	On	Power supply over maximum
4	On	Over position
5	On	Communication Error
6	On	CCWdirection limit
7	On	CWdirection limit
8	On	HWdirection limit
9	On	Drive encoder Error
10	On	Overload
11	On	EEPROM Write/Read Error
12	On	Electronic gear ratio setting Error
13	On	Power-on again after modify parameter
14	On	Current range Error

7 Quick Guides

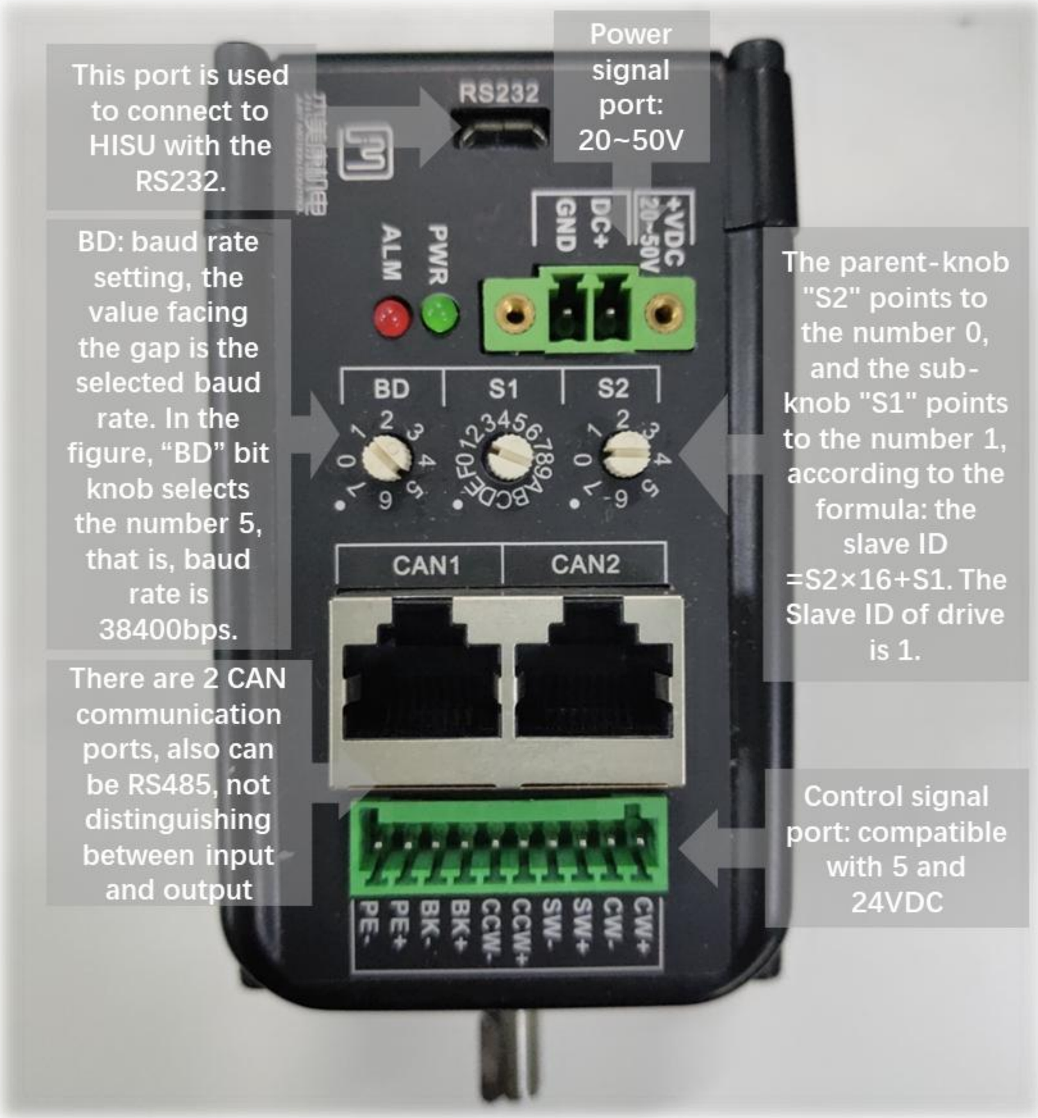


Figure 145 JMC iHSV57/60-R/RC Practicality

See "*Ports and Connections Introduction*" in this section for the specific definition of each port (Ctrl+ Mouse left or Click text to jump).

8 Drive Parameter Setting

- Open JmcServoPcControl and double - click to open the following window:

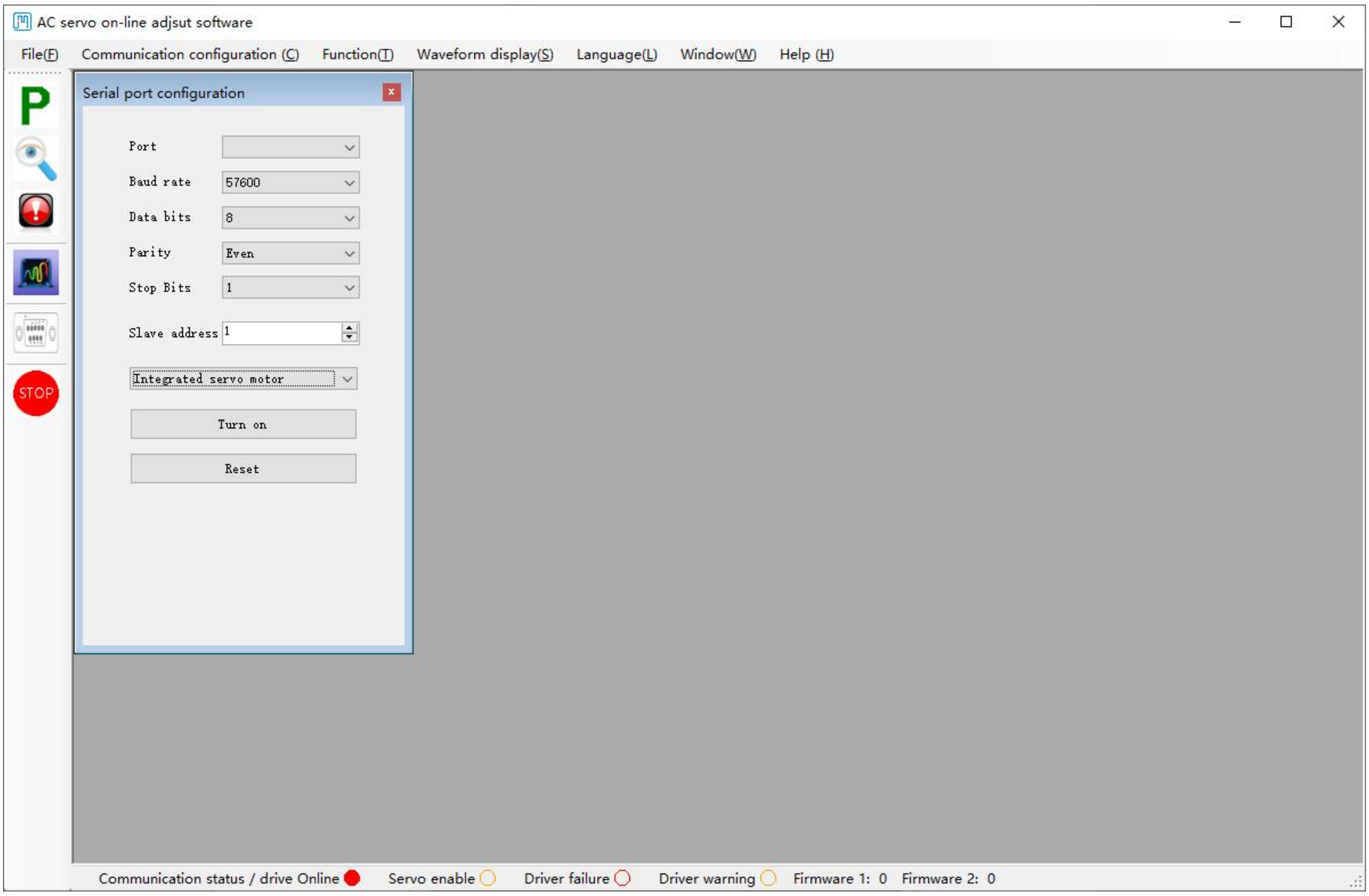


Figure 146 JmcServoPcControl

- In the pop-up dialog box, select the corresponding options and click Open. The operation is as follows:

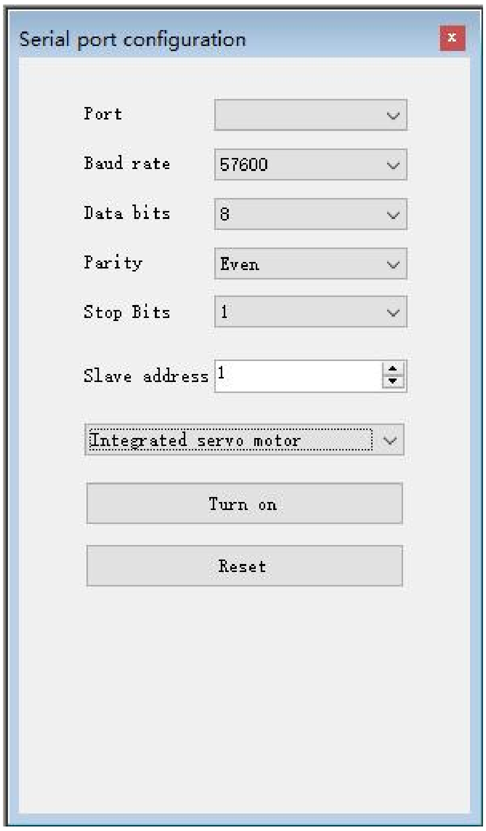


Figure 147 Serial port Settings

- After clicking open, if the communication is successful, it will be shown as follows:

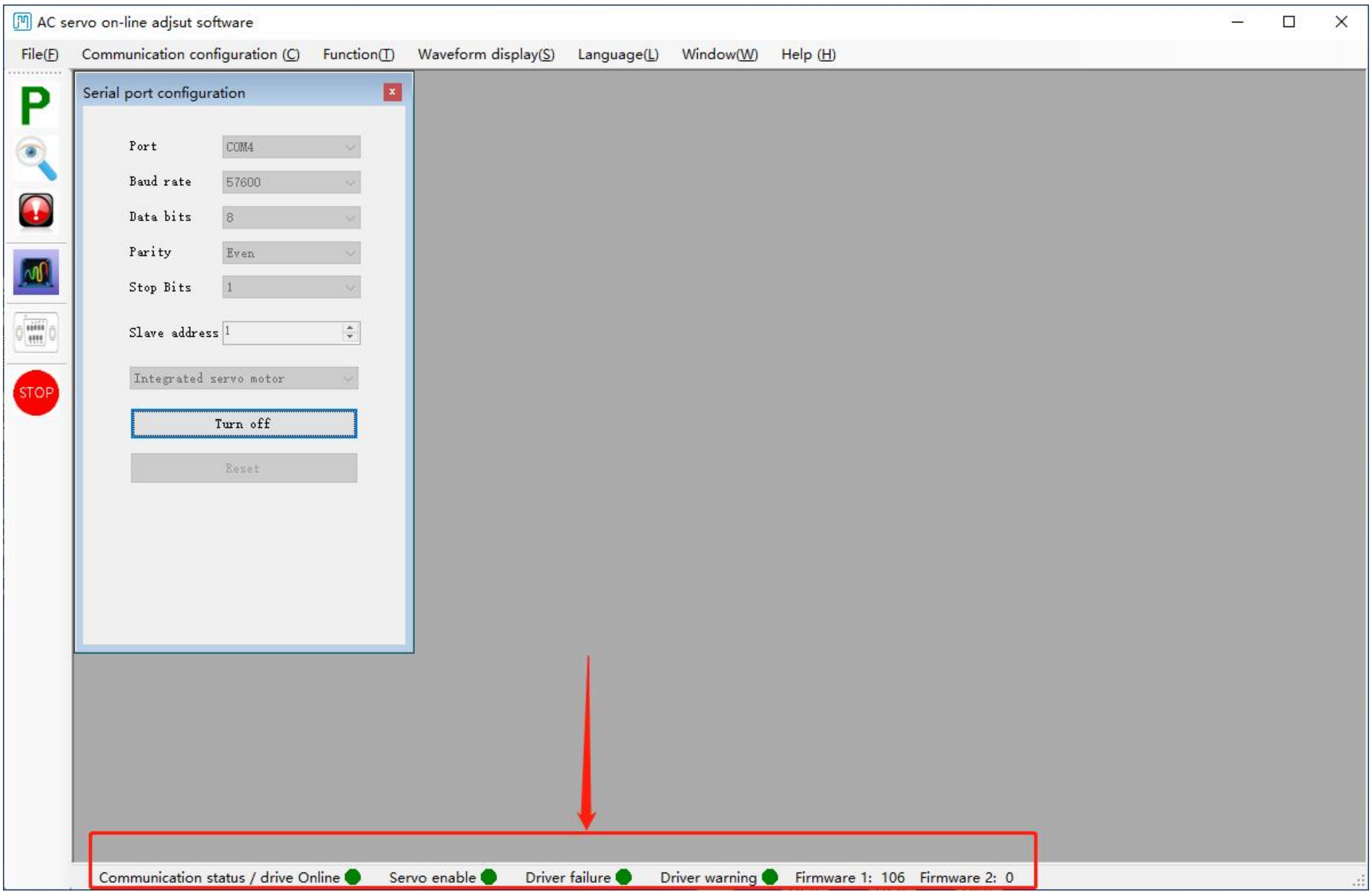


Figure 148 Successful software communication

Note: if the connection is not available, please confirm whether the COM port is selected correctly and whether the communication line is connected correctly. After confirmation, please reconnect according to the above steps.

- Click option [P] on the upper left, and the following window will pop up. Then the internal parameters of the drive will be uploaded automatically. After uploading, the user can change the parameters.

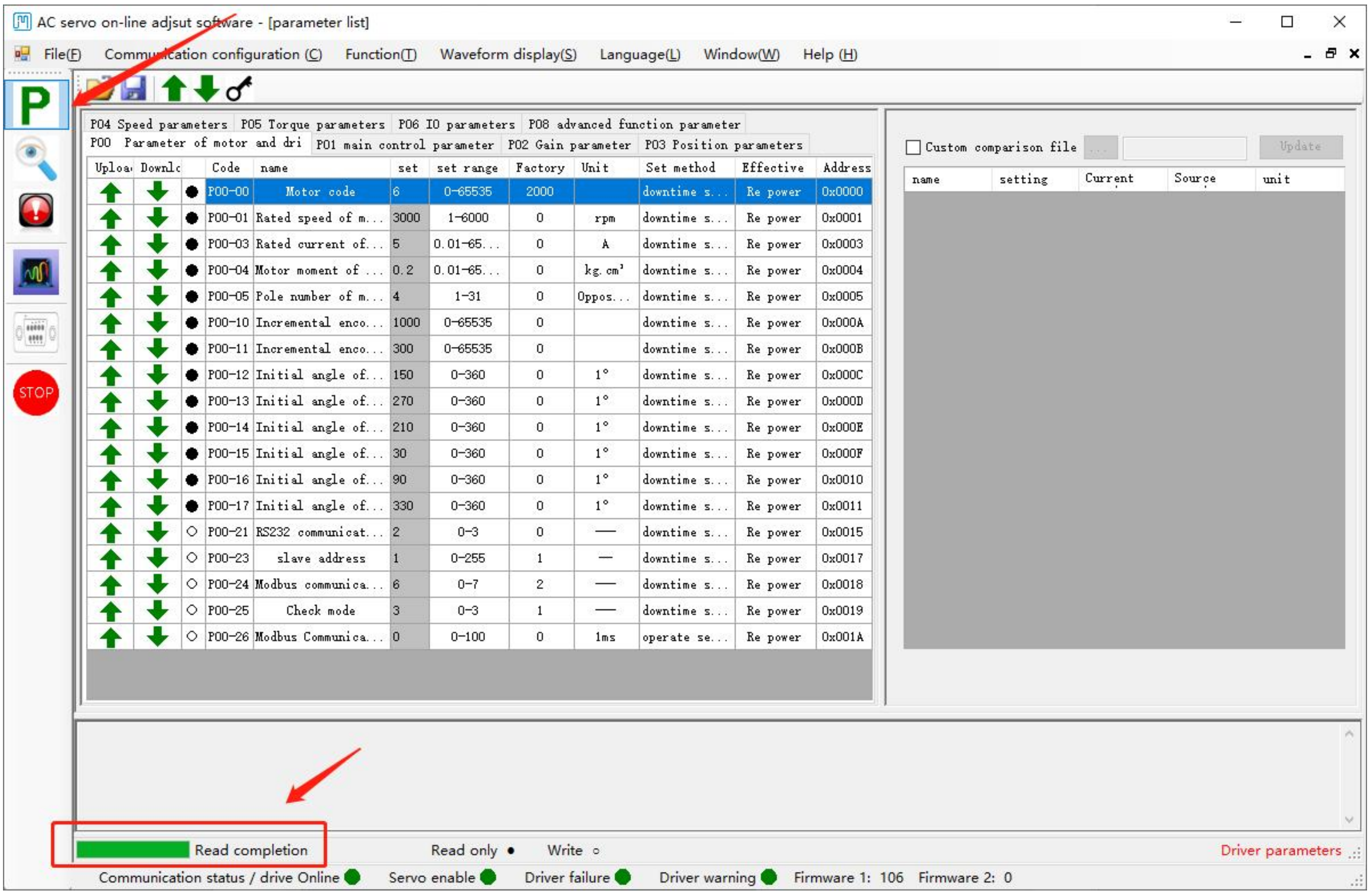


Figure 149 Parameter reading completed

Notice: P00-xx is the manufacturer arameters, which have been set and cannot be changed by the customer.

- Parameters are set according to the following three steps: modify → download → upload, as shown:

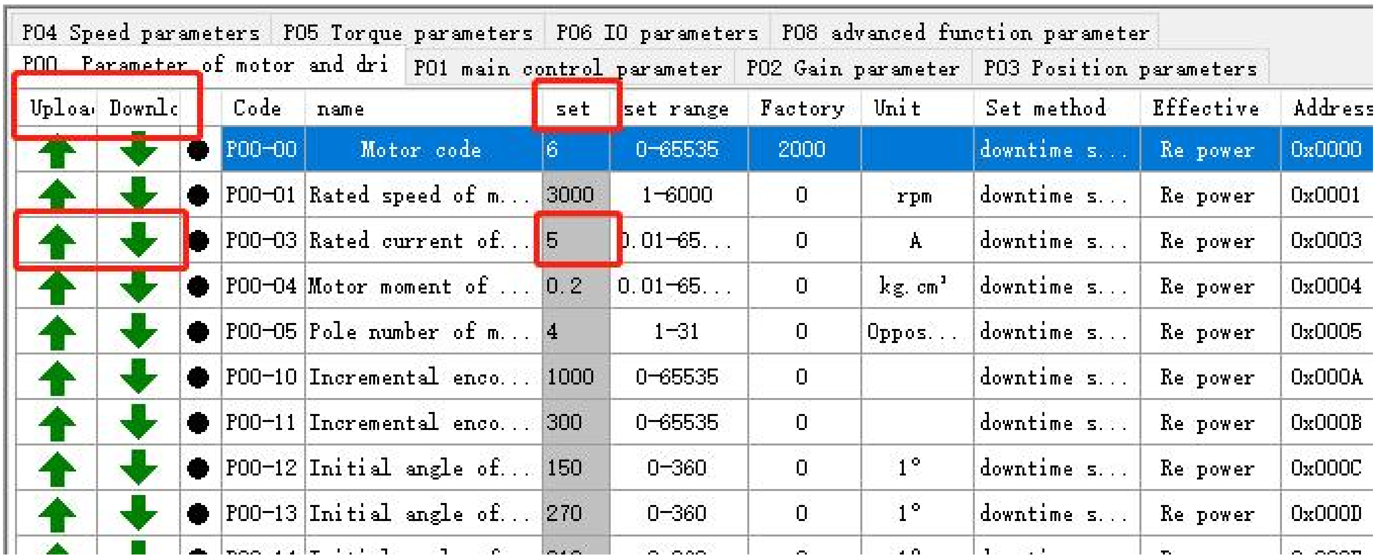


Figure 150 Parameter setting

Notice: After setting the corresponding parameters in the Settings, press the Download to download the changed parameters to the drive, and then press the Upload to upload the parameters to the soft to verify whether the parameters have been changed.

Notice: *The parameter all can be browsed on the software.*

9 Manual Gain Adjustment

When the automatic gain adjustment fails to achieve the desired effect, the gain can be adjusted manually to optimize the effect. The servo system is composed of three control loops. The basic control block diagram is as follows:

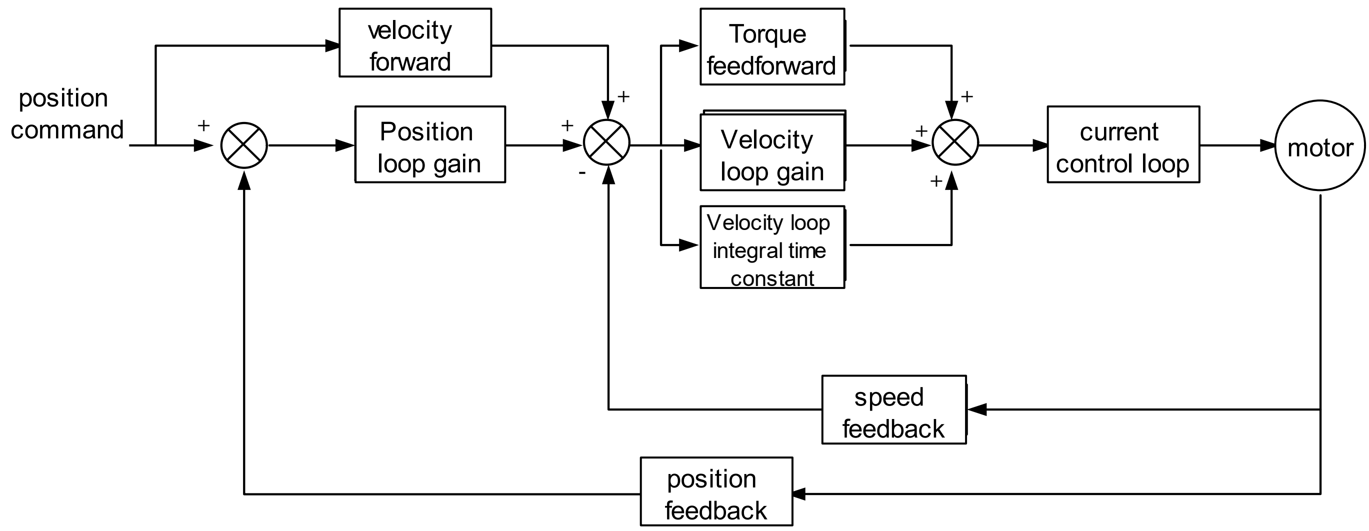


Figure 151 Servo control block diagram

The gain adjustment shall follow the order of first inner ring and then outer ring. Firstly, the load inertia ratio P01-04 shall be set, then the gain of velocity ring shall be adjusted, and finally the gain of position ring shall be adjusted.

Velocity ring gain: increase the setting value as much as possible without vibration or noise, which can improve the tracking performance of velocity and velocity up the positioning time.

Velocity integral constant: the smaller the setting value is, the faster the integral velocity will be, and the stronger the integral effect will be.

Table 146 Basic gain parameter

Parm	Name	Range	Dimension	Definition
P01-02	Adjust the mode automatically in real time	0-2	2	0：Manual adjustment。 1: Standard mode automatic adjustment。In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03. Manual adjustment of these parameters will not work.The following parameters are set by the user: P02-03 (velocity feedforward gain), P02-04 (velocity feedforward smoothing constant). 2：Positioning mode automatically adjusts rigidity.In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03. Manual adjustment of these parameters will not work.The following parameters will be fixed

				and cannot be changed: P02-03 (velocity feedforward gain) : 30.0% P02-04 (velocity feedforward smoothing constant) : 0.50
P01-03	Real-time automatic adjustmen t of rigid Settings	0-31	13	Built-in 32 gain class parameters that work when P01-02 is set to 1, or 2.Can be directly called according to the actual situation, the greater the set value, the stronger the rigidity.
P02-0 0	Position control gain 1	0-3000. 0	80.0	▸The higher the set value, the higher the gain, the greater the rigidity and the smaller the position lag. ▸Make the value as large as possible without oscillating. ▸For the gain at rest.
P02-01	Position control gain 2	0-3000.0	80.0	▸The higher the set value, the higher the gain, the greater the rigidity and the smaller the position lag. ▸ Make the value as large as possible without oscillating. ▸For the gain in motion.
P02-0 3	Velocity feedforwar d gain	0-100.0	30.0	The larger the parameter value, the smaller the tracking error and the faster the response.However, if the feedforward gain is too large, the position loop of the system will be unstable and prone to overshoot and shock.
P02-0 4	Velocity feedforwar d smoothing constant	0-64.00	0	This parameter is used to set the velocity loop feedforward filter time constant.The larger the value, the greater the filtering effect, but at the same time the phase lag increases.
P02-10	Velocity proportion al gain 1	1-2000.0	40.0	▸The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load. ▸Make the value as large as possible without oscillating. ▸For the gain at rest.
P02-11	Velocity integral constant 1	0.1-1000.0	10.0	▸ The velocity regulator integration time constant, the smaller the set value, the faster the integration velocity, the greater the stiffness, too small is easy to produce vibration, noise. ▸ Reduce this parameter as far as possible under the condition that the system does not oscillate. ▸This parameter is for steady-state response.
P02-12	Pseudo	0-100.0	100.0	▸When set to 100.0%, the velocity loop adopts

	differential feedforward control coefficient 1			PI control, and the dynamic response is fast.When set to 0, the velocity ring integral plays an obvious role in filtering low-frequency interference, but the dynamic response is slow. ▸By adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low frequency interference.
P02-13	Velocity proportional gain 2	1-2000.0	45.0	▸The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load. ▸Make the value as large as possible without oscillating. ▸For the gain in motion.
P02-14	Velocity integral constant 2	0.1-1000.0	1000.0	▸ The velocity regulator integration time constant, the smaller the set value, the faster the integration velocity, the greater the stiffness, too small is easy to produce vibration, noise. ▸ Reduce this parameter as far as possible under the condition that the system does not oscillate. ▸This parameter is for steady-state response.
P02-15	Pseudo differential feedforward control coefficient 2	0-100.0	100.0	▸When set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast.When set to 0, the velocity ring integral plays an obvious role in filtering low-frequency interference, but the dynamic response is slow. ▸By adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low frequency interference.

10 Parameters and Functions

10.1 List of Parameters

P00-xx represents the motor and driver parameters
P01-xx primary control parameters
P02-xx represents the gain class parameters
P03-xx represents the position parameter
P04-xx represents the velocity parameter
P05-xx represents torque parameters

P06-xx represents the I/O parameter
P08-xx represents advanced functional parameters

Table 147 List of parameters

type	Param-eter	Name	setting range	Factory Default	unit	plcethernet	time of taking effect
Motor and driver param-eters	P00-00	Motor number	0-65535	---		Halt On	power-on again
	P00-01	Motor rated rotating velocity	1-6000	---	rpm	Halt On	power-on again
	P00-02	rated motor toroue	0.01-655.35	---	N.M	Halt On	power-on again
	P00-03	motor rated current	0.01-655.35	---	A	Halt On	power-on again
	P00-04	Moment of inertia of motor	0.01-655.35	---	kg.cm²	Halt On	power-on again
	P00-05	Log of motor pole	1-31	---	P	Halt On	power-on again
	P00-10	Incremental encoder line count	0-65535	---		Halt On	power-on again
	P00-11	Incremental encoder Z pulse electrical Angle	0-65535	---		Halt On	power-on again
	P00-12	Initial angle of rotor 1	0-360	---	1°	Halt On	power-on again
	P00-13	Initial angle of rotor 2	0-360	---	1°	Halt On	power-on again
	P00-14	Initial angle of rotor 3	0-360	---	1°	Halt On	power-on again
	P00-15	Initial angle of rotor 4	0-360	---	1°	Halt On	power-on again
	P00-16	Initial angle of rotor 5	0-360	---	1°	Halt On	power-on again
	P00-17	Initial angle of rotor 6	0-360	---	1°	Halt On	power-on again
	P00-21	RS232Communication baud rate	0-3	2	---	Halt On	power-on again
	P00-23	From the station address	0-255	1	---	Halt On	power-on again
	P00-24	ModbusCommunication baud rate	0-7	7	---	Halt On	power-on again
	P00-25	verification mode	0-3	1	---	Halt On	power-on again
	P00-26	ModbusCommunication response delay	0-100	0	1ms	Runtime setting	power-on again

	P00-27	CANopen Communication baud rate	0-7	6	---	Runtime setting	Power-on again
	P00-42	Overvoltage protection threshold	0-300	0	1V	Halt On	power-on again
Main control param-eter	P01-01	Control mode setting	0-6	0	---	Halt On	With imme-diate effect
	P01-02	Adjust the mode automatically in real time	0-2	1	---	Runtime setting	With imme-diate effect
	P01-03	Real-time automatic adjustment of rigid Settings	0-31	13	---	Runtime setting	With imme-diate effect
	P01-04	Moment of inertia ratio	0-100.00	1	multiple	Runtime setting	With imme-diate effect
	P01-30	The brake instruction - servo OFF delay time (Brake open delay)	0-255	100	1ms	Runtime setting	With imme-diate effect
	P01-31	The velocity limit of the output of the brake command	0-3000	100	1rpm	Runtime setting	With imme-diate effect
	P01-32	Wait time of servo OFF brake instruction	0-255	100	1ms	Runtime setting	With imme-diate effect
Gain type param-eters	P02-00	Position control gain 1	0-3000.0	48.0	1/S	Runtime setting	With imme-diate effect
	P02-01	Position control gain 2	0-3000.0	57.0	1/S	Runtime setting	With imme-diate effect
	P02-03	Velocity feedforward gain	0-100.0	30.0	1.0%	Runtime setting	With imme-diate effect
	P02-04	Velocity feedforward smoothing constant	0-64.00	0.5	1ms	Runtime setting	With imme-diate effect
	P02-10	Velocity proportional gain 1	1.0-2000.0	27.0	1Hz	Runtime setting	With imme-diate effect
	P02-11	Velocity integral constant 1	0.1-1000.0	10.0	1ms	Runtime setting	With imme-diate effect
	P02-12	Pseudo differential	0-100.0	100.0	1.0%	Runtime	With

		feedforward control coefficient 1				setting	imme-diat e effect
	P02-13	Velocity proportional gain 2	1.0-2000.0	27.0	1Hz	Runtime setting	With imme-diat e effect
	P02-14	Velocity integral constant 2	0.1-1000.0	1000.0	1ms	Runtime setting	With imme-diat e effect
	P02-15	Pseudo differential feedforward control coefficient 2	0-100.0	100.0	1.0％	Runtime setting	With imme-diat e effect
	P02-19	Torque feedforward gain	0-30000	0	1.0％	Runtime setting	With imme-diat e effect
	P02-20	Torque feedforward smoothing constant	0-64.00	0.8	1ms	Runtime setting	With imme-diat e effect
	P02-30	Gain switching mode	0-10	0	---	Runtime setting	With imme-diat e effect
	P02-31	Gain switching level	0-20000	800	---	Runtime setting	With imme-diat e effect
	P02-32	Gain switching hysteresis	0-20000	100	---	Runtime setting	With imme-diat e effect
	P02-33	Gain switching delay	0-1000.0	10.0	1ms	Runtime setting	With imme-diat e effect
	P02-34	Position gain switching time	0-1000.0	10.0	1ms	Runtime setting	With imme-diat e effect
	P02-41	Mode switch level	0-20000	10000	---	Runtime setting	With imme-diat e effect
	P02-50	Added value of torque command	-100.0-100. 0	0	1.0％	Runtime setting	With imme-diat e effect
	P02-51	Forward torque compensation	-100.0-100. 0	0	1.0％	Runtime setting	With imme-diat e effect
	P02-52	Reverse torque compensation	-100.0-100. 0	0	1.0％	Runtime setting	With imme-diat e effect
locatio n	P03-00	Location command source	0-1	0	---	Halt On	With imme-diat

param-eter							e effect
	P03-03	Command pulse reversal	0-1	0	---	Halt On	With imme-diate effect
	P03-04	Position pulse filtering	0-3	2	---	Runtime setting	With imme-diate effect
	P03-05	Judgment conditions for positioning completion	0-2	1	---	Runtime setting	With imme-diate effect
	P03-06	Positioning complete range	0-65535	30	Encoder unit	Runtime setting	With imme-diate effect
	P03-09	The number of instruction pulses per turn of the motor	0-65535	4000	Pulse	Runtime setting	power-on again
	P03-10	Molecule of electronic gear 1	1-65535	4000	---	Runtime setting	power-on again
	P03-11	Denominator of electronic gear 1	1-65535	4000	---	Runtime setting	power-on again
	P03-15	Excessive position deviation setting	0-65535	0	Comma-nd unit *10	Runtime setting	With imme-diate effect
	P03-16	Position command smoothing filter time	0-1000.0	0	1ms	Runtime setting	With imme-diate effect
Velocity param-eter	P04-00	Velocity command source	0-1	1	---	Halt On	With imme-diate effect
	P04-01	Reverse velocity command analog quantity	0-1	0	---	Halt On	With imme-diate effect
	P04-02	Given value of digital velocity	-6000—6000	0	1rpm	Runtime setting	With imme-diate effect
	P04-05	Overvelocity alarm value	0-6500	6400	1rpm	Runtime setting	With imme-diate effect
	P04-06	Forward velocity limit	0-6000	5000	1rpm	Runtime setting	With imme-diate effect
	P04-07	Reverse velocity limit	0-6000	-5000	1rpm	Runtime setting	With imme-diate effect
	P04-10	Zero velocity	0-200.0	40	1rpm	Runtime	With

		detection value				setting	imme-diat e effect
	P04-14	Acceleration time	0-10000	500	1ms/ 1000 rpm	Runtime setting	With imme-diat e effect
	P04-15	Deceleration time	0-10000	500		Runtime setting	With imme-diat e effect
Torque param-eter	P05-10	Internal forward torque limiting amplitude	0-300.0	200.0	1.0%	Runtime setting	With imme-diat e effect
	P05-11	Internal reverse torque limiting amplitude	0-300.0	200.0	1.0%	Runtime setting	With imme-diat e effect
I/O param-eter	P06-00	Enable input port effective level	0-4	1	---	Runtime setting	power-on again
	P06-20	Alarm output port effective level	0-1	1	---	Runtime setting	power-on again
	P06-22	Effective level of output port in place	0/1	1	---	Runtime setting	power-on again
Advan-ced functio n param-eters	P08-19	Feedback velocity low pass filter constant	0-25.00	0.8	1ms	Runtime setting	With imme-diat e effect
	P08-20	Torque command filter constant	0-25.00	0.84	1ms	Runtime setting	With imme-diat e effect
	P08-25	Disturbance torque compensation gain	0-100.0	0	%	Runtime setting	With imme-diat e effect
	P08-26	Time constant of disturbance torque filtering	0-25.00	0.8	1ms	Runtime setting	With imme-diat e effect

10.2 Parameter Analysis Description

10.2.1 P00-xx Motor and driver parameters

Table 148 P00-xx Motor and driver parameters

Parameter code	Name	Explain
P00-00	Motor number	Factory has been set, there is no need to set 0：P0-01 to P0-17 works
P00-01	Motor rated rotating velocity	Setting range：1-6000，unit：rpm Factory has been set, there is no need to set
P00-02	Rated motor toroue	Setting range：0.01-655.35，unit：N.M Factory has been set, there is no need to set
P00-03	Motor rated current	Setting range：0.01-655.35，unit：A

		Factory has been set, there is no need to set
P00-04	Moment of inertia of motor	Setting range：0.01-655.35，unit：$kg.cm^2$ Factory has been set, there is no need to set
P00-05	Log of motor pole	Setting range：1-31，unit：P Factory has been set, there is no need to set
P00-10	Incremental encoder line count	Factory has been set, there is no need to set
P00-11	Incremental encoder Z pulse electrical Angle	Factory has been set, there is no need to set
P00-12	Initial angle of rotor 1	Factory has been set, there is no need to set
P00-13	Initial angle of rotor 2	Factory has been set, there is no need to set
P00-14	Initial angle of rotor 3	Factory has been set, there is no need to set
P00-15	Initial angle of rotor 4	Factory has been set, there is no need to set
P00-16	Initial angle of rotor 5	Factory has been set, there is no need to set
P00-17	Initial angle of rotor 6	Factory has been set, there is no need to set
P00-21	RS232 Communication baud rate	Setting range：0-3 Select the baud rate when communicating with PC 0：9600 1：19200 2：57600 3：115200
P00-23	From the station address	Setting range：0—255，default 1 Set according to equipment requirements
P00-24	Modbus Communication baud rate	Setting range：0-7，default 2 0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200
P00-25	Verification mode	Setting range：0-3，default 1 0：NONE，2 stop bit 1：Even parity check，1 stop bit 2：Odd parity check，1 stop bit 3：NONE，1 stop bit
P00-26	Modbus Communication response delay	Setting range：0-100，unitms
P00-27	CANopen Communication baud rate	Set the baud rate of CAN bus 0：12.5KHz 1：120KHz 2：20KHz 3：100KHz 4：125KHz

<table>
<tr><td></td><td></td><td>5：250KHz
6：500KHz
7：1000KHz</td></tr>
<tr><td>P00-42</td><td>Overvoltage protection threshold</td><td>Setting range：0-300，unitV</td></tr>
</table>

10.2.2 P01-xx Main control parameter

Table 149 P02-xx Main control parameter

<table>
<tr><th>Parameter code</th><th>Name</th><th>Explain</th></tr>
<tr><td>P01-01</td><td>Control mode setting</td><td>Setting range：0-6
0：Position control mode
1：Velocity control mode
2：Torque control mode
3：Velocity, torque control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to switch the control mode.
<table>
<tr><td>Terminal logic</td><td>Control mode</td></tr>
<tr><td>Effective</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Torque mode</td></tr>
</table>
4：Position and velocity control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to switch the control mode.
<table>
<tr><td>Terminal logic</td><td>Control mode</td></tr>
<tr><td>Effective</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Velocity mode</td></tr>
</table>
5：Position, torque control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to switch the control mode.
<table>
<tr><td>Terminal logic</td><td>Control mode</td></tr>
<tr><td>Effective</td><td>Position mode</td></tr>
</table>
</td></tr>
</table>

		Invalid / Torque mode 6：whole-close-loop
P01-02	Adjust the mode automatically in real time	Setting range：0-2 0：Manual adjustment。 1： Standard mode automatic adjustment 。 In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03. Manual adjustment of these parameters will not work. The following parameters are set by the user: P02-03 (velocity feedforward gain), P02-04 (velocity feedforward smoothing constant). 2：Positioning mode automatically adjusts rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03. Manual adjustment of these parameters will not work. The following parameters will be fixed and cannot be changed: P02-03 (velocity feedforward gain): 30.0% P02-04 (velocity feedforward smoothing constant): 0.50
P01-03	Real-time automatic adjustment of rigid Settings	Setting range：0-31 Built-in 32 gain class parameters that work when P01-02 is set to 1, or 2. Can be directly called according to the actual situation, the greater the set value, the stronger the rigidity.
P01-04	Moment of inertia ratio	Setting range：0-100，unit：Multiple Set the load inertia ratio of the corresponding motor as follows: P01-04= load inertia/motor inertia This inertia ratio can use the value identified by AF-J-L automatic inertia to write the identified value into the parameter
P01-30	The brake instruction - servo OFF delay time (Brake open delay)	Setting range：0-255，unit：ms When enabling: after the enabling command is executed, the driver will receive the position command after the time of P01-30. When closing enabling: when the motor is in the static state, the time from the closing enabling command to the time when the motor becomes non energized after the holding brake is closed.
P01-31	The velocity limit of the output of the	Setting range：0-3000，unit：rpm Motor velocity threshold when the holding brake

	brake command	output is valid when the motor is in rotation state. Below this threshold, the holding brake output command is valid, otherwise, the holding brake output command will be valid after waiting for P01-32 time.
P01-32	Wait time of servo OFF brake instruction	Setting range：0-255，unit：ms The maximum waiting time of holding brake output when the motor is in rotation state.

10.2.3 P02-xx Gain type parameter

Table 150 P02-xx Gain type parameter

Parameter code	Name	Explain
P02-00	Position control gain 1	Setting range：0-3000.0，unit：1/S ‣ For the proportional gain of the position ring regulator, the larger the parameter value, the higher the gain ratio, the larger the stiffness, the smaller the position tracking error, and the faster the response. However, if the parameters are too large, vibration and overshoot are easily caused. ‣ This parameter is for steady-state response.
P02-01	Position control gain 2	Setting range：0-3000.0，unit：1/S ‣ For the proportional gain of the position ring regulator, the larger the parameter value, the higher the gain ratio, the larger the stiffness, the smaller the position tracking error, and the faster the response. However, if the parameters are too large, vibration and overshoot are easily caused. ‣ This parameter is for dynamic response.
P02-03	Velocity feedforward gain	Setting range：0-100.0，unit：1.0% The larger the parameter value, the smaller the tracking error and the faster the response. However, if the feedforward gain is too large, the position loop of the system will be unstable and prone to overshoot and shock.
P02-04	Velocity feedforward smoothing constant	Setting range：0-64.00，unit：ms This parameter is used to set the velocity loop feedforward filter time constant. The larger the value, the greater the filtering effect, but at the same time the phase lag increases.
P02-10	Velocity proportional gain 1	Setting range：1.0-2000.0，unit：Hz ‣The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load. ‣ Make the value as large as possible without oscillating. ‣For the gain at rest.

P02-11	Velocity integral constant 1	Setting range：1.0-1000.0，unit：ms ▸The velocity regulator integration time constant, the smaller the set value, the faster the integration velocity, the greater the stiffness, too small is easy to produce vibration, noise. ▸Reduce this parameter as far as possible under the condition that the system does not oscillate. ▸This parameter is for steady-state response.
P02-12	Pseudo differential feedforward control coefficient 1	Setting range： 0-100.0，unit：1.0% ▸When set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast.When set to 0, the velocity ring integral plays an obvious role in filtering low-frequency interference, but the dynamic response is slow. ▸By adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low frequency interference.
P02-13	Velocity proportional gain 2	Setting range：1.0-2000.0，unit：Hz ▸The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load. ▸ Make the value as large as possible without oscillating. ▸For the gain in motion.。
P02-14	Velocity integral constant 2	Setting range：1.0-1000.0，unit：ms ▸The velocity regulator integration time constant, the smaller the set value, the faster the integration velocity, the greater the stiffness, too small is easy to produce vibration, noise. ▸Reduce this parameter as far as possible under the condition that the system does not oscillate. ▸This parameter is for steady-state response.
P02-15	Pseudo differential feedforward control coefficient 2	Setting range：0-100.0，unit：1.0% ▸When set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast.When set to 0, the velocity ring integral plays an obvious role in filtering low-frequency interference, but the dynamic response is slow. ▸By adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low frequency interference.
P02-19	Torque feedforward gain	Setting range：0-30000，unit：1.0% Set the weighted value of current loop feedforward. This parameter weighted the differential of the velocity instruction and added the current loop.

<table>
<tr><td>P02-20</td><td>Torque feedforward smoothing constant</td><td>Setting range：0-64.00，unit：ms
This parameter is used to set the torque feedforward filter time constant.</td></tr>
<tr><td>P02-30</td><td>Gain switching mode</td><td>Setting range：0-10
Set the conditions for the first and second gain switching
<table>
<tr><td>value</td><td>Switching condition s</td><td>Remarks</td></tr>
<tr><td>0</td><td>Fixed as first gain</td><td>P02-00、P02-10、P02-11、P02-12</td></tr>
<tr><td>1</td><td>Fixed as second gain</td><td>P02-01、P02-13、P02-14、P02-15</td></tr>
<tr><td>2</td><td>Switch with DI input</td><td>DI port should be set to 9 (gain switching input)
Invalid: first gain
Effective: second gain</td></tr>
<tr><td>3</td><td>Large torque command</td><td>Switch to second gain when torque command is greater than threshold (determined by P02-31 and P02-32). When less than the threshold and more than the P02-33 delay setting, switch to the first gain.</td></tr>
<tr><td>4</td><td>Velocity command changes a lot</td><td>When the velocity instruction change is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.</td></tr>
<tr><td>5</td><td>High velocity command</td><td>When the velocity command is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.</td></tr>
</table></td></tr>
</table>

		6	Large position deviation	Switch to the second gain when the position deviation is greater than the threshold (determined by P02-31 and P02-32). When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.
		7	Location instruction	Switch to the second gain when there is a position command. When the position command ends and the delay setting of P02-33 is exceeded at the same time, switch to the first gain.
		8	Positioning incomplete	Switch to the second gain when the positioning is not completed. When the positioning is completed and the delay setting of P02-33 is exceeded, switch to the first gain.
		9	High actual velocity	When the actual velocity is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.
		10	Position command + actual velocity	Switch to the second gain when there is a position command. When there is no position command and the actual velocity is less than the threshold (determined by P02-31 and P02-32), and the delay setting of P02-33 is exceeded at the same time, switch to the first gain.
P02-31	Gain switching level	Setting range：0-20000 Judging threshold value in gain switching.		

		Torque unit：1000bit=25%Rated torque Velocity unit：1000bit=200 rpm/min Position unit：131072biteach circle
P02-32	Gain switching hysteresis	Setting range：0-20000 Hysteresis level in gain switching Torque unit：1000bit=25%Rated torque Velocity unit：1000bit=200 rpm/min Position unit：131072biteach circle
P02-33	Gain switching delay	Setting range：0-1000.0，unit：ms When switching from the second gain to the first gain, the time from the trigger condition to the actual switching.
P02-34	Position gain switching time	Setting range：0-1000.0，unit：ms Time for position control gain 1 to smoothly switch to position control gain 2.
P02-41	Mode switch level	Setting range：0-20000 Set the threshold value of switching. Torque unit：1000bit=25%Rated torque Velocity unit：1000bit=200 rpm/min Position unit：131072biteach circle
P02-50	Added value of torque command	Setting range：-100.0-100，unit：1.0% Valid in position control mode. This value is added to the torque given value for static torque compensation of vertical axis.
P02-51	Forward torque compensation	Setting range：-100.0-100.0，unit：1.0% Valid in position control mode. Used to compensate for positive static friction.
P02-52	Reverse torque compensation	Setting range：-100.0-100.0，unit：1.0% Valid in position control mode. Used to compensate for negative static friction.

10.2.4 P03-xx Position Parameter

Table 151 P03-xx Position parameter

Parameter code	Name	Explain
P03-00	Location command source	0：impulsbefehl 1：Number given,Used for communication control.
P03-03	Command pulse reversal	Used to adjust the counting direction of pulse command. 0：normal. 1：Direction reversal.
P03-04	Position pulse filtering	Setting range：0-3，unit：us 0：0.1us。 1：0.4us

		2：0.8us。 3：1.6us
P03-05	Judgment conditions for positioning completion	0：Output when the position deviation is less than the set value of P03-06. 1：Output when the position setting is completed and the position deviation is less than the set value of P03-06. 2：Output when the position setting is completed (after filtering) and the position deviation is less than the set value of P03-06.
P03-06	Positioning complete range	Setting range：0-65535，unit：Encoder unit Use to set the threshold value for locating the completion output. If the incremental encoder motor is used, the number of encoder lines *4 shall be calculated for each turn.
P03-09	The number of instruction pulses per turn of the motor	Setting range：0-65535 Used to set the number of command pulses for one revolution of motor. When this parameter is set to 0, parameters P03-10 and P03-11 are valid.
P03-10	Molecule of electronic gear 1	Calculation formula of electronic gear ratio of incremental motor: *G=member/denominator=C*4/P* *C: Number of encoder lines;* *P: Input the number of pulses per revolution* *For example: the number of encoder lines is 2500;* *the number of input pulses per revolution is 3200;* *calculate the electronic gear ratio?* *G=C*4/P=2500*4/3200=10000/3200=25/8*
P03-11	Denominator of electronic gear 1	
P03-15	Excessive position deviation setting	Setting range：0-65535，unit：指令 unit*10 Set the pulse number of allowable deviation, and an alarm will be given if it exceeds the set value. Example: set value 20, when the following deviation exceeds 20 * 10, the driver will alarm **AL.501** (position deviation is too large)
P03-16	Position command smoothing filter time	Setting range：1000，unit：ms Set the time constant of the position command smoothing filter.

10.2.5 P04-xx Velocity parameter

Table 152 P04-xx Velocity parameter

Parameter code	Name	Explain
P04-00	Velocity command source	0: external analog command 1: Digital command (parameter setting) 2: Digital command (Communication) 3: Internal multiple groups of instructions
P04-01	Reverse velocity command analog quantity	Used to adjust the polarity relationship of analog quantity 0: normal

		1: Polarity reversal
P04-02	Given value of digital velocity	Setting range：-6000—6000，unit：rpm When P04-00 is set to 1, P04-02 is the velocity control setting value
P04-05	Overvelocity alarm value	Setting range：0-6500，unit：rpm Set the allowable maximum velocity value. If it exceeds the set value, **AL.420** overvelocity alarm will be given
P04-06	Forward velocity limit	Setting range：0-6000，unit：rpm Limit motor forward velocity value
P04-07	Reverse velocity limit	Setting range：0-6000，unit：rpm Limit motor reverse velocity value
P04-10	Zero velocity detection value	Setting range：0-200.0，unit：rpm Set the threshold value of zero velocity detection, when the motor velocity is lower than the threshold value, **"motor zero velocity output"** signal can be output through the output port
P04-14	Acceleration time	Setting range：0-10000，unit：1ms/1000rpm Set acceleration for velocity control
P04-15	Deceleration time	Setting range：0-10000，unit：1ms/1000rpm Set deceleration at velocity control

10.2.6 P05-xx Torque parameter

Table 153 P05-xx Torque parameter

Parameter code	Name	Explain
P05-10	Internal forward torque limiting amplitude	Setting range：0-300.0，unit：1.0% Limit the forward output of the motor, 100 represents 1 time of torque, 300 represents 3 times of torque. When the torque output reaches the limit value, the output signal can be detected through the do port output torque limit.
P05-11	Internal reverse torque limiting amplitude	Setting range：0-300.0，unit：1.0% Limit the reverse output of the motor, 100 represents 1 time of torque, 300 represents 3 times of torque. When the torque output reaches the limit value, the output signal can be detected through the do port output torque limit.

10.2.7 P06-xx I/O parameter

Table 154 P06-xx I/Oparameter

Parameter code	Name	Explain
P06-00	Enable input port effective level	Setting range：0-1，Factory settings：1

P06-20	Alarm output port effective level	Setting range：0-1，Factory settings：1
P06-22	Effective level of output port in place	Setting range：0-1，Factory settings：1

10.2.8 P08-xx Advanced function parameters

Table 155 P08-xx Advanced function parameters

Parameter code	Name	Explain
P08-19	Feedback velocity low pass filter constant	Setting range：0-25.00，unit：ms The time constant of the low-pass filter of the feedback velocity can be properly set to a large value when the motor squeaks during operation.
P08-20	Torque command filter constant	Setting range：0-25.00，unit：ms The filtering time constant of torque command can be properly set to a large value when the motor is howling during operation.
P08-25	Disturbance torque compensation gain	Setting range：0-100.0 Gain coefficient of disturbance torque observation value. The larger the value is, the stronger the anti disturbance torque ability is, but the action noise may also increase.
P08-26	Time constant of disturbance torque filtering	Setting range：0-25.00，unit：ms The larger the value is, the stronger the filtering effect is, and the action noise can be suppressed. However, excessive phase delay will affect the restraining effect of disturbance torque.

10.3 List of Monitoring Items

Table 156 List of monitoring items

Displaying Serial Number	Display Item	Explain	Unit
d00.C. PU	Sum of position command pulses	This parameter can monitor the number of pulses sent by the user to the servo driver to confirm whether there is pulse loss.	Instruction unit
d01.F. PU	Describe the sum of position feedback pulses	This parameter can monitor the number of pulses fed back by the servo motor. The unit is the same as the unit of user input instruction.	Instruction unit
d02.E. PU	Number of position deviation pulses	This parameter can monitor the pulse number of position lag during servo system operation. The unit is the same as the unit of user input instruction.	Instruction unit

d03.C.PE	Position given pulse sum / Gantry machine feedback pulse	This parameter can monitor the number of pulses sent by the user to the servo driver. Unit: when absolute motor is used, it is calculated as 131072bit per turn. If incremental encoder motor is used, the number of encoder lines * 4 shall be calculated for each turn.	Encoder unit/ Instructio n unit
d04.F.PE	Position feedback pulse sum / Gantry machine feedback pulse	This parameter can monitor the number of pulses fed back by the servo motor. Unit: when absolute motor is used, it is calculated as 131072bit per turn. If incremental encoder motor is used, the number of encoder lines * 4 shall be calculated for each turn.	Encoder unit/ Instructio n unit
d05.E.PE	Position deviation pulse number/Gantry pulse deviation	This parameter can monitor the pulse number of position lag during the operation of the servo system. Unit: when using absolute value motor, calculate by 131072bit per lap. If the incremental encoder motor is used, the number of encoder lines *4 shall be calculated for each turn.	Encoder unit/ Instructio n unit
d06.C. Fr	Pulse command input frequency	This parameter monitors the input frequency of the external pulse command	KPPS
d07.C. SP	Velocity control command		rpm
d08.F. SP	Motor velocity	This parameter can monitor the velocity of the servo motor when it is running	rpm
d09. C.tQ	Torque command	This parameter can monitor the torque when the servo motor is running	%
d10. F. tQ	Torque feedback value	This parameter can monitor the feedback torque when the servo motor is running	%
d11.AG.L	Average torque	This parameter can monitor the average torque of the servo motor in the past 10 seconds	%
d12.PE.L	Peak torque	This parameter can monitor the peak torque of servo motor after power on	%
d13.oL	Overload rate	This parameter can monitor the load occupancy rate of the servo motor in the past 10 seconds	%
d14.rG	Regeneration load rate	This parameter monitors the load rate of the regeneration resistor	%
d16.I. Io	Input IO status	This parameter can monitor the input port status of CN1. The upper vertical bar	Binary

		represents high level (optocoupler cutoff), and the lower vertical bar represents low level optocoupler conduction). The corresponding relationship with the input port is that the vertical bars of the operation panel from right to left correspond to di1-di4 respectively	
d17.o. Io	Output IO status	This parameter can monitor the output port status of CN1. The upper vertical bar represents the conduction of optocoupler, the lower vertical bar represents the cutoff of optocoupler, and the corresponding relationship with the output port is that the vertical bar of the operation panel from right to left corresponds to do1-do3 respectively	Binary
d18.AnG	Mechanical angle of motor	This parameter can monitor the mechanical angle of the motor, and the rotation of 1 turn is 360 degrees	0.1°
d19.HAL	Motor UVW phase sequence	This parameter can monitor the phase sequence position of the incremental encoder motor	
d20.ASS	Absolute value encoder single turn value	This parameter can monitor the feedback value of absolute encoder, and the rotation is 0xFFFF	0-0xFFFF
d21.ASH	Absolute value encoder multi turn value	This parameter can monitor the number of turns of the absolute encoder motor	
d22.J-L	Inertia ratio	This parameter can monitor the real-time inertia of the load of the motor	%
d23.dcp	Main circuit voltage (AC value)	This parameter can monitor the voltage value of the main circuit	V
d24.Ath	Driver temperature	This parameter can monitor the drive temperature	℃
d25.tiE	Cumulative running time	This parameter can monitor the running time of the drive, unit is second	Sec
d26.1. Fr	Resonance frequency 1	This parameter can monitor resonance frequency 1	Hz
d28.2. Fr	Resonance frequency 2	This parameter can monitor resonance frequency 2	Hz
d30.Ai1	Input voltage of analog quantity command 1 （V_REF）	This parameter can monitor the input voltage value of the analog command (V_REF) of the velocity loop.	0.01V
d31.Ai2	Input voltage of	This parameter can monitor the input	0.01V

	analog quantity command 2 （T_REF）	voltage value of the analog command (T_REF) of the torque ring.	

11 Fault Analysis and Treatment

11.1 Fault Alarm Information Table

Table 157 Fault alarm information table

Alarm type	Serial number code	Alarm content
Hardware failure	AL.051	EEPROM Parameter exception
	AL.052	PLC configuration failure
	AL.053	Initialization failed
	AL.054	System exception
	AL.060	Product model selection failure
	AL.061	Product matching failure
	AL.062	Parameter storage failure
	AL.063	Overcurrent detection
	AL.064	Servo power on self check finds output short circuit to ground
	AL.066	Servo unit control power supply voltage low
	AL.070	AD sampling fault 1
	AL.071	Current sampling fault
	AL.100	Parameter combination exception
	AL.101	AI Set fault
	AL.102	DI Allocation failure
	AL.103	DO Allocation failure
	AL.105	Electronic gear setting error
	AL.106	Abnormal setting of frequency division pulse output
	AL.110	Power on again after parameter setting
	AL.120	Servo ON command invalid alarm
	AL.401	Undervoltage
	AL.402	Overvoltage
	AL.410	Overload (instantaneous maximum load)
	AL.411	Driver overload
	AL.412	Motor overload (continuous maximum load)
	AL.420	Over velocity
	AL.421	Out of control detection
	AL.422	Runaway fault
	AL.425	AI sampling voltage too high
	AL.435	Impulse current limit resistor overload
	AL.436	DB overload
	AL.440	heatsink OT

	AL.441	Motor overheat fault
	AL.500	Frequency division pulse output over velocity
	AL.501	Excessive position deviation
	AL.502	The position deviation between the full closed-loop encoder and the motor is too large
	AL.505	P command input pulse abnormal
	AL.550	Inertia identification failure
	AL.551	Home Return timeout fault
	AL.552	Angle identification failure
Encoder failed	AL.600	Encoder output power short circuit fault
	AL.610	Incremental encoder off line
	AL.611	Z signal loss of incremental encoder
	AL.620	Bus encoder off line
	AL.621	EEPROM parameter of encoder of reading and writing motor is abnormal
	AL.622	Data check error in motor encoder EEPROM
Warning	AL.900	Excessive position deviation
	AL.901	Position deviation is too large when servo is on
	AL.910	Motor overload
	AL.912	Driver overload
	AL.941	Parameter change to be switched on again
	AL.942	Write EEPROM frequent warning
	AL.943	Serial communication is abnormal
	AL.950	Overtravel warning prompt
	AL.971	Undervoltage warning

11.2 Cause and Treatment of Fault Alarm

AL.051：EEPROM Parameter exception

Cause of fault alarm	Fault alarm check	Disposal measures
Servo unit EEPROM data abnormal	Check wiring	Correct wiring,power up again If it always appears, replace the drive

AL.052：PLC configuration failure

Cause of fault alarm	Fault alarm check	Disposal measures
Main control MCU power on initialization abnormal Serial port baud rate set too high	Check wiring Check the baud rate parameter P00-21 of serial communication	Reduce the baud rate of serial communication If it always appears, replace the drive

AL.053：Initialization failed

Cause of fault alarm	Fault alarm check	Disposal measures
Main control MCU	Check wiring	If it always appears, replace the

power on initialization failed	Power up again	drive

AL.054：System exception

Cause of fault alarm	Fault alarm check	Disposal measures
Abnormal operation of main control MCU	Check wiring Power up again	If it always appears, replace the drive

AL.060：Product model selection failure

Cause of fault alarm	Fault alarm check	Disposal measures
Product parameter setting does not match the actual hardware	Check product parameter setting and hardware model The rated current of the selected motor is greater than the output current of the driver	Set product parameters correctly If it always appears, contact the manufacturer

AL.061：Product matching failure

Cause of fault alarm	Fault alarm check	Disposal measures
Servo unit and servo motor model do not match	Check whether the servo unit supports the motor	Replace the servo unit matching the motor

AL.063：Overcurrent detection

Cause of fault alarm	Fault alarm check	Disposal measures
Servo unit power module current too high	U, V, W wiring for short circuit Is there a short circuit between B1 and B3	Correct wiring If it always appears, replace the drive

AL.071：Current sampling fault

Cause of fault alarm	Fault alarm check	Disposal measures
Abnormal sampling data of current sensor	Check wiring	Correct wiring If it always appears, replace the drive

AL.100：Parameter combination exception

Cause of fault alarm	Fault alarm check	Disposal measures
Parameter setting error	Check the set (P03-07) parameter	Set parameters correctly If it always appears, please initialize the parameters

AL.102 DI Allocation failure

Cause of fault alarm	Fault alarm check	Disposal measures
At least 2 input ports have the same function selection	Check port input function selection parameters	Set parameters correctly Power on the drive again

AL.103：DO Allocation failure

Cause of fault alarm	Fault alarm check	Disposal measures
At least 2 output ports have the same function selection parameters	Check port output function selection parameters	Set parameters correctly Power on the drive again

AL.105：Electronic gear setting error

Cause of fault alarm	Fault alarm check	Disposal measures
Electronic gear ratio setting error	Check the electronic gear ratio setting parameters. P03-10, P03-11	Set the electronic gear ratio correctly
Gantry output pulse setting too small	Check the number of feedback pulses of the gantry function motor for one revolution: P03-52 must be greater than 128	Correctly set the number of feedback pulses for one revolution of gantry function motor

AL.106：Abnormal setting of frequency division pulse output

Cause of fault alarm	Fault alarm check	Disposal measures
Frequency division pulse output parameter setting out of range	Check the frequency division pulse output setting parameters. P03-22，P03-23，P03-25	Correctly set the output parameters of frequency division pulse Incremental encoderP03-22≤P03-23 Bus encoderP03-25<65535 Power on the drive again

AL.110：Power on again after parameter setting

Cause of fault alarm	Fault alarm check	Disposal measures
After the servo parameter is set, it can take effect only after power on again	Power on the drive again	Power on the drive again

AL.120：Servo ON command invalid alarm

Cause of fault alarm	Fault alarm check	Disposal measures
Servo on command performs auxiliary functions R. S, T voltage port is not powered	Check wiring and input voltage	Check wiring Power on the drive again

AL.401：Undervoltage

Cause of fault alarm	Fault alarm check	Disposal measures
The input voltage of the main circuit is lower than the rated voltage	Check whether the main circuit input R, S, T wiring is correct and what is the voltage value	Make sure the wiring is correct and use the correct voltage source or series voltage

or there is no input voltage		regulator

AL.402: Overvoltage

Cause of fault alarm	Fault alarm check	Disposal measures
Main circuit input voltage is higher than rated voltage	Use a voltmeter to test whether the input voltage of the main circuit is correct	Use correct voltage source or series voltage regulator
Drive hardware failure	When it is confirmed that the input voltage is correct, the over-voltage alarm still occurs	Please return it to the dealer or the original factory for maintenance
The regeneration resistance is not connected or the selection of regeneration resistance is wrong	Verify that P00-30 is set to 0 or 1	Correct setting and external regeneration resistance

AL.410: Overload (instantaneous maximum load)

Cause of fault alarm	Fault alarm check	Disposal measures
The machine is stuck when the motor starts	Check if the mechanical connection is blocked	Adjust the mechanical structure
Drive hardware failure	Confirm that the mechanical part is normal and still alarm	Please return it to the dealer or the original factory for maintenance

AL.412: Motor overload (continuous maximum load)

Cause of fault alarm	Fault alarm check	Disposal measures
Continuous use beyond the rated load of the drive	It can be monitored through d13. oL.	Change the motor or reduce the load
Improper setting of control system parameters	1. Whether the mechanical system is installed 2. Acceleration setting constant is too fast 3. Whether gain parameters are set correctly	1. Adjust control loop gain 2. Acceleration and deceleration setting time slows down
Motor wiring error	Check U, V, W wiring	Correct wiring

AL.420: Over velocity

Cause of fault alarm	Fault alarm check	Disposal measures
Input velocity command too high	Check whether the input signal is normal with the signal detector	Adjust the frequency of the input signal
Over velocity determination parameter setting is	Check whether P04-05 (overvelocity alarm value) is set reasonably	Set P04-05 (overvelocity alarm value) correctly

incorrect		

AL.440: heatsink OT

Cause of fault alarm	Fault alarm check	Disposal measures
The internal temperature of the driver is higher than 95 ℃	Check whether the cooling condition of the drive is good	Improve the cooling condition of the drive. If there is any alarm again, please send the drive back to the original factory for maintenance

AL.501: Excessive position deviation

Cause of fault alarm	Fault alarm check	Disposal measures
Too large position deviation, too small parameter setting	Confirm the parameter setting of P03-15 (excessive position deviation setting)	Increase the setting value of P03-15 (position deviation is too large)
Gain value set too small	Confirm whether the gain parameters are set properly	Adjust the parameters of gain class correctly
Internal torque limit set too small	Confirm internal torque limiting amplitude	Correct internal torque limiter readjustment
Excessive external load	Check external load	Load reduction or high-power motor replacemen

AL.505: P command input pulse abnormal

Cause of fault alarm	Fault alarm check	Disposal measures
Pulse command frequency higher than rated input frequency	Check whether the input frequency is higher than the rated input frequency with pulse frequency detector	Set the input pulse frequency correctly

AL.551: Home Return timeout fault

Cause of fault alarm	Fault alarm check	Disposal measures
Time out for home operation	Confirm whether the parameter P03-68 (maximum time limit for searching the origin) is reasonable	Set P03-68 correctly

AL.600: Encoder output power short circuit fault

Cause of fault alarm	Fault alarm check	Disposal measures
Encoder power wiring error	Check whether the encoder power supply + 5V and GND are connected reversely	Correct wiring

AL.610: Incremental encoder off line

Cause of fault alarm	Fault alarm check	Disposal measures
Incremental encoder HallU, HallV, HallW	Check encoder wiring	Correct wiring

signal abnormal		

AL943: Serial communication is abnormal

Cause of fault alarm	Fault alarm check	Disposal measures
Large interference in serial communication Serial port baud rate set too high	Check wiring Check the baud rate parameter P00-21 of serial communication	Add filter on wire Reduce the baud rate of serial communication

JASD/JAND-R / RC Bus High Voltage Servo Driver Series

➢ Product Introduction

JASD series universal servo driver is a High-Performance AC servo unit developed by gemicom. The servo driver of this series adopts advanced special DSP chip for motor control, large-scale programmable gate array (FPGA) and IPM power module. It has the characteristics of small volume, high integration, stable performance and reliable protection. It has rich digital and analog I / O interfaces, can be used with a variety of upper computer devices, and supports Modbus-RTU and CANopen communication protocol to facilitate networking. Through the optimized PID control algorithm, the full digital control of position, velocity and torque accuracy is realized, which has the advantages of high precision and fast response. At the same time, it supports 2500-line incremental encoder and 17-bit, 20 bit high-precision absolute encoder motor to meet the different requirements of customer performance. Widely used in CNC machine tools, printing and packaging machinery, textile machinery, robots, automatic production lines and other automation fields.

➢ Technical Characteristics

- ✧ Using DSP + FPGA dual chip platform and optimized current loop design, the driver has the characteristics of high dynamic response, very short setting time, stable operation and small vibration at stop.
- ✧ It supports standard CIA301 CANopen communication protocol, and supports 128 slave stations at most.
- ✧ Support standard Modbus-RTU protocol and CANopen protocol.
- ✧ Support standard CIA402 motion control protocol.
- ✧ RJ45 standard network connection, the slave stations can be connected through twisted pair cable.
- ✧ With automatic gain adjustment module, users can choose rigidity according to demand.
- ✧ Built in FIR filter and multiple notch filter can automatically identify and suppress mechanical vibration.
- ✧ The built-in disturbance torque observer makes the driver have a strong ability of resisting external disturbance.
- ✧ It has a variety of control modes for selection, position control, velocity control, torque control, and can switch various control modes.
- ✧ It has RS485 and CAN2.0 interfaces, supports Modbus-RTU communication, and can be flexibly applied to manipulator and other industries with multi circle absolute value encoder with memory function.
- ✧ There are programmable 8-way INPUT and 5-way OUTPUT ports, users can customize input and output through parameter settings, and the application is flexible.
- ✧ Support incremental encoder and 17-bit, 20-bit, 23-bit high-precision absolute value encoder.
- ✧ It has perfect protection functions such as over-voltage, under voltage, over velocity, overload, position deviation, encoder error, etc., and can memorize 8 groups of historical fault information.
- ✧ There are rich monitoring projects, users can choose the desired monitoring project to monitor the operation status in the process of use.

- ✧ The driver can communicate with PC through RS232 interface to realize simple and quick debugging of servo drive system.

➢ 1 Safety Precautions

In order to prevent harm to personal and property safety, please observe the following precautions, and make the following marks to distinguish:

⚠ Danger	Indicates a high risk of death or serious injury
⚠ Notice	Indicates that it is likely to cause minor injury or endanger property safety
🚫	Indicates prohibited items

1.1 Precautions for Receiving and Installation

⚠ **Danger**：1、Please use it with the driver and motor according to the specified way, otherwise it will cause equipment damage or fire.

2、It is forbidden to use in places with serious water vapor, combustible gas, corrosive gas, etc., otherwise electric shock, fire, equipment damage, etc. will be caused.

1.2 Precautions for Wiring

⚠ **Danger**：1、Do not connect the power supply of the driver to the output terminals of U, V and W motors, otherwise the driver will be damaged, which may cause personal injury or fire.

2、Please make sure the connection wire of power supply and motor output terminal is locked, otherwise it may cause sparking and fire.

3、Please select the power cord and motor power extension cord correctly to avoid fire caused by insufficient current bearing capacity of the wire.

4、Please make sure that the enclosure of the driver and the motor are grounded. Poor grounding may cause electric shock to personnel.

⚠ **Notice**：1、Please do not tie the motor power line and signal line together or pass through the same pipe to prevent interference to the signal.

2、For signal line and encoder feedback extension line, please use multi stranded shielded wire to enhance anti-interference ability.

3、Before power on, please confirm whether the wiring is connected correctly.

After the power of the driver is turned off, there is still high voltage inside. Please do not touch the power terminal within 5 minutes, and confirm that the discharge indicator is off before operation.

1.3 Precautions for Operation and Operation

⚠ Danger：1、Before installing the equipment, please conduct no-load test run to avoid accidents.

2、 Do not allow untrained personnel to operate, to prevent equipment damage and personnel injury caused by misoperation.

3、During normal operation, please do not touch the radiator and its interior of the driver with your hands to prevent high temperature scalding or electric shock.

⚠ Notice：1、Please adjust the parameters of the driver before long-term test to prevent the poor use of the driver and equipment.

2、Please confirm that the equipment start, emergency stop, shutdown and other switches are effective before operating the equipment.

3、Please do not switch on and off the power supply frequently.

1.4 Precautions for Maintenance and Inspection

🚫: 1、During operation, it is forbidden to touch the inside of the driver and motor to prevent electric shock.

2、Do not change the connecting wire when it is powered on to prevent electric shock or personal injury.

3、Must be operated and maintained by trained professionals.

4、Please do not disassemble or repair except for the company's personnel.

5、Within 5 minutes after the power is turned off, do not touch the power supply and power terminal to prevent electric shock.

➢ 2 Product Introduction

2.1 Servo Driver

2.1.1Name of each part of servo driver

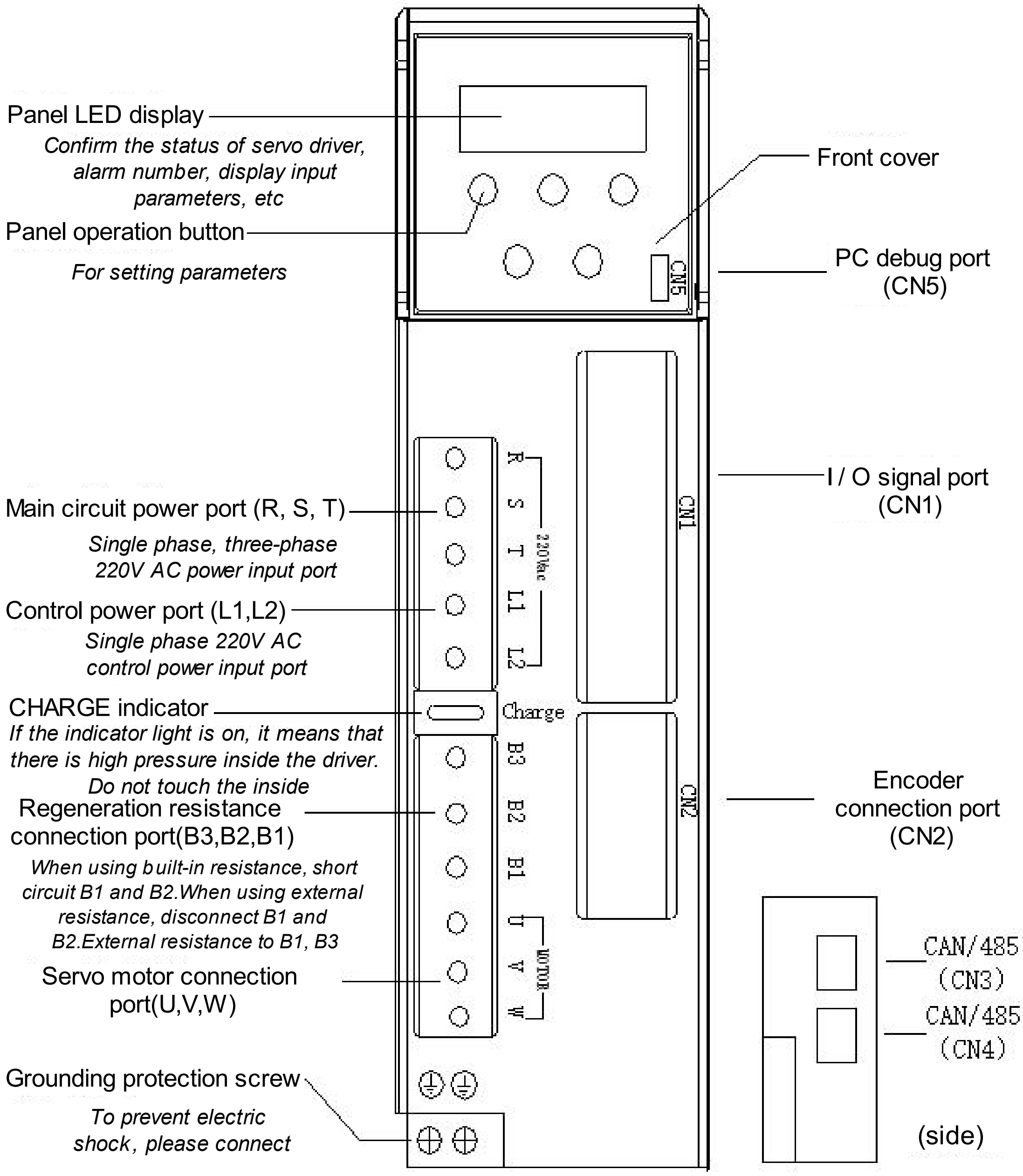


Figure 152 Name of each part of servo driver

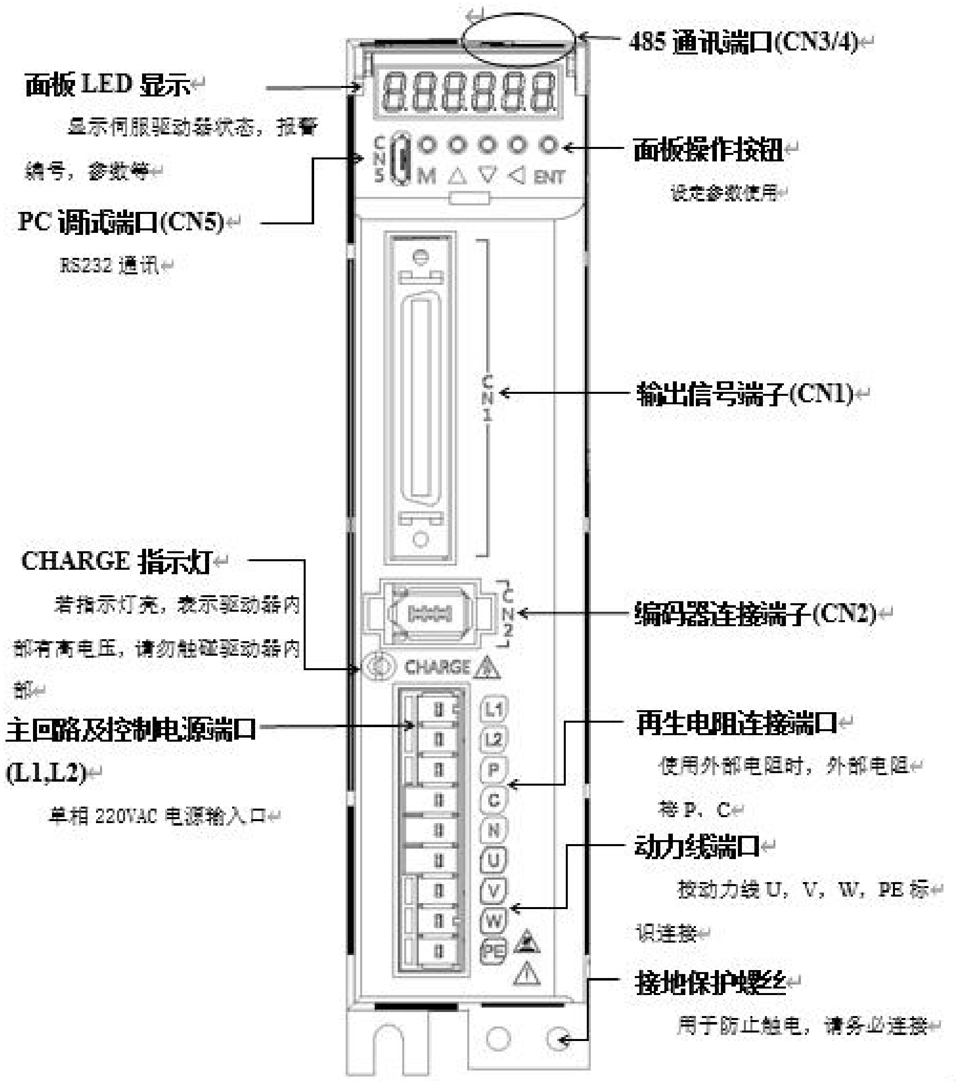


Figure 153 JAND-R/RC servo drive section names

2.1.2Drive specifications

Table 158 Single phase 220V level servo driver

Model JASD***2-20B	200	400	750	1500
Single phase continuous input current Arms	1.9	3.2	6.7	8.8
Continuous output current Arms	2.1	2.8	5.5	8
Maximum output current Arms	5.8	9.6	16.9	19
Main current supply	Single-phase AC180-240V，50/60Hz			
Control current supply	Single-phase AC180-240V，50/60Hz			
Brake handling function	External brake resistor		Built in brake resistor	

Table 159 Three phase 220V level servo driver

Model JASD***2-20B	750	1500	2000	3000
Three phase continuous input Arms	3.6	6	8.7	11

Continuous output current Arms	5.5	8	14	20
Maximum output current Arms	16.9	19	33	50
Main current supply	Three-phase AC180-240V，50/60Hz			
Control current supply	Single-phase AC180-240V，50/60Hz			
Brake handling function	Built in brake resistor			

Table 160 Basic specification

Project		Describe
Control mode		Single phase / three phase full wave rectifier, IGBT PWM control, sine wave current drive mode
Feedback		Incremental encoder Absolute encoder
Conditions of use	Temperature	Work: 0～55℃storage: -25～85℃
	Humidity	Work: 10%～90%
	Altitude	<1000m，When it is higher than 1000M, it shall be derated according to GB/T 3859.2-93
	Protection level	Protection level: IP10，Cleanliness: 2 No corrosive gas, combustible gas, oil, water splash, dust, salt and less metal powder
Performance	Velocity adjustment range	1:5000
	Steady velocity accuracy	±0.01%: External load variation 0-100% ± 0.01%: power input variation ± 10% (220V) ±0.1%: Ambient temperature ± 25 ℃ (25 ℃)
	Velocity response frequency	1200Hz
	Torque control accuracy	±2%
I / O signal	Encoder frequency division pulse output	Phase A, phase B, phase C: linear drive output Frequency division pulse number: can be set arbitrarily
	Input signal	Points: 8 Functions: servo ON, alarm clearing, forward overtravel signal input, reverse overtravel signal input, control mode switching, P action command input, forward side external torque limit, reverse side external torque limit, gain switching input, zero fixed input, command pulse forbidden input, encoder absolute value data requirement input, internal set velocity switching input 1. Internal set velocity switching input 2. Internal set velocity switching input

		3. Position command clear input, pole detection input, command pulse input multiple switching input
	output signal	Points: 5 Functions: alarm output, holding brake open output, servo ready output, positioning completion output, positioning close output, velocity consistent output, motor zero velocity output, torque limit detection output, velocity limit detection output, warning output, command pulse input multiple conversion output
Display function		High voltage power indicator, 6-bit 8-segment LED
Communication function	RS485	Support Modbus-RTU protocol， Communication rate：2400~115200bps
	CAN	Support CANopen protocol，Communication rate：12.5~500Kbps
	RS232	Connect PC for debugging
Regeneration treatment		Built in regeneration resistor or external regeneration resistor
Protection function		Overvoltage, undervoltage, overcurrent, overload, etc

Table 161 Single phase 220V level servo driver

Model JAND***2-20B	200	400	750	1000
Single phase continuous input current Arms	2.3	4.6	8.7	11.6
Continuous output current Arms	2.1	2.8	5.5	7.6
Maximum output current Arms	5.8	9.6	16.9	23
Power supply specifications	Single-phase AC180-240V，50/60Hz			
Brake handling function	External brake resistor		Built in brake resistor	

Table 160 Basic specification

Project		Describe
Control mode		Single phase full wave rectifier, IGBT PWM control, sine wave current drive mode
Feedback		Incremental encoder Absolute encoder
Conditions of use	Temperature	Work: 0～55℃storage: -25～85℃
	Humidity	Work: 10%～90%
	Altitude	<1000m，When it is higher than 1000M, it shall be derated according to GB/T 3859.2-93
	Protection level	Protection level: IP10，Cleanliness: 2 No corrosive gas, combustible gas, oil, water

		splash, dust, salt and less metal powder
Performance	Velocity adjustment range	1:5000
	Steady velocity accuracy	±0.01%: External load variation 0-100% ± 0.01%: power input variation ± 10% (220V) ±0.1%: Ambient temperature ± 25 ℃ (25 ℃)
	Velocity response frequency	1200Hz
	Torque control accuracy	±2%
I / O signal	Encoder frequency division pulse output	Phase A, phase B, phase C: linear drive output Frequency division pulse number: can be set arbitrarily
	Input signal	Points: 8 Functions: servo ON, alarm clearing, forward overtravel signal input, reverse overtravel signal input, control mode switching, P action command input, forward side external torque limit, reverse side external torque limit, gain switching input, zero fixed input, command pulse forbidden input, encoder absolute value data requirement input, internal set velocity switching input 1. Internal set velocity switching input 2. Internal set velocity switching input 3. Position command clear input, pole detection input, command pulse input multiple switching input
	output signal	Points: 5 Functions: alarm output, holding brake open output, servo ready output, positioning completion output, positioning close output, velocity consistent output, motor zero velocity output, torque limit detection output, velocity limit detection output, warning output, command pulse input multiple conversion output
Display function		High voltage power indicator, 6-bit 8-segment LED
Communication function	RS485	Support Modbus-RTU protocol， Communication rate：2400~115200bps
	CAN	Support CANopen protocol，Communication rate：12.5~500Kbps
	RS232	Connect PC for debugging

Regeneration treatment	Built in regeneration resistor or external regeneration resistor
Protection function	Overvoltage, undervoltage, overcurrent, overload, etc

2.1.3Servo driver model

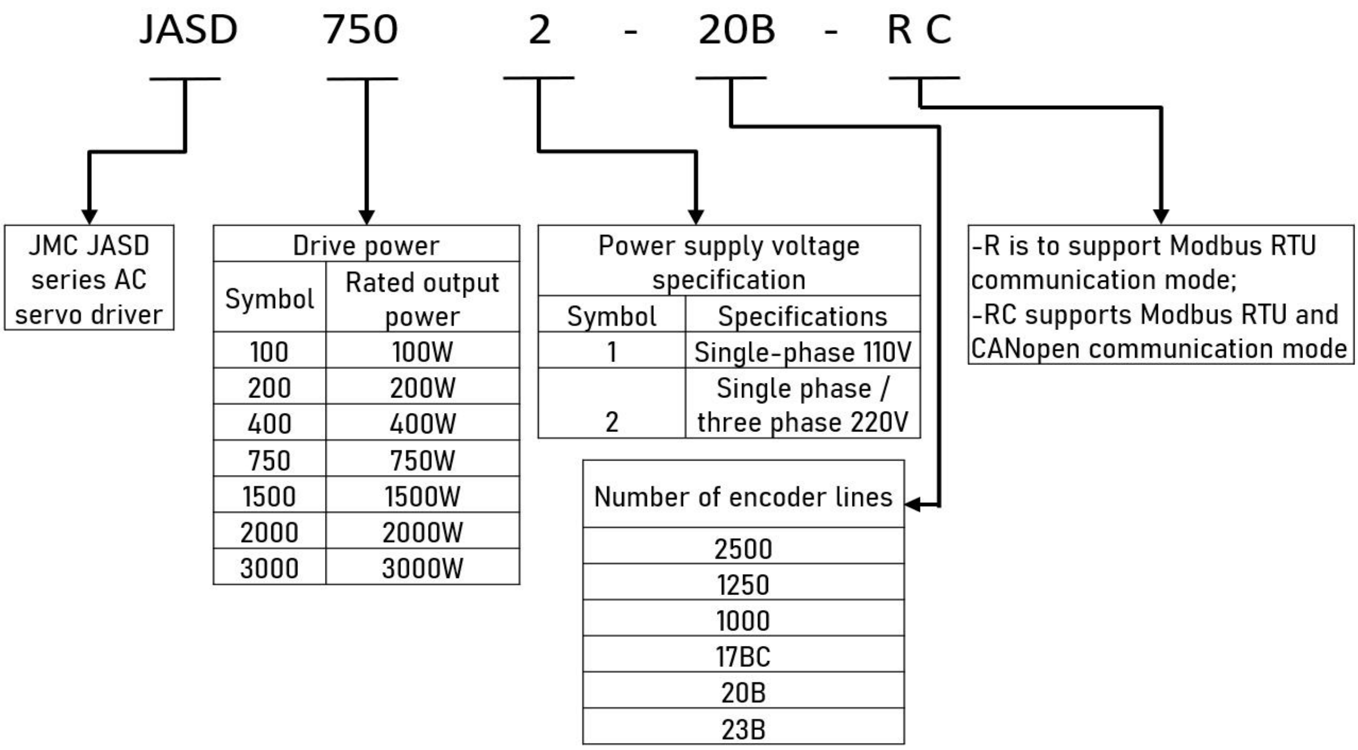


Figure 153 JASD Servo driver model

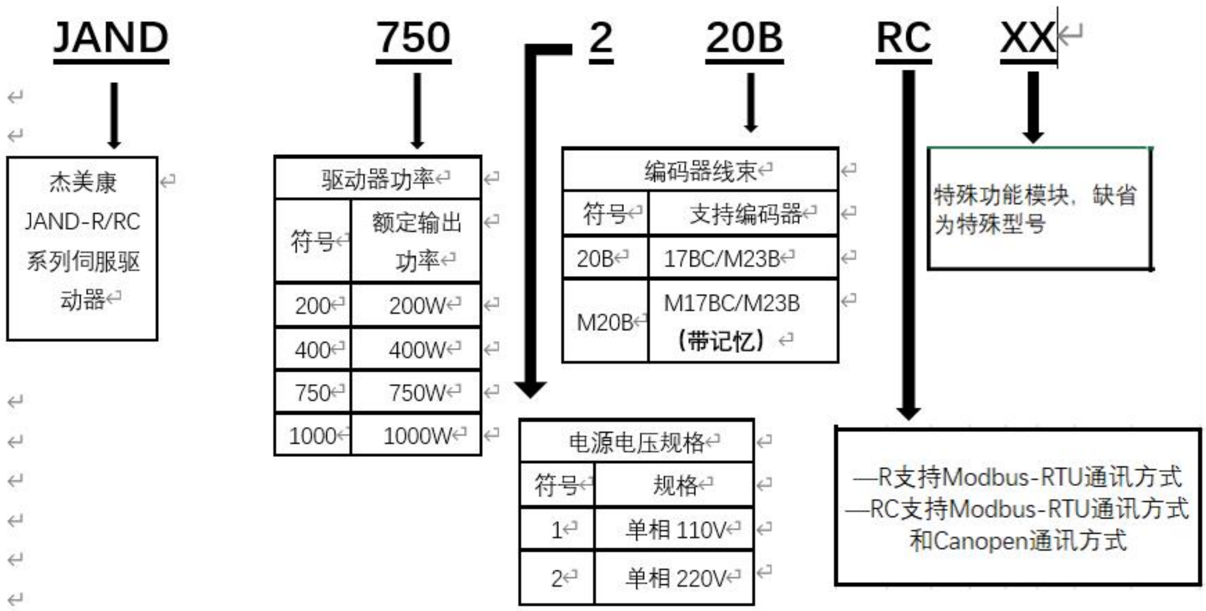


Figure 154 JAND-R/RC series servo drive models

2.1.4Drive nameplate

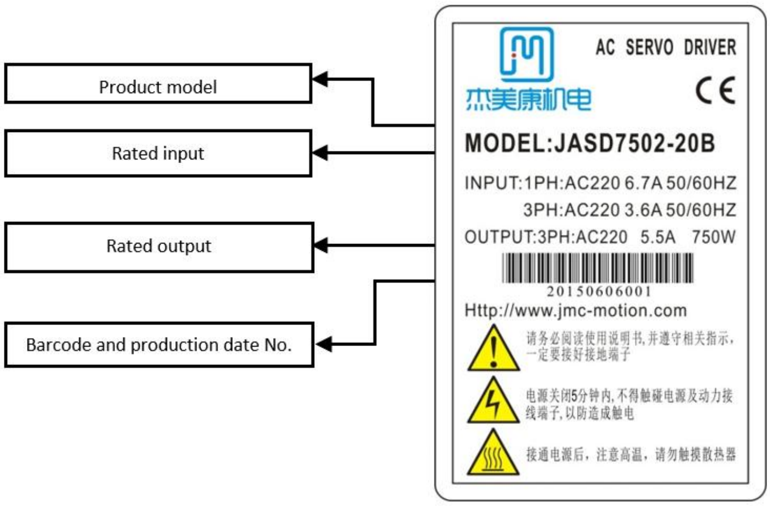


Figure 154 JASD Drive nameplate

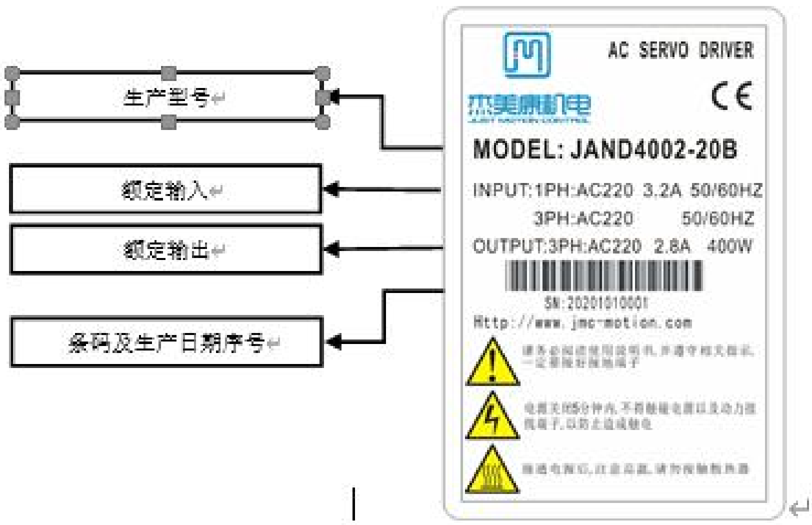


Figure 155 JAND Drive nameplate

2.2 Servo Motor

2.2.1Summary

JASM series servo motor is a high-velocity, high-precision servo motor developed by JMC to meet the requirements of modern automatic control; this series of servo motor can make the control velocity and position accuracy very accurate, and can convert the voltage signal into torque and velocity to drive the control object. The rotor velocity of this series of servo motor is controlled by the input signal, and can react quickly. In the automatic control system, it is used as the actuator, and has the characteristics of small electrical and mechanical time constant, high linearity, starting voltage, etc. it can convert the received electrical signal into the angular displacement or angular velocity output on the motor shaft, and can feedback the signal to the servo driver in real time Adjust to achieve high precision control.

