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Chapter 1 safety reminder

This chapter describes important matters that users must observe, including product identification, storage, transportation, installation, wiring, operation, and inspection.

1.1 Safety Notes

●Turn off the power for more than 5 minutes before disassembling and installing the driver, otherwise it may cause electric shock due to residual voltage.

●Do not disassemble or install the driver when the servo unit is powered on, otherwise it may cause electric shock, stop the product or burn it out.

●Please never touch the inside of the servo drive, otherwise it may cause electric shock.

●When the power is turned on and for a period of time after the power is cut off, the heat sink of the servo drive, the external braking resistor, the servo motor, etc. may be high temperature, please do not touch, otherwise it may cause burns. To prevent inadvertent contact with hands or parts (such as cables, etc.), take safety measures such as installing a cover.

●Please use the power supply specification that conforms to the product for the power supply of the servo drive, otherwise it may cause the product to burn out, electric shock or fire.

●Between the power supply and the main circuit power supply of the servo drive, be sure to connect a magnetic contactor and a non-fuse circuit breaker. Otherwise, when the servo drive fails, the large current cannot be cut off, resulting in a fire.

●The ground terminal of the servo drive must be grounded, otherwise it may cause electric shock.

●Unless you are a professional, do not set up, disassemble, or repair the product, as this may result in electric shock or injury.

●Please never modify this product, otherwise injury or mechanical damage may result.

●Do not damage or pull the cable too hard, do not subject the cable to excessive force, do not place it under heavy objects or cause it to be pinched, otherwise it will cause malfunction, damage, and electric shock.

●When the servo motor is running, please never touch its rotating parts, otherwise you may be injured.

●Do not use this product near places where it will be splashed with water, corrosive environments, flammable gas environments and combustibles, otherwise it may cause electric shock or fire.

●Please install the servo drive, servo motor and external braking resistor on incombustible materials, otherwise it may cause fire.

●In the servo driver and servo motor, do not mix flammable foreign objects such as oil and grease, and conductive foreign objects such as screws and metal pieces, otherwise it may cause a fire.

● When installing it on the supporting machine and starting to run, please put the servo motor in a state where it can be stopped at any time in advance, otherwise it may cause injury.

● In the state where the servo motor and the machine are connected, if an operation error occurs, it will not only cause mechanical damage, but may also lead to personal accidents.

● Install an external emergency stop device to ensure that the power is turned off and operation is stopped immediately when an error occurs.

● Please use a noise filter, etc. to reduce the influence of electromagnetic interference, otherwise it will cause electromagnetic interference to the electronic devices used near the servo unit.

● Servo unit and servo motor should be used in the specified combination.

1.2 Precautions for storage

● Do not place too much of this product on top of one another, as this may cause injury or malfunction.

● Please store in the following environment:

- Places without direct sunlight;
- Places where the ambient temperature is within the range of -20℃ to +65℃;
- The relative humidity is in the range of 0% to 95%, and there is no condensation;
- Places without water droplets, steam, dust and oily dust;
- Places without high-heating devices;
- Non-corrosive, flammable gas and liquid places;
- Places that are not easy to be splashed with water, oil, medicines, etc.;
- Places that will not be exposed to radioactive radiation;
- Strong and vibration-free place;
- A place without electromagnetic noise interference.

Storage in an environment other than the above may result in product failure or damage.

1.3 Precautions for transportation

● When operating the servo unit and servo motor, be careful of sharp parts such as the corners of the equipment, otherwise injury may result.

● Do not place too much of this product on top of one another, as this may cause injury or malfunction.

● This is a precision device, please do not drop it or apply strong impact to it, otherwise it will cause malfunction or damage.

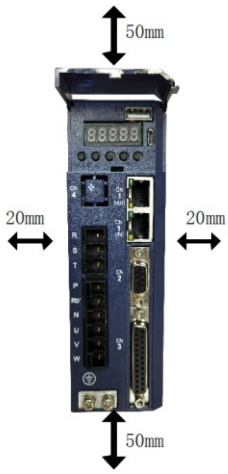
● Do not apply shock to the connector part, otherwise it will cause poor connection or malfunction.