2.2.2Main features

- ✧ High energy magnetic force
- ✧ 300% overload capacity in a short time
- ✧ Flange size (mm): 60, 80, 110, 130
- ✧ Power: 0.1-3KW optional
- ✧ Low noise, low heat, high precision, high velocity, etc

2.2.3Model description

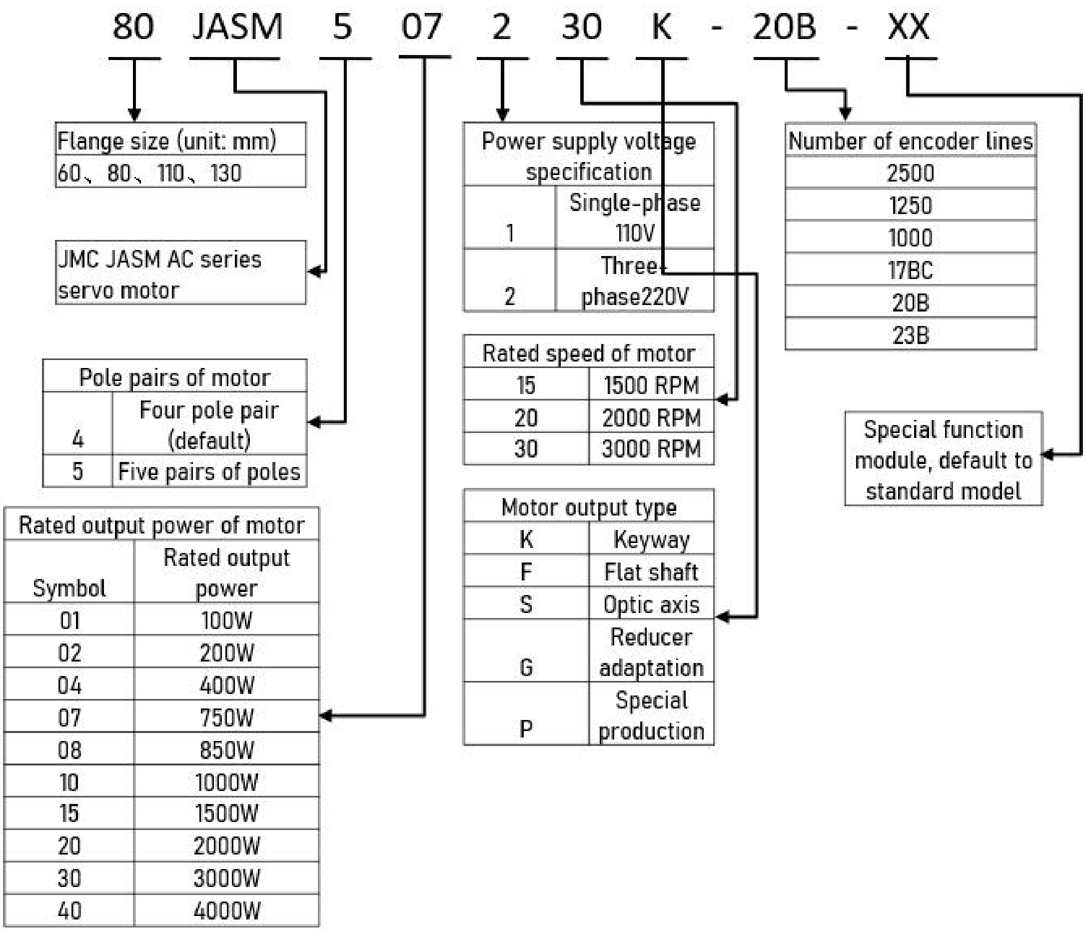


Figure 155 Servo motor model

2.2.4Motor nameplate

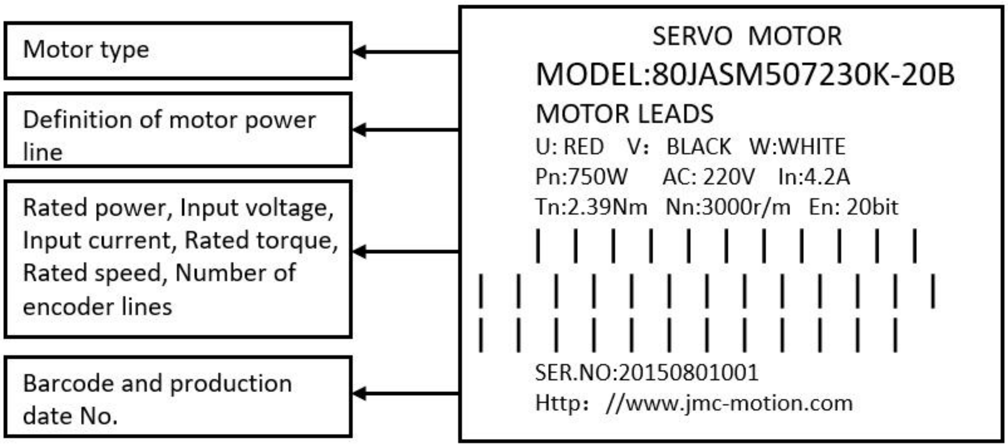


Figure 156 Motor nameplate

2.3 Connection Between Servo Control System and Main Power Circuit

2.3.1Wiring diagram of servo control system

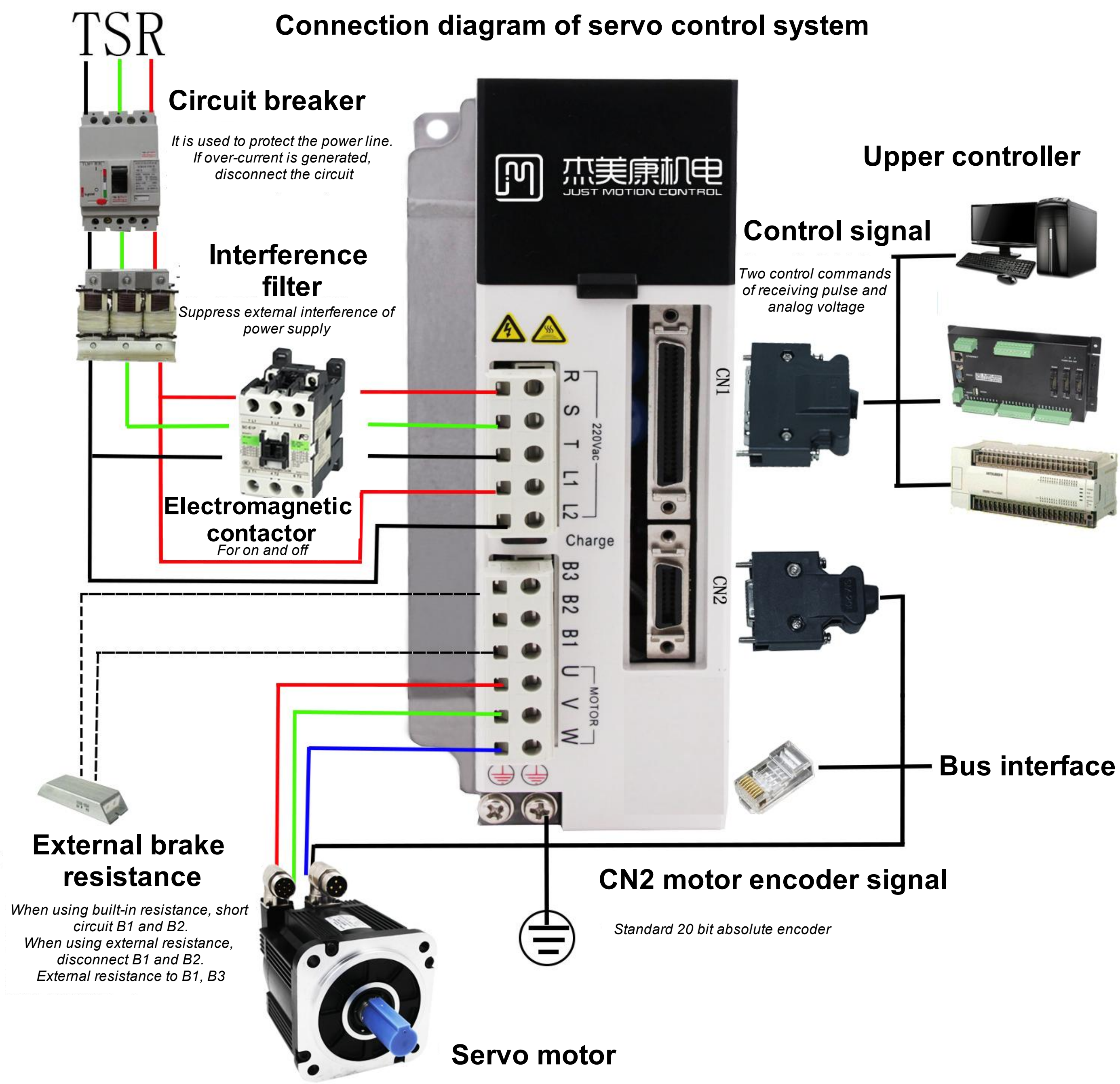


Figure 157 Wiring diagram of servo control system

The servo driver is directly connected to the industrial power supply, without power isolation such as transformer. In order to prevent cross electric shock accident of servo system, please use fuse or circuit breaker for wiring on input power supply. Because the servo driver has no built-in grounding protection circuit, in order to form a more secure system, please use a leakage circuit breaker with overload and short-circuit protection or a matching ground wire protection dedicated leakage circuit breaker.

2.3.2Main power circuit connection

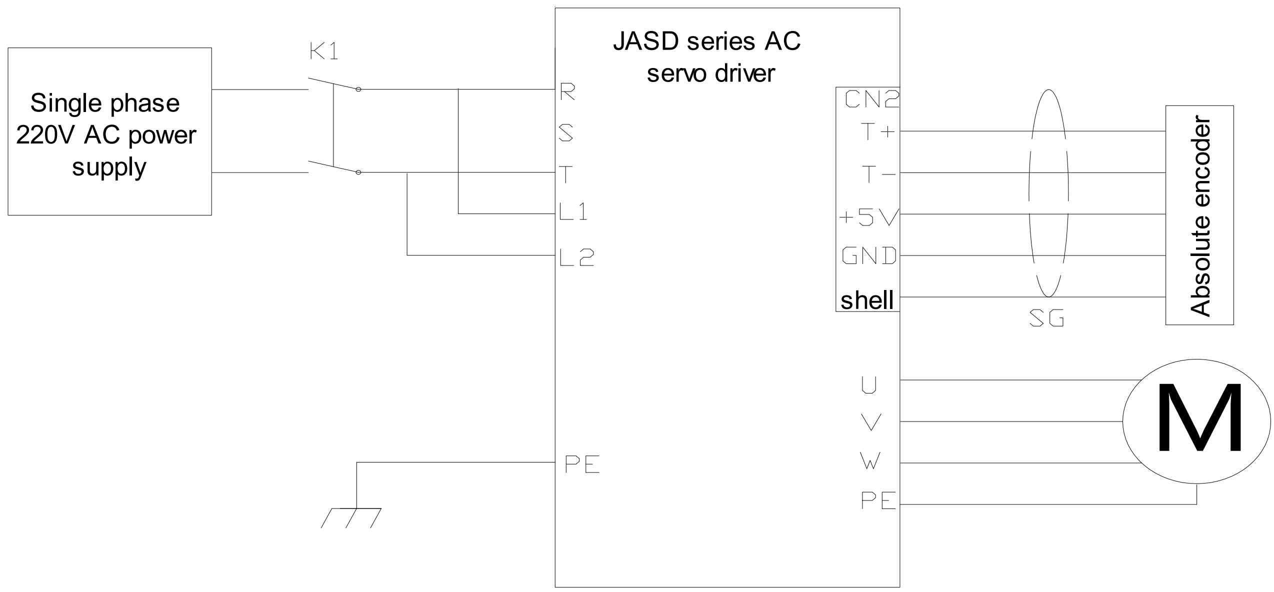


Figure 158 Single phase power connection method

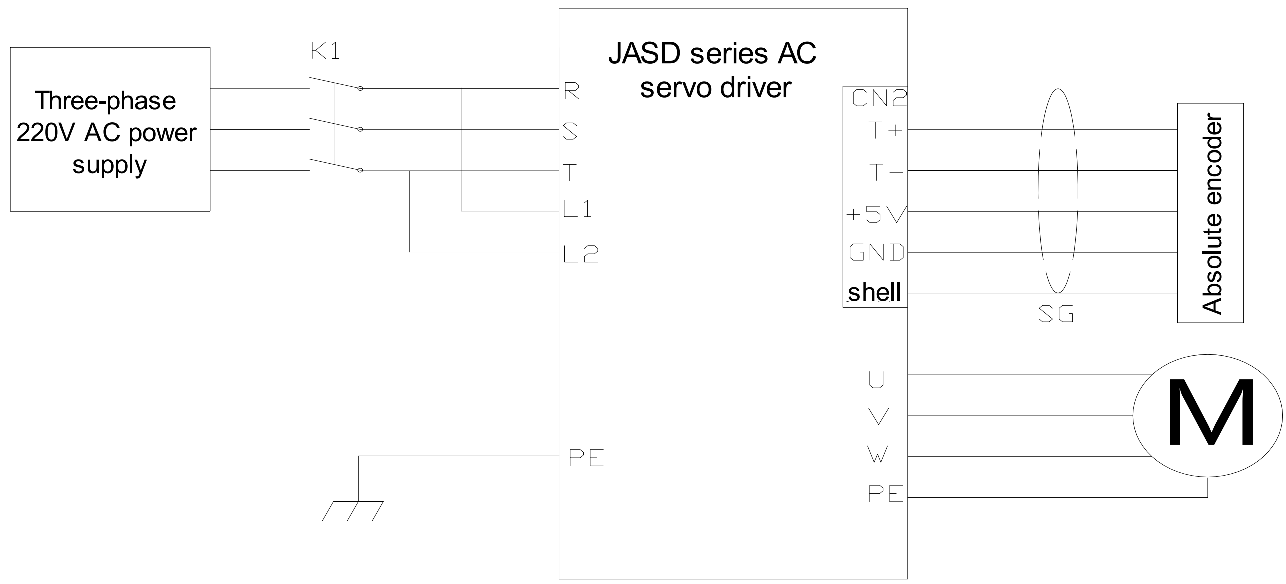


Figure 159 Three phase power connection method

➢ 3Port Description and Wiring

3.1Description of The Control Port for Drive CN1

3.1.1 Definition of CN1 control port

The interface between upper control and driver is used for upper control driver and driver feedback output

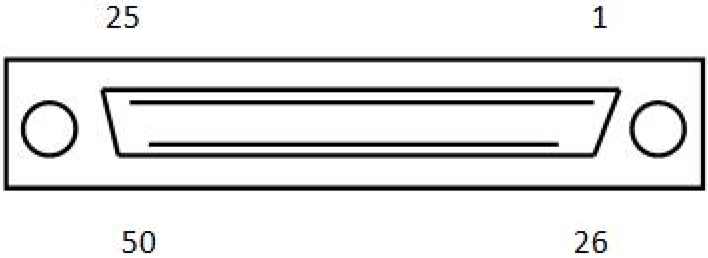


Figure 160 CN1 connector (male) back port description

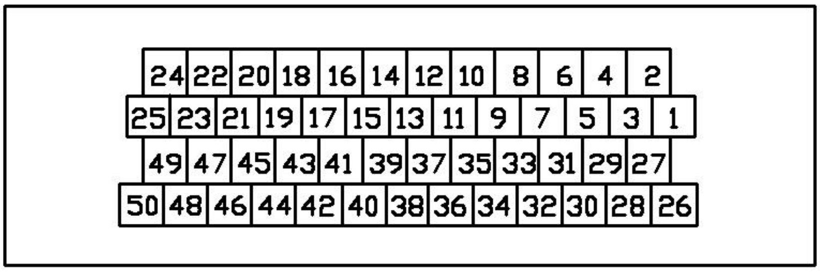


Figure 161 Pin distribution of SCSI-50P terminal for CN1 port

Figure 162 Physical drawing of SCSI-50P

Table 161 Definition of CN1 control port

Pin number	Label	Definition	Explain
1	DO4+	Digital output +	Custom output port
2	DO3-	Digital output -	Custom output port
3	DO3+	Digital output +	Custom output port
4	DO2-	Digital output -	Custom output port
5	DO2+	Digital output +	Custom output port
6	DO1-	Digital output -	Custom output port

7	DO1+	Digital output +	Custom output port
8	DI4-	Digital input -	Custom input port
9	DI1-	Digital input -	Custom input port
10	DI2-	Digital input -	Custom input port
11	COM+	Common input	High level 24V effective
12	GNDA	Simulated ground	
13	GNDA	Simulated ground	
14	NC	NC	
15	MON2	Analog data monitoring output 2	This function is not supported yet
16	MON1	Analog data monitoring output 1	This function is not supported yet
17	+24V	+24V output (for external I / O)	Maximum allowable output current：150mA
18	T_REF	Torque analog control positive	
19	GNDA	Simulated ground	
20	+12V	+12V output (for analog command)	Maximum allowable output current：50 mA
21	OA+	Encoder A-phase positive output	
22	OA-	Encoder A-phase negative output	
23	OB-	Encoder B-phase negative output	
24	OZ-	Encoder Z-phase negative output	
25	OB+	Encoder B-phase positive output	
26	DO4-	Digital output -	Custom output port
27	DO5-	Digital output -	Custom output port
28	DO5+	Digital output +	Custom output port
29	HPUL-	High velocity pulse -	
30	DI8-	Digital input -	Custom input port
31	DI7-	Digital input -	Custom input port
32	DI6-	Digital input -	Custom input port
33	DI5-	Digital input -	Custom input port
34	DI3-	Digital input -	Custom input port
35	24V SIGN+	24V Direction +	High level 24V effective
36	SIGN+	Direction +	High level 5V effective
37	SIGN-	Direction -	Low level 0V effective
38	HPUL+	High velocity pulse +	
39	24V PULS+	24V Pulse +	High level 24V effective
40	HSIGN-	High velocity direction -	
41	PULS-	Pulse -	Low level 0V effective
42	V_REF	Velocity analog quantity control positive	
43	PULS+	Pulse +	High level 5V effective
44	GND	Digitally	
45	COM	+24V output ground	
46	HSIGN+	High velocity direction +	

47	COM	+24V output ground	
48	OCZ	Encoder Z-phase open collector output	
49	COM	+24V output ground	
50	OZ+	Encoder Z-phase positive output	

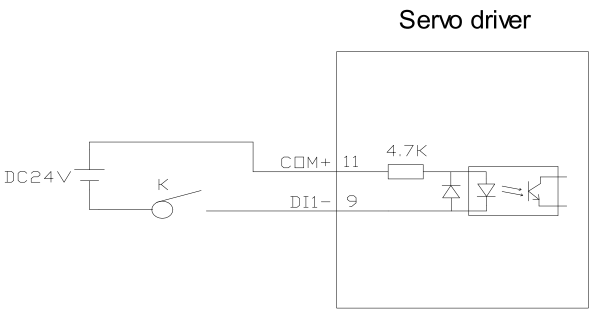
Notice:

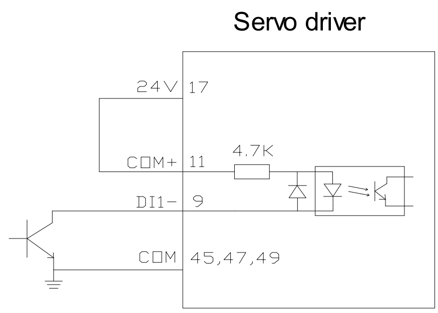
1. When CN1 terminal is connected, 24V PULS + and PULS + share PULS -, 24V SIGN + and SIGN + share SIGN -, the difference is only one 24V high-level input, one 5V high-level input.

2. Please refer to "parameter description" to set the custom function settings of digital input (DI) and output (DO) ports.

3.1.2 CN1 control port connection description

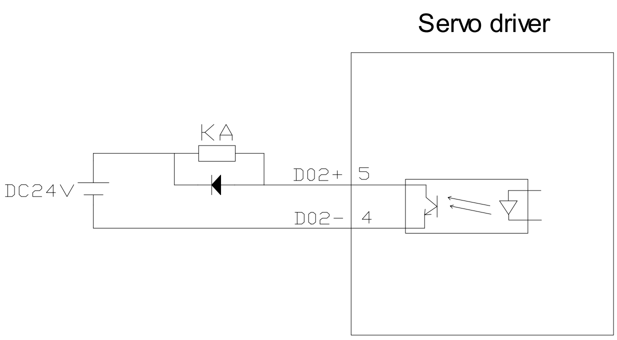
Digital input DI (DI1-DI8) can be connected by switches, relays and collector open circuit transistors. You can use the power supply provided inside the drive, or you can use the external power supply. (refer to **P06-xx I / O parameter** for function setting of input I / O port)



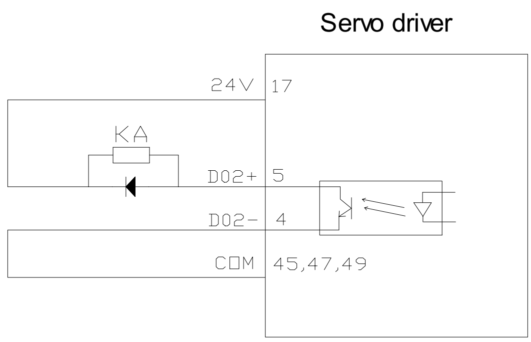


Use external power inputUse internal power input

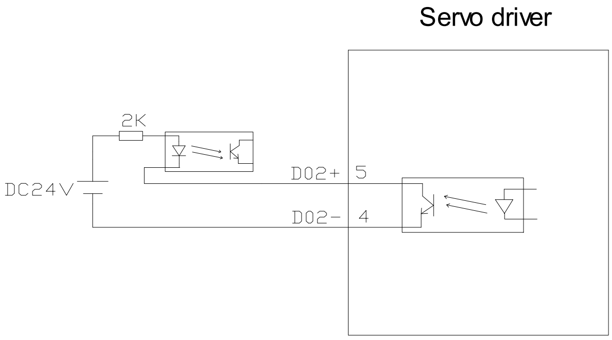
Digital output DO (DO1-DO5) output can be connected with relay, optocoupler, etc. You can use the power supply provided inside the drive, or you can use the external power supply. When using internal power supply, the internal 24V power supply can only provide 150mA current. When the load is greater than 150mA, please use external power supply. The power supply voltage range is 5-24V. (see **P06-xx I / O parameter** for function setting of output I / O port)

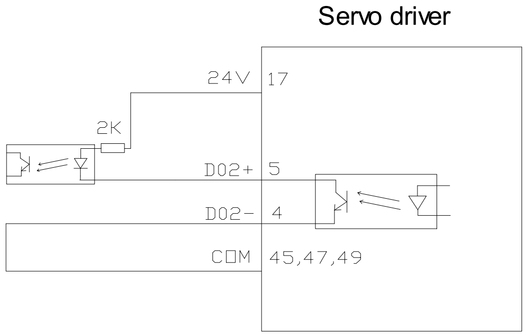


Use external power supply (relay)



Use internal power supply

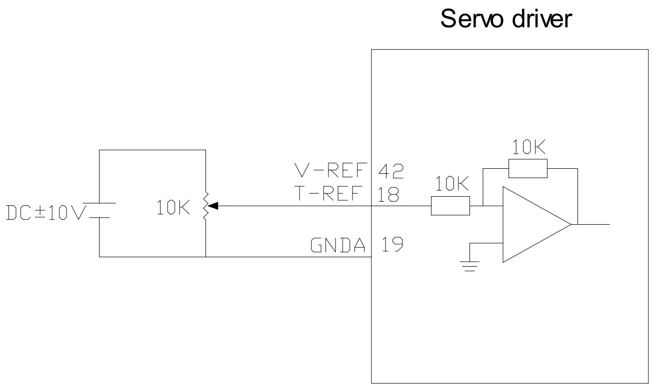


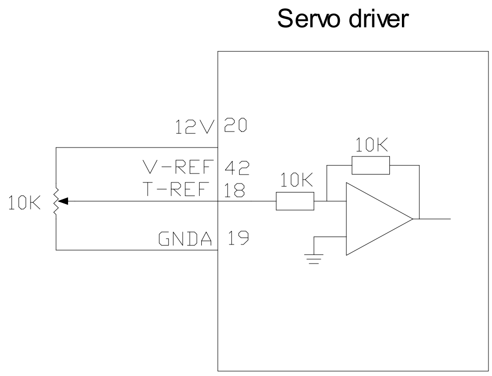


Use external power supply (optocoupler)

Use internal power supply (optocoupler)

The effective voltage range (- 10V ~ 10V) of velocity and torque control analog input can be set by the following parameters: velocity analog command input gain of P06-40 and torque analog command input gain of P06-43. Please read the detailed description of parameters for specific setting methods.





External power analog signal setting

Internal 12V power supply,
velocity / torque regulated by potentiometer

3.2Port Description of Drive CN2 Encoder

3.2.1 Connector description for SCSI-20P encode

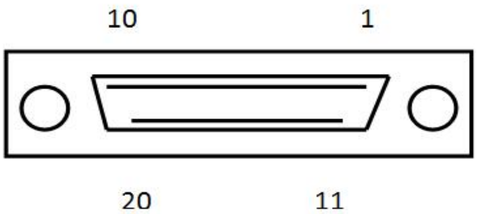


Figure 163 CN2 Port specification

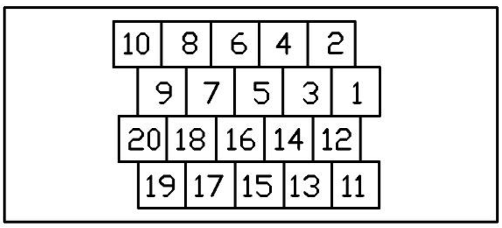


Figure 164 Pin distribution diagram of SCSI-20P terminal for CN2 port

Figure 165 Physical drawing of SCSI-20P

Table 162 Connector description for SCSI-20P encoder

Pin number	Label	Definition	Explain
1	NC		
2	EZ-	Encoder Z-phase negative input	
3	NC		
4	T-	Bus encoder T-	Special for bus drive
5	T+	Bus encoder T+	Special for bus drive
6	EW-	Pole W phase negative input	
7	EB+	Encoder B -phase positive input	
8	EW+	Pole W phase positive input	
9	EB-	Encoder B -phase negative input	
10	EZ+	Encoder Z-phase positive input	
11	EA+	Encoder A -phase positive input	
12	EA-	Encoder A -phase negative input	
13	GND	Output power ground	
14	+5V	Output + 5V power supply	
15	GND	Output power ground	
16	+5V	Output + 5V power supply	
17	EV+	Pole V phase positive input	
18	EV-	Pole V phase negative input	
19	EU-	Pole U phase negative input	
20	EU+	Pole U phase positive input	

3.2.2 Connector description for 1394-6P encoder

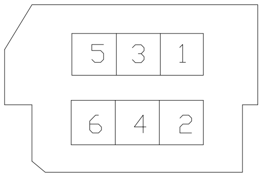


Figure 166 Encoder connector

Table 163 Encoder pin definition

Pin number	Label	Definition	Explain
1	+5V	Output + 5V power supply	
2	GND	Output power ground	
3	NC	NC	
4	NC	NC	
5	T+	Bus encoder T+	Special for bus drive
6	T-	Bus encoder T-	Special for bus drive

Notice: 1394-6P encoder connector is special for 400W drive and the following models. Please connect according to terminal identification for wiring

3.3Port Description of Power Supply and Motor Power Line

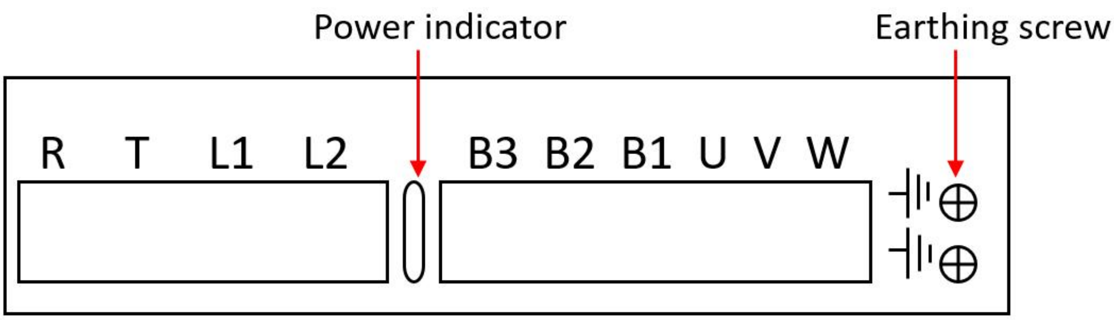


Figure 167 Drive power line of 400W and below

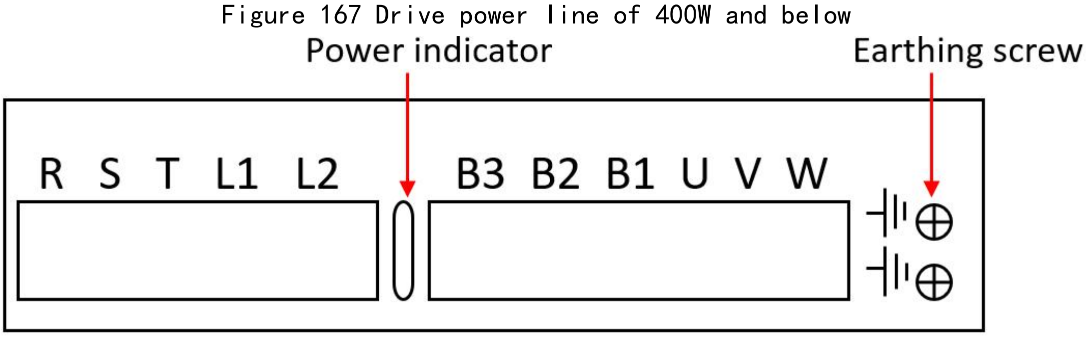


Figure 168 Power line port of 750W and above drive

Table 84 Port definition of power line

Label	Definition	Explain
R、S、T	Main circuit power input	Connected to single / three-phase 220V AC Connection R and T of 0.4KW and below

L1、L2	Control loop power input	Connected to single-phase 220V AC
U、V、W	Motor power line connection end	Connecting the motor power line
B1、B2、B3	Regeneration resistance connection end	When using the built-in regenerative resistor, short circuit B1 and B2 (the company's 750W and above drivers have built-in regenerative resistor) When external resistance is used, both ends of the resistance are connected to B1 and B3 ends
Earthing screw	Drive protection screw	Ground wire of power supply and motor
Power indicator	Drive power indication	Display whether there is high voltage inside the driver

Notice:

1. Please be sure to connect the electromagnetic contactor between the power supply and the main circuit power supply of the servo driver, so as to cut off the power supply in case of failure of the servo driver and prevent the fire caused by excessive current.

2. There is no built-in regeneration resistance for drives of 0.4KW and below. When the feedback energy exceeds the absorption capacity of the capacitor, the AL.402 over-voltage alarm will appear. At this time, it is necessary to connect the regeneration resistance externally and set P00-30, P00-31 and P00-32 to the corresponding values. For details, please refer to the **Parameters and Functions**.

➢ 4Installation Instructions

4.1Installation Dimension

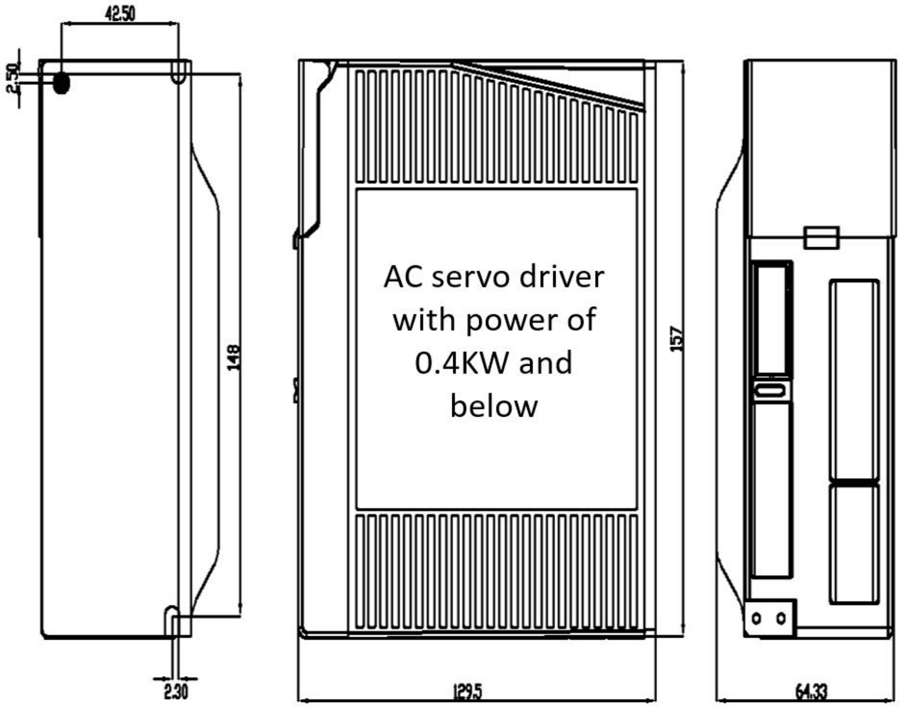


Figure 169 AC servo driver with power of 400W JASD-R/RC and below (unit: mm)

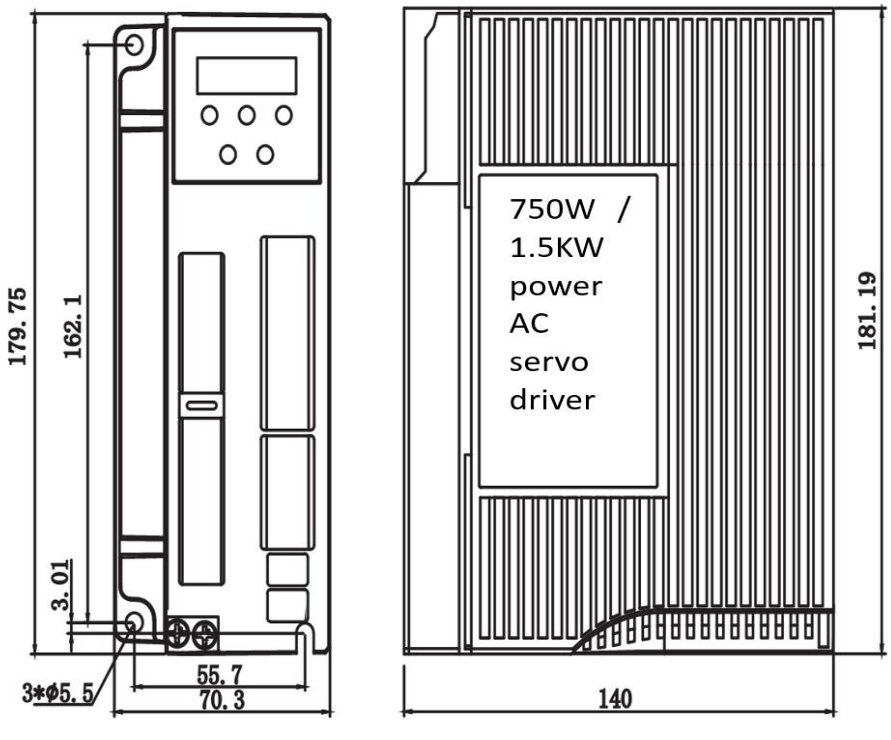


Figure 170 750W / 1.5KW power AC servo JASD-R/RC driver (unit: mm)

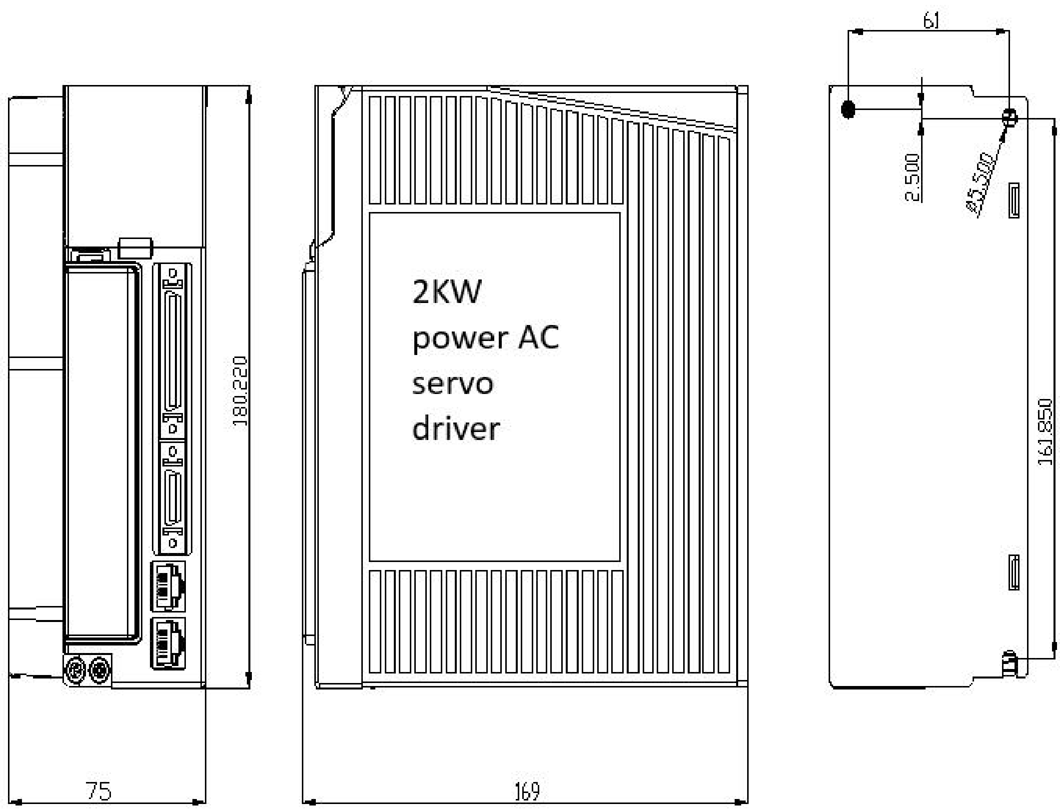


Figure 171 2KW power AC servo JASD-R/RC driver (unit: mm)

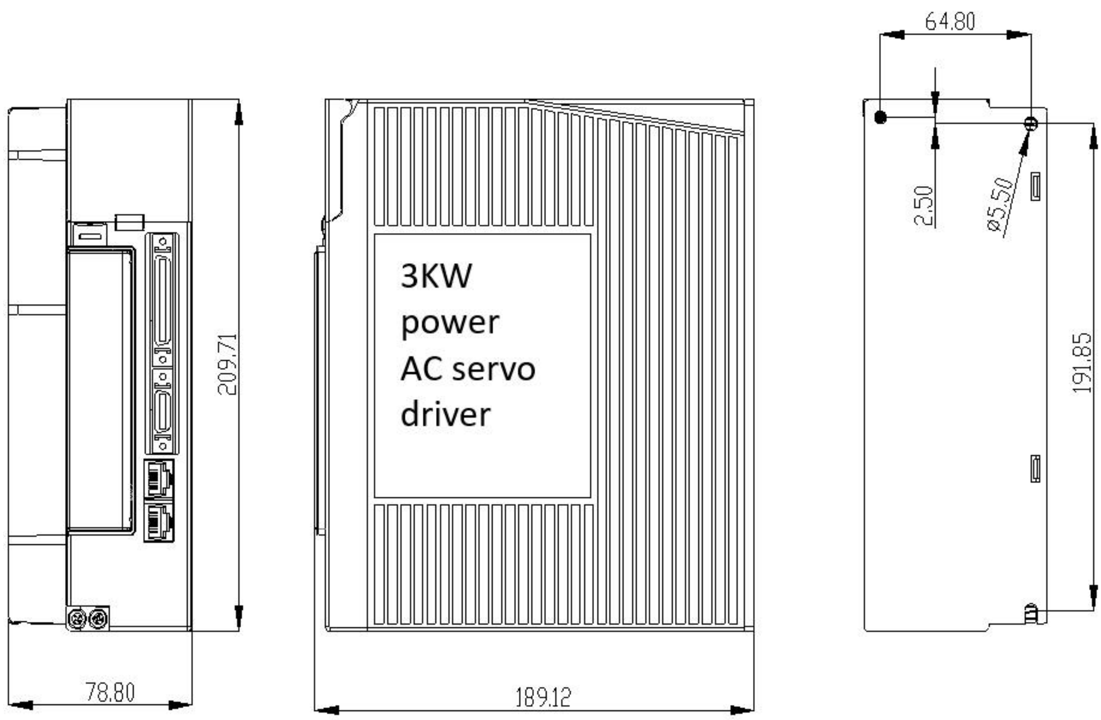


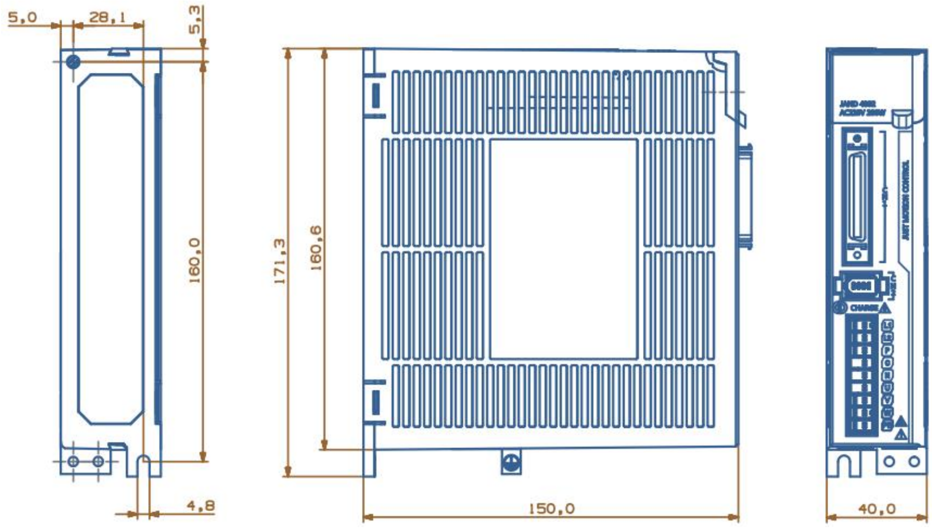
Figure 172 3KW power AC servo JASD-R/RC driver (unit: mm)

Notice:

1. The normal installation direction of the servo driver must be vertical and upright, with the top facing up for heat dissipation.

2. The driver shall be installed with good ventilation. When there are multiple drivers in the cabinet, the distance between them shall not be less than 5cm.

3. In order to ensure the safety of use, please make sure that the ground protection terminal of the driver is well connected with the equipment protection ground!



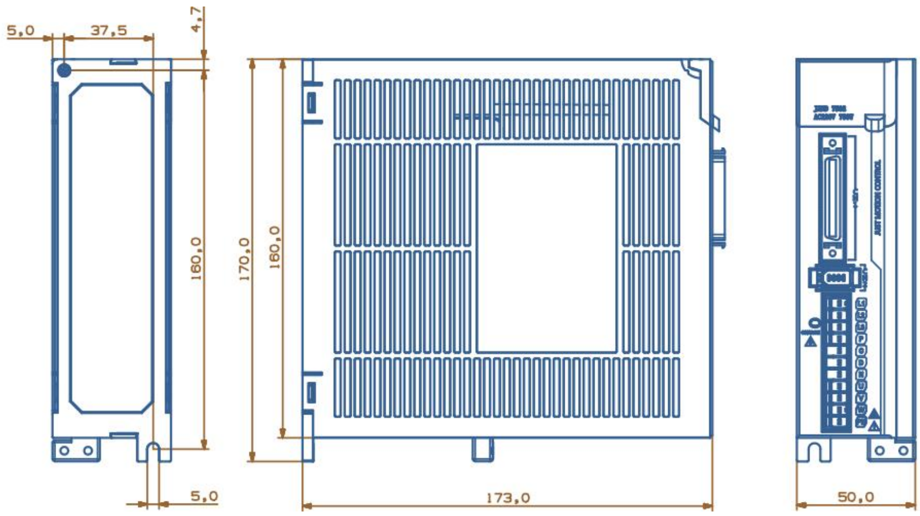
400W and below power AC servo JAND-R/RC drive (unit: mm)

Notice:

1. The normal installation direction of the servo driver must be vertical and upright, with the top facing up for heat dissipation.

2. The driver shall be installed with good ventilation. When there are multiple drivers in the cabinet, the distance between them shall not be less than 5cm.

3. In order to ensure the safety of use, please make sure that the ground protection terminal of the driver is well connected with the equipment protection ground!



1000W and below power AC servo JAND-R/RC drive (unit: mm)

Notice:

1. The normal installation direction of the servo driver must be vertical and upright, with the top facing up for heat dissipation.

2. The driver shall be installed with good ventilation. When there are multiple drivers in the cabinet, the distance between them shall not be less than 5cm.

3. In order to ensure the safety of use, please make sure that the ground protection terminal of the driver is well connected with the equipment protection ground!

4.2Installation and Use Environment

The installation and use environment have a direct impact on the normal operation and service life of the product, so the following conditions must be met:

1. Working environment temperature: 0-55 ℃; working environment humidity: below 10% - 90% (no condensation).
2. Storage environment: - 20 ℃ ~ + 85 ℃; storage environment humidity: below 90% (no condensation).
3. Vibration: below 0.5G.
4. Prevent rain drips or wet environment.
5. Avoid exposure to sunlight.
6. Prevent oil mist and salt erosion.
7. Prevent corrosive liquid, gas, etc.
8. Prevent the invasion of dust, cotton and metal filings.
9. Keep away from radioactive materials and combustibles.
10. Space shall be reserved around the place where the drives are placed in the cabinet to facilitate loading, unloading and maintenance.
11. Pay attention to the air flow in the cabinet. If necessary, install an external fan to enhance the air flow and reduce the ambient temperature of the driver to facilitate heat dissipation. The long-term working temperature is below 55 ℃.
12. Try to avoid vibration source nearby, and install damping device such as vibration absorber or anti vibration rubber gasket.
13. If there is an electromagnetic interference source nearby, the power supply and control circuit of the driver are easy to be interfered and lead to misoperation, the noise filter can be added or various effective anti-interference measures can be adopted to ensure the normal operation of the driver (the noise filter will increase the leakage current, and the input end of the driver power supply needs to be loaded with an isolation transformer).

➢ 5Panel Display Description and Settings

5.1Function Introduction of Each Part of The Panel

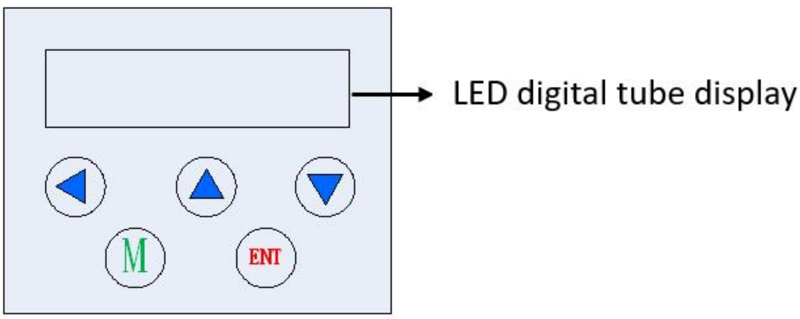
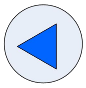
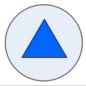
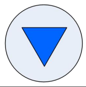
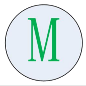
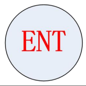


Figure 173 Key panel

JASD series AC servo panel uses six LED nixie tubes to display the status; five key input instructions, with specific key functions as follows:

Table 165 Key function description

Panel key label	Definition	Explain
	LEFT key	Displacement function Switch display of high / low position in parameter mode
	UP key	Display change, value adding function
	DOWN key	Display change, value reduction function
	M key	Function switching and withdrawal
	ENT key	Determine or save function

Notice:

Press and hold **ENT key** for 3 seconds to confirm or save the function.

In the monitoring and parameter interface, long press **ENT key** to turn quickly.

5.2Operation Mode Switching Flow

JASD series ac servo has four functional modes, which are status display mode, monitoring mode, parameter setting mode and auxiliary mode. The switching process between them is as follows:

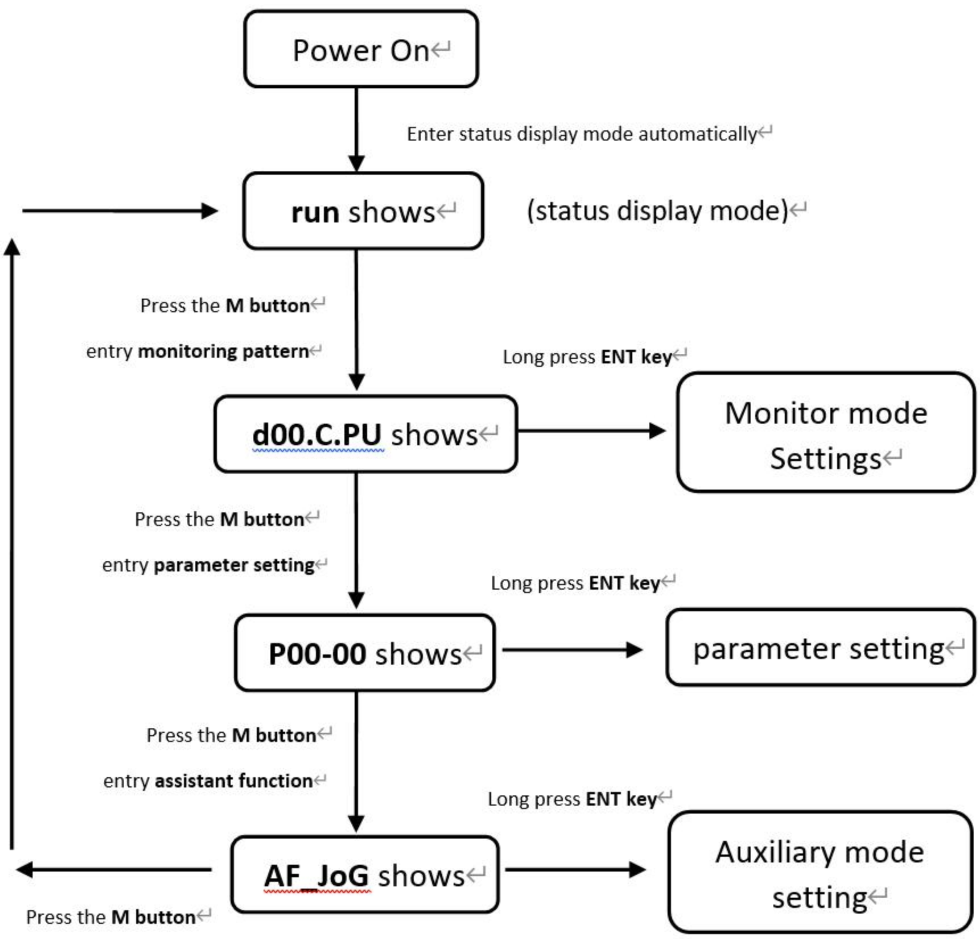


Figure 174 Operation mode switching process

Notice： After pressing **ENT key** to enter the mode setting, you can exit the mode selection by pressing **M key**

5.3Status Display

The display discrimination is as follows:

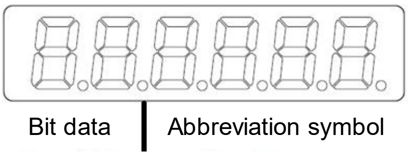


Figure 175 LED Shows

Table 166 Status display bit data meaning

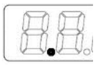
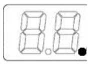
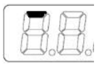
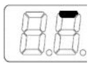
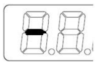
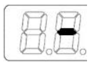
Show	Meaning	Show	Meaning
	Power on display of control circuit power supply		Main circuit power supply ready display
	Velocity and torque control: velocity consistent display Position control: positioning complete display		Rotate checkout display
	Base blocking display Servo OFF status lights up, ON status lights out		Velocity and torque control: velocity command input Position control: display in command pulse input

Table 167 Meaning of status display abbreviation

Show	Meaning
nrdY	Servo not ready (power supply not powered on)
rdY	Servo ready (servo motor is not powered)
run	Servo enable state (servo motor energized state)
Pot	Indicates that the forward over travel signal input port is in a valid state, and the motor forward rotation command is invalid
not	Indicates that the input port of reverse overtravel signal is in a valid state, and the motor reverse command is invalid
FinSh	Servo related operation completed correctly
SY_on	The servo is in the enable state and cannot operate. It must be closed to enable operation
no_oP	Invalid value entered; servo does not perform current operation
LocKd	Relevant parameters of servo are locked and can only be operated after unlocking
AL-501	Servo fault display, please refer to Chapter 9 for fault definition

5.4Parameter Setting Writing and Saving Method

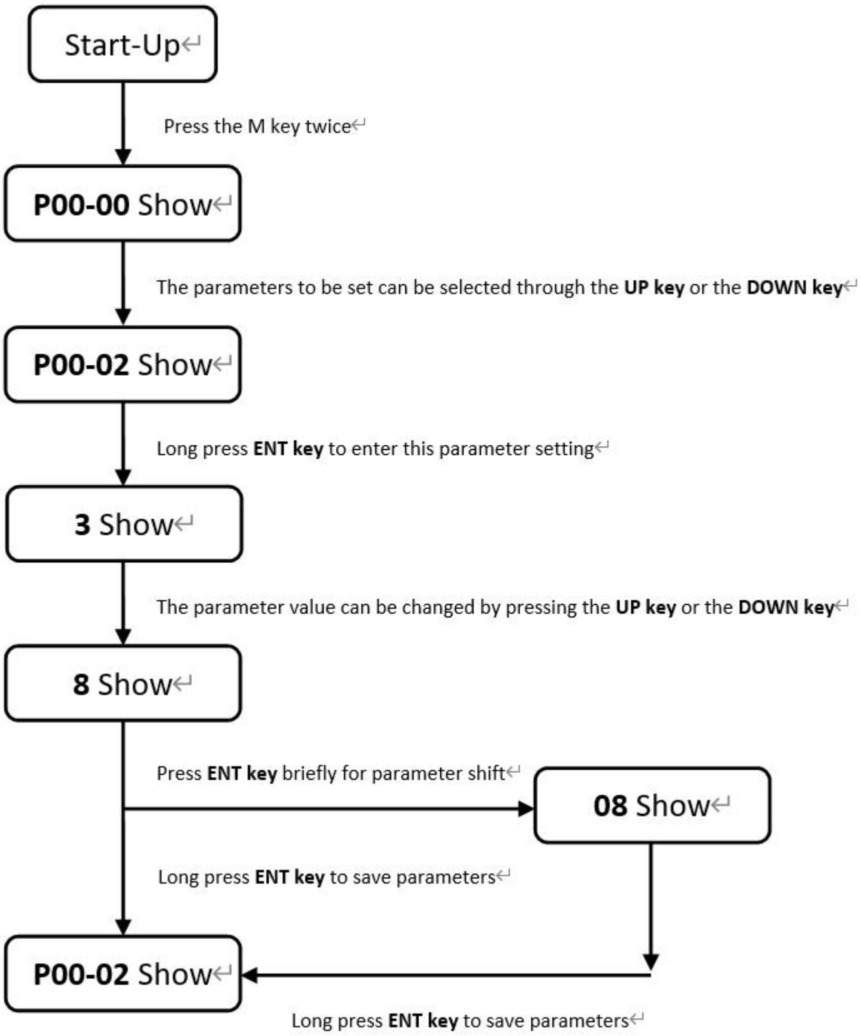


Figure 176 Parameter Setting Writing and Saving Method

➢ 6Control Mode and Setting

6.1Position Control

6.1.1Location control wiring diagram

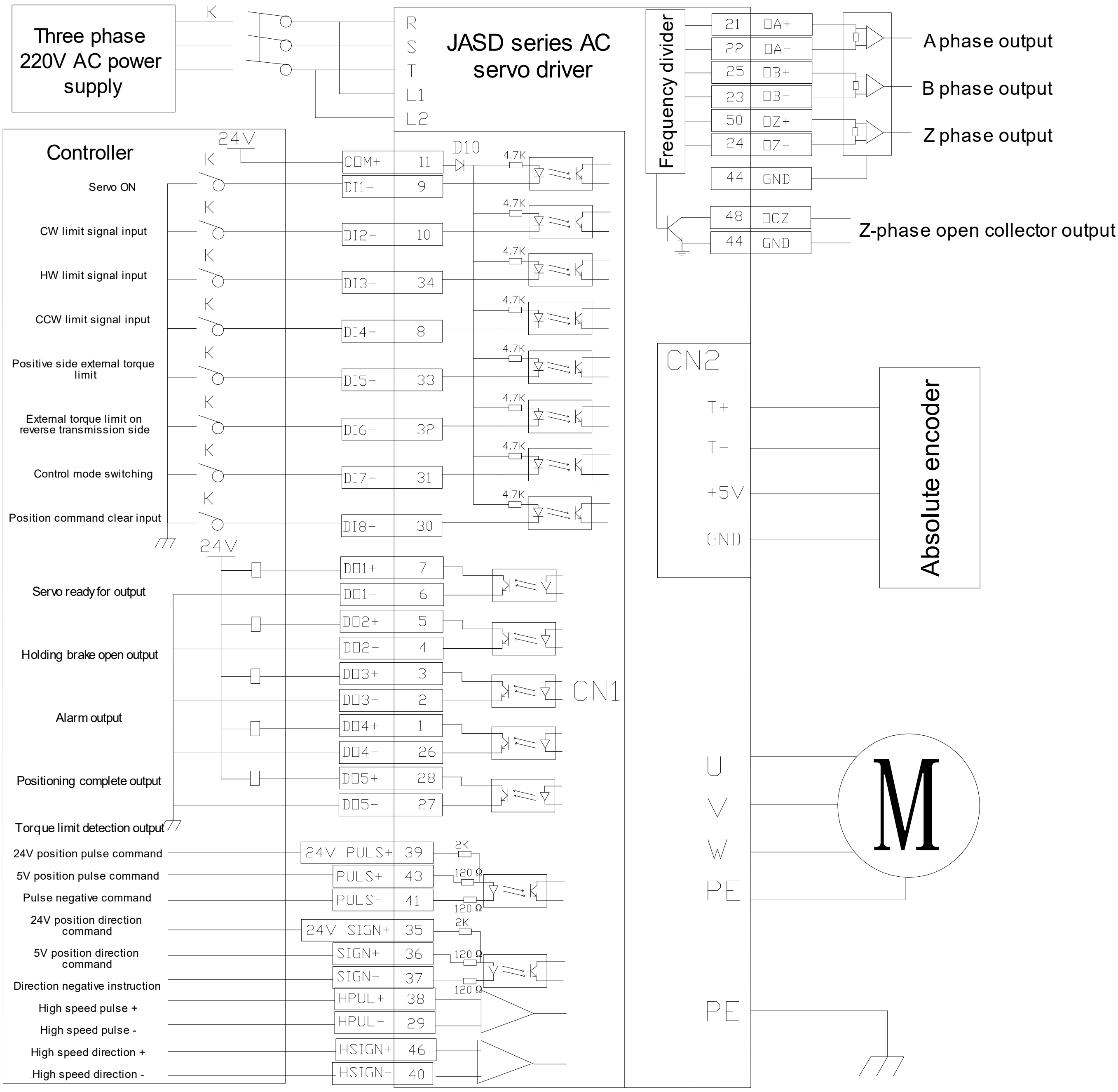
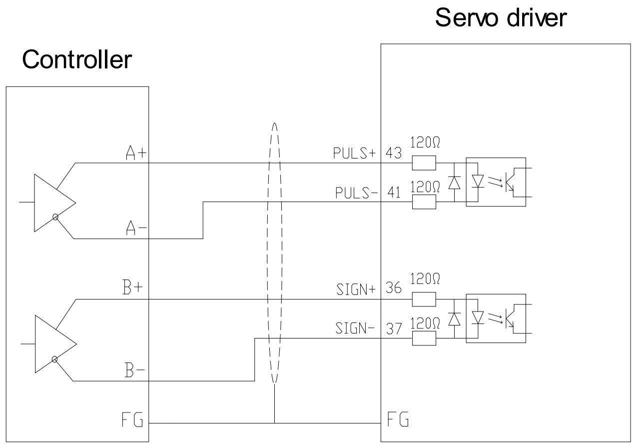


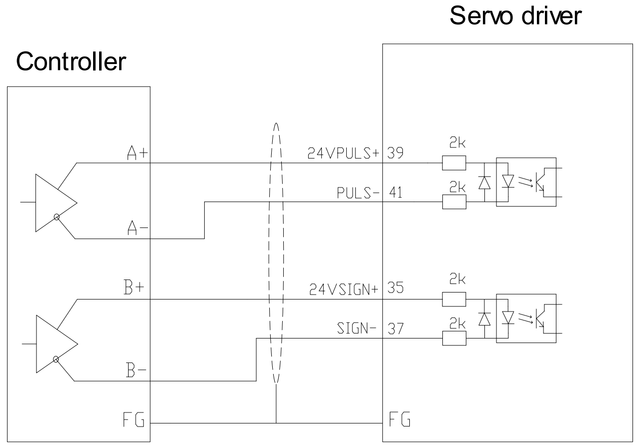
Figure 177 Location control wiring diagram

6.1.2Wiring diagram of position control

Description of controller end direction + pulse input mode: direction + pulse input is divided into 5V, 24V signal input mode, which can improve anti-interference ability by using twisted pair connection. In general, this kind of position control wiring method is often used in MCU system. The maximum input pulse frequency of this control mode is 500KHz.

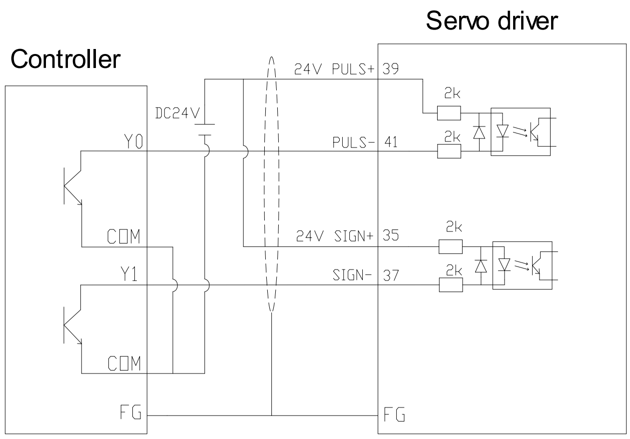


5V pulse + direction input mode

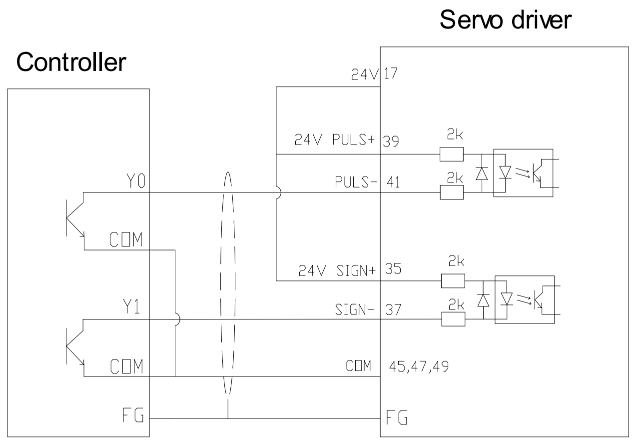


24V pulse + direction input mode

Open circuit input mode description of collector at controller end: single end input mode can use the power supply provided inside the driver or external power supply. However, the dual power input cannot be used to avoid damage to the drive. In general, this kind of position control wiring method is often used in PLC controller system.



Open collector using external power



Open collector using internal power supply

Notice: the high level of high-velocity pulse port input must be between 3.3-5V

6.1.3Description of position control mode parameters

Table 168 Control parameters of motor and driver

Parameter code	Name	Set scope	Set up	Explain
P01-01	Control mode setting	0-6	0	0: Location mode 1: Velocity mode 2: Torque mode 3: Velocity, Torque 4: Position, Velocity 5: Position, Torque 6: Full closed loop
P00-05	Pole pairs of motor	1-31	---	Specific parameter setting depends on the motor
P00-07	Encoder selection	0-3	---	

P00-10	Number of incremental encoder lines	0-65535	---	
P03-00	Location command source	0-1	0	0：Pulse command 1：Number given
P03-01	Command pulse mode	0-3	1	0：Quadrature pulse instruction 1：Direction + pulse command 2 or 3：Double pulse command
P03-02	Command pulse input terminal	0-1	0	0：Low velocity pulse 1：High velocity pulse
P03-03	Command pulse reversal	0-1	0	Set the initial direction of motor rotation
P03-09	The number of command pulses for one revolution of motor	0-65535	0	Set according to user requirements See **8.2 Parameter Analysis Description**
P03-10	Molecule of electronic gear 1	1-65535	1	Set according to user requirements See **8.2 Parameter Analysis Description**
P03-11	Denominator of electronic gear 1	1-65535	1	

Notice：**For gain parameters,** please refer to **"parameter adjustment"** for adjustment

6.1.4 Example of electronic gear ratio calculation

1、 Ball screw drive

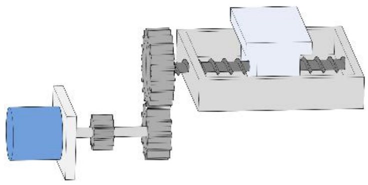


Figure 178 Ball screw drive

If：

（1）Mechanical parameters：Reduction ratio R is 2 / 1, lead of lead screw is 10 mm

（2）Absolute Encoder position ring resolution per turn：17bit=131072

（3）Load displacement corresponding to 1 position instruction (instruction unit) is required：0.001mm

Then：

From (1) and (3), the position command (command unit) value required for the lead screw to rotate for 1 turn (the workbench moves for 10 mm)：

$$\frac{10}{0.001}=10000$$

The ratio of electronic gear is: (B is molecule, A is denominator)

$$\frac{B}{A}=\frac{131072}{10000}\times\frac{2}{1}=\frac{16384}{625}$$

Finally, parameter P03-10 is set to 16384, and P03-11 is set to 625

2、 Pulley drive

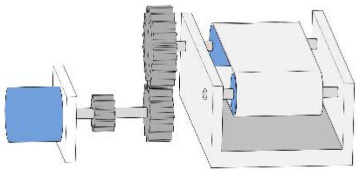


Figure 179 Pulley drive

If:

（1）Mechanical parameters: reduction ratio R: 5 / 1, pulley diameter: 0.2m (pulley circumference: 0.628m)

（2）Absolute Encoder position ring resolution per turn：17bit=131072

（3）Load displacement corresponding to 1 position instruction (instruction unit) is required：0.000005m

Then：

From (1) and (3), the position command (command unit) value required for the lead screw to rotate for 1 turn：

$$\frac{0.628}{0.000005}=125600$$

The ratio of electronic gear is: (B is molecule, A is denominator)

$$\frac{B}{A}=\frac{131072}{125600}\times\frac{5}{1}=\frac{4096}{785}$$

Finally, parameter P03-10 is set to 4096, and P03-11 is set to 785

3、 Rotating load

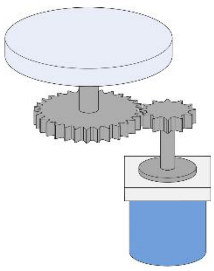


Figure 180 Rotating load

If:

（1）Mechanical parameters: the reduction ratio R is 10 / 1, and the rotation angle of the load shaft is 360 °

（2）Absolute encoder position ring resolution per revolution：17bit=131072

（3）Load displacement corresponding to 1 position instruction (instruction unit)：0.01°

Then：

From (1) and (3), the position command (command unit) value required for the lead screw to rotate for 1 turn：

$$\frac{360}{0.01}=36000$$

The ratio of electronic gear is: (B is molecule, A is denominator)

$$\frac{B}{A}=\frac{131072}{36000}\times\frac{10}{1}=\frac{8192}{225}$$

Finally, parameter P03-10 is set to 8192, and P03-11 is set to 225

6.2Velocity Control Description

6.2.1Velocity control wiring diagram

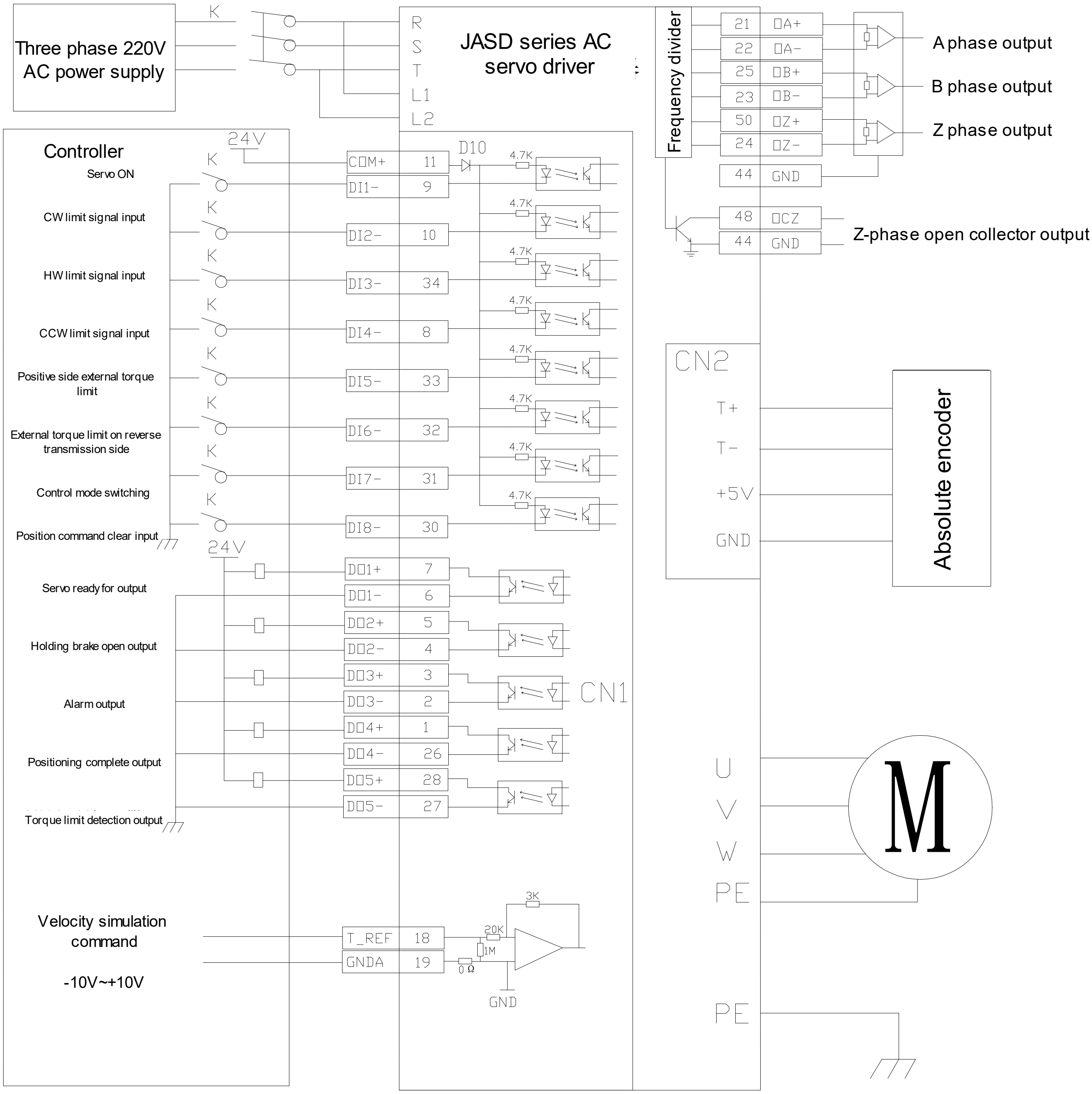


Figure 181 Velocity control wiring diagram

6.2.2 Description of velocity control parameters

Table 169 Control parameters of motor and driver

Parameter	Name	Setting range	Set up	Explain

P01-01	Control mode setting	0-6	1	0： Position control mode 1： Velocity control mode 2： Torque control mode 3：Velocity，Torque 4：Position，Velocity 5：Position，Torque 6：Full closed loop
P00-05	Log of motor pole	1-31	---	Specific parameter setting depends on the motor
P00-07	Encoder selection	0-3	---	
P00-10	Incremental encoder line count	0-65535	---	
P04-00	Velocity command source	0-3	0	0: external analog command 1: Digital command (parameter setting) 2：Digital command (Communication) 3: Internal multiple groups of instructions
P04-01	Reverse velocity command analog quantity	0-1	0	Set the initial direction of motor rotation
P04-02	Given value of digital velocity	-6000—6000	0	Set the velocity command value, the velocity mode is valid when P04-00 is 1.
P04-06	Forward velocity limit	0-6000		Limit forward velocity
P04-07	Reverse velocity limit	0-6000		Limit reverse velocity
P06-40	Velocity analog command input gain	10-2000		Set according to user requirements

Notice： **For gain parameters,** please refer to **"Parameter Adjustment"** for adjustment

6.3 Torque Control

6.3.1 Torque control wiring diagram

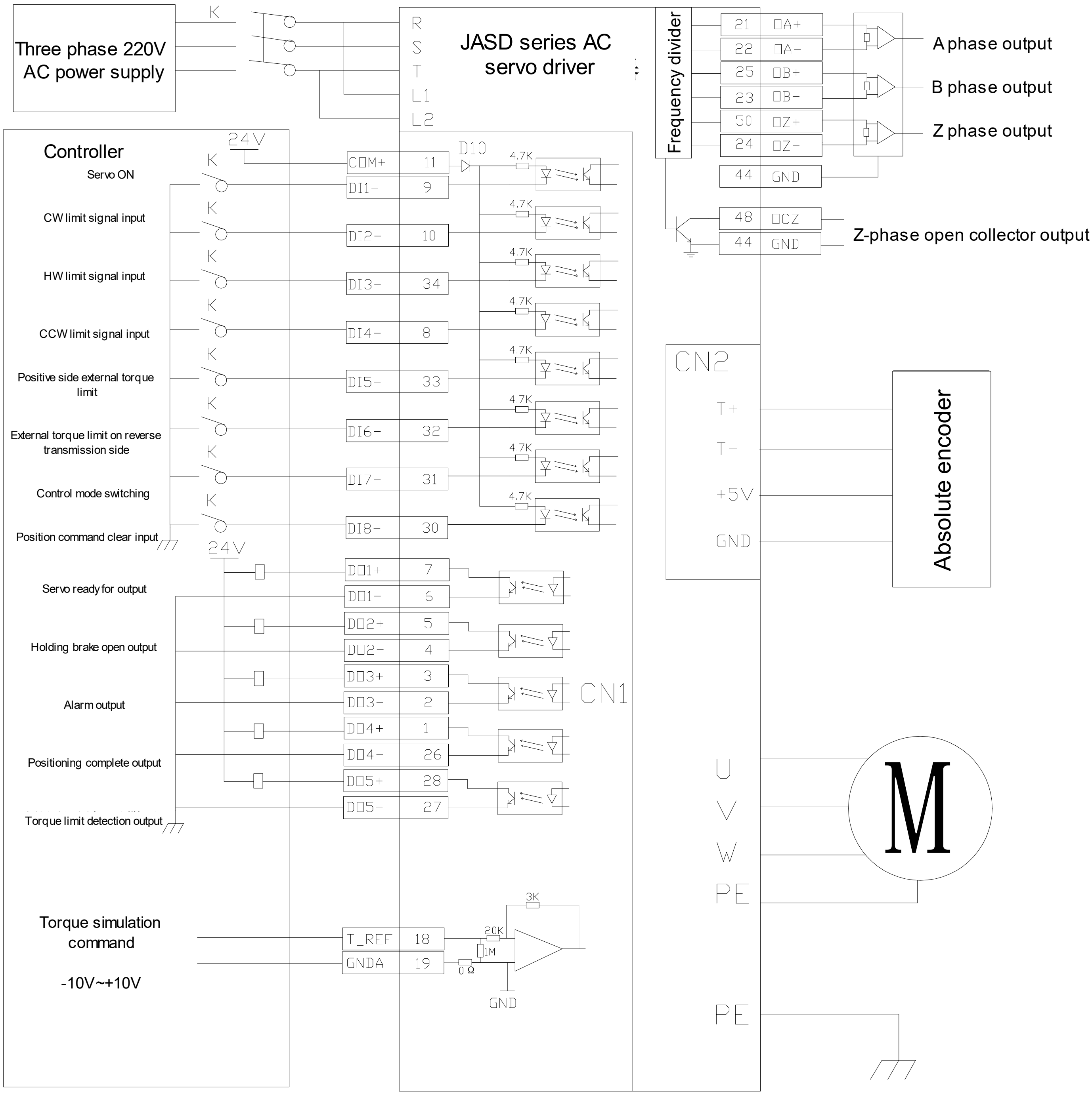


Figure 182 JASD-R/RC Torque control wiring diagram

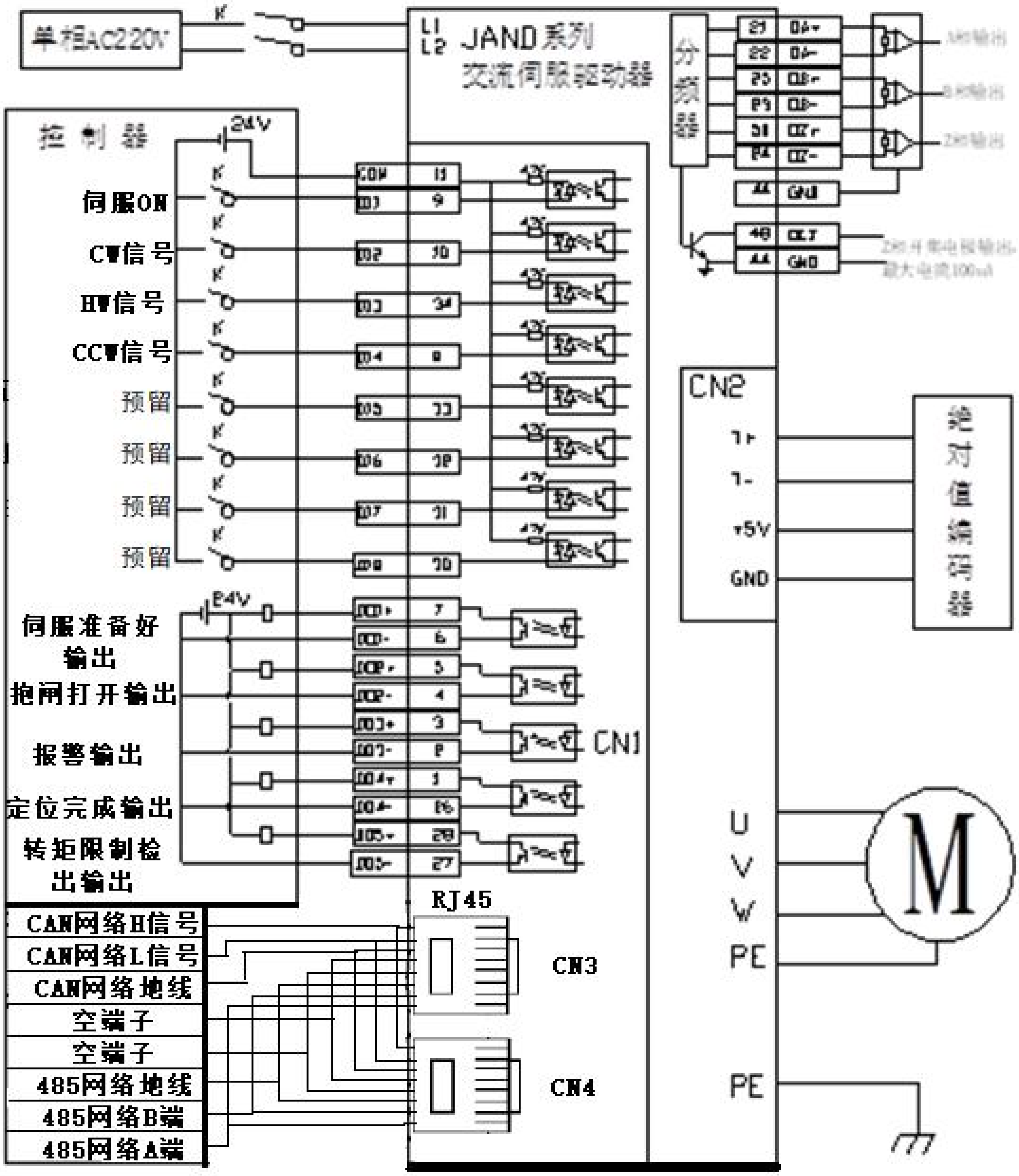


Figure 189 JAND-R/RC Torque control wiring diagram

6.3.2 Parameter description of torque control mode

Table 170Parameter description of torque control mode

Paramete r code	Name	Set scope	Set up	Explain
P01-01	Control mode setting	0-6	2	0: Position control mode 1: Velocity control mode 2: Torque control mode 3: Velocity, Torque 4: Position, Velocity 5: Position, Torque 6: Full closed loop
P00-05	Pole pairs of motor	1-31	---	Specific parameter setting depends on the motor
P00-07	Encoder selection	0-3	---	

P00-10	Number of incremental encoder lines	0-65535	---	
P05-00	Torque command source	0-3	0	0: external analog command (velocity limit amplitude is set by P05-02) 1: Digital command (velocity limit amplitude is set by P05-02) 2: External simulation command (velocity limit amplitude is determined by velocity simulation command) 3: Digital command (velocity limit amplitude is determined by velocity analog command)
P05-01	Reverse torque command analog quantity	0-1	0	Set the initial direction of motor rotation
P05-02	Torque mode velocity limit given value	0-6000	1000	Sets the maximum velocity of the motor in torque mode. Valid when P05-00 is 0,1
P05-05	Torque limiting setting source	0-1	0	Source for adjusting torque limits
P05-10	Internal forward torque limiting amplitude	0-300.0	200.0	Limit forward torque value
P05-11	Internal reverse torque limiting amplitude	0-300.0	200.0	Limit reverse torque value
P06-43	Torque analog command input gain	0-100	10	Set according to user requirements

Notice: **For gain parameters,** please refer to **"Parameter Adjustment"** for adjustment

➢ 7 Commissioning and Parameter Adjustment

7.1Test Run

7.1.1Pre operation detection

In order to avoid injury to the servo driver or mechanism, please remove all loads of the servo motor before operation, carefully check whether the following precautions are normal, and then power on for no-load test; after the no-load test is normal, connect the load of the servo motor for the next test.

Table 171 Matters needing attention

Detection before power on	1、 Check the servo driver for obvious appearance damage 2、 Please insulate the connecting part of wiring terminal 3、 Look inside the drive for foreign material 4、 Servo driver, motor and external regeneration resistance shall not be placed on combustible objects 5、 To avoid failure of electromagnetic brake, please check whether the power circuit can be stopped and cut off immediately 6、 Confirm whether the external power supply voltage of servo driver meets the requirements 7、Confirm whether the U, V, W power lines, encoder lines and signal lines of the motor are connected correctly (confirm according to the motor label and instructions)
Detection when power on	1、 Whether the LED display of servo driver is normal 2、 Confirm whether all parameters are set correctly, and unexpected actions may occur according to different mechanical characteristics, do not adjust the parameters excessively 3、 Servo motor self-locking 4、Please contact the manufacturer if the servo motor has excessive vibration and sound during operation

7.1.2 No load test run

JoG mode no-load trial run test, users do not need to connect additional wiring, for safety reasons, before the JoG no-load velocity test, please fix the motor frame, to prevent the motor velocity change caused by the reaction force to cause danger.The following is a simple wiring diagram in JoG mode：

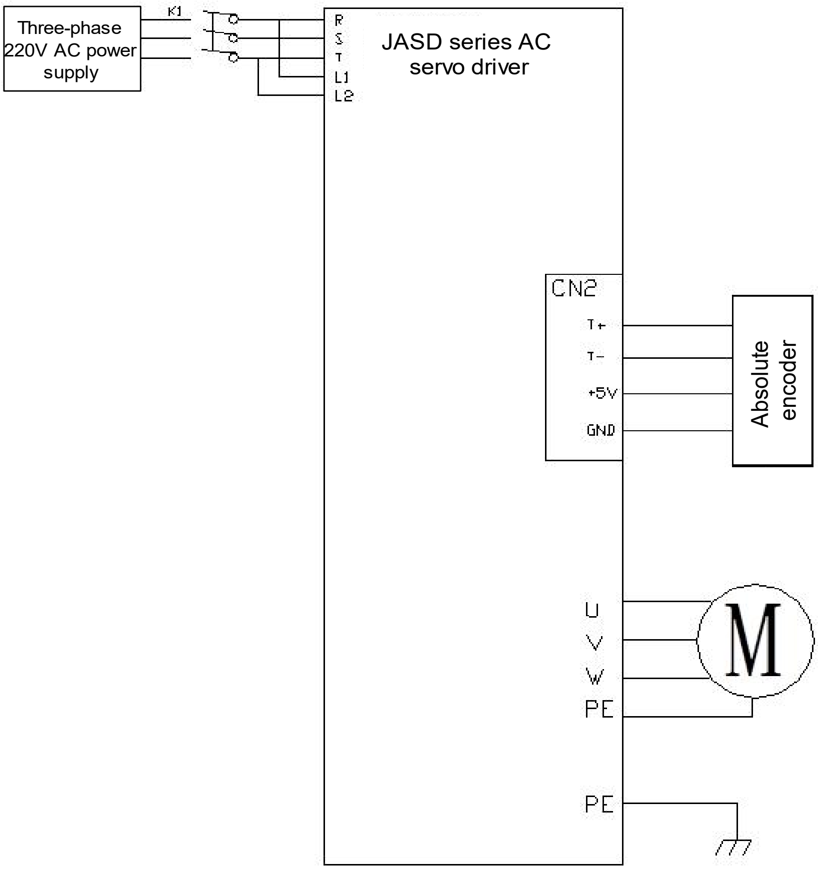


Figure 183 JASD-R/RC Simple wiring diagram in JoG mode

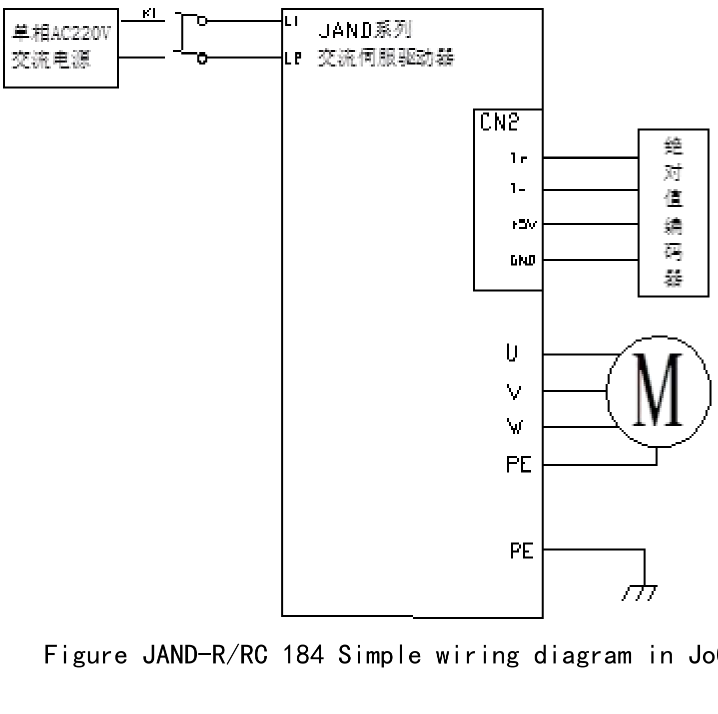


Figure JAND-R/RC 184 Simple wiring diagram in JoG mode

Select JoG mode for trial operation according to the following flow chart:

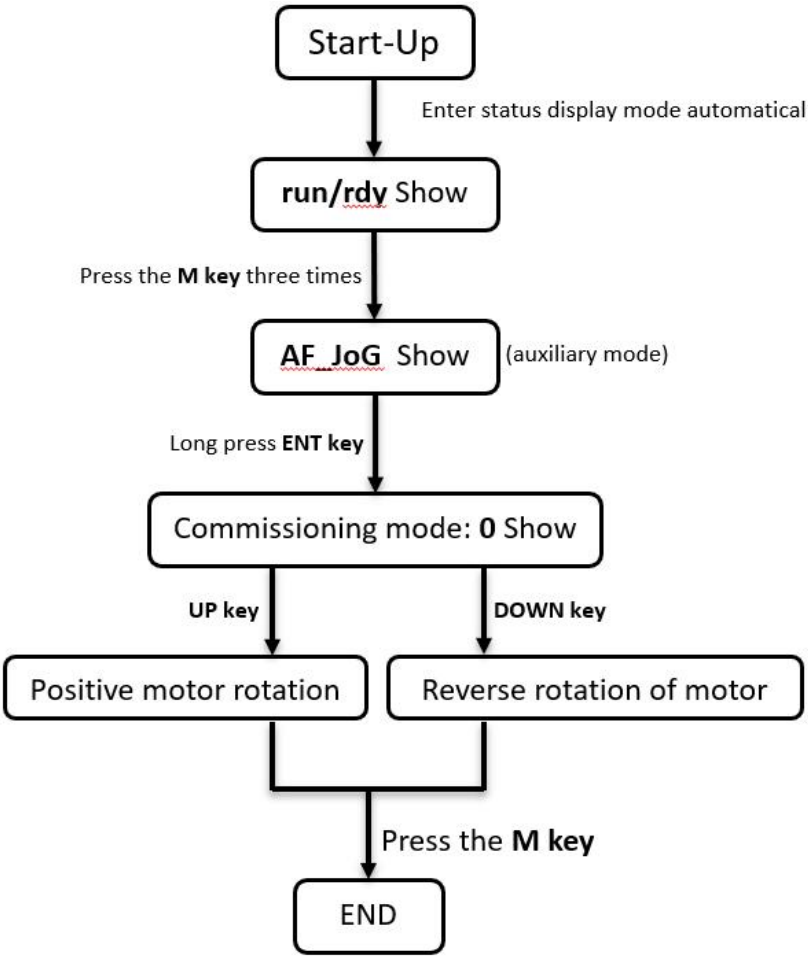


Figure 184 JoG mode flow chart

7.2 Parameter Adjustment

According to the requirements of the equipment, after choosing the appropriate control mode, the servo gain parameters need to be adjusted reasonably. So that the servo driver can drive the motor quickly and accurately, and maximize the mechanical performance.

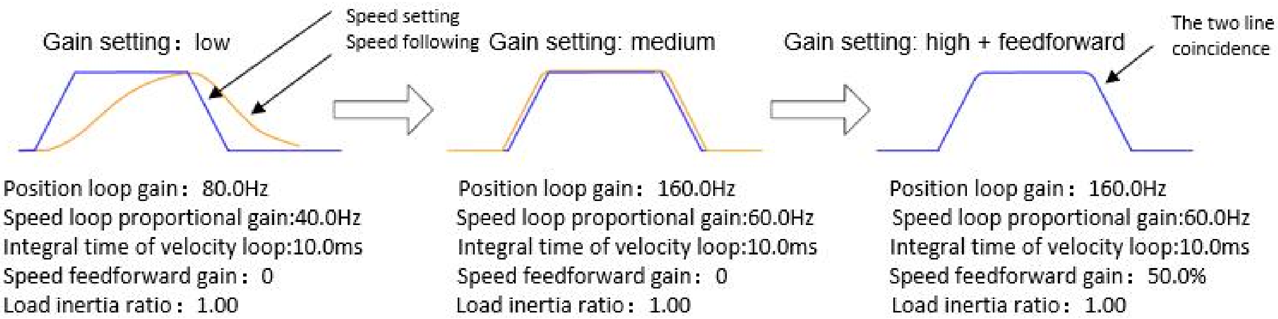


Figure 185 Curve under different gain

The servo gain is adjusted by several loop parameters (position loop, velocity loop, filter, etc.), which will affect each other. Therefore, the gain setting needs to be balanced and adjusted according to certain rules.

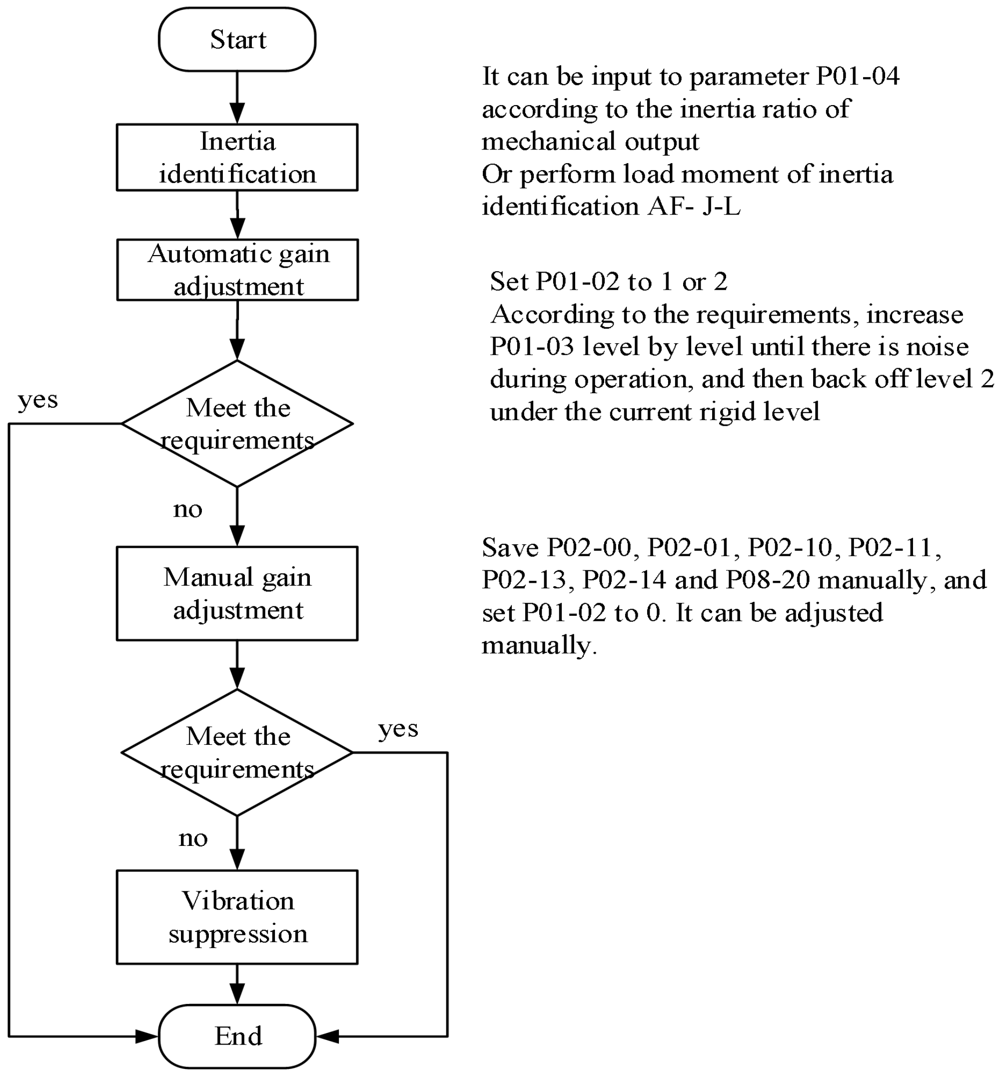


Figure 186 Gain adjustment flow chart

7.3 Manual Gain Adjustment

7.3.1 Basic parameters

When the automatic gain adjustment fails to achieve the desired effect, you can manually fine tune the gain to optimize the effect. The servo system consists of three control loops. The basic control block diagram is as follows：

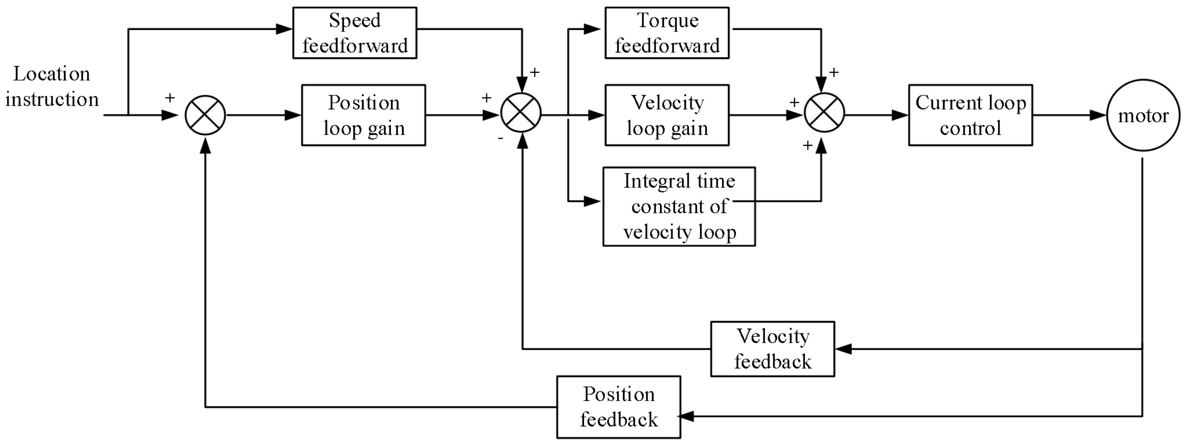


Figure 187 Control block diagram of servo system

The gain adjustment needs to set the load inertia ratio P01-04 first, then adjust the velocity loop gain, and finally adjust the position loop gain according to the order of the inner loop and the outer ring.

Velocity loop gain: increase the setting value as much as possible without vibration and noise, which can improve the velocity following performance and velocity up the positioning time.

Velocity integral constant: the smaller the setting value is, the faster the integration velocity is, and the stronger the integration effect is. If it is too small, it is easy to produce vibration and noise.

Table 172 Basic gain parameters

Parameter code	Name	Set scope	Set up	Explain
P01-02	Real time automatic adjustment mode	0-2	2	0: adjust the rigidity manually. 1: Standard mode automatically adjusts rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03, and manual adjustment of these parameters will not work. The following parameters are set by the user: P02-03 (velocity feedforward gain), P02-04 (velocity feedforward smoothing constant). 2: The positioning mode automatically adjusts the rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03, and manual adjustment of these parameters will not work. The following parameters will be fixed and cannot be changed: P02-03 (velocity feedforward gain): 30.0% P02-04 (velocity feedforward smoothing constant): 0.50
P01-03	Real time automatic adjustment of rigidity	0-31	13	32 kinds of gain parameters are built in, which will work when P01-02 is set to 1 or 2. It can be called directly according to the actual situation. The larger the setting value is, the

	setting			stronger the rigidity is.
P02-00	Position control gain 1	0-3000.0	80.0	▸The larger the setting value is, the higher the gain is, the greater the rigidity is, and the smaller the position lag is. However, if the value is too large, the system will oscillate and overshoot. ▸ Increase the value as much as possible without shock. ▸For gain at rest.
P02-01	Position control gain 2	0-3000.0	80.0	▸the larger the setting value is, the higher the gain is, the greater the rigidity is, and the smaller the position lag is. However, if the value is too large, the system will oscillate and overshoot. ▸ increase the value as much as possible without shock. ▸for gain in motion.
P02-03	Velocity feedforward gain	0-100.0	30.0	The larger the feedforward gain of the velocity loop, the smaller the position tracking error and the faster the response. However, if the feedforward gain is too large, the position loop of the system will be unstable and prone to overshoot and oscillation.
P02-04	Velocity feedforward smoothing constant	0-64.00	0	This parameter is used to set the feedforward filter time constant of velocity loop. The larger the value, the larger the filtering effect, but the larger the phase lag.
P02-10	Velocity proportional gain 1	1-2000.0	40.0	▸the larger the setting value, the greater the gain and rigidity, and the parameter value is set according to the motor and load conditions. ▸ increase the value as much as possible without shock. ▸for gain at rest.
P02-11	Velocity integral constant 1	0.1-1000.0	10.0	▸ the integration time constant of velocity regulator, the smaller the setting value is, the faster the integration velocity is, the greater the rigidity is, and it is easy to produce vibration and noise if it is too small. ▸try to reduce the parameter value as much as possible when there is no vibration in the system. ▸this parameter is for steady-state response.

P02-12	Pseudo differential feedforward control coefficient 1	0-100.0	100.0	▸when it is set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast; when it is set to 0, the integral effect of the velocity loop is obvious, which can filter the low-frequency interference, but the dynamic response is slow. ▸by adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low-frequency interference.
P02-13	Velocity proportional gain 2	1-2000.0	45.0	▸the larger the setting value, the greater the gain and rigidity, and the parameter value is set according to the motor and load conditions. ▸ increase the value as much as possible without shock. ▸for gain in motion.
P02-14	Velocity integral constant 2	0.1-1000.0	1000.0	▸ the integration time constant of velocity regulator, the smaller the setting value is, the faster the integration velocity is, the greater the rigidity is, and it is easy to produce vibration and noise if it is too small. ▸try to reduce the parameter value as much as possible when there is no vibration in the system. ▸this parameter is for steady-state response.
P02-15	Pseudo differential feedforward control coefficient 2	0-100.0	100.0	▸when it is set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast; when it is set to 0, the integral effect of the velocity loop is obvious, which can filter the low-frequency interference, but the dynamic response is slow. ▸by adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low-frequency interference.

7.3.2 Gain switching

The gain switching function can be triggered by the servo internal state or external DI Port, and is only effective in the position control and velocity control modes. With gain switching, you can:

Switch to a lower gain when the motor is stationary (servo enabled) to suppress vibration;

Switch to a higher gain when the motor is at rest (servo enable), so as to shorten the positioning time;

In order to obtain better command following performance, switch to higher gain in the motor running state;

According to the usage, different gain settings are switched with external signals.

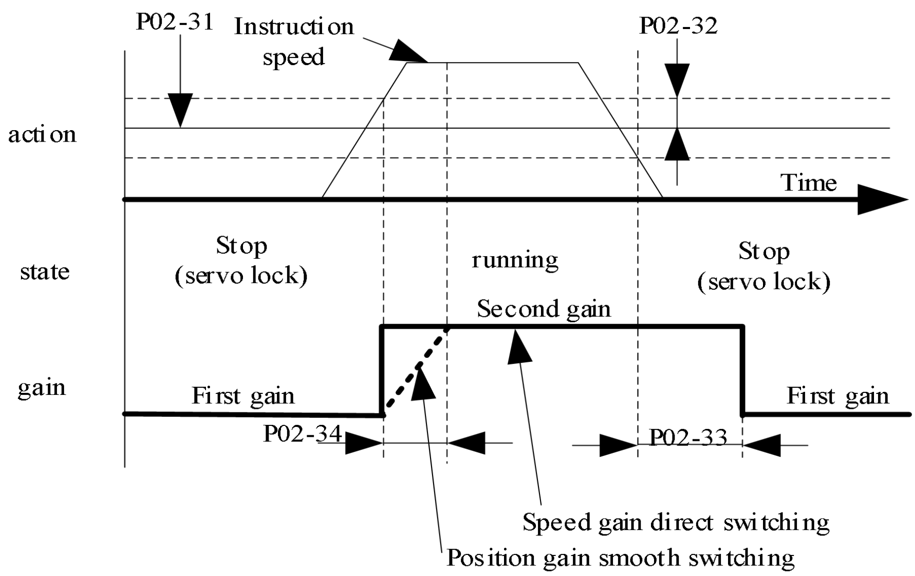


Figure 188 Gain switching

Table 173 Gain switching parameters

Parameter	Name	setting range	Factory Default	unit	time of taking effect
P02-30	Gain switching mode	0-10	7	---	Immediate effect
P02-31	Gain switching level	0-20000	800	---	Immediate effect
P02-32	Gain switching hysteresis	0-20000	100	---	Immediate effect
P02-33	Gain switching delay	0-1000.0	10.0	1ms	Immediate effect
P02-34	Position gain switching time	0-1000.0	10.0	1ms	Immediate effect

7.3.3 Feedforward function

Velocity feedforward: in position control, the velocity control command required by the calculation of position command is added to the output of position regulator to reduce the position deviation and improve the response of position control.

Torque feedforward: the torque command required by the velocity control command calculation is added to the velocity regulator output to improve the velocity control response.

1、Velocity feedforward operation

When the smooth constant of velocity feedforward is set to 50 (0.5ms), the feedforward gain of velocity is gradually increased to meet the system requirements. But too large velocity feedforward gain will cause position overshoot, which will make the setting time longer.

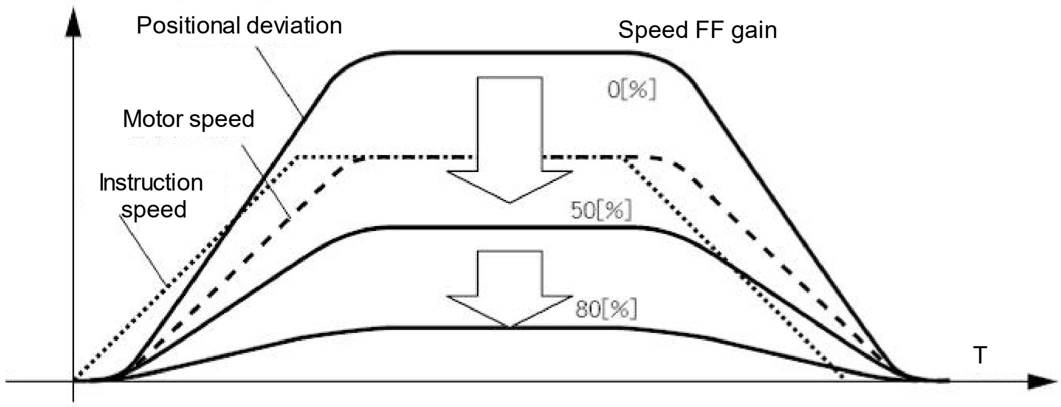


Figure 189 Velocity feedforward function

2、Torque feedforward operation

When the smooth constant of torque feedforward is set to 50 (0.5ms), the gain of torque feedforward is gradually increased to meet the system requirements.

Table 143Feedforward function related parameters

Parameter	Name	setting range	Factory Default	unit	time of taking effect
P02-03	Velocity feedforward gain	0-100.0	30.0	1.0%	Immediate effect
P02-04	Velocity feedforward smoothing constant	0-64.00	0.5	1ms	Immediate effect
P02-19	Torque feedforward gain	0-30000	0	1.0%	Immediate effect
P02-20	Torque feedforward smoothing constant	0-64.00	0.8	1ms	Immediate effect

7.3.4Disturbance observer

The disturbance torque can be reduced and the vibration can be reduced by using disturbance observer to deduce the disturbance torque value and compensate on the torque command. In position mode and velocity mode, the observation function is effective.

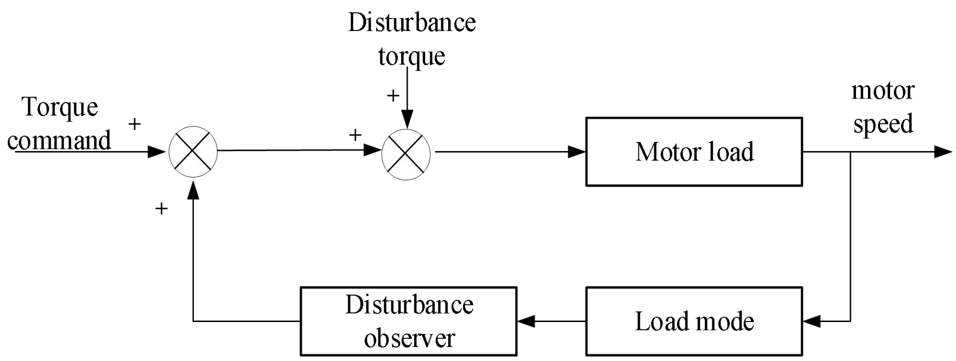


Figure 190 Disturbance observer

usage method:

1. Set P08-26 (filter constant) to a large value, and then gradually increase P08-25 (compensation gain), at this time, the action sound may become larger; after confirming that the current compensation

gain is effective, gradually reduce P08-26.
2. Increasing the gain can improve the effect of disturbance torque suppression, but the action sound becomes larger.
3. When the time constant of the filter is reduced, the disturbance torque with less delay can be estimated, and the effect of restraining the disturbance can be improved, but the action sound will become larger.
4. Please look for a balanced setting.

Table 144Related parameters of disturbance observer

Parameter	Name	setting range	Factory Default	unit	time of taking effect
P08-25	Disturbance torque compensation gain	0-100.0	0	%	Immediate effect
P08-26	Time constant of disturbance torque filtering	0-25.00	0.8	1ms	Immediate effect

7.3.5 Resonance suppression

If the servo system is too large and the response is too fast, it may cause resonance of the mechanical system, which can be improved by reducing the gain of the control loop. Without reducing the gain, the resonance can also be suppressed by using a low-pass filter and a notch filter.

1、Resonance frequency detection

The resonance frequency of the mechanical system can be observed by monitoring item d26.1.Fr

2、Torque command low pass filter (P08-20)

The low-pass filter can be used in the case of vibration frequency deviation, and it can be used in the case of high-frequency vibration. By setting the filter time constant, the resonance can be attenuated near the resonance frequency. However, the low-pass filter will make the system phase lag, reduce the bandwidth, and reduce the phase margin, which is easy to cause loop oscillation. So it can only be used in high frequency vibration.

Filter cut off frequency（Hz）= 1/(2*pi*P08-20(ms)*0.001)

Table 145Torque command filter constant

Parameter	Name	setting range	Factory Default	unit	time of taking effect
P08-20	Torque command filter constant	0-25.00	0.8	1ms	Immediate effect

3、Notch filter

The notch filter is used when the resonance frequency of the system is fixed. By reducing the gain at a specific frequency, the notch filter can suppress the mechanical resonance. When the notch filter is set correctly, the vibration can be restrained effectively, and the servo gain can be increased continuously. There are 4 groups of traps in the servo. When P08-11 is set to 0, 4 groups of traps can be started at the same time, and parameters can be input manually.

A. Adaptive notch mode

Through the Adaptive Notch function module, the servo system will automatically identify the current resonance frequency and automatically configure the notch parameters. Use steps:

a) Set P08-11 to 1 or 2 according to the number of resonance points. When resonance occurs, first set P08-11 to 1, open an adaptive notch filter. After gain adjustment, if a new resonance occurs, then set P08-11 to 2, open two adaptive notch filters.

b) During servo operation, the third and fourth group of notch filter parameters will be automatically updated, and the corresponding function code will be automatically stored every 30min. After storage, the notch filter parameters will be maintained after power failure.

c) If resonance is suppressed, the adaptive notch filter is effective. After waiting for the servo to run stably for a period of time, set P08-11 to 0, and the notch filter parameter will be fixed to the last updated value. This operation can prevent the parameter of the wave trap from being updated to the wrong value due to the misoperation in the servo operation, which will aggravate the vibration.

d) If the vibration cannot be eliminated for a long time, please turn off the servo enable in time.

If there are more than two resonance frequency points, the adaptive notch filter can not meet the demand, and the manual notch filter can be used at the same time.

Table 177 Mode selection of adaptive notch filter

Parameter code	Name	Explain
P08-11	Mode selection of adaptive notch filter	Setting range: 0-4 0: the third and fourth trapper parameters are no longer automatically updated, but saved as the current value. But manual input is allowed 1: One adaptive notch filter is effective, the parameters of the third notch filter are updated automatically and cannot be input manually 2: Two adaptive notch filters are effective. The parameters of the third and fourth notch filters are updated automatically and cannot be input manually 3: Resonance frequency only 4: Clear the third and fourth notch filter parameters and restore them to the factory settings

B. Manual setting of trap parameters

a) The resonance frequency of the mechanical system can be observed by monitoring items d26.1.Fr and d28.2.Fr.

b) Input the resonant frequency observed in the previous step into the parameters of the notch filter, and input the width level and depth level of the notch filter.

c) If the vibration is suppressed, the notch filter will work. Increase the gain continuously. Repeat the previous 2 steps after new vibration.

d) If the vibration cannot be eliminated for a long time, please turn off the servo enable in time.

C. Notch width class

$$\text{Notch width class} = \frac{\text{Notch width}}{\text{Center frequency of notch}}$$

The notch width represents the frequency bandwidth with an amplitude attenuation rate of - 3dB relative to the notch center frequency

D. Notch depth class

$$\text{Notch width class} = \frac{\text{Notch width}}{\text{Center frequency of notch}}$$

When the depth level of the notch is 0, the input is completely suppressed at the center frequency; when the depth level is 100, the input can pass completely at the center frequency.

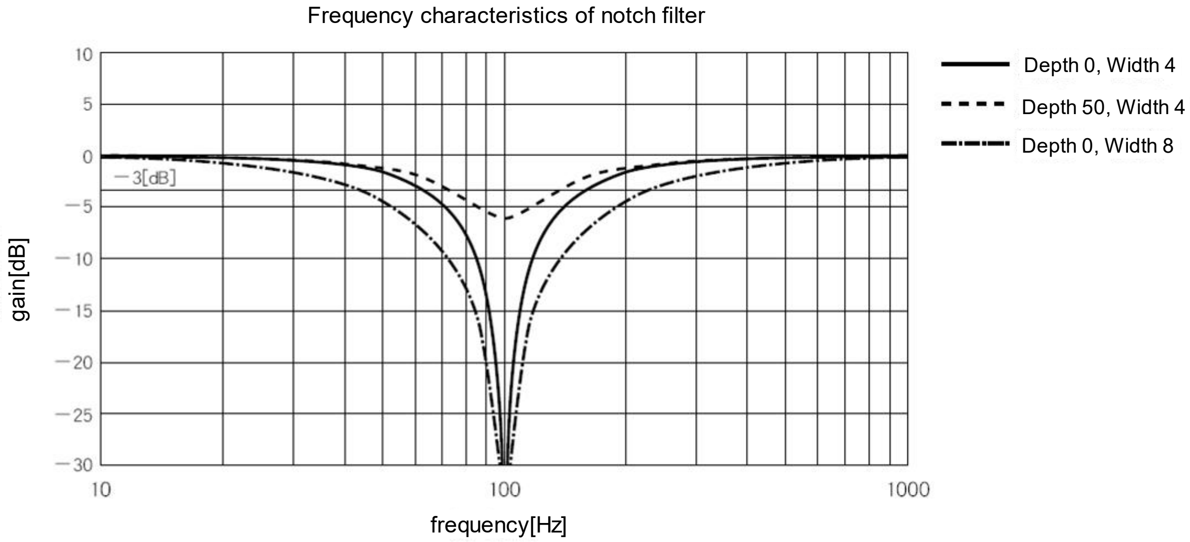


Figure 191 Frequency characteristics of notch filter

Relevant parameters of notch filter are shown in the table below：

Table 178 Relevant parameters of notch filter

Parameter code	Name	Explain
P08-30	Notch filter 1 frequency	Setting range: 50-5000, unit: Hz Center frequency of Notch 1 When it is set to 5000, the notch filter is invalid
P08-31	Notch filter 1 width	Setting range: 0-20 Notch width class of Notch 1 Is the ratio of width to center frequency
P08-32	Notch filter 1 depth	Setting range: 0-99 Notch depth level of Notch 1 The ratio relationship between output and input for the center frequency of the notch filter The larger the parameter, the smaller the depth of the notch and the weaker the effect

The relevant parameters of the notch filter are shown in the table below：

Table 179Relevant parameters of notch filter

Parameter	Name	setting range	Factory Default	unit	time of taking effect
P08-11	Mode selection of adaptive notch filter	0-4	0	---	Immediate effect
P08-30	Notch filter 1 frequency	50-5000	5000	HZ	Immediate effect
P08-31	Notch filter 1 width	0-20	2	---	Immediate

					effect
P08-32	Notch filter 1 depth	0-99	0	---	Immediate effect
P08-33	Notch filter 2 frequency	50-5000	5000	HZ	Immediate effect
P08-34	Notch filter 2 width	0-20	2	---	Immediate effect
P08-35	Notch filter 2 depth	0-99	0	---	Immediate effect
P08-36	Notch filter 3 frequency	50-5000	5000	HZ	Immediate effect
P08-37	Notch filter 3 width	0-20	2	---	Immediate effect
P08-38	Notch filter 3 depth	0-99	0	---	Immediate effect
P08-39	Notch filter 4 frequency	50-5000	5000	HZ	Immediate effect
P08-40	Notch filter 4 width	0-20	2	---	Immediate effect
P08-41	Notch filter 4 depth	0-99	0	---	Immediate effect

➢ 8 Parameters and Functions

8.1 Parameter List

P00-xx indicates motor and driver parameters
P01-xx main control parameters
P02-xx indicates gain type parameter
P03-xx indicates position parameter
P04-xx represents velocity parameter
P05-xx represents torque parameter
P06-xx indicates I / O parameters
P08-xx indicates advanced function parameters

Table 180 Parameter list

type	Param-eter	Name	setting range	Factory Default	unit	Plcether-net	time of taking effect
Motor and driver param-eters	P00-00	Motor number	0-65535	2000		Downtime setting	Power up again
	P00-01	Motor rated rotating velocity	1-6000	---	rpm	Downtime setting	Power up again
	P00-02	rated motor toroue	0.01-655.35	---	N.M	Downtime setting	Power up again
	P00-0	motor rated current	0.01-655.3	---	A	Downtim	Power up

	3		5			e setting	again
	P00-04	Moment of inertia of motor	0.01-655.35	---	kg.cm²	Downtime setting	Power up again
	P00-05	Log of motor pole	1-31	---	P	Downtime setting	Power up again
	P00-07	Encoder selection	0-3	---	---	Downtime setting	Power up again
	P00-08	Save line incremental encoder	0-1	---	---	Downtime setting	Power up again
	P00-09	Absolute encoder type	0-1	---	---	Downtime setting	Power up again
	P00-10	Incremental encoder line count	0-65535	---		Downtime setting	Power up again
	P00-11	Incremental encoder Z pulse electrical Angle	0-65535	---		Downtime setting	Power up again
	P00-12	Initial angle of rotor 1	0-360	---	1°	Downtime setting	Power up again
	P00-13	Initial angle of rotor 2	0-360	---	1°	Downtime setting	Power up again
	P00-14	Initial angle of rotor 3	0-360	---	1°	Downtime setting	Power up again
	P00-15	Initial angle of rotor 4	0-360	---	1°	Downtime setting	Power up again
	P00-16	Initial angle of rotor 5	0-360	---	1°	Downtime setting	Power up again
	P00-17	Initial angle of rotor 6	0-360	---	1°	Downtime setting	Power up again
	P00-20	Power on interface display setting	0-100	100	---	Operation settings	Power up again
	P00-21	RS232 Communication baud rate	0-3	0	---	Downtime setting	Power up again
	P00-23	From the station address	0-255	1	---	Downtime setting	Power up again
	P00-24	Modbus Communication baud rate	0-7	2	---	Downtime setting	Power up again
	P00-25	verification mode	0-3	1	---	Downtime setting	Power up again
	P00-27	CANopen communication baud rate	0-7	6	---	Downtime setting	Power up again
	P00-28	485 protocol selection	0-2	0	---	Downtime setting	Power up again
	P00-30	Brake resistance setting	0-2	---	---	Downtime setting	Power up again
	P00-31	External brake	0-65535	---	10W	Operation	Power up

		resistance power				settings	again
	P00-32	External brake resistance	0-1000	---	1Ohm	Downtime setting	Power up again
	P00-40	Over temperature protection settings	0-1	1	---	Downtime setting	Power up again
	P00-41	Control power failure protection settings	0-1	1	---	Downtime setting	Power up again
Main control param-eter	P01-01	Control mode setting	0-6	0	---	Downtime setting	Immediate effect
	P01-02	Adjust the mode automatically in real time	0-2	2	---	Operation settings	Immediate effect
	P01-03	Real-time automatic adjustment of rigid Settings	0-31	13	---	Operation settings	Immediate effect
	P01-04	Moment of inertia ratio	0-100.00	1	multiple	Operation settings	Immediate effect
	P01-10	Control mode after overtravel	0-1	1	---	Operation settings	Immediate effect
	P01-20	Dynamic brake delay	0-250	50	1ms	Operation settings	Immediate effect
	P01-21	Disable dynamic brake when main power is OFF	0-1	1	---	Operation settings	Immediate effect
	P01-22	Disable dynamic brake when servo is OFF	0-1	1	---	Operation settings	Immediate effect
	P01-23	Disable dynamic brake in case of fault alarm	0-1	1	---	Operation settings	Immediate effect
	P01-24	No dynamic brake during overtravel	0-1	1	---	Operation settings	Immediate effect
	P01-30	The brake instruction - servo OFF delay time (Brake open delay)	0-255	50	1ms	Operation settings	Immediate effect
	P01-31	The velocity limit of the output of the brake command	0-3000	100	1rpm	Operation settings	Immediate effect
	P01-32	Wait time of servo OFF brake instruction	0-255	50	1ms	Operation settings	Immediate effect
	P01-40	Out of control detection enable	0-1	1	---	Operation settings	Immediate effect
Gain type param-eters	P02-00	Position control gain 1	0-3000.0	48.0	1/S	Operation settings	Immediate effect
	P02-01	Position control gain 2	0-3000.0	57.0	1/S	Operation settings	Immediate effect
	P02-03	Velocity feedforward gain	0-100.0	30.0	1.0%	Operation settings	Immediate effect

	P02-04	Velocity feedforward smoothing constant	0-64.00	0.5	1ms	Operation settings	Immediate effect
	P02-10	Velocity proportional gain 1	1.0-2000.0	27.0	1Hz	Operation settings	Immediate effect
	P02-11	Velocity integral constant 1	0.1-1000.0	10.0	1ms	Operation settings	Immediate effect
	P02-12	Pseudo differential feedforward control coefficient 1	0-100.0	100.0	1.0％	Operation settings	Immediate effect
	P02-13	Velocity proportional gain 2	1.0-2000.0	27.0	1Hz	Operation settings	Immediate effect
	P02-14	Velocity integral constant 2	0.1-1000.0	1000.0	1ms	Operation settings	Immediate effect
	P02-15	Pseudo differential feedforward control coefficient 2	0-100.0	100.0	1.0％	Operation settings	Immediate effect
	P02-16	Limit amplitude of velocity integral error	0-32767	25000	---	Downtime setting	Immediate effect
	P02-19	Torque feedforward gain	0-30000	0	1.0％	Operation settings	Immediate effect
	P02-20	Torque feedforward smoothing constant	0-64.00	0.8	1ms	Operation settings	Immediate effect
	P02-30	Gain switching mode	0-10	7	---	Operation settings	Immediate effect
	P02-31	Gain switching level	0-20000	800	---	Operation settings	Immediate effect
	P02-32	Gain switching hysteresis	0-20000	100	---	Operation settings	Immediate effect
	P02-33	Gain switching delay	0-1000.0	10.0	1ms	Operation settings	Immediate effect
	P02-34	Position gain switching time	0-1000.0	10.0	1ms	Operation settings	Immediate effect
	P02-40	Mode switch selection	0-4	0	---	Operation settings	Immediate effect
	P02-41	Mode switch level	0-20000	10000	---	Operation settings	Immediate effect
	P02-50	Added value of torque command	-100.0-100.0	0	1.0％	Operation settings	Immediate effect
	P02-51	Forward torque compensation	-100.0-100.0	0	1.0％	Operation settings	Immediate effect
	P02-52	Reverse torque compensation	-100.0-100.0	0	1.0％	Operation settings	Immediate effect
location param-eter	P03-00	Location command source	0-1	0	---	Downtime setting	Immediate effect
	P03-01	Command pulse mode	0-3	1	---	Downtime setting	Immediate effect

	P03-02	Command pulse input terminal	0-1	0	---	Downtime setting	Immediate effect
	P03-03	Command pulse reversal	0-1	0	---	Downtime setting	Immediate effect
	P03-04	Position pulse filtering	0-3	2	---	Operation settings	Immediate effect
	P03-05	Judgment conditions for positioning completion	0-2	1	---	Operation settings	Immediate effect
	P03-06	Positioning complete range	0-65535	100	Encoder unit	Operation settings	Immediate effect
	P03-07	Position feedback format	0-1	0	---	Downtime setting	Immediate effect
	P03-09	The number of instruction pulses per turn of the motor	0-65535	0	Pulse	Operation settings	Power up again
	P03-10	Molecule of electronic gear 1	1-65535	8192	---	Operation settings	Power up again
	P03-11	Denominator of electronic gear 1	1-65535	625	---	Operation settings	Power up again
	P03-12	Molecular high position of electronic gear 1	0-32767	0	---	Operation settings	Power up again
	P03-15	Excessive position deviation setting	0-65535	30000	command unit *10	Operation settings	Immediate effect
	P03-16	Position command smoothing filter time	0-1000.0	0	1ms	Operation settings	Immediate effect
	P03-20	Position feedback source	0-1	0	---	Operation settings	Immediate effect
	P03-21	Encoder frequency division output enable	0-1	1	---	Downtime setting	Immediate effect
	P03-22	Numerator of the output pulse division ratio of the incremental encoder	1-65535	1	---	Operation settings	Immediate effect
	P03-23	Output pulse division ratio denominator of incremental encoder	1-65535	1	---	Operation settings	Immediate effect
	P03-25	Output pulse number of one revolution of absolute motor	0-60000	2500	---	Operation settings	Immediate effect
	P03-30	Linear encoder inverting	0-1	0	---	Downtime setting	Immediate effect
	P03-31	Polarity of Z pulse of	0-1	1	---	Downtim	Immediat

		linear encoder				e setting	e effect
	P03-40	Output pulse source	0-1	0	---	Downtime setting	Immediate effect
	P03-42	Output Z-pulse polarity	0-1	1	---	Downtime setting	Immediate effect
	P03-45	Digital instruction caching	0-1	0	---	Downtime setting	Immediate effect
	P03-46	Maximum velocity of motor when digital position command is running	0-6000	1000	---	Operation settings	Immediate effect
	P03-50	Gantry function enable	0-1	0	---	Downtime setting	Immediate effect
	P03-51	Gantry function input signal reversal	0-1	0	---	Downtime setting	Immediate effect
	P03-52	The number of feedback pulses for one revolution of gantry function motor	0-65535	10000	---	Downtime setting	Immediate effect
	P03-53	Too large deviation setting of gantry function position	0-65535	10000	---	Operation settings	Immediate effect
	P03-55	Proportional gain of gantry synchronous position	0-200	10	---	Operation settings	Immediate effect
	P03-60	Origin regression enable control	0-6	0	---	Downtime setting	Immediate effect
	P03-61	Origin regression model	0-9	0	---	Downtime setting	Immediate effect
	P03-65	High velocity when searching the origin switch	0-3000	100	---	Operation settings	Immediate effect
	P03-66	Velocity when searching the origin switch	0-1000	10	---	Operation settings	Immediate effect
	P03-67	Acceleration and deceleration time of search origin switch	0-5000	0	---	Operation settings	Immediate effect
	P03-68	Search origin maximum time limit	0-10000	0	---	Operation settings	Immediate effect
	P03-69	Mechanical origin offset H	0-65535	0	---	Operation settings	Immediate effect
	P03-70	Mechanical origin offset L	0-65535	1000	---	Operation settings	Immediate effect
Velocity	P04-00	Velocity command source	0-3	0	---	Downtime setting	Immediate effect

param-eter	P04-01	Reverse velocity command analog quantity	0-1	0	---	Downtime setting	Immediate effect
	P04-02	Given value of digital velocity	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-03	Zero velocity position clamping function	0-1	0	---	Operation settings	Immediate effect
	P04-04	Zero velocity position clamping velocity threshold	0-6000	30	1rpm	Operation settings	Immediate effect
	P04-05	Overvelocity alarm value	0-6500	6400	1rpm	Operation settings	Immediate effect
	P04-06	Forward velocity limit	0-6000	5000	1rpm	Operation settings	Immediate effect
	P04-07	Reverse velocity limit	0-6000	5000	1rpm	Operation settings	Immediate effect
	P04-10	Zero velocity detection value	0-200.0	2	1rpm	Operation settings	Immediate effect
	P04-11	Rotate check out value	0-200.0	30	1rpm	Operation settings	Immediate effect
	P04-12	Velocity consistent amplitude	0-200.0	30	1rpm	Operation settings	Immediate effect
	P04-14	Acceleration time	0-10000	0	1ms/1000rpm	Operation settings	Immediate effect
	P04-15	Deceleration time	0-10000	0		Operation settings	Immediate effect
	P04-30	Internal velocity setting 1	0-6000	0	1rpm	Operation settings	Immediate effect
	P04-31	Internal velocity setting 2	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-32	Internal velocity setting 3	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-33	Internal velocity setting 4	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-34	Internal velocity setting 5	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-35	Internal velocity setting 6	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-36	Internal velocity setting 7	-6000—6000	0	1rpm	Operation settings	Immediate effect
	P04-37	Internal velocity setting 8	-6000—6000	0	1rpm	Operation settings	Immediate effect
Torque param-eter	P05-00	Torque command source	0-3	0	---	Downtime setting	Immediate effect
	P05-01	Reverse torque command analog	0-1	0	---	Downtime setting	Immediate effect

		quantity					
	P05-02	Torque mode velocity limit given value	0-6000	1000	1rpm	Operation settings	Immediate effect
	P05-05	Torque limiting setting source	0-1	0	---	Downtime setting	Immediate effect
	P05-06	Torque limit detection output delay	0-10000	0	ms	Operation settings	Immediate effect
	P05-10	Internal forward torque limiting amplitude	0-300.0	200.0	1.0%	Operation settings	Immediate effect
	P05-11	Internal reverse torque limiting amplitude	0-300.0	200.0	1.0%	Operation settings	Immediate effect
	P05-12	External positive torque limiting amplitude	0-300.0	100.0	1.0%	Operation settings	Immediate effect
	P05-13	Limit amplitude of external reverse torque	0-300.0	100.0	1.0%	Operation settings	Immediate effect
I/O param-eter	P06-00	DI1 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-01	Function selection of DI1 input port (servo ON)	0-18	1	---	Operation settings	Power up again
	P06-02	DI2 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-03	Function selection of DI2 input port	0-18	13	---	Operation settings	Power up again
	P06-04	DI3 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-05	Function selection of DI3 input port	0-18	14	---	Operation settings	Power up again
	P06-06	DI4 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-07	Function selection of DI4 input port	0-18	15	---	Operation settings	Power up again
	P06-08	DI5 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-09	Function selection of DI5 input port (positive side external torque limit)	0-18	7	---	Operation settings	Power up again
	P06-10	DI6 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-11	Function selection of DI6 input port	0-18	8	---	Operation settings	Power up again

		(external torque limit on reverse side)					
	P06-12	DI7 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-13	Function selection of DI7 input port (control mode switching)	0-18	5	---	Operation settings	Power up again
	P06-16	DI8 input port effective level	0-4	0	---	Operation settings	Power up again
	P06-17	Function selection of DI8 input port (position command clear)	0-18	16	---	Operation settings	Power up again
	P06-20	DO1 output port effective level	0-1	1	---	Operation settings	Power up again
	P06-21	Function selection of DO1 output port (servo ready)	0-11	3	---	Operation settings	Power up again
	P06-22	DO2 output port effective level	0/1	1	---	Operation settings	Power up again
	P06-23	Function selection of DO2 output port (holding brake open)	0-11	2	---	Operation settings	Power up again
高级功能参数 Advan-ced functio n param -eters	P06-2 4	DO3 output port effective level	0/1	1	---	Operation settings	Power up again
	P06-25	DI1 input port effective level (alarm output)	0-11	1	---	Operation settings	Power up again
	P06-26	Function selection of DI1 input port	0/1	1	---	Operation settings	Power up again
	P06-27	DI2 input port effective level (positioning complete)	0-11	4	---	Operation settings	Power up again
	P06-2 8	Function selection of DI2 input port	0/1	1	---	Operation settings	Power up again
	P06-29	DI3 input port effective level (torque limit detection)	0-11	8	---	Operation settings	Power up again
	P06-4 0	Function selection of DI3 input port	10-2000	500	1rpm/V	Operation settings	Immediat e effect
	P06-41	DI4 input port effective level	0-65535	0.8	1ms	Operation settings	Immediat e effect
	P06-4 2	Function selection of DI4 input port	-10.000 — 10.000	0	1V	Operation settings	Immediat e effect
	P06-4 3	DI5 input port effective level	0.0-100.0	10	%	Operation settings	Immediat e effect
	P06-4 4	Function selection of DI5 input port	0-64.00	0.8	1ms	Operation settings	Immediat e effect

	P06-45	DI6 input port effective level	-10.000 — 10.000	0	1V	Operation settings	Immediate effect
	P06-46	Function selection of DI6 input port	0-10.000	0	1V	Operation settings	Immediate effect
	P06-47	DI7 input port effective level	0-10.000	0	1V	Operation settings	Immediate effect
	P08-01	Load rotation convention identification mode	0-1	0	---	Operation settings	Immediate effect
	P08-02	Maximum velocity of inertia identification	100-2000	800	1rpm	Operation settings	Immediate effect
	P08-03	Acceleration and deceleration time of inertia identification	20-800	100	1ms	Operation settings	Immediate effect
	P08-04	Waiting time after single inertia identification	50-10000	1000	1ms	Operation settings	Immediate effect
	P08-05	Motor turns required to complete a single inertia		1.33	circle	Operation settings	RO
	P08-11	Mode selection of adaptive notch filter	0-4	0	---	Operation settings	Immediate effect
	P08-20	Torque command filter constant	0-25.00	0.8	1ms	Operation settings	Immediate effect
	P08-25	Disturbance torque compensation gain	0-100.0	0	%	Operation settings	Immediate effect

8.2 Parameter Analysis Description

8.2.1 P00-xx Motor and driver parameters

Table 181 P00-xx Motor and driver parameters

Parameter code	Name	Explain
P00-00	Motor number	Factory has been set, there is no need to set 0：P0-01 to P0-17 works
P00-01	Motor rated rotating velocity	Setting range：1-6000，unit：rpm Factory has been set, there is no need to set
P00-02	Rated motor toroue	Setting range：0.01-655.35，unit：N.M Factory has been set, there is no need to set
P00-03	Motor rated current	Setting range：0.01-655.35，unit：A Factory has been set, there is no need to set
P00-04	Moment of inertia of motor	Setting range：0.01-655.35，unit：kg.cm² Factory has been set, there is no need to set

P00-05	Log of motor pole	Setting range：1-31，unit：P Factory has been set, there is no need to set
P00-07	Encoder selection	Setting range: 0-3 0, 1: incremental encoder; 2: Single turn absolute value encoder; 3: Multi turn absolute encoder
P00-08	Save line incremental encoder	Setting range: 0-1 0: non provincia 1: Dart type
P00-09	Absolute encoder type	Setting range: 0-1 0: tamakawa encoder; 1: Nikon encoder
P00-10	Incremental encoder line count	According to the setting of the matched motor, it has been set in the factory
P00-11	Incremental encoder Z pulse electrical Angle	According to the setting of the matched motor, it has been set in the factory
P00-12	Initial angle of rotor 1	According to the setting of the matched motor, it has been set in the factory
P00-13	Initial angle of rotor 2	According to the setting of the matched motor, it has been set in the factory
P00-14	Initial angle of rotor 3	According to the setting of the matched motor, it has been set in the factory
P00-15	Initial angle of rotor 4	According to the setting of the matched motor, it has been set in the factory
P00-16	Initial angle of rotor 5	According to the setting of the matched motor, it has been set in the factory
P00-17	Initial angle of rotor 6	According to the setting of the matched motor, it has been set in the factory
P00-20	Power on interface display setting	Setting range: 0-100, default 100 Set according to customer display requirements When setting 100, the operation status will be displayed when the driver is powered on Other parameter settings correspond to the serial number of the list of monitoring items (Chapter 8.3) For example: when the customer needs to drive and display the motor velocity d08. F. SP the parameter is set to 8
P00-21	RS232 Communication baud rate	Setting range：0-3 Select the baud rate when communicating with PC 0：9600 1：19200 2：57600 3：115200
P00-23	From the station address	Setting range：0—255，default 1 Set according to equipment requirements

P00-24	Modbus Communication baud rate	Setting range：0-7，default 2 0: 2400 1: 4800 2: 9600 3: 19200 4: 38400 5: 57600 6: 115200 7: 25600
P00-25	verification mode	Setting range：0-3，default 1 0：NONE，2 stop bit 1：even parity check，1 stop bit 2：odd parity check，1 stop bit 3：NONE，1 stop bit
P00-27	CANopen communication baud rate	Set the baud rate of CAN bus 0：12.5KHz 1：120KHz 2：20KHz 3：100KHz 4：125KHz 5：250KHz 6：500KHz 7：1000KHz
P00-28	485 protocol selection	0: Reserve 1: acquiescence 2: Compatible with RS485 communication
P00-30	Brake resistance setting	Setting range: 0-2 0: use built-in resistance 1: Use external resistance 2: Do not use brake resistor
P00-31	External brake resistance power	Setting range: 0-65535, unit: 10W Set correctly according to the external braking resistance. For example, if the setting value is 4, the resistance power is 40W
P00-32	External brake resistance	Setting range: 0-1000, unit: Ohm Set correctly according to the external braking resistance
P00-40	Over temperature protection settings	Setting range: 0-1 0: turn off the over temperature protection function 1: Turn on the over temperature protection function
P00-41	Control power failure protection settings	Setting range: 0-1 0: turn off the power-off protection function of the control power supply 1: Turn on the power-off protection function of the control power supply

8.2.2 P01-xx Main control parameter

Table 182 P01-xx Main control parameter

<table>
<tr><th>Parameter code</th><th>Name</th><th>Explain</th></tr>
<tr><td>P01-01</td><td>Control mode setting</td><td>Setting range：0-6
0：Position control mode
1：Velocity control mode
2：Torque control mode
3：Velocity, torque control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to switch the control mode.
<table>
<tr><td>Terminal logic</td><td>Control mode</td></tr>
<tr><td>Effective</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Torque mode</td></tr>
</table>
4：Position and Velocity control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to switch the control mode.
<table>
<tr><td>Terminal logic</td><td>Control mode</td></tr>
<tr><td>Effective</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Velocity mode</td></tr>
</table>
5：Position, torque control mode. One of the external input ports in CN1 shall be used for switching, and the function selection of the selected DI port input port shall be set to 5 (control mode switching). Control the logical state of the port to switch the control mode.
<table>
<tr><td>Terminal logic</td><td>Control mode</td></tr>
<tr><td>Effective</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Torque mode</td></tr>
</table>
6：whole-close-loop</td></tr>
<tr><td>P01-02</td><td>Adjust the mode automatically in real time</td><td>Setting range：0-2
0：Manual adjustment。
1：Standard mode automatic adjustment。In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and</td></tr>
</table>

		P08-20 will be set automatically according to the rigidity level set by P01-03. Manual adjustment of these parameters will not work. The following parameters are set by the user: P02-03 (velocity feedforward gain), P02-04 (velocity feedforward smoothing constant). 2：Positioning mode automatically adjusts rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14 and P08-20 will be set automatically according to the rigidity level set by P01-03. Manual adjustment of these parameters will not work. The following parameters will be fixed and cannot be changed: P02-03 (velocity feedforward gain): 30.0% P02-04 (velocity feedforward smoothing constant): 0.50
P01-03	Real-time automatic adjustment of rigid Settings	Setting range：0-31 Built-in 32 gain class parameters that work when P01-02 is set to 1 or 2. It Can be directly called according to the actual situation, the greater the set value, the stronger the rigidity.
P01-04	Moment of inertia ratio	Setting range：0-100，unit：Multiple Set the load inertia ratio of the corresponding motor as follows: P01-04= load P01-04= load inertia/motor inertia This inertia ratio can use the value identified by AF-J-L automatic inertia to write the identified value into the parameter
P01-10	Control mode after overtravel	Setting range: 0-1 0: after overtravel, the motor is in free state and only receives the reverse direction signal for operation 1: After overtravel, the motor is locked and only receives the reverse direction signal to run
P01-20	Dynamic brake delay	Setting range: 0-150, unit: ms Dynamic brake action delay time when braking conditions are met
P01-21	Disable dynamic brake when main power is OFF	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-22	Disable dynamic brake when servo is OFF	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-23	Disable dynamic brake in case of fault alarm	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-24	No dynamic brake during overtravel	Setting range: 0-1 0: use dynamic braking 1: Turn off dynamic braking
P01-30	The brake	Setting range：0-255，unit：ms

	instruction - servo OFF delay time (Brake open delay)	When enabling: after the enabling command is executed, the driver will receive the position command after the time of P01-30. When closing enabling: when the motor is in the static state, the time from the closing enabling command to the time when the motor becomes non energized after the holding brake is closed.
P01-31	The velocity limit of the output of the brake command	Setting range：0-3000，unit：rpm Motor velocity threshold when the holding brake output is valid when the motor is in rotation state. Below this threshold, the holding brake output command is valid, otherwise, the holding brake output command will be valid after waiting for P01-32 time.
P01-32	Wait time of servo OFF brake instruction	Setting range：0-255，unit：ms The maximum waiting time of holding brake output when the motor is in rotation state.
P01-40	Out of control detection enable	Prevent the motor from out of control and abnormal rotation. 0: off enable 1: On enable

8.2.3 P02-xx Gain type parameter

Table 183 P02-xx Gain type parameter

Parameter code	Name	Explain
P02-00	Position control gain 1	Setting range：0-3000.0，unit：1/S ‣ For the proportional gain of the position ring regulator, the larger the parameter value, the higher the gain ratio, the larger the stiffness, the smaller the position tracking error, and the faster the response. However, if the parameters are too large, vibration and overshoot are easily caused. ‣ This parameter is for steady-state response.
P02-01	Position control gain 2	Setting range：0-3000.0，unit：1/S ‣ For the proportional gain of the position ring regulator, the larger the parameter value, the higher the gain ratio, the larger the stiffness, the smaller the position tracking error, and the faster the response. However, if the parameters are too large, vibration and overshoot are easily caused. ‣ This parameter is for dynamic response.
P02-03	Velocity feedforward gain	Setting range：0-100.0，unit：1.0% The larger the parameter value, the smaller the tracking error and the faster the response. However, if the feedforward gain is too large, the position loop of the system will be unstable and prone to overshoot and shock.
P02-04	Velocity feedforward	Setting range：0-64.00，unit：ms This parameter is used to set the velocity loop feedforward

	smoothing constant	filter time constant. The larger the value, the greater the filtering effect, but at the same time the phase lag increases.
P02-10	Velocity proportional gain 1	Setting range：1.0-2000.0，unit：Hz ▸The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load. ▸Make the value as large as possible without oscillating. ▸For the gain at rest.
P02-11	Velocity integral constant 1	Setting range：1.0-1000.0，unit：ms ▸The velocity regulator integration time constant, the smaller the set value, the faster the integration velocity, the greater the stiffness, too small is easy to produce vibration, noise. ▸Reduce this parameter as far as possible under the condition that the system does not oscillate. ▸This parameter is for steady-state response.
P02-12	Pseudo differential feedforward control coefficient 1	Setting range： 0-100.0，unit：1.0% ▸When set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast.When set to 0, the velocity ring integral plays an obvious role in filtering low-frequency interference, but the dynamic response is slow. ▸By adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low frequency interference.
P02-13	Velocity proportional gain 2	Setting range：1.0-2000.0，unit：Hz ▸The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load. ▸Make the value as large as possible without oscillating. ▸For the gain in motion.。
P02-14	Velocity integral constant 2	Setting range：1.0-1000.0，unit：ms ▸The velocity regulator integration time constant, the smaller the set value, the faster the integration velocity, the greater the stiffness, too small is easy to produce vibration, noise. ▸Reduce this parameter as far as possible under the condition that the system does not oscillate. ▸This parameter is for steady-state response.
P02-15	Pseudo differential feedforward control coefficient 2	Setting range：0-100.0，unit：1.0% ▸When set to 100.0%, the velocity loop adopts PI control, and the dynamic response is fast.When set to 0, the velocity ring integral plays an obvious role in filtering low-frequency interference, but the dynamic response is slow. ▸By adjusting this coefficient, the velocity loop can have better dynamic response and increase the resistance to low frequency interference.
P02-16	Limit amplitude of velocity integral	Setting range: 0-32767 Limit amplitude of velocity integral error

<table>
<tr><td></td><td>error</td><td></td></tr>
<tr><td>P02-19</td><td>Torque feedforward gain</td><td>Setting range：0-30000，unit：1.0%
Set the weighted value of current loop feedforward. This parameter weighted the differential of the velocity instruction and added the current loop.</td></tr>
<tr><td>P02-20</td><td>Torque feedforward smoothing constant</td><td>Setting range：0-64.00，unit：ms
This parameter is used to set the torque feedforward filter time constant.</td></tr>
<tr><td>P02-30</td><td>Gain switching mode</td><td>Setting range：0-10
Set the conditions for the first and second gain switching
<table>
<tr><td>value</td><td>Switching conditions</td><td>Remarks</td></tr>
<tr><td>0</td><td>Fixed as first gain</td><td>P02-00、P02-10、P02-11、P02-12</td></tr>
<tr><td>1</td><td>Fixed as second gain</td><td>P02-01、P02-13、P02-14、P02-15</td></tr>
<tr><td>2</td><td>Switch with DI input</td><td>DI port should be set to 9 (gain switching input)
Invalid: first gain
Effective: second gain</td></tr>
<tr><td>3</td><td>Large torque command</td><td>Switch to second gain when torque command is greater than threshold (determined by P02-31 and P02-32). When less than the threshold and more than the P02-33 delay setting, switch to the first gain.</td></tr>
<tr><td>4</td><td>Velocity command changes a lot</td><td>When the velocity instruction change is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.</td></tr>
<tr><td>5</td><td>High velocity command</td><td>When the velocity command is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.</td></tr>
<tr><td>6</td><td>Large position deviation</td><td>Switch to the second gain when the position deviation is greater</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td></td><td>
<table>
<tr><td></td><td></td><td>than the threshold (determined by P02-31 and P02-32). When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.</td></tr>
<tr><td>7</td><td>Location instruction</td><td>Switch to the second gain when there is a position command. When the position command ends and the delay setting of P02-33 is exceeded at the same time, switch to the first gain.</td></tr>
<tr><td>8</td><td>Positioning incomplete</td><td>Switch to the second gain when the positioning is not completed. When the positioning is completed and the delay setting of P02-33 is exceeded, switch to the first gain.</td></tr>
<tr><td>9</td><td>High actual velocity</td><td>When the actual velocity is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the delay setting of P02-33, it will switch to the first gain.</td></tr>
<tr><td>10</td><td>Position command + actual velocity</td><td>Switch to the second gain when there is a position command. When there is no position command and the actual velocity is less than the threshold (determined by P02-31 and P02-32), and the delay setting of P02-33 is exceeded at the same time, switch to the first gain.</td></tr>
</table>
</td></tr>
<tr><td>P02-31</td><td>Gain switching level</td><td>Setting range：0-20000
Judging threshold value in gain switching.
Torque unit：1000bit=25%Rated torque
Velocity unit：1000bit=200 rpm/min
Position unit：131072biteach circle</td></tr>
<tr><td>P02-32</td><td>Gain switching hysteresis</td><td>Setting range：0-20000
Hysteresis level in gain switching
Torque unit：1000bit=25%Rated torque</td></tr>
</table>

<table>
<tr><td></td><td></td><td>Velocity unit：1000bit=200 rpm/min
Position unit：131072biteach circle</td></tr>
<tr><td>P02-33</td><td>Gain switching delay</td><td>Setting range：0-1000.0，unit：ms
When switching from the second gain to the first gain, the time from the trigger condition to the actual switching.</td></tr>
<tr><td>P02-34</td><td>Position gain switching time</td><td>Setting range：0-1000.0，unit：ms
Time for position control gain 1 to smoothly switch to position control gain 2.</td></tr>
<tr><td>P02-40</td><td>Mode switch selection</td><td>Setting range: 0-4
Set the conditions of PI control and P control of velocity loop
<table>
<tr><td>value</td><td>Judgement condition</td><td>Remarks</td></tr>
<tr><td>0</td><td>Torque command</td><td>When the torque command is less than the threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control</td></tr>
<tr><td>1</td><td>Velocity command</td><td>When the velocity command is less than the threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control</td></tr>
<tr><td>2</td><td>acceleration</td><td>When the acceleration is less than the threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control</td></tr>
<tr><td>3</td><td>Positional deviation</td><td>When the positional deviation is less than the threshold set in P02-41, it is PI control; when it is greater than the threshold, it is P control</td></tr>
<tr><td>4</td><td>No mode switch</td><td>PI control for velocity environmental protection, no switching</td></tr>
</table></td></tr>
<tr><td>P02-41</td><td>Mode switch level</td><td>Setting range：0-20000
Set the threshold value of switching.
Torque unit：1000bit=25%Rated torque
Velocity unit：1000bit=200 rpm/min
Position unit：131072biteach circle</td></tr>
<tr><td>P02-50</td><td>Added value of torque command</td><td>Setting range：-100.0-100，unit：1.0%
Valid in position control mode. This value is added to the torque given value for static torque compensation of vertical axis.</td></tr>
<tr><td>P02-51</td><td>Forward torque compensation</td><td>Setting range：-100.0-100.0，unit：1.0%
Valid in position control mode. Used to compensate for positive static friction.</td></tr>
<tr><td>P02-52</td><td>Reverse torque</td><td>Setting range：-100.0-100.0，unit：1.0%
Valid in position control mode. Used to compensate for</td></tr>
</table>

	compensatio n	negative static friction.

8.2.4 P03-xx Position parameter

Table 184 P03-xx Position parameter

Parameter code	Name	Explain
P03-00	Location command source	0：impulsbefehl 1：Number given,Used for communication control.
P03-01	Command pulse mode	0: orthogonal pulse command 1: Direction + pulse command 2 or 3: dual pulse command
P03-02	Command pulse input terminal	Used to specify pulse input port in CN1 port 0: low velocity pulse port 1: High velocity pulse port
P03-03	Command pulse reversal	Used to adjust the counting direction of pulse command. 0：normal. 1：Direction reversal.
P03-04	Position pulse filtering	Setting range：0-3，unit：us 0：0.1us。 1：0.4us 2：0.8us。 3：1.6us
P03-05	Judgment conditions for positioning completion	0：Output when the position deviation is less than the set value of P03-06. 1: Output when the position setting is completed and the position deviation is less than the set value of P03-06. 2：Output when the position setting is completed (after filtering) and the position deviation is less than the set value of P03-06.
P03-06	Positioning complete range	Setting range：0-65535，unit：Encoder unit Use to set the threshold value for locating the completion output.If the incremental encoder motor is used, the number of encoder lines *4 shall be calculated for each turn.
P03-07	Position feedback format	Setting range: 0-1 0: incremental format. 1: Multicycle absolute value format
P03-09	The number of instruction pulses per turn of the motor	Setting range：0-65535 Used to set the number of command pulses for one revolution of motor. When this parameter is set to 0, parameters P03-10 and P03-11 are valid.

P03-10	Molecule of electronic gear 1	When absolute value motor is used, see the example of electronic gear ratio calculation method Calculation formula of electronic gear ratio of incremental motor： *G=member/denominator=C*4/P* *C: Number of encoder lines;* *P: Input the number of pulses per revolution* *For example: the number of encoder lines is 2500;* *the number of input pulses per revolution is 3200;* *calculate the electronic gear ratio?* *G=C*4/P=2500*4/3200=10000/3200=25/8* Note: the numerator of 20b encoder is 131072 The numerator of 17Z encoder is 160000
P03-11	Denominator of electronic gear 1	
P03-12	Molecular high position of electronic gear 1	Setting range: 0-32767 Using this parameter, the electronic gear ratio can be enlarged: molecular value = P03-12 * 10000 + P03-10
P03-15	Excessive position deviation setting	Setting range：0-65535，unit：Command unit *10 Set the pulse number of allowable deviations, and an alarm will be given if it exceeds the set value. Example: set value 20, when the following deviation exceeds 20 * 10, the driver will alarm **AL.501** (position deviation is too large)
P03-16	Position command smoothing filter time	Setting range：1000，unit：ms Set the time constant of the position command smoothing filter.
P03-20	Position feedback source	Set the source of position feedback 0: encoder 1: Grating ruler
P03-21	Encoder frequency division output enable	Set whether CN1 port has encoder frequency division output 0: Off enable 1: On enable
P03-22	Numerator of the output pulse division ratio of the incremental encoder	When using incremental encoder, set the number of output pulses of CN1 port. P03-23 should be less than or equal to P03-22, calculation formula: $G = \frac{\text{molecule}}{\text{denominator}} = \frac{C \times 4}{P \times 4}$ *C:* Number of encoder lines *P:* Desired output A, B pulses per revolution Example: The number of encoder lines is 2500 ; The number of A and B pulses per revolution is 500 ; $G = \frac{C \times 4}{P \times 4} = \frac{2500 \times 4}{500 \times 4} = \frac{5}{1}$
P03-23	Output pulse division ratio denominator of incremental encoder	
P03-25	Output pulse number of one revolution of	Setting range: 0-60000 Set the absolute value to rotate the motor for one turn, and output the number of A and B frequency pulses respectively.

	absolute motor	For example, if the set value is 2048, 2048 pulses will be output for signal A and signal B for each revolution of the motor
P03-30	Linear encoder inverting	Set whether the phase sequence of grating ruler input A and B is reversed 0: do not reverse 1: take the opposite
P03-31	Polarity of Z pulse of linear encoder	Set the effective level of grating ruler input Z signal 0: low level 1: High level
P03-40	Output pulse source	Set the source of frequency division output signal in CN1 terminal 0: motor encoder 1: Grating ruler
P03-42	Output Z-pulse polarity	Set the effective level of Z signal of frequency division output signal of CN1 terminal 0: low level 1: High level
P03-45	Digital instruction caching	Setting range: 0-1 0: do not cache (execute now) 1: Cache (execute new data after last data execution)
P03-46	Maximum velocity of motor when digital position command is running	Setting range: 0-6000 Set the maximum velocity of the motor when the digital position command is running

8.2.5 P04-xx Velocity parameter

Table 185 P04-xx Velocity parameter

Parameter code	Name	Explain
P04-00	Velocity command source	0: external analog command 1: Digital command (parameter setting) 2: Digital command (Communication) 3: Internal multiple groups of instructions
P04-01	Reverse velocity command analog quantity	Used to adjust the polarity relationship of analog quantity 0: normal 1: Polarity reversal
P04-02	Given value of digital velocity	Setting range：-6000—6000，unit：rpm When P04-00 is set to 1, P04-02 is the velocity control setting value
P04-03	Zero velocity	0: no position clamping function

	position clamping function	1: With position clamping function When the velocity control mode meets the following conditions at the same time, enter the position locking mode A: P04-03 is set to 1 B: The absolute value of velocity command is less than the set threshold of P04-04 C: The function of the external input port is set to 10 (fixed zero position), and it is in the valid input state
P04-04	Zero velocity position clamping velocity threshold	Setting range: 0-6000, unit: rpm Set the velocity command threshold to trigger the zero velocity position clamping function
P04-05	Overvelocity alarm value	Setting range：0-6500，unit：rpm Set the allowable maximum velocity value. If it exceeds the set value, **AL.420** overvelocity alarm will be given
P04-06	Forward velocity limit	Setting range：0-6000，unit：rpm Limit motor forward velocity value
P04-07	Reverse velocity limit	Setting range：0-6000，unit：rpm Limit motor reverse velocity value
P04-10	Zero velocity detection value	Setting range：0-200.0，unit：rpm Set the threshold value of zero velocity detection, when the motor velocity is lower than the threshold value, "**motor zero velocity output**" signal can be output through the output port
P04-11	Rotate check out value	Setting range: 0-200.0, unit: rpm Set the detection threshold of motor rotation. If the motor velocity is higher than this value, the status can be displayed through the LED panel
P04-12	Velocity consistent amplitude	Setting range: 0-200.0, unit: rpm Set the threshold value of the velocity consistent signal. When the difference between the motor velocity and the command velocity is within the threshold value, the "**velocity consistent output**" signal can be output through the output port
P04-14	Acceleration time	Setting range：0-10000，unit：1ms/1000rpm Set acceleration for velocity control
P04-15	Deceleration time	Setting range：0-10000，unit：1ms/1000rpm Set deceleration at velocity control
P04-30 ----- P04-37	Internal velocity setting 1-8	Setting range: - 6000-6000, unit: rpm Parameters P04-30 to P04-37 set the internal velocity 1 to internal velocity 8 respectively The internal velocity switching method is as follows: When the velocity loop is controlled, P04-00 is set to 3, The corresponding input port functions are defined as 13, 14, 15 The switching of internal velocity is realized by setting the input port function to the combination of on-off states of 13, 14 and 15. The switching relationship is shown in the table below

		DI13	DI14	DI15	Interaction parameter
		0	0	0	P04-30
		1	0	0	P04-31
		0	1	0	P04-32
		1	1	0	P04-33
		0	0	1	P04-34
		1	0	1	P04-35
		0	1	1	P04-36
		1	1	1	P04-37

8.2.6 P05-xx Torque parameter

Table 186 P05-xx Torque parameter

Parameter code	Name	Explain
P05-00	Torque command source	0: external analog command (velocity limit amplitude is set by P05-02) 1: Digital command (velocity limit amplitude is set by P05-02) 2: External simulation command (velocity limit amplitude is determined by velocity simulation command) 3: Digital command (velocity limit amplitude is determined by velocity analog command)
P05-01	Reverse torque command analog quantity	Used to adjust torque direction 0: normal 1: Reverse direction
P05-02	Torque mode velocity limit given value	Setting range: 0 - maximum velocity, unit: rpm Set the maximum velocity value of the motor in the torque mode to prevent the mechanical damage caused by the high velocity of the motor in no-load condition Effective torque control mode
P05-05	Torque limiting setting source	Source for adjusting torque limiting amplitude 0: internal digital quantity (set by P05-10, P05-11 or P05-12, P05-13) 1: External analog quantity (given by external analog quantity input t-ref. In this mode, the positive and negative limiting amplitudes are the same.)
P05-06	Torque limit detection output delay	Setting range: 0-10000, unit: ms Set the output torque limit of DO port to detect the output signal delay time
P05-10	Internal forward torque	Setting range：0-300.0，unit：1.0% Limit the forward output of the motor, 100 represents 1 time of torque, 300 represents 3 times of torque.

<table>
<tr><td></td><td>limiting amplitude</td><td>When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit.</td></tr>
<tr><td>P05-11</td><td>Internal reverse torque limiting amplitude</td><td>Setting range：0-300.0，unit：1.0%
Limit the reverse output of the motor, 100 represents 1 time of torque, 300 represents 3 times of torque.
When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit.</td></tr>
<tr><td>P05-12</td><td>External positive torque limiting amplitude</td><td>Setting range: 0-300.0, unit: 1.0%
For this function, one of the external input ports in CN1 is required to switch, and the function selection of the selected DI port input port is set to 7 (external torque limit on the positive side). Control the logical state of the port to switch the control mode.<table><tr><td>Terminal logic</td><td>Torque limiting amplitude</td></tr><tr><td>Effective</td><td>External limiting amplitude P05-12</td></tr><tr><td>Invalid</td><td>Internal limiting amplitude P05-10</td></tr></table>If the DI function is not assigned, the default torque limit amplitude of the system is P05-10
When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit</td></tr>
<tr><td>P05-13</td><td>Limit amplitude of external reverse torque</td><td>Setting range: 0-300.0, unit: 1.0%
This function needs to use an external input port in CN1 to switch, and set the function selection of the selected DI port input port to 8 (external torque limit on the reverse side). Control the logic state of the port to switch the control mode.<table><tr><td>Terminal logic</td><td>Torque limiting amplitude</td></tr><tr><td>Effective</td><td>External limiting amplitude P05-13</td></tr><tr><td>Invalid</td><td>Internal limiting amplitude P05-11</td></tr></table>If the DI function is not assigned, the default torque limit amplitude of the system is P05-11
When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit</td></tr>
</table>

8.2.7 P06-xx I/O parameter

Table 187 P06-xx I/O parameter

Parameter code	Name	Explain
P06-00	DI1 input	Setting range: 0-4, factory setting: 0

	port effective level	Set valid input of DI1 input port of CN1 0: valid for low level (optocoupler on) 1: Valid for high level (optocoupler off) 2: Rising edge effective 3: Falling edge effective 4: Both rising and falling edge are effective
P06-01	Function selection of DI1 input port	Setting range: 0-18, factory setting: 1 Set the function of DI1 input port of CN1 0: invalid pin 1: servo ON 2: Alarm clear 3: Reserve 4: Reserve 5: Control mode switching 6: P action command input 7: Positive side external torque limit 8: Reverse side external torque limit 9: Gain switching input 10: Zero fixed input 11: Command pulse inhibit input 12: Encoder absolute value data required input 13: CW limit signal input 14: HW limit signal input 15: CCW limit signal input 16: Position command clear input 17: Pole detection input 18: Command pulse input rate switching input 19: Gantry simultaneous movement enable 20: Gantry alignment clear signal 21: origin switch signal 22: origin reset start signal
P06-02	DI2 input port effective level	See to P06-00
P06-03	Function selection of DI2 input port	See to P06-01，Factory settings：13
P06-04	DI3 input port effective level	See to P06-00
P06-05	Function selection of DI3 input port	See to P06-01，Factory settings：14

P06-06	DI4 input port effective level	See to P06-00
P06-07	Function selection of DI4 input port	See to P06-01，Factory settings：15
P06-08	DI5 input port effective level	See to P06-00
P06-09	Function selection of DI5 input port	See to P06-01，Factory settings：7
P06-10	DI6 input port effective level	See to P06-00
P06-11	Function selection of DI6 input port	See to P06-01，Factory settings：8
P06-12	DI7 input port effective level	See to P06-00
P06-13	Function selection of DI7 input port	See to P06-01，Factory settings：5
P06-16	DI8 input port effective level	See to P06-00
P06-17	Function selection of DI8 input port	See to P06-01，Factory settings：16
P06-20	DO1 output port effective level	Setting range: 0-1, factory setting: 1 0: when the status is valid, the optocoupler is cut off 1: When the representative state is valid, the optocoupler is on
P06-21	Function selection of	Setting range: 0-11, factory setting: 3 0: invalid pin

	DO1 output port	1: Alarm output 2: Holding brake open output 3: Servo ready for output 4: Positioning complete output 5: Positioning approach output 6: Velocity consistent output 7: Motor zero velocity output 8: Torque limit detection output 9: Velocity limit check out output 10: Warning output 11: Command pulse input rate switching output 12: Origin regression complete output 13: Electrical origin regression complete output
P06-22	DO2 output port effective level	See to P06-20
P06-23	Function selection of DO2 output port	See to P06-21，Factory settings：2
P06-24	DO3 output port effective level	See to P06-20
P06-25	Function selection of DO3 output port	See to P06-21，Factory settings：1
P06-26	DO4 output port effective level	See to P06-20
P06-27	Function selection of DO4 output port	See to P06-21，Factory settings：4
P06-28	DO5 output port effective level	See to P06-20
P06-29	Function selection of DO5 output port	See to P06-21，Factory settings：8
P06-40	Velocity	Setting range: 10-2000, unit: 1rpm / V

	analog command input gain	Set the coefficient between the analog command input by CN1 and the velocity control command For example, 500 represents 500 rpm per V
P06-41	Velocity analog command filter constant	Setting range: 0-64.00, unit: ms Set the filtering time coefficient of the analog command input by CN1
P06-42	Velocity analog instruction offset	Setting range: - 10.000-10.000, unit: V Set zero offset of analog command input by CN1
P06-43	Torque analog command gain	Setting range: 0-100.0, unit: 1% Set the coefficient between the analog command input by CN1 and the velocity control command For example, 30.0 represents 30% of rated torque per V
P06-44	Torque analog command filter constant	Setting range: 0-64.00, unit: ms Set the filtering time coefficient of the analog command input by CN1
P06-45	Torque analog command offset	Setting range: - 10.000-10.000, unit: V Set zero offset of analog command input by VN1
P06-46	Velocity analog command deadband	Setting range: 0-10.000, unit: V Set the dead time voltage value of the velocity analog command. When the analog quantity is set within the range of the positive and negative values, the system will default to zero
P06-47	Torque analog command deadband	Setting range: 0-10.000, unit: V Set the dead time voltage value of torque simulation command. When the analog value is within the range of the positive and negative values, the system default value is zero

8.2.8 P08-xx Advanced function parameters

Table 188 P08-xx Advanced function parameters

Parameter code	Name	Explain
P08-01	Load rotation convention identification mode	Setting range: 0-1 0: effective 1: invalid
P08-02	Maximum velocity of	Setting range: 100-2000, unit: RPM The highest velocity of the motor in off-line inertia identification

	inertia identification	
P08-03	Acceleration and deceleration time of inertia identification	Setting range: 20-800, unit: ms Acceleration and deceleration time of motor in off-line inertia identification
P08-04	Waiting time after single inertia identification	Setting range: 50-10000, unit: ms Waiting time after single inertia identification is completed
P08-05	Motor turns required to complete a single inertia	This parameter is the rotation circle value automatically generated according to the set conditions of P08-02, P08-03 and P08-04
P08-11	Mode selection of adaptive notch filter	Setting range: 0-4 Setting range: 0-4 The parameters of the third and fourth traps are no longer updated automatically, but are saved as the current values. But manual input is allowed 1: One adaptive notch filter is effective, the parameters of the third notch filter are updated automatically and cannot be input manually 2: Two adaptive notch filters are effective. The parameters of the third and fourth notch filters are updated automatically and cannot be input manually 3: Resonance frequency only 4: Clear the third and fourth notch filter parameters and restore them to the factory settings
P08-20	Torque command filter constant	Setting range：0-25.00，unit：ms The filtering time constant of torque command can be properly set to a large value when the motor is howling during operation.
P08-25	Disturbance torque compensatio n gain	Setting range：0-100.0 Gain coefficient of disturbance torque observation value. The larger the value is, the stronger the anti disturbance torque ability is, but the action noise may also increase.
P08-26	Time constant of disturbance torque filtering	Setting range：0-25.00，unit：ms The larger the value is, the stronger the filtering effect is, and the action noise can be suppressed. However, excessive phase delay will affect the restraining effect of disturbance torque.
P08-30	Notch filter 1 frequency	Setting range: 50-5000, unit: Hz Center frequency of Notch 1 When it is set to 5000, the notch filter is invalid

P08-31	Notch filter 1 width	Setting range: 0-20 Notch width class of Notch 1 Is the ratio of width to center frequency
P08-32	Notch filter 1 depth	Setting range: 0-99 Notch depth level of Notch 1 The ratio relationship between output and input for the center frequency of the notch filter The larger the parameter, the smaller the depth of the notch and the weaker the effect
P08-33	Notch filter 2 frequency	Same P08-30
P08-34	Notch filter 2 width	Same P08-31
P08-35	Notch filter 2 depth	Same P08-32
P08-36	Notch filter 3 frequency	Same P08-30
P08-37	Notch filter 3 width	Same P08-31
P08-38	Notch filter 3 depth	Same P08-32
P08-39	Notch filter 4 frequency	Same P08-30
P08-40	Notch filter 4 width	Same P08-31
P08-41	Notch filter 4 depth	Same P08-32

8.3 List of Monitoring Items

Table 189 List of monitoring items

Displaying Serial Number	Display Item	Explain	Unit
d00.C. PU	Sum of position command pulses	This parameter can monitor the number of pulses sent by the user to the servo driver to confirm whether there is pulse loss.	Instruction unit
d01.F. PU	Describe the sum of position feedback pulses	This parameter can monitor the number of pulses fed back by the servo motor. The unit is the same as the unit of user input instruction.	Instruction unit
d02.E. PU	Number of position deviation pulses	This parameter can monitor the pulse number of position lag during servo	Instruction unit

		system operation. The unit is the same as the unit of user input instruction.	
d03.C.PE	Position given pulse sum / Gantry machine feedback pulse	This parameter can monitor the number of pulses sent by the user to the servo driver. Unit: when absolute motor is used, it is calculated as 131072bit per turn. If incremental encoder motor is used, the number of encoder lines * 4 shall be calculated for each turn.	Encoder unit/ Instruction unit
d04.F.PE	Position feedback pulse sum / Gantry machine feedback pulse	This parameter can monitor the number of pulses fed back by the servo motor. Unit: when absolute motor is used, it is calculated as 131072bit per turn. If incremental encoder motor is used, the number of encoder lines * 4 shall be calculated for each turn.	Encoder unit/ Instruction unit
d05.E.PE	Position deviation pulse number/Gantry pulse deviation	This parameter can monitor the pulse number of position lag during the operation of the servo system. Unit: when using absolute value motor, calculate by 131072bit per lap.If the incremental encoder motor is used, the number of encoder lines *4 shall be calculated for each turn.	Encoder unit/ Instruction unit
d06.C. Fr	Pulse command input frequency	This parameter monitors the input frequency of the external pulse command	KPPS
d07.C. SP	Velocity control command		rpm
d08.F. SP	Motor velocity	This parameter can monitor the velocity of the servo motor when it is running	rpm
d09. C.tQ	Torque command	This parameter can monitor the torque when the servo motor is running	%
d10. F. tQ	Torque feedback value	This parameter can monitor the feedback torque when the servo motor is running	%
d11.AG.L	Average torque	This parameter can monitor the average torque of the servo motor in the past 10 seconds	%
d12.PE.L	Peak torque	This parameter can monitor the peak torque of servo motor after power on	%
d13.oL	Overload rate	This parameter can monitor the load occupancy rate of the servo motor in	%

		the past 10 seconds	
d14.rG	Regeneration load rate	This parameter monitors the load rate of the regeneration resistor	%
d16.I. Io	Input IO status	This parameter can monitor the input port status of CN1. The upper vertical bar represents high level (optocoupler cutoff), and the lower vertical bar represents low level optocoupler conduction). The corresponding relationship with the input port is that the vertical bars of the operation panel from right to left correspond to di1-di4 respectively	Binary
d17.o. Io	Output IO status	This parameter can monitor the output port status of CN1. The upper vertical bar represents the conduction of optocoupler, the lower vertical bar represents the cutoff of optocoupler, and the corresponding relationship with the output port is that the vertical bar of the operation panel from right to left corresponds to do1-do3 respectively	Binary
d18.AnG	Mechanical angle of motor	This parameter can monitor the mechanical angle of the motor, and the rotation of 1 turn is 360 degrees	0.1°
d19.HAL	Motor UVW phase sequence	This parameter can monitor the phase sequence position of the incremental encoder motor	
d20.ASS	Absolute value encoder single turn value	This parameter can monitor the feedback value of absolute encoder, and the rotation is 0xFFFF	0-0xFFFF
d21.ASH	Absolute value encoder multi turn value	This parameter can monitor the number of turns of the absolute encoder motor	
d22.J-L	Inertia ratio	This parameter can monitor the real-time inertia of the load of the motor	%
d23.dcp	Main circuit voltage (AC value)	This parameter can monitor the voltage value of the main circuit	V
d24.Ath	Driver temperature	This parameter can monitor the drive temperature	℃
d25.tiE	Cumulative running time	This parameter can monitor the running time of the drive, unit is second	Sec
d26.1. Fr	Resonance	This parameter can monitor resonance	Hz

	frequency 1	frequency 1	
d28.2. Fr	Resonance frequency 2	This parameter can monitor resonance frequency 2	Hz
d30.Ai1	Input voltage of analog quantity command 1（V_REF）	This parameter can monitor the input voltage value of the analog command (V_REF) of the velocity loop.	0.01V
d31.Ai2	Input voltage of analog quantity command 2（T_REF）	This parameter can monitor the input voltage value of the analog command (T_REF) of the torque ring.	0.01V

8.4 Auxiliary Function

Table 190 Auxiliary function

Serial number	Display item	Function	Operation
1	AF_JoG	JOG trial run	1. Press the **M key** on the operation panel to switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_JoG**, and press the **ENT key** to enter the JoG working mode. The default JoG velocity is 30 rpm. 2. Press the **Up key**, the motor will rotate forward at the velocity of 30R / min; press the **Down key**, the motor will reverse at the velocity of 30R / min 3. Press **ENT key** for a long time to enter the velocity Edit menu. Edit the velocity through the combination of **Up**, **Down** and **LEFT keys**. After editing, press **ENT key** for a long time to enter JoG mode again. The set velocity will not be saved after exiting jog mode. 4. Press the **M key** to exit JoG mode.
2	AF_run	Forced enable operation velocity mode	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_run**, and press the **ENT key** to enter the working mode. 2. Press **Up key**, the motor will rotate forward, and press **Up key** for a long time, the motor velocity will continue to increase; press **Down key,** the motor will reverse, press **Up key** for a long time, the motor velocity will continue to increase. 3. Press the **M key** to exit the mode.
3	AF_oF1	Analog input 1 automatic zero drift calibration（VCMD）	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF – of1**, and press the **ENT key**, **clr.Ai1** will be displayed. 2. Long press **ENT key** until **finsh** flashes, i.e. automatic zero drift calibration of analog input 1 (velocity analog) is completed. 3. Press the **M key** to exit the mode.

4	AF_oF2	Analog input 2 automatic zero drift calibration （TCMD）	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF － of2**, and press the **ENT key**, **clr.Ai2**will be displayed. 2. Long press **ENT key** until **finsh** flashes, i.e. automatic zero drift calibration of analog input 1 (torque analog) is completed. 3. Press the **M key** to exit the mode.
5	AF_oF3	U,W current automatic zero drift calibration	Same AF_oF1 Note: when performing this function, the servo must be in the off enable state, otherwise the **finsh** flashing page will not appear, and the automatic calibration cannot be completed
6	AF_En0	Absolute encoder fault clearing	The auxiliary function must be operated in the non enabled state. The operation steps are as follows 1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_En0**, and press the **ENT key**, **clr. Err** will be displayed. 2. Long press **ENT** until **finsh** flashes, i.e. the absolute encoder fault is cleared. 3. Press the **M key** to exit the mode.
7	AF_En1	Absolute value encoder multi turn value clear	The auxiliary function must be operated in the non enabled state. The operation steps are as follows 1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_En1**, and press the **ENT key**, **clr.ASH** will be displayed. 2. Long press **ENT** until **finsh** flashes, that is to say, the absolute value encoder multi turn value is cleared. 3. Press the **M key** to exit the mode.
8	AF_ini	Restore factory parameters	Contact the manufacturer
9	AF_Err	Fault record display	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_Err**, and press the **ENT key** to display the past 8 times of historical fault information. A left digit of 0 indicates the last fault 2. Press **Up** to display the past faults one by one. Press and hold **ENT key** for a long time to display the time of fault occurrence. Refer to **d25.tiE** for time coordinate. 3. Press the **M key** to exit the mode. Note: there may be a deviation of 30 minutes in the recording time of the faults generated during multiple power on and power off within 30 minutes.
10	AF_uEr	Version display	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_uEr**, and press the **ENT key** to display the servo

			information. 2. Press the **M key** to exit the mode.
11	AF_unL	Operation permission setting	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_unL**, and press the **ENT key** to edit the operation authority. 0: all parameters are locked and cannot be changed; 1: P00-xx parameters are locked and other parameters can be changed; 2: not locked and can be changed. Set the value of 0,1, which can be saved after power failure. When setting 2, power off is not saved. 2. Press the **M key** to exit the mode.
12	AF_ Io	Forced output port level	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_Io**, and press the **ENT key** to edit. The corresponding relationship with the output port is that the vertical bars of the operation panel from right to left correspond to DO1-DO5 respectively 2. Press the **M key** to exit the mode. The output port returns to the original output state.
13	AF_J-L	Load inertia ratio measurement	1. Press the **M key** on the operation panel, switch to the auxiliary mode **AF_xxx**, operate the **Up / Down key** to **AF_J-L**, and press the **ENT key** to measure the inertia ratio. 2. Long press the **Up key** or **Down key**, the motor will run back and forth according to the maximum velocity set by P08-02, acceleration and deceleration time set by P08-03, waiting time of P08-04, and turns set by P08-05 until the load inertia ratio appears. 3. Press the **M key** to exit the mode. 4. Record the measured value and write it into P01-04 (moment of inertia ratio) parameter

➢ 9 Fault Analysis and Treatment

9.1 Fault Alarm Information Table

Table 191 Fault alarm information table

Alarm type	Serial number code	Alarm content
Hardware failure	AL.051	EEPROM Parameter exception
	AL.052	PLC configuration failure
	AL.053	Initialization failed
	AL.054	System exception

	AL.060	Product model selection failure
	AL.061	Product matching failure
	AL.062	Parameter storage failure
	AL.063	Overcurrent detection
	AL.064	Servo power on self check finds output short circuit to ground
	AL.066	Servo unit control power supply voltage low
	AL.070	AD sampling fault 1
	AL.071	Current sampling fault
	AL.101	AI Set fault
	AL.102	DI Allocation failure
	AL.103	DO Allocation failure
	AL.105	Electronic gear setting error
	AL.106	Abnormal setting of frequency division pulse output
	AL.110	Power on again after parameter setting
	AL.110	Power on again after parameter setting
	AL.401	Undervoltage
	AL.402	Overvoltage
	AL.410	Overload (instantaneous maximum load)
	AL.411	Driver overload
	AL.412	Motor overload (continuous maximum load)
	AL.420	Over velocity
	AL.421	Out of control detection
	AL.422	Runaway fault
	AL.425	AI sampling voltage too high
	AL.435	Impulse current limit resistor overload
	AL.436	DB overload
	AL.440	heatsink OT
	AL.441	Motor overheat fault
	AL.500	Frequency division pulse output over velocity
	AL.501	Excessive position deviation
	AL.502	The position deviation between the full closed-loop encoder and the motor is too large
	AL.505	P command input pulse abnormal
	AL.550	Inertia identification failure
Encoder Warning	AL.600	Encoder output power short circuit fault
	AL.610	Incremental encoder off line
	AL.611	Z signal loss of incremental encoder
	AL.941	Parameter change to be switched on again

9.2 Cause and Treatment of Fault Alarm

AL.051： EEPROM Parameter exception

Cause of fault alarm	Fault alarm check	Disposal measures
Servo unit EEPROM	Check wiring	Correct wiring,power up again

data abnormal		If it always appears, replace the drive

AL.052：PLC configuration failure

Cause of fault alarm	Fault alarm check	Disposal measures
Main control MCU power on initialization abnormal Serial port baud rate set too high	Check wiring Check the baud rate parameter P00-21 of serial communication	Reduce the baud rate of serial communication If it always appears, replace the drive

AL.053：Initialization failed

Cause of fault alarm	Fault alarm check	Disposal measures
Main control MCU power on initialization failed	Check wiring Power up again	If it always appears, replace the drive

AL.054：System exception

Cause of fault alarm	Fault alarm check	Disposal measures
Abnormal operation of main control MCU	Check wiring Power up again	If it always appears, replace the drive

AL.060：Product model selection failure

Cause of fault alarm	Fault alarm check	Disposal measures
Product parameter setting does not match the actual hardware	Check product parameter setting and hardware model The rated current of the selected motor is greater than the output current of the driver	Set product parameters correctly If it always appears, contact the manufacturer

AL.061：Product matching failure

Cause of fault alarm	Fault alarm check	Disposal measures
Servo unit and servo motor model do not match	Check whether the servo unit supports the motor	Replace the servo unit matching the motor

AL.063：Overcurrent detection

Cause of fault alarm	Fault alarm check	Disposal measures
Servo unit power module current too high	U,V,W wiring for short circuit Is there a short circuit between B1 and B3	Correct wiring If it always appears, replace the drive

AL.071：Current sampling fault

Cause of fault alarm	Fault alarm check	Disposal measures
Abnormal sampling data of current sensor	Check wiring	Correct wiring If it always appears, replace the

		drive

AL.100：Parameter combination exception

Cause of fault alarm	Fault alarm check	Disposal measures
Parameter setting error	Check the set (P03-07) parameter	Set parameters correctly If it always appears, please initialize the parameters

AL.102 DI Allocation failure

Cause of fault alarm	Fault alarm check	Disposal measures
At least 2 input ports have the same function selection	Check port input function selection parameters	Set parameters correctly Power on the drive again

AL.103：DO Allocation failure

Cause of fault alarm	Fault alarm check	Disposal measures
At least 2 output ports have the same function selection parameters	Check port output function selection parameters	Set parameters correctly Power on the drive again

AL.105：Electronic gear setting error

Cause of fault alarm	Fault alarm check	Disposal measures
Electronic gear ratio setting error	Check the electronic gear ratio setting parameters. P03-10, P03-11	Set the electronic gear ratio correctly
Gantry output pulse setting too small	Check the number of feedback pulses of the gantry function motor for one revolution: P03-52 must be greater than 128	Correctly set the number of feedback pulses for one revolution of gantry function motor

AL.106：Abnormal setting of frequency division pulse output

Cause of fault alarm	Fault alarm check	Disposal measures
Frequency division pulse output parameter setting out of range	Check the frequency division pulse output setting parameters. P03-22，P03-23，P03-25	Correctly set the output parameters of frequency division pulse Incremental encoderP03-22≤P03-23 Bus encoderP03-25<65535 Power on the drive again

AL.110：Power on again after parameter setting

Cause of fault alarm	Fault alarm check	Disposal measures
After the servo parameter is set, it can take effect only after power on again	Power on the drive again	Power on the drive again

AL.401: Undervoltage

Cause of fault alarm	Fault alarm check	Disposal measures
The input voltage of the main circuit is lower than the rated voltage or there is no input voltage	Check whether the main circuit input R, S, T wiring is correct and what is the voltage value	Make sure the wiring is correct and use the correct voltage source or series voltage regulator

AL.402: Overvoltage

Cause of fault alarm	Fault alarm check	Disposal measures
Main circuit input voltage is higher than rated voltage	Use a voltmeter to test whether the input voltage of the main circuit is correct	Use correct voltage source or series voltage regulator
Drive hardware failure	When it is confirmed that the input voltage is correct, the over-voltage alarm still occurs	Please return it to the dealer or the original factory for maintenance
The regeneration resistance is not connected or the selection of regeneration resistance is wrong	Verify that P00-30 is set to 0 or 1	Correct setting and external regeneration resistance

AL.410: Overload (instantaneous maximum load)

Cause of fault alarm	Fault alarm check	Disposal measures
The machine is stuck when the motor starts	Check if the mechanical connection is blocked	Adjust the mechanical structure
Drive hardware failure	Confirm that the mechanical part is normal and still alarm	Please return it to the dealer or the original factory for maintenance

AL.412: Motor overload (continuous maximum load)

Cause of fault alarm	Fault alarm check	Disposal measures
Continuous use beyond the rated load of the drive	It can be monitored through d13. oL.	Change the motor or reduce the load
Improper setting of control system parameters	1. Whether the mechanical system is installed 2. Acceleration setting constant is too fast 3. Whether gain parameters are set correctly	1. Adjust control loop gain 2. Acceleration and deceleration setting time slows down
Motor wiring error	Check U, V, W wiring	Correct wiring

AL.420: Over velocity

Cause of fault alarm	Fault alarm check	Disposal measures
Input velocity command too high	Check whether the input signal is normal with the signal detector	Adjust the frequency of the input signal
Over velocity determination parameter setting is incorrect	Check whether P04-05 (overvelocity alarm value) is set reasonably	Set P04-05 (overvelocity alarm value) correctly

AL.440：heatsink OT

Cause of fault alarm	Fault alarm check	Disposal measures
The internal temperature of the driver is higher than 95 ℃	Check whether the cooling condition of the drive is good	Improve the cooling condition of the drive. If there is any alarm again, please send the drive back to the original factory for maintenance

AL.501：Excessive position deviation

Cause of fault alarm	Fault alarm check	Disposal measures
Too large position deviation, too small parameter setting	Confirm the parameter setting of P03-15 (excessive position deviation setting)	Increase the setting value of P03-15 (position deviation is too large)
Gain value set too small	Confirm whether the gain parameters are set properly	Adjust the parameters of gain class correctly
Internal torque limit set too small	Confirm internal torque limiting amplitude	Correct internal torque limiter readjustment
Excessive external load	Check external load	Load reduction or high power motor replacemen

AL.505：P command input pulse abnormal

Cause of fault alarm	Fault alarm check	Disposal measures
Pulse command frequency higher than rated input frequency	Check whether the input frequency is higher than the rated input frequency with pulse frequency detector	Set the input pulse frequency correctly

AL.551：Home Return timeout fault

Cause of fault alarm	Fault alarm check	Disposal measures
Time out for home operation	Confirm whether the parameter P03-68 (maximum time limit for searching the origin) is reasonable	Set P03-68 correctly

AL.600：Encoder output power short circuit fault

Cause of fault alarm	Fault alarm check	Disposal measures
Encoder power wiring error	Check whether the encoder power supply + 5V and GND are	Correct wiring

	connected reversely	

AL.610： Incremental encoder off line

Cause of fault alarm	Fault alarm check	Disposal measures
Incremental encoder HallU, HallV, HallW signal abnormal	Check encoder wiring	Correct wiring

➢ 10 Special Function Instructions

10.1 Gantry Synchronization Function

10.1.1Function description

The large-span machinery is basically driven by two motors in the connection mode of the gantry beam. In order to improve the synchronization of the two shafts, the synchronization mode is needed. The synchronization in the early stage is realized by the upper computer, and the servo is only used as the actuator. Now, the servo driver is used to complete the simultaneous control of the gantry, and the upper computer is only used for simple open-loop position control and logic control.