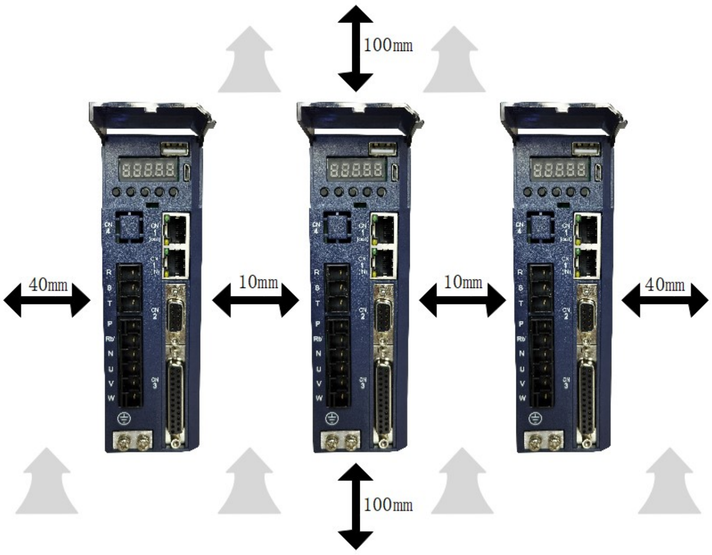
1.4 Notes on installation

●Please install the drive on a dry and sturdy platform, maintain good ventilation and heat dissipation, and maintain a good grounding during installation.

●Please install it in the prescribed direction to avoid malfunction.

●When installing, please make sure to keep the specified distance between the servo drive and the inner surface of the electric cabinet and other machines, otherwise it will cause fire or failure.





●When installing, do not block the air inlet and air outlet, and do not allow foreign objects to enter the product, otherwise it may cause malfunction or fire due to the aging of the internal components.

●Do not place heavy objects on or on top of this product, as this may result in injury.

●Please install in the following environment:

- Places without direct sunlight;
- Locations where the ambient temperature is in the range of 0℃ to 55℃;
- The relative humidity is in the range of 0% to 95%, and there is no condensation;
- Places without water droplets, steam, dust and oily dust;
- Places without high-heating devices;
- Non-corrosive, flammable gas and liquid places;
- Places that are not easy to be splashed with water, oil, medicines, etc.;
- Places that will not be exposed to radioactive radiation;
- A firm and vibration-free place;
- A place without electromagnetic noise interference.

Installation in an environment other than the above may result in product failure or damage.

1.5 Wiring Precautions

●It is recommended not to use single-phase 220V main power supply, as the electrolytic capacitor may be damaged due to lack of phase.

●Do not change the wiring while the power is on, otherwise electric shock or injury may result.

●Please have professional technicians perform wiring or inspection operations, otherwise it will cause electric shock or product failure.

●Please check the wiring and power supply carefully. The output circuit may be short-circuited due to incorrect wiring or the application of different voltages. When the above fault occurs, the brake does not operate, so it may cause mechanical damage or personal injury.

●Do not connect the input power cable to the U, V, W terminals of the drive, otherwise the servo drive will be damaged.

●When wiring, do not pass the power cable and the signal cable through the same pipe, and do not bundle them together. The distance between the two should be more than 30cm to avoid interference.

●The ground terminal of the driver must be connected to the ground to avoid leakage and reduce the interference to the system, and the diameter of the ground wire should be the same or larger than that of the power supply wire.

●When connecting the AC power supply and DC power supply to the servo unit, please connect to the designated terminals, otherwise it may cause malfunction or fire.

●For the wiring length, the maximum length of the command input line is 3m, and the maximum length of the encoder line is 20m.

●Please use twisted-pair shielded cables for signal cables and encoder cables, and the shielding layer is grounded at one end.

●The U, V, W terminals of the driver and the U, V, W terminals of the motor should be connected one by one according to their names. If they are connected incorrectly, the motor cannot run normally.

●Products that share the DC bus should have a varistor, and the wiring should be secure.

●Please wait at least 5 minutes after the power is turned off before performing the inspection. Even if the power is turned off, high voltage may still remain inside the servo drive. Therefore, within 5 minutes after the power is turned off, do not touch the power terminals, otherwise it will cause electric shock.

●Do not turn on/off the power frequently. When it is necessary to repeatedly turn on/off the power continuously, please control it to less than once a minute. Since the power supply part of the servo driver has a capacitor, a large charging current will flow (charging time 0.2 seconds) when the power is turned ON/OFF. Therefore, if the power is turned on/off frequently, the performance of the main circuit components inside the servo drive will be degraded.

●Do not power on when the terminal block screws or cables are loose, otherwise it may cause fire.

●In the following places, please take appropriate shielding measures, otherwise it may cause damage to the machine:

- Places where there is interference due to static electricity;
- Places where strong electric or magnetic fields are generated;
- places where radiation exposure may occur;
- Places with power lines nearby.

1.6 runtime considerations

●During the test run, in order to prevent accidents, please run the servo motor with no load (not connected to the transmission shaft), otherwise it may cause injury.

●When it is installed on the matching machine and starts to run, please set the user parameters that match the machine in advance. If the operation is started without parameter setting, it may cause loss of control or malfunction of the machine.

●To avoid accidents, please install a limit switch or stopper at the end of the moving part of the machine, otherwise it will cause damage to the machine or injury to personnel.

●Do not make extreme changes to the parameter settings, otherwise it will cause unstable movement, mechanical damage or injury.