10.1.2Connection diagram of gantry function realization

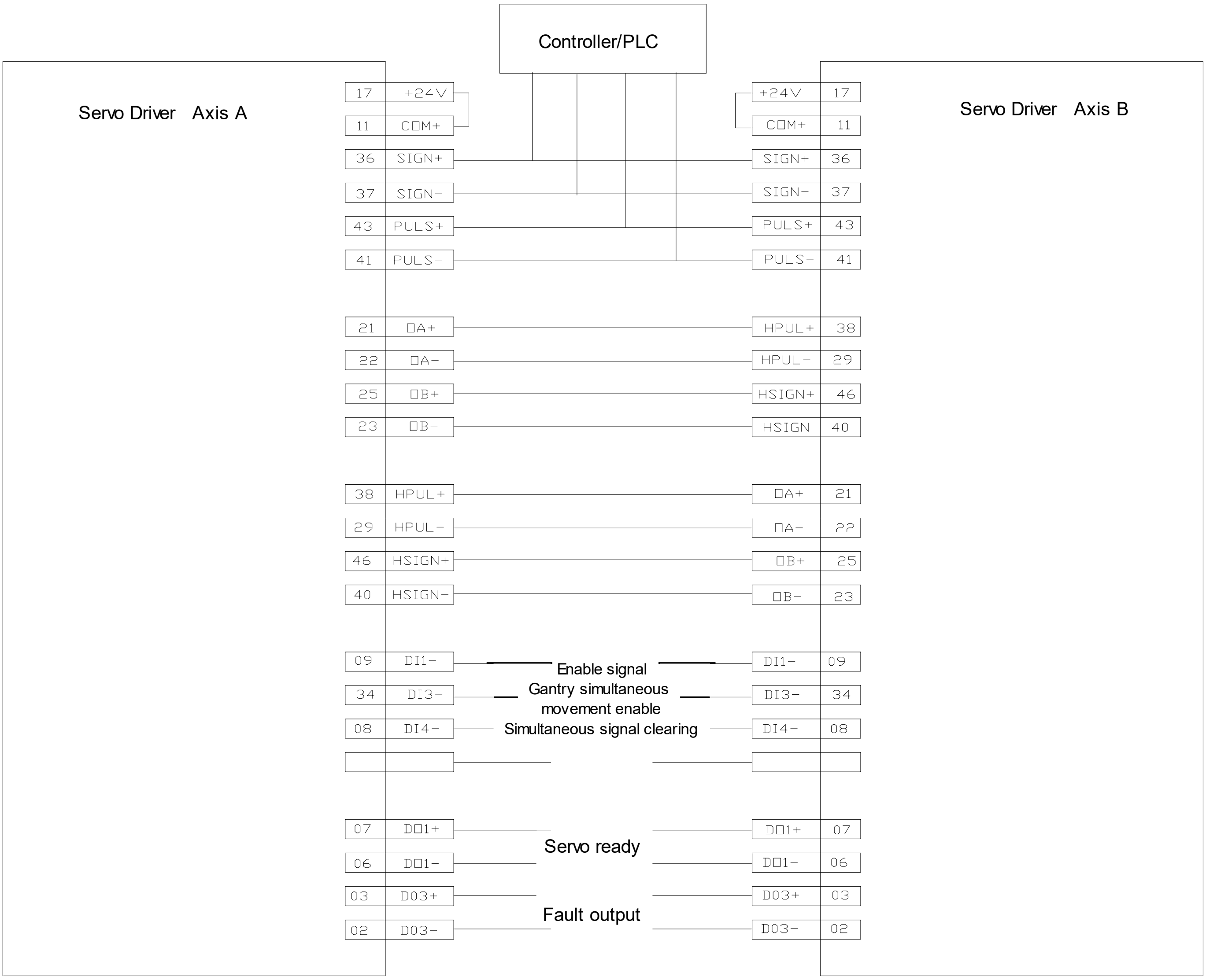


Figure 192 Connection diagram of gantry function realization

10.1.3Basic setting and description of servo

Table 146 Basic setting and description of gantry function

Parameter code	Name	Explain
P03-25	Absolute output pulse number of motor rotating one revolution	Setting range: 0-60000 Set the absolute value to rotate the motor for one turn, and output the number of A and B frequency division pulses respectively. Example: if the setting value is 2048, 2048 pulses will be output for A and B signals for each revolution of the motor
P03-50	Gantry function enable	Setting range: 0-1, default 0 0: Do not use the gantry function 1: Use the gantry function
P03-51	Gantry function input	Setting range: 0-1, default 0

	signal reversal	0: do not reverse 1: take the opposite
P03-52	The number of feedback pulses for one revolution of gantry function motor	Setting range: 0-65535, default 10000 After the gantry function is turned on, the driver rotates one circle to feedback the number of pulses Note: this value must be set the same for two axes to be synchronized
P03-53	Too large deviation setting of gantry function position	Setting range: 0-65535, default 10000 Set the excessive deviation of gantry function position: (P03-53) * 10 command unit When the set value is exceeded, the driver will alarm AL.510 (too large synchronous deviation of gantry)
P03-55	Proportional gain of Longmen function in the same moving position	Setting range: 0-200 The increase of parameter value can improve the position synchronization of the two shafts and help to reduce the synchronization error, but it is easy to generate vibration and noise when the setting is too large.
P06-01	Di1 input port function selection	Di1 set 1, servo ON
P06-05	Di3 input port function selection	Di3 is set with 19, and the simultaneous action function of gantry is enabled
P06-07	Di4 input port function selection	Di4 is set to 20, and the gantry synchronous command is cleared

10.1.4Synchronization setting on

After the above-mentioned gantry synchronization parameters are set, observe the feedback pulse of another axis through d03.C.PE, and judge whether the wiring of gantry synchronization is correct. If the pulse wiring is correct, enter the synchronization setting opening step.

Parameter setting of synchronous opening:

P03-50 set 1: gantry simultaneous movement enable

This parameter is set as the gantry synchronous enable. In this mechanical system, the enable signal is sent by the upper computer. The steps are as follows:

After power on, check the position by returning to the origin mode or manually. After completion, the gantry synchronization function is enabled, the synchronous deviation is cleared, and then the servo driver enters the gantry synchronous operation state.

10.2 Origin Reset Function

10.2.1Function description

Origin: that is, mechanical origin. It can indicate the position of origin switch or motor Z signal. It is set by function code P03-61.

Zero point: refers to the positioning target point, which can be expressed as the origin + offset (set by

P03-69 / P03-70). When P03-69 / P03-70 is set to 0, the zero point coincides with the original point.

The origin reset function refers to that in the position control mode, when the servo enable is ON, after the origin reset function is triggered, the servo motor will actively find the zero point and complete the positioning function。

10.2.2Basic setting and description of servo

Table 147 Basic setting and description of origin reset function

Parameter code	Name	Explain
P03-60	Origin regression enable control	Setting range: 0-6, default 0 Set origin regression mode and trigger signal source 0: turn off the origin reset function 1: Enable the origin reset function through the DI input origin reset start signal 2: Enable the electrical zero return function through the DI input origin reset start signal 3: Start the origin reset immediately after power on 4: Immediate origin reset 5: Start electrical zero return command 6: Take the current position as the origin
P03-61	Origin regression model	Setting range: 0-9, default 0 Set the control signal source of return to zero direction, deceleration point and origin during the operation of origin regression 0: forward return to zero, deceleration point, origin as origin switch 1: Reverse return to zero, deceleration point, origin as origin switch 2: Forward return to zero, deceleration point and origin are motor Z signals 3: Reverse return to zero, deceleration point and origin are motor Z signals 4: Forward return to zero, deceleration point as origin switch, origin as motor Z signal 5: Reverse return to zero, the deceleration point is the origin switch, and the origin is the motor Z signal 6: Forward return to zero, deceleration point and origin are forward override switches 7: Reverse return to zero, deceleration point and origin are reverse override switches 8: Forward return to zero, deceleration point is forward over travel switch, origin is motor Z signal 9: Reverse return to zero, deceleration point is reverse override switch, origin is motor Z signal
P03-65	High velocity when	Setting range: 0-3000, default 100

	searching the origin switch	Set the high-velocity value of the deceleration point signal when the origin returns to zero. When returning to zero, the motor always runs at high velocity of P03-65.
P03-66	Velocity when searching the origin switch	Setting range: 0-1000, default 10 Set the low velocity value when searching the origin when the origin returns to zero. The velocity setting should be low enough to prevent mechanical shock during shutdown.
P03-67	Acceleration and deceleration time of search origin switch	Set the time when the motor changes from 0 to 1000 rpm when the origin is reset. uint: MS
P03-68	Search origin maximum time limit	Limit the total time of origin reset. If the time-out occurs, the warning AL.551 (return to origin timeout fault) will occur.
P03-69	Mechanical origin offset H	Set the high and low values of the absolute position of the motor after the origin reset. Total offset calculation method: Offset = (P03-69) * 65535 + (P03-70)
P03-70	Mechanical origin offset L	
P06-01	Di1 input port function selection	Di1 set 1, servo ON
P06-05	Di3 input port function selection	Di3 set 3, forward over travel signal input
P06-07	Di4 input port function selection	Di4 set 4, reverse override signal input
P06-09	Di5 input port function selection	Di5 set 21, origin switch signal
P06-11	Di6 input port function selection	Di6 Set 22, origin reset start signal

10.2.3Precautions for use of origin reversion

If the deceleration point signal is effective, and the origin signal is effective under the condition of insufficient deceleration, the final positioning may be unstable. The displacement required for deceleration shall be fully considered, and then the deceleration point and origin signal input position shall be set. Acceleration and deceleration time (P03-67) and velocity (P03-65) when searching the origin switch will also have an impact on the positioning stability, which should be taken into account when setting.

10.3 Absolute Encoder Use

10.3.1Function description

Using the servo motor with absolute value encoder, the absolute value detection system can be built by the upper device. Through the absolute value detection system, it is unnecessary to reset the origin every time the power is connected. This function is based on Modbus or CANopen communication to read the absolute encoder turns and position data, and the upper device processes and controls to realize the absolute encoder related functions.

10.3.2Basic setting and description of servo based on bus communication

When the system using absolute value encoder is put into use, it is necessary to initialize the data of rotation turns (the multi turn value of AF-En0 absolute value encoder is cleared). Therefore, when initialization is required for the first power on and so on, an alarm related to the absolute value encoder will occur. By setting (initializing) the absolute value encoder, the alarm related to the absolute value encoder will be cleared after the initialization of the rotation numb er data.

Table 148 Basic setting and description of servo based on bus communication

Parameter code	Name	Explain
P00-23	Slave address	Setting range: 0-255, default 1 Set according to equipment requirements
P00-24	Modbus communication baud rate	Setting range: 0-7, default 20：2400 1：4800 2：9600 3：19200 4：38400 5：57600 6：115200 7：25600
P00-25	Verification mode	Setting range: 0-3, default 1 0: no check, 2 stop bits 1: Even check, 1 stop bit 2: Odd check, 1 stop bit 3: No check, 1 stop bit
P00-27	CANopen communication baud rate	Set the baud rate of CAN bus 0：12.5KHz 1：120KHz 2：20KHz 3：100KHz 4：125KHz 5：250KHz 6：500KHz
P00-07	Encoder selection	Setting range: 0-3, default 3 0, 1: incremental encoder; 2: Single turn absolute value encoder; 3: Multi turn absolute encoder

10.3.3Absolute encoder related alarm processing

Table 149 Absolute encoder related alarm processing

Alarm	Cause of fault	Fault alarm check	Disposal measures

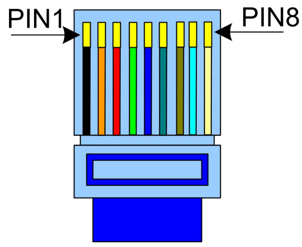
code	alarm		
AL.640	Bus encoder overvelocity	Appears on initial use	Clear the alarm by AF-EN0 (see **parameters and functions for details**)
AL.642 AL.643	When the bus encoder is set to the absolute value of multiple turns, the external battery voltage is low	Check the external battery voltage of encoder, and make sure it is higher than 3.0V	Replace the battery and clear the alarm through AF-EN0 (see **parameters and functions for details**)
AL.644 AL.645	Abnormal reading of multi turn data, or multi turn data greater than 32767	Check the value of d21.ASH (see **parameters and functions for details**)	If the multi turn value is greater than 32767, clear the multi turn data through AF-EN1 (see **parameters and functions for details**)
AL.930	Absolute encoder battery failure	Check the external battery voltage of encoder	Replace the battery and clear the alarm through AF-EN0 (see **parameters and functions for details**)

Communication Interface and Wiring

➢ RS485/CAN Bus – RJ45 Port Definition

RS485/CANCommunication interface pin definition as follow:

Table 150 RS485/CAN Bus – RJ45 Port Definition

RJ45	It is recommended to use twisted pair or shielded wire. The length of line of communicationis adjusted according to baud rate.		
PIN.num	Signal	Name	Diagram
1	CANH	CAN bus high level	
2	CANL	CAN bus low level	
3	GND	CAN bus ground	
4	NC	Not Connect	
5	NC	Not Connect	
6	GND	485 bus ground	
7	485B	485 bus B terminal	
8	485A	485 bus A terminal	

➢ RS485 Interface Converter

In view of the fact that some users want to communicate 485 with the driver of JMC via PC. We hereby recommend an available interface converter to users, but it is not a product produced by JMC. Thus we would not bear any economic loss caused by this interface converter.

SHENGWEI UDC-2225, USB2.0 TO RS422/485

Working Mode: asynchronous, point to point or multi-point, 2-line half duplex, 4-line full duplex

Baud Rate:300~128000bps,it can automatically detect serial signal rate

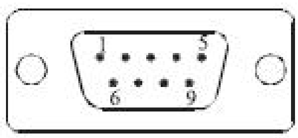
Transmission Distance:Wire of USB port isn't more than 5 meters

Interface Mode: USB A type (male), connector of BD9 male

Port definition:

Table 151 BD9 male of UDC-2225

PIN	Signal	RS-422 Full-duplex	RS-485 Half-duplex
1	T/R+	Send(A+)	RS-485(A+)
2	T/R-	Send(B-)	RS-485(B-)
3	RXD+	Receive(A+)	—
4	RXD-	Receive(B-)	—
5	GND	Ground	Ground
6	N/A		
7	N/A		
8	N/A		
9	N/A		



Notice:After purchasing this interface converter, users shall make JMC 485 communication line according to the "RS485/CAN bus - RJ45 Port Definition". That is, connect A and B terminals at one end of the communication line with A and B of UDC interface.

Meanwhile, SSCOM is recommended for serial port communication, which supports ModbusCRC16 check. When sending Modbus-RTU messages, users do not need to calculate CRC check codes by themselves, and the software will automatically calculate as well as add to the designated position.

➢ RS232 Interface Definition

Currently, all RS232 communication interfaces of JMC drives are micro USB interfaces, including HISU handheld debugger special cable and special RS232 communication cable with host computer, one of which is also micro USB port. The interface definition of the special RS232 communication line with upper-computer is shown in the figure below:

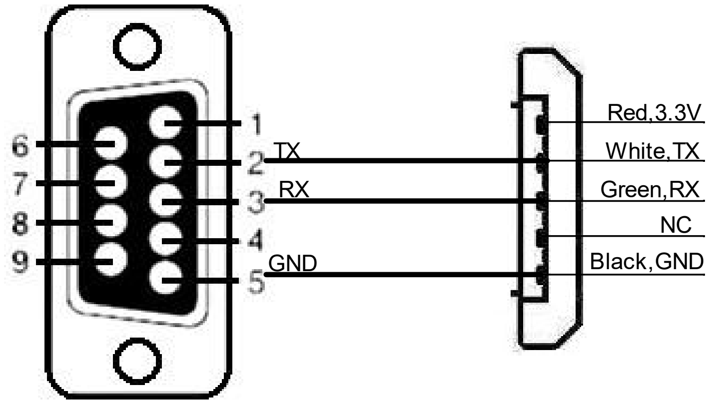


Figure 193 JMC Drive RS232 communication port

About Baud rate and other Settings, usercan refer to the following table:

Table 152 JMC RS232 communication parameter setting

Parameter	Baud rate	Start	Data	Stop	Check
Value	0~115200bps	1Bit	8Bit	1Bit	None

➢ RS485 Bus Network Schematic Diagram

The Modbus-RTU bus drive of JMC supports the connection mode based on the RS-485 two-wire half-duplex, and can connect slave from 1 to 32 to construct the RS-485 network with topology structure.

The schematic diagram of RS-485 as follow:

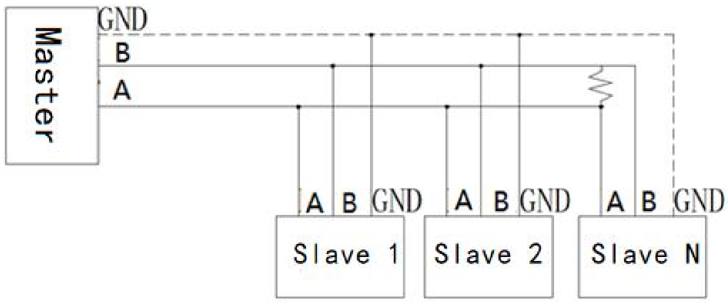


Figure 194 RS-485 Bus Network Schematic Diagram

N: The RS-485 communication network can support up to 32 slaves to connect.

➢ CAN Bus Network Schematic Diagram

The CANopen products of JMC are made of four-wire wiring, as shown in the figure below. The wiring shall be in accordance with CIA301 protocol. The connection mode between slaves should be Daisy-chain and a terminal resistor should be connected to the network terminal device. But Star connection are not recommended because of possible surges.

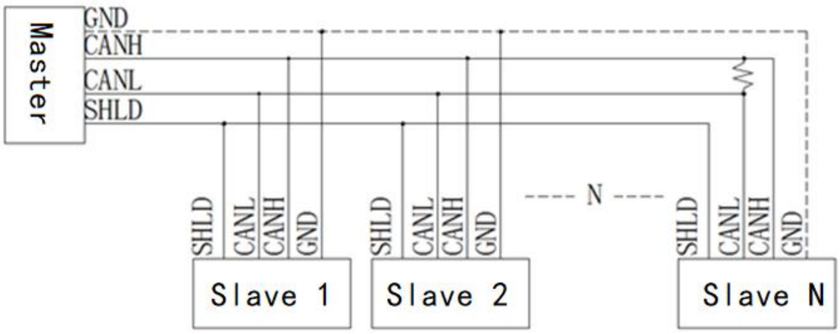


Figure 195 CAN Bus Network Schematic Diagram

Resistor: At the end of the network, between the CANH of the last slave and CANL connect a 120 Ω resistor, to avoid communication disorders.

N: The CAN communication network can support up to 127 slavesto connect.

Communication

Modbus-RTU

➢ Modbus-RTU Protocol

Modbus protocol is a bus protocol designed by MODICON company, permitting one master share data with one or multi-slave. The Master can read and write single registers or multiple registers.

The communication port of the JMC Modbus-RTU driver is a RS485 compatible serial interface that defines the connector, wiring cable, signal grade, transmission baud rate and parity. Controller uses master-slave technology, that is, the master can start data transmission, query, and other devices (slave) respond to the information inquired by the master station, or do the action required by the master station.

Master equipment includes master-slave processor and PLC. Slave includes servo drive and step drive.The relationship between master and slave query-feedback is as right drawing:

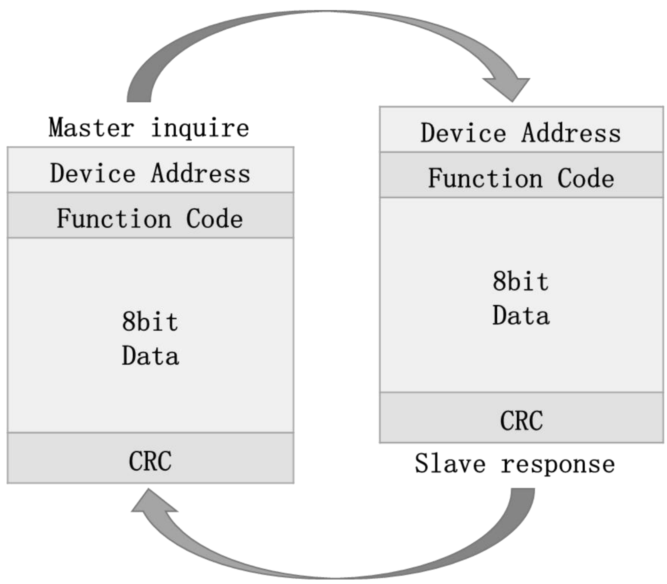


Figure 196 Master and slave query-feedback relationship

➢ Modbus-RTU Message format

Modbus-RTU is a master-slave technology, and the CRC check range from the device address bits to the data bits; detailed message format of the function code, see the appendix. Modbus-RTU message frame is as follows:

Table 153 Modbus-RTU message format

Address field	Function code	Data	CRC low byte	CRC high byte
8bit	8bit	N*8bit	8bit	8bit
The Modbus protocol defines a simple protocol data unit (PDU) independent of the underlying communication layers. The mapping of Modbus protocol on specific buses or network can introduce some additional fields on the application data unit				

(ADU).

MODBUS uses a "big-Endian" representation for addresses and data items. This means that when a numerical quantity larger than a single byte is transmitted, the most significant byte is sent first.

➢ Modbus-RTU Transfer Protocol

1 Message processing

As a slave, the drive will wait for receiving the data sent by the master station, and when receivingthe data, it is judged whether it is the data of own slave and responds.When the time out 3.5Ttimes did not receive the next frame of data, the slave drive default error data received, theprevious data cleared, re-receive new data.

2 Message frame structure

The message exchanged by "master-slave" starts with the slave address, followed by the function code, Transmission of data. The structure of the data field depends on the function code used. The CRC code is transmitted at the end of the message frame.

The message frame structure is shown in the following table:

Table 200 Modbus-RTU Message frame structure

Address	Function	Data	CRC code
1 byte	1 byte	N byte	2 bytes

Address	Modbus Slave address 1~32
Function	Modbus function code
Data	Modbus data: Register address, the number of registeraddresses, the data of register
CRC	Message frame checksum

3 Broadcast message

The master uses slave address 0 to address all slaves on the bus.

Broadcast messages are only allowed with write function code 0x06 and 0x10.

Broadcast messages do not require reply message frames from slave.

4 Modbus function code

JMC Modbus-RTU Drive support the following Modbus function code:

1) 0x03: Read Holding Registers

This function code is used to read the contents of a contiguous block of holding registers in a remote device. The Request PDU specifies the starting register address and the number ofregisters. In the PDU Registers are addressed starting at zero. Therefore, registers numbered1-16 are addressed as 0-15.

The register data in the response message are packed as two bytes per register, with thebinary contents right justified within each byte. For each register, the first byte contains thehigh order bits and the second contains the low order bits。

2) 0x06: Write Single Register

This function code is used to write a single holding register in a remote device.

The Request PDU specifies the address of the register to be written. Registers are addressedstarting at zero. Therefore, register numbered 1 is addressed as 0.

The normal response is an echo of the request, returned after the register contents have beenwritten.

3) 0x10: Write Multiple registers

This function code is used to write a block of contiguous registers (1 to 123 registers) in aremote device.

The requested written values are specified in the request data field. Data is packed as twobytes per register.

The normal response returns the function code, starting address, and quantity of registerswritten.

Notice: The quantity of address of 16-bit register is 1, and the quantity of address of 32-bit register is 2. The 32-bit registers can only be written in 0x10 function code.

4.1Read register

Request message frame:

Table 156 Read register: Request message frame

Read register: Request		
Slave address	1Byte	0xXX
Function code	1Byte	0x03
Starting Address	2Byte	0xXXXX
Quantity of Registers	2Byte	1~126
CRC check code “low byte”	1Byte	0xXX
CRC check code “high byte”	1Byte	0xXX

Respond message frame:

Table 157 Read register: Respond message frame

Read register: Respond		
Slave address	1Byte	0xXX
Function code	1Byte	0x03
Start address	1Byte	-
Quantity of Registers	N Byte	-
CRC check code “low byte”	1Byte	0xXX
CRC check code “high byte”	1Byte	0xXX

Example: Read the value of the 32-bit register (0x607Ah)

If the value of register 0x6000 equal 0:

Request: 01 03 60 7A 00 02 FB D2 (h)

Respond: 01 03 04 00 03 0D 40 0F 53 (h)

If the value of register 0x6000 equal 1:

Request: 01 03 60 7A 00 02 FB D2 (h)
Respond: 01 03 04 0D 40 00 03 B9 4A (h)

If the value of register 0x6000 equal 0:

Request message explained as follows:

Message	01	03	607A	0002	FBD2
Explanation	Slave ID	Function code	Start address	The number of address	Check code

Respond message explained as follows:

Message	01	03	04	0003	0D40	0F53
Explanation	Slave ID	Function code	The number of address	Data of address 1	Data of address 2	Check code

4.2 Write a single register

Request message frame:

Table 203 Write a single register: Request

Write a single register: Request		
Slave address	1Byte	0xXX
Function code	1Byte	0x06
Register address	2Byte	0xXXXX
Register Value	2Byte	0xXXXX
CRC check code “low byte”	1Byte	0xXX
CRC check code “high byte”	1Byte	0xXX

Respond message frame:

Table 154 Write a single register: Respond

Write a single register: Respond		
Slave address	1Byte	0xXX
Function code	1Byte	0x06
Register Address	2Byte	0xXXXX
Register Value	2Byte	0xXXXX
CRC check code “low byte”	1Byte	0xXX
CRC check code “high byte”	1Byte	0xXX

Note: 32-bit register cannot be written with 0x06 function code, need to use 0x10 function code to write.
Example: Write 0x0003 to slave2's 16-bit register (0x6060h).
Request and Response Data:

Message	02	06	6060	0003	XXXX
Explanation	Slave address	Function code	Register address	Data	Check code

4.3 Write Multiple registers

Request message frame:

Table 155 Request message frame: Request

Request message frame: Request		
Slave address	1Byte	0xXX
Function	1Byte	0x10
Starting address	2Byte	0xXXXX
Quantity of Register	2Byte	0xXXXX
Byte count	1Byte	0xXX
Registers Value	N*2 Byte	0xXX
CRC check code “low byte”	1Byte	0xXX
CRC check code “high byte”	1Byte	0xXX

Respond message frame:

Table 206 Write a single register: Respond

Write a single register: Respond		
Slave address	1Byte	0xXX
Function code	1Byte	0x10
Stating Address	2Byte	0xXXXX
Quantity of Registers	2Byte	0xXXXX
CRC check code “low byte”	1Byte	0xXX
CRC check code “high byte”	1Byte	0xXX

Example:

0x0064 is written to the 16-bit register profile acceleration (6083h) and the profile deceleration (6084h).

Request: 01 10 60 83 00 02 04 00 64 00 64 53 EC (h)

Respond： 01 10 60 83 00 04 AE 20 (h)

Request message explained as follows:

Message	01	10	6083	0002	04	0064	0064	53EC
Explanation	Slave address	Function code	Starting address	Quantity of Register	Byte count	Written to 0x6083	Written to 0x6084	Check code

Respond message explained as follows:

Message	01	10	6083	0002	AE20
Explanation	Slave address	Function code	Starting address	Quantity of Register	Check code

4.4 Error Code

Respond message frame:

Table 207 Respond message frame: Error Code

Respond message frame: Error Code		
Address	1Byte	0xXX
Error code	1Byte	Function code + 0x80

Exception code	1Byte	0~11
CRC check code “low byte”	1Byte	0xXX
CRC check code “low byte”	1Byte	0xXX

Example：

Write 0x0003 to salave1's 16-bit register (0x6090h). An exception occurred, return no this register.

Request: 01 06 60 90 00 03 D7 E6 (h)

Respond: 01 86 0B 03 A7 (h)

Request message explained as follows:

Message	01	06	6090	0003	D7E6
Explanation	Slave address	Function code	Register address	Written data	CRC code

Respond message explained as follows:

Message	01	86	0B	03A7
Explanation	Slave address	Error code	Register doesn’t exist	CRC code

5 Data Field

Data field is used to transmit function code and specific data, for example: The number of bytes, start address of register, read and write address number, data value and so on.

Note that the 16-bit register has an address number of 1, and the 32-bit register has an address number of 2. The 32-bit registers can only be written in 0x10 function code.

6 Cyclic Redundancy Check (CRC)

The last frame of the message is a CRC 16 checksum of 2 bytes. The checksum is calculated as follows: $X^{16} + X^{15} + X^2 + 1$.

The low byte is transmitted first, followed by the high byte.

7 Error Response

When detecting the master request message that is wrong, such as the receive register address is invalid, will set the highest bit of the function code to 1.

Subsequent transmission is a one-byte error code describing the error.

Table 208 MODBUS Exception Codes

Code	Name	Meaning
1	Illegal function	Function code is illegal
2	Illegal data address	Slave has an illegal data address
3	Illegal data value	Slaves have illegal data values
4	The associated device has failed	An internal error from the slave
5	Write the read-only register	Cannot execute the corresponding write operation

6	Busy, reject the message	The slave is not ready to receive the message
7	Read the write-only register	Cannot perform the corresponding read operation
8	Data write error	The number of bytes does not match the number ofregisters
9	Parityerror	Parity error (with parity configuration)
10	CRC check error	An error occurred in the CRC check, requestingretransmission of data
11	R / W register does not exist	The R / W register address does not exist, cannot becompleted

8 Node Guarding

Because the JMC driver supports CiA402 and part of the CiA301 motion control protocol, the master can determine whether the slave is dropped by setting the Lifetime of the slave, to make the slave stopping in time.

Lifetime = Guard time (0x100C) × Life time factor (0x100D).If the slave is not polled for the value of the monitor register (0x6039) by the master during the lifetime time, the slave is considered dropped.

Example:

$01 $06 $10 0C $03 E8 $4D B7 Setting Guard time to 1000ms

$01 $06 $10 0D $00 02 $9D 08 Setting Life time factor to 2

$01 $03 $60 39 $00 01 $4A 07 Reading register 0x6039

Register 0x100C is set as 1000ms and register 0x100D is set as 2. In other words, if the message of register 0x6039 read by the master is not received by the slave within 2s, the slave is considered be dropped and all actions will be stopped.

Notice: To turn off monitoring, 0x100C and 0x100D should be written to 0 and read 0x6039 again.

➢ Modbus-RTU Communication Protocol

0x1001 Error register

Table 209 Object 1001h: Error register

Register	Data type	Access type	Default value
1001h	UNSIGNED16	RO	0
This object shall provide error information.			
Bit 0: generic error Bit 1: current error Bit 2: voltage error Bit 3: temperature error Bit 4: communication error Bit 5: over position error protection (Only stepper servo and servo drive) Bit 6: Reserve (Default 0) Bit 7: Motor phase loss			

0x1008 Manufacturer device name

Table 210 Object 1008h: Manufacturer device name

Register	Data type	Access type	Default value
1008h	Vis-String	RO	JMC XXX
This object is the name of the manufacturer device.			

0x1009 Manufacturer hardware version

Table 211 Object 1009h: Manufacturer hardware version

Register	Data type	Access type	Default value
1009h	Vis-String	RO	XXX
Device hardware version number			

0x100A Manufacturer software version

Table 212 Object 100Ah: Manufacturer software version

Register	Data type	Access type	Default value
1008h	Vis-String	RO	JMC XXX
Device internal software version number			

0x100C Guard time

Table 213 Object 100Ch: Guard time

Register	Data type	Access type	Default value
100Ch	UNSIGNED16	RW	0
The value shall be given in multiple of ms. The value of 0000 h shall disable the life guarding.			

0x100D Life time factor

Table 214 Object 100Dh: Life time factor

Register	Data type	Access type	Default value
100Dh	UNSIGNED8	RW	0
Lifetime = Guard time (0x100C) × Life time factor (0x100D). If the slave is not polled for the value of the monitor register (0x6039) by the master during the Lifetime time, the slave is considered dropped.			

Register 0x100C is set as 1000ms and register 0x100D is set as 2. In other words, if the message of register 0x6039 read by the master is not received by the slave within 2s, the slave is considered be dropped and all actions will be stopped.

0x6000 Format register

Table 215 Object 6000h: Format register

Register	Data type	Access type	Default value
6000h	UNSIGNED16	RO	0
32-bit register storage format			
when 0x6000=0, 32-bit register the high 16-bit in the previousaddress, the low 16-bit in the next address; when 0x6000=1, 32-bit register the low 16-bit in theprevious address, the high16-bits in the next address.			

0x6039 Monitor register

Table 216 Object 6039h: Monitor register

Register	Data type	Access type	Default value
6039h	UNSIGNED16	RO	0
To monitor node status.			
If the message of register 0x6039 read by the master is not received by the slave within 2s, the slave is considered be dropped and all actions will be stopped. To turn off monitoring, 0x100C and 0x100D should be written to 0 and read 0x6039 again.			

0x6040 Controlword

Table 217 Object 6040h: Controlword

Register	Data type	Access type	Default value
6040h	UNSIGNED16	WO	0
The control word for the drive.Used to enable or disable the drive power and brake output, startand stop the motor in different operating modes, clear the error alarm and so on.			

The bits of the controlword are defined as follows:

Table 218 The bits of the controlword

Byte	BIT	Bit definition			
		Position mode	Velocitymode	Homingmode	Torquemode

LSB	0	0→1: Parameter and variable initialization (Brake shut down).			
	1	0→1: Drive power supply (Brake open).			
	2	0→1:Quick stop			
	3	0→1:Motor enable			
		1→0: Motor enable disable			
	4	0→1: Position sampling	Reserve	Starthoming	Reserve
	5	0: Complete the current position and then execute the next position;	Reserve	Reserve	Reserve
		1:Run directly to the next given position			
	6	0: Absolute positioning; 1: Relative positioning:	Reserve	Reserve	Reserve
	7	0→1: Reset and clear error			
MSB	8	0→1: Halt			
		1→0: Normal operation			
	9	0:Finish the previous position stop and run the next position	Reserve	Reserve	Reserve
		1:The current position and the next position do not stop			
	10	Reserve			
	11	Reserve			
	12	Reserve			
	13	Reserve			
	14	Reserve			
	15	Reserve			

Device control commands are triggered by the following bit patterns in the controlword:

Table 219 Device control commands

Command	The bit of the Controlword				
	Error reset bit7	Enable operation bit3	Quick stop bit2	Enable voltage bit1	Initialization device bit0
Initialization	0	X	X	X	1
Open brake	0	0	0	1	1
Enable device operation	0	1	1	1	1
Quick stop	0	X	0	1	X
Forbid enable	0	0	1	1	1
Error reset	0→1	X	X	X	X

0x6041 Statusword

Table 220 Object 6041h: Statusword

Register	Data type	Access type	Default value
6041h	UNSIGNED16	RO	0
The statusword indicates the current state of the drive. No bits are			

latched.

Table 221 Bits in the statusword

<table>
<tr><th rowspan="2">Byte</th><th rowspan="2">BIT</th><th colspan="5">Bits in the statusword</th></tr>
<tr><th></th><th>Position mode</th><th>Velocity mode</th><th>Homing mode</th><th>Torquemode</th></tr>
<tr><td rowspan="8">LSB</td><td>0</td><td colspan="5">0:Unprepared initialization 1:Ready to initialize</td></tr>
<tr><td>1</td><td colspan="5">0:Initialization drive is not completed 1:Initialization drive completion</td></tr>
<tr><td>2</td><td colspan="5">0: Motor enable disable 1:Motor enable</td></tr>
<tr><td>3</td><td colspan="5">0:Drive normal status 1:Drive error status</td></tr>
<tr><td>4</td><td colspan="5">0:Drive not work 1: Drive work normally</td></tr>
<tr><td>5</td><td colspan="5">0: Normal operation 1:Quick stop</td></tr>
<tr><td>6</td><td colspan="5">0:Normal operation 1:Device enters the initialization state</td></tr>
<tr><td>7</td><td colspan="5">0: Normal operation 1:Warning</td></tr>
<tr><td rowspan="16">MSB</td><td>8</td><td colspan="5">0: Normal operation 1:Motor halt</td></tr>
<tr><td>9</td><td colspan="5">0: motor is stopped 1:Motor is running</td></tr>
<tr><td rowspan="4">10</td><td rowspan="2">0</td><td rowspan="2">Not arrived</td><td>Bit8=0:Notreachingthe target velocity</td><td>Bit8=0:Notreachingthe homing position</td><td>Bit8=0:Notreachingthe target torque</td></tr>
<tr><td>Bit8=1:Deceleration</td><td>Bit8=1:Deceleration</td><td>Bit8=1:Deceleration</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">arrived</td><td>Bit8=0:Reachingthe target velocity</td><td>Bit8=0:Reachingthehoming position</td><td>Bit8=0:Reachingthe target torque</td></tr>
<tr><td>Bit8=1:The velocity is0</td><td>Bit8=1:The speed is0</td><td>Bit8=1:The speed is0</td></tr>
<tr><td>11</td><td colspan="5">SW mechanical origin limit</td></tr>
<tr><td rowspan="2">12</td><td>0</td><td>can't set newposition</td><td>The velocity is not 0</td><td>Homing operation notcomplete</td><td>Notreachingthe target torque</td></tr>
<tr><td>1</td><td>can set newposition</td><td>The velocity is 0</td><td>Homingoperationcomplete</td><td>Reachingthe target torque</td></tr>
<tr><td rowspan="2">13</td><td>0</td><td>Normal operation</td><td>No maximumacceleration</td><td>Homing operation noterror</td><td rowspan="2">Reserve</td></tr>
<tr><td>1</td><td>over position error</td><td>Maximumacceleration</td><td>Homing operation error</td></tr>
<tr><td>14</td><td colspan="5">CW clockwise direction limit</td></tr>
<tr><td>15</td><td colspan="5">CCW counter clockwise direction limit</td></tr>
</table>

The following bits indicate the status of the device:

Table 222 Device state bits (x ... irrelevant for this state)

Status word value (Binary)	State
XXXX XXXX X0XX 0000	Uninitialized device
XXXX XXXX X01X 0001	Initialized device
XXXX XXXX X01X 0011	Device power on and operation
XXXX XXXX X01X 0111	Device enable
XXXX XXXX X00X 0111	Quick stop active
XXXX XXXX X0XX 1111	Device error alarm occurs
XXXX XXXX X0XX 1000	The device is in an error state

0x605A Quick stop option code

Table 223 Object 605Ah: Quick stop option code

Register	Data type	Access type	Default value
605Ah	INTEGER16	RW	0

The parameter quick stop option code determines what action should be taken if the Quick StopFunction is executed.

Value	Description
-32768…-1	manufacturer specific
1	slow down on slow down ramp
2	slow down on quick stop ramp
3…32767	Stop immediately

0x605D Halt option code

Table 224 Object 605Dh: Halt option code

Register	Data type	Access type	Default value
605Dh	INTEGER16	RW	0

The parameter halt option code determines what action should be taken if the bit 8 (halt) in thecontrolword is active.

Value	Description
-32768…-1	manufacturer specific
1	halt with the current deceleration
2	halt with fast stop speed
3…32767	halt immediately

0x6060 Modes of operation

Table 225 Object 6060h: Modes of operation

Register	Data type	Access type	Default value
6060h	INTEGER16	WO	0

The parameter modes of operation switches the actually chosen operation mode.

Value	Description
1	Profile Position Mode
2	Velocity Mode
3	Profile Velocity Mode
4	Torque Profile Mode (servo only)
6	Homing Mode

0x6061 Modes of operation display

Table 226 Object 6061h: Modes of operation display

Register	Data type	Access type	Default value
6061h	INTEGER16	RO	0
The modes of operation display show the current mode of operation.The meaning of the returnedvalue corresponds to that of the modes of operation option code (index 6060 h).			

0x6064 Position actual value

Table 227 Object 6064h: Position actual value

Register	Data type	Access type	Default value
6064h	INTEGER32	RO	0
This object represents the actual value of the position measurement device in user defined units.			

0x606C Velocity actual value

Table 228 Object 606Ch: Velocity actual value

Register	Data type	Access type	Default value
606Ch	INTEGER32	RO	0
The velocity actual value is also represented in velocity units and is coupled to the velocity used asinput to the velocity controller. Unit: rps / min unit. e.g. If the value of index 606C is 100, it means the current speed is 10rps.			

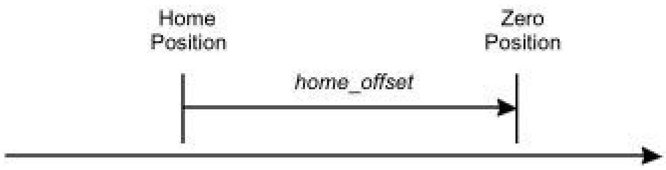
0x607A Target position

Table 229 Object 607Ah: Target position

Register	Data type	Access type	Default value
607Ah	INTEGER32	RW	0
The target position is the position that the drive should move in position mode.The related parameters are the target velocity, acceleration and deceleration. Thetarget position is related to different subdivisions and can be treated as a calculation orrelated parameter according to the bit6 of the control word.			

0x607C Home offset

Table 230 Object 607Ch: Home offset

<table>
<tr><th>Register</th><th>Data type</th><th>Access type</th><th>Default value</th></tr>
<tr><td>607Ch</td><td>INTEGER32</td><td>RW</td><td>0</td></tr>
<tr><td colspan="4">The home offset object is the difference between the zero position for the application and the machine home position (found during homing), it is measured in position units. During homing the machine home position is found and once the homing is completed the zero position is offset from the home position by adding the home offset to the home position. All subsequent absolute moves shall be taken relative to this new zero position. This is illustrated in the following diagram.

</td></tr>
</table>

0x6081 Profile velocity

Table 231 Object 6081h: Profile velocity

<table>
<tr><th>Register</th><th>Data type</th><th>Access type</th><th>Default value</th></tr>
<tr><td>6081h</td><td>INSIGNED32</td><td>RW</td><td>0</td></tr>
<tr><td colspan="4">The profile velocity is the velocity normally attained at the end of the acceleration ramp during aprofiled move and is valid for both directions of motion. The profile velocity is given in user definedspeed units.
If the parameter 45 of drive is 0, the unit of profile velocity is 0.1 RPS. For example, while profile velocity is 100, its actual speed of movement is 10RPS (= 600RPM);
If the parameter 45 of drive is 1, the unit of profile velocity is 1/Revolution RPS. For example, while parameter 17 of drive is 13 (Revolution = 10000) and profile velocity is 100, its actual speed of movement is 0.01 RPS.</td></tr>
</table>

0x6083 Profile acceleration

Table 232 Object 6083h: Profile acceleration

<table>
<tr><th>Register</th><th>Data type</th><th>Access type</th><th>Default value</th></tr>
<tr><td>6083h</td><td>UNSIGNED16</td><td>RW</td><td>0</td></tr>
<tr><td colspan="4">The profile acceleration is given in user defined acceleration units.
If the parameter 45 of drive is 0, the unit of profile acceleration is 0.1</td></tr>
</table>

r/s^2. For example, while profile acceleration is 100, its actual acceleration of movement is $10r/s^2$. If the parameter 45 of drive is 1, the unit of profile acceleration is 1/Revolution*10 r/s^2. For example, while parameter 17 of drive is 13 (Revolution = 10000) and profile acceleration is 100, its actual acceleration of movement is 0.1 r/s^2.

0x6084 Profile deceleration

Table 233 Object 6084h: Profile deceleration

Register	Data type	Access type	Default value
6084h	UNSIGNED16	RW	0
The profile deceleration is given in the same units as profile acceleration (refer to 6083h).			

0x6085 Quick stop deceleration

Table 234 Object 6085h: Quick stop deceleration

Register	Data type	Access type	Default value
6085h	UNSIGNED16	RW	0
The quick stop deceleration is the deceleration used to stop the motor if the 'Quick Stop' command isgiven and the quick stop option code (see 605Ah) is set to 2. The quick stop deceleration is given inthe same units as the profile acceleration.			

0x6098 Homing method

Table 235 Object 6098h: Homing method

Register	Data type	Access type	Default value
6098h	INTEGER16	RW	0
The homing method object determines the method that will be used during homing (Method 1~10).			

0x6099 Homing speeds

Table 236 Object 6099h: Homing speeds

Register	Data type	Access type	Default value
6099h	UNSIGNED32	RW	0
This entry in the object dictionary defines the speeds used during			

homing and is given velocity units.Speed during search for switch. Note that this range of value is from 0 to 100000. The homing speed is given in the same units as profile velocity (refer to 6081h).

0x609A Homing acceleration

Table 237 Object 609Ah: Homing acceleration

Register	Data type	Access type	Default value
609A	UNSIGNED16	RW	0
The homing acceleration establishes the acceleration to be used for all accelerations and decelerations with the standard homing modes and is given in acceleration units. The homing acceleration is given in the same units as profile acceleration (refer to 6083h).			

0x609B Speed of finding zero origin

Table 238 Object 609Bh: Speed to find zero origin

Register	Data type	Access type	Default value
609B	UNSIGNED32	RW	0
The speed of finding zero origin. The range of speed value: 0 ~ 100000, beyond this range will lead to homing operation failed This speed is given in the same units as profile velocity (refer to 6081h).			

0x6071 Target torque (Servo only)

Table 239 Object 6071h: Target torque

Register	Data type	Access type	Default value
6071	UNSIGNED16	RW	0
This parameter is the input value for the torque controller in profile torque mode and the value is given per thousand of rated torque. For example, input value is 500, that is, the output torque of the motor is set as 500‰ of the rated torque.Value range: 0~1000.			

0x6072 Max torque (Servo only)

Table 240 Object 6072h: Max torque

Register	Data type	Access type	Default value

6072	UNSIGNED16	RW	0
This value represents the maximum permissible torque in the motor and is given per thousand of rated torque.Value range: 0~1000.			

0x6077 Torque actual value (Servo only)

Table 241 Object 6077h: Torque actual value

Register	Data type	Access type	Default value
6077	UNSIGNED16	RW	0
The torque actual value corresponds to the instantaneous torque in the drive motor. The value is given per thousand of rated torque.			

0x6087 Torque slope (Servo only)

Table 242 Object 6078h: Current actual value

Register	Data type	Access type	Default value
6087	UNSIGNED16	RW	0
The current actual value refers to the instantaneous current in the drive motor. The value is given per thousand of rated current.			

➢ Register Address Description List

The following table is the Modbus-RTU communication register address description list:

Table 243 Register address description list

Register	Access Type	Data Type	Description
0x1001	RO	UNSIGNED16	The device's internal error will bemapped to this register
0x1008	RO	Via-String	Manufacturer Device name
0x1009	RO	Via-String	Manufacturer hardware version
0x100A	RO	Via-String	Manufacturer software version
0x100C	RW	UNSIGNED16	Guard time
0x100D	RW	UNSIGNED8	Life time factor
0x6000	RW	UNSIGNED16	The register format of 32-bit data
0x605A	RW	INTEGER16	The way to quick stop
0x605D	RW	INTEGER16	The way to quick halt
0x6040	WO	UNSIGNED16	Drive status and motion’s control word
0x6060	WO	INTEGER16	Modes of operation
0x6081	RW	INTEGER32	Target velocity
0x6083	RW	INTEGER16	Motor running acceleration
0x6084	RW	INTEGER16	Motor running deceleration
0x6085	RW	UNSIGNED16	Quick stop deceleration
0x607A	RW	INTEGER32	The position the drive is moving on

0x607C	RW	INTEGER32	The offset position between the homeposition and the zero position
0x6098	RW	INTEGER16	Homing method
0x6099	RW	UNSIGNED32	The speed to find mechanical origin
0x609A	RW	UNSIGNED16	Homing acceleration/deceleration
0x609B	RW	UNSIGNED32	The speed to find zero origin
0x6071	RW	UNSIGNED16	Target torque (Servo only)
0x6087	RW	UNSIGNED16	Torque slope (Servo only)
0x6039	RO	UNSIGNED16	Monitor register
0x6041	RO	UNSIGNED16	The current status of the drive
0x6061	RO	INTEGER16	The current mode of the drive
0x6064	RO	INTEGER32	The position of the current moment inthe position mode
0x606C	RO	INTEGER32	The speed of the current time
0x6077	RO	UNSIGNED16	Torque actual value (Servo only)

TIP: If you want to use function code 0x10 mode to write to the register in succession, the register written must be consecutive in the above table, for example: 0x6041, 0x6061, 0x6064 The three registers are continuous in the above table, so you can use 0x10 mode one time Write parameters to these three registers.

➢ Program Example

This section will take position mode as an example to explain part of the programming. For specific example, please refer to “Example - motion control under Modbus-RTU communication protocol” in “Example”.

The register of JMC Modbus-RTU Drive in the example:

Table 244 Register of JMC Modbus-RTU Drive in the example

Register address	Input Value (Actual value)	Data Type	Unit (Actual value)	Description
607Ah	200000 -200000	INT32		Target position
6081h	50（5）	INT32	rps	Profile velocity
6083h	100（10）	UNINT16	rps/s.s	Profile acceleration
6084h	100（10）	UNINT16	rps/s.s	Profile deceleration
6085h	100（10）	UNINT16	rps/s.s	Quick stop deceleration

Notice: The quantity of address of 16-bit register is 1, and the quantity of address of 32-bit register is 2. The 32-bit registers can only be written in 0x10 function code.

Supposing the Slave ID to be 1, pre-write Controlword (reg.0x6040 = 0x000F), Modes of operation (reg.0x6060 = 0x0001), Profile velocity (reg.0x6081 = 0x00000064), Profile acceleration (reg.0x6083 = 0x0064), Profile deceleration (reg.0x6084 = 0x0064), Quick stop deceleration (reg.0x6085 = 0x0064), Target position (reg.0x607A = 0x00030D40)

It can be written all in 0x10 function code or written singly in 0x06 function code

Request message:

01 10 60 40 00 09 12 00 0F 00 01 00 00 00 64 00 64 00 64 00 64 00 03 0D 40 40 1C

Respond message:
01 10 60 40 00 09 1F DB

Request message explained as follows:

Message	01	10	6040	0009	12	000F	0001
Explanation	Slave ID	Function code	Starting Address	Quantity of Registers	Byte count	Written 0x6040	Written 0x6060

0000	0064	0064	0064	0064	0003	0D40	401C
Written 0x6081 high 16bit	Written 0x6081 low 16bit	Written 0x6083	Written 0x6084	Written 0x6085	Written 0x607A high 16bit	Written 0x607A low 16bit	CRC code

Respond message explained as follows:

Message	01	10	0009	1FDB
Explanation	Slave ID	Function code	Quantity of Registers	CRC code

➢ CRC Check Code

Cyclic Redundancy Check, CRC data length is 2 bytes and contains a 16-bit binary data. The CRC value is calculated by the sending device and the calculated value is attached to the message. The receiving device recalculates the CRC value when receiving the message and compares the calculated value with the actual value received in the CRC area. If the two are different, it produces an error.

At the beginning of CRC, 16 bits of registers, it all bits set to '1', then the next two 8-bit data are put into the current register, and start bits, stop bits and parity bits are not added to calculation.

During CRC code generation, every 8 bits of data and register's value are used to XOR operation, and the result is shifted to one side to the right direction (to LSB direction), and '0' is used to fill in MSB. To detect LSB, if the LSB is '1', it will be XOR with the preset fixed value, and if the LSB is '0' then not XOR. Repeat the above process, until the shift 8 times. After the completion of the 8th shift, the next 8-bit data and the current value of the register are used to XOR operation. After all the information is processed, the final value of the register as the CRC value.

The process of generating CRC:

1)Set 16-bit CRC register to $FFFF_h$.

2)The first 8-bit data and the CRC register low 8-bit exclusiveOR operation, the results into theCRC register.

3)CRC register moves to one bit to the right, MSB fills in the zero, and checks LSB.

4) If LSB is 0: repeat steps 3, and then move right one.

If LSB is 1: CRC register exclusive XOR operation with $A001_h$.

5) Repeat steps 3 and 4 until 8 shifts are completed, completing the 8-bit byte processing.

6)Repeat steps 2 to 5 to process the next 8-bit data until all bytes have been processed.

7)The final CRC register value is the CRC value.

8)The CRC value into the message, the high 8 and low 8 should be placed separately. Whensending a 16-bit CRC value in a message, it sends the lower 8 bits first and then the higher 8 bits.

CANopen

➢ CANopen Overview

CANopen is drafted and reviewed by the CiA (CAN in Automation), a non-profit organization. The basic CANopen communication sub-protocol is defined in CiA301, the "CANopen communication protocol" section of this article.

The sub-protocols for individual devices are expanded based on CiA301, and the "CANopen device protocol" section, which will be mentioned below, is written in accordance with the CiA402 for motion control.

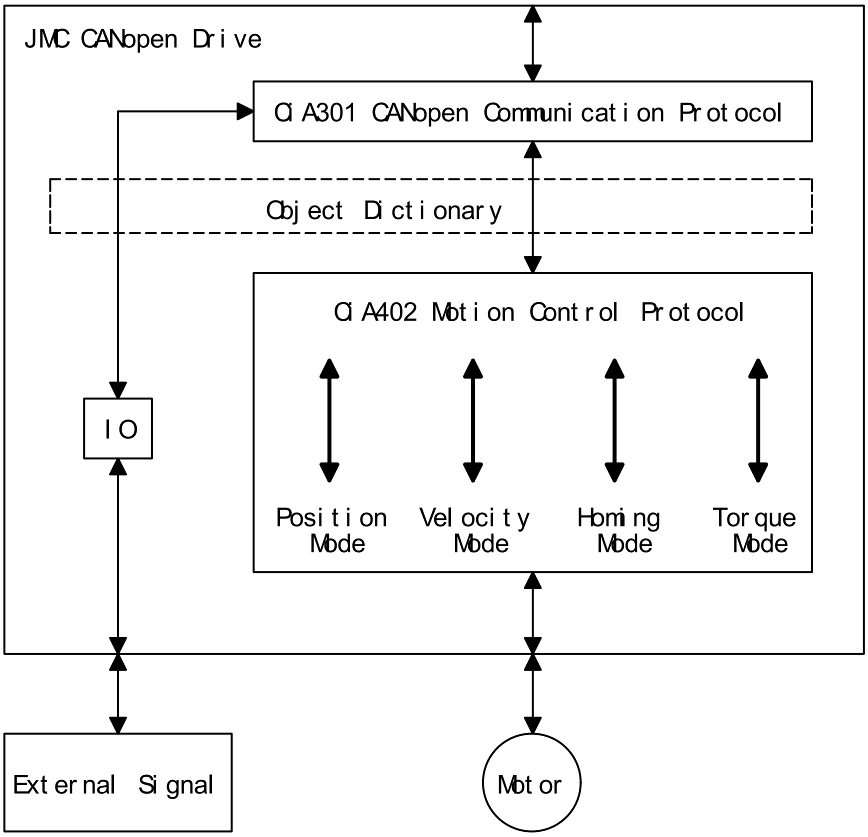


Figure 197 CANopen Communication Framework

JMC CANopen equipment can be compatible with other CANopen manufacturers' equipment as follow:

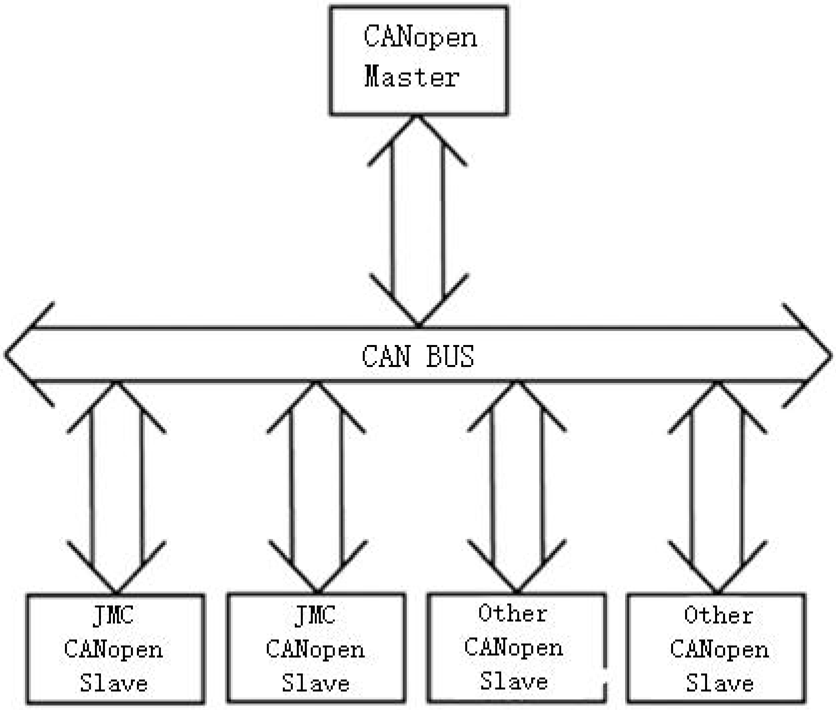


Figure 198 JMC CANopen Drive Compatibility diagram

JMC CANopen The equipment supports CiA402 motion control protocol:

Table 245 Operation mode supported by stepping servo products

Mode	The operation modesupported by stepping servo products
Velocity	✔
Position	✔
Homing	✔
Torque	

CAN provides all the network management services and messaging protocols, but does not define the content of an Object or the type of Object being communicated. CANopen allocates COB_ID and the use of the data field in detail on the basis of CAN frames. Its core concept is Object Dictionary.

Object Dictionary is an important part of communication protocol. Object Dictionaries can be accessed through the network in a set order, and each Object Dictionary is made up of 16-bit indexes.

As follows, the definition of standard Object Dictionary is consistent with other devices manufactured according to the standard serial bus.

Table 246 Object dictionary structure

Index (hex)	Object
0	not used
0001-001F	Static data types
0020-003F	Complex data types
0040-005F	Manufacturer-specific complex data types
0060-007F	Device profile Static data types
0080-009F	Device profile complex data types
00A0-0FFF	reserved

1000-1FFF	Communication profile area
2000-5FFF	Manufacturer-specific profile area
6000-9FFF	Standardized profile area logical device
A000-FFFF	reserved

The mentioned velocity mode, position mode, homing mode and object dictionary will be explained later. Please refer to CiA301 and CiA402 manuals.

➢ CANopen Message Format

Frame header	Arbitration field		control field	data field	Check field	ACK Field	Frame tail
	COB-ID (Communication Object Identifier)	RTR Remote request					
1bit	11 or 29 bits	1bit	6bits	0~8bytes	16bits	2bits	7bits

Figure 199 Data frame structure of CANopen

CANopen communication can access all the parameters of the drive through the Object Dictionary.

The frame ID we usually refer to is COB_ID, COB_ID (11bits) = function code (4bits) +Node_ID (7bits), which also theoretically indicates that CAN communication can have up to 127 nodes. In practice, the maximum number of nodes depends on the performance of the CAN transceiver used. Among them, various communication objects are identified by the function code part (10-7bits) in the 11-bit identifier, such as the function code of NMT control command sent by the master is 0000_b, and the function code of SDO is 1011_b(send) and 1100_b(receive).

The function code determines whether each data frame is used as SDO or PDO, TPDO or RPDO. Node_ID is the node number of each device.

The following table is a list of objects for Master/Slave connection sets:

Table 156 Master/Slave connection sets

Object	Function code（bit10~bit7）	COB-ID（bit6-bit0）	Index
NMT	0000B	000H	-
SYNC	0001B	080H	1005H,1006H,1007H
TIME	0010B	100H	1012H,1013H
EMCY	0001B	081H~0FFH	1014H,1015H
PDO1 (tx)	0011B	181H~1FFH	1800H
PDO1 (rx)	0100B	201H~27FH	1400H
PDO2 (tx)	0101B	281H~2FFH	1801H
PDO2 (rx)	0110B	301H~37FH	1401H
PDO3 (tx)	0111B	381H~3FFH	1802H
PDO3 (rx)	1000B	401H~47FH	1402H
PDO4 (tx)	1001B	481H~4FFH	1803H
PDO4 (rx)	1010B	501H~57FH	1403H
SDO (tx)	1011B	581H~5FFH	1200H
SDO (rx)	1100B	601H~67FH	1200H
NMT Error Control	1110	701H~77FH	1016H~1017H

Among them, NMT, SYNC and TIME are communication objects of broadcast, and the rest are point-to-point communication objects. The size of cob-id determines the priority of the communication object.NMT has the highest priority and PDO has a higher priority than SDO.

The indexes and sub-indexes of the object dictionary are added to the EDS file and are associated with the drive run parameters. In the following sections, we will describe in detail the capabilities of each object dictionary. Certain object dictionaries can only be accessed by SDO, while some object dictionaries can be accessed quickly via PDO.EDS files list the properties of all object dictionaries and can be downloaded from the JMC website.

Indexes and sub-indexes of the object dictionary are added to the EDS file, associated with the drive run parameters. In the following sections, we will describe in detail the capabilities of each object dictionary. Certain object dictionaries can only be accessed by SDO, while some object dictionaries can be accessed quickly via PDO.EDS files list the properties of all object dictionaries and can be downloaded from the JMC website.

For details of CANopen agreement, please read the CiA402 manual.

1 NMT Services

NMT (Network Management, NMT) takes CANopen devices as objects and follows the master-slave structure.

The NMT object is used to execute the NMT services. Through the NMT services, CANopen devices can be initialized, started, monitored, reset, or stopped.

When all slave devices support NMT Module Control service in the network, NMT master node can and can only transmit NMT Module Control message by NMT master node, and NMT Module Control message does not need reply.

Table 157 NMT message format

COB-ID	BYTE0	BYTE1
0x000	Command Specifier	Node_ID

When Node_ID=0, NMT-master sends a broadcast message to all NMT slave devices (all NMT slave devices are addressed).

Table 158 NMT Command Specifier

CS	NMT services
1	Start remote node
2	Stop remote node
128	Enter pre-operational
129	Reset node
130	Reset communication

1.1 NMTNode Guarding

Through node guarding, the NMT service provider on the NMT master indicates that a remote error is occurred or is resolved for the remote CANopen device identified by node-ID.

First, the NMT master node sends remote frames (no data) to NMT slave:

Table 159 NMT master send NMT node guarding message

COB_ID
0x700+Node_ID

Then NMT slave node sends the response message to NMT master:

Table 160 NMT slave respond NMT node guarding message

COB_ID	BYTE0	
0x700+Node_ID	Bit7:the state of the NMT slave	Bit6~0:toggle bit

The BYTE0 data returned by NMT slave node contains a trigger bit (Bit7), which is set as "0" at the first node guarding request and then alternately set as "0" or "1" in each node guarding response. Bit0~6 represents the state of the NMT slave and is shown in the table below, where "disconnected, connected, ready" is provided only by nodes that support extended boot-up.

Table 161 State of the NMT slave

State	Boot-up	Disconnected	Connecting	In-preparation	Stopped	Operational	Pre-operational	unknown
Value	0x00	0x01	0x02	0x03	0x04	0x05	0x7F	0x0F

It is important to note that state 0x00 never appears in the node guarding respond because a node does not feedback the node guarding message in this state.

Users can also set the life guarding, to protect node. The node lifetime is given by the guard time multiplied by the lifetime factor. The node lifetime may be different for each NMT slave. If the NMT slave has not been polled during its lifetime, a remote node error is indicated through the NMT service life guarding event. Lifetime = Guarding time (100C) × lifetime factor (100D).

For example, register 0x100C is set as 1000ms and register 0x100D is set as 2. In other words, if The RTR is not confirmed within the 2s, the slave is considered be dropped and all actions will be stopped.

The following is an example of life guarding service:

$0603 $8 $2B $0C 10 $00 $E8 03 00 00	Set guarding time to 1000ms
$0603 $8 $2F $0D 10 $00 $02 00 00 00	Set lifetime factor to 2
$0080 $0	Send synchronization object message
($0703 $8 $00 $00 00 $00 $00 00 00 00	Send remote transmission request)

Synchronization object and remote transmission request need only be sent one or the other.

Note: if you want to turn off monitoring, you need to write 100C and 100D to 0, and then send a synchronization object message or remote transmission request. At the same time, when using node guarding, heartbeat service and life guarding service can only choose to use one.

1.2 NMT heartbeat

During CANopen communication, a node can send a remote transmission request through NMT to query the state of another node, or periodically send a heartbeat message to inform other nodes on the bus about the state of the node.

The node that sends the heartbeat message is called the producer, and the node that receives the heartbeat message is called the consumer. The relationship between producer and consumer is configurable via the object dictionary. The heartbeat consumer guards the reception of the heartbeat within the heartbeat consumer time. If the heartbeat is not received within the heartbeat consumer time a heartbeat event will be generated.

The format of the message sent by the producer to the consumer is:

Table 162 Consumer heartbeat message format

COB-ID	DATA
0x700+Node_ID	State

The value of State is given in the following table:

Table 163 Value of state

State	Boot-up	Stopped	Operational	Pre-operational
DATA	0x00	0x04	0x05	0x7F

The heartbeat message consumer is usually the nmt-master node, which sets a timeout value for each heartbeat node and takes action when the timeout occurs. When a heartbeat node is started, its boot-up message is its first heartbeat message.

NMT slave node sends boot-up message to inform the NMT master node that NMT Slave has entered the pre-operation state from the initialization state, and its message format is as follows:

Table 164 NMT slave respond heartbeat message

COB-ID	DATA
0x700+Node_ID	0

If the user wants to turn off the heartbeat service, he can change the value of the 0x1017 producer heartbeat time to 0, which means that the heartbeat service is not used, such as $0603 $8 $2B $17 10 $00 00 00 00.If the user wishes to modify the heartbeat time, the heartbeat time can be changed by writing a non-zero value to the object dictionary 0x1017, in ms.

2 SDOCommunications

SDO (Service Data Object) is mainly used to access the Object dictionary of nodes. It uses Client/Server mode to establish point-to-point communication mode to realize the reading and writing of items in the Object dictionary, as shown in the figure below. The device that accesses the object dictionary is the Server, and the device that accesses the object dictionary is the Client. Each SDO communication has two CAN data frames, one request and one respond.

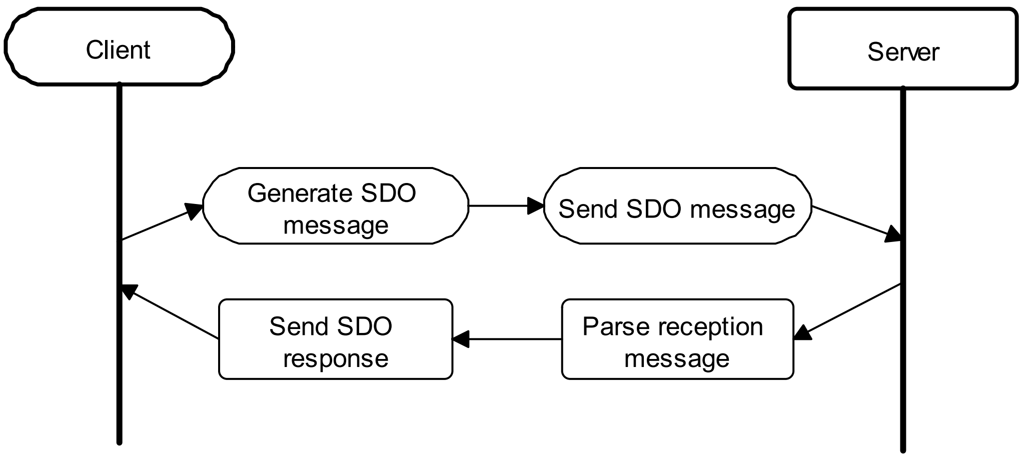


Figure 200 SDO Communication

SDO provides five main services: SDO download (segment transfer), SDO upload (segment transfer), SDO abort transfer, SDO block download, and SDO block upload.When using the SDO segment download and the SDO segment upload service, SDO data will be transmitted in segments. If the transfer object data is larger than 4 bytes, SDO should be used for segment transfer. SDO block transfers with higher bus utilization and performance can be selected for large data sets as needed.When using SDO blocks to download and upload services, SDO data is transferred in block.

When you need to read the value of an object dictionary in a CANopen node, use the SDO upload protocol. Use the SDO download protocol when the value of the object dictionary in the node needs to be written. According to the data sizes of object dictionary, it can be divided into SDO upload/download expedited transfer and SDO upload normal transfer (segment transfer):

1) When the data dictionary is less than or equal to 4 bytes in length, use SDO upload/download expedited transfer.
2) When the data dictionary is more than 4 bytes long and a frame of data cannot be fully transmitted, use SDO upload/download normal transfer.

2.1 SDO Segment Transfer

For SDO segment transfers, the client initiates the communication, the server responds, and so on until the data transfer is complete. When the length of the transmitted data less than 4 bytes, the data completes the transmission in once.

Protocol SDO upload and Protocol SDO download as follows:

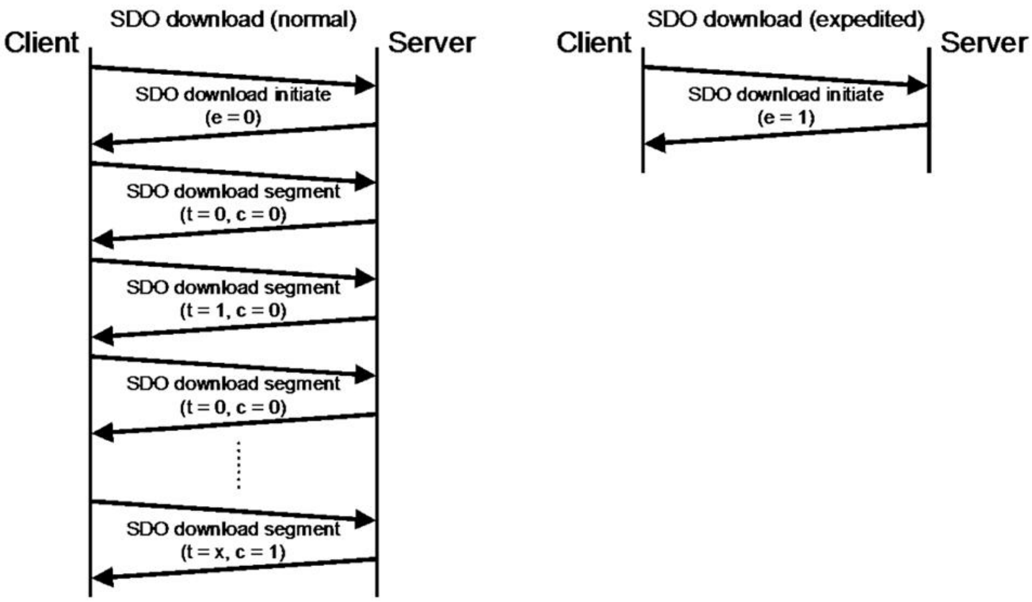


Figure 201 Protocol SDO download

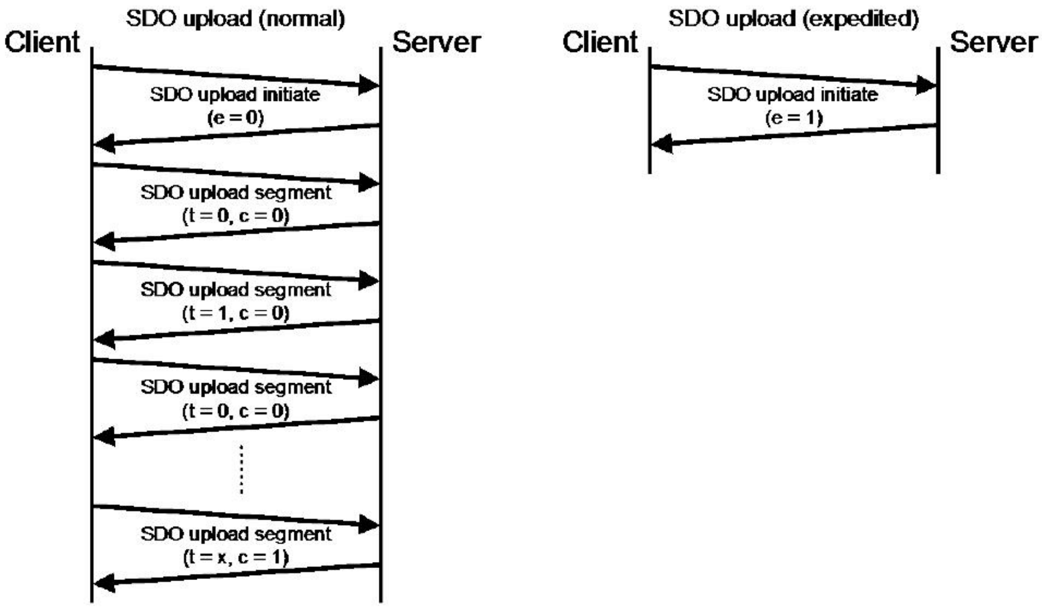


Figure 202 Protocol SDO upload

If in the download of two consecutive segments the toggle bit does not alter, the content of the last segment shall be ignored. If such an error is reported to the application, the application may decide to abort the download.

SDO download initiate service as follow:

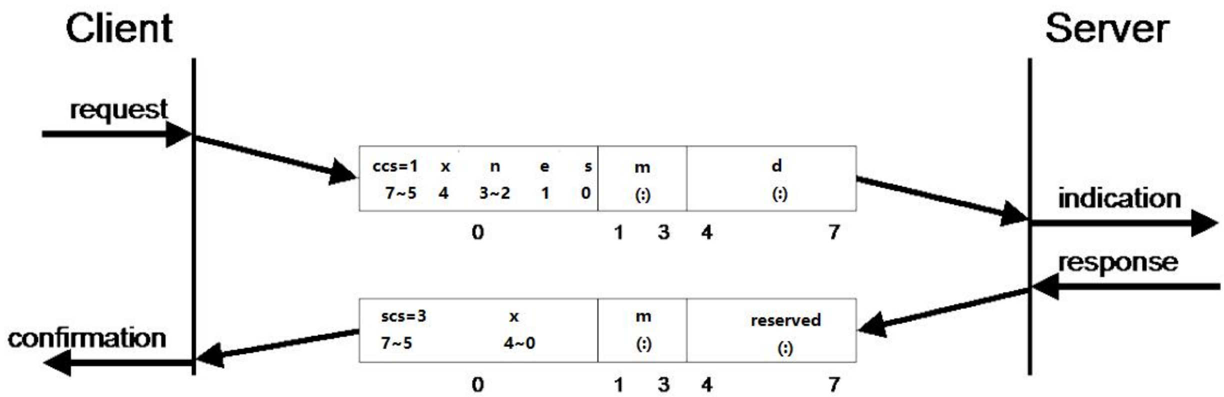


Figure 203 SDO download initiate service

SDO download segment service as follow:

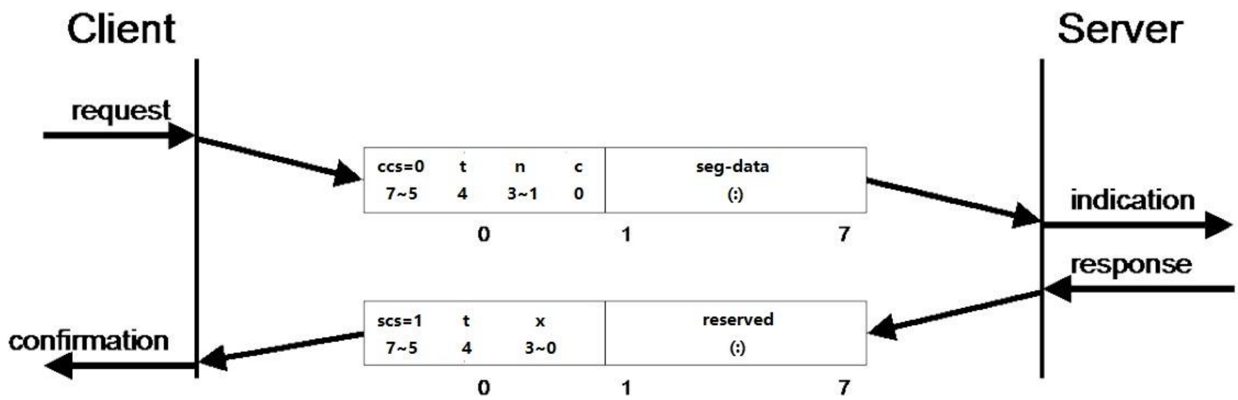


Figure 204 SDO download segment service

SDO upload initiate service as follow:

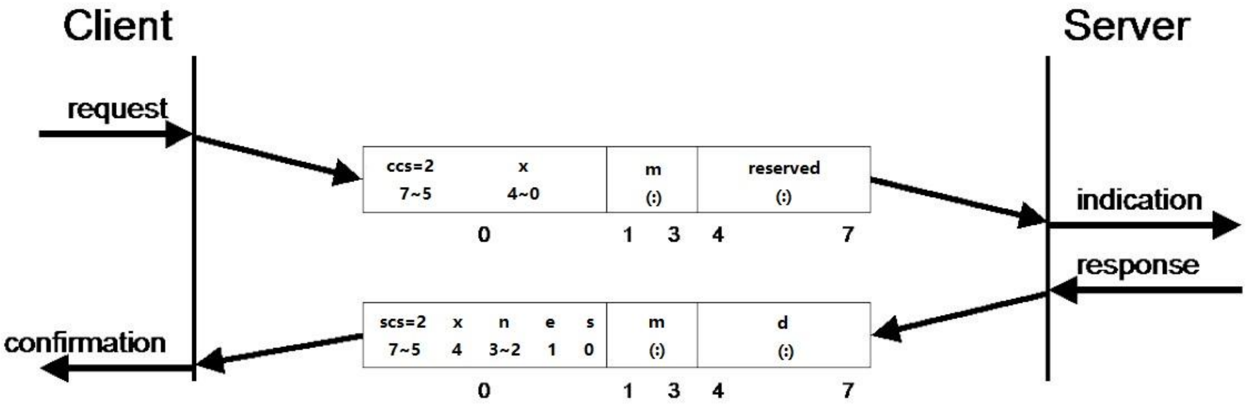


Figure 205 SDO upload initiate service

SDO upload segment service as follow:

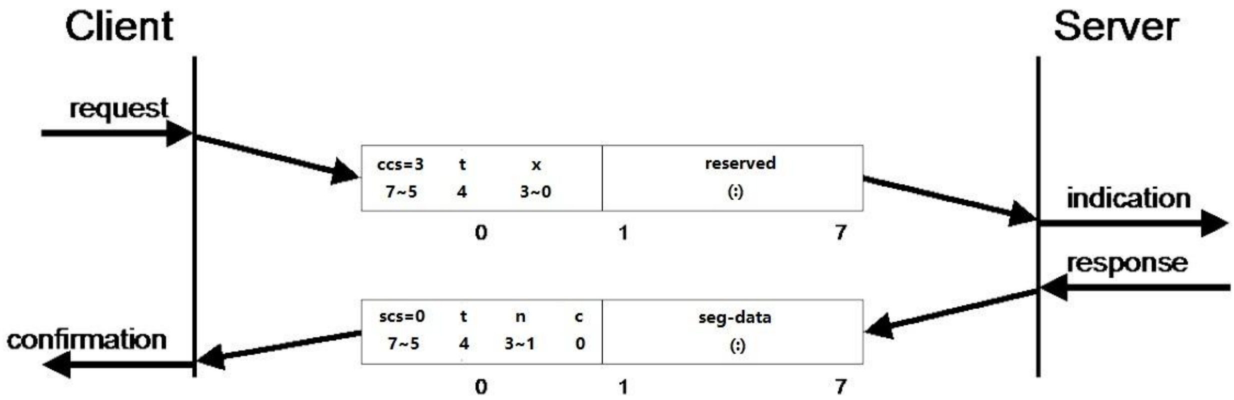


Figure 206 SDO upload segment service

- **ccs**: client command specifier
  0: download segment request
  1: initiate download request
  2: initiate upload request
  3: upload segment request
- **scs**: server command specifier
  0: upload segment response
  1: download segment response
  2: initiate upload response
  3: initiate download response
- **n**: Only valid if e = 1 and s = 1, otherwise 0. If valid it indicates the number of bytes in d that do notcontain data. Bytes [8-n, 7] do not contain data.
- **e**: transfer type
  0: normal transfer
  1: expedited transfer (data bytes <= 4)
- **s**: size indicator
- **m**: multiplexer. It represents the index/sub-index of the data to be transfer by the SDO.
- **d**: data
  e=0, s=0: d is reserved for further use.

e=0, s=1: d contains the number of bytes to be downloaded. Byte 4 contains the LSB and byte 7 contains the MSB.

e=1, s=1: d contains the data of length 4-n to be downloaded, the encoding depends on the type of thedata referenced by index and sub-index e=1, s=0: d contains unspecified number of bytes to be downloaded/upload.

- **x**: not used, always 0
- **c**: indicates whether there are still more segments to be downloaded/upload.
  0: more segments to be downloaded.
  1: no more segments to be downloaded.
- **t**: toggle bit. The firstsegment shall have the toggle-bit set to 0. The toggle bit shall be equal for the request and theresponse message.
- **reserved**: reserved for further use, always 0

How to determine command word:

1) the value of “e”: In general, SDO communication uses accelerated transfer (up to 4 bytes of data), e = 1

2) the value of “s”:If the length of the data is not specified, s=0, otherwise s=1

3) the value of “n”: According to the values of “e” and “s”, if we do not specify the length of the data, then “n” is meaningless, n=0, then the command word is equal to 00100010b, that is, 0x22;If the length of data is specified, s=1. In this case, “n” is valid, and “n” represents the number of bytes of meaningless data in the data part.

If we only write 1 byte data, the number of meaningless bytes data are 3 (byte6~8),n=11_b, then the command word is equal to 00101111_b, that is 0x2F (note the data format of SDO here, 8 bytes in order: command word byte1, index byte2~3, sub-index byte4, data byte5~8); Similarly, if we write two bytes data, the number of meaningless bytes is 2, (byte7~8),n=10_b. So, the command word is equal to 00101011_b, which is 0x2B.

Frame formatof SDO download

Client message:

COB_ID	RTR	D1	D2	D3	D4	D5	D6	D7	D8
0x600+Node_ID	0	CMD	Index		Sub Index	d0	d1	d2	d3

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
ccs=1			0	n		1	1

Figure 207 Client send SDO

Here are a few cases where n corresponds to the dictionary length of the object:

Table 165 “n” and OD length

n	OD length	CMD	Valid
0	4byte	0x23	d0, d1, d2, d3
1	3byte	0x27	d0, d1, d2
2	2byte	0x2B	d0, d1
3	1byte	0x2F	d0

Server normal response frame:

COB_ID	RTR	D1	D2	D3	D4	D5	D6	D7	D8
0x580+Node_ID	0	CMD	Index		Sub Index	0	0	0	0

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
scs=3			0	0	0	0	0

Figure 208 Server normal response

Server error response frame:

COB_ID	RTR	D1	D2	D3	D4	D5	D6	D7	D8
0x580+Node_ID	0	0x80	Index		Sub Index	Abort code			

Figure 209 Server error response

Abort code, see section 2.3 of this chapter.

2.2 SDO Block Transfer

The main purpose of block transfer is to improve transmission efficiency. The main difference between it and segment transfer is that during block transfer, data can be transmitted several times before there is a respond, as shown in the figure below. CANopen defines data as multiple blocks, each of which consists of 1-127 segments. After a block's data has been transferred, there is a respond.

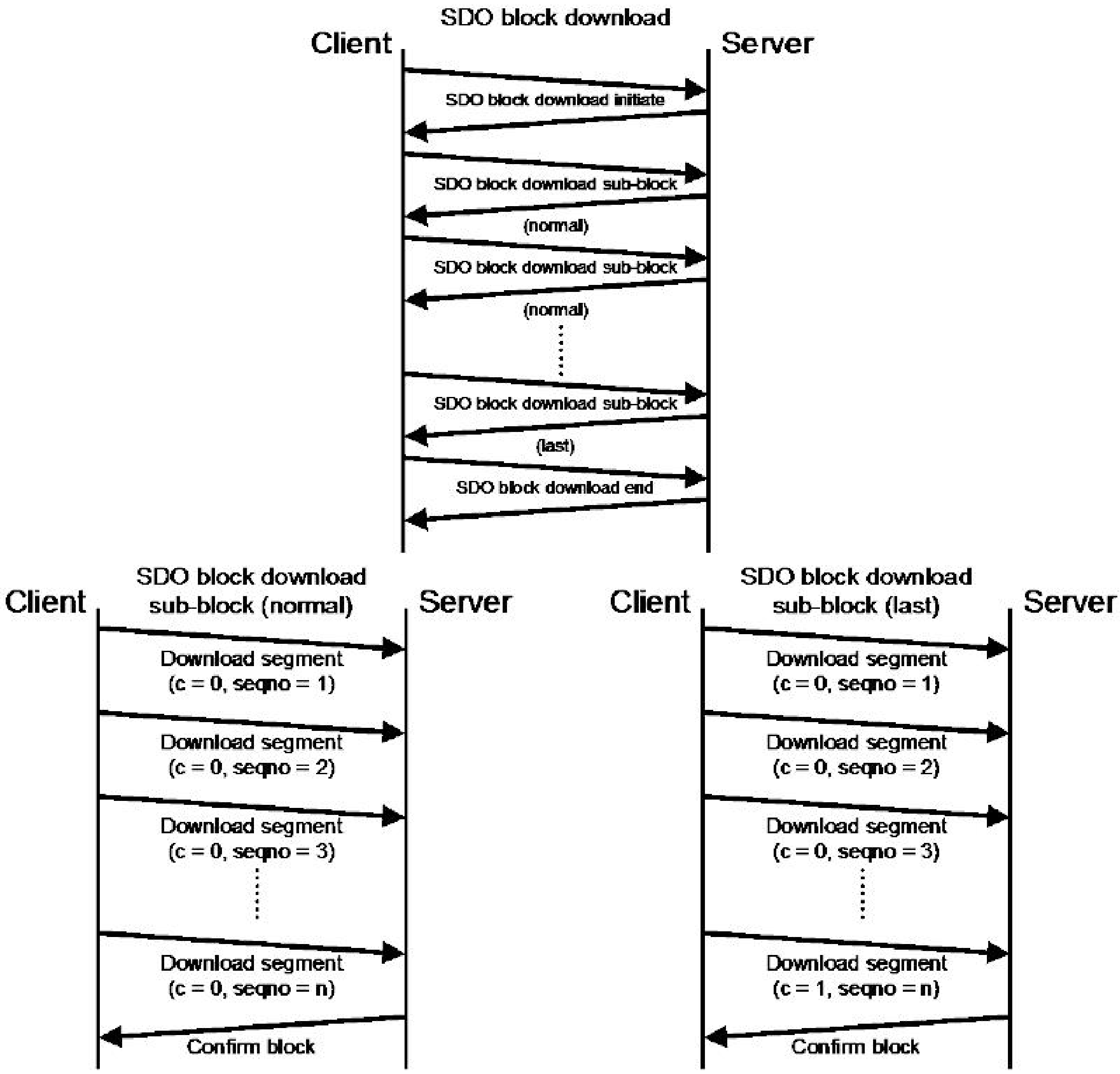


Figure 210 SDO block download

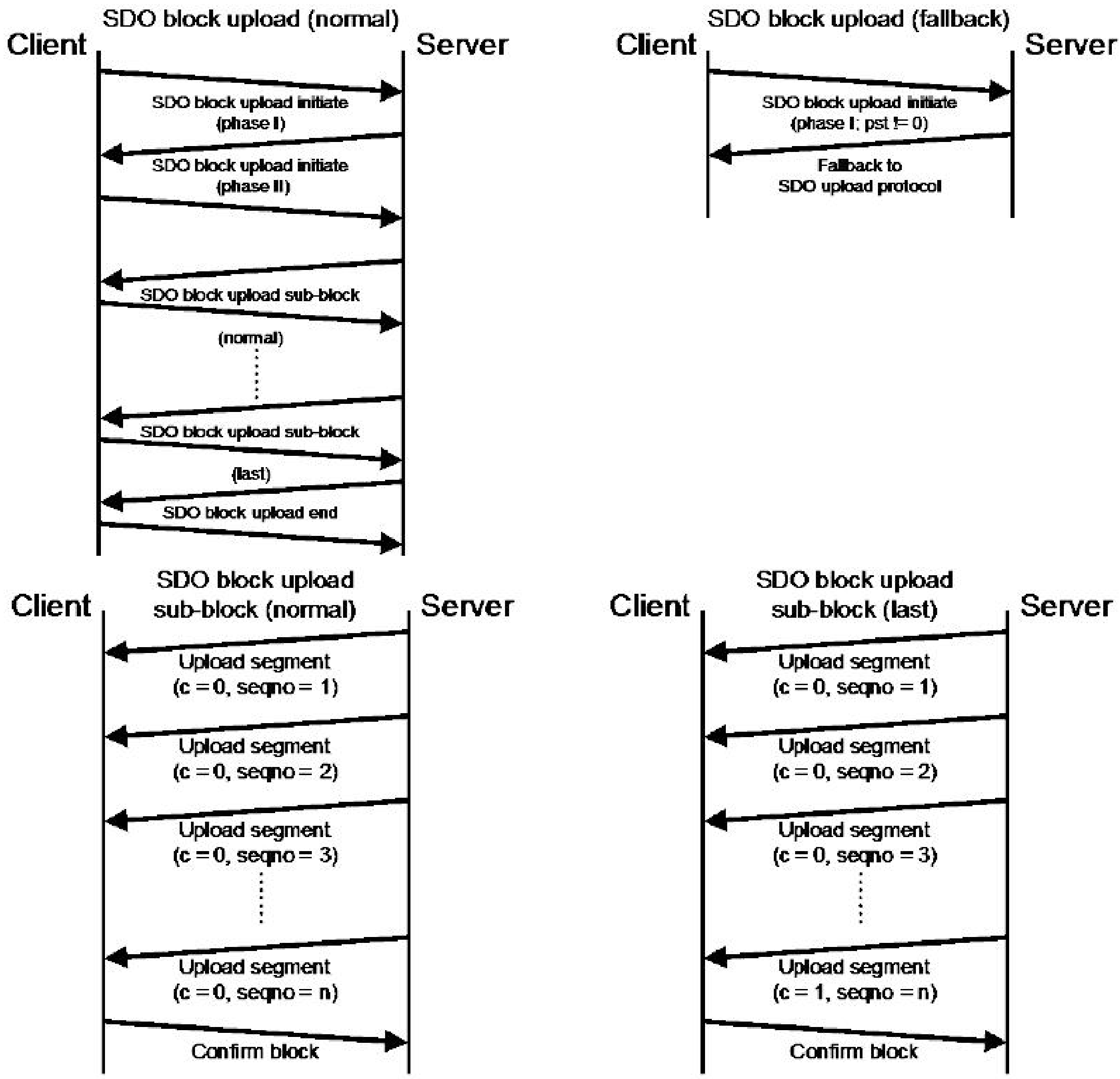


Figure 211 SDO block upload

2.3 SDO Abort Transfer

To abort the SDO transfer, you should use protocol SDO abort transfer as follow:

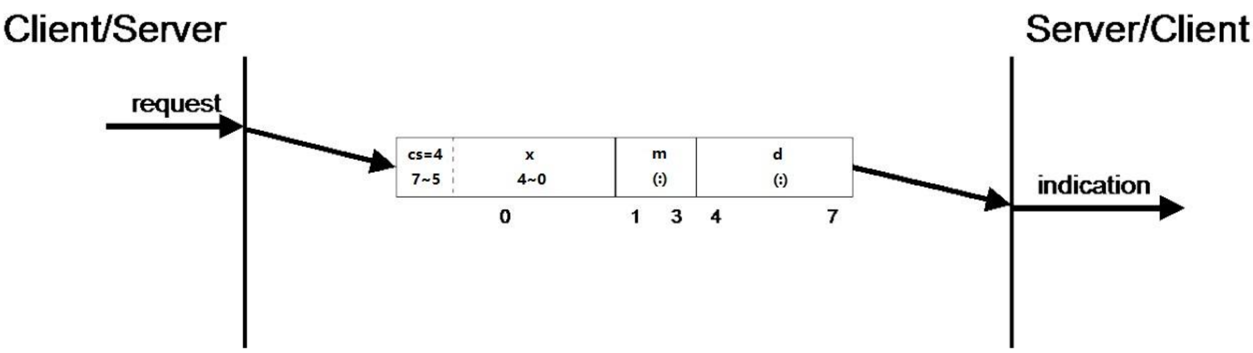


Figure 212 SDO abort transfer

- cs: command specifier
  4: abort transfer request
- x: not used, always 0

- m: multiplexer. It represents index and sub-index of the SDO.
- d: contains a 4-byte abort code about the reason for the abort.

Table 166 SDO abort codes

Abort Code	Description
0503 0000h	Toggle bit not alternated.
0504 0000h	SDO protocol timed out.
0504 0001h	Client/server command specifier not valid or unknown.
0504 0002h	Invalid block size (block mode only).
0504 0003h	Invalid sequence number (block mode only).
0504 0004h	CRC error (block mode only).
0504 0005h	Out of memory.
0601 0000h	Unsupported access to an object.
0601 0001h	Attempt to read a write only object.
0601 0002h	Attempt to write a read only object.
0602 0000h	Object does not exist in the object dictionary.
0604 0041h	Object cannot be mapped to the PDO.
0604 0042h	The number and length of the objects to be mapped would exceed PDO length.
0604 0043h	General parameter incompatibility reason.
0604 0047h	General internal incompatibility in the device.
0606 0000h	Access failed due to a hardware error.
0607 0010h	Data type does not match, length of service parameter does not match.
0607 0012h	Data type does not match, length of service parameter too high.
0607 0013h	Data type does not match, length of service parameter too low.
0609 0011h	Sub-index does not exist.
0609 0030h	Invalid value for parameter (download only).
0609 0031h	Value of parameter written too high (download only).
0609 0032h	Value of parameter written too low (download only).
0609 0036h	Maximum value is less than minimum value.
060A 0023h	Resource not available: SDO connection
0800 0000h	General error
0800 0020h	Data cannot be transferred or stored to the application.
0800 0021h	Data cannot be transferred or stored to the application because of local control.
0800 0022h	Data cannot be transferred or stored to the application because of the presentdevice state.
0800 0023h	Object dictionary dynamic generation fails or no object dictionary is present.
0800 0024h	No data available.

3 PDO Communications

PDO(Process Data Object) communication is used to transmit real-time Data, through which device application objects can be directly accessed.The number of data bytes transferred by PDO must be less than or equal to 8.The communication model is based on the producer/consumer model, as shown below.The node that produces the data puts the data on the bus, and the node that needs the data can receive the PDO if it is configured to RPDO.

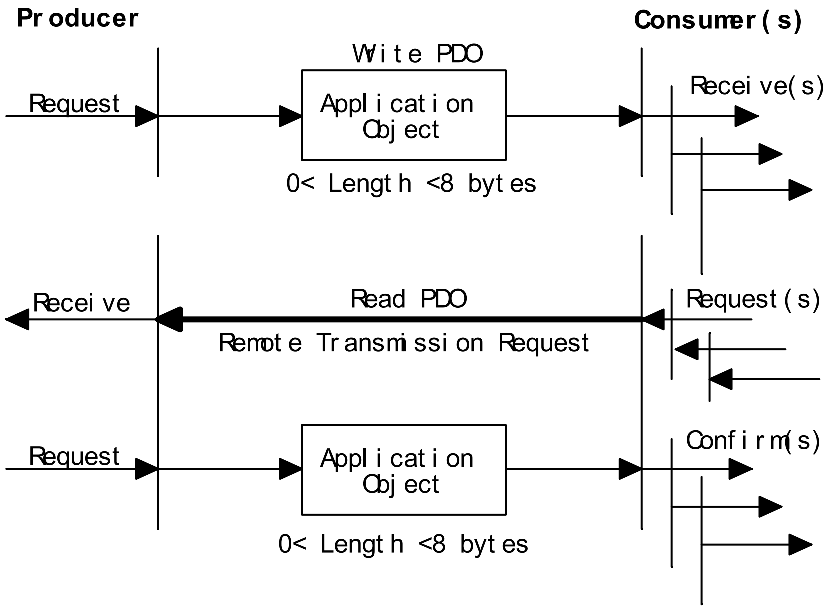


Figure 213 PDO Communication

Each PDO has two object descriptions in the object dictionary: Communication Parameter and Mapping Parameter.

Communication parameters indicate which COB_ID, transport type, disable time and timing time to use; The Mapping parameter indicates the mapping relationship between PDO message and data, and determines the positioning of transmitted data in the data field.

There are three message-triggering modes for PDO communication.

1) Event- and timer-driven

   Message transmission is either triggered by the occurrence of an application-specific event specified in the device profile, application profile or manufacturer-specific, or if a specified time (event-time) has elapsed without occurrence of an event.

2) Remotely requested

   The transmission of an event-driven PDO is initiated on receipt of an RTR initiated by a PDO consumer.

3) Synchronously triggered

   Message transmission is triggered by the occurrence of the SYNC object. The trigger condition is the number of Sync and optionally an internal event.

The trigger mode of PDO communication is determined by the transmission type in PDO communication parameters, which is an 8-bit unsigned integer. The corresponding relationship between the value of this transmission type and the PDO trigger mode is shown in the following table.

Table 167 PDO transmission type and PDO trigger condition

Transmission Type	PDO trigger condition (B=Both needed; O=One or Both)			PDO transmission
	SYNC	RTR	Event	
0	B		B	synchronous (acyclic)
1~240	O			synchronous (cyclic every sync)
241~251	Reserve			Reserve
252	B	B		RTR-only (synchronous)

253		0		RTR-only (event-driven)
254		0	0	event-driven (manufacturer-specific)
255		0	0	event-driven (device profile and application profile specific)

*SYNC - Synchronization object

*RTR - Remote transmission request

Synchronous means that the PDO is transmitted after the SYNC. The CANopen device will start sampling of the data with the reception of the SYNC. In case it is acyclic the CANopen device internal event is given and with the next SYNC the sampling is started and the PDO is transmitted afterwards. In case it is cyclic the sampling is started with the reception of every SYNC, every 2nd SYNC, every 3rd SYNC, and so. depending on the given value and the PDO is transmitted afterwards.

RTR-only means that the PDO is not transmitted normally it shall be requested via RTR. In case it is synchronous the CANopen device will start sampling with the reception of every SYNC and then will buffer the PDO. In case it is event-driven the CANopen device will start sampling with the reception of the RTR and will transmit the PDO immediately.

Event-driven means that the PDO may be transmitted at any time based on the occurrence of a CANopen device internal event. The definition of the event does not fall into the scope of this specification and may be specified in device profiles and application profiles.

3.1 PDO Communication Parameter

This object contains the communication parameters for the PDOs the CANopen device is able to receive or transmit.

Sub-index 00 h contains the number of valid object entries within the record. Its value is at least 02_h. If inhibit time supported the value is 03_h and if event timer is supported the value is 05_h.

Sub-index 01 h contains the COB-ID of the PDO

Table 168 Description of COB-ID

Bit(s)	Value	Description
31(MSB)	0	PDO exists / is valid
	1	PDO does not exist / is not valid
30	0	RTR allowed on this PDO
	1	no RTR allowed on this PDO
29	0	11-bit ID (CAN 2.0A)
	1	29-bit ID (CAN 2.0B)
28-11	0	If bit 29=0
	x	If bit 29=1: bits 28-11 of 29-bit-COB-ID
10-0(LSB)	x	Bits 10-0 of COB-ID

PDO transmission is valid only in operating state. PDO can be all configured or at the same time set to invalid. By default, the device supports 4 TPDO and 4 RPDO. The device supports standard CAN data frames, and does not support the remote request frame. To modify the 29th bit to 1 or the 30th bit to 0 will cause the error code: 0609 0030h. When PDO already exists, it is not allowed to modify the value of bits 0-29.

Sub-index 2 defines the PDO transfer type, which is described below. Modifying the PDO transfer type will generate an error code: 0609 0030h.

Table 169 PDO Transmission type

Value	Periodic	Periodic	Synchronize	Synchronize	RTR only
0		X	X		
1-240	X		X		
241-251	Reserve				
252			X		X
253				X	X
254				X	
255				X	

Synchronous transmission (transmission types 0-240 and 252) represents the PDO transmission associated with the SYNC message. It is reasonable to use SYNC to trigger the output or to process the PDO received by the last SYNC to update the next transmitted data.

Asynchronous transfer means PDO transfer is not related to synchronous message. A transmission type of 0 indicates that the PDO needs to synchronize with the synchronized SYNC object, but not periodically. 1-240 indicates that PDO needs to be sent synchronously with SYNC.

Receive PDOs with transmission type 0-240, trigger with the next SYNC. Transmission types 252 and 253 indicate that the PDO transmits only on a remote request. When the transmission type is 252, it automatically updates the data upon receipt of SYNC but does not send. When the transmission type is 253, the data will be updated upon receipt of the remote request frame. The data will only be used for TPDO.

When the transmission type is 254, the events defined by the application layer will be triggered.

When the transmission type is 255, the application event is defined in the device protocol definition. The RPDO and trigger type will decide to update the received mapping data.

Transmit PDOs with these transmission types may be sent immediately for transmission type 254 and 255 or with the first Sync for transmission type 0 after entering the operational state, if not specified differently in the corresponding profiles.

Sub-index 03_h contains the inhibit time. The time is the minimum interval for PDO transmission if the transmission type is set to FE_h and FF_h. The value is defined as multiple of 100 µs. The value of 0 shall disable the inhibit time. The value shall not be changed while the PDO exists (bit 31 of sub-index 01_h is set to 0_b).

Sub-index 04_h is reserved. It does shall not be implemented; in this case read or write access leads to the SDO abort transfer service (abort code: 0609 0011_h).

3.2 PDO Mapping Parameter

The PDO mapping parameter can be used to modify the mapping information of the application variable, forcing changes to the data length of the mapping.

MSB		LSB
Index	Sub-index	Object length (8 bit)

Figure 214 Structure of the mapping parameter

If you modify the mapping parameters unsuccessfully, the device will return an SDO transfer abort code. Sub-index 0 indicates the number of valid data objects to be mapped. If you need to remap the Sub-index first set to 0. In the newly added mapping, the device will check the object dictionary index, sub-index exists, if it does not exist will have a termination code 0602 0000h or 0604 0041h.

After all objects are mapped, Sub-index 0 indicates the number of valid data objects to be mapped. After writing the COB-ID of the communication parameters, the PDO will be set up. New PDO mapping When the value of sub-index 0 is greater than 0, the device will take effect before sending SDO transmissions. If the device detects an error, an end code will be transmitted via SDO: 0602 0000h, 0604 0041h or 0604 0042h.

Reading the value of sub-index 0 will return the actual number of mapped objects. If the data type is mapped as a “virtual portal”, the device will not evaluate the responding PDO data. When multiple devices use one PDO transfer, each device uses only a portion of the PDO. You cannot create a TPDO virtual map.

If a device supports the dynamic mapping of the PDO, it must support dynamic mapping underpre-operation. If the device supports dynamic mapping in operating mode, the SDO client must maintain data consistency.

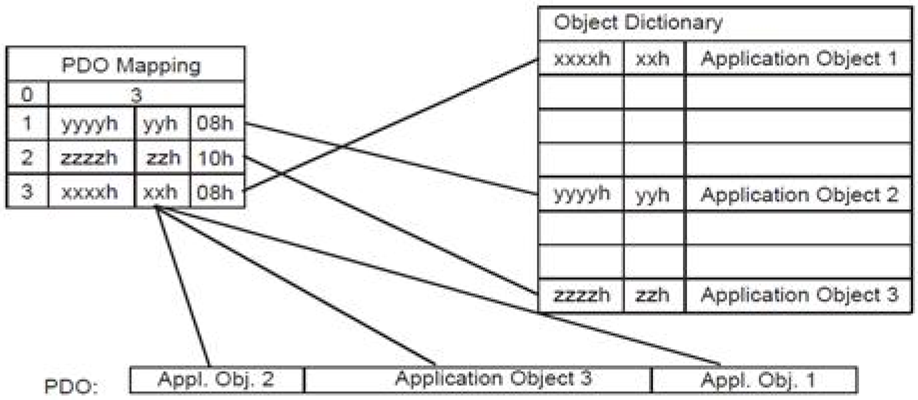


Figure 215 PDO mapping rules

TPDO and RPDO transfer can be turned off or modified by setting communication parameters and mapping parameters. Taking the second TPDO and the third RPDO as examples, the index of the object dictionary of the second TPDO's mapping parameter is 0x1A01, the index of the object dictionary of the communication parameter is 0x1801, and its sub-index is shown below in “CANopen Communication Protocol”. The object dictionary index of the third RPDO communication parameter is 0x1402, the object dictionary index of the mapping parameter is 0x1602, and its sub-indexes are shown below in “CANopen Communication Protocol”.

Through SDO, users can set the index 0x1400 of a certain node as synchronous message RPDO, modify the data of control word 0x6040 and target position 0x607A object dictionary, and configure TPDO.For example:

Configuration RPDO:

Configure the COB-ID number (0x203) of the RPDO0 communication parameter and write 0x203 to sub-index 1 of index 0x1400

$603 $23 $00 14 $01 $03 02 00 00

Configure the transmission type of RPDO0 communication parameter, writing 1 to the sub-index 2 of index 0x1400 for synchronous transmission.

$603 $2F $00 14 $02 $01 00 00 00

To clear the sub-index of the RPDO0 mapping parameter, writes 0 to sub-index 0 of index 0x1600.

$603 $2F $00 16 $00 $00 00 00 00

The mapping object 1 of RPDO0 mapping parameter is configured as the profile velocity, and the register address (profile velocity 0x6081) and register data length (32bit) are written into the sub-index 1 of index 0x1600.

$603 $23 $00 16 $01 $20 00 $81 60

The mapping object 2 of RPDO0 mapping parameters is configured as the profile acceleration, and the register address (profile acceleration 0x6083) and register data length (16bit) are written into the sub-index 2 of index 0x1600.

$603 $23 $00 16 $02 $10 00 $83 60

The mapping object 3 of RPDO0 mapping parameter is configured as the profile decceleration, and the register address (profile deceleration 0x6084) and register data length (16bit) are written into sub-index 3 of index 0x1600.

$603 $23 $00 16 $03 $10 00 $84 60

Set the number of sub-index of RPDO0 mapping parameters and write 3 to the sub-index 0 of index 0x1600, that is, RPDO0 contains application objects 0x6081, 0x6083 and 0x6084.

$603 $2F $00 16 $00 $03 00 00 00

Configuration TPDO:

Configure the COB-ID number (0x183) of the TPDO0 communication parameter and write 0x183 to sub-index 1 of index 0x1800

$603 $23 $00 18 $01 $83 01 00 00

Configure the transmission type of TPDO0 communication parameter, writing 1 to the sub-index 2 of index 0x1800 for synchronous transmission.

$603 $2F $00 18 $02 $01 00 00 00

To clear the sub-index of the TPDO0 mapping parameter, writes 0 to sub-index 0 of index 0x1A00.

$603 $2F $00 1A $00 $00 00 00 00

The mapping object 1 of TPDO0 mapping parameter is configured as the controlword, and the register address (controlword 0x6041) and register data length (16bit) are written into the sub-index 1 of index 0x1A00.

$603 $23 $00 1A $01 $10 00 $41 60

The mapping object 1 of TPDO0 mapping parameter is configured as the position actual value, and the register address (position actual value 0x6081) and register data length (32bit) are written into the sub-index 2 of index 0x1A00.

$603 $23 $00 1A $02 $20 00 $64 60

Set the number of sub-index of TPDO0 mapping parameters and write 2 to the sub-index 0 of index 0x1A00, that is, TPDO0 contains application objects 0x6041 and 0x6064.

$603 $2F $00 1A $00 $02 00 00 00

➢ CANopen Communication Protocol

0x1000 Device type

Table 170 Object 1000h: Device type

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED32	RO	NO	NO	0x00060912
This object provides information about the device type.Composed of 32-bit data, the lower 16 bitsdescribe the protocol used by the device and the upper 16 bits provide additional informationdescribing optional features of the device. For multiple logical device modules, the additional information parameter shall be $FFFF_h$ and the device profile number referenced by object 1000_h shall be the profile of the first logical device in the object dictionary. All other profiles of a multiple logical device module shall identify their profiles at objects $67FF_h$ + x * 800_h with x = internal number of the logical device (from 1 to 8) minus 1. These objects shall describe the device type of the preceding logical device, having the very same value definition as object 1000_h.					
Bit 0-15: Device profile number Bit 16-31: Additional information Notes: COS: TPDO Detection of changes in their state					

0x1001 Error register

Table 171 Object 1001h: Error register

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED8	RO	Optional	NO	0
The device's internal error will be mapped to this register. 1001h is the object part of the emergency message sending.					
Bit 0: Generic error Bit 1: Current Bit 2:Voltage Bit 3: Temperature Bit 4: Communication error Bit 5: Motor phase loss (Stepping servo drive) Bit 6: Over position error protection (Stepping servo drive) Bit 7:Reserve (Default 0)					

0x1002 Manufacturer status register (unused)

Table 172 Object 1002h: Manufacturer status register

Object type	Data type	Access type	PDO mapping	COS	Default value

VAR	UNSIGNED32	RO	Optional	NO	0
This register is a device status special register.					

0x1003 Pre-defined error field

Table 173 Object 1003h: Pre-defined error field

Object type	Sub-index	Data type	Access type	PDO mapping	COS	Default value
VAR	4	UNSIGNED32	RO	Optional	NO	0

This object provides the errors that occurred on the CANopen device and were signaled via theemergency object. In doing so it provides an error history.

1) The object entry at sub-index 00_h shall contain the number of actual errors that are recorded in the array starting at sub-index 01_h.
   NOTE: If no error is present the value of sub-index 00_h is 00_h and a read access to sub-index 01_h is responded with an SDO abort message (abort code: 0800 0024_h or 0800 0000_h).
2) Every new error shall be stored at sub-index 01_h; older errors shall be moved to the next higher sub-index.
3) Writing 00_h to sub-index 00_h shall delete the entire error history (empties the array). Other values than 00_h are not allowed and shall lead to an abort message (error code: 0609 0030_h).
4) The error numbers are of type UNSIGNED32 and are composed of a 16-bit error code and a 16-bit additional error information field, which is manufacturer-specific. The error code shall be contained in the lower 2 bytes (LSB) and the additional information shall be included in the upper 2 bytes (MSB). If this object is supported it shall consist of two object entries at least. The length entry on sub-index 00_h and at least one error entry at sub-index 01_h

Sub-index	Name	Default value
0	Number of errors	0
1	Standard error field	0
2	Standard error field	0
3	Standard error field	0

Error number (sub-index number = 0):
Bit 0-7: Write “0”to erase history error
Standard error code (sub-index number = 1~ 3):
Bit 0-15: Emergency message transmission error code
Bit 16-31: Manufacturer-defined additional error code

0x1005 COB-ID SYNC message

Table 174 Object 1005h: COB-ID SYNC message

Object type	Data type	Access type	PDO mapping	COS	Default value

VAR	UNSIGNED32	RW	NO	NO	0x00000080

This object indicates the configured COB-ID of the synchronization object (SYNC). Further, it defines whether the CANopen device generates the SYNC.

Bit	Value	Description
31(MSB)	X	do not care
30(gen.)	0	CANopen device does not generate SYNC message
	1	CANopen device generates SYNC message
29(frame)	0	11-bit ID (CAN 2.0A)
	1	29-bit ID (CAN 2.0B)
28-11	0	If bit 29=0
	X	If bit 29=1: bit 28-11 of 29-bit-TIME-COB-ID
10-0(LSB)	X	Bits 10-10 of TIME-COB-ID

Bits 29 (frame) and bit 30 (gen.) may be static (not changeable). If a CANopen device is not able to generate SYNC messages, an attempt to set bit 30 (gen.) to 1_b is responded with the SDO abort transfer service (abort code: 0609 0030_h). CANopen devices supporting the CAN base frame type only, an attempt to set bit 29 (frame) to 1_b is responded with the SDO abort transfer service (abort code: 0609 0030_h). The first transmission of SYNC object starts within 1 sync cycle after setting bit 30 to 1_b. By setting bit 30 to 1_b while the synchronous counter overflow value is greater than 0 the first SYNC message shall start with the counter reset to 1. It is not allowed to change bits 0 to 29, while the object exists (bit 30 = 1_b).

Bit 0-10: COB-ID of the synchronization object
Bit 11-29: set 0
Bit 30: 1(0) –The node generates (does not generate) synchronization messages
Bit 31: set 0

0x1006 Communication cycle period

Table 175 Object 1006h: Communication cycle period

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED32	RW	NO	NO	0

The object dictionary defines the communication time period in ms. It defines the period ofthe internal synchronization message. If the value is 0, it is invalid. If the value is not 0, asynchronization message will be sent at each value.

Bits 0-31: PDO must be sent in window length after synchronization message in µs (0 = invalid).

0x1007 Synchronization window length

Table 176 Object 1007h: Synchronous window length

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED32	RW	NO	NO	0
The object dictionary contains the PDO transmission time window length in ms. A value of 0means it is not enabled.					
Bits 0-31: PDO must be sent in window length after synchronization message in µs (0 = invalid).					

0x1008 Manufacturer device name (unused)

Table 177 Object 1008h: Manufacturer device name

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	VISIBLE_STRING	const	NO	NO	XXX
This object provides the name of the device as given by the JMC.					

0x1009 Manufacturer hardware version (unused)

Table 178 Object 1009h: Manufacturer hardware version

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	VISIBLE_STRING	const	NO	NO	XXX
This object provides the manufacturer hardware version description.					

0x100A Manufacturer software version (unused)

Table 179 Object 100Ah: Manufacturer software version

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	VISIBLE_STRING	const	NO	NO	XXX
This object provides the manufacturer software version description.					

0x100C Guard time

Table 180 Object 100Ch: Guard time

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	Optional	NO	0
The objects at index 100Ch and 100Dh shall indicate the configured guard time respectively the lifetime factor. The life time factor multiplied with the guard time					

gives the life time for the life guardingprotocol. The master polls the slave at set intervals. The value shall be given in multiple of ms. The value of 0000 h shall disable the life guarding.

0x100D Life time factor

Table 181 Object 100Dh: Life time factor

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED8	RW	Optional	NO	0
Lifetime = Guard time (0x100C) × Life time factor (0x100D). If the slave is not received for remote transmission request or SYNC message by the master during the Lifetime time, the slave is considered dropped. For example, register 0x100C is set as 1000ms and register 0x100D is set as 2. In other words, if The RTR is not confirmed within the 2s, the slave is considered be dropped and all actions will be stopped.					

0x1010 Store parameters

Table 182 Object 1010h: Store parameters

Object type	Sub-index	Data type	Access type	PDO mapping	COS	Default value
ARRAY	3	UNSIGNED32	RW	NO	NO	0x00000003
This object shall control the saving of parameters in non-volatile memory.						

Sub-index	Name	Default value
0	highest sub-index supported	3
1	save all parameters	0
2	save communication parameters	0x00000003
3	save application parameters	0x00000003

1) Sub-index 00h contains the highest sub-index that is supported
2) Sub-index 01h refers to all parameters that may be stored on the CANopen device.
3) Sub-index 02h refers to communication related parameters (index from 1000h to 1FFFh).
4) Sub-index 03h refers to application related parameters (index from 6000h to 9FFFh).
5) Sub-index from 04h to 7Fh manufacturers may store their choice of parameters individually.
6) Sub-index from 80h to FEh are reserved for future use.

In order to avoid storage of parameters by mistake, storage shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is “save”:

Signature	MSB			LSB
ISO 8859("ASCII")	e	v	a	s
Hex	65h	76h	61h	73h

0x1011 Restore default parameters

Table 183 Object 1011h: Restore default parameters

Object type	Sub-index	Data type	Access type	PDO mapping	COS	Default value
VAR	3	UNSIGNED32	RW	NO	NO	0x00000003

With this object the default values of parameters according to the communication profile, deviceprofile, and application profile are restored.

Sub-index	Name	Default value
0	highest sub-index supported	3
1	restore all default parameters	0xFFFFFFFF
2	restore communication default parameters	0xFFFFFFFF
3	restore application default parameters	0xFFFFFFFF

1) Sub-index 00 h contains the highest sub-index that is supported.
2) Sub-index 01 h refers to all parameters that may be restored.
3) Sub-index 02 h refers to communication related parameters (Index from 1000h to 1FFFh).
4) Sub-index 03 h refers to application related parameters (Index from 6000h to 9FFFh).

In order to avoid the restoring of default parameters by mistake, restoring shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is “load” (0x64616F6C).

0x1014 COB-ID EMCY

Table 184 Object 1014h: COB-ID EMCY

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED32	RO	NO	NO	0x80+$NODEID

This object indicates the configured COB-ID for the EMCY write service.

The device only supports standard CAN protocol data frames. If you modify the 29th bit, it will return the error code: 0609 0030h. When bit 31 is 0, 0-29 bits are not allowed to be changed.

Bit(s)	Value	Description
31(MSB)	0	EMCY exists / is valid
	1	EMCY does not exist / is not valid
30	0	Reserved (always 0 b)
29	0	11-bit CAN-ID(CAN2.0A)
	1	29-bit CAN-ID(CAN2.0B)
28-11	0	If bit 29=0
	x	If bit 29=1: bit 28-11 of 29-bit-COB-ID
10-0(LSB)	x	Bits 10-0 of COB-ID

Bit 0-10: COB-ID Bit 11-30: If bit 29=0, bit 11-30 are all equal 0 Bit 31: 0(1) –The node uses (does not use) emergency messages.

0x1015 Inhibit time EMCY (unused)

Table 185 Object 1015h: Inhibit time EMCY

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	NO	NO	200
Emergency message prohibition time, the basic unit of time is 100ms.					
Bit 0-15:Emergency message prohibited time					

0x1017 Producer heartbeat time

Table 277 Object 1017h: Producer heartbeat time

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	NO	NO	1000
The producer heartbeat time shall indicate the configured cycle time of the heartbeat. The value is given in multiples of 1 ms. The value 0 can disable the producer heartbeat.					

0x1018 Identity object (unused)

Table 186 Object 1018h: Identity object

Object Type	Number of sub-index
RECORD	4
This object shall provide general identification information of the CANopen device. (MSB)31~16:Major revision number 15~0 (LSB):Minor revision number	

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
0	Highest sub-index supported	UNSIGNDE8	RO	NO	NO	4
1	Vendor-ID	UNSIGNDE32	RO	NO	NO	0x000002D9
2	Product code	UNSIGNDE32	RO	NO	NO	0x00000000
3	Revision number	UNSIGNDE32	RO	NO	NO	0x00000000
4	Serial number	UNSIGNDE32	RO	NO	NO	0x00000000

Sub-index 01 h shall contain the unique value 1 that is allocated uniquely to each vendor of a CANopen device. The value 0000 0000 h shall indicate an invalid vendor-ID.

Sub-index 02 h shall contain the unique value that identifies a specific type of CANopen devices. The value of 0000 0000 h shall be reserved.

Sub-index 03 h shall contain the major revision number and the minor revision number of the revision of the CANopen device. The major revision number shall identify a specific CANopen behavior. That means if the CANopen functionality is different, the major revision number shall be incremented. The minor revision number shall identify different versions of CANopen device with the same CANopen behavior. The value of 0000 0000 h shall be reserved.

Sub-index 04 h shall contain the serial number that identifies uniquely a CANopen device within a
product group and a specific revision. The value of 0000 0000 h shall be reserved.

0x1019 Synchronous counter overflow value (unused)

Table 187 Object 1019h: Synchronous counter overflow value

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED8	RW	NO	NO	0
The count of synchronization message. 0 means sending synchronization message without counting value. Not 0 is sent on behalf of the synchronization message with a byte count value.					
0:The SYNC message shall be transmitted as a CAN message of data length 0 1:reserved 2-240: The SYNC message shall be transmitted as a CAN messageof data length 1. The first data byte contains the counter. 241-255: reserved					

0x1029 Error behavior object (unused)

Table 188 Object 1029h: Error behavior object

Object Type	Sub-index	Data type	Access type	PDO mapping	COS	Default value
VAR	2	UNSIGNED32	RW	NO	NO	
Device error message.						

Sub-index	Name	Default value
0	Highest sub-index supported	6
1	Communication error	0x00
2-FEh	Profile- or manufacturer-specific error	0x00

0x1200 SDO server parameter

Table 189 Object 1200h: SDO server parameter

Object type	Number of sub-index
RECORD	3

The number of supported object entries in the SDO object record is specified at sub-index 00_h.The values at sub-index 01_h and sub-index 02_h specify the COB-ID for this SDO. Sub-index 03_h isthe node-ID of the SDO client associated to this CANopen device.

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	Highest sub-index supported	UNSIGNDE8	RO	NO	NO	3
01	COB-ID client → server (rx)	UNSIGNDE32	RO	NO	NO	0x600+$NODEID
02	COB-ID server → client (tx)	UNSIGNDE8	RO	NO	NO	0x580+$NODEID
03	Node-ID of the SDO client	UNSIGNDE8	RO	NO	NO	$NODEID

0x1400~0x1403 RPDO Communication Parameter 0~3

Table 190 Object 1400h to 1403h: RPDO communication parameter

Object type	Number of sub-index
RECORD	3

This object contains the communication parameters for the PDOs the CANopen device is able toreceive.

Sub-index 00_h contains the number of valid object entries within the record. Its value is at least 02_h. If inhibit time supported the value is 03_h and if event timer is supported the value is 05_h.

Sub-index 01_h contains the COB-ID of the RPDO.

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	highest sub-index supported	UNSIGNDE8	RO	NO	NO	2
01	COB-ID used by RPDO	UNSIGNDE32	RW	NO	NO	$NODEID+0x200
02	transmission	UNSIGNDE8	RW	NO	NO	254

	type					

Description of RPDO COB-ID:
Bit 0-10: RPDO COB-ID, if you need to modify the value, the bit31 needs to be set.
Bit 11-29: If it is the 11-bit CAN-ID of the CAN base frame, these bits set 0.
Bit 30: 0(1) –Do not care
Bit 31: 0(1) –PDO (does not) exists / is (not) valid

Description of RPDO transmission type:
0-240: Synchronous (Synchronous means that the CANopen device shall actuate the received data with the reception of the next SYNC)
241-253:Reserved
254: Event-driven (manufacturer-specific,the PDO may be received at any time)
255:Event-driven (device profile and application profile specific,the PDO may be received at any time)

NOTE:
Index 1400.01h default value is 0x200+$Node_ID
Index 1401.01h default value is 0x300+$Node_ID
Index 1402.01h default value is 0x400+$Node_ID
Index 1403.01h default value is 0x500+$Node_ID

0x1600~0x1603 RPDO Mapping Parameter 0~3

Table 191 Object 1600h: RPDO mapping parameter

Object type	Number of sub-index
RECORD	4
This object contains the mapping parameters for the PDOs the CANopen device is able to receive.	

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	number of mapped application objects in PDO	UNSIGNDE8	RW	NO	NO	3
01	1st application object	UNSIGNDE32	RW	NO	NO	0x60810020
02	2nd application object	UNSIGNDE32	RW	NO	NO	0x60830010
03	3rd application object	UNSIGNDE32	RW	NO	NO	0x60840010

Structure of RPDO mapping
Bit 0-7: Length

Bit 8-15: Sub-index Bit 16-31: Index

Table 192 Object 1601h: RPDO mapping parameter

Object type	Number of sub-index
RECORD	3
0x1601 RPDO mapping parameter, refer to 1600h.	

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	number of mapped application objects in PDO	UNSIGNDE8	RW	NO	NO	2
01	1st application object	UNSIGNDE32	RW	NO	NO	0x607C0020
02	2nd application object	UN IGNDE 2	RW	NO	NO	0x60990220

Table 193 Object 1602h: RPDO mapping parameter

Object type	Number of sub-index
RECORD	4
0x1602 RPDO mapping parameter, refer to 1600h.	

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	number of mapped application objects in PDO	UNSIGNDE8	RW	NO	NO	3
01	1st application object	UNSIGNDE32	RW	NO	NO	0x60990120
02	2nd application object	UNSIGNDE32	RW	NO	NO	x609A0010
03	3rd application object	UNSIGNDE32	RW	NO	NO	0x60850010

Table 194 Object 1603h: RPDO mapping parameter

Object type	Number of sub-index
RECORD	5
0x1603 RPDO mapping parameter, refer to 1600h.	

Sub-index	Name	Data type	Access	PDO	COS	Default value

			type	mapping		
00	number of mapped application objects in PDO	UNSIGNDE8	RW	NO	NO	4
01	1st application object	UNSIGNDE32	RW	NO	NO	0x60600008
02	2nd application object	UNSIGNDE32	RW	NO	NO	0x60980008
03	3rd application object	UNSIGNDE32	RW	NO	NO	x607A0020
04	4th application object	UNSIGNDE32	RW	NO	NO	0x60400010

0x1800~0x1801 TPDO Communication Parameter

Table 195 Object 1800 h to 1801h: TPDO communication parameter

Object type	Number of sub-index
RECORD	3

This object contains the communication parameters for the PDOs the CANopen device is able totransmit.

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	highest sub-index supported	UNSIGNED8	RO	NO	NO	2
01	COB-ID used by TPDO	UNSIGNED32	RW	NO	NO	0x180+$NODEID
02	transmission type	U SIGNED8	RW	NO	NO	0x00000001

Description of TPDO COB-ID:
Bit 0-10: TPDO COB-ID, if you need to modify the value, the bit31 needs to be set.
Bit 11-29: If it is the 11-bit CAN-ID of the CAN base frame, these bits set 0.
Bit 30: 0(1) – (no)RTR allowed on this PDO
Bit 31: 0(1) –PDO (does not) exists / is (not) valid

Description of TPDO transmission type:
0: synchronous (acyclic,Synchronous means that the PDO is transmitted after the SYNC)
1-240: synchronous (cyclic every N sync)
241-251: reserved
252:RTR-only (synchronous,RTR-only means that the PDO is not transmitted normally it shall be requested via RTR)

253: RTR-only (event-driven) 254:event-driven (manufacturer-specific,Event-driven means that the PDO may be transmitted at any time based on the occurrence of a CANopen device internal event) 255: event-driven (device profile and application profile specific) Prohibition time: Bit 0-15: PDO transmission interval of the shortest time Compatibility entry: Bit 0-7: Reserve Event time: Bit 0-15: PDO cycle transmission time SYNC Starting value: 0: The sync count will not be processed 1-240: When the count value of the synchronization message equals this value, thesynchronization message will be considered as the first received SYNC message. **NOTE**: Index 1800.01h default valueis 0x180+$NODEID Index 1801.01h default value is 0x280+$NODEID Index 1802.01h default value is 0x380+$NODEID Index 1803.01h default value is 0x480+$NODEID

0x1A00~0x1A01 TPDO mapping parameter

Table 196 Object 1A00h: TPDO mapping parameter

Object type	Number of sub-index
RECORD	3
This object contains the mapping for the PDOs the device is able to transmit.	

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	number of mapped application objects in TPDO	UNSIGNED8	RW	NO	NO	2
01	1st application object	UNSIGNED32	RW	NO	NO	0x60410010
02	2ndapplication object	UNSIGNED32	RW	NO	NO	0x60640020

Structure of TPDO mapping:
Bit 0-7: Length
Bit 8-15: Sub-index
Bit 16-31: Index

Table 197 Object 1A01h: TPDO mapping parameter

Object type	Number of sub-index
RECORD	2

This object contains the mapping for the PDOs the device is able to transmit.

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	number of mapped application objects in TPDO	UNSIGNED8	RW	NO	NO	1
01	1st application object	UNSIGNED32	RW	NO	NO	0x606C0020

Structure of TPDO mapping:
Bit 0-7: Length
Bit 8-15: Sub-index
Bit 16-31: Index

JMC CANopen Default PDO Mapping

Table 198 JMC CANopen Default PDO Mapping

PDO type		COB-ID	Mapping List			
			Application Objects 1	Application Objects 2	Application Objects 3	Application Objects 4
RPDO	0x1600H	0x200+node	0x60810020	0x60830010	0x60840010	
	0x1601H	0x300+node	0x607c0020	0x60990220		
	0x1602H	0x400+node	0x60990120	0x609a0010	0x60850010	
	0x1603H	0x500+node	0x60600008	0x60980008	0x607a0020	0x60400010
TPDO	0x1a00H	0x180+node	0x60410010	0x60640020		
	0x1a01H	0x280+node	0x606c0020			

➢ CANopen Motion Control Protocol

0x603F Error code (unused)

Table 199 Object 603Fh: Error code

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RO	YES	NO	0

The Error code captures the code of the last error that occurred in the drive. It corresponds to thevalue of the lower 16 bits of object 1003 h pre-defined error field.

0x6040 Controlword

Table 200 Object 6040h: Controlword

<table>
<tr><th>Object Type</th><th>Data Type</th><th>Access type</th><th>PDO mapping</th><th>COS</th><th>Default value</th></tr>
<tr><td>VAR</td><td>UNSIGNED16</td><td>RW</td><td>YES</td><td>YES</td><td>0</td></tr>
<tr><td colspan="6">The control word for the drive. Used to enable or disable the drive power and brake output, start and stop the motor in different operating modes, clear the error alarm and so on.</td></tr>
</table>

The bits of the controlword are defined as follows:

Table 201 The bits of the controlword

<table>
<tr><th rowspan="2">Byte</th><th rowspan="2">BIT</th><th colspan="4">Bit definition</th></tr>
<tr><th>Position mode</th><th>Velocitymode</th><th>Homingmode</th><th>Torquemode</th></tr>
<tr><td rowspan="11">LSB</td><td>0</td><td colspan="4">0→1: Parameter and variable initialization (Brake shut down).</td></tr>
<tr><td>1</td><td colspan="4">0→1: Drive power supply (Brake open).</td></tr>
<tr><td>2</td><td colspan="4">0→1:Quick stop</td></tr>
<tr><td rowspan="2">3</td><td colspan="4">0→1:Motor enable</td></tr>
<tr><td colspan="4">1→0: Motor enable disable</td></tr>
<tr><td>4</td><td>0→1: Position sampling</td><td>Reserve</td><td>Starthoming</td><td>Reserve</td></tr>
<tr><td rowspan="2">5</td><td>0: Complete the current position and then execute the next position;</td><td rowspan="2">Reserve</td><td rowspan="2">Reserve</td><td rowspan="2">Reserve</td></tr>
<tr><td>1:Run directly to the next given position</td></tr>
<tr><td>6</td><td>0: Absolute positioning; 1: Relative positioning:</td><td>Reserve</td><td>Reserve</td><td>Reserve</td></tr>
<tr><td>7</td><td colspan="4">0→1: Reset and clear error</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td rowspan="10">MSB</td><td rowspan="2">8</td><td colspan="4">0→1: Halt</td></tr>
<tr><td colspan="4">1→0: Normal operation</td></tr>
<tr><td rowspan="2">9</td><td>0:Finish the previous position stop and run the next position</td><td rowspan="2">Reserve</td><td rowspan="2">Reserve</td><td rowspan="2">Reserve</td></tr>
<tr><td>1:The current position and the next position do not stop</td></tr>
<tr><td>10</td><td colspan="4">Reserve</td></tr>
<tr><td>11</td><td colspan="4">Reserve</td></tr>
<tr><td>12</td><td colspan="4">Reserve</td></tr>
<tr><td>13</td><td colspan="4">Reserve</td></tr>
<tr><td>14</td><td colspan="4">Reserve</td></tr>
<tr><td>15</td><td colspan="4">Reserve</td></tr>
</table>

Device control commands are triggered by the following bit patterns in the controlword:

Table 202 Device control commands

<table>
<tr><th rowspan="2">Command</th><th colspan="5">The bit of the Controlword</th></tr>
<tr><th>Error reset bit7</th><th>Enable operation bit3</th><th>Quick stop bit2</th><th>Enable voltage bit1</th><th>Initialization device bit0</th></tr>
<tr><td>Initialization</td><td>0</td><td>X</td><td>X</td><td>X</td><td>1</td></tr>
<tr><td>Open brake</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
</table>

Enable device operation	0	1	1	1	1
Quick stop	0	X	0	1	X
Forbid enable	0	0	1	1	1
Error reset	0→1	X	X	X	X

0x6041 Statusword

Table 203 Object 6041h: Statusword

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RO	YES	YES	0
The statusword indicates the current state of the drive. No bits are latched.					

Table 204 Bits in the statusword

<table>
<tr><th rowspan="2">Byte</th><th rowspan="2">BIT</th><th colspan="5">Bits in the statusword</th></tr>
<tr><th></th><th>Position mode</th><th>Velocity mode</th><th>Homing mode</th><th>Torquemode</th></tr>
<tr><td rowspan="8">LSB</td><td>0</td><td colspan="5">0:Unprepared initialization 1:Ready to initialize</td></tr>
<tr><td>1</td><td colspan="5">0:Initialization drive is not completed 1:Initialization drive completion</td></tr>
<tr><td>2</td><td colspan="5">0: Motor enable disable 1:Motor enable</td></tr>
<tr><td>3</td><td colspan="5">0:Drive normal status 1:Drive error status</td></tr>
<tr><td>4</td><td colspan="5">0:Drive not work 1: Drive work normally</td></tr>
<tr><td>5</td><td colspan="5">0: Normal operation 1:Quick stop</td></tr>
<tr><td>6</td><td colspan="5">0:Normal operation 1:Device enters the initialization state</td></tr>
<tr><td>7</td><td colspan="5">0: Normal operation 1:Warning</td></tr>
<tr><td rowspan="16">MSB</td><td>8</td><td colspan="5">0: Normal operation 1:Motor halt</td></tr>
<tr><td>9</td><td colspan="5">0: motor is stopped 1:Motor is running</td></tr>
<tr><td rowspan="4">10</td><td rowspan="2">0</td><td rowspan="2">Not arrived</td><td>Bit8=0:Notreachingthe target velocity</td><td>Bit8=0:Notreachingthe homing position</td><td>Bit8=0:Notreachingthe target torque</td></tr>
<tr><td>Bit8=1:Deceleration</td><td>Bit8=1:Deceleration</td><td>Bit8=1:Deceleration</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">arrived</td><td>Bit8=0:Reachingthe target velocity</td><td>Bit8=0:Reachingthehoming position</td><td>Bit8=0:Reachingthe target torque</td></tr>
<tr><td>Bit8=1:The velocity is0</td><td>Bit8=1:The speed is0</td><td>Bit8=1:The speed is0</td></tr>
<tr><td>11</td><td colspan="5">SW mechanical origin limit</td></tr>
<tr><td rowspan="2">12</td><td>0</td><td>can't set newposition</td><td>The velocity is not 0</td><td>Homing operation notcomplete</td><td>Notreachingthe target torque</td></tr>
<tr><td>1</td><td>can set newposition</td><td>The velocity is 0</td><td>Homingoperationcomplete</td><td>Reachingthe target torque</td></tr>
<tr><td rowspan="2">13</td><td>0</td><td>Normal operation</td><td>No maximumacceleration</td><td>Homing operation noterror</td><td rowspan="2">Reserve</td></tr>
<tr><td>1</td><td>over position error</td><td>Maximumacceleration</td><td>Homing operation error</td></tr>
<tr><td>14</td><td colspan="5">CW clockwise direction limit</td></tr>
<tr><td>15</td><td colspan="5">CCW counter clockwise direction limit</td></tr>
</table>

The following bits indicate the status of the device:

Table 205 Device state bits (x ... irrelevant for this state)

Status word value (Binary)	State
XXXX XXXX X0XX 0000	Uninitialized device
XXXX XXXX X01X 0001	Initialized device
XXXX XXXX X01X 0011	Device power on and operation
XXXX XXXX X01X 0111	Device enable
XXXX XXXX X00X 0111	Quick stop active
XXXX XXXX X0XX 1111	Device error alarm occurs
XXXX XXXX X0XX 1000	The device is in an error state

0x605A Quick stop option code

Table 206 Object 605Ah: Quick stop option code

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	INTEGER16	RW	NO	NO	0

The parameter quick stop option code determines what action should be taken if the Quick Stop Function is executed.

Value	Description
-32768…-1	manufacturer specific
1	slow down on slow down ramp
2	slow down on quick stop ramp
3…32767	Stop immediately

0x605D Halt option code

Table 207 Object 605Dh: Halt option code

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	INTEGER16	RW	NO	NO	0

The parameter halt option code determines what action should be taken if the bit 8 (halt) in the controlword is active.

Value	Description
-32768…-1	manufacturer specific
1	halt with the current deceleration
2	halt with fast stop speed
3…32767	halt immediately

0x6060 Modes of operation

Table 300 Object 6060h: Modes of operation

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	INTEGER8	WO	YES	NO	0
The parameter modes of operation switches the actually chosen operation mode.					

Value	Description
1	Profile Position Mode
2	Velocity Mode
3	Profile Velocity Mode
4	Torque Profile Mode (servo only)
6	Homing Mode

0x6061 Modes of operation display

Table 301 Object 6061h: Modes of operation display

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	INTEGER8	RO	YES	YES	0
The modes of operation display show the current mode of operation. The meaning of the returned value corresponds to that of the modes of operation option code (index 6060h).					

0x6064 Position actual value

Table 302 Object 6064h: Position actual value

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	INTEGER32	RO	YES	YES	0
This object represents the actual value of the position measurement device in user defined units.					

0x606C Velocity actual value

Table 303 Object 606Ch: Velocity actual value

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	INTEGER32	RO	YES	YES	0
The velocity actual value is also represented in velocity units and is coupled to the velocity used as input to the velocity controller. Unit: rps / min unit. e.g. If the value of index 606C is 100, it means the current speed is 10rps.					

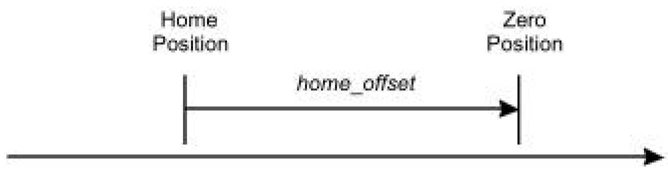
0x607A Target position

Table 304 Object 607Ah: Target position

<table>
<tr><th>Object Type</th><th>Data Type</th><th>Access type</th><th>PDO mapping</th><th>COS</th><th>Default value</th></tr>
<tr><td>VAR</td><td>INTEGER32</td><td>RW</td><td>YES</td><td>NO</td><td>0</td></tr>
<tr><td colspan="6">The target position is the position that the drive should move in position mode. The related parameters are the target velocity, acceleration and deceleration. The target position is related to different subdivisions and can be treated as a calculation or related parameter according to the bit6 of the control word.</td></tr>
</table>

0x607C Home offset

Table 305 Object 607Ch: Home offset

<table>
<tr><th>Object Type</th><th>Data Type</th><th>Access type</th><th>PDO mapping</th><th>COS</th><th>Default value</th></tr>
<tr><td>VAR</td><td>INTEGER32</td><td>RW</td><td>YES</td><td>NO</td><td>0</td></tr>
<tr><td colspan="6">The home offset object is the difference between the zero position for the application and the machine home position (found during homing), it is measured in position units. During homing the machine home position is found and once the homing is completed the zero position is offset from the home position by adding the home offset to the home position. All subsequent absolute moves shall be taken relative to this new zero position. This is illustrated in the following diagram.

</td></tr>
</table>

0x6081 Profile velocity

Table 306 Object 6081h: Profile velocity

<table>
<tr><th>Object Type</th><th>Data Type</th><th>Access type</th><th>PDO mapping</th><th>COS</th><th>Default value</th></tr>
<tr><td>VAR</td><td>INTEGER32</td><td>RW</td><td>YES</td><td>NO</td><td>0</td></tr>
<tr><td colspan="6">The profile acceleration is given in user defined acceleration units.
If the parameter 45 of drive is 0, the unit of profile acceleration is 0.1 r/s^2. For example, while profile acceleration is 100, its actual acceleration of movement is 10r/s^2;
If the parameter 45 of drive is 1, the unit of profile acceleration is 1/Revolution*10 r/s^2. For example, while parameter 17 of drive is 13 (Revolution = 10000) and profile acceleration is 100, its actual acceleration of movement is 0.1 r/s^2.</td></tr>
</table>

0x6083 Profile acceleration

Table 307 Object 6083h: Profile acceleration

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	YES	NO	0

The profile acceleration is given in user defined acceleration units.

If the parameter 45 of drive is 0, the unit of profile acceleration is 0.1 r/s^2. For example, while profile acceleration is 100, its actual acceleration of movement is $10r/s^2$;

If the parameter 45 of drive is 1, the unit of profile acceleration is 1/Revolution*10 r/s^2. For example, while parameter 17 of drive is 13 (Revolution = 10000) and profile acceleration is 100, its actual acceleration of movement is 0.1 r/s^2.

0x6084 Profile deceleration

Table 308 Object 6084h: Profile deceleration

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	YES	NO	0

The profile deceleration is given in the same units as profile acceleration (refer to 6083h).

0x6085 Quick stop deceleration

Table 309 Object 6085h: Quick stop deceleration

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	YES	NO	0

The quick stop deceleration is the deceleration used to stop the motor if the 'Quick Stop' command isgiven and the quick stop option code (see 605Ah) is set to 2. The quick stop deceleration is given inthe same units as the profile acceleration.

0x6098 Homing method

Table 310 Object 6098h: Homing method

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	INTEGER8	RW	YES	NO	0

The homing method object determines the method that will be used during homing (Method 1~10).

0x6099 Homing speeds

Table 311 Object 6099h: Homing speeds

Object Type	Sub-index	Data Type	Access type	PDO mapping	COS	Default value
ARRAY	3	UNSIGNED32	RW	YES	NO	0

This entry in the object dictionary defines the speeds used during homing and is given velocity units. Note that this range of value is from 0 to 100000.

The homing speed is given in the same units as profile velocity (refer to 6081h).

Sub-index	Name	Value Range	Default
0	number of entries	2	2
1	Speed during search for switch	UNSIGNED32	0
2	Speed during search for zero	UNSIGNED32	0

0x609A Homing acceleration

Table 312 Object 609Ah: Homing acceleration

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	YES	NO	0

The homing acceleration establishes the acceleration to be used for all accelerations and decelerations with the standard homing modes and is given in acceleration units.

The homing acceleration is given in the same units as profile acceleration (refer to 6083h).

0x6071 Target torque (Servo only)

Table 313 Object 6071h: Target torque

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	YES	NO	0

This parameter is the input value for the torque controller in profile torque mode and the value is given per thousand of rated torque. For example, input value is 500, that is, the output torque of the motor is set as 500‰ of the rated torque.Value range: 0~1000.

0x6072 Max torque (Servo only)

Table 314 Object 6072h: Max torque

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	YES	NO	0

This value represents the maximum permissible torque in the motor and is given per thousand of rated torque.Value range: 0~1000.

0x6077 Torque actual value (Servo only)

Table 315 Object 6077h: Torque actual value

Object Type	Data Type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	YES	NO	0
The torque actual value corresponds to the instantaneous torque in the drive motor. The value is given per thousand of rated torque.					

0x6087 Torque slope (Servo only)

Table 316 Object 6087h: Torque slope

Object Type	Data Type	Access type	PDO mapping	COS	Default value
6087	UNSIGNED16	RW	YES	NO	0
The current actual value refers to the instantaneous current in the drive motor. The value is given per thousand of rated current.					

➢ CiA301 Object Dictionary

The following is a description of CiA301 object dictionary in EDS file of CANopen JMC device:

Table 317 CiA301 Object Dictionary

Index	Sub-index	Description	Data type	Access type	PDO mapping
1000h	0	Device type	USIGNED32	RO	
1001h	0	Error register	USIGNED8	RO	YES
1003h		Pre-defined error field	ARRAY		
	0	Number of errors	USIGNED32	RW	
	1	Standard error field	USIGNED32	RO	
	2	Standard error field	USIGNED32	RO	
	3	Standard error field	USIGNED32	RO	
	4	Standard error field	USIGNED32	RO	
1005h	0	COB-ID SYNC message	USIGNED32	RW	
1006h	0	Communication cycle period	USIGNED32	RW	
1007h	0	Synchronous window length	USIGNED32	RW	
1008h	0	Manufacturer device name	VISIBLE_STRING	CONST	
1009h	0	Manufacturer hardware version	VISIBLE_STRING	CONST	
100Ah	0	Manufacturer software version	VISIBLE_STRING	CONST	
100Ch	0	Guard time	UNSIGNED16	RW	
100Dh	0	Life time factor	UNSIGNED8	RW	
1010h		Store parameters	ARRAY		
	0	highest sub-index supported	USIGNED8	RO	

	1	save all parameters	USIGNED32	RW	
1014h	0	COB-ID EMCY	USIGNED32	RO	
1017h	0	Producer heartbeat time	USIGNED16	RW	
1018h		Identity object	RECORD		
	0	Highest sub-index supported	USIGNED8	RO	
	1	Vendor-ID	USIGNED32	RO	
	2	Product code	USIGNED32	RO	
	3	Revision number	USIGNED32	RO	
	4	Serial number	USIGNED32	RO	
1200h	0	SDO server parameter	RECORD		
1400h	0	RPDO communication parameter0	RECORD		
1401h	0	RPDO communication parameter1	RECORD		
1402h	0	RPDO communication parameter2	RECORD		
1403h	0	RPDO communication parameter3	RECORD		
1600h	0	RPDO mapping parameter 0	RECORD		
1601h	0	RPDO mapping parameter 1	RECORD		
1602h	0	RPDO mapping parameter 2	RECORD		
1603h	0	RPDO mapping parameter 3	RECORD		
1800h	0	TPDO communication parameter 0	RECORD		
1801h	0	TPDO communication parameter 1	RECORD		
1802h	0	TPDO communication parameter 2	RECORD		
1803h	0	TPDO communication parameter 3	RECORD		
1A00h	0	TPDO mapping parameter0	RECORD		
1A01h	0	TPDO mapping parameter1	RECORD		
1A02h	0	TPDO mapping parameter2	RECORD		
1A03h	0	TPDO mapping parameter3	RECORD		

The above list just lists the object dictionaries used by JMC CANopen devices. For more information about the object dictionaries, you can read the CiA301 documentation intensively. Users can download it from the following address: http://www.can-cia.com/.

➢ CiA402 Object Dictionary

The following is a description of CiA402 object dictionary in EDS file of CANopen JMC device:

Table 318 CiA402 Object Dictionary

Index	Sub-index	Description	Data type	Access type	PDO mapping	Used

6040h	0	Controlword	UNSIGNED16	WO	YES	YES
6041h	0	Statusword	UNSIGNED16	RO	YES	YES
605Ah	0	Quick stop option code	INSIGNED16	WR	YES	YES
605Dh	0	Halt option code	INSIGNED16	WR	YES	NO
6060h	0	Modes of operation	INSIGNED8	WO	YES	YES
6061h	0	Modes of operation display	INSIGNED8	RO	YES	YES
6064h	0	Position actual value	INSIGNED32	WR	YES	YES
606Ch	0	Velocityactualvalue	INSIGNED32	WR	YES	YES
607Ah	0	Target position	INSIGNED32	WR	YES	YES
607Ch	0	Home offset	INSIGNED32	WR	YES	YES
6081h	0	Profile velocity	INSIGNED32	WR	YES	YES
6083h	0	Profile acceleration	UNSIGNED16	WR	YES	YES
6084h	0	Profile deceleration	UNSIGNED16	WR	YES	YES
6085h	0	Quick stop deceleration	UNSIGNED16	WR	YES	YES
6098h	0	Homing method	INSIGNED8	WR	YES	YES
6099h		Homing speeds	ARRAY			
	0	Number of entries	UNSIGNED8	RO		
	1	Speed during search for switch	UNSIGNED32	WR	YES	YES
	2	Speed during search for zero	UNSIGNED32	WR	YES	YES
609Ah	0	Homing acceleration	UNSIGNED16	WR	YES	YES
60C5h	0	Max acceleration	UNSIGNED16	WR	YES	NO
60C6h	0	Max deceleration	UNSIGNED16	WR	YES	NO
6071h	0	Target torque	UNSIGNED16	WR	YES	YES
6087h	0	Torque slope	UNSIGNED16	WR	YES	YES
6077h	0	Torque actual value	UNSIGNED16	RO	YES	YES

The above list just lists the object dictionaries used by JMC CANopen devices. For more information about the object dictionaries, you can read the CiA402 documentation intensively. Users can download it from the following address: http://www.can-cia.com/。

Motion Control

Motion control with Modbus-RTU communication protocol

➢ Profile Position mode

Position mode: The point-to-point motion control mode is realized by parameters such as acceleration, deceleration, target velocity and target position. When all the parameters are set, the drive will run according to the corresponding parameters. During the movement, the position of the next point can be set during the operation of one point, so as to realize the continuous motion control.

1 Enable the operation of the drive

The drive is disabled after the drive is powered on or reset. Writes 000Fh to the controlword (6040h) to put the device into operation enabled state.

2 Enable profile position mode

To enable position mode, first, you need to write 01h into object dictionary 6060h and check current operation mode by reading object dictionary 6061h.When the drive is running to a point and the Bit4 of controlword (6040h) is set to 0, a new point can be set. And the drive will run directly to the second position after device was arrived the first point.

3 Setting running parameters

Set the target position (607Ah), profile velocity (6081h), profile acceleration (6083h), profile deceleration (6084h) parameters.

4 Start/stop running

After writing completely the above parameters, set the Bit4 of controlword to start the motor. During the operation of the motor, if the Bit8 of controlword is set, the motor will be stop.

After writing the above operating parameters of the position operation, set bit4 of the control word to start the motor running. During the operation of the motor, if the control word bit8 is set, the motor will stop.

5 The Bit of controlword

Set new position: When the Bit12 of statusword is 1 as well as the Bit4 of controlword is changed from 0 to 1, the new target position value will be loaded, but if the Bit12 of statusword is 0, it not.

If the Bit9 of controlword is 0, the drive will run to the last target position and stop. If the Bit9 is 1, the drive will complete the movement of the previous target position according to the current speed and then run to next point according to speed of next point.

Set the Bit5 of controlword to 1, the newly set position will take effect immediately, and the drive will run immediately at the velocity of new position.

Set the Bit6 of controlword to 1, the final position is the sum of two positions before and after, that is, the relative positioning. When the Bit6 is 0, the final position is the latest position, that is, absolute positioning.

5.1 Position motion mode 1

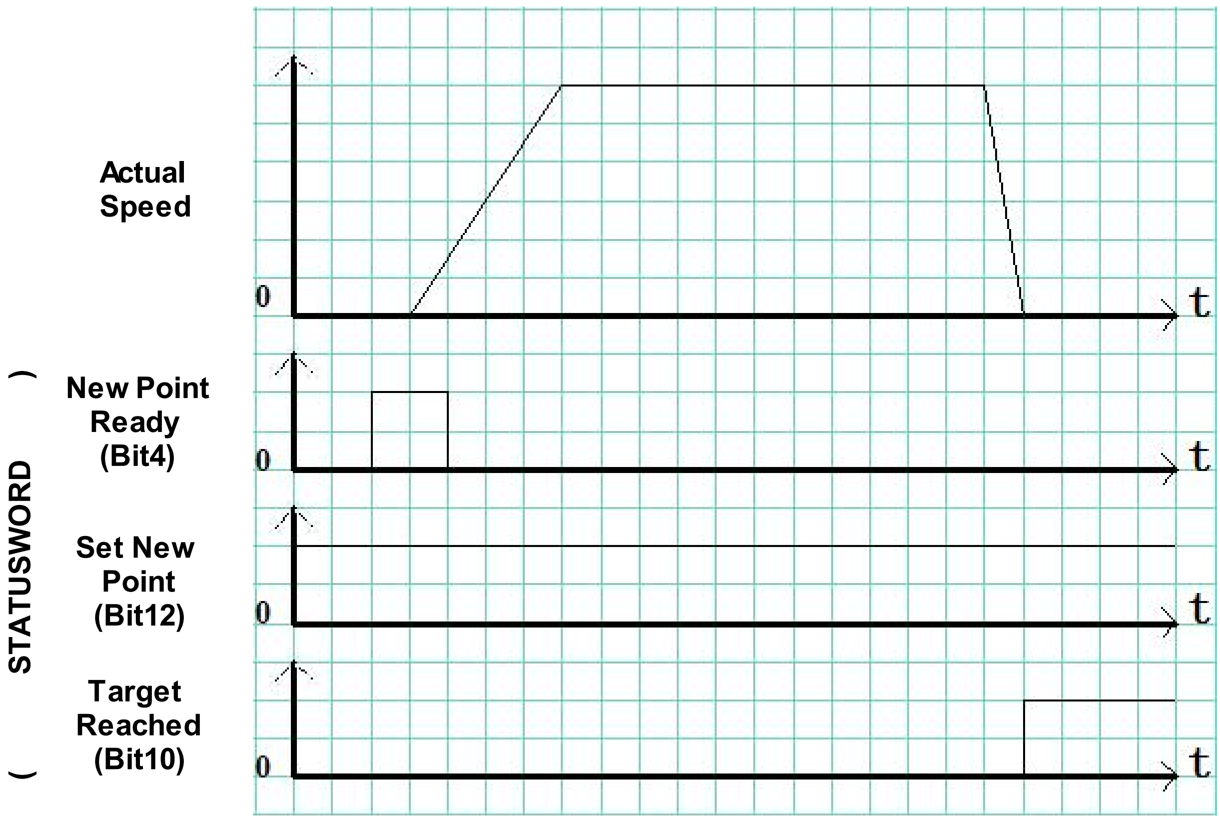


Figure 216 Position motion mode 1

Singlepoint motion, in this way, the Bit9 of controlword is 0 and the motor will stop after it is in place.

5.2 Position motion mode 2

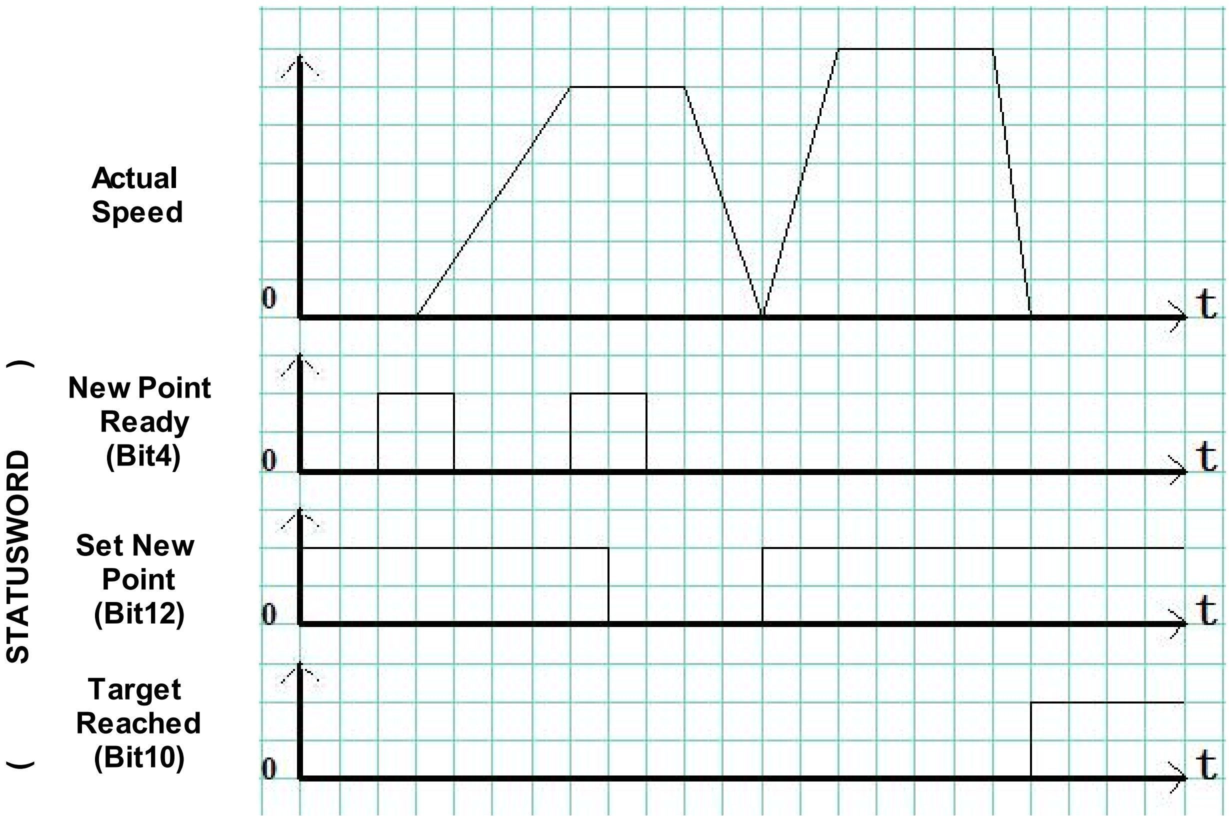


Figure 217 Position motion mode 2

Multi-point motion, the motor will stop running between two positions.In this way, the Bit9 and Bit5 of controlword are all 0.

5.3 Position motion mode 3

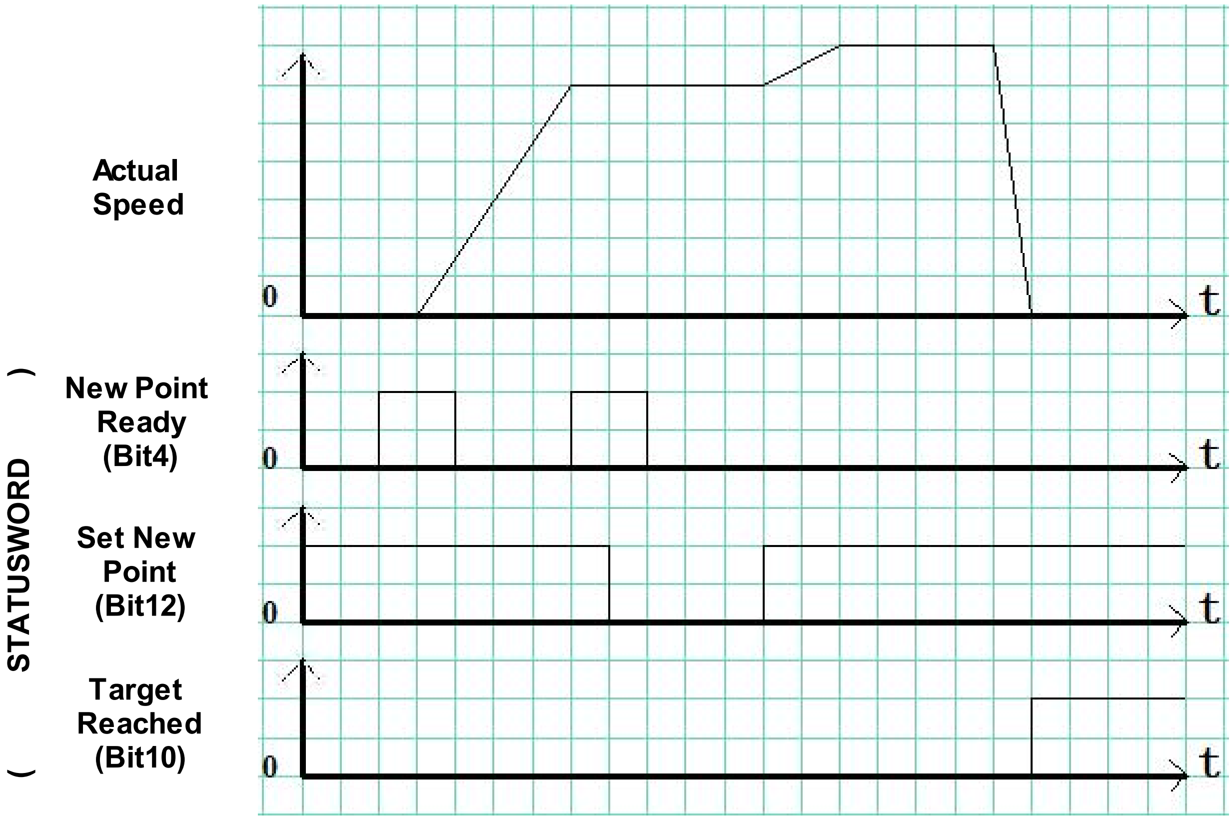


Figure 218 Position motion mode 3

Multi-point movement, the motor will do not stop the continuous movement. In this mode, the Bit9 of the controlword is 1, the Bit5 is 0, and the motor runs at a constant speed according to the speed set by the first point before reaching the first point. After reaching the first point, the motor will run at the speed set by the second point, and the motor will not stop.

5.4 Position motion mode 4

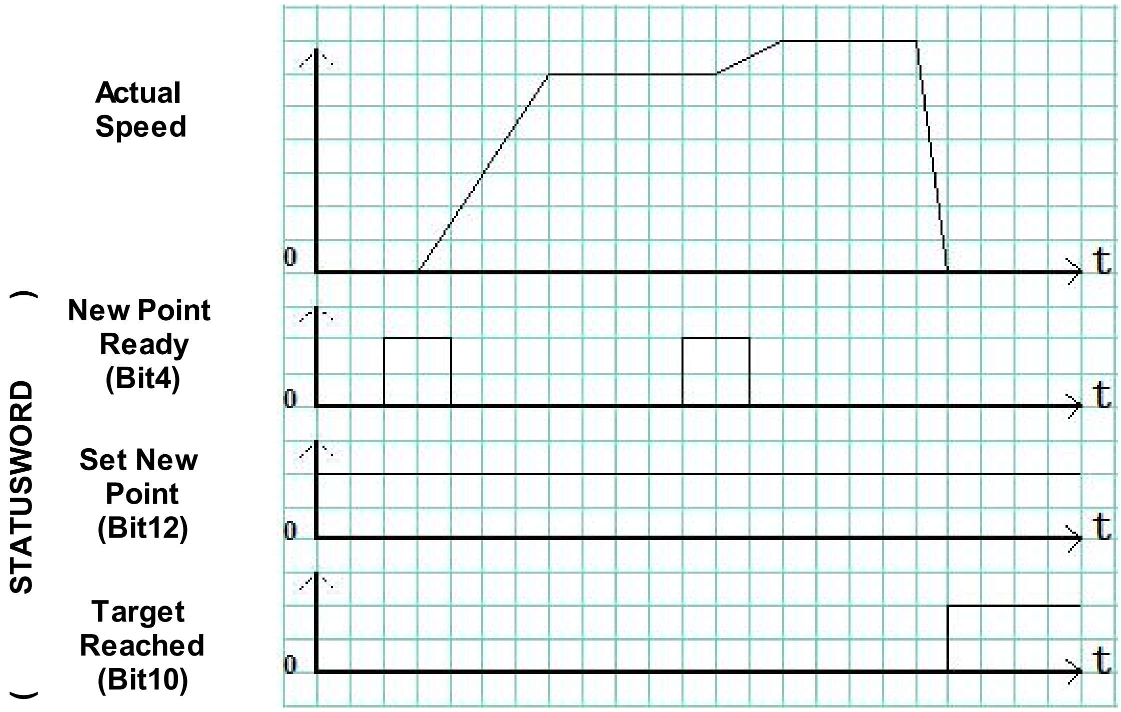


Figure 219 Position motion mode 4

Multi-point motion, the speed of switching to second points directly after setting second points.In this way, the Bit9 of the controlword and Bit5 are 1, the motor will switch directly to the second point's velocity without completing the first point's motion. The motor is running at a continuous speed.

For detailed example, please read “Example--Motion control with Modbus-RTU communication protocol” in “Example” section.

➢ Profile Velocity mode

Velocity mode: The velocity mode includes the profile velocity (0x6081), profile acceleration (0x6083), profile deceleration (0x6084) and so on. During running, motor can be halted by the controlword to suspend the movement.

1 Enable the operation of the drive

The drive is disabled after the drive is powered on or reset. Writes 000Fh to the controlword (6040h) to put the device into operation enabled state. Before writing the speed parameter, theBit8 of controlword should be set to 1 to stop the motor running, that is, write 010Fh to the controlword (6040h).

2 Enable profile velocity mode

Write 0003h to the object dictionary 6060h, enabling velocity mode and check current operation mode by reading object dictionary 6061h.

3 Setting running parameters

Set the profile velocity (6081h), profile acceleration (6083h), profile deceleration (6084h) parameters.

4 Start/Stop

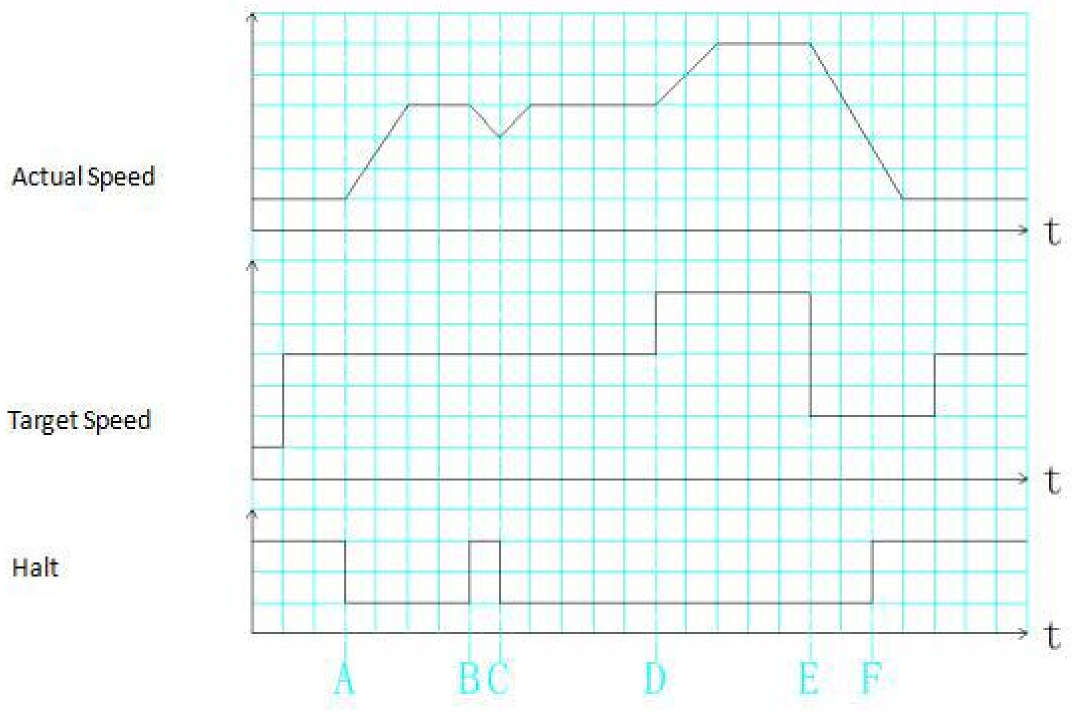


Figure 220 Profile Velocity Mode

Write 000Fh to the controlword to start the motor. Write 010Fh to the controlword to stop the motor.

For detailed example, please read "Example--Motion control with Modbus-RTU communication protocol" in "Example" section.

➢ Homing mode

Homing mode: User can control drive to execute homing operation through three limit switches, namely clockwise limit (CW limit), counter-clockwise limit (CCW limit), and mechanical origin limit (HW limit).

1 Enable the operation of the drive

The drive is disabled after the drive is powered on or reset. Writes 000Fh to the controlword (6040h) to put the device into operation enabled state.

2 Enable homing mode

Write 06h to object dictionary 6060h, enabling home mode.

3 Setting running parameters

Need to set parameters of the Homing method (6098h), Homing speeds(6099h), Homing acceleration (609Ah), Home offset (607Ch) and Speed to find zeroorigin (609Bh).

4 Start homing operation

After writing completely the above parameters, set the Bit4 of controlword to start homing operation.

5 Home offset

Home offset is the offset distance between the Home position and the Zero position, and the direction of the offset can be on the left or right of the mechanical origin.

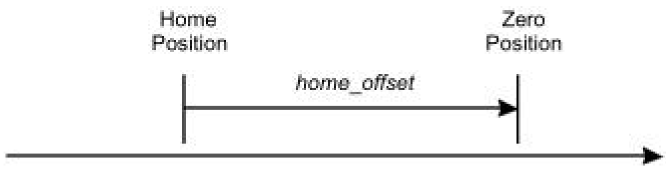


Figure 221 Home offset

6 Diagram of homing operation

6.1 Homing method 0

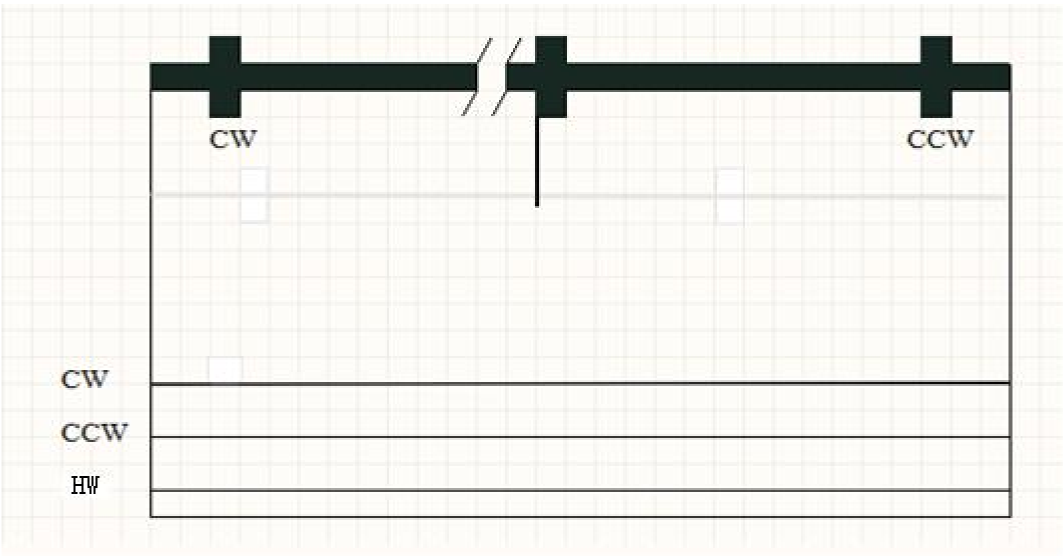


Figure 222 Homing method 0

No movement, the motor residence as a zero origin.

6.2 Homing method 1

Move left and stop when moving back to CW limit (maximum homing speed of 300r/min).

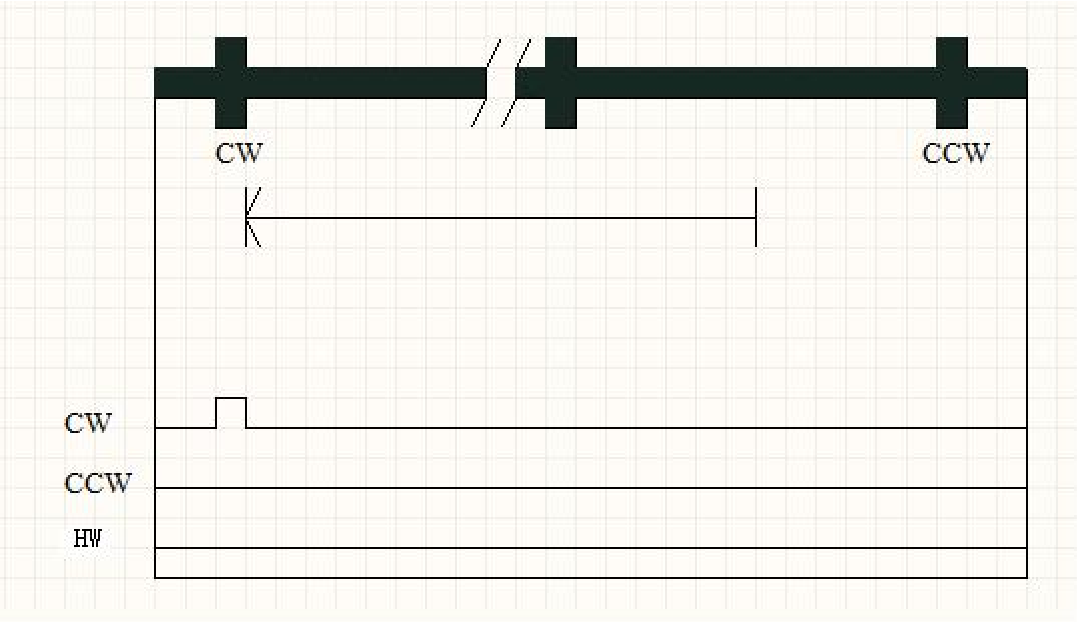


Figure 223 Homing method 1

6.3 Homing method 2

Move right and stop when moving back to CCW limit (maximum homing speed of 300r / min).

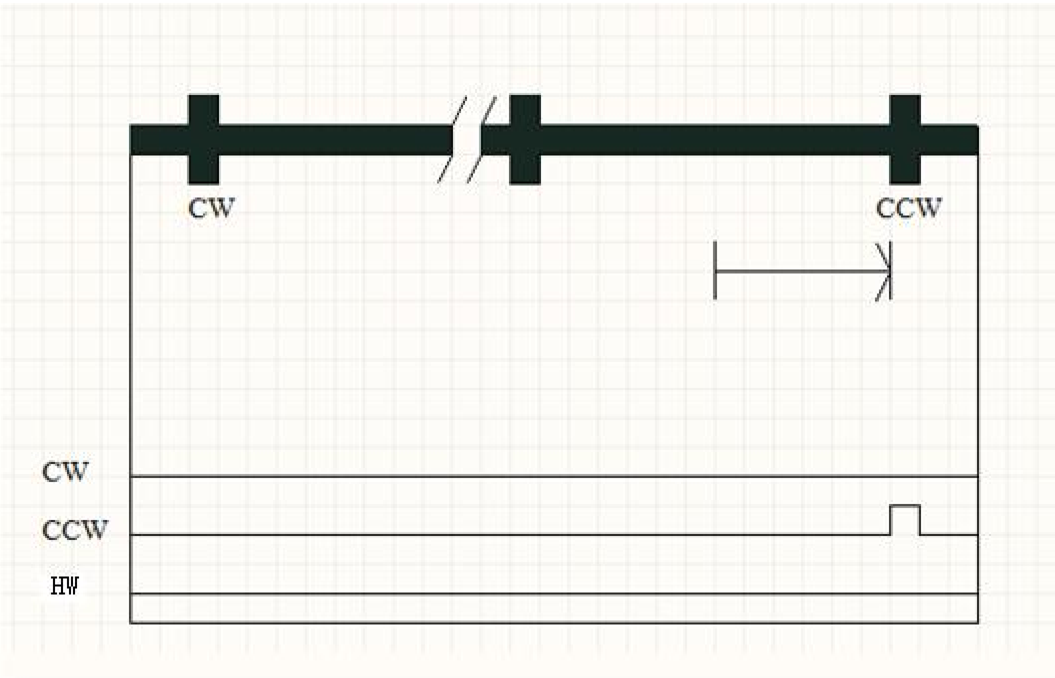


Figure 224 Homing method 2

6.4 Homing method 3

Move to left, (continue to the left without touching the SW limit) if the CW limit is reached, move to right and stop at the mechanical origin limit (maximum homing speed of 300r/min).

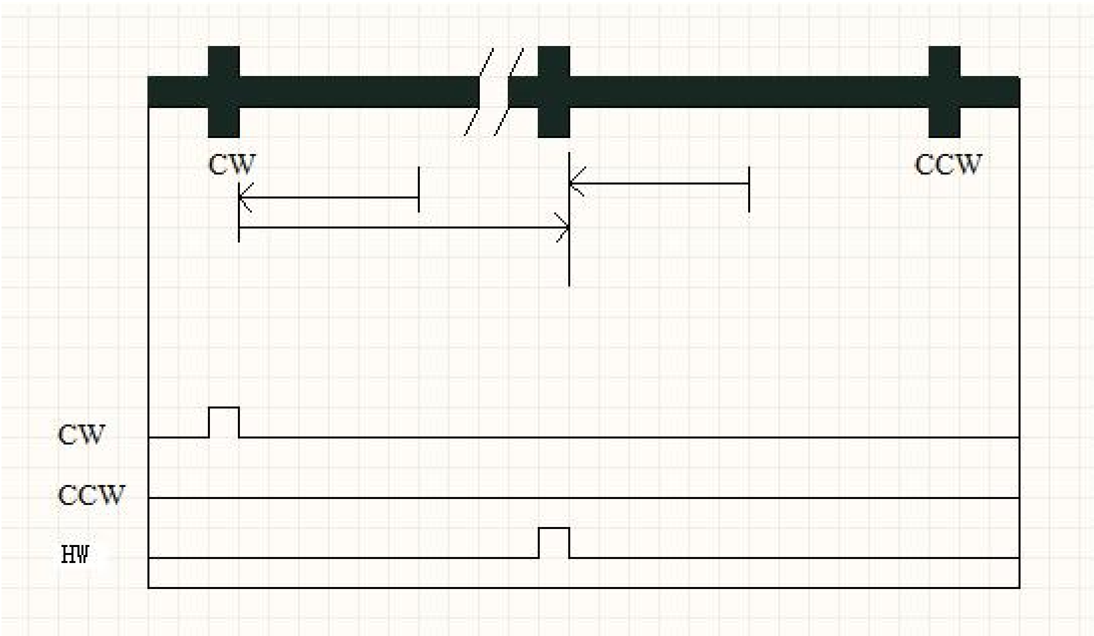


Figure 225 Homing method 3

6.5 Homing method 4

Move to right, (continue to the right without touching the SW limit) if the CCW limit is reached, move to left and stop at the mechanical origin limit (maximum homing speed of 300r/min).

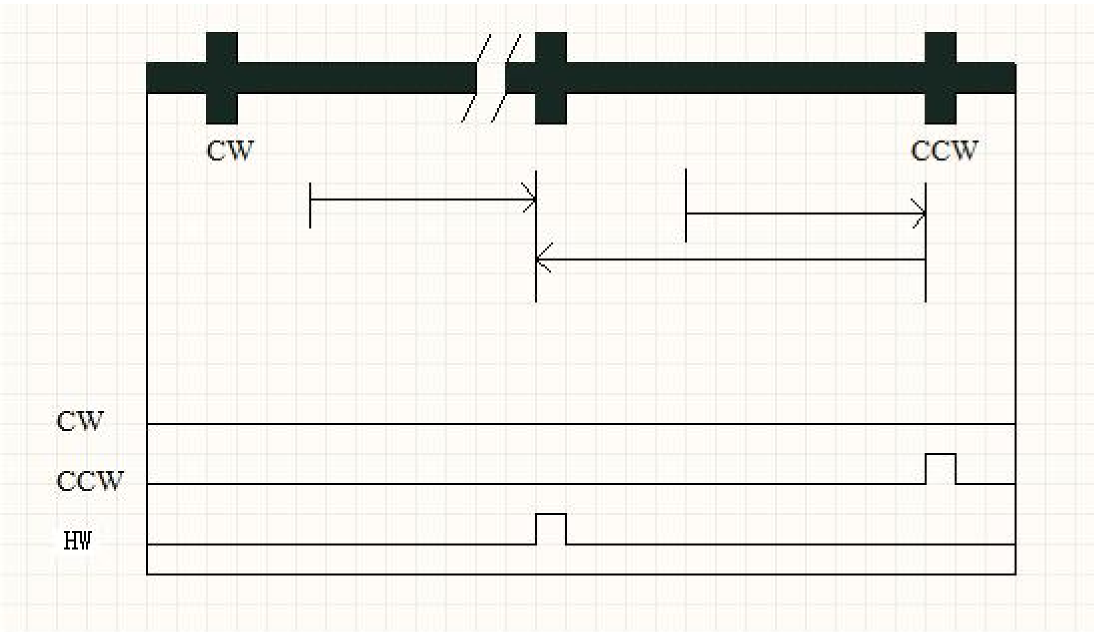


Figure 226 Homing method 4

6.6 Homing method 5

Motor runs to the CW limit at high speed then runs to CCW at low speed after arriving limit. After passing CW limit, motor runs back to CW limit at low speed (maximum homing speed of 1200r/min).

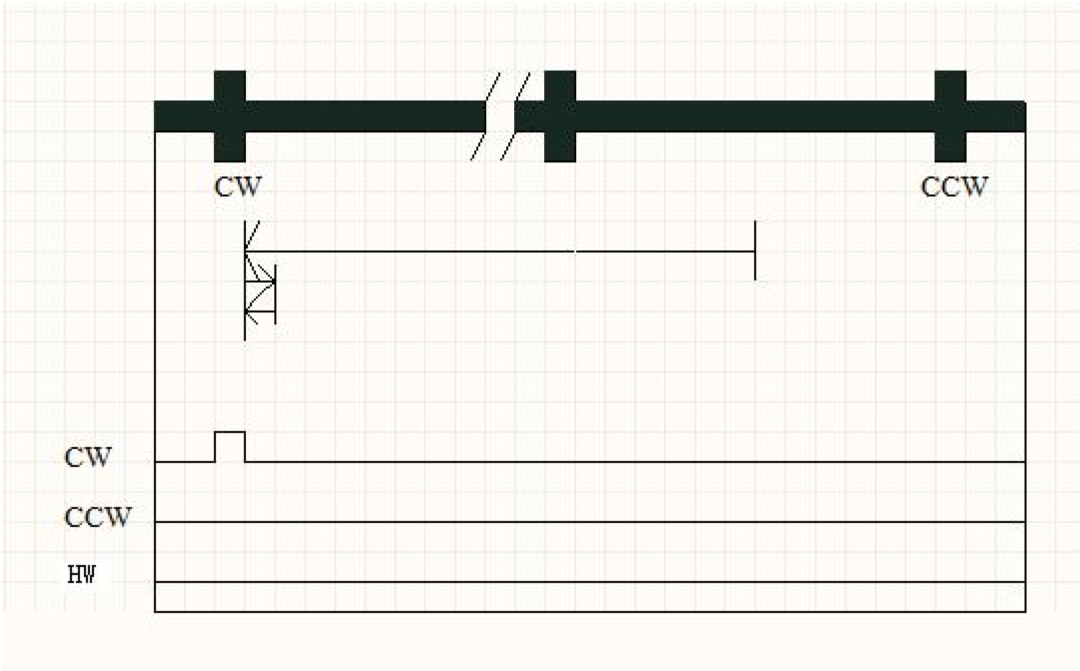


Figure 227 Homing method 5

6.7 Homing method 6

Motor runs to the CCW limit at high speed then runs to CW at low speed after arriving limit. After passing CCW limit, motor runs back to CCW limit at low speed (maximum homing speed of 1200r/min).

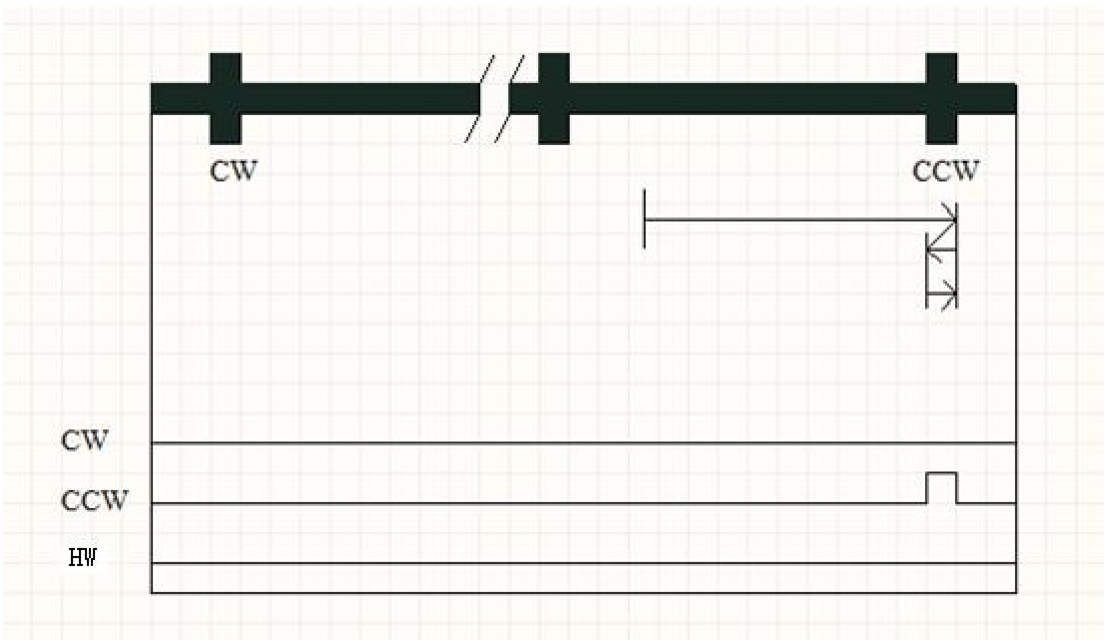


Figure 228 Homing method 6

6.8 Homing method 7

Run at high speed to CW, if drive does not get the HW limit signal, motor will continue to run to CW. Ifthe CW limit signal is gotten, it will run to CCW at high speed. When drive get the HWlimit signal, movement speed rapidly decreases and then moves to the CCW at low speed. After passing the HW limit, it runs at low speed to the CW and stop at mechanical origin switch (maximum homing speed of1200r / min).

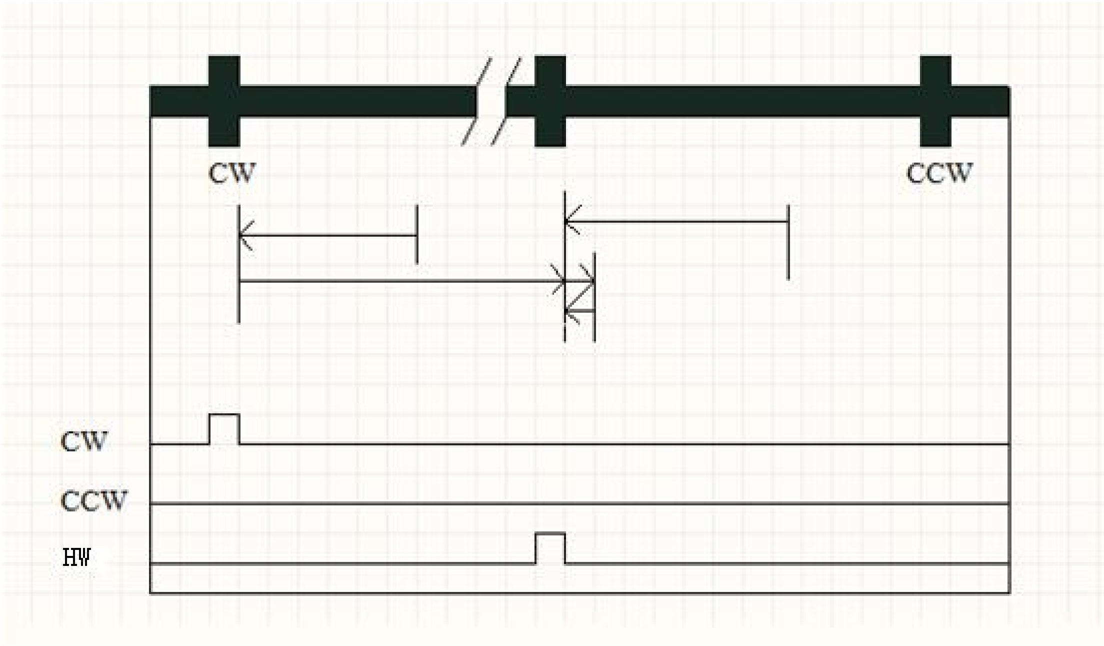


Figure 229 Homing method 7

6.9 Homing method 8

Run at high speed to CCW, if drive does not get the HW limit signal, motor will continue to run to CCW. If the CCW limit signal is gotten, it will run to CW at high speed. When drive get the HW limit signal, movement speed rapidly decreases and then moves to the CW at low speed. After passing the HW limit, it runs at low speed to the CCW and stop at mechanical origin switch (maximum homing speed of 1200r/min).

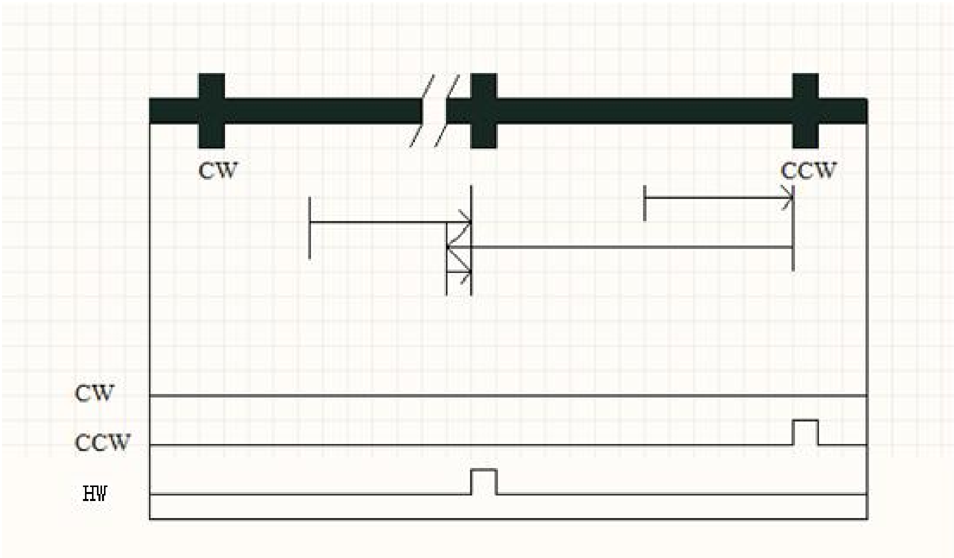


Figure 230 Homing method 8

6.10 Homing method 9

Motor runs to the CW limit at high speed then runs to CCW at low speed after arriving limit.After passing CW limit, motor runs back to CW limit at low speed (Note: This mode can set positive and negative homing offset, maximum homing speed of 1200r/min).

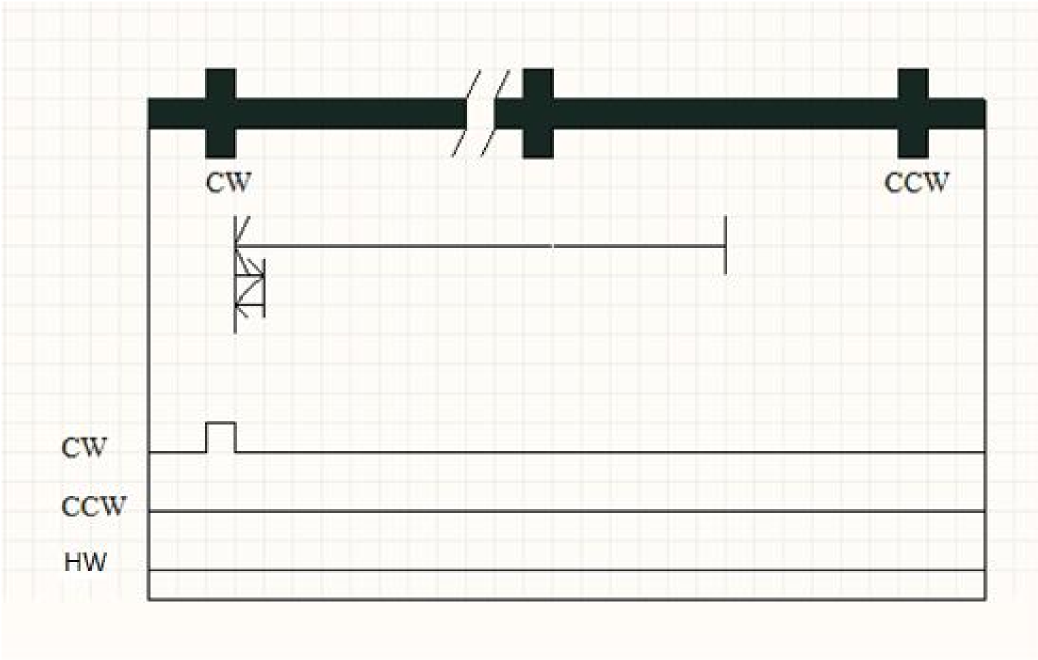


Figure 231 Homing method 9

6.11 Homing method 10

Motor runs to the CCW limit at high speed then runs to CW at low speed after arriving limit. After passing CCW limit, motor runs back to CCW limit at low speed (Note: This mode can set positive and negative homing offset, maximum homing speed of 1200r/min).

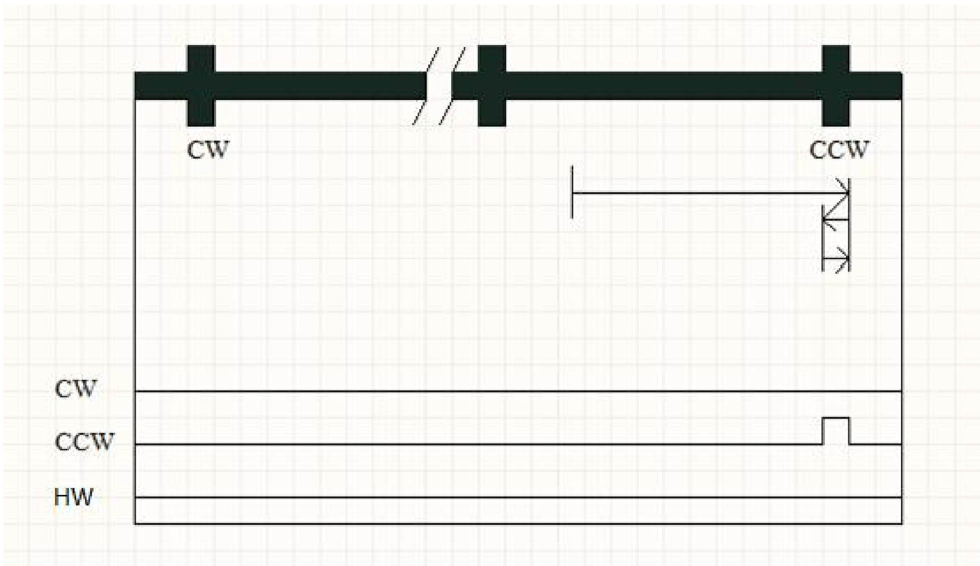


Figure 232 Homing method 10

6.12 Homing method 11

Run at high speed to CW, if drive does not get the HW limit signal, motor will continue to run to CW. If the CW limit signal is gotten, it will run to CCW at high speed. When drive get the HW limit signal, movement speed rapidly decreases and then moves to the CCW at low speed. After passing the HW limit, it runs at low speed to the CW and stop at mechanical origin switch (Note: This mode can set positive and negative homing offset, maximum homing speed of 1200r/min).

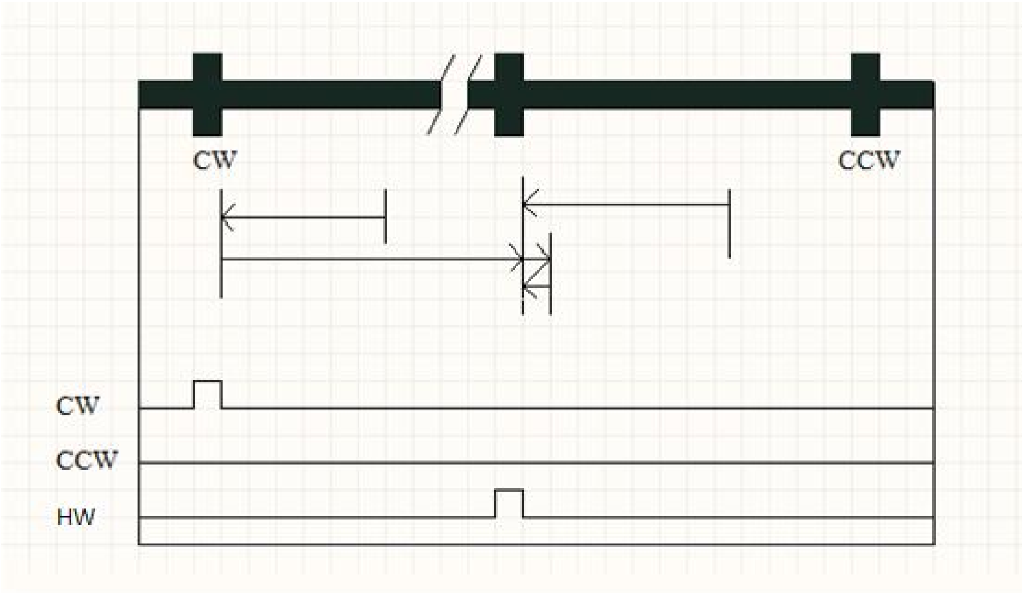


Figure 233 Homing method 11

6.13 Homing method 12

Run at high speed to CCW, if drive does not get the HW limit signal, motor will continue to run to CCW. If the CCW limit signal is gotten, it will run to CW at high speed. When drive get the HW limit signal, movement speed rapidly decreases and then moves to the CW at low speed. After passing the HW limit, it runs at low speed to the CCW and stop at mechanical origin switch (Note: This mode can set positive and negative homing offset, maximum homing speed of 1200r/min).

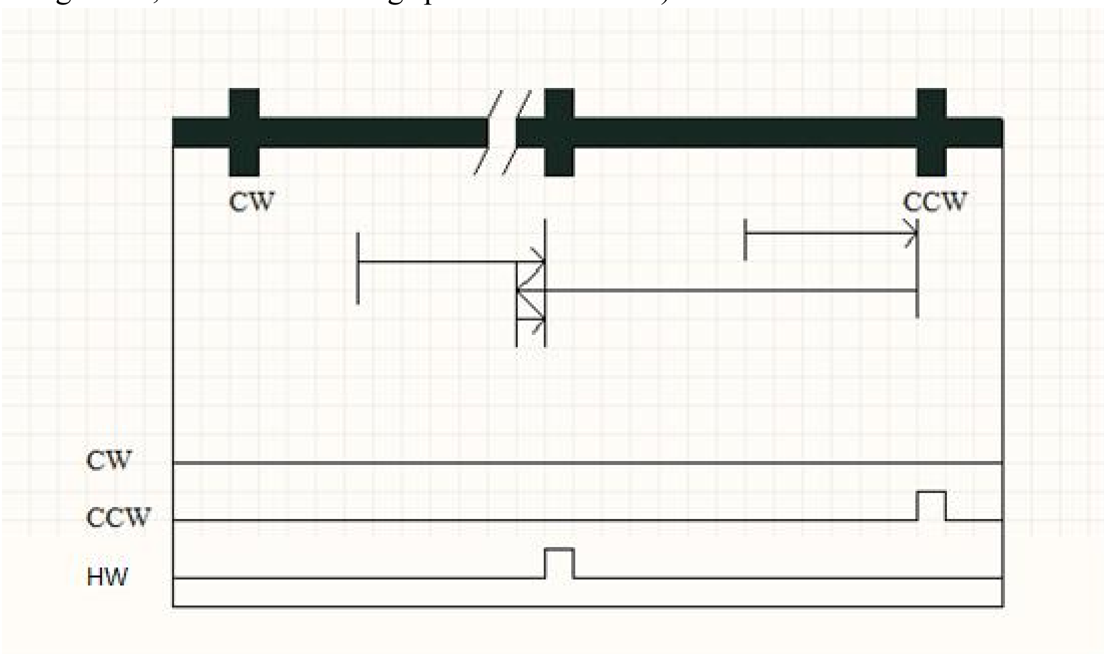


Figure 234 Homing method 12

For detailed example, please read “ Example--Motion control with Modbus-RTU communication protocol” in “Example” section.

➢ Profile Torque mode

Torque mode: The motion control mode of the moment is realized by the target torque, the slope of the moment, the limit of the moment and the target speed. When all the parameter settings are complete, the drive will run with the appropriate parameters.

1 Operation of enabling drive

The drive is disabled after it is powered on or reset. Write the control word 0x000F to the drive control register to enable the device to operate.

2 Enabling Torque Mode

To enable location mode, you need to write 0X04 to the registers for 6060h first. View the current motion mode from the register 6061h.

3 Set Run Parameters

Target speed (6081h), target torque (6071h), and torque slope (6087h) are set.

4 Start/Stop Running

After writing the above operation parameters for the position operation, set bit4 of the control word to 1 and start the motor operation. During the operation of the motor, the bit8 position of the control word will be set and the motor will be suspended.

Motion control with CANopen communication protocol

➢ Profile Position mode

Position mode: The point-to-point motion control mode is realized by parameters such as acceleration, deceleration, target velocity and target position. When all the parameters are set, the drive will run according to the corresponding parameters. During the movement, the position of the next point can be set during the operation of one point, so as to realize the continuous motion control.

1 Enable the operation of the drive

The drive is disabled after the drive is powered on or reset. Writes 000Fh to the controlword (6040h) to put the device into operation enabled state.

2 Enable profile position mode

To enable position mode, first, you need to write 01h into object dictionary 6060h and check current operation mode by reading object dictionary 6061h.When the drive is running to a point and the Bit4 of controlword (6040h) is set to 0, a new point can be set. And the drive will run directly to the second position after device was arrived the first point.

3 Setting running parameters

Set the target position (607Ah), profile velocity (6081h), profile acceleration (6083h), profile deceleration (6084h) parameters.

4 Start/stop running

After writing completely the above parameters, set the Bit4 of controlword to start the motor. During the operation of the motor, if the Bit8 of controlword is set, the motor will be stop.

After writing the above operating parameters of the position operation, set bit4 of the control word to start the motor running. During the operation of the motor, if the control word bit8 is set, the motor will stop.

5 The Bit of controlword

Set new position: When the Bit12 of statusword is 1 as well as the Bit4 of controlword is changed from 0 to 1, the new target position value will be loaded, but if the Bit12 of statusword is 0, it not.

If the Bit9 of controlword is 0, the drive will run to the last target position and stop. If the Bit9 is 1, the drive will complete the movement of the previous target position according to the current speed and then run to next point according to speed of next point.

Set the Bit5 of controlword to 1, the newly set position will take effect immediately, and the drive will run immediately at the velocity of new position.

Set the Bit6 of controlword to 1, the final position is the sum of two positions before and after, that is, the relative positioning. When the Bit6 is 0, the final position is the latest position, that is, absolute positioning.

5.1 Position motion mode 1

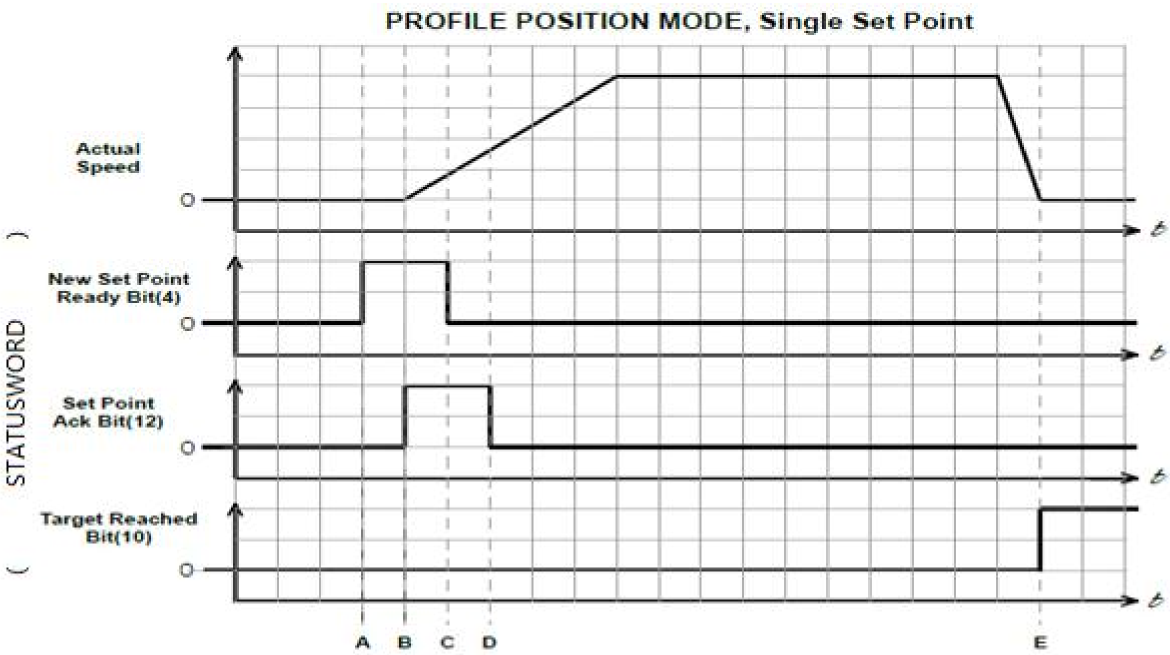


Figure 235 Position motion mode 1

Single point motion, in this way, the Bit9 of controlword is 0 and the motor will stop after it is in place.

5.2 Position motion mode 2

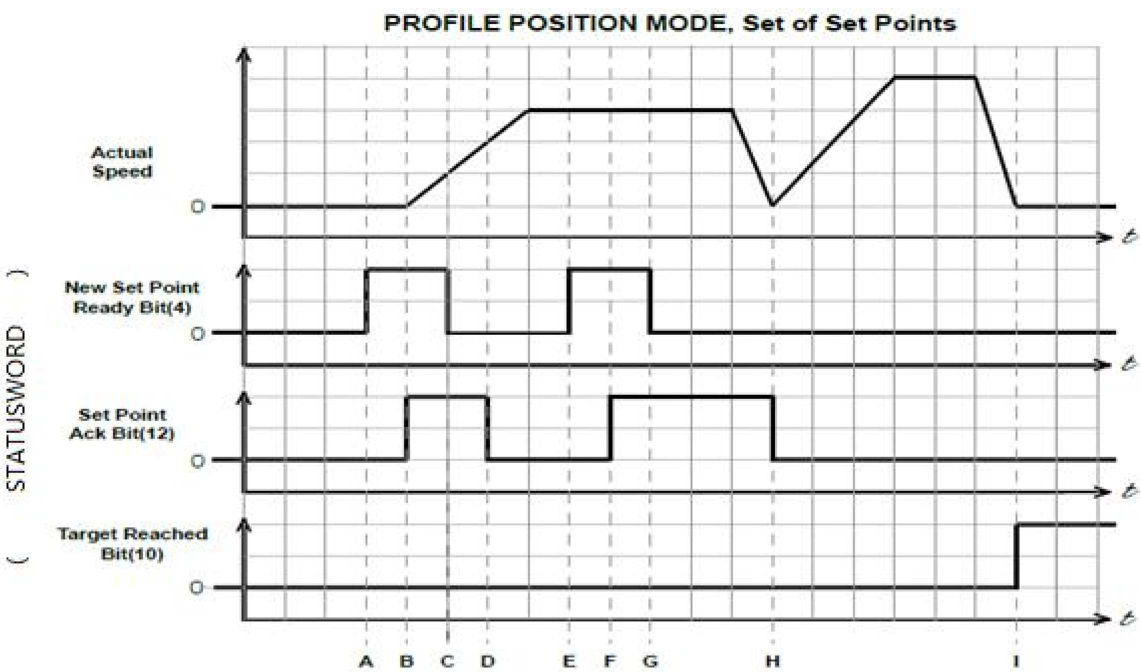


Figure 236 Position motion mode 2

Multi-point motion, the motor will stop running between two positions. In this way, the Bit9 and Bit5 of controlword are all 0.

5.3 Position motion mode 3

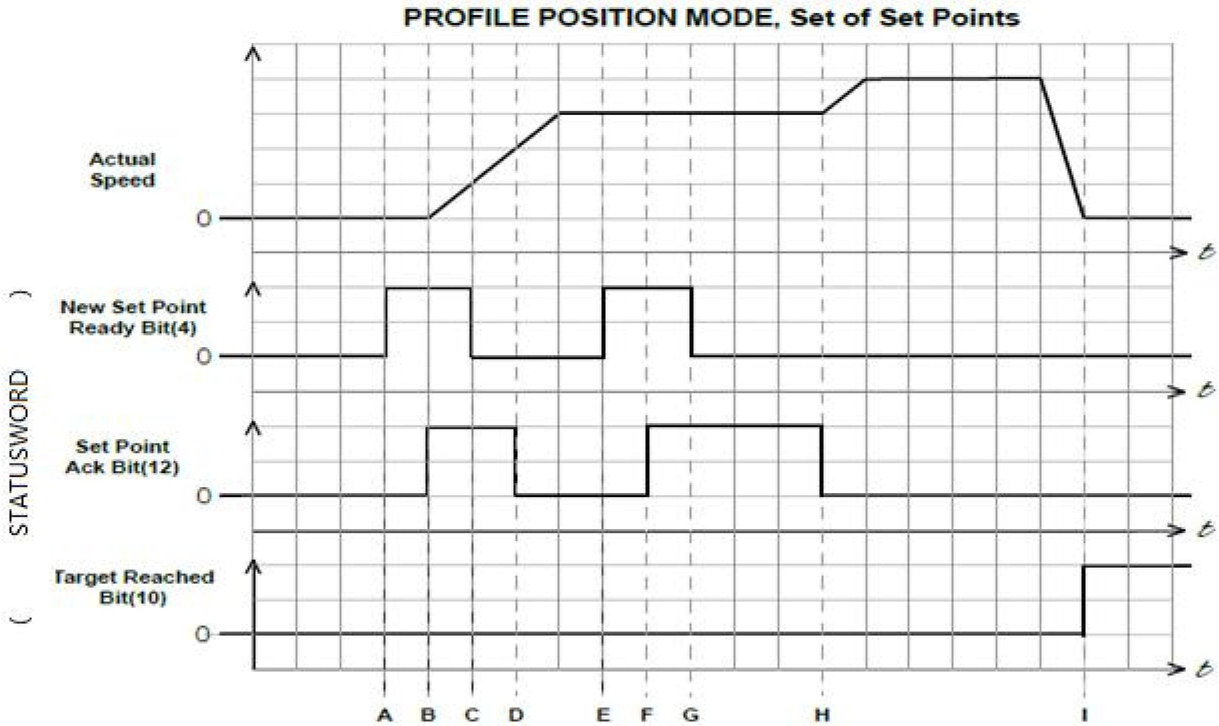


Figure 237 Position motion mode 3

Multi-point movement, the motor will do not stop the continuous movement. In this mode, the Bit9 of the controlword is 1, the Bit5 is 0, and the motor runs at a constant speed according to the speed set by the first point before reaching the first point. After reaching the first point, the motor will run at the speed set by the second point, and the motor will not stop.

5.4 Position motion mode 4

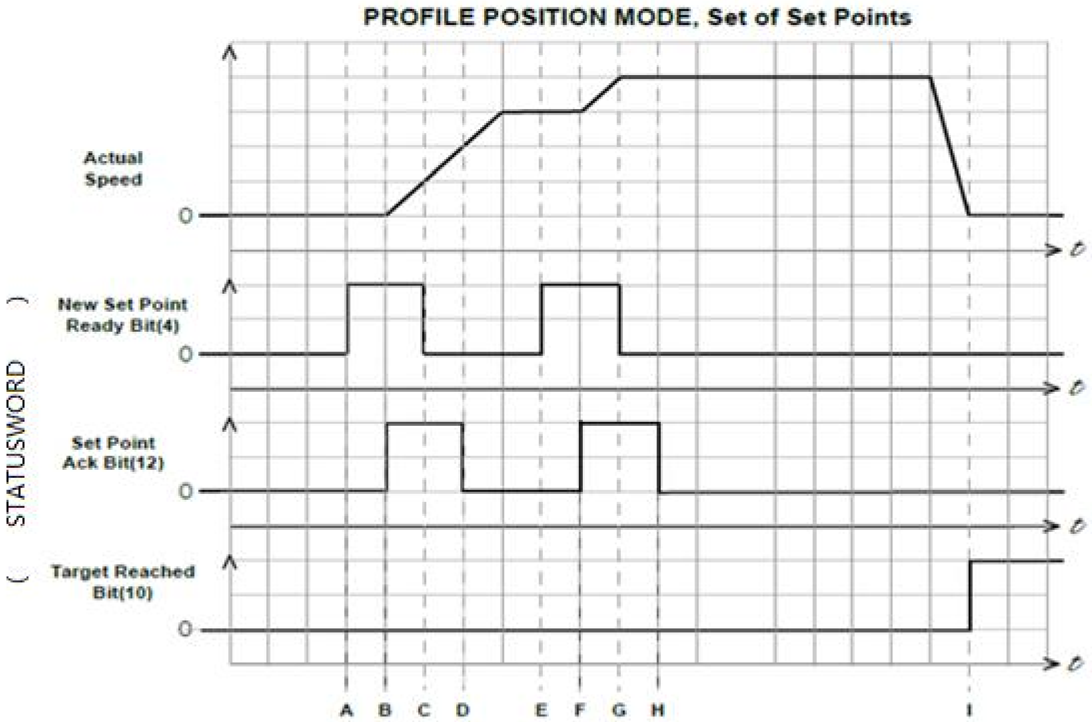


Figure 238 Position motion mode 4

Multi-point motion, the speed of switching to second points directly after setting second points. In this way, the Bit9 of the controlword and Bit5 are 1, the motor will switch directly to the second point's velocity without completing the first point's motion. The motor is running at a continuous speed.

For detailed example, please read “Example--Motion control with CANopen communication protocol” in “Example” section.

➢ Profile Velocity mode

Velocity mode: The velocity mode includes the profile velocity (0x6081), profile acceleration (0x6083), profile deceleration (0x6084) and so on. During running, motor can be halted by the controlword to suspend the movement.

1 Enable the operation of the drive

The drive is disabled after the drive is powered on or reset. Writes 000Fh to the controlword (6040h) to put the device into operation enabled state. Before writing the speed parameter, the Bit8 of controlword should be set to 1 to stop the motor running, that is, write 010Fh to the controlword (6040h).

2 Enable profile velocity mode

Set the profile velocity (6081h), profile acceleration (6083h), profile deceleration (6084h) parameters.

3 Setting running parameters

Set the profile velocity (6081h), profile acceleration (6083h), profile deceleration (6084h) parameters.

4 Start/Stop

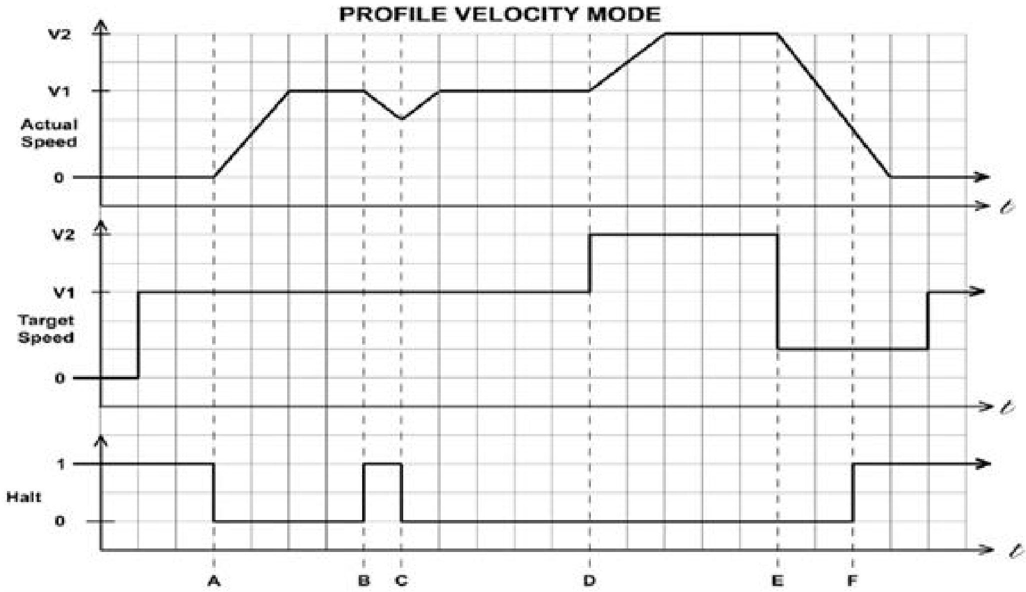


Figure 239 Profile Velocity Mode

Write 000Fh to the controlword to start the motor. Write 010Fh to the controlword to stop the motor.

For detailed example, please read "Example--Motion control with CANopen communication protocol" in "Example" section.

➢ Homing mode

Homing mode: User can control drive to execute homing operation through three limit switches, namely clockwise limit (CW limit), counter-clockwise limit (CCW limit), and mechanical origin limit (HW limit).

1 Enable the operation of the drive

The drive is disabled after the drive is powered on or reset. Writes 000Fh to the controlword (6040h) to put the device into operation enabled state.

2 Enable homing mode

Write 06h to object dictionary 6060h, enabling home mode.

3 Setting running parameters

Need to set parameters of the Homing method (6098h), Homing speeds (6099h), Homing acceleration (609Ah), Home offset (607Ch) and Speed to find zero origin (609Bh).

4 Start homing operation

After writing completely the above parameters, set the Bit4 of controlword to start homing operation.

5 Home offset

Home offset is the offset distance between the Home position and the Zero position, and the direction of the offset can be on the left or right of the mechanical origin.

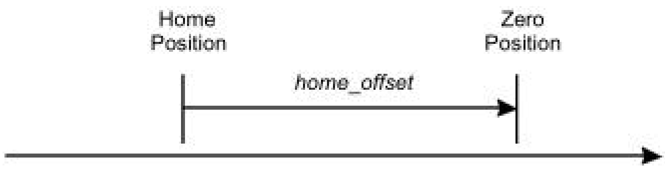


Figure 240 Home offset

6 Diagram of homing operation

6.1 Homing method 0

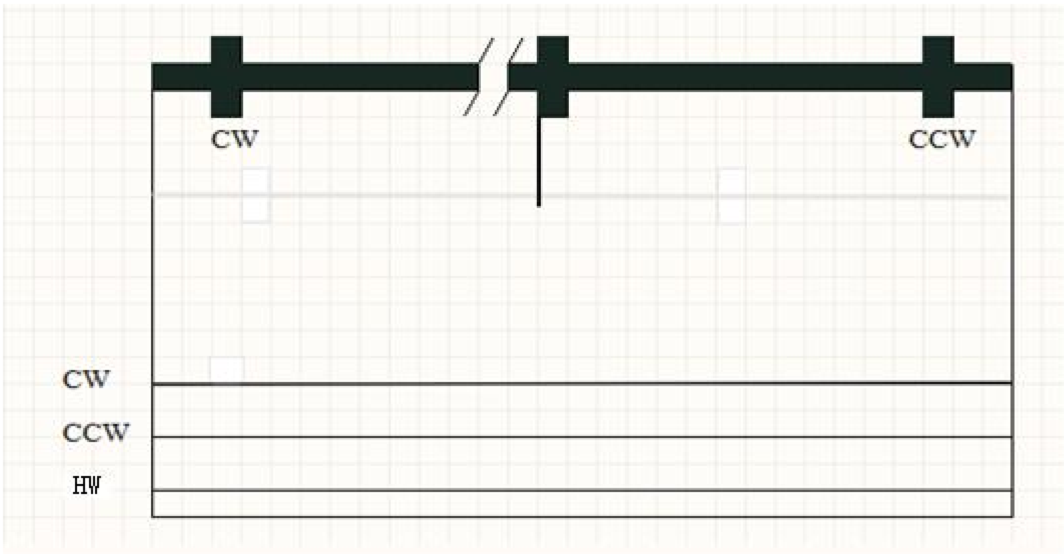


Figure 241 Homing method 0

No movement, the motor residence as a zero origin.

6.2 Homing method 1

Move left and stop when moving back to CW limit (maximum homing speed of 300r/min).

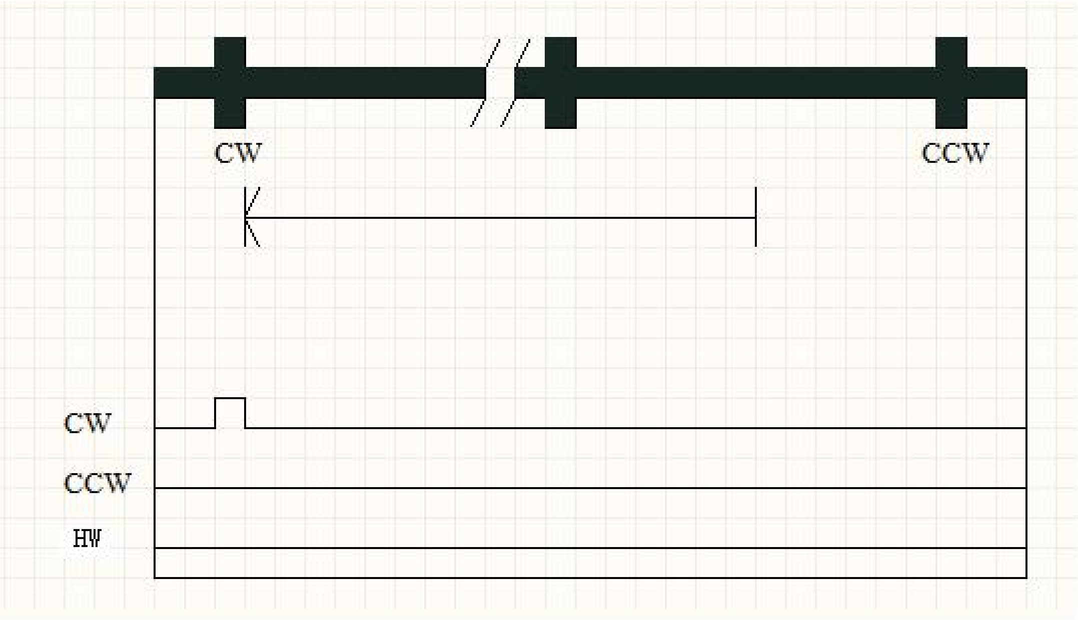


Figure 242 Homing method 1

6.3 Homing method 2

Move right and stop when moving back to CCW limit (maximum homing speed of 300r / min).

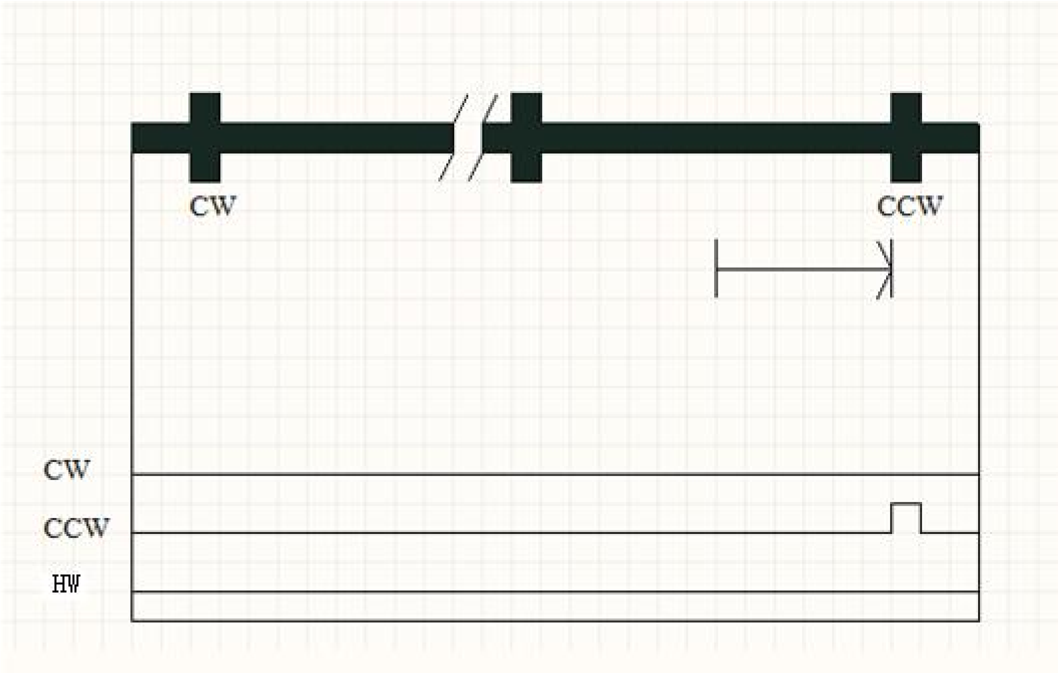


Figure 243 Homing method 2

6.4 Homing method 3

Move to left, (continue to the left without touching the SW limit) if the CW limit is reached, moveto right and stop at the mechanical origin limit (maximum homing speed of 300r/min).

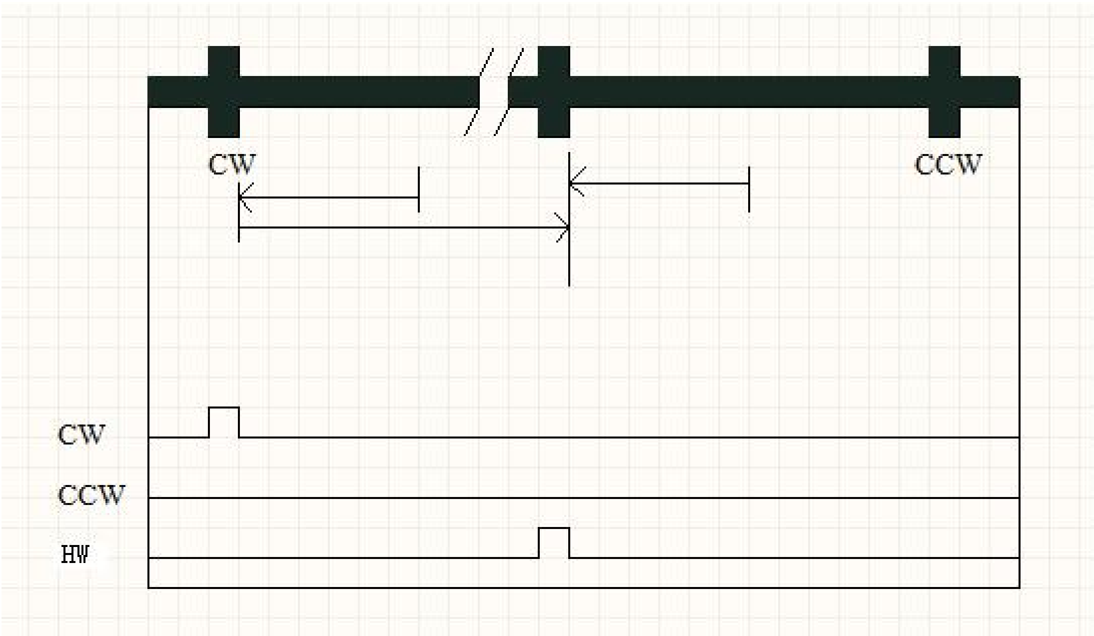


Figure 244 Homing method 3

6.5 Homing method 4

Move to right, (continue to the right without touching the SW limit) if the CCW limit is reached, move to left and stop at the mechanical origin limit (maximum homing speed of 300r/min).

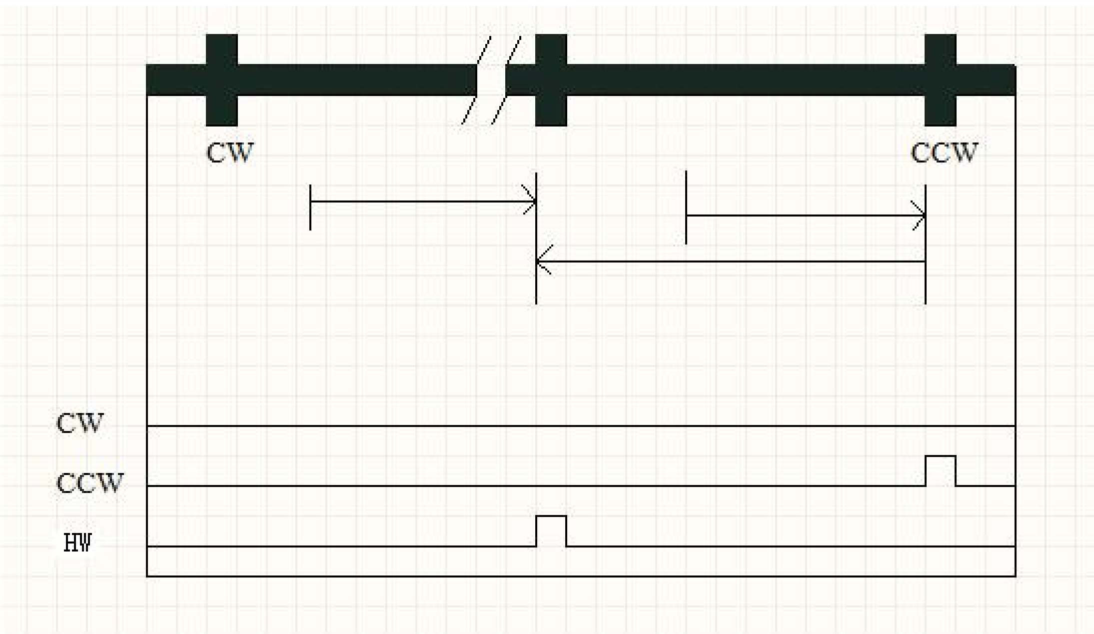


Figure 245 Homing method 4

6.6 Homing method 5

Motor runs to the CW limit at high speed then runs to CCW at low speed after arriving limit. After passing CW limit, motor runs back to CW limit at low speed (maximum homing speed of 1200r/min).

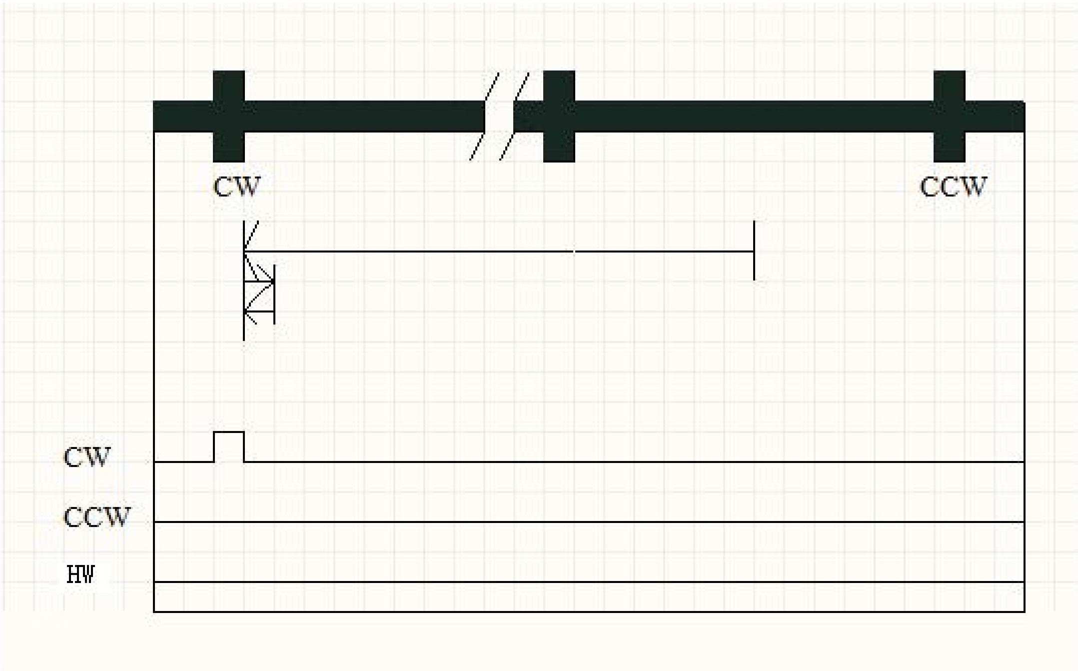


Figure 246 Homing method 5

6.7 Homing method 6

Motor runs to the CCW limit at high speed then runs to CW at low speed after arriving limit. After passing CCW limit, motor runs back to CCW limit at low speed (maximum homing speed of 1200r/min).

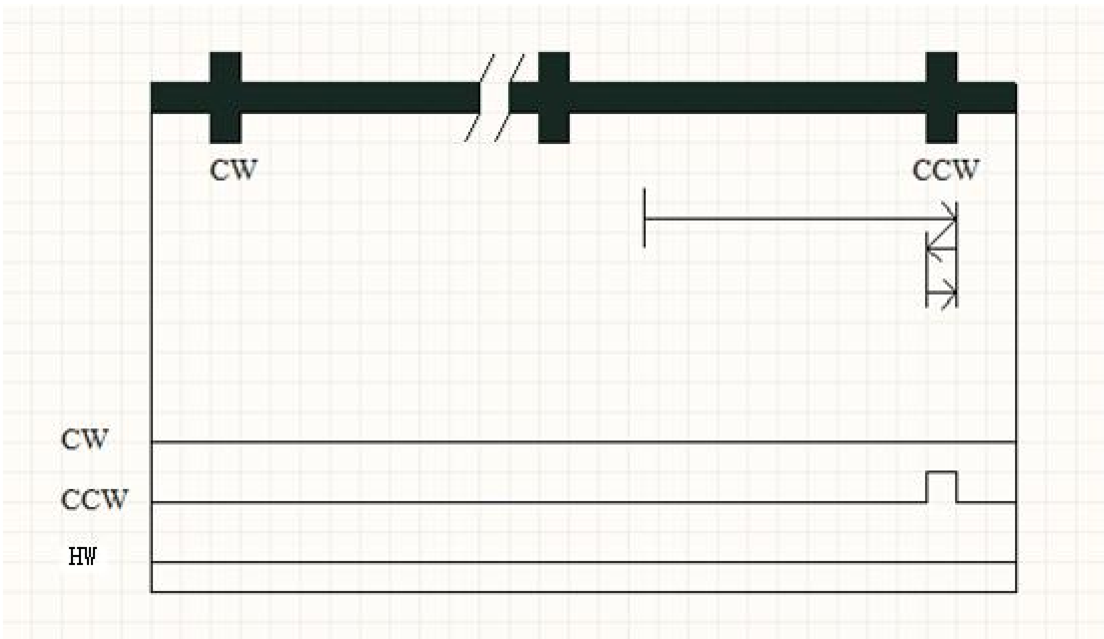


Figure 247 Homing method 6

6.8 Homing method 7

Run at high speed to CW, if drive does not get the HW limit signal, motor will continue to run to CW. If the CW limit signal is gotten, it will run to CCW at high speed. When drive get the HW limit signal, movement speed rapidly decreases and then moves to the CCW at low speed. After passing the HW limit, it runs at low speed to the CW and stop at mechanical origin switch (maximum homing speed of 1200r / min).

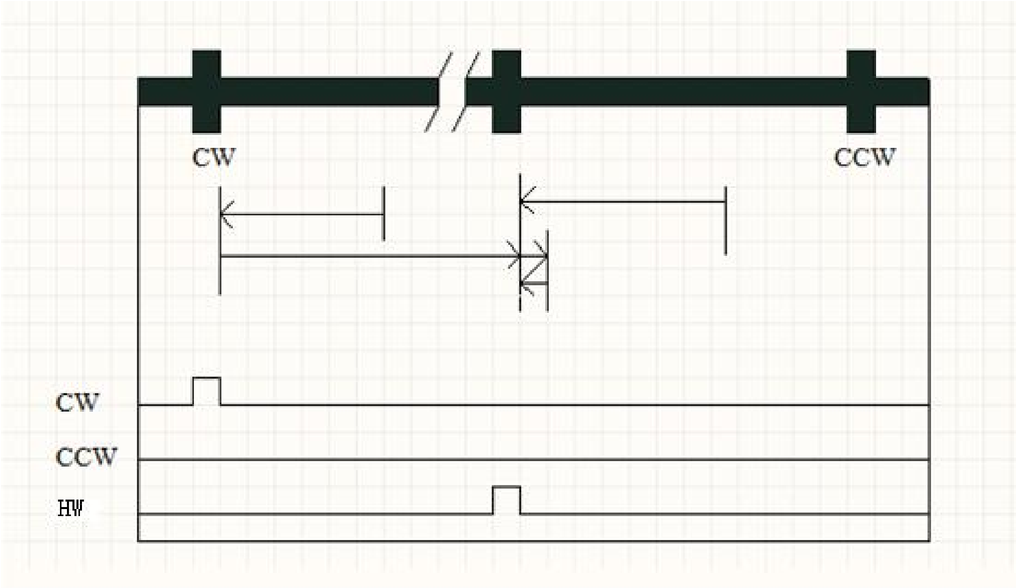


Figure 248 Homing method 7

6.9 Homing method 8

Run at high speed to CCW, if drive does not get the HW limit signal, motor will continue to run to CCW. If the CCW limit signal is gotten, it will run to CW at high speed. When drive get the HW limit signal, movement speed rapidly decreases and then moves to the CW at low speed. After passing the HW limit, it runs at low speed to the CCW and stop at mechanical origin switch (maximum homing speed of 1200r/min).

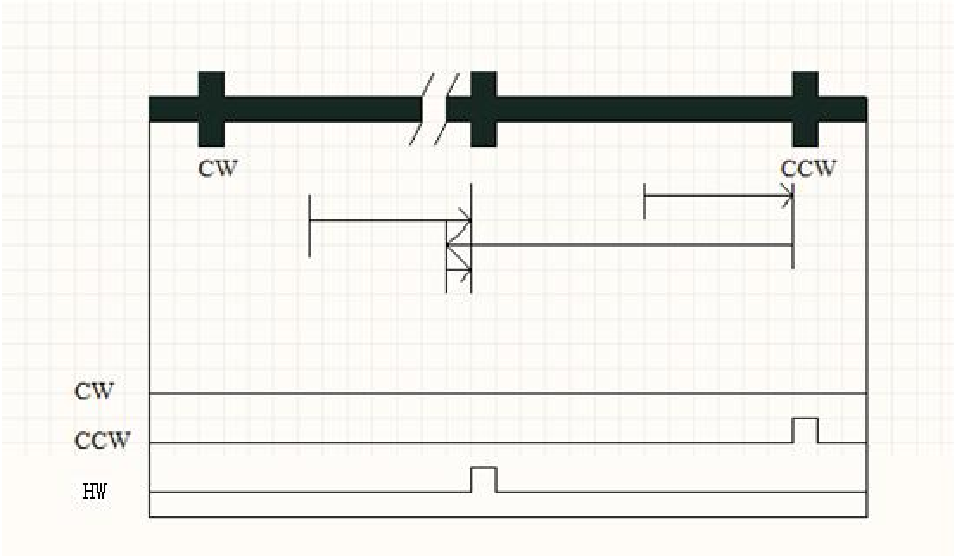


Figure 249 Homing method 8

6.10 Homing method 9

Motor runs to the CW limit at high speed then runs to CCW at low speed after arriving limit. After passing CW limit, motor runs back to CW limit at low speed (Note: This mode can set positive and negative homing offset, maximum homing speed of 1200r/min).

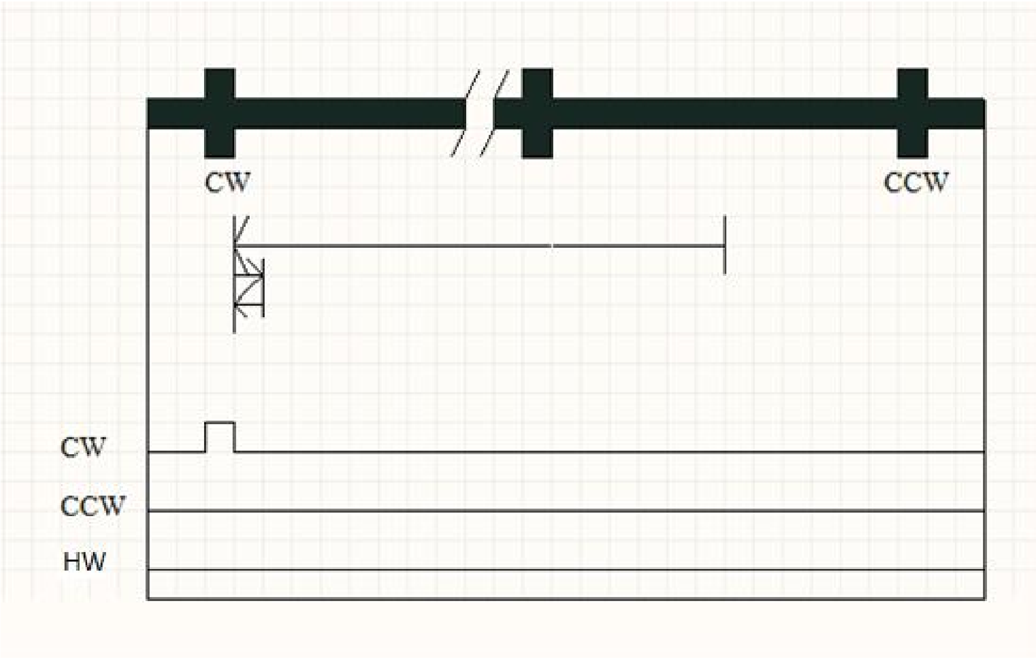


Figure 250 Homing method 9

6.11 Homing method 10

Motor runs to the CCW limit at high speed then runs to CW at low speed after arriving limit. After passing CCW limit, motor runs back to CCW limit at low speed (Note: This mode can set positive and negative homing offset, maximum homing speed of 1200r/min).

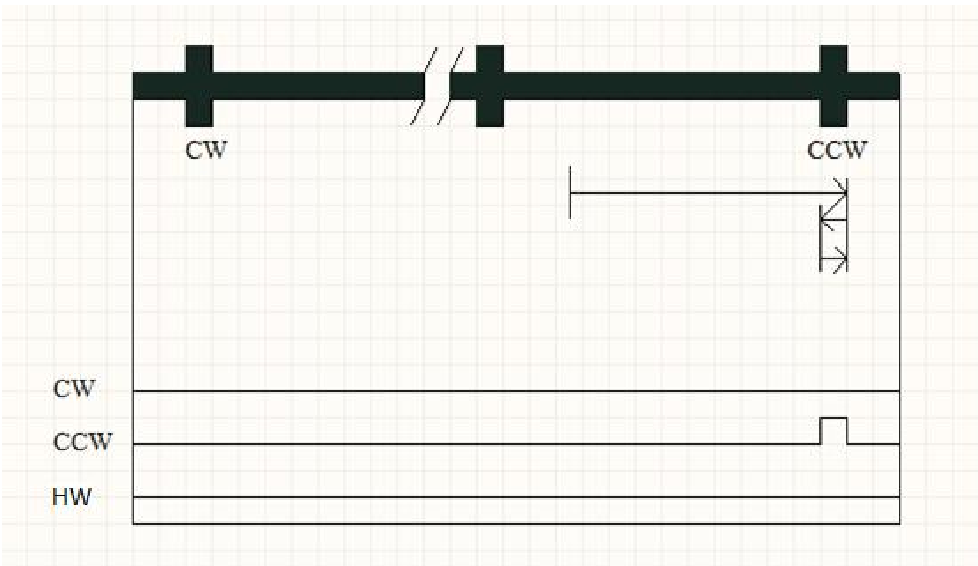


Figure 251 Homing method 10

6.12 Homing method 11

Run at high speed to CW, if drive does not get the HW limit signal, motor will continue to run to CW. If the CW limit signal is gotten, it will run to CCW at high speed. When drive get the HW limit signal, movement speed rapidly decreases and then moves to the CCW at low speed. After passing the HW limit, it runs at low speed to the CW and stop at mechanical origin switch (Note: This mode can set positive and negative homing offset, maximum homing speed of 1200r/min).

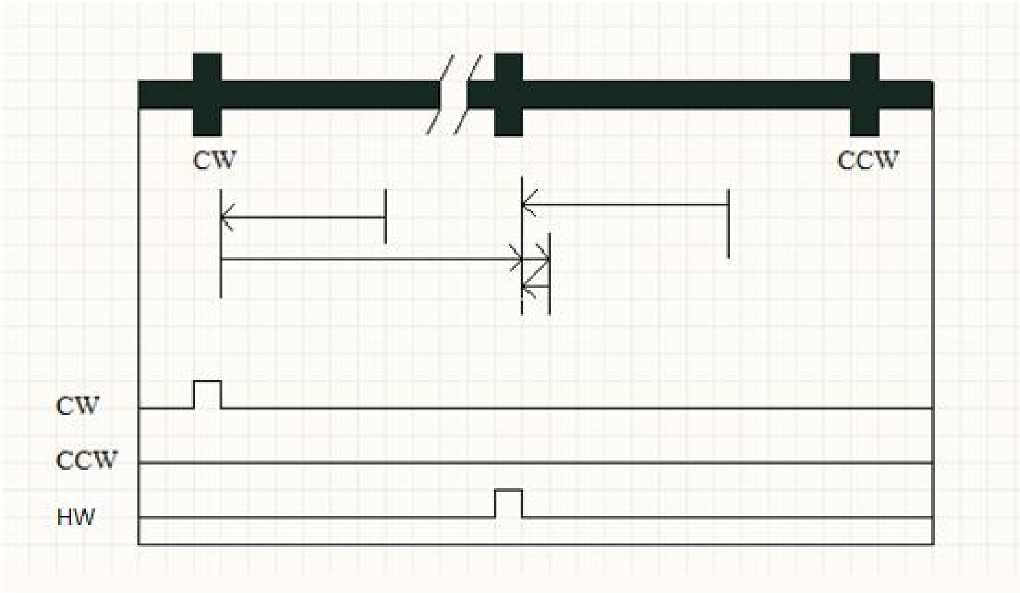


Figure 252 Homing method 11

6.13 Homing method 12

Run at high speed to CCW, if drive does not get the HW limit signal, motor will continue to run to CCW. If the CCW limit signal is gotten, it will run to CW at high speed. When drive get the HW limit signal, movement speed rapidly decreases and then moves to the CW at low speed. After passing the HW limit, it runs at low speed to the CCW and stop at mechanical origin switch (Note: This mode can set positive and negative homing offset, maximum homing speed of 1200r/min).

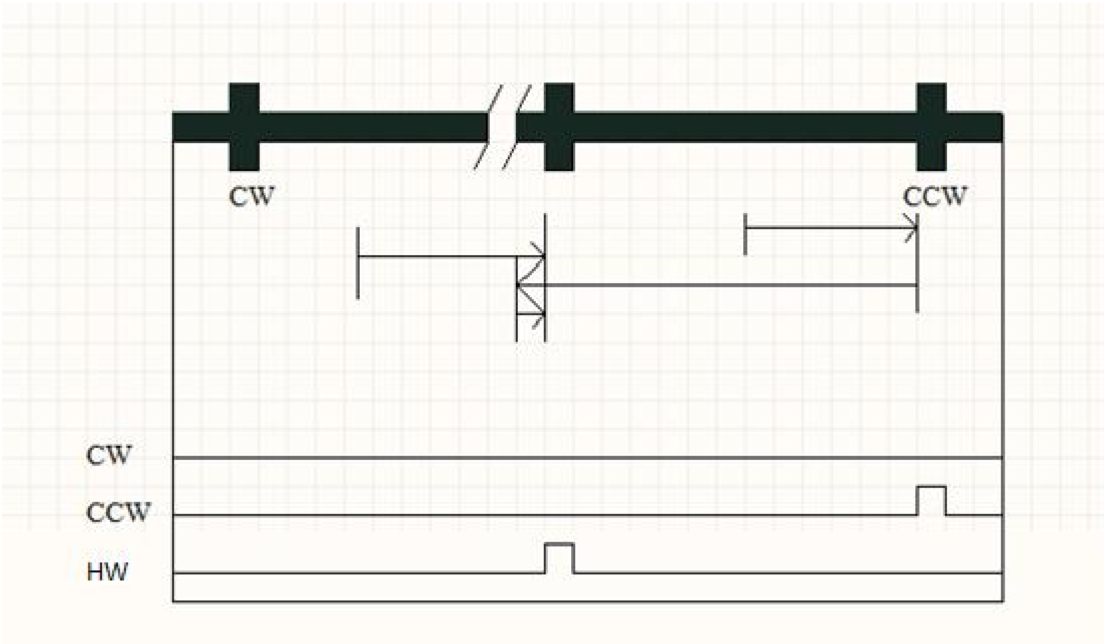


Figure 253 Homing method 12

For detailed example, please read “Example--Motion control with CANopen communication protocol” in “Example” section.

➢ Profile Torque mode

Torque mode: The motion control mode of the moment is realized by the target torque, the slope of the moment, the limit of the moment and the target speed. When all the parameter settings are complete, the drive will run with the appropriate parameters.

1 Operation of enabling drive

The drive is disabled after it is powered on or reset. Write the control word 0x000F to the drive control register to enable the device to operate.

2 Enabling Torque Mode

To enable location mode, you need to write 0X04 to the registers for 6060h first. View the current motion mode from the register 6061h.

3 Set Run Parameters

Target speed (6081h), target torque (6071h), and torque slope (6087h) are set.

4 Start/Stop Running

After writing the above operation parameters for the position operation, set bit4 of the control word to 1 and start the motor operation. During the operation of the motor, the bit8 position of the control word will be set and the motor will be suspended.

CRC Check

➢ C Programming Language

The function's return value CRC is of type 'unsigned short'.

```
unsigned char *PMSG; //To generate a CRC value, point the pointer to a buffer containing binary
unsigned short DataLen; //data
unsigned short CRC16(PMSG, DataLen)
{
    unsigned char uchCRCHi = 0xFF ; /* Initialize high byte*/
    unsigned char uchCRCLo = 0xFF ;/* Initialize low byte*/
    unsigned uIndex ;
    while (DataLen—)
    {
        uIndex = uchCRCHi ^ *PMSG++ ; /*counter CRC*/
        uchCRCHi = uchCRCLo ^ auchCRCHi[uIndex] ;
        uchCRCLo = auchCRCLo[uIndex] ;
    }
    return (uchCRCHi<< 8 | uchCRCLo) ;
}
```

➢ C# Programming Language

```
using System;
using System.Collections.Generic;
using System.Text;
namespace Modbus
{
    public static class Utility
    {
        private static readonlyushort[] m_CrcTable =
        {
            0X0000, 0XC0C1, 0XC181, 0X0140, 0XC301, 0X03C0, 0X0280, 0XC241,
            0XC601, 0X06C0, 0X0780, 0XC741, 0X0500, 0XC5C1, 0XC481, 0X0440,
            0XCC01, 0X0CC0, 0X0D80, 0XCD41, 0X0F00, 0XCFC1, 0XCE81, 0X0E40,
            0X0A00, 0XCAC1, 0XCB81, 0X0B40, 0XC901, 0X09C0, 0X0880, 0XC841,
            0XD801, 0X18C0, 0X1980, 0XD941, 0X1B00, 0XDBC1, 0XDA81, 0X1A40,
            0X1E00, 0XDEC1, 0XDF81, 0X1F40, 0XDD01, 0X1DC0, 0X1C80, 0XDC41,
            0X1400, 0XD4C1, 0XD581, 0X1540, 0XD701, 0X17C0, 0X1680, 0XD641,
            0XD201, 0X12C0, 0X1380, 0XD341, 0X1100, 0XD1C1, 0XD081, 0X1040,
            0XF001, 0X30C0, 0X3180, 0XF141, 0X3300, 0XF3C1, 0XF281, 0X3240,
            0X3600, 0XF6C1, 0XF781, 0X3740, 0XF501, 0X35C0, 0X3480, 0XF441,
```

```
            0X3C00, 0XFCC1, 0XFD81, 0X3D40, 0XFF01, 0X3FC0, 0X3E80, 0XFE41,
            0XFA01, 0X3AC0, 0X3B80, 0XFB41, 0X3900, 0XF9C1, 0XF881, 0X3840,
            0X2800, 0XE8C1, 0XE981, 0X2940, 0XEB01, 0X2BC0, 0X2A80, 0XEA41,
            0XEE01, 0X2EC0, 0X2F80, 0XEF41, 0X2D00, 0XEDC1, 0XEC81, 0X2C40,
            0XE401, 0X24C0, 0X2580, 0XE541, 0X2700, 0XE7C1, 0XE681, 0X2640,
            0X2200, 0XE2C1, 0XE381, 0X2340, 0XE101, 0X21C0, 0X2080, 0XE041,
            0XA001, 0X60C0, 0X6180, 0XA141, 0X6300, 0XA3C1, 0XA281, 0X6240,
            0X6600, 0XA6C1, 0XA781, 0X6740, 0XA501, 0X65C0, 0X6480, 0XA441,
            0X6C00, 0XACC1, 0XAD81, 0X6D40, 0XAF01, 0X6FC0, 0X6E80, 0XAE41,
            0XAA01, 0X6AC0, 0X6B80, 0XAB41, 0X6900, 0XA9C1, 0XA881, 0X6840,
            0X7800, 0XB8C1, 0XB981, 0X7940, 0XBB01, 0X7BC0, 0X7A80, 0XBA41,
            0XBE01, 0X7EC0, 0X7F80, 0XBF41, 0X7D00, 0XBDC1, 0XBC81, 0X7C40,
            0XB401, 0X74C0, 0X7580, 0XB541, 0X7700, 0XB7C1, 0XB681, 0X7640,
            0X7200, 0XB2C1, 0XB381, 0X7340, 0XB101, 0X71C0, 0X7080, 0XB041,
            0X5000, 0X90C1, 0X9181, 0X5140, 0X9301, 0X53C0, 0X5280, 0X9241,
            0X9601, 0X56C0, 0X5780, 0X9741, 0X5500, 0X95C1, 0X9481, 0X5440,
            0X9C01, 0X5CC0, 0X5D80, 0X9D41, 0X5F00, 0X9FC1, 0X9E81, 0X5E40,
            0X5A00, 0X9AC1, 0X9B81, 0X5B40, 0X9901, 0X59C0, 0X5880, 0X9841,
            0X8801, 0X48C0, 0X4980, 0X8941, 0X4B00, 0X8BC1, 0X8A81, 0X4A40,
            0X4E00, 0X8EC1, 0X8F81, 0X4F40, 0X8D01, 0X4DC0, 0X4C80, 0X8C41,
            0X4400, 0X84C1, 0X8581, 0X4540, 0X8701, 0X47C0, 0X4680, 0X8641,
            0X8201, 0X42C0, 0X4380, 0X8341, 0X4100, 0X81C1, 0X8081, 0X4040
        };
//Calculate vertical redundancy check
//Parameters: 'data' for LRC operations
//Return value: LRC calculation result
    public static byte CalculateLrc(byte[] data)
    {
        if (data == null)
        {
            thrownewArgumentNullException("data");
        }

        byte lrc = 0;

        foreach (byte b in data)
        {
            lrc += b;
        }

        lrc = (byte)((lrc ^ 0xFF) + 1);
        return lrc;
    }
// Calculate the period redundancy check
// parameter: 'data' is used for CRC calculation
// Return value: CRC calculation result
    public static byte CalculateLrc(byte[] data)
```

```
        {
            if (data == null)
            {
                thrownewArgumentNullException("data");
            }

            ushortcrc = ushort.MaxValue;

            foreach (byte b in data)
            {
                byte tableIndex = (byte)(crc ^ b);
                crc>>= 8;
                crc ^= m_CrcTable[tableIndex];
            }
            return BitConverter.GetBytes(crc);
         }
    }
}


//The following is the calling method:
byte[] _Data = new byte[] { 0x18, 0x18};
byte[] _Crc = Modbus.Utility.CalculateCrc(_Data);
```

Example

Example—Motion control with Modbus-RTU

➢ Example 1 Profile Position Mode

Notice:Register 0x6000=0 and all values are hexadecimal
/***** Power-on & Enable ***** /
01 06 60 40 00 01 57 DE 'Drive initialization'
01 06 60 40 00 03 D6 1F 'Loosens the brake'
01 06 60 40 00 0F D6 1A 'Power the Motor and its operation is enabled'

/***** Set operation mode to PP *****/
01 06 60 60 00 01 56 14 'Set operation mode to profile position mode'

/***** Set parameters for the position mode *****/
01 10 60 81 00 02 04 00 00 00 0A 12 06 'Set profile velocity to 1RPS'
01 06 60 83 00 64 67 C9 'Set profile acceleration 10RPS/S'
01 06 60 84 00 64 D6 08 'Set profile deceleration 10RPS/S'

These can also be written in function code 0x10 at once:
01 10 60 81 00 04 08 00 00 00 0A 00 64 00 64 10 52

/***** Single point motion *****/
01 10 60 7A 00 02 04 00 03 0D 40 29 96 'Set target position to 200000 steps'

If user want to motor running opposite direction, the negation should be taken for positive value (e.g. 200000) and then add 1. For example, if you want to motor running to -200000 steps, you should negate $(00\ 03\ 0D\ 40)_H$ to $(FF\ FC\ F2\ BF)_H$ and then add 1 to $(FF\ FC\ F2\ C0)_H$. This value represents the distance of motion equaling to 200000 steps, but its direction is opposite.
(01 10 60 7A 00 02 04 FF FC F2 C0 69 E2 'Set target position to -200000 steps')

01 06 60 40 00 1F D7 D6 'Setting new position and running'
01 06 60 40 00 0F D6 1A 'The bit4 of controlword should be set to 0 for setting next position'
/**************************/

/***** The absolute motion between two points, and stay before running second point *****/
01 10 60 81 00 02 04 00 00 00 32 13 D4 'Set profile velocity 5RPS'
01 10 60 7A 00 02 04 00 03 0D 40 29 96 'Set target position to 200000 steps'
01 06 60 40 00 1F D7 D6 'Setting new position and running'
01 06 60 40 00 0F D6 1A 'The bit4 of controlword should be set to 0 for setting next position'
01 10 60 81 00 02 04 00 00 00 64 93 EA 'Set the velocity of second position to 10RPS'

01 10 60 7A 00 02 04 00 09 27 C0 17 54 ‘Set the second position to 600000’
01 06 60 40 00 1F D7 D6 ‘Setting new position and readying’
/***/

/***** The relation motion between two points, and don’t stay before running second point *****/
01 10 60 81 00 02 04 00 00 00 32 13 D4 ‘Set profile velocity 5RPS’
01 10 60 7A 00 02 04 00 03 0D 40 29 96 ‘Set target position to 200000 steps’
01 06 60 40 02 5F D7 46 ‘Setting new position and running’
01 06 60 40 02 4F D6 8A ‘The bit4 of controlword should be set to 0 for setting next position’
01 10 60 81 00 02 04 00 00 00 64 93 EA ‘Set the velocity of second position to 10RPS’
01 10 60 7A 00 02 04 00 09 27 C0 17 54 ‘Set the second position to 600000’
01 06 60 40 02 5F D7 46 ‘Setting new position and readying’
/**/

/*****Multi-point motion, directly changes the running speed*****/
01 10 60 81 00 02 04 00 00 00 32 13 D4 ‘Set profile velocity 5RPS’
01 10 60 7A 00 02 04 00 03 0D 40 29 96 ‘Set target position to 200000 steps’
01 06 60 40 00 7F D7 FE ‘Setting new position and running’
01 06 60 40 00 6F D6 32 ‘The bit4 of controlword should be set to 0 for setting next position’
01 10 60 81 00 02 04 00 00 00 64 93 EA ‘Set the velocity of second position to 10RPS’
01 10 60 7A 00 02 04 00 09 27 C0 17 54 ‘Set the second position to 600000’
01 06 60 40 00 7F D6 9E ‘Setting new position and directly running’
/**/

➢ Example 2 Profile Velocity Mode

Notice:Register 0x6000=0 and all values are hexadecimal
/***** Power-on & Enable ***** /
01 06 60 40 00 01 57 DE ‘Drive initialization’
01 06 60 40 00 03 D6 1F ‘Loosens the brake’
01 06 60 40 00 0F D6 1A ‘Power the Motor and its operation is enabled’

/***** Set operation mode to PV *****/
01 06 60 60 00 03 D7 D5 ‘Set operation mode to profile velocity mode’
01 06 60 40 01 0F D7 8A ‘Stop motor’

/***** Set parameters for the velocity mode *****/
01 10 60 81 00 02 04 00 00 00 0A 12 06 ‘Set profile velocity to 1RPS’

If user want to motor reverses, the negation should be taken for the positive value (e.g. $0A_h$) and then add 1. For example, if you want to motor running to -1 RPS, you should negate $(00\ 00\ 00\ 0A)_h$ to $(FF\ FF\ FF\ F5)_h$ and then add 1 to $(FF\ FF\ FF\ F6)_h$. This value represents the velocity of motion equaling to 1 RPS, but its direction is opposite.
(01 10 60 81 00 02 04 FF FF FF F6 53 93 ‘Set profile velocity to -1 RPS’)

01 06 60 83 00 64 67 C9 ‘Set profile acceleration 10RPS/S’
01 06 60 84 00 64 D6 08 ‘Set profile deceleration 10RPS/S’

These can also be written in function code 0x10 at once:
01 10 60 81 00 04 08 00 00 00 0A 00 64 00 64 10 52

/***** Run/Stop *****/
01 06 60 40 00 0F D6 1A ‘Run’
01 10 60 81 00 02 04 00 00 00 64 93 EA ‘Set profile velocity to 10RPS’
01 06 60 40 01 0F D7 8A ‘Stop’

➢ Example 3 Homing Mode

Notice:Register 0x6000=0 and all values are hexadecimal
/***** Power-on & Enable ***** /
01 06 60 40 00 01 57 DE ‘Drive initialization’
01 06 60 40 00 03 D6 1F ‘Loosens the brake’
01 06 60 40 00 0F D6 1A ‘Power the Motor and its operation is enabled’

/***** Set operation mode to HM *****/
01 06 60 60 00 06 17 D6 ‘Set operation mode to homing mode’

/***** Set parameters for the homing mode *****/
01 06 60 98 00 01 D7 E5 ‘Set homing method to 1’
01 06 60 9A 03 E8 B7 5B ‘Set homing acceleration 100RPS/S’
01 10 60 99 00 02 04 00 00 00 64 93 40 ‘Set homing speeds to 10RPS’
01 10 60 9B 00 02 04 00 00 00 64 12 99 ‘Set speed of finding zero origin to 10RPS’
01 10 60 7C 00 02 04 00 00 03 E8 5C 62 ‘Set homing offset to 1000’

These can also be written in function code 0x10 at once:
01 10 60 7C 00 08 10 00 00 03 E8 00 01 00 00 00 64 03 E8 00 00 00 64 09 42

/***** Run/Stop *****/
01 06 60 40 00 0F D6 1A ‘Run’
01 06 60 40 01 0F D7 8A ‘Stop’

➢ Example 4 Profile Torque Mode

Torque Mode Code Routine（**0x6000=0**）:

```
/***** Power-on & Enable ***** /
01 06 60 40 00 01 57 DE        'Drive initialization'
01 06 60 40 00 03 D6 1F        'Loosens the brake'
01 06 60 40 00 0F D6 1A        'Power the Motor and its operation is enabled'

*****Set to Torque Mode *****
01 06 60 60 00 0496 17 "Set to Torque Mode"

*****Setting Torque Parameters *****
01 10 60 81 00 02 04 00 00 00 64 93 EA'Set target speed to 10rps '
01 06 60 71 01 F4 C7 C6                   'Set target torque to 500‰ '
01 06 60 87 03 E8 27 5D                   'Set Torque Slope 1000‰ '

/***** Run/Stop *****/
01 06 60 40 00 1F D7 D6  'Run'
01 06 60 40 01 1F D6 46  'Stop'
```

Example— Motion control with CANopen

➢ Setting PDO

1 RPDO Configuration

Configure the node 3 to receive PDOs for each synchronization message, andmapping controlword 6040_h and target position $607A_h$ to it.

ID	Data
603	23 02 14 01 03 02 00 00
603	2F 02 14 02 01 00 00 00
603	2F 02 16 00 00 00 00 00
603	23 02 16 01 10 00 40 60
603	23 02 16 02 20 00 7A 60
603	2F 02 16 00 02 00 00 00

Notice:All values are hexadecimal.

2 TPDO Configuration

Configure the node 3 to transmit PDOs for each synchronization message, and mapping statusword 6041_h and position actual value 6064_h to it.

ID	Data
603	23 01 18 01 83 01 00 00
603	2F 01 18 02 01 00 00 00
603	2F 01 1A 00 00 00 00 00
603	23 01 1A 01 10 00 41 60
603	23 01 1A 02 20 00 64 60
603	2F 01 1A 00 02 00 00 00

Notice:All values are hexadecimal.

➢ Example 1 Profile Position Mode

Notice:All values are hexadecimal.

/***** CIA301 State Machine *****/

$000 $2 $01 $00 ‘From Pre-Operation state to Operating state’

/***** Power-on & Enable ***** /

$0603 $8 $2B $40 $60 $00 $01 $00 $00 $00 ‘Drive initialization’

$0603 $8 $2B $40 $60 $00 $03 $00 $00 $00 ‘Loosens the brake’

$0603 $8 $2B $40 $60 $00 $0F $00 $00 $00 ‘Power the Motor and its operation is enabled’

/***** Set operation mode to PP *****/
$0603 $8 $2F $60 $60 $00 $01 $00 $00 $00 ‘Set operation mode to profile position mode’

/***** Set parameters for the position mode*****/
$0603 $8 $23 $81 $60 $00 $0A $00 $00 $00 ‘Set profile velocity to 1RPS’
$0603 $8 $2B $83 $60 $00 $E8 $03 $00 $00 ‘Set profile acceleration 100RPS/S’
$0603 $8 $2B $84 $60 $00 $E8 $03 $00 $00 ‘Set profile deceleration 100RPS/S’

/***** Single point motion *****/
$0603 $8 $23 $7A $60 $00 $40 $0D $03 $00 ‘Set target position to 200000 steps’

If user want to motor running opposite direction, the negation should be taken for positive value (e.g. 200000) and then add 1. For example, if you want to motor running to -200000 steps, you should negate $(00\ 03\ 0D\ 40)_h$ to $(FF\ FC\ F2\ BF)_h$ and then add 1 to $(FF\ FC\ F2\ C0)_h$. This value represents the distance of motion equaling to 200000 steps, but its direction is opposite.
($0603 $8 $23 $7A $60 $00 $C0 $F2 $FC $FF ‘Set target position to -200000 steps’)

$0603 $8 $2B $40 $60 $00 $1F $00 $00 $00 ‘Setting new position and running’
$0603 $8 $2B $40 $60 $00 $0F $00 $00 $00 ‘The bit4 of controlword should be set to 0 for setting next position’
/**************************/

/***** The absolute motion between two points, and stay before running second point *****/
$0603 $8 $23 $81 $60 $00 $32 $00 $00 $00 ‘Set profile velocity 5RPS’
$0603 $8 $23 $7A $60 $00 $40 $0D $03 $00 ‘Set target position to 200000 steps’
$0603 $8 $2B $40 $60 $00 $5F $00 $00 $00 ‘Setting new position and running’
$0603 $8 $2B $40 $60 $00 $4F $00 $00 $00 ‘The bit4 of controlword should be set to 0 for setting next position’
$0603 $8 $23 $81 $60 $00 $64 $00 $00 $00 ‘Set the velocity of second position to 10RPS’
$0603 $8 $23 $7A $60 $00 $C0 $27 $09 $00 ‘Set the second position to 600000’
$0603 $8 $2B $40 $60 $00 $5F $00 $00 $00 ‘Setting new position and readying’
$0603 $8 $2B $40 $60 $00 $4F $00 $00 $00 ‘The bit4 of controlword should be set to 0 for setting next position’
/***/

/***** The relation motion between two points, and don’t stay before running second point *****/
$0603 $8 $23 $81 $60 $00 $32 $00 $00 $00 ‘Set profile velocity 5RPS’
$0603 $8 $23 $7A $60 $00 $40 $0D $03 $00 ‘Set target position to 200000 steps’
$0603 $8 $2B $40 $60 $00 $5F $02 $00 $00 ‘Setting new position and running’
$0603 $8 $2B $40 $60 $00 $4F $02 $00 $00 ‘The bit4 of controlword should be set to 0 for setting next position’
$0603 $8 $23 $81 $60 $00 $64 $00 $00 $00 ‘Set the velocity of second position to 10RPS’
$0603 $8 $23 $7A $60 $00 $C0 $27 $09 $00 ‘Set the second position to 600000’
$0603 $8 $2B $40 $60 $00 $5F $02 $00 $00 ‘Setting new position and readying’
$0603 $8 $2B $40 $60 $00 $4F $02 $00 $00 ‘The bit4 of controlword should be set to 0 for setting

next position'
/**/

/*****Multi-point motion, directly changes the running speed*****/

$0603 $8 $23 $81 $60 $00 $32 $00 $00 $00	'Set profile velocity 5RPS'
$0603 $8 $23 $7A $60 $00 $40 $0D $03 $00	'Set target position to 200000 steps'
$0603 $8 $2B $40 $60 $00 $7F $02 $00 $00	'Setting new position and running'
$0603 $8 $2B $40 $60 $00 $6F $02 $00 $00	'The bit4 of controlword should be set to 0 for setting next position'
$0603 $8 $23 $81 $60 $00 $64 $00 $00 $00	'Set the velocity of second position to 10RPS'
$0603 $8 $23 $7A $60 $00 $C0 $27 $09 $00	'Set the second position to 600000'
$0603 $8 $2B $40 $60 $00 $7F $02 $00 $00	'Setting new position and directly running'
$0603 $8 $2B $40 $60 $00 $6F $02 $00 $00	'The bit4 of controlword should be set to 0 for setting next position'

/***/

➢ Example 2 Profile Velocity Mode

Notice:All values are hexadecimal.

/***** CIA301 State Machine *****/

$000 $2 $01 $00 'From Pre-Operation state to Operating state'

/***** Power-on & Enable ***** /

$0603 $8 $2B $40 $60 $00 $01 $00 $00 $00	'Drive initialization'
$0603 $8 $2B $40 $60 $00 $03 $00 $00 $00	'Loosens the brake'
$0603 $8 $2B $40 $60 $00 $0F $00 $00 $00	'Power the Motor and its operation is enabled'

/***** Set operation mode to PV *****/

$0603 $8 $2F $60 $60 $00 $03 $00 $00 $00 'Set operation mode to profile velocity mode'

/***** Set parameters for the velocity mode *****/

$0603 $8 $23 $81 $60 $00 $0A $00 $00 $00 'Set profile velocity to 1RPS'

If user want to motor reverses, the negation should be taken for the positive value (e.g. $0A_h$) and then add 1. For example, if you want to motor running to -1RPS, you should negate $(00\ 00\ 00\ 0A)_h$ to $(FF\ FF\ FF\ F5)_h$ and then add 1 to $(FF\ FF\ FF\ F6)_h$. This value represents the velocity of motion equaling to 1RPS, but its direction is opposite.

($0603 $8 $23 $81 $60 $00 $F6 $FF $FF $FF 'Set profile velocity to -1RPS')

$0603 $8 $2B $83 $60 $00 $E8 $03 $00 $00	'Set profile acceleration 100RPS/S'
$0603 $8 $2B $84 $60 $00 $E8 $03 $00 $00	'Set profile deceleration 100RPS/S'

/***** Run/Stop *****/

$0603 $8 $2B $40 $60 $00 $0F $00 $00 $00	'Run'
$0603 $8 $23 $81 $60 $00 $64 $00 $00 $00	'Set profile velocity to 10RPS'

$0603 $8 $2B $40 $60 $00 $0F $01 $00 $00 ‘Stop’

➢ Example 3 Homing Mode

Notice:All values are hexadecimal.
/***** CIA301 State Machine *****/
$000 $2 $01 $00 ‘From Pre-Operation state to Operating state’

/***** Power-on & Enable ***** /
$0603 $8 $2B $40 $60 $00 $01 $00 $00 $00 ‘Drive initialization’
$0603 $8 $2B $40 $60 $00 $03 $00 $00 $00 ‘Loosens the brake’
$0603 $8 $2B $40 $60 $00 $0F $00 $00 $00 ‘Power the Motor and its operation is enabled’

/***** Set operation mode to HM *****/
$0603 $8 $2F $60 $60 $00 $06 $00 $00 $00 ‘Set operation mode to homing mode’

/***** Set parameters for the homing mode *****/
$0603 $8 $2F $98 $60 $00 $01 $00 $00 $00 ‘Set homing method to 1’
$0603 $8 $2B $9A $60 $00 $E8 $03 $00 $00 ‘Set homing acceleration 100RPS/S’
$0603 $8 $23 $99 $60 $01 $0A $00 $00 $00 ‘Set speed during search for switch to 1RPS’
$0603 $8 $23 $99 $60 $02 $05 $00 $00 $00 ‘Set speed during search for zero to 0.5RPS’

/***** Run/Stop *****/
$0603 $8 $2B $40 $60 $00 $1F $00 $00 $00 ‘Run’
$0603 $8 $2B $40 $60 $00 $1F $01 $00 $00 ‘Stop’

➢ Example 4Profile Torque Mode

/***** CIA301 State Machine *****/
$000 $2 $01 $00 ‘From Pre-Operation state to Operating state’

/***** Power-on & Enable ***** /
ID DLC Data
$0603 $8 $2B $40 $60 $00 $01 $00 $00 $00 ‘Drive initialization’
$0603 $8 $2B $40 $60 $00 $03 $00 $00 $00 ‘Loosens the brake’
$0603 $8 $2B $40 $60 $00 $0F $00 $00 $00 ‘Power the Motor and its operation is enabled’

**** Set Torque Mode ****
$0603 $8 $2F $60 $60 $00 $04 $00 $00 $00 ‘Set Torque Mode’

**** Setting Torque Parameters ****
$0603 $8 $23 $81 $60 $00 $0A $00 $00 $00 ‘Set target speed to 1rps’

$0603 $8 $2B $71 $60 $00 $F4 $01 $00 $00 ‘Set target torque to 500‰’
$0603 $8 $2B $87 $60 $00 $E8 $03 $00 $00 ‘Set Torque Slope 1000‰’

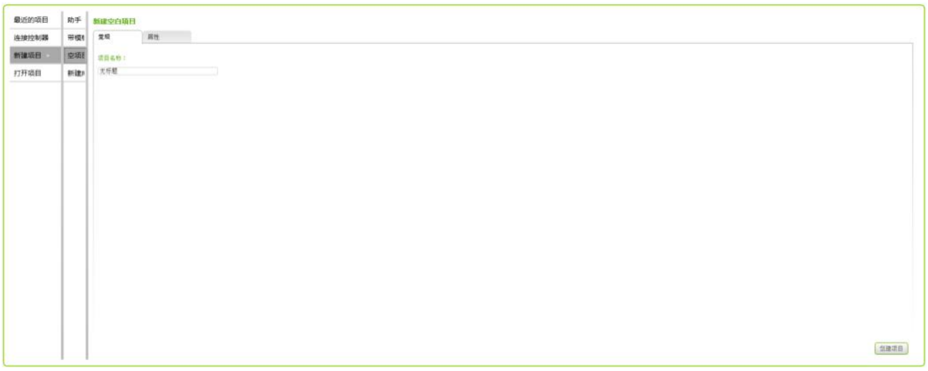
**** Start/Stop Running ****
$0603 $8 $2B $40 $60 $00 $1F $00 $00 $00‘Run’
$0603 $8 $2B $40 $60 $00 $1F $01 $00 $00 ‘Stop’

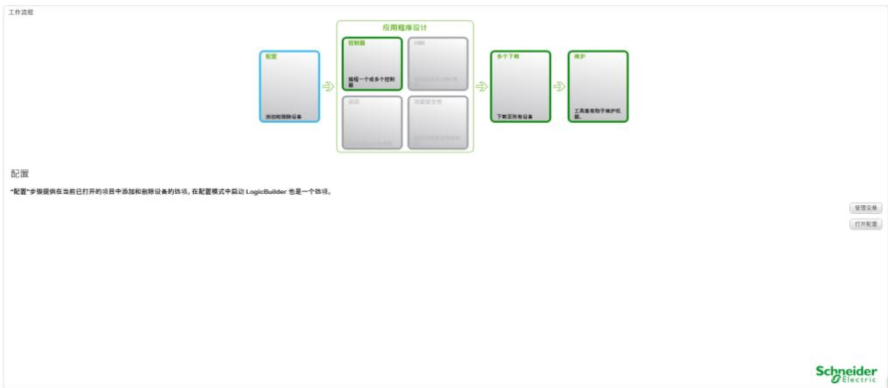
Appendix

Modbus-RTU communication in Schneider controller

➢ Create New Project

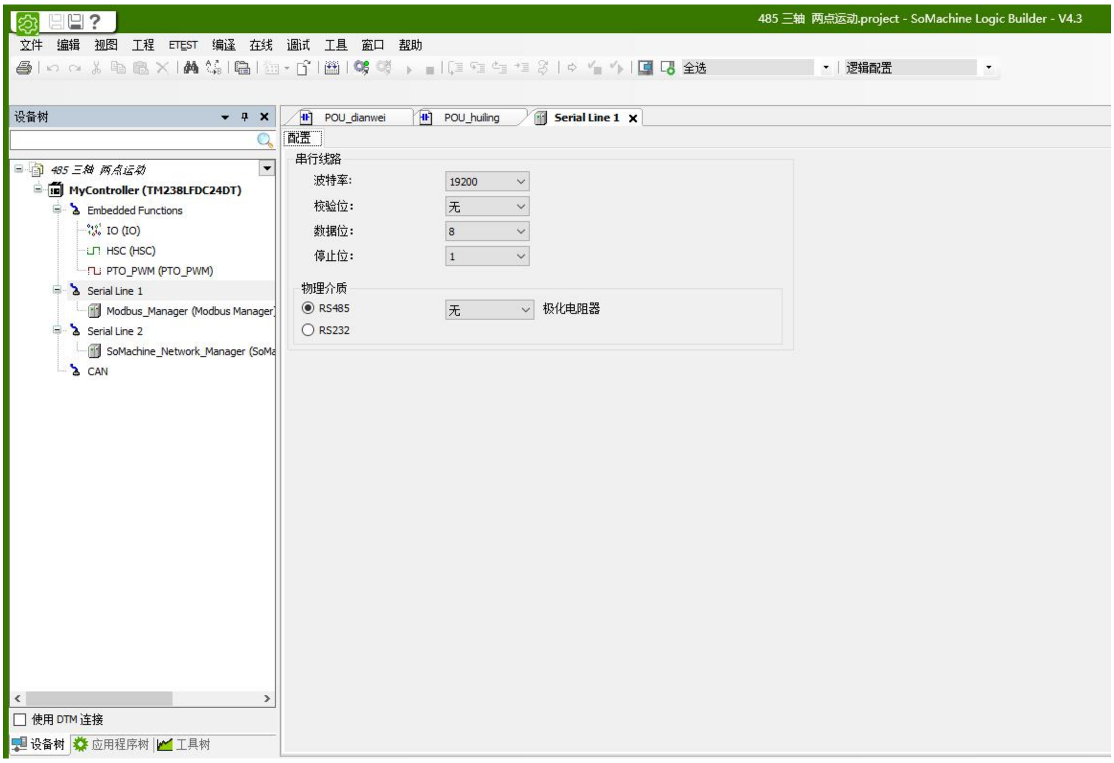
Open the software SoMachine V4.3 → New project → Empty project → Create project → Manage Devices → Add a controller to your project → OK



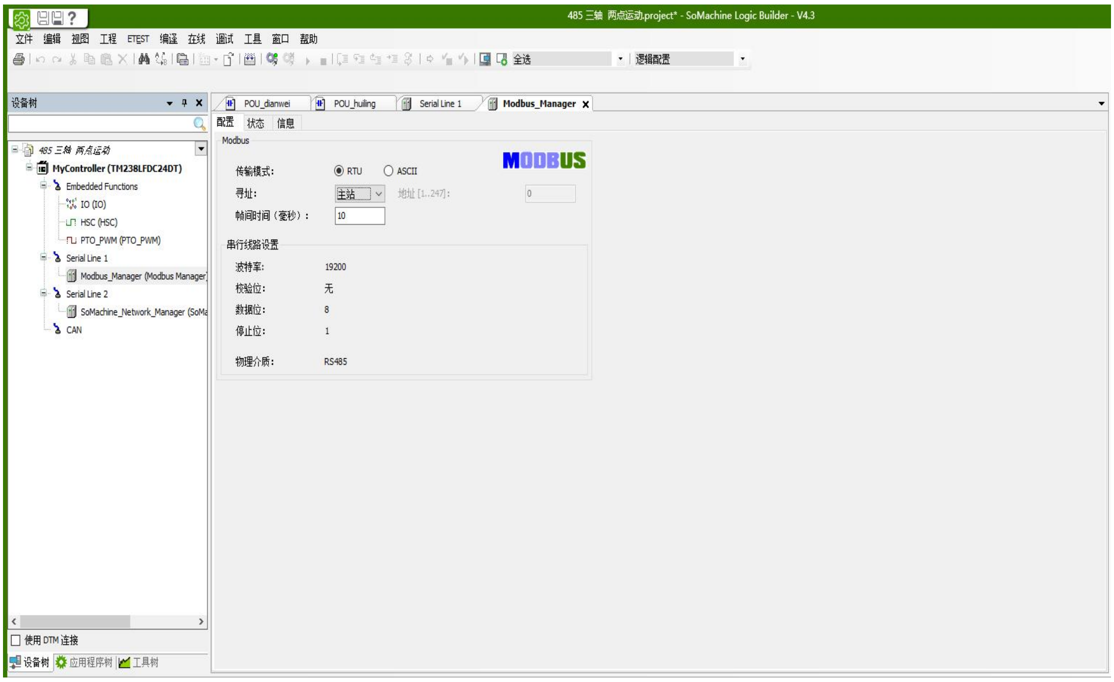


➢ Setting Parameter

Open configuration → Devices tree → Double-click Serial Line 1 → Change Check bit to None, Data bit to 8, Stop bit to 1;



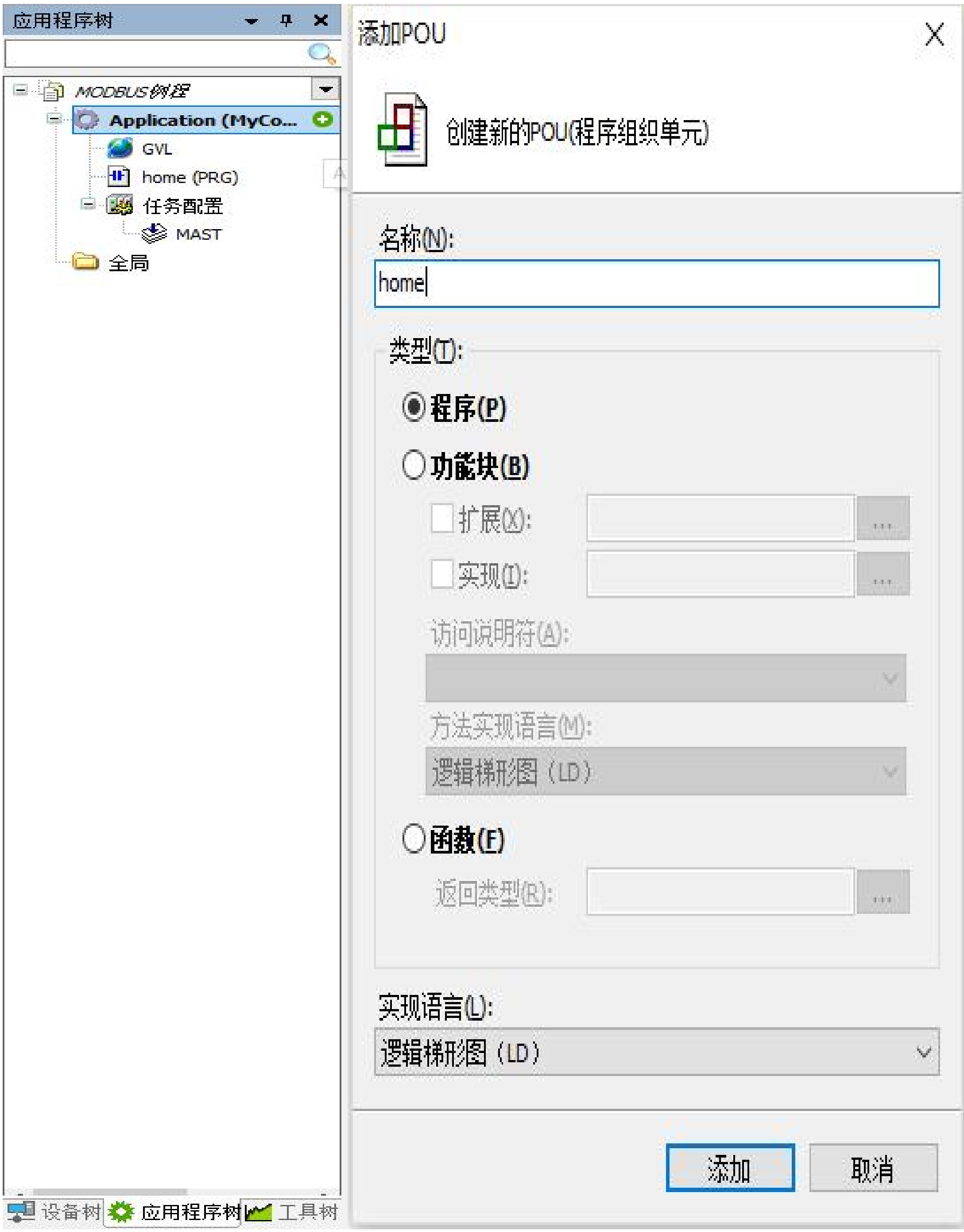
Double-click Modbus_Manager→ Change Addressing to Master;



➢ Create POU

Application tree → Click the plus sign of Application

Create POU → Type: Program, Implementation language: Ladder Logic Diagram → Add



➢ Function Block

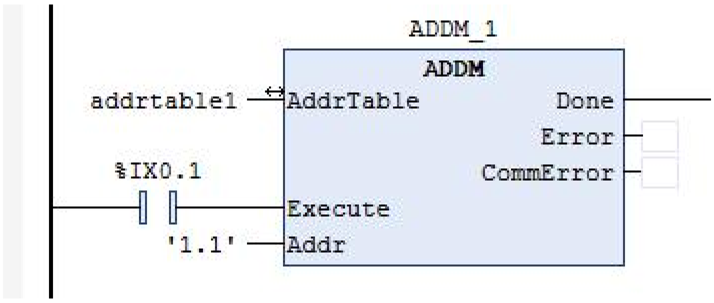
1 ADDM

The ADDM function block converts a destination address that is represented as a string to an ADDRESS structure.

Addrtable: This is the ADDRESS structure to be filled by the function block.
Execute: Executes the function at the rising edge.

Addr: Address in STRING type to be converted in ADDRESS type (see details below).

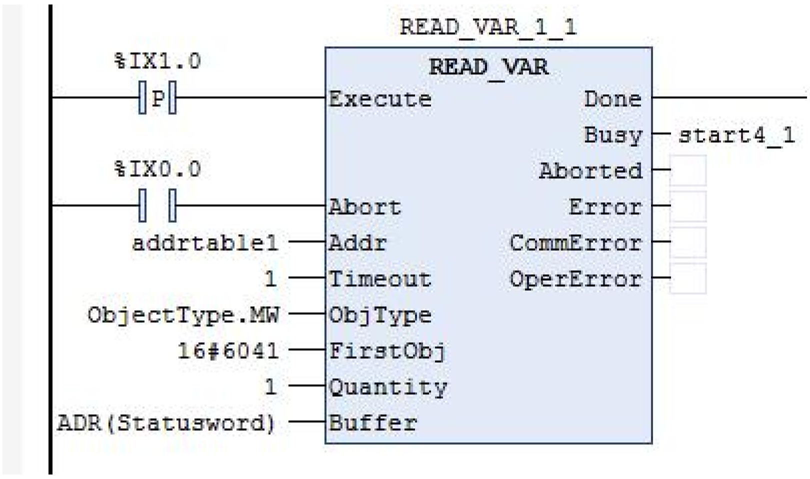
For example, ADDM converts the address of slave 1 on serial line 1 from the string '1.1' to an ADDRESS type.



2 READ_VAR

The READ_VAR function block reads data from an external device in the Modbus protocol.

Execute: The function is executed on the rising edge of this input.
Abort: Aborts the ongoing operation at the rising edge.
Addr: Address of the targeted external device (can be the output of the ADDM function block)
Timeout: Exchange timeout is a multiple of 100 ms (0 for infinite).
ObjType: ObjType is the type of object to be read (MW, I, IW, Q).
FirstObj: FirstObj is the index of the first object to be read.
Quantity: Quantity is the number of objects to be read.
Buffer: Buffer is the address of the buffer in which object values are stored.
Done: Done is set to TRUE when the function is completed successfully.
Busy: Busy is set to TRUE while the function is ongoing.
Aborted: Aborted is set to TRUE when the function is aborted with the Abort input.

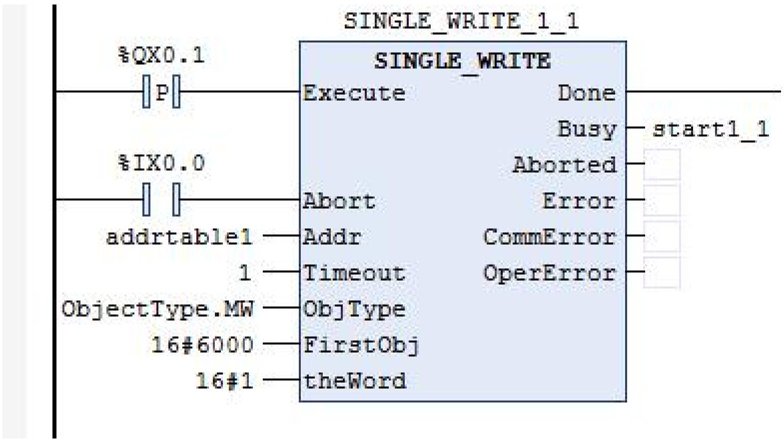


3 SINGLE_WRITE

The SINGLE_WRITE function block writes a single internal register to an external Modbus device.

Execute: The function is executed on the rising edge of this input.

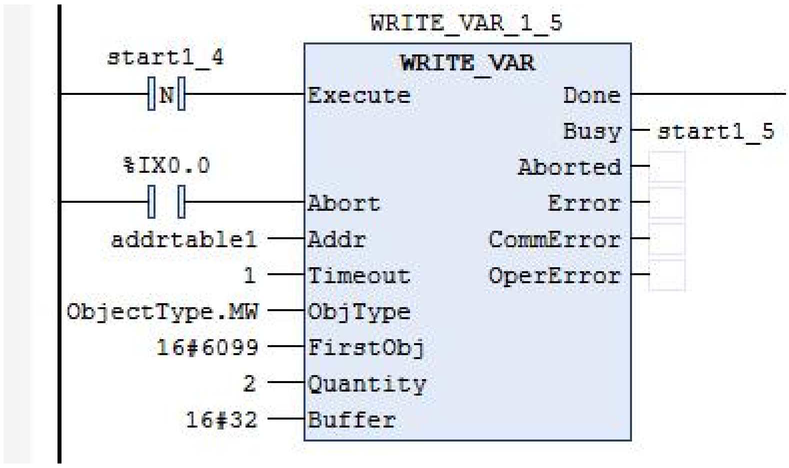
Abort: Aborts the ongoing operation at the rising edge.
Addr: Address of the targeted external device (can be the output of the ADDM function block).
Timeout: Exchange timeout is a multiple of 100 ms (0 for infinite).
ObjType: ObjType describes the type of object(s) to write (MW only).
FirstObj: FirstObject is the index of the object to write.
TheWord: This input contains the value to write.
Done: Done is set to TRUE when the function is completed successfully.
Busy: Busy is set to TRUE while the function is ongoing.
Aborted: Aborted is set to TRUE when the function is aborted with the Abort input.



4 WRITE_VAR

The WRITE_VAR function block writes data to an external device in the Modbus protocol.

Execute: The function is executed on the rising edge of this input.
Abort: Aborts the ongoing operation at the rising edge.
Addr: Address of the targeted external device (can be the output of the ADDM function block).
Timeout: Exchange timeout is a multiple of 100 ms (0 for infinite).
ObjType: ObjType describes the type of object(s) to write (MW, Q).
FirstObj: FirstObj is the index of the first object to write.
Quantity: Quantity is the number of objects to be read.
Buffer: Buffer is the address of the buffer in which object values are stored.
Done: Done is set to TRUE when the function is completed successfully.
Busy: Busy is set to TRUE while the function is ongoing.
Aborted: Aborted is set to TRUE when the function is aborted with the Abort input.



➢ Programming

1 Homing Mode

Create POU→ Double-click, Programming→ Use function block to send message.

1.1 Message Description

01 06 60 00 00 01	Register high and low bits are exchanged	(USE SINGLE_WRITE)
01 06 60 40 00 01	Driver initialization	(USE SINGLE_WRITE)
01 06 60 40 00 03	Loosens the brake	(USE SINGLE_WRITE)
01 06 60 40 00 0F	Enable motor	(USE SINGLE_WRITE)
01 06 60 60 00 06	Setting operation mode	(USE SINGLE_WRITE)
01 06 60 98 00 05	Setting homing method	(USE SINGLE_WRITE)

01 10 60 99 00 02 04 00 00 00 32 Setting speed of find zero (USE WRITE_VAR)
(32_h=50_d, it represents for speed of find zero which is 5r/s, that is, 300r/min)

01 06 60 9A 00 64 Setting homing acceleration (USE SINGLE_WRITE)
(64_h=100_d, it represents for actual homing acceleration which is 10rps/s)

01 06 60 40 00 1F Start homing (USE SINGLE_WRITE)

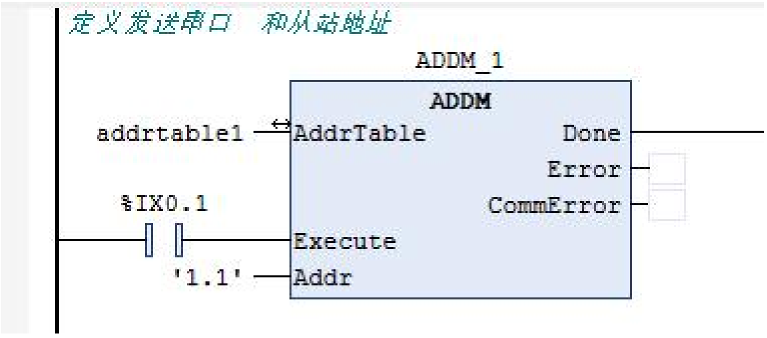
Notice:All values are hexadecimal and Check codes have not been added at the end of all messages.

1.2 Use ADDM

For example, ADDM converts the address of slave 1 on serial line 1 from the string ‘1.1’ to an ADDRESS type.

%IX0.1: Take a rising edge to Execute.

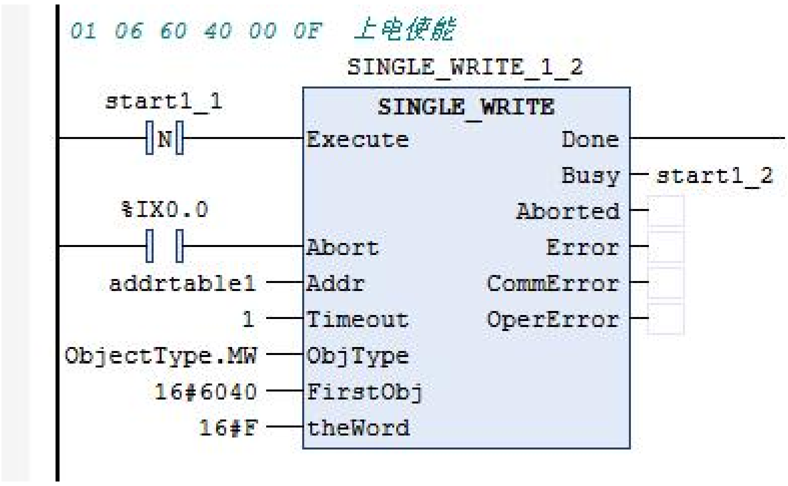
Addrtable1: This an ADDRESS type and this value according to Addr, to store Slave ID.



1.3 Use SINGLE_WRITE

Example: Send the message 01 06 60 40 00 0F

Execute: Take a rising edge to execute function block by start1_1.
Abort: Take a rising edge to abort running function block.
Addr: Device address, according to addrtable1.
Timeout: The '1' means 100ms.
ObjType: What type data will be written (only MW).
FirstObj: The register 0x6040 is written as an object.
TheWord: Write data 16#F(16_h).
Done: Done is set to TRUE when the function is completed successfully.
Busy: Busy is set to TRUE while the function is ongoing.
Aborted: Aborted is set to TRUE when the function is aborted with the Abort input.

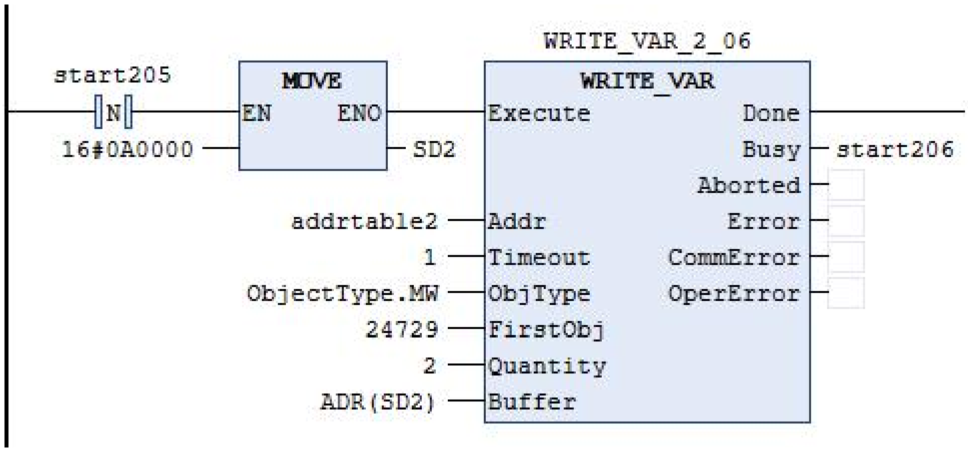


1.4 Use WRITE_VAR

Example: Send message 01 10 60 99 00 02 04 00 00 00 0A (Setting speed of find zero)

Execute: Take a rising edge to execute function block by start205.
Abort: Take a rising edge to abort running function block.
Addr: Device address, according to addrtable2.
Timeout: The '1' means 100ms.
ObjType: What type data will be written (only MW).
FirstObj: The register 24729(6099_h) is written as an object.

Quantity: Because register 0x6099 is a 32bit register, the Quantity is 2 (2*16bit).
Buffer: The address of data is SD2 that data will be written.
Done: Done is set to TRUE when the function is completed successfully.
Busy: Busy is set to TRUE while the function is ongoing.
Aborted: Aborted is set to TRUE when the function is aborted with the Abort input.



2 Profile Position Mode

Create POU→ Double-click, Programming→ Use function block to send message.

2.1 Message Description

01 06 60 00 00 01 Register high and low bits are exchanged (SINGLE_WRITE)
01 06 60 40 00 0F Enable motor (SINGLE_WRITE)
01 06 60 60 00 01 Setting operation mode (SINGLE_WRITE)

01 10 60 81 00 02 04 00 00 00 64 Setting profile velocity (WRITE_VAR)
(64_h=100_d, it represents for profile velocity which is 10r/s, that is, 600r/min)

01 10 60 83 00 02 04 00 C8 00 C8 Setting acceleration and deceleration (WRITE_VAR)
($C8_h$=200_d, it represents for profile acceleration which is 20rps/s)

01 10 60 7A 00 02 04 00 03 0D 40 Setting target position (WRITE_VAR)
($030D40_h$=200000_d, it represents for motor shaft turning 50 circle)

01 06 60 40 00 1F Setting new position and running (SINGLE_WRITE)
01 06 60 40 00 0F The bit4 of controlword should be set to 0 (SINGLE_WRITE)
for setting next position

The usage of function block for position mode the same as homing mode.
Notice:All values are hexadecimal and Check codes have not been added at the end of all messages.

3 Profile Velocity Mode

Create POU→ Double-click, Programming→ Use function block to send message.

3.1 Message Description

01 06 60 00 00 01	Register high and low bits are exchanged	(SINGLE_WRITE)
01 06 60 40 00 0F	Enable motor	(SINGLE_WRITE)
01 06 60 60 00 03	Setting operation mode	(SINGLE_WRITE)
01 06 60 40 01 0F	Stop motor	(SINGLE_WRITE)

01 10 60 81 00 02 04 00 00 00 64 Setting profile velocity (WRITE_VAR)
($64_h=100_d$, it represents for profile velocity which is 10r/s, that is, 600r/min)

01 10 60 83 00 02 04 00 C8 00 C8 Setting acceleration and deceleration (WRITE_VAR)
($C8_h=200_d$, it represents for profile acceleration which is 20rps/s)

01 06 60 40 00 0F	Start motor	(SINGLE_WRITE)
01 06 60 40 01 0F	Stop motor	(SINGLE_WRITE)

The usage of function block for velocity mode the same as homing mode.
Notice:All values are hexadecimal and Check codes have not been added at the end of all messages.

4 Inquire

Create POU→ Double-click, Programming→ Use function block to send message.

4.1 Message Description

01 03 60 41 00 01	Read statusword	(READ_VAR)
01 03 60 64 00 02	Read position actual value	(READ_VAR)
01 06 60 6C 00 02	Read velocity actual value	(READ_VAR)

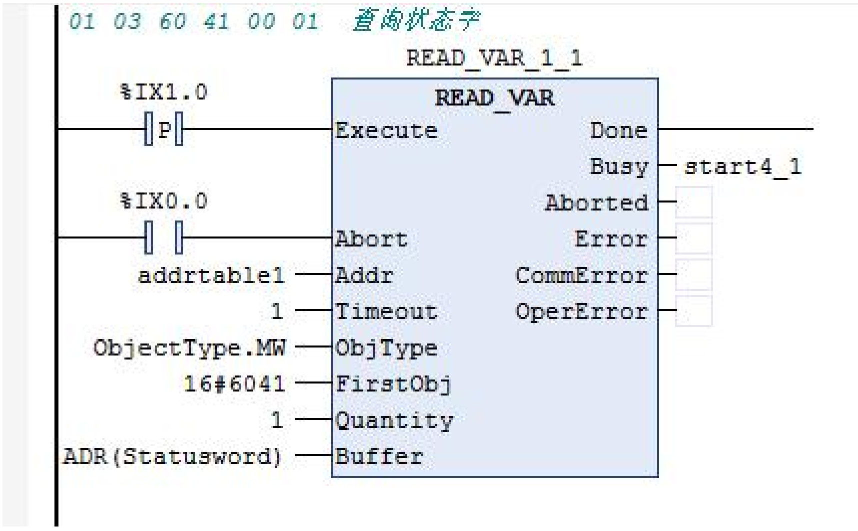
Notice:All values are hexadecimal and Check codes have not been added at the end of all messages.

4.2 Use READ_VAR

Example: Send message 01 03 60 41 00 01 (Read statusword)

Execute: Take a rising edge to execute function block by %IX1.0.
Abort: Take a rising edge to abort running function block.
Addr: Device address, according to addrtable1.
Timeout: The ‘1’ means 100ms.
ObjType: What type data will be written (only MW).
FirstObj: The address of be read register is 6041_h.

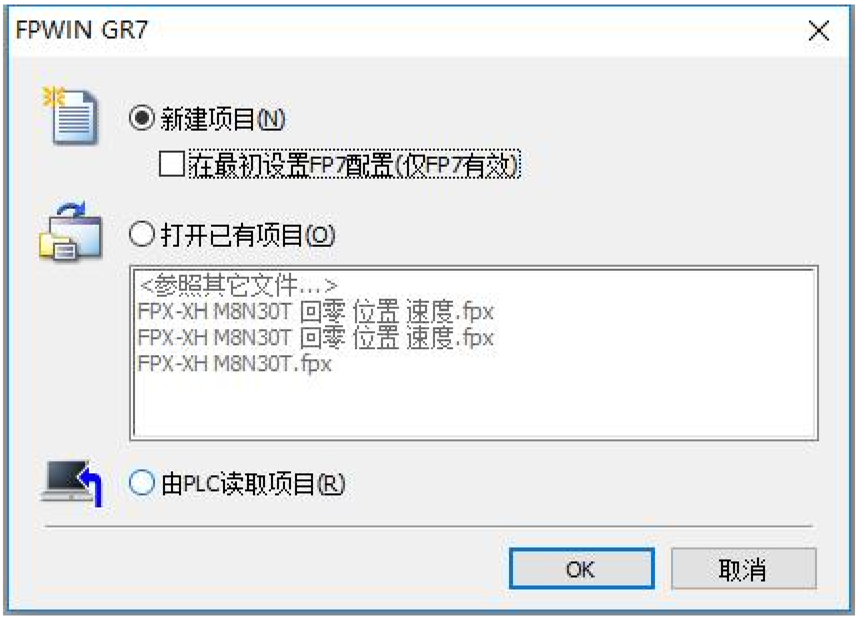
Quantity: Because register 6041h is 16bit register, the Quantity is 1.
Buffer: The address of data is Statusword that data is statusword.
Done: Done is set to TRUE when the function is completed successfully.
Busy: Busy is set to TRUE while the function is ongoing.
Aborted: Aborted is set to TRUE when the function is aborted with the Abort input.

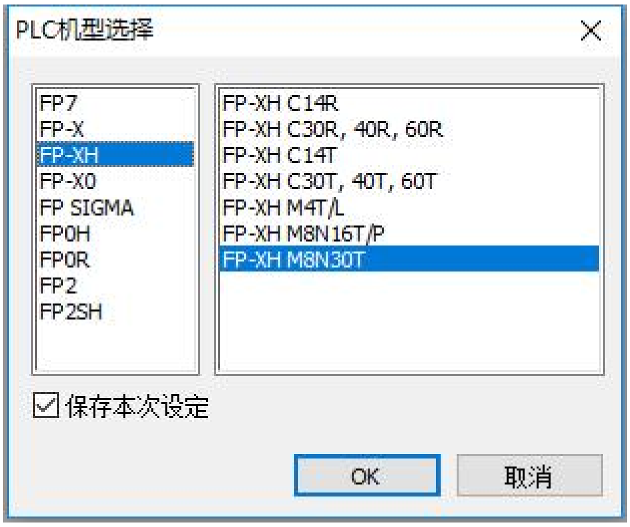


Modbus-RTU communication in Panasonic controller

➢ Create New Project

- Open software FPWIN GR7 → Create New Project → Select PLC type → OK

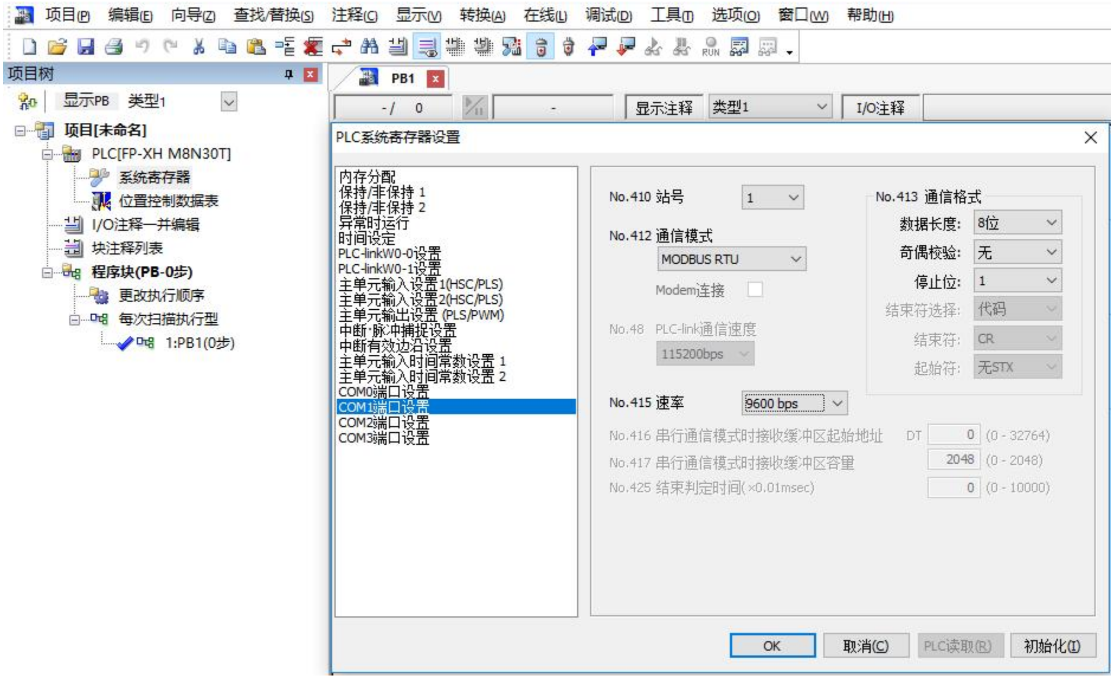




➢ Setting Parameter

Double-click system register → click COM port configuration.

Modify Parameters (Communication mode: MODBUS RTU, Baud rate, data length: 8bit, Parity: None, Stop bit: 1) → OK.



➢ Instruction

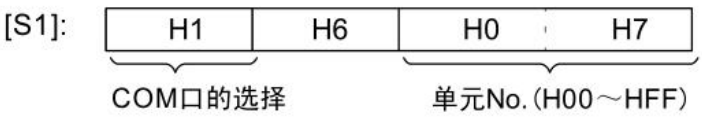
1 F145 SEND

Send message by function code 0x06.

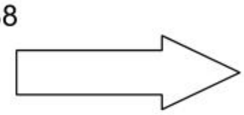
●指令06(寄存器单点预置)

例) 从COM1将WR3的1字数据传输到站号7的地址H7788时。

[F145(SEND), H1607, WR3, H7788, K1]



[S1]:H1607
[S2]:WR3(WR3=1234H)
[D]:H7788
[N]:K1



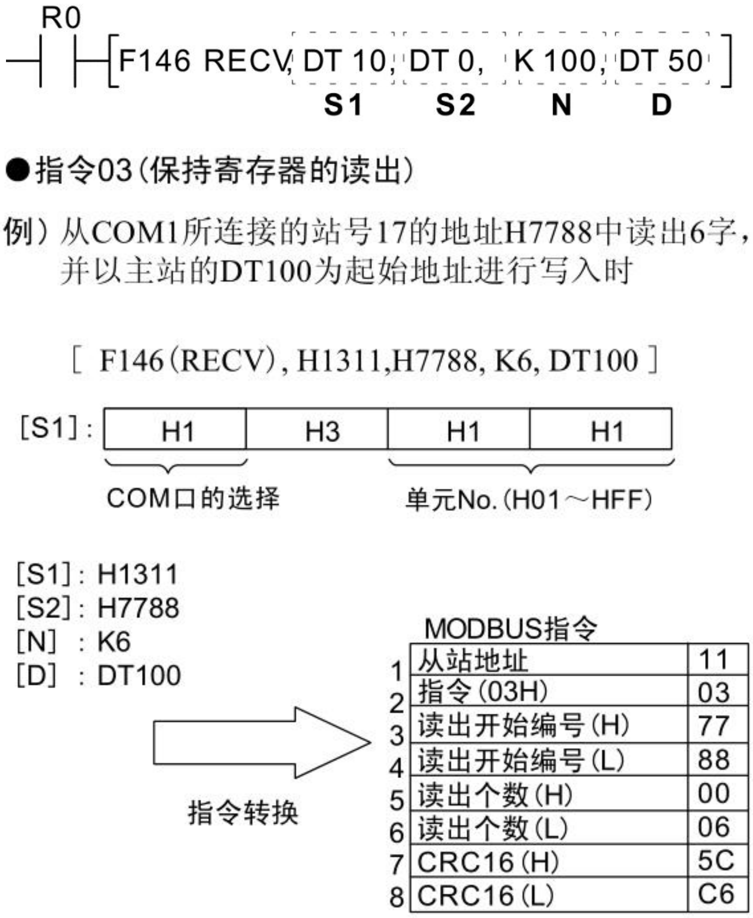
指令转换

MODBUS指令

1	从站地址	07
2	指令(06H)	06
3	写入开始编号(H)	77
4	写入开始编号(L)	88
5	写入数据(H)	12
6	写入数据(L)	34
7	CRC16(H)	53
8	CRC16(L)	C2

2 F146 RECV

Send message by function code 0x03.



➢ Operation Mode

1 Homing Mode

1.1 Message Description

01 06 60 00 00 01 Register high and low bits are exchanged
01 06 60 40 00 0F Enable motor
01 06 60 60 00 06 Setting operation mode
01 06 60 98 00 05 Setting homing method

01 10 60 99 00 02 04 00 00 00 32 Setting speed of find zero
($32_h=50_d$, it represents for speed of find zero which is 5r/s, that is, 300r/min)

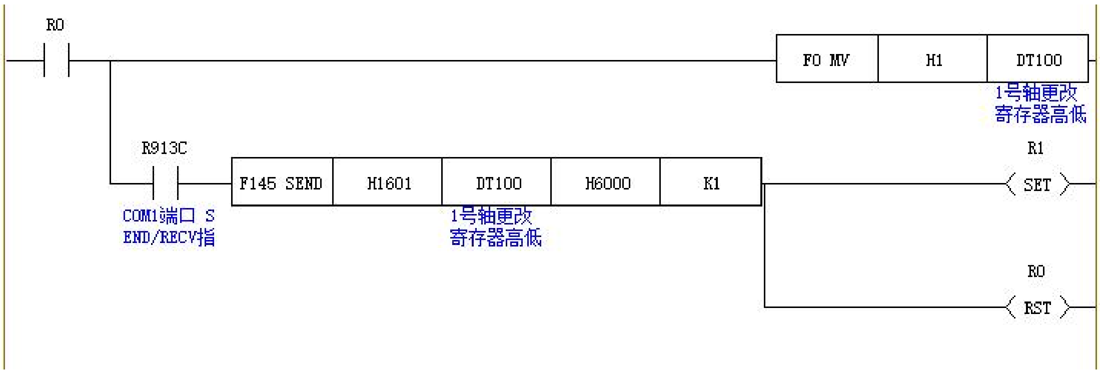
01 06 60 9A 00 64 Setting homing acceleration
($64_h=100_d$, it represents for actual homing acceleration which is 10rps/s)

01 06 60 40 00 1F Start homing

Notice:All values are hexadecimal and Check codes have not been added at the end of all messages.

1.2 Programming

For example: 01 06 60 00 00 01   Register high and low bits are exchanged



DT100:	What data will be written;
R913C:	It is a flag that allow the SEND/RECV executed for COM1 Port (If the SEND/RECV is called, this flag is OFF. If no, it is ON);
F145 SEND:	The instruction of send data.
H1601:	The '1' means COM port, the '6' means to write register, the '01' means Slave ID;
H6000:	The address of the register;
K1:	The number of written registers.

2 Profile Position Mode

2.1 Message Description

01 06 60 00 00 01   Register high and low bits are exchanged
01 06 60 40 00 0F   Enable motor
01 06 60 60 00 01   Setting operation mode
01 10 60 81 00 02 04 00 00 00 32   Setting profile velocity
($32_h=50_d$, it represents for profile velocity which is 5r/s, that is, 300r/min)

01 06 60 83 00 64   Setting profile acceleration
($64_h=100_d$, it represents for profile acceleration which is 10rps/s)

01 06 60 84 00 64   Setting profile decelerations
($64_h=100_d$, it represents for profile deceleration which is 10rps/s)

01 10 60 7A 00 02 04 00 03 0D 40   Setting target position
($030D40_h=200000_d$, it represents for motor shaft turning 50 circle)

01 06 60 40 00 1F   Setting new position and running
01 06 60 40 00 0F   The bit4 of controlword should be set to 0   for setting next position

Notice:All values are hexadecimal and Check codes have not been added at the end of all messages.

2.2 Programming

Refer to Homing Mode, please.

3 Profile Velocity Mode

3.1 Message Description

01 06 60 00 00 01 Register high and low bits are exchanged
01 06 60 40 00 0F Enable motor
01 06 60 60 00 03 Setting operation mode

01 10 60 81 00 02 04 00 00 00 32 Setting profile velocity
($32_h=50_d$, it represents for profile velocity which is 5r/s, that is, 300r/min)

01 06 60 83 00 64 Setting profile acceleration
($64_h=100_d$, it represents for profile acceleration which is 10rps/s)

01 06 60 83 00 64 Setting profile decelerations
($64_h=100_d$, it represents for profile deceleration which is 10rps/s)

01 06 60 40 00 1F Start motor
01 06 60 40 01 0F Stop motor

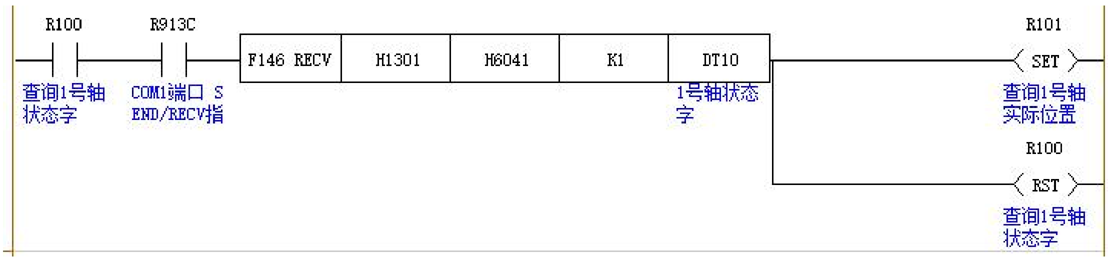
Notice:All values are hexadecimal and Check codes have not been added at the end of all messages.

3.2 Programming

Refer to Homing Mode, please.

4 Inquire

For example: Send message 01 03 60 41 00 01 Read statusword



DT10: Where data will be stored.
R913C: It is a flag that allow the SEND/RECV executed for COM1 Port (If the SEND/RECV is called, this flag is OFF. If no, it is ON);

F146 RECV: The Instruction of receive data;

H1301: The ‘1’ means COM port, the ‘3’ means to read register, the ‘01’ means Slave ID;

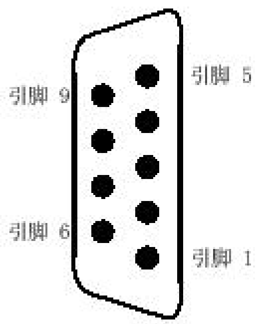
H6041: The address of the register;

K1: The number of written registers;

Modbus-RTU communication in Siemens controller

➢ Hardware Wiring

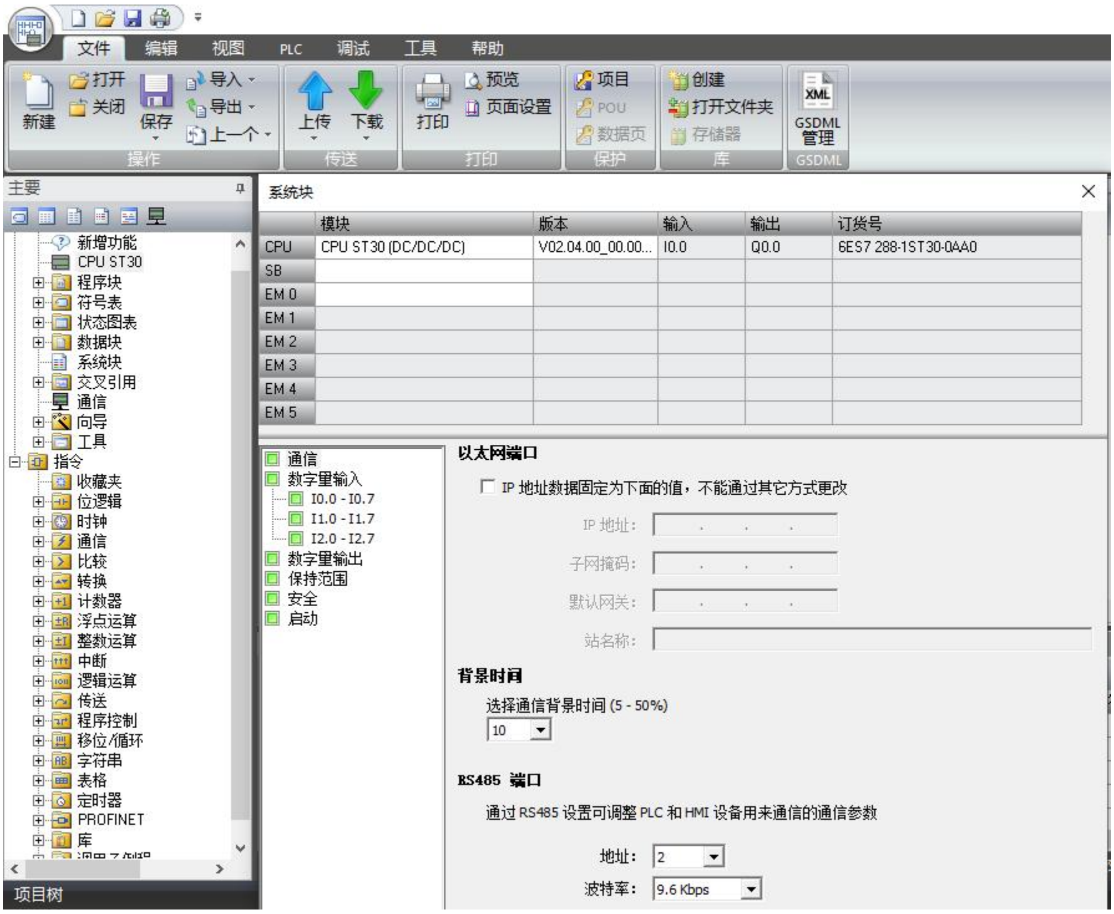
This part will introduce the Modbus-RTU communication mode with the example of Siemens controller smart-200. The communication port definition of smart-200 as follow:

PIN	Signal	Definition	Connector
1	Shield	Rack earth	
2	24V COM	Logical COM	
3	RS485 B	RS485 terminal B	
4	RTS	Request to Send (TTL)	
5	5V COM	Logical COM	
6	+5V	+5V Output	
7	+24V	+24V Output	
8	RS485 A	RS485 terminal A	
9	NC		
Shell	Shield	Rack earth	

According to the above "*RS485/CAN Bus - RJ45 Port Definition*" (Ctrl+ Mouse left or Click text to jump) in "Communication Interface and Wiring", determine the wiring: The DB9_PIN3 of PLC connect to RJ45_PIN8 and the DB9_PIN8 of PLC connect to RJ45_PIN7.

➢ Create New Project

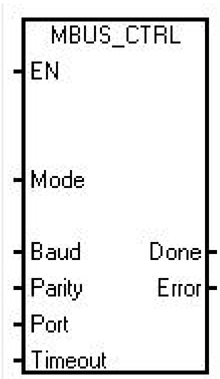
- Open the software → Select the PLC model
- Uncheck Ethernet ports
- Set the Communication background time
- Set the Address and Baud rate under the RS485 port.



➢ Instruction

1 MBUS_CTRL

Use the MBUS_CTRL instruction to initialize, monitor, or disable Modbus communication.



Before executing the MBUS_MSG instruction, the program must first execute MBUS_CTRL without any errors. When this command is complete, Done is ON and proceed to the next command. When EN is ON, this instruction is executed at each scan.

MBUS_CTRL		
Parameter	**Type**	**Operand**

MBUS_CTRL		
Parameter	**Type**	**Operand**
Mode	BOOL	I、Q、M、S、SM、T、C、V、L
Baud	DWORD	VD、ID、QD、MD、SD、SMD、LD、AC、constant、*VD、*AC、*LD
Parity, Port	BYTE	VB、IB、QB、MB、SB、SMB、LB、AC、constant、*VD、*AC、*LD
Timeout	WORD	VW、IW、QW、MW、SW、SMW、LW、AC、constant、*VD、*AC、*LD
Done	BOOL	I、Q、M、S、SM、T、C、V、L
Error	BYTE	VB、IB、QB、MB、SB、SMB、LB、AC、*VD、*AC、*LD

Mode:

The value entered is used to select the communication protocol.

When the input value is 1, the CPU port is assigned to the Modbus protocol and enable Modbus communication.

When the input value is 0, the CPU port is assigned to the PPI system protocol and the Modbus protocol is disabled.

Parity:

It should be set to match the parity of Modbus Slave. It sets a start bit and a stop bit.

The allowed values are 0 (none), 1 (odd), and 2 (even).

Port:

Set physical communication ports (0 = RS-485 integrated in CPU, 1 = rs-485 or RS-232 on optional CM01 signal board).

Timeout:

The number of milliseconds to wait for a response from the slave.

The Timeout value can be set to any value between 1ms and 32767ms.The typical value is 1000ms.

The Timeout parameter should be set large enough that the Slave has time to respond at the selected baud rate.

The Timeout parameter is used to determine whether the Modbus Slave is responding to the inquire. The Timeout value determines how long the Modbus Master waits for the first character of the response after sending the last character of the request. If at least one response character is received within the Timeout, the Modbus Master receives the entire response from the Modbus Slave.

Done:

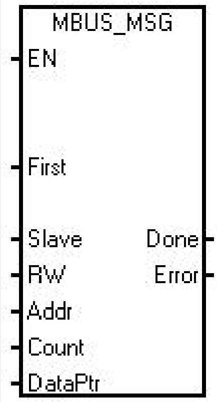
When the MBUS_CTR instruction completes, the instruction returns TRUE to the output Done.

Error:

Contains the result of the execution of the instruction. Please see Modbus RTU Master execution error code.

2 MBUS_MSG

Use the MBUS_MSG to start the request to the Modbus Slave and process the response.



MBUS_MSG		
Parameter	**Type**	**Operand**
First	BOOL	I、Q、M、S、SM、T、C、V、L (energy flow controlled by rising edge)
Slave	BYTE	VB、IB、QB、MB、SB、SMB、LB、AC、C、*VD、*AC、*LD
RW	BYTE	VB、IB、QB、MB、SB、SMB、LB、AC、constant、*VD、*AC、*LD
Addr	DWORD	VD、ID、QD、MD、SD、SMD、LD、AC、constant、*VD、*AC、*LD
Count	INT	VW、IW、QW、MW、SW、SMW、LW、AC、constant、*VD、*AC、*LD
DataPtr	DWORD	&VB
Done	BOOL	I、Q、M、S、SM、T、C、V、L
Error	BYTE	VB、IB、QB、MB、SB、SMB、LB、AC、*VD、*AC、*LD

Slave:

Address of Modbus Slave. The allowable range is 0 to 247. Address 0 is the broadcast address. Use address 0 only for write requests. The system will not respond to a broadcast request to address 0. Not all Slave support broadcast addresses. The s7-200 SMART Modbus slave library does not support broadcast addresses.

RW:

Read when RW=0 and write when RW=1

Addr:

Initial MODBUS address, 400001+ register address of Slave. For example, 0x6040=24640, you should write data 424641.

Count:

The number of words written or read.

DataPtr:

Indirect address pointer to the V memory of the data in the CPU associated with read/write requests. For a read request, the DataPtr is set as the first CPU storage unit to store the data read from the Modbus Slave. For a write request, set the DataPtr as the first CPU storage location for the data to be sent to the Modbus slave.

Done:

When the MBUS_MSG instruction completes, it returns TRUE to the output Done.

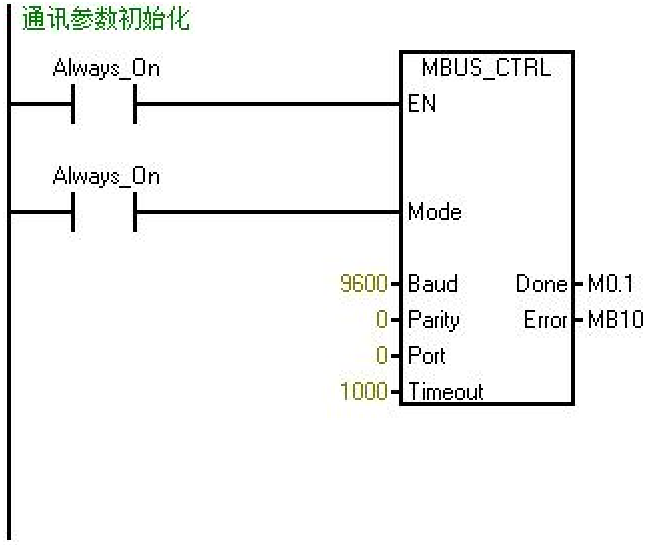
Error:

Contains the result of the execution of the instruction. Please see Modbus RTU Master execution error code.

➢ Example

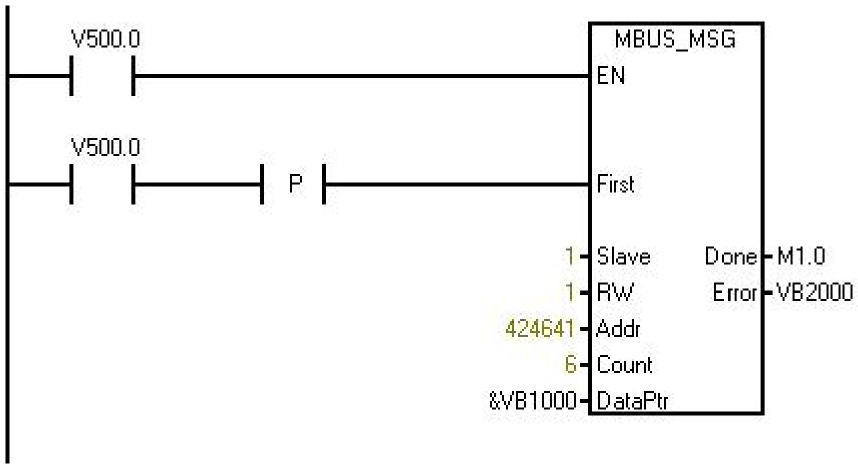
1 Communication Parameter

8 bits Data, 1 stop bit, no parity, baud rate according to actual needs.

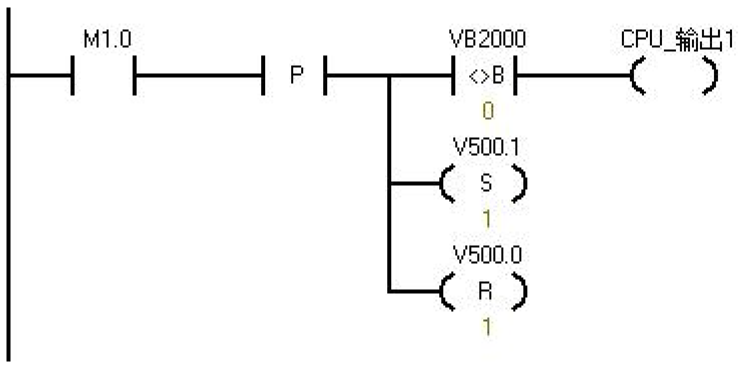


2 Write Data

When the flag V500.0 is enabled and RW=1, this instruction will write data to Slave 1, starting with Slave address 24640(=0x6040), and write data in vb1000~vb1011.

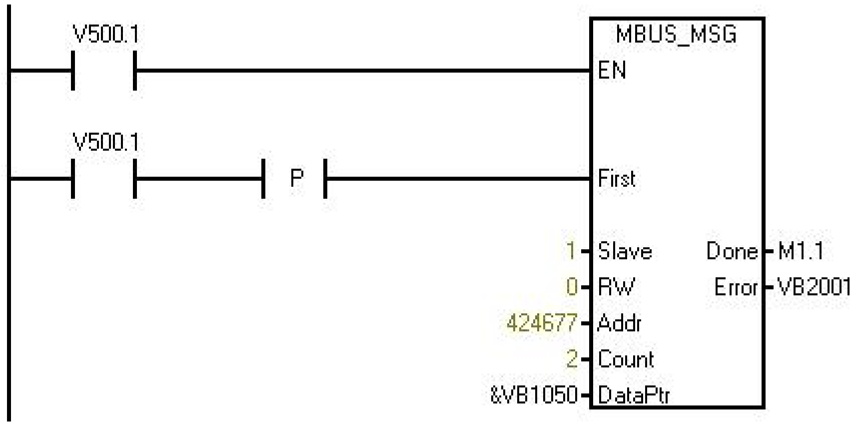


When the first MBUS_MSG instruction completes, the completion bit Done switch from 0 to 1. When the error output is not 0, it output an alarm.

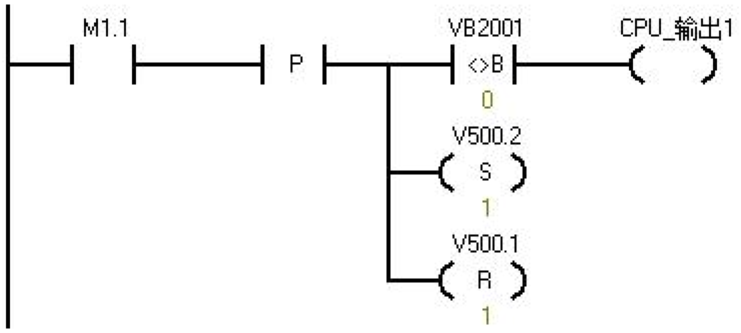


3 Read Data

When the flag V500.1 is enabled and RW=0, the MBUS_MSG will read the data from Slave 1 and put the read data into vb1050-vb1053 with the address from 24676=0x6064 as the starting address.

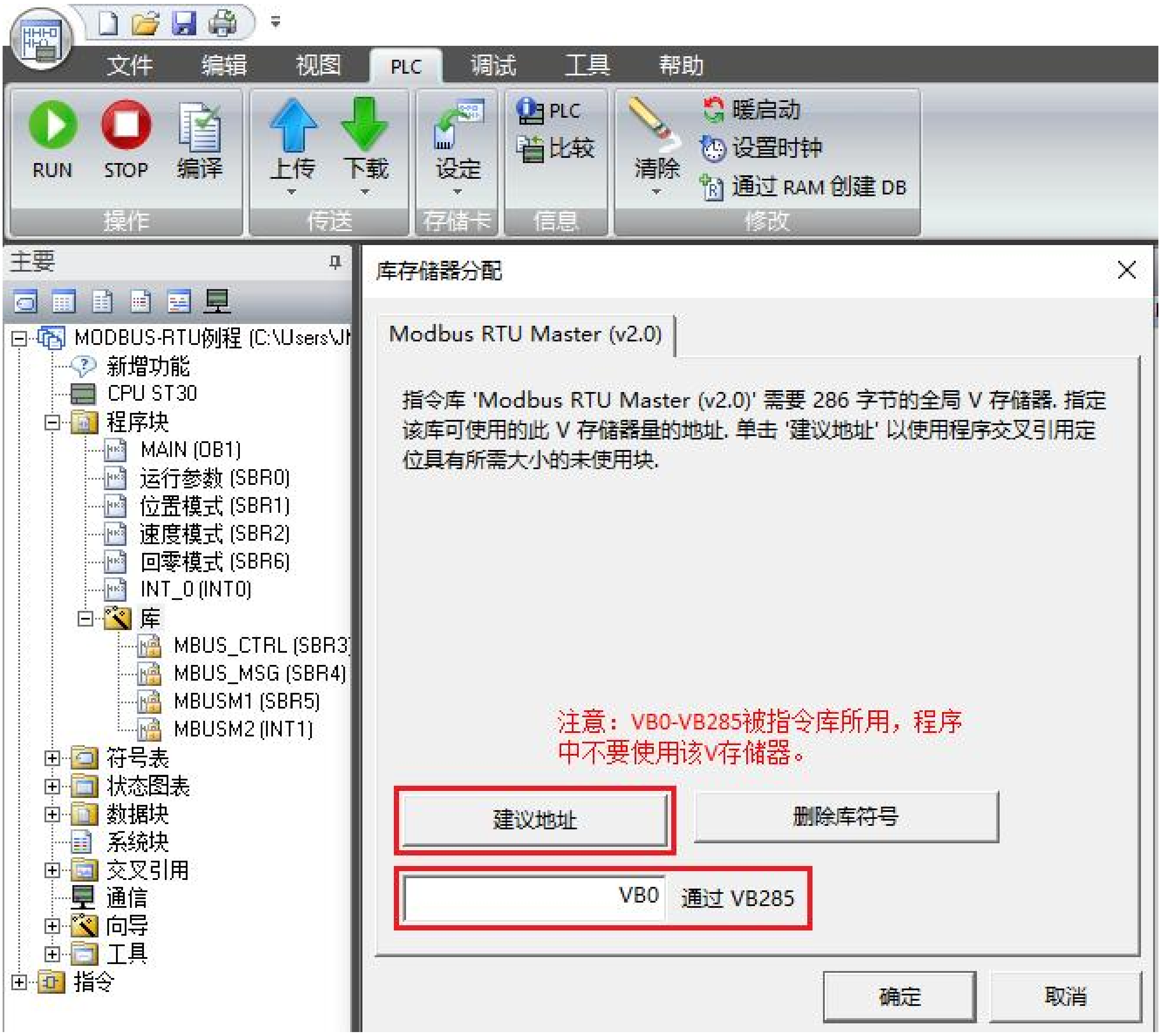


When the first MBUS_MSG instruction completes, the completion bit Done switch from 0 to 1. When the error output is not 0, it output an alarm.



➢ Library Storage

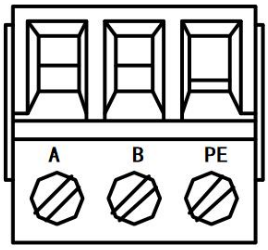
After program editing is completed, the library storage is allocated, otherwise the compilation fails. Select library→right click→Library Storage→Suggested Address


文件
编辑
视图
PLC
调试
工具
帮助
RUN
STOP
编译
上传
下载
设定
PLC
比较
清除
暖启动
设置时钟
通过 RAM 创建 DB
操作
传送
存储卡
信息
修改
主要
MODBUS-RTU例程
新增功能
CPU ST30
程序块
MAIN (OB1)
运行参数 (SBR0)
位置模式 (SBR1)
速度模式 (SBR2)
回零模式 (SBR6)
INT_0 (INT0)
库
MBUS_CTRL (SBR3)
MBUS_MSG (SBR4)
MBUSM1 (SBR5)
MBUSM2 (INT1)
符号表
状态图表
数据块
系统块
交叉引用
通信
向导
工具
指令
库存储器分配
Modbus RTU Master (v2.0)
指令库 'Modbus RTU Master (v2.0)' 需要 286 字节的全局 V 存储器. 指定该库可使用的此 V 存储器量的地址. 单击 '建议地址' 以使用程序交叉引用定位具有所需大小的未使用块.
注意：VB0-VB285被指令库所用，程序中不要使用该V存储器。
建议地址
删除库符号
VB0
通过 VB285
确定
取消

Modbus-RTU communication in Xinjie controller

➢ Hardware Wiring

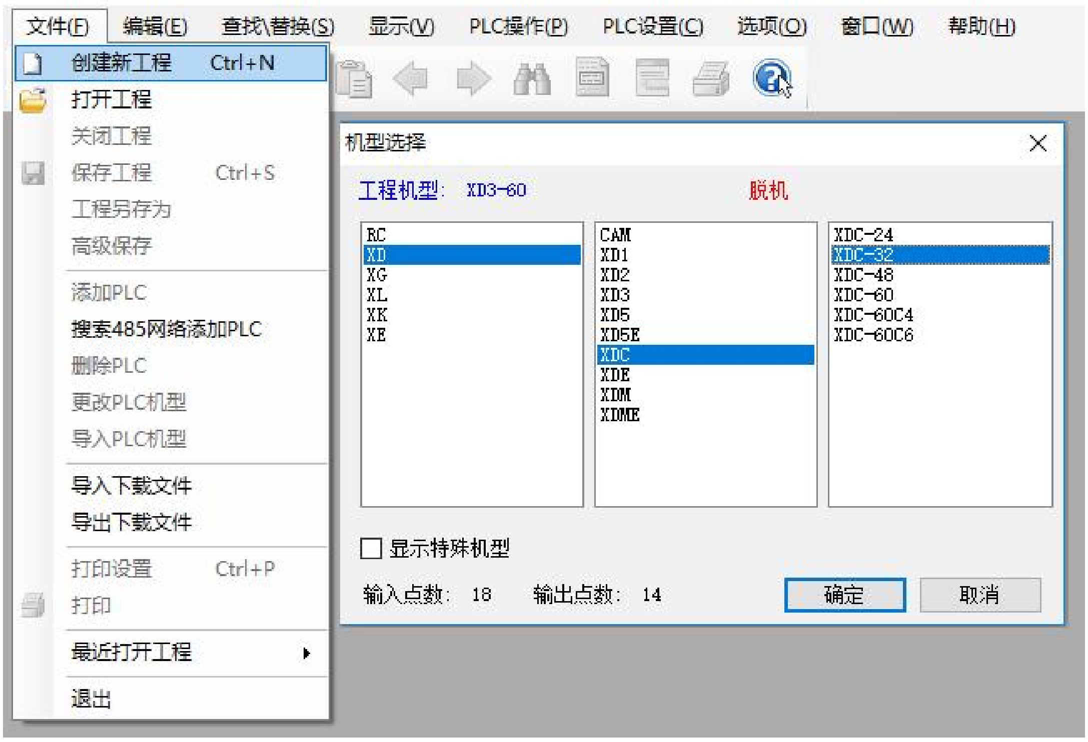
This part will introduce the Modbus-RTU communication mode with the example of Xinjie controller XDC-32. The communication port definition of XDC-32 as follow:

PIN	Definition	Connector
A	RS485 terminal A	
B	RS485 terminal B	

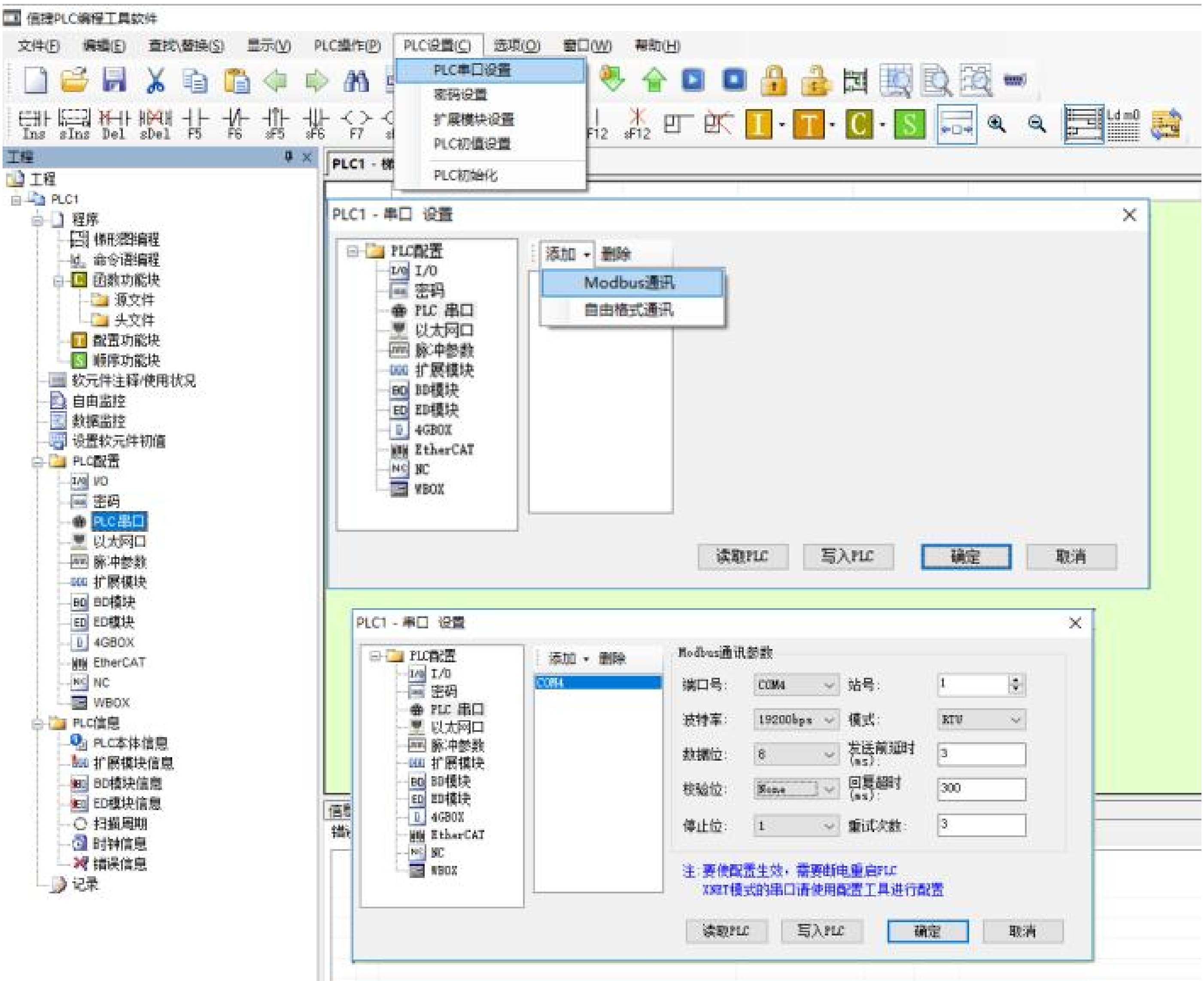
According to the above "*RS485/CAN Bus - RJ45 Port Definition*" (Ctrl+ Mouse left or Click text to jump) in "Communication Interface and Wiring", determine the wiring: The DB9_PIN3 of PLC connect to RJ45_PIN8 and the DB9_PIN8 of PLC connect to RJ45_PIN7.

➢ Create New Project

- Open software → click File → click Create New Project → select PLC model → OK



- Click PLC setting →PLC serial port setting → add Modbus communication → select COM port → set Communication Parameters → OK



8 bits Data, 1 stop bit, no parity, baud rate according to actual needs.

The above parameters, Master shall be set in the same way as the Slave, otherwise the communication will fail.

➢ Instruction

1 REGR/REGW

1.1 Overview

Register Read / Register write			
16-bit	REGR / REGW	32-bit	-
Trigger	Normally open/closed, edge triggered	Applicable models	XD Series, XL Series
Firmware	-	Software	-

1.2 Operand

Operand	Action	Type
S1	Specify the remote communications office number	16-bit, BIN
S2	Specifies the remote register header address number	16-bit, BIN
S3	Specifies the number of registers	16-bit, BIN
D1	Specifies the local receive register header address number	16-bit, BIN
D2	Specify serial port number	16-bit, BIN

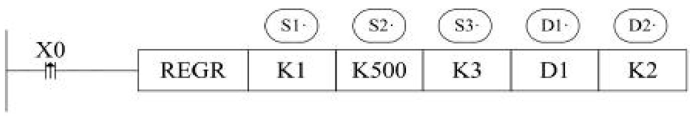
1.3 Soft Element

字软元件	操作数	系统								常数	模块	
		D注	FD	TD注	CD注	DX	DY	DM注	DS注	K/H	ID	QD
	S1	•	•	•	•					•		
	S2	•		•	•					•		
	S3	•	•	•	•					•		
	D1	•										
	D2									K		

***注：D 表示 D HD ；TD 表示 TD HTD ；CD 表示 CD HCD HSCD HSD DM 表示 DM DHM;**
DS 表示 DS DHS。

1.4 Function

功能和动作



Modbus function code of REGR is 0x03.

Modbus function code of REGW is 0x06

S1: Slave ID;

S2: Initial Modbus address. The register address from which the data of Slave is read.

S3: The number of registers read, the maximum number of operands S3 and registers read is 125.

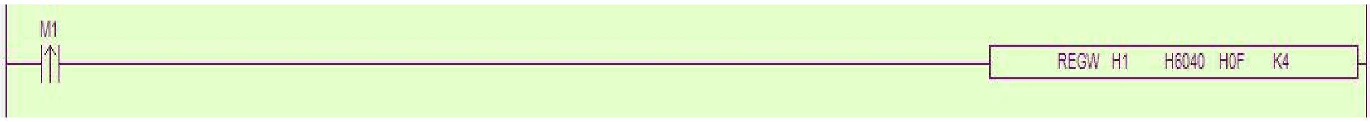
D1: Receiving data storage unit

D2: PLC serial number, its range: K0~K5. K0: Port0 (RS232), Port1 (RS232), Port2 (RS485), Port3 (left extension port), Port4 (upper extension Port1), Port5 (upper extension Port2).

When X0 is ON, REGR instruction is executed, the execution flag SM160 (serial port 2) is set ON, and SM160 (serial port 2) is set OFF when execution is completed. If a communication error occurs and the number of retransmissions is set, automatic retransmissions are made. The user can query the relevant registers to determine the cause of the error. REGR/REGW execution result of serial port 2 is in SD160.

1.5 Example

01 06 60 40 00 0F XX XX (XX XX is CRC check, this code will be automatically calculated and attached to the data)



When M1 is ON, write data 0x0F to register address 0x6040 through PLC serial port 4.

Notice: The quantity of address of 16-bit register is 1, and the quantity of address of 32-bit register is 2. The 32-bit registers can only be written in 0x10 function code (use MRGW). This command is used for registers of 16-bit data types.

2 MRGW

2.1 Overview

Multi-register Write			
16-bit	MEGW	32-bit	-
Trigger	Normally open/closed, edge triggered	Applicable models	XD Series, XL Series
Firmware	-	Software	-

2.2 Operand

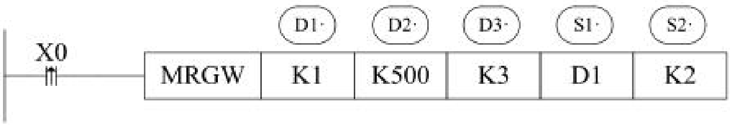
Operand	Action	Type
S1	Specify the remote communications office number	16-bit, BIN
S2	Specifies the remote register header address number	16-bit, BIN
S3	Specifies the number of registers	16-bit, BIN
D1	Specifies the local receive register header address number	16-bit, BIN
D2	Specify serial port number	16-bit, BIN

2.3 Soft Element

字软元件	操作数	系统								常数	模块	
		D注	FD	TD注	CD注	DX	DY	DM注	DS注	K/H	ID	QD
	D1	•	•	•	•					•		
	D2	•	•	•	•					•		
	D3	•	•	•	•					•		
	S1	•										
	S2									K		

*注：D 表示 D　HD；TD 表示 TD　HTD；CD 表示 CD　HCD　HSCD　HSD; DM 表示 DM　DHM; DS 表示 DS　DHS。

2.4 Function



Modbus function code of MEGW is 0x10

D1: Slave ID;

D2: Initial Modbus address. The register address from which the data of Slave is write;

D3: The number of registers written, the maximum number of operands D3 is 123;

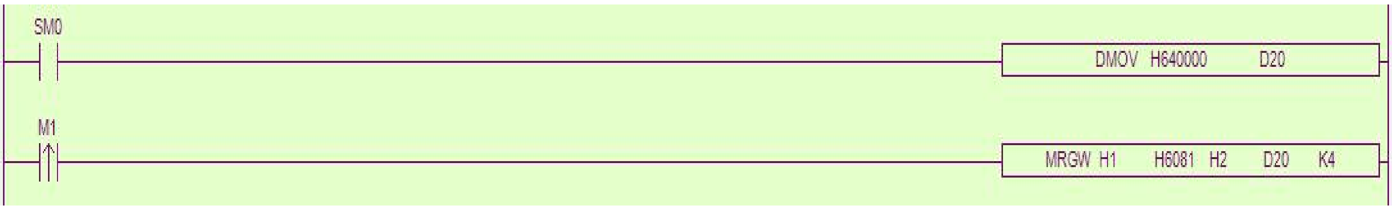
S1: Written data;

S2: PLC serial number, its range: K0~K5. K0: Port0 (RS232), Port1 (RS232), Port2 (RS485), Port3 (left extension port), Port4 (upper extension Port1), Port5 (upper extension Port2).

When X0 is ON, REGR instruction is executed, the execution flag SM160 (serial port 2) is set ON, and SM160 (serial port 2) is set OFF when execution is completed. If a communication error occurs and the number of retransmissions is set, automatic retransmissions are made. The user can query the relevant registers to determine the cause of the error. REGR/REGW execution result of serial port 2 is in SD160.

2.5 Example

01 10 60 81 00 02 04 00 00 00 64 XX XX (XX XX is CRC check, this code will be automatically calculated and attached to the data)



When M1 is ON, the data in D20-D21 is written into the address 0x6081 of the register of Slave 1 through PLC serial port 4.

Notice: The quantity of address of 16-bit register is 1, and the quantity of address of 32-bit register is 2. This instruction is used to write a register of a 32-bit data type or a continuous write register greater than or equal to 32 bits.

➢ Communication Flag and Registers

1 Communication flag bits

Serial Port	Register	Function	Description
Serial Port 0	SM140	Modbus Read and write instruction execution flags	When the instruction starts execution, set ON; Set OFF when execution is complete.
	SM141		

	SM142	Free format communication sending flags	When the instruction starts execution, set ON; Set OFF when execution is complete.
	SM143	Free form communication reception completion flag	Set ON when a frame of data is received or time out; Need the user to set OFF
	SM144		
	……		
	SM149		
Serial Port 1	SM150	Modbus Read and write instruction execution flags	When the instruction starts execution, set ON; Set OFF when execution is complete.
	SM151		
	SM152	Free format communication sending flags	When the instruction starts execution, set ON; Set OFF when execution is complete.
	SM153	Free form communication reception completion flag	Set ON when a frame of data is received or time out; Need the user to set OFF
	SM154		
	……		
	SM159		
Serial Port 2	SM160…SM169	:	:
Serial Port 3	SM170…SM179	:	:
Serial Port 4	SM180…SM189	:	:
Serial Port 5	SM190…SM199	:	:

2 Communication registers

Serial Port	Register	Function	Description
Serial Port 0	SD140	Modbus Read and write instruction execution results	0: Normal 100: Reception error 101: Receive timeout 180: CRC error 181: LRC error 182: ID error 183: Sending buffer overflow

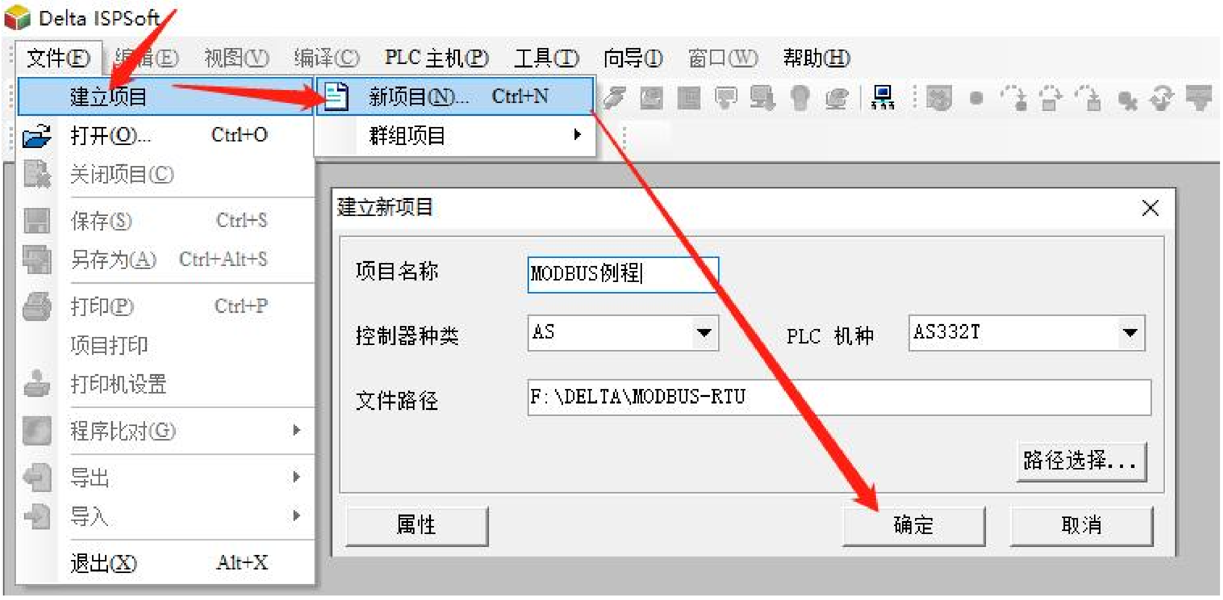
			400: Function code error 401: Address error 402: Length error 403: Data error 404: Slave busing 405:Memory error (FLASH wipe)
	SD141	X-Net communication results	0: Normal 1: Communication timeout 2: Memory error 3: Receive CRC error
	SD142	Free form communication sending results	0: Normal 410: Free format sending buffer overflow
	SD143	Free form communication reception results	0: Normal 410:Sending data overflow 411: Short received data 412: long received data 413: Reception error 414: Receive timeout 415: Start character 416: Stop character
	SD144	The number of data received by free form communication	In bytes, no start character, no end character
	……		
	SD149		
Serial Port 1	SD150	Modbus Read and write instruction execution results	0: Normal 100: Reception error 101: Receive timeout 180: CRC error 181: LRC error 182: ID error 183: Sending buffer overflow 400: Function code error 401: Address error 402: Length error 403: Data error 404: Slave busing 405: Memory error (FLASH wipe)
	SD151	X-Net communication results	0: Normal 1: Communication timeout 2: Memory error 3: Receive CRC error
	SD152	Free form communication sending results	0: Normal 410: Free format sending buffer overflow
	SD153	Free form communication reception results	0: Normal 410: Sending data overflow 411: Short received data

			412: long received data 413: Reception error 414: Receive timeout 415: Start character 416: Stop character
	SD154	The number of data received by free form communication	In bytes, no start character, no end character
	……		
	SD159		
Serial Port 2	SD160…SD169		
Serial Port 3	SD170…SD179		
Serial Port 4	SD180…SD189		
Serial Port 5	SD190…SD199		

Modbus-RTU communication in Delta controller

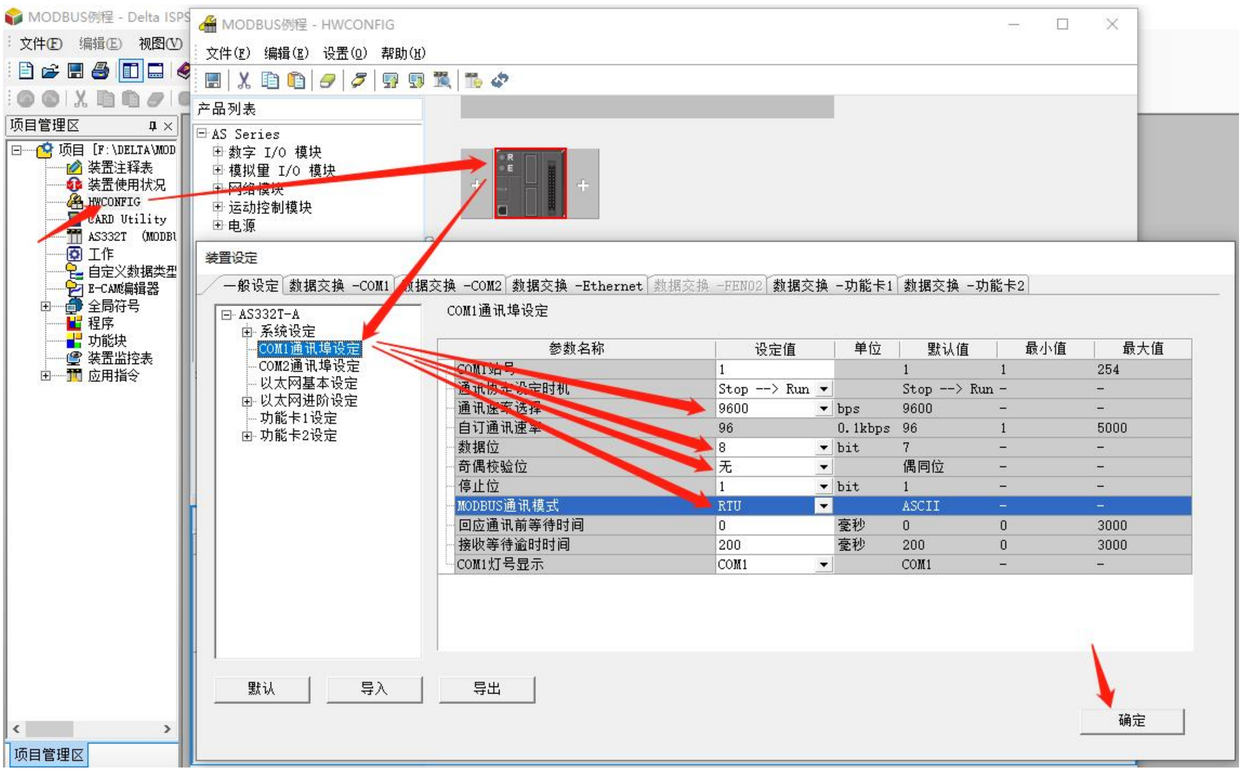
➢ Create New Project

- Open Delta ISPSoft → Select PLC model



➢ Communication Parameter Setting

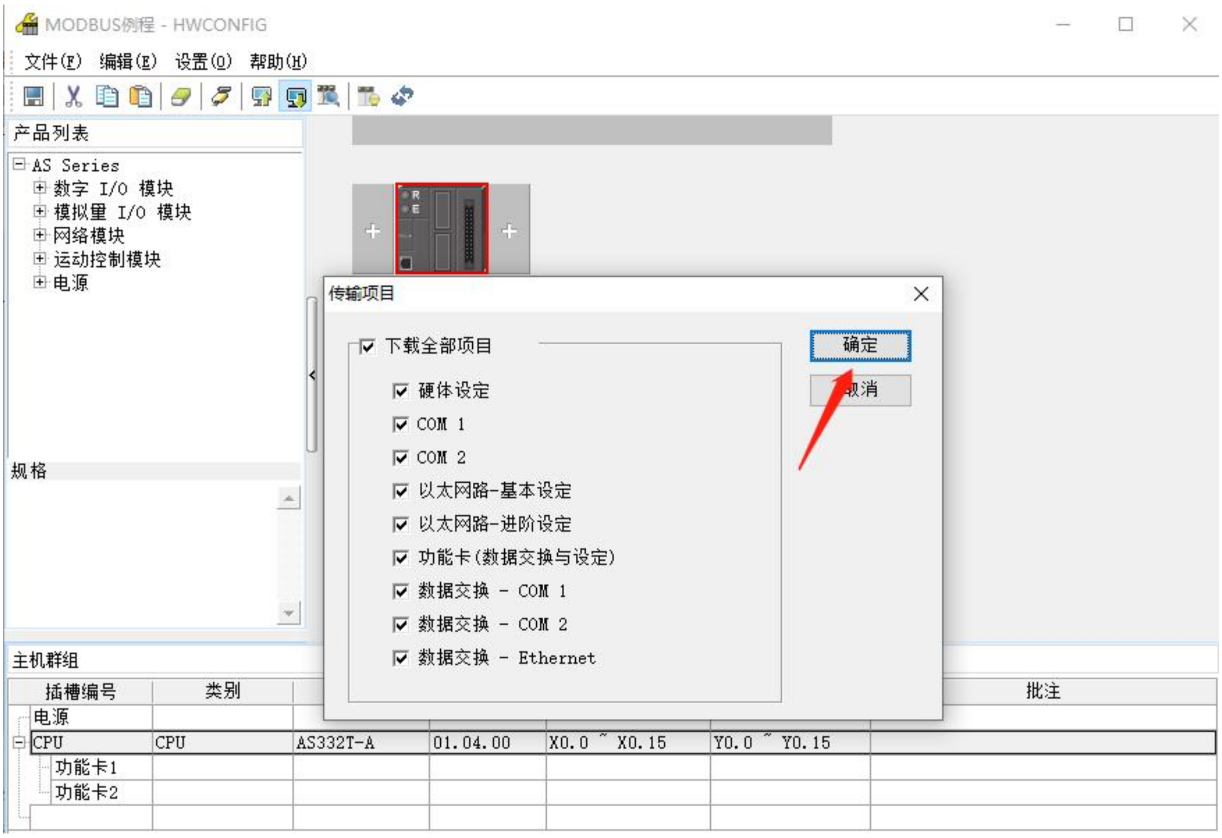
- Double-click HWCONFIG → Double-click PLC icon → Select COM Port to communication → Set communication parameter → OK



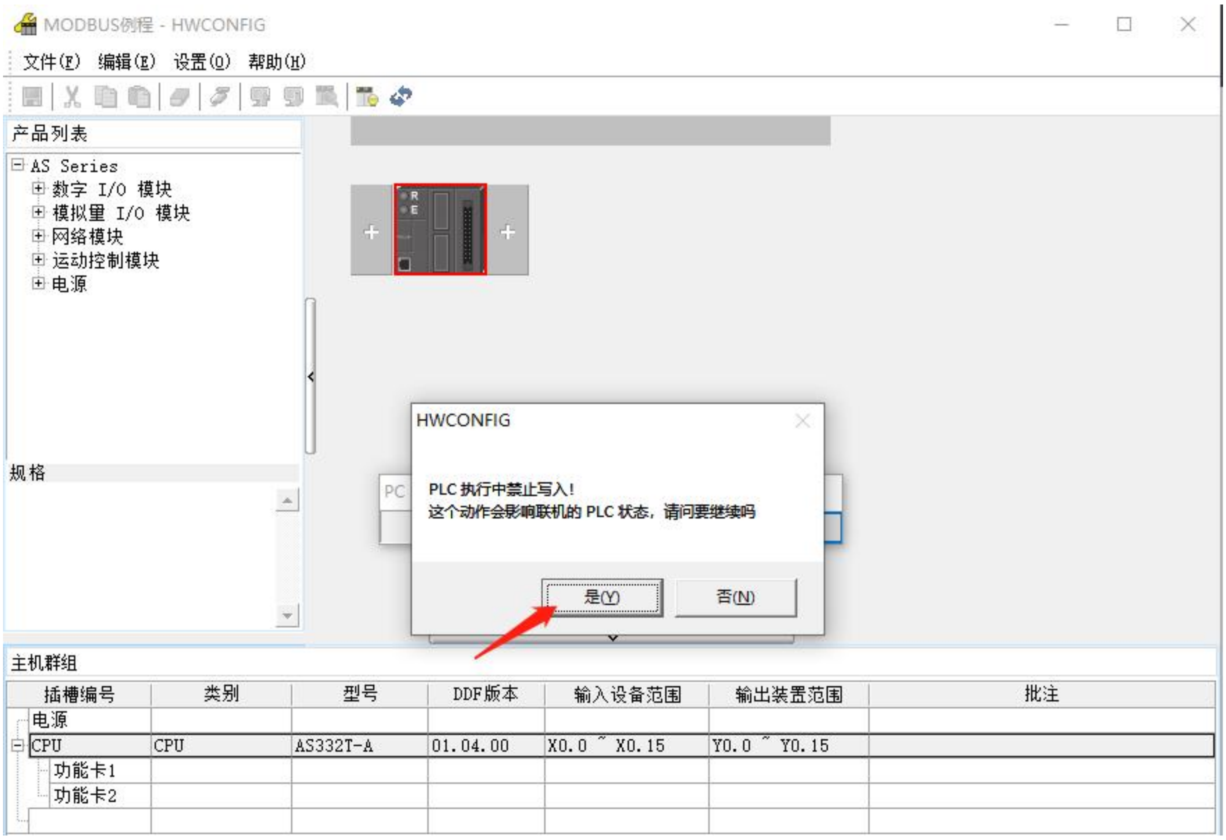
Slave station parameters: Modbus-RTU mode, data bit: 8, stop bit: 1, Parity: None.

The above parameters, Master shall be set in the same way as the Slave, otherwise the communication will fail.

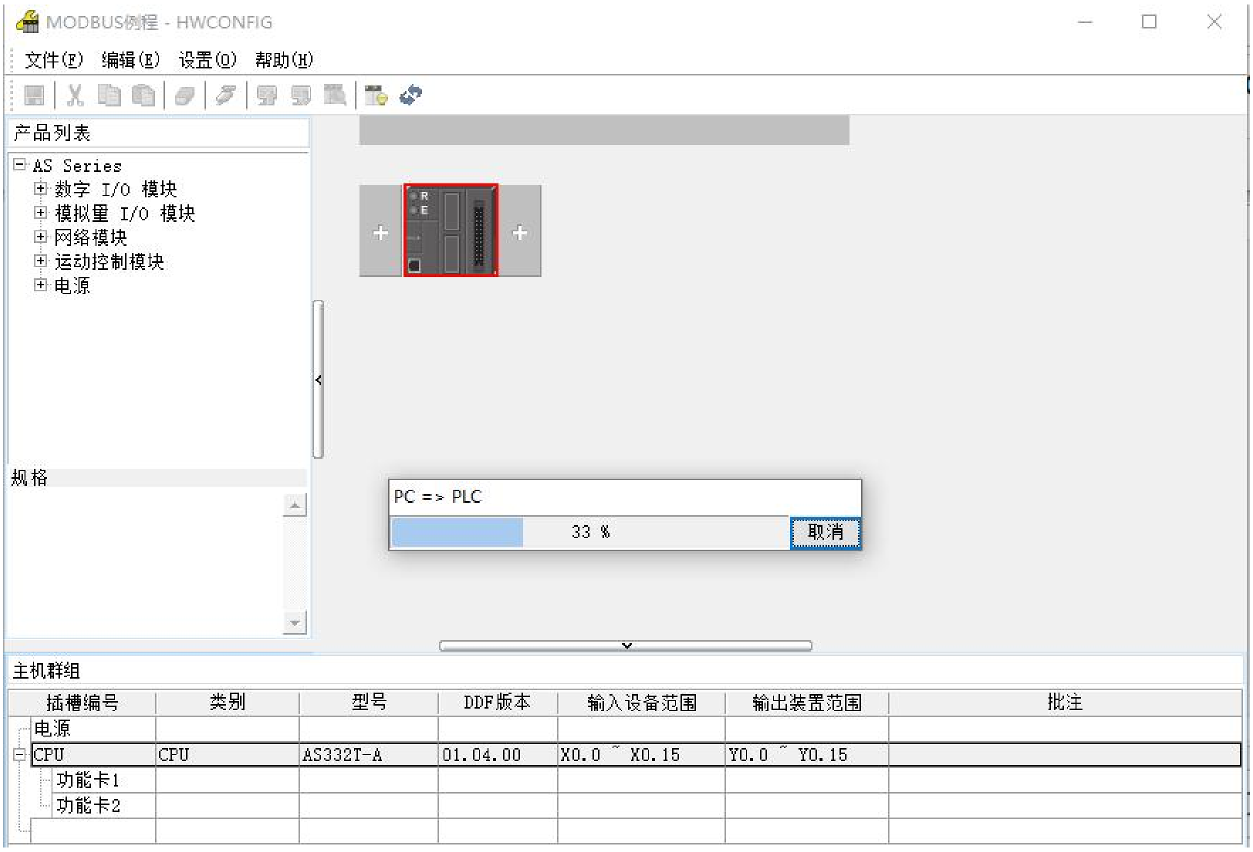
- Click OK to execute the action



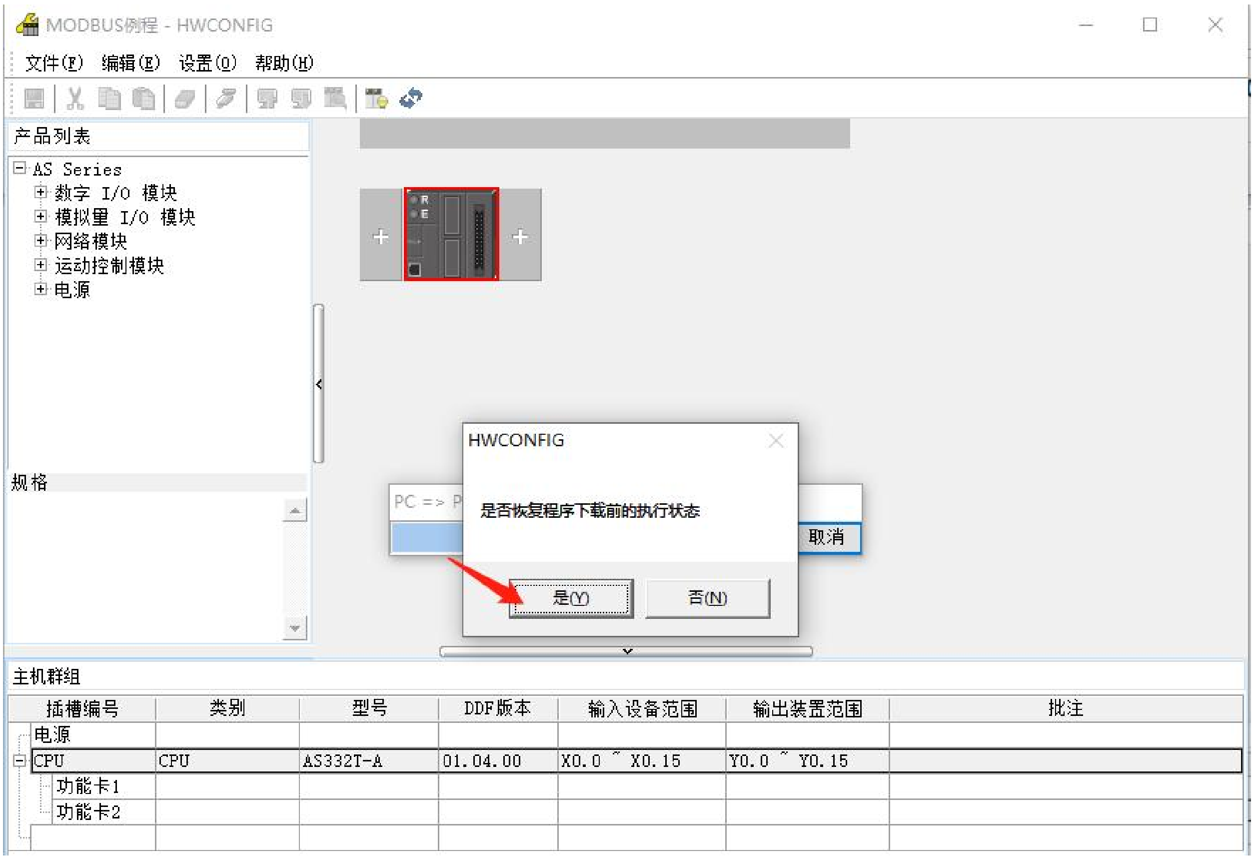
- Click YES



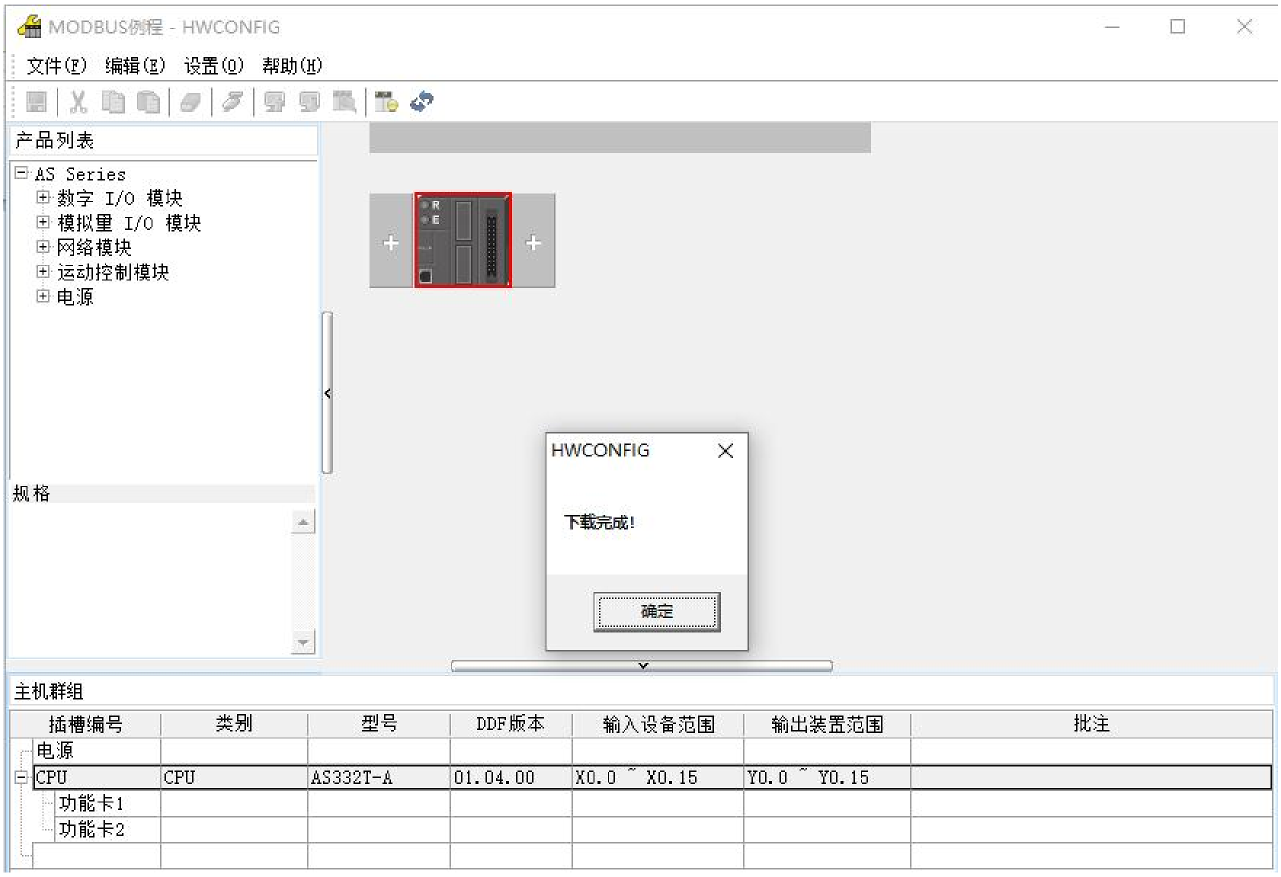
- Wait until the action is finished



- When done, click OK

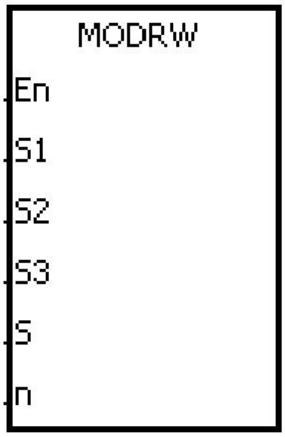


- When the download is complete, click OK



➢ MODRW

符号：



S$_1$ ： 联机装置地址

S$_2$ ： 通讯功能码

S$_3$ ： 欲读写数据的地址

S ： 欲读写之数据存放寄存器

n ： 读写数据长度

S1: Unit Address. Its range 0~254. 0 is broadcast mode.

S2: Modbus Function Code.

0x03: Read register

0x06: Write single register

0x10: Write multiple registers

S3: Device Address. It's Slave ID.

S: Source or Destination. The register is set by the user, and the data to be written into the register is stored in advance or a register stored after data has been read.

n: Data Length. When using word type communication function code, the set data amount cannot be greater than 100 words.

There is no limit to the number of times for this instruction, but only one instruction can be executed when different communication instructions use the same communication port at the same time. In addition, when matching the sending flags of each communication port, it should be set before this instruction, otherwise, it is easy to cause the two communication ports' communication data mixed with each other.

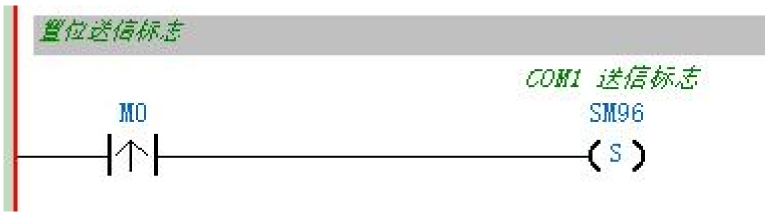
When a communication timeout occurs, the timeout flag changes to ON.If the problem has been resolved, you can set the timeout flag to OFF.When using MODRW instruction, the timeout time cannot be set to 0 and it must be within the range of 100 ~ 32767ms. If the timeout is set to 0, it will be executed in 200ms.

In Modbus-RTU mode, the user only needs to set the data, and this instruction will automatically add the check code (CRC), and the received data will be stored in S as HEX value.

➢ Example

1 Sending Flag

Each instruction triggered requires to set sending flag, which will be cleared automatically after the completion of data transmission.



2 Function Code 03h

01 03 60 41 00 06 XX XX (XX XX is CRC check, this code will be automatically calculated and attached to the data)

Description: when M1 is ON, read the 6 registers data from the Slave 1 through the COM1 of PLC and that register 6041h as the first address, put them into D10-D15.

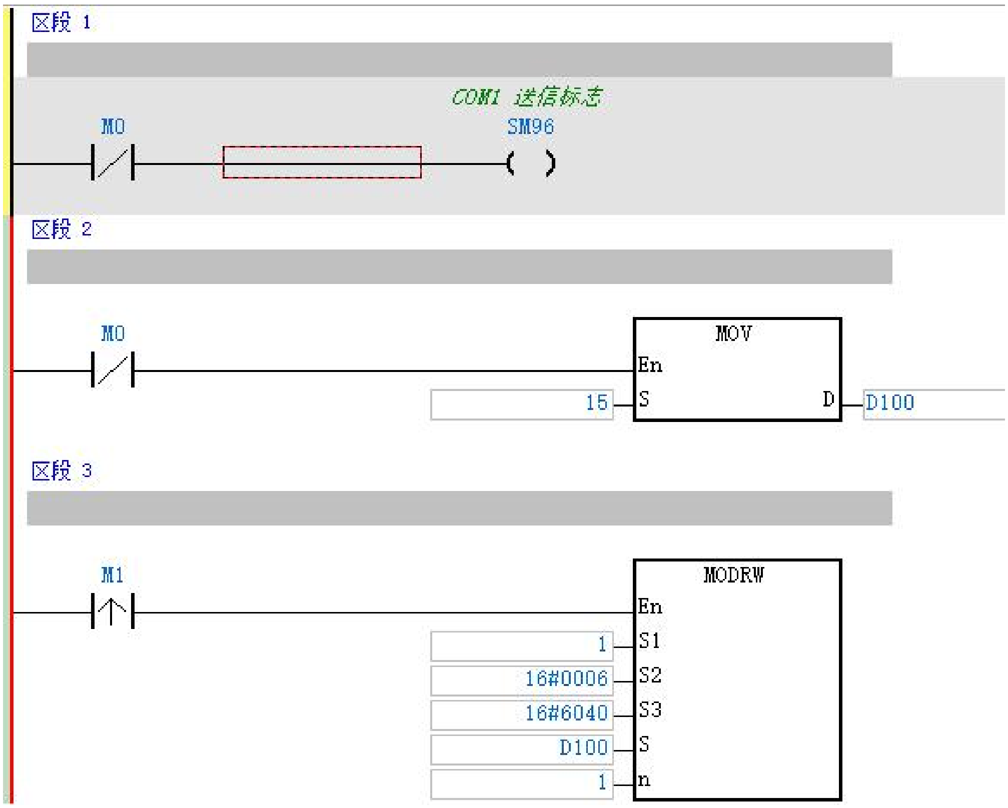
Notice: The quantity of address of 16-bit register is 1, and the quantity of address of 32-bit register is 2.

3 Function Code 06h

01 06 60 41 00 0F XX XX (XX XX is CRC check, this code will be automatically calculated and attached to the data)

When M1 is ON, write the data in D100 through the COM1 of PLC to register address 0x6040 of Slave 1.

Notice: The quantity of address of 16-bit register is 1, and the quantity of address of 32-bit register is 2.



4 Function Code 10h

01 06 60 00 00 01 XX XX

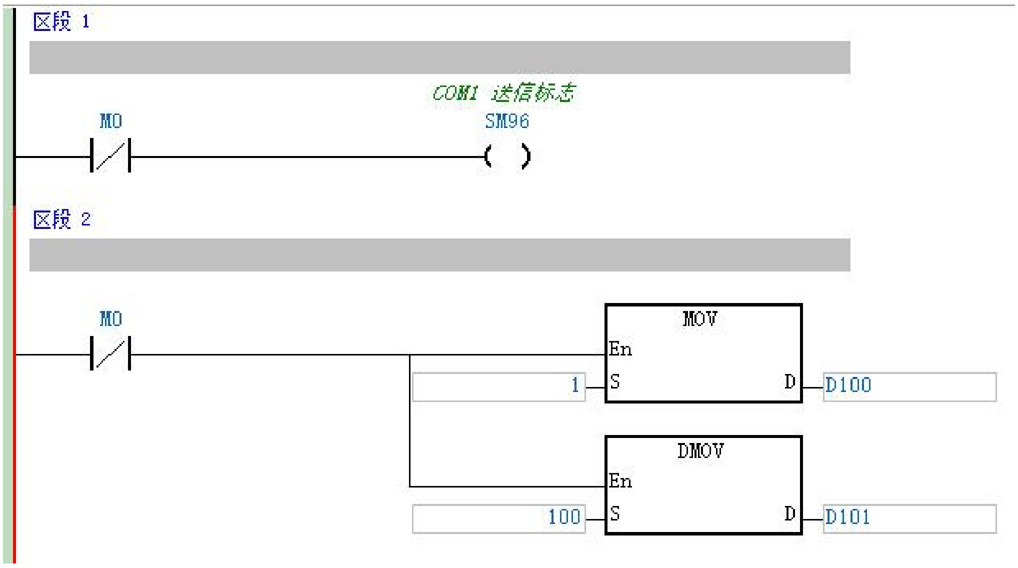
01 10 60 81 00 02 04 00 64 00 00 XX XX

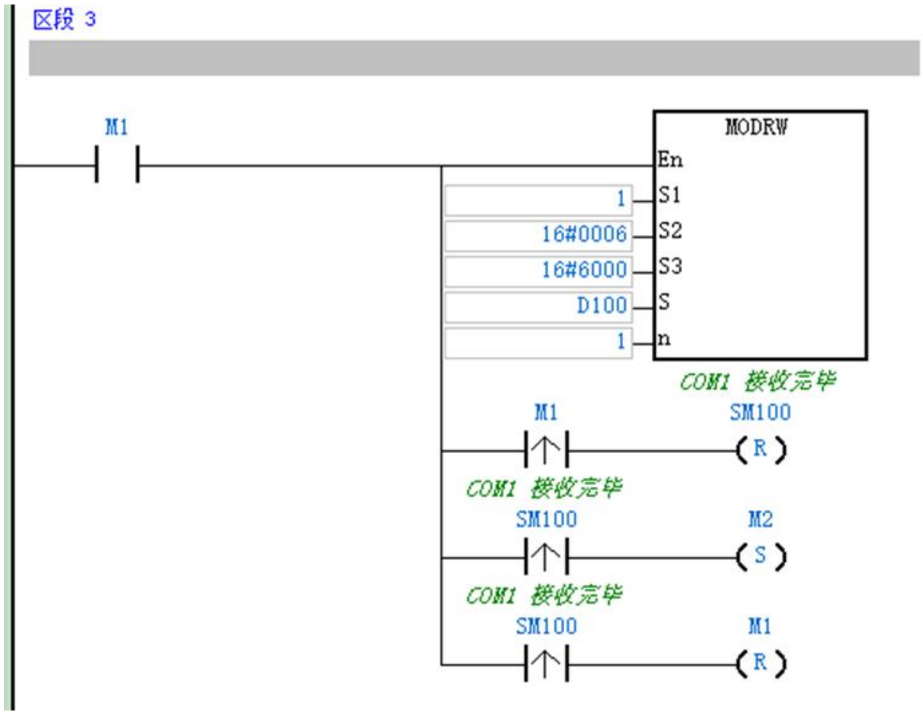
(XX XX is CRC check, this code will be automatically calculated and attached to the data)

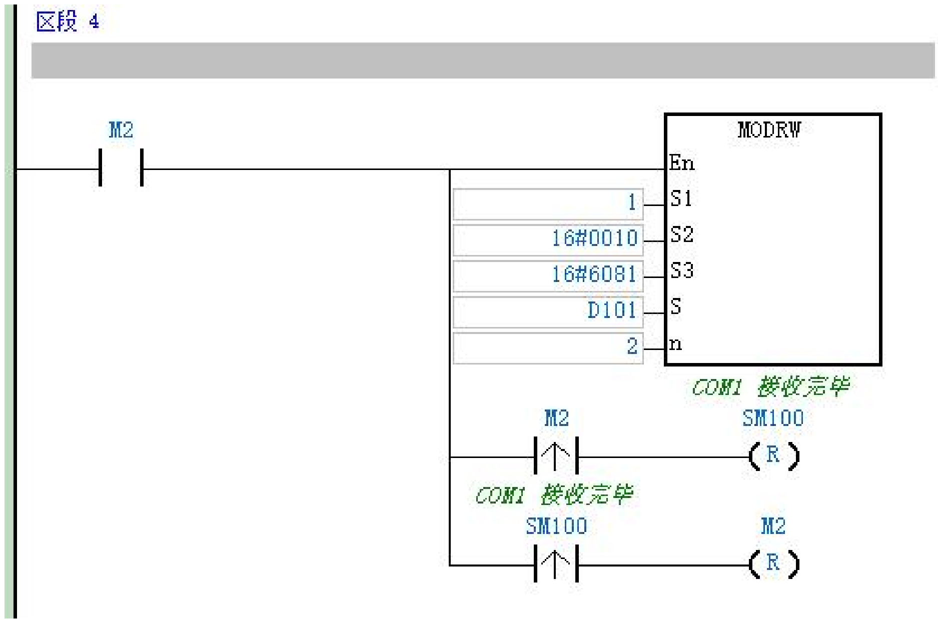
When DMOV is used to transmit data, the high and low bits are interchanged. So, we need to write 1 into the 0x6000 format register.

When M1 is ON, write the data in D100 through the COM1 of PLC to register address 0x6000 of the Slave 1. When the data is received, set the position M1 to ON and write the data in D101-D102 into the register address 0x6081 of the Slave 1 through the COM1 of PLC.

Notice: The quantity of address of 16-bit register is 1, and the quantity of address of 32-bit register is 2.



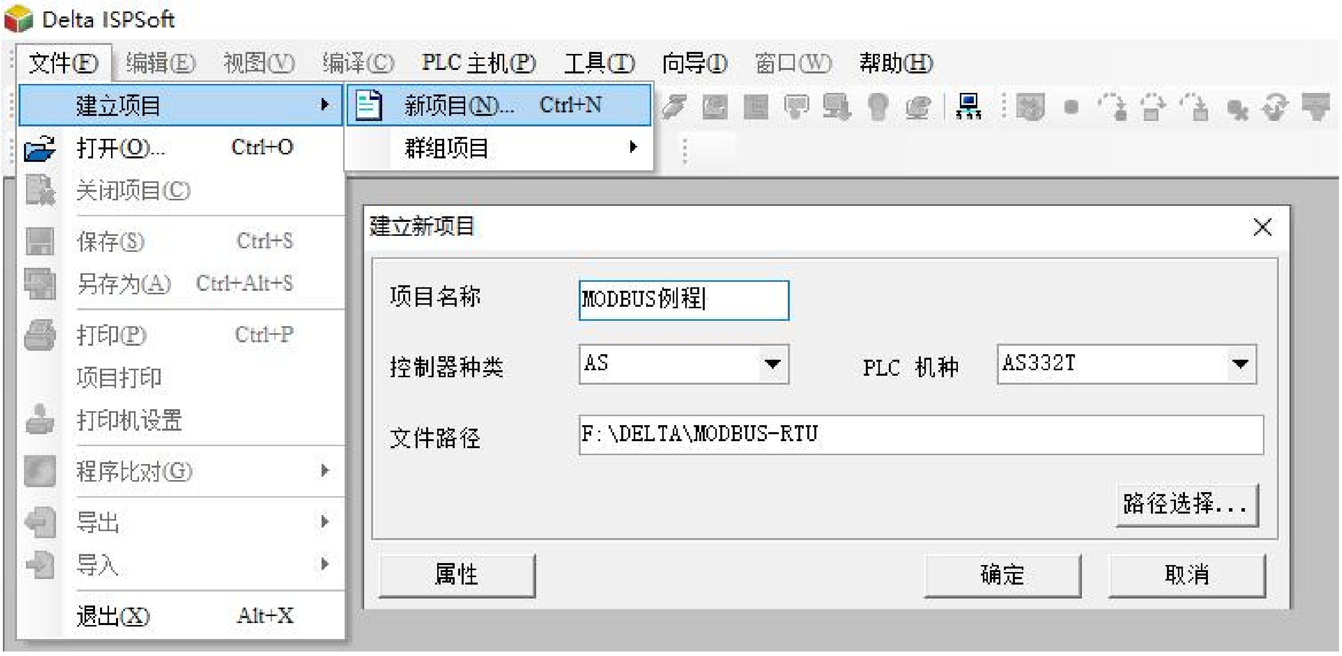

区段 3
M1
MODRW
En
1
S1
16#0006
S2
16#6000
S3
D100
S
1
n
COM1 接收完毕
M1
SM100
R
COM1 接收完毕
SM100
M2
S
COM1 接收完毕
SM100
M1
R


区段 4
M2
MODRW
En
1
S1
16#0010
S2
16#6081
S3
D101
S
2
n
COM1 接收完毕
M2
SM100
R
COM1 接收完毕
SM100
M2
R

CANopen communication in Delta controller

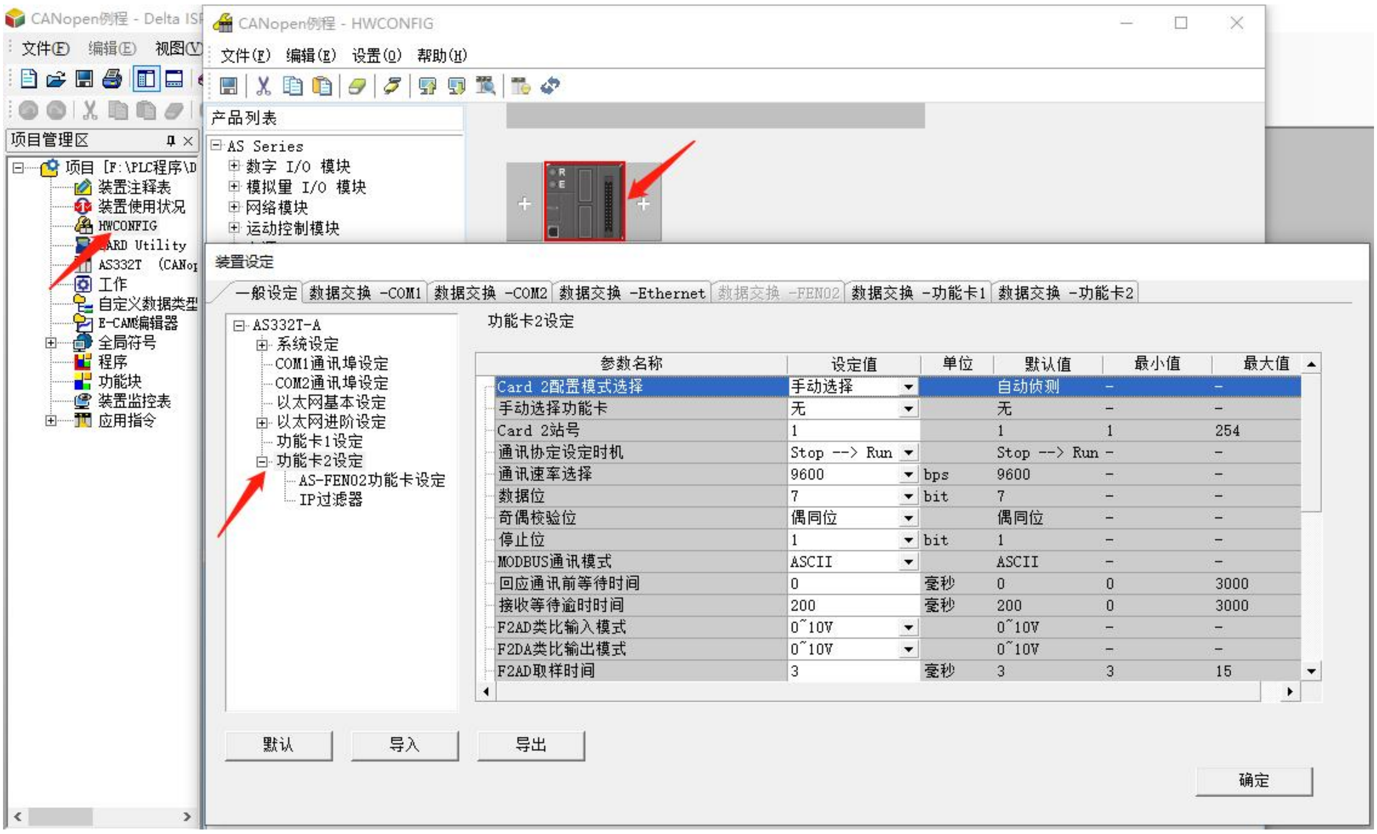
➢ Create New Project

- Open software → click File → click Create New Project → select PLC model → OK

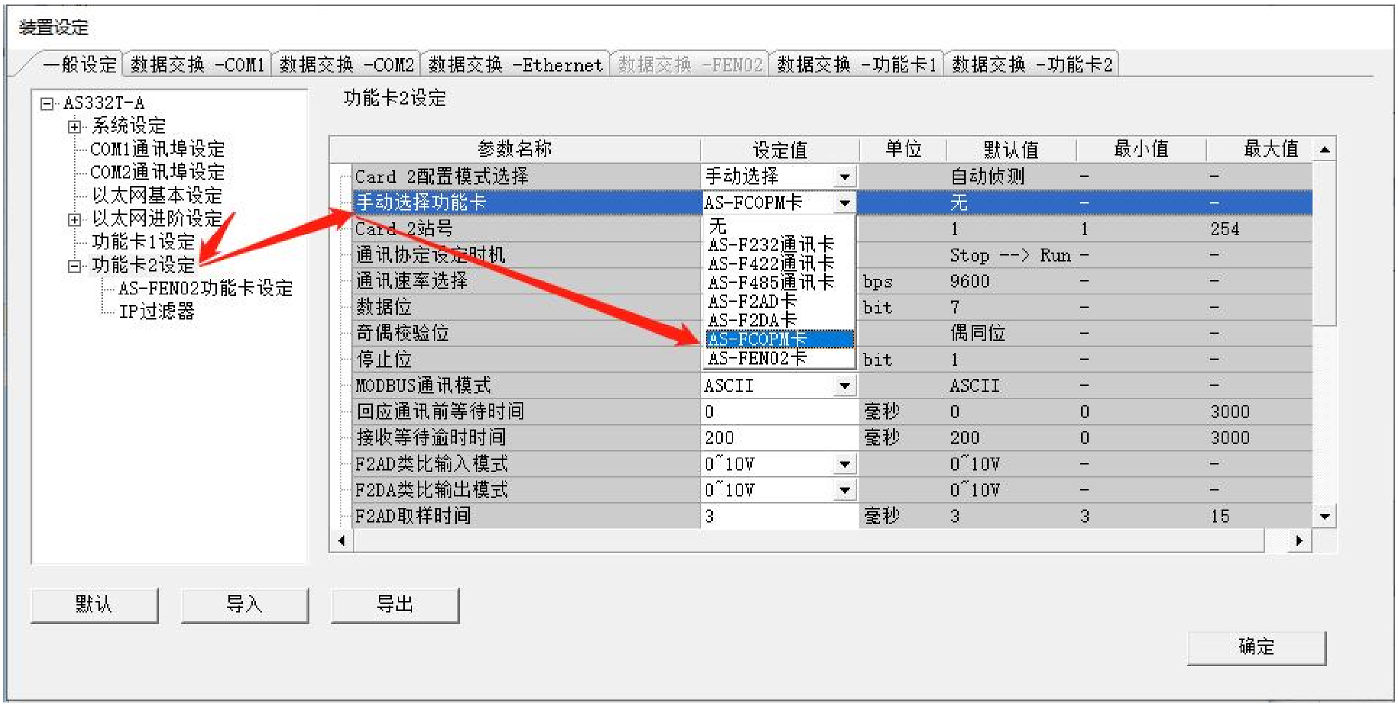


➢ Communication Parameter Setting

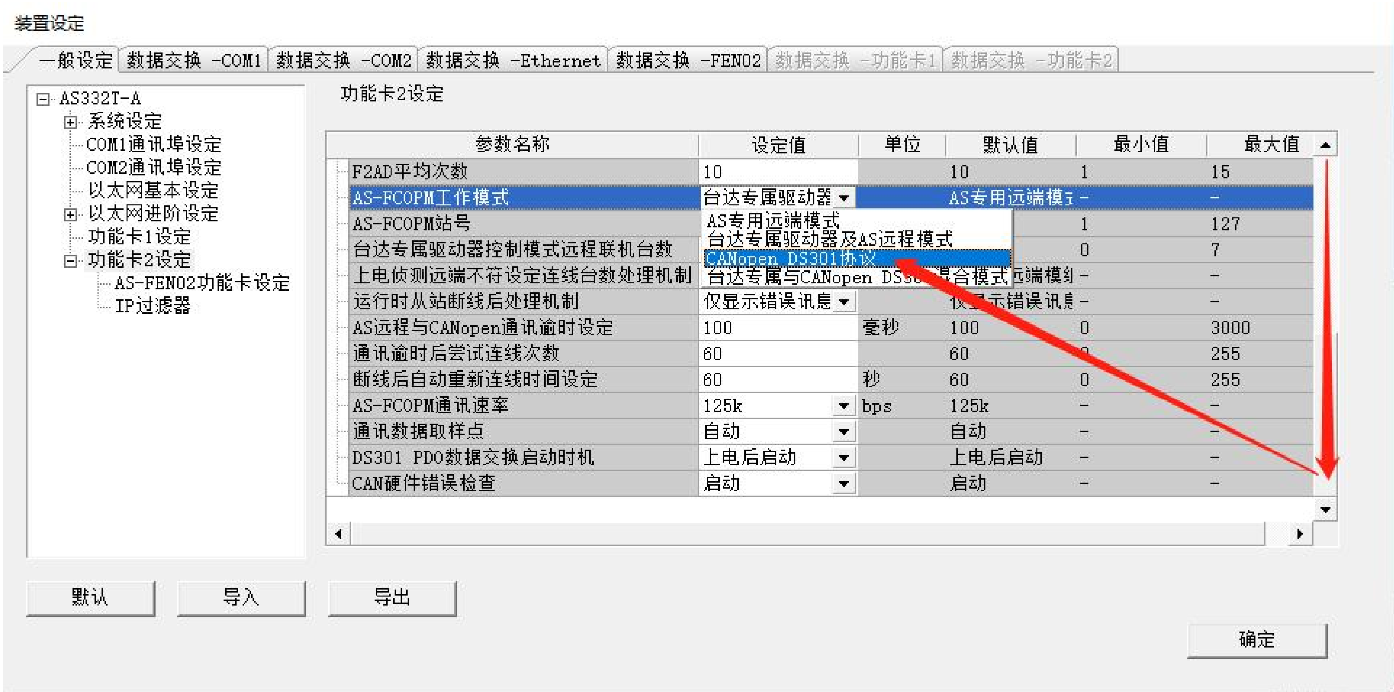
Double-click HWCONFIG → Double-click PLC icon → Select function card →set Communication Parameters → OK



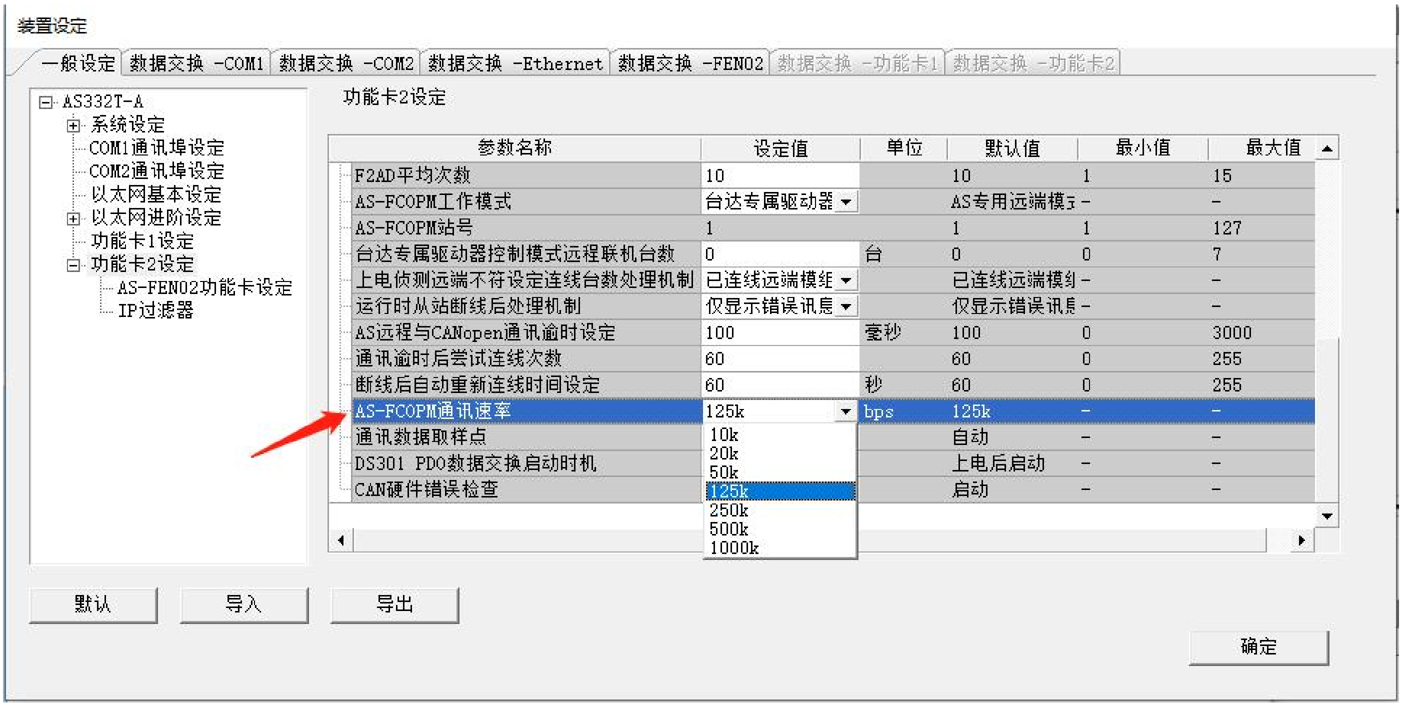
- Select function card setting → Function Card 2 Setting → Manually select function card → AS-FCOPM card



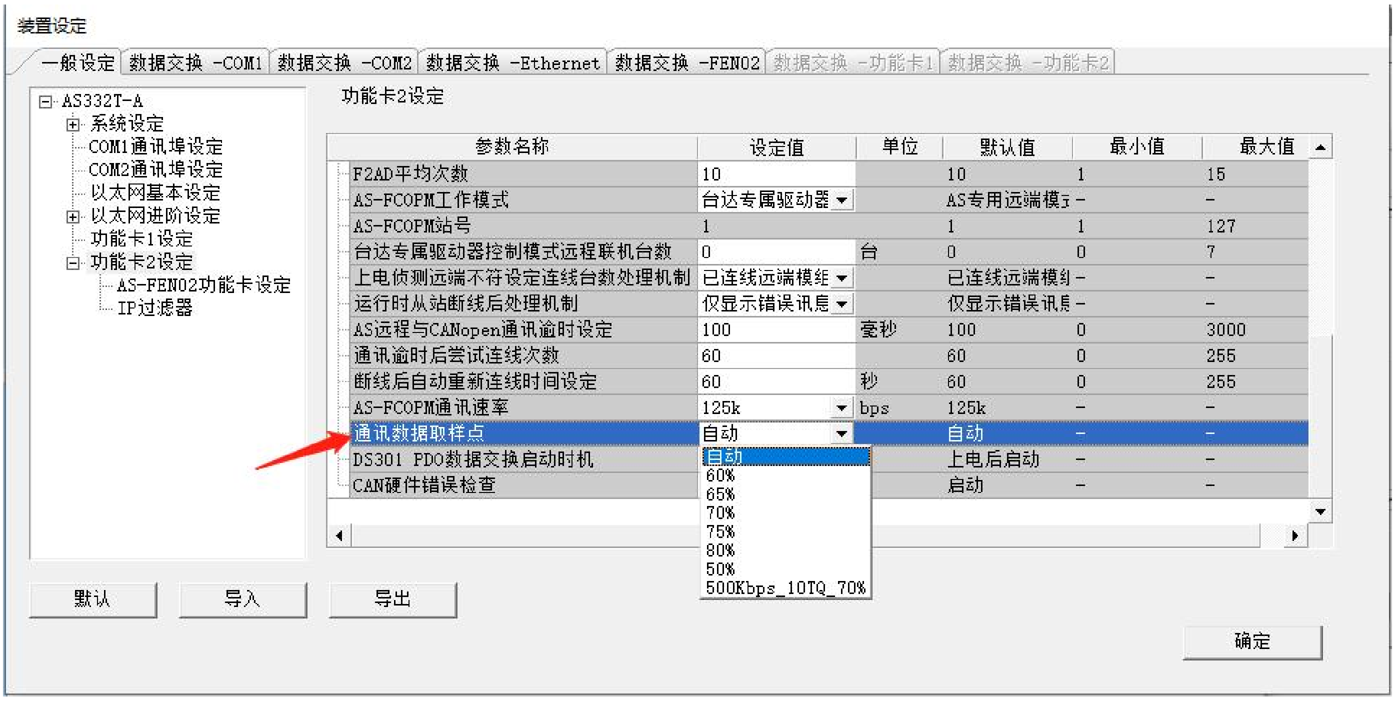
- Drop-down list → AS-FCOPM work mode → CANopen DS301 protocol



- Set AS-FCOPM Communication rate, according to Slave station.

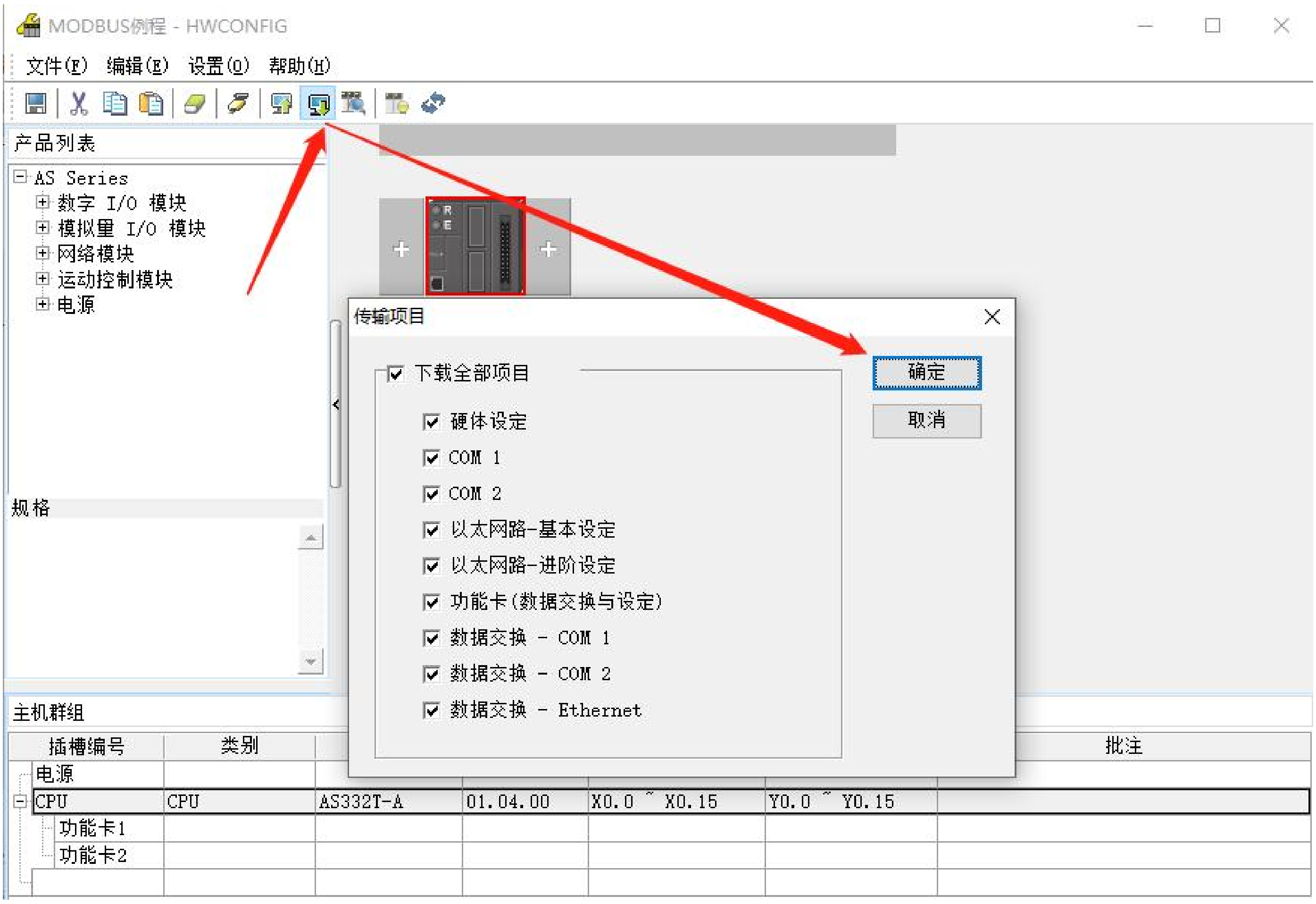


- Set Communication data sampling point, according to Slave station to select appropriate value.

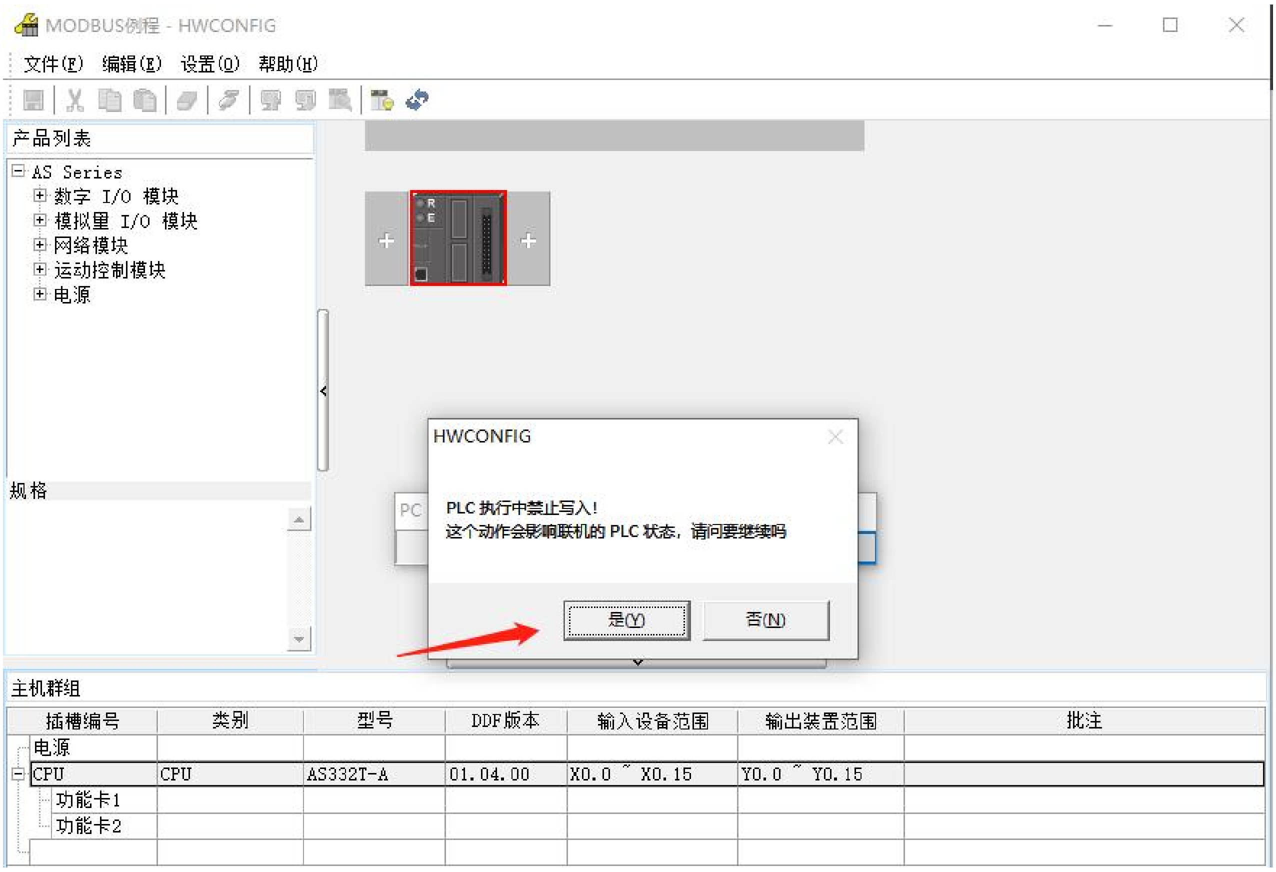


➢ Communication Parameter Download

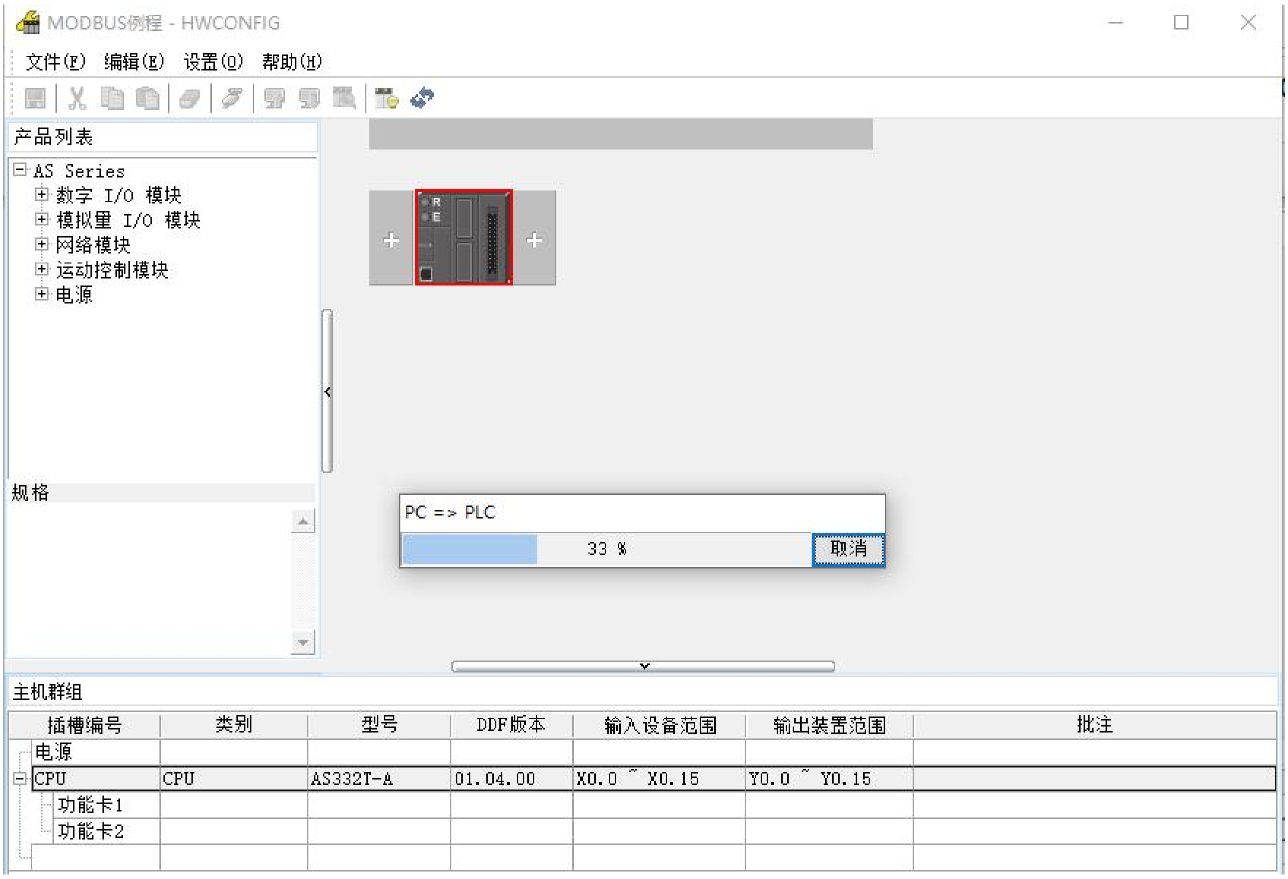
- Click Download icon → OK



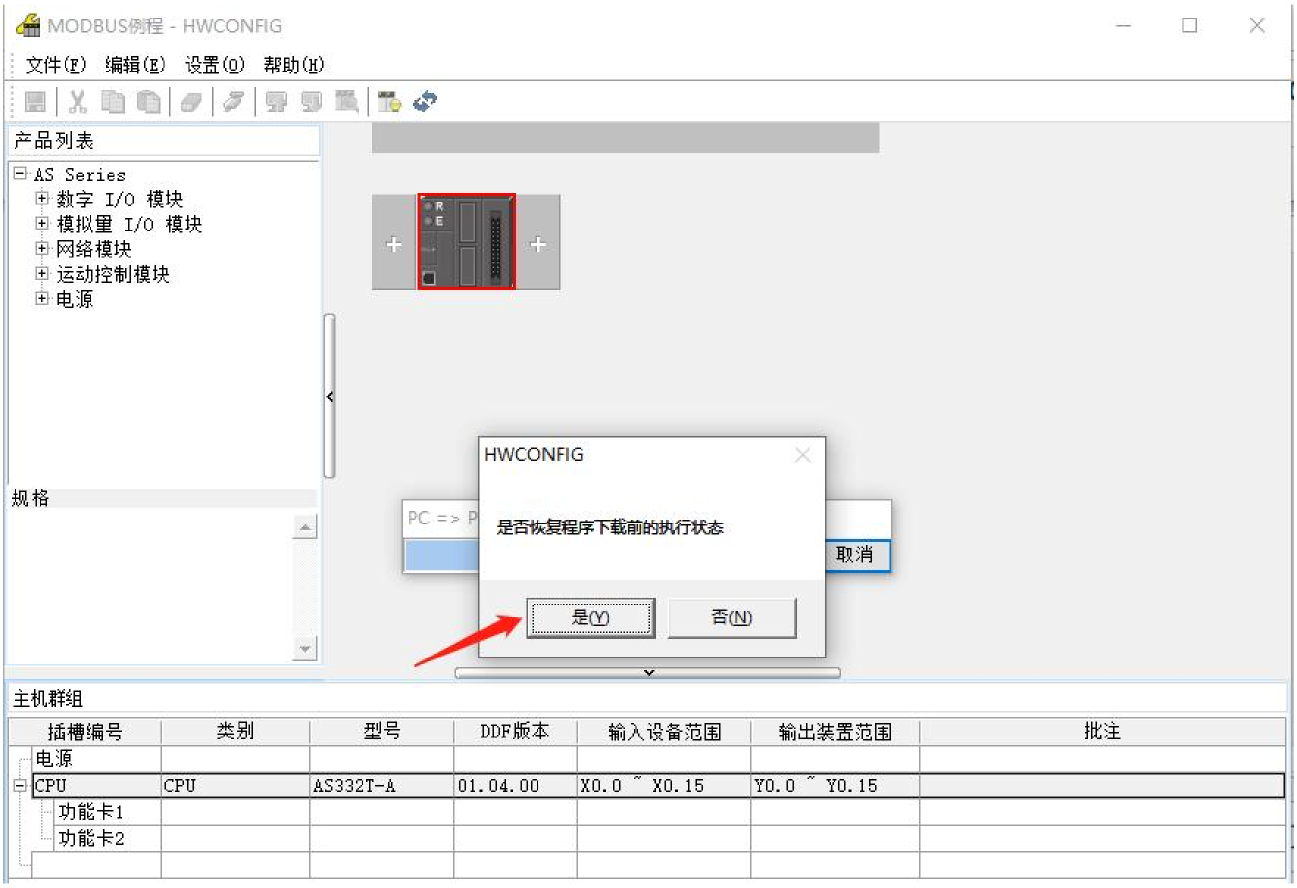
- Click YES to download



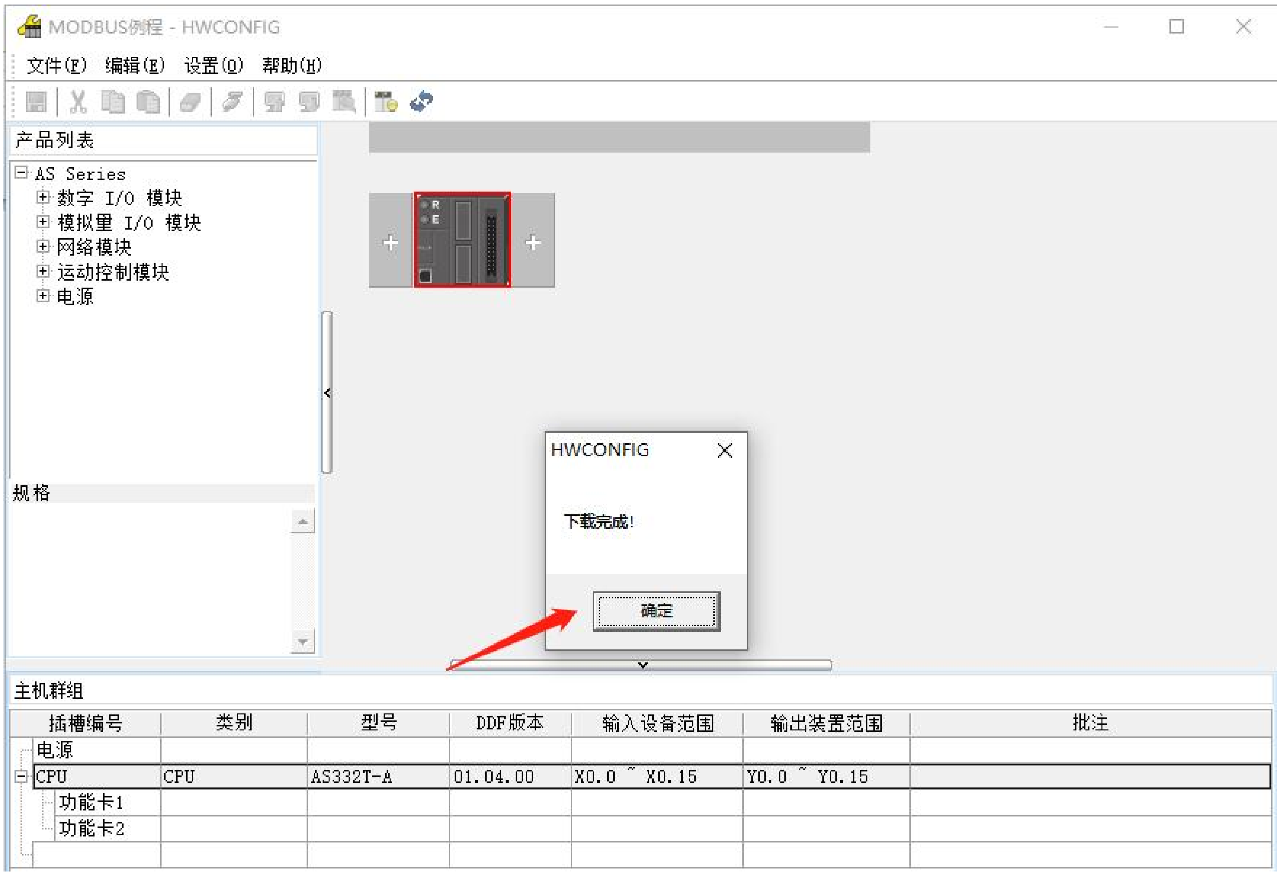
- Wait until the action is finished



- Click ok to enter the execution state

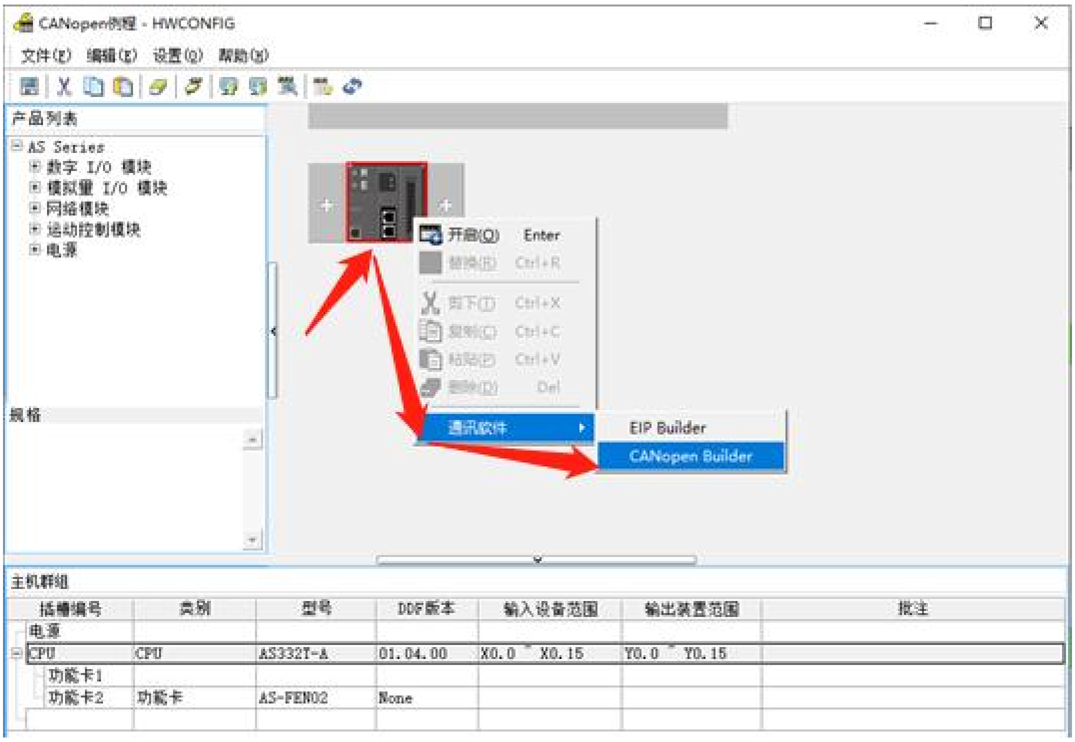


- Wait until the action is complete and click the OK button

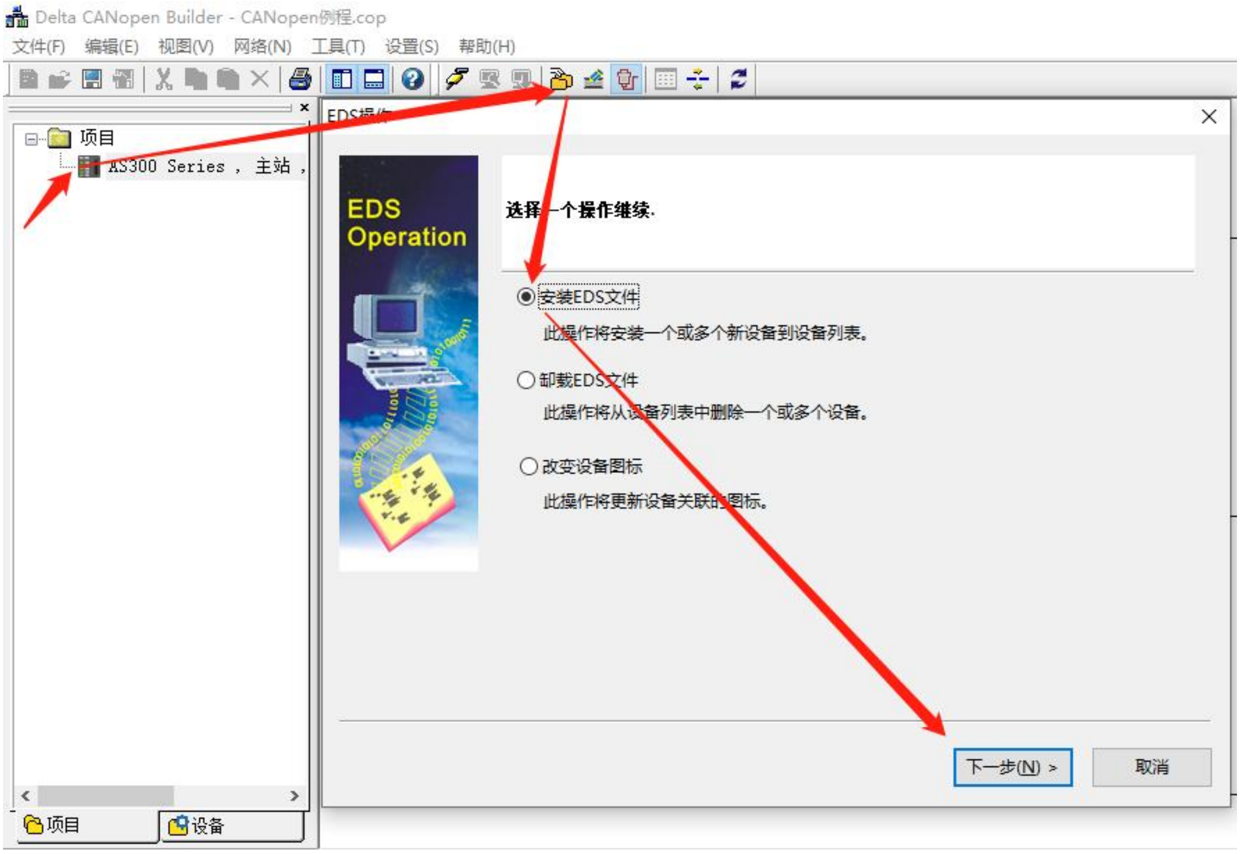


➢ Add EDS File

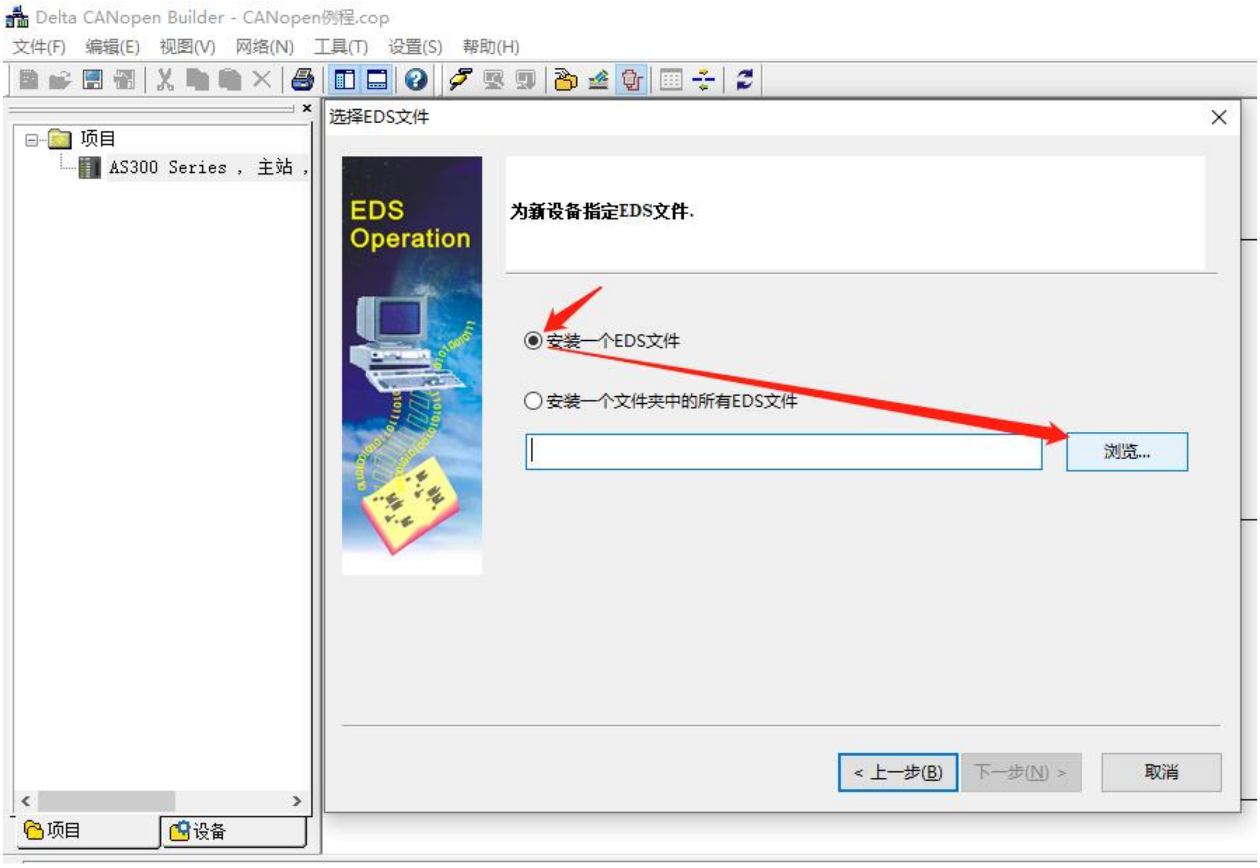
- Click PLC icon →Mouse Right → Communication software → CANopen Builder



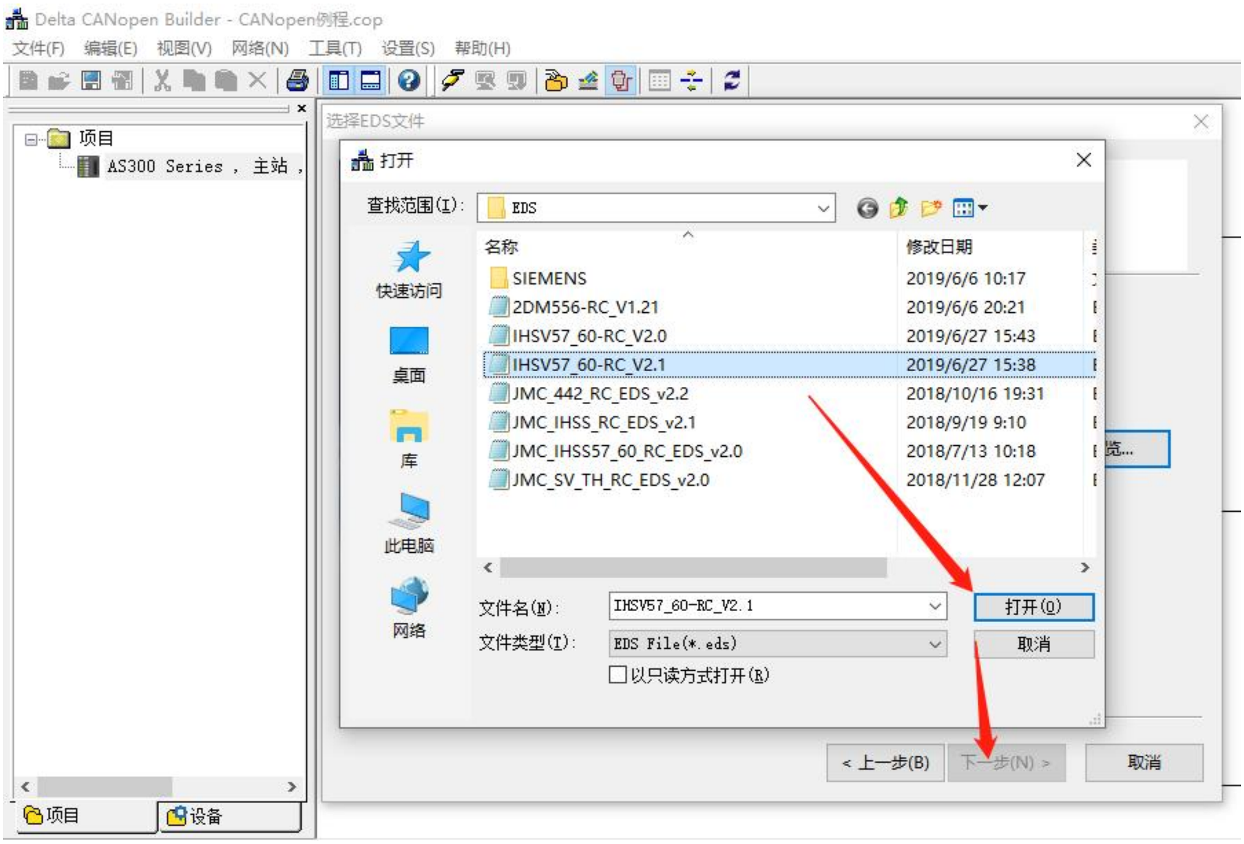
- Click EDS operation → Install EDS file → Next



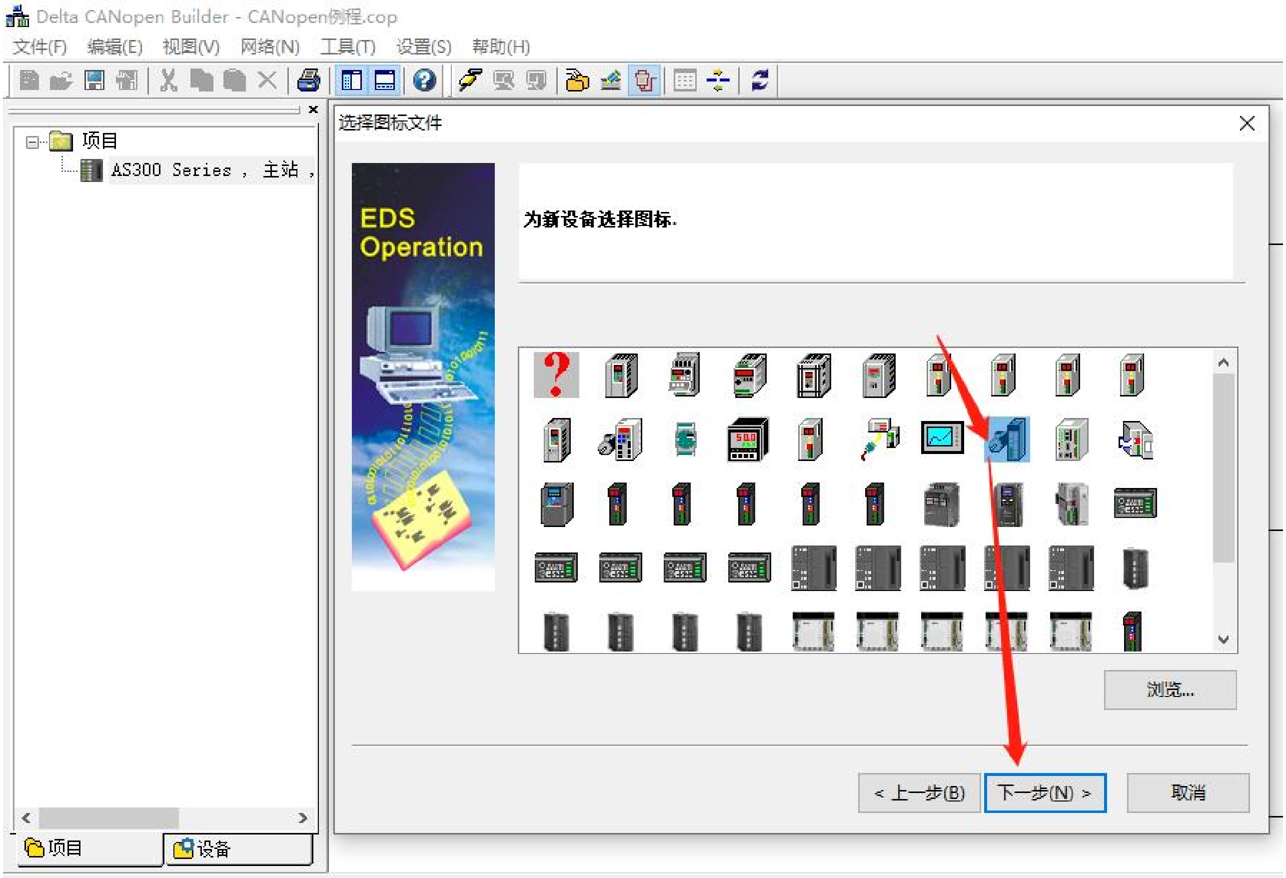
- Install EDS file → Browsing

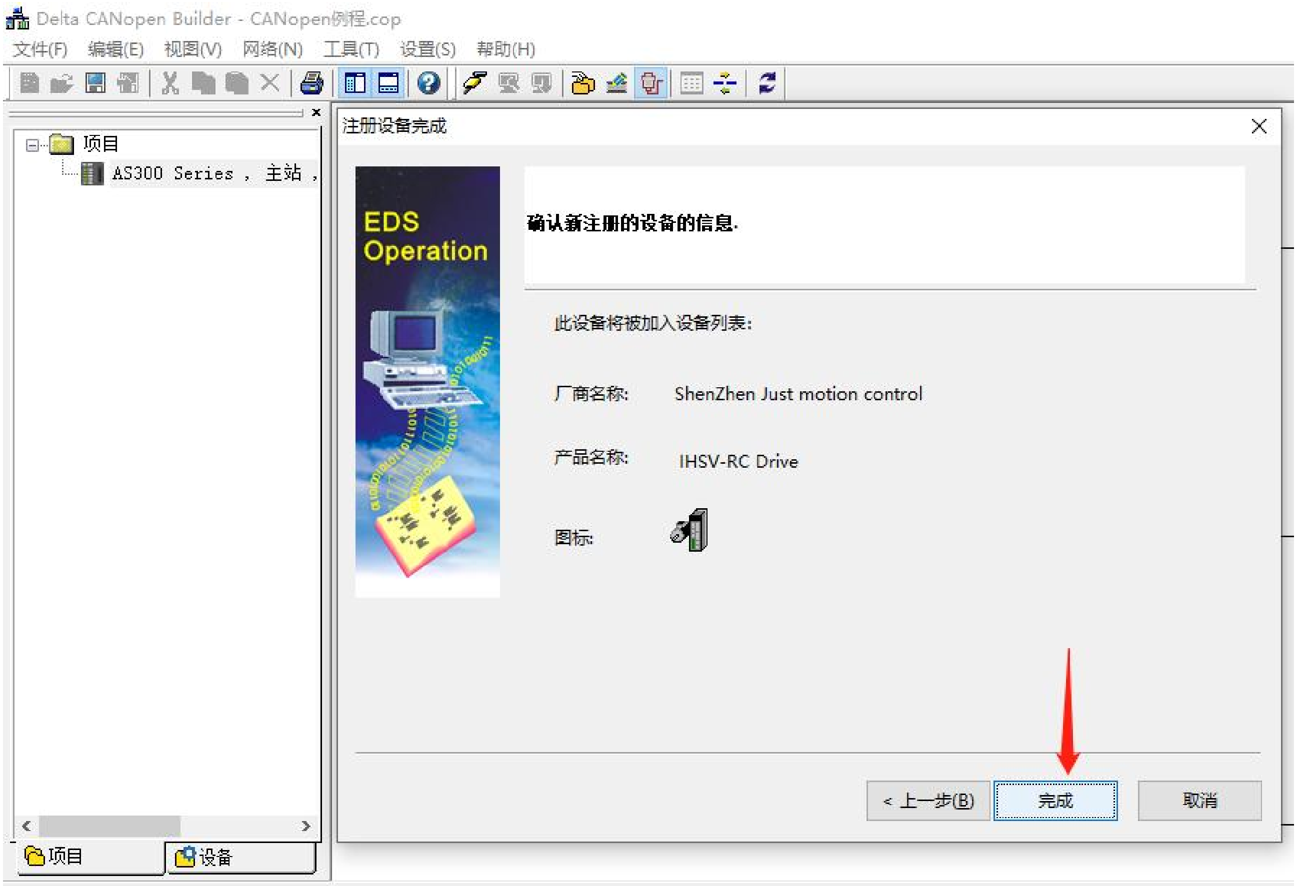


- Select EDS file



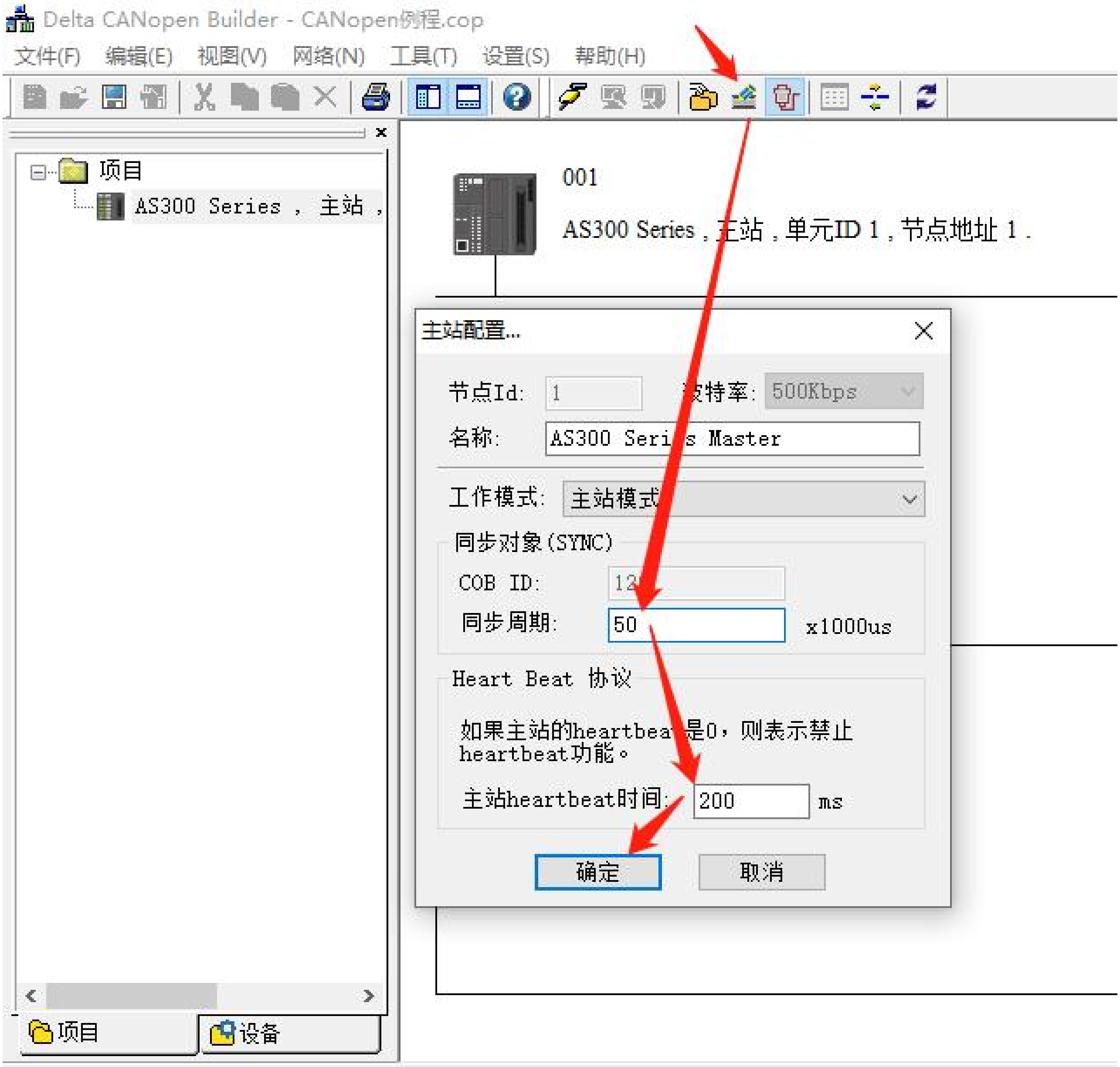
- Select devices (optional) → Next


Delta CANopen Builder - CANopen例程.cop
文件(F) 编辑(E) 视图(V) 网络(N) 工具(T) 设置(S) 帮助(H)
项目
AS300 Series , 主站 ,
项目
设备
选择图标文件
EDS Operation
为新设备选择图标.
浏览...
< 上一步(B)
下一步(N) >
取消


Delta CANopen Builder - CANopen例程.cop
文件(F) 编辑(E) 视图(V) 网络(N) 工具(T) 设置(S) 帮助(H)
项目
AS300 Series , 主站 ,
项目
设备
注册设备完成
EDS Operation
确认新注册的设备的信息.
此设备将被加入设备列表:
厂商名称: ShenZhen Just motion control
产品名称: IHSV-RC Drive
图标:
< 上一步(B)
完成
取消

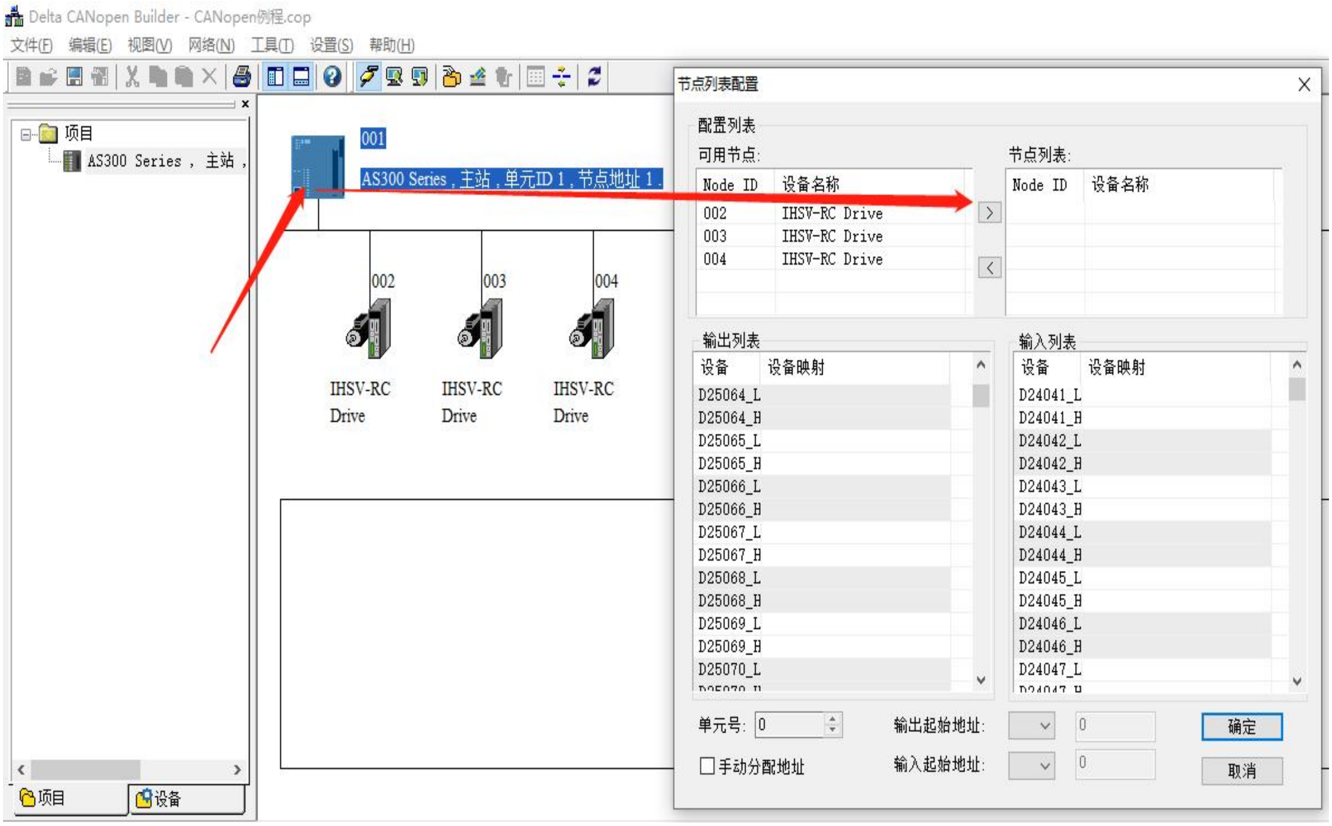
➢ Master Parameter Setting

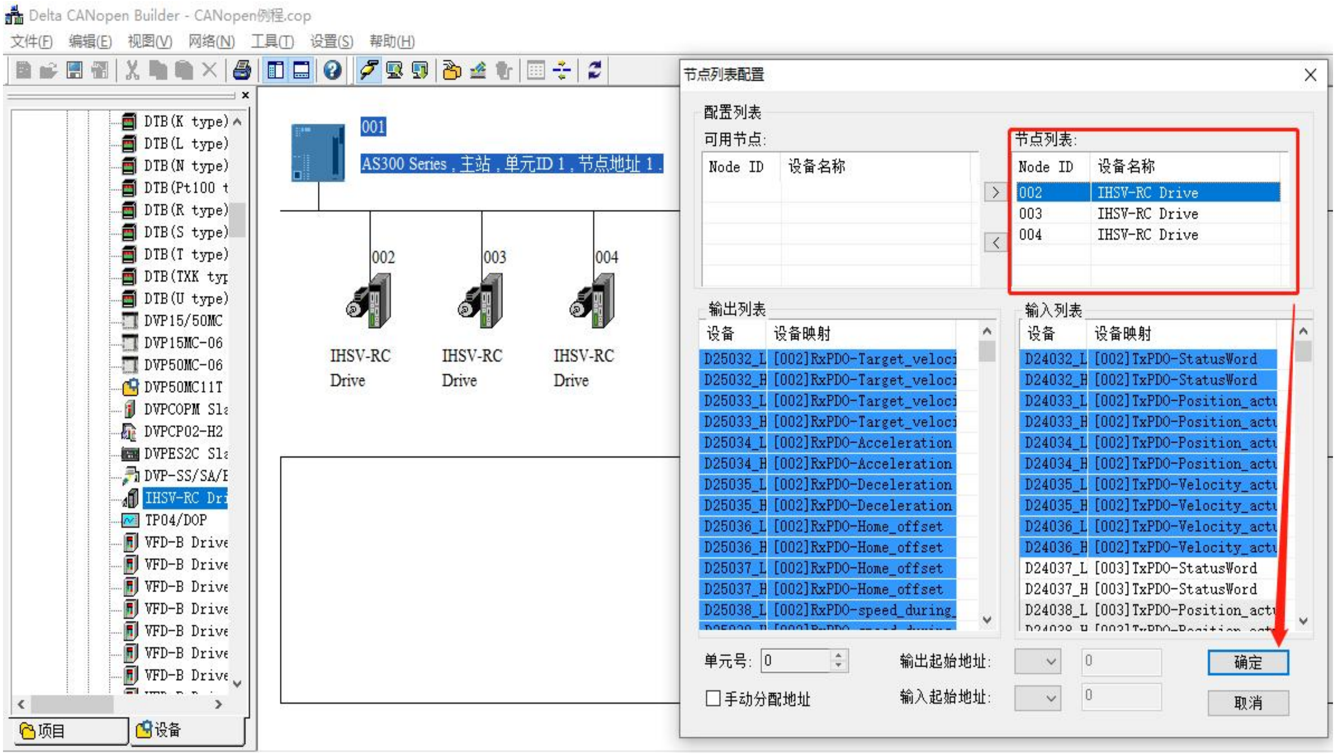
The synchronization cycle time can be set. The more axis you control, the higher the synchronization cycle time needs to be set.



➢ Add Slave station

Double-click Master → Adds the available nodes on the left to the node list on the right.





➢ Device mapping

The RPDO of the first slave station maps to the address in the PLC.

Address	Signal	Definition	Remark
D25032	Target_velocity	32-bit Profile velocity	6081h
D25033	Target_velocity		
D25034	Acceleration	Profile acceleration	6083h

D25035	Deceleration	Profile deceleration	6084h
D25036	Homing_offset	Homing offset	607Ch
D25037	Homing_offset		
D25038	speed_during_search_for_zero	Speed during search for zero	6099h 02
D25039	speed_during_search_for_zero		
D25040	speed_during_search_for_switch	Speed during search for switch	6099h 01
D25041	speed_during_search_for_switch		
D25042	Homing_acceleration	Homing acceleration	609Ah
D25043	Quick_stop_deceleration	Quick stop deceleration	6085h
D25044_L	Modes_of_operation	Modes of operation	6060h
D25044_H	Homing_method	Homing method	6098h
D25045	Target_position	32-bit Profile position	607Ah
D25046	Target_position		
D25047	ControlWord	Controlword	6040h

The TPDO of the first slave station maps to the address in the PLC.

Address	Signal	Definition	Remark
D24032	StatusWord	Statusword	6041h
D24033	Position_actual_value	Position actual value	6064h
D24034	Position_actual_value		
D24035	Velocity_actual_value	Velocity actual value	606Ch
D24036	Velocity_actual_value		

The RPDO of the second slave station is mapped to the address in the PLC by moving 16 registers back from the first slave station.

The TPDO of the second slave station is mapped to the address in the PLC by moving 5 registers back from the first slave station.