●When the power is turned on or the power is just cut off, the heat sink, external braking resistor, motor, etc. of the servo drive may be in a high temperature state. Please do not touch it, otherwise it may cause burns.

●When using a servo motor on a vertical axis, please install a safety device to prevent the work piece from falling in the state of alarm, over travel, etc. In addition, please set the stop setting of the servo lock when over travel occurs, otherwise the work piece may drop in the over travel state.

●Do not enter the operating range of the machine during operation, otherwise injury may result.

●Do not touch the servo motor and the moving parts of the machine during operation, otherwise injury may result.

●Install a safety system to ensure safety even in the event of a signal line disconnection or other failure. For example, when the forward over-travel switch (P-OT) and reverse over-travel switch (N-OT) signals are disconnected at the factory settings, a safety action is performed.

●When turning off the power, be sure to set the servo OFF status.

●Do not turn on/off the power frequently. After starting the actual operation, the interval between power ON/OFF should be more than 1 hour, otherwise the components inside the servo unit will be aged prematurely.

●When an alarm occurs, reset the alarm after eliminating the cause and ensuring safety, and restart the operation. Otherwise, injury may occur.

●Do not use the brake of the brake motor for normal braking, otherwise it may cause malfunction.

1.7 Maintenance and Inspection Precautions

●Do not change the wiring while the power is on. Doing so may result in electric shock or injury.

● Please have professional technicians perform wiring or inspection operations, otherwise it will cause electric shock or product failure.

●Please wait at least 5 minutes after the power is turned off before performing the inspection. Even if the power is turned off, high voltage may still remain inside the servo drive. Therefore, within 5 minutes after the power is turned off, do not touch the power terminals, otherwise it will cause electric shock.

●When replacing the servo drive, please back up the user parameters of the servo drive to be replaced before replacing, and transfer the backup to the new servo drive, and then restart the operation, otherwise the machine may be damaged.

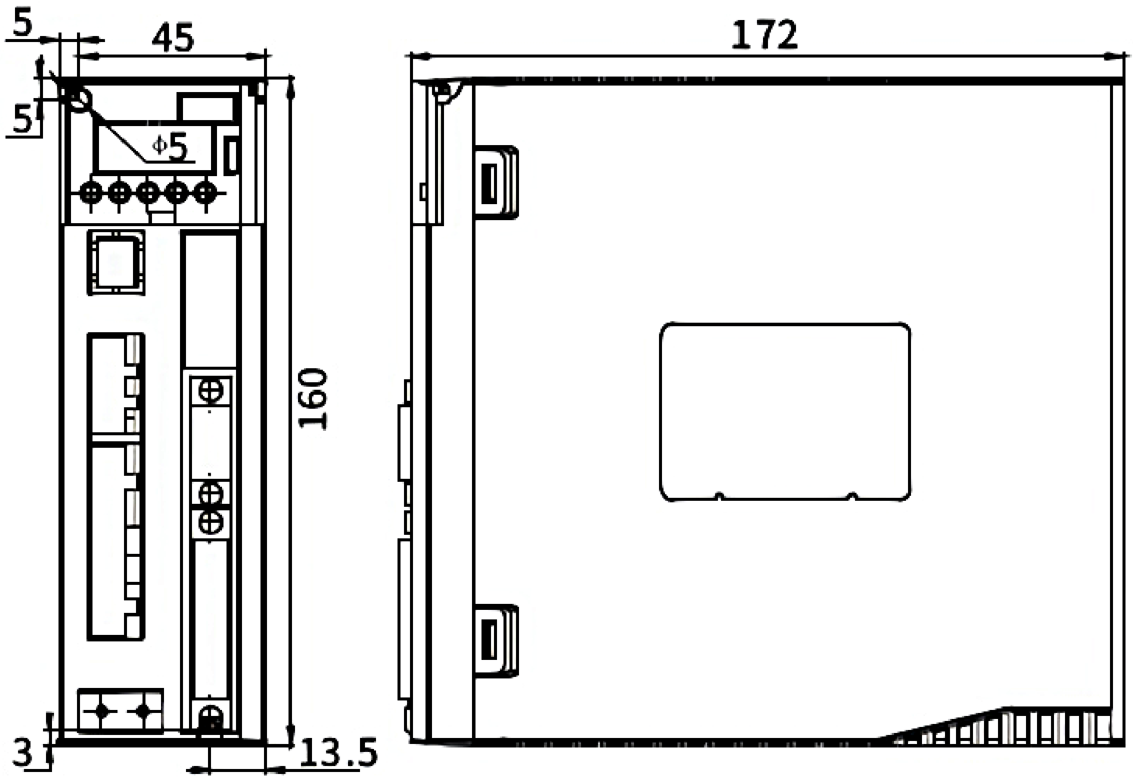
Chapter 2 Product Information

2.1 Drive form factor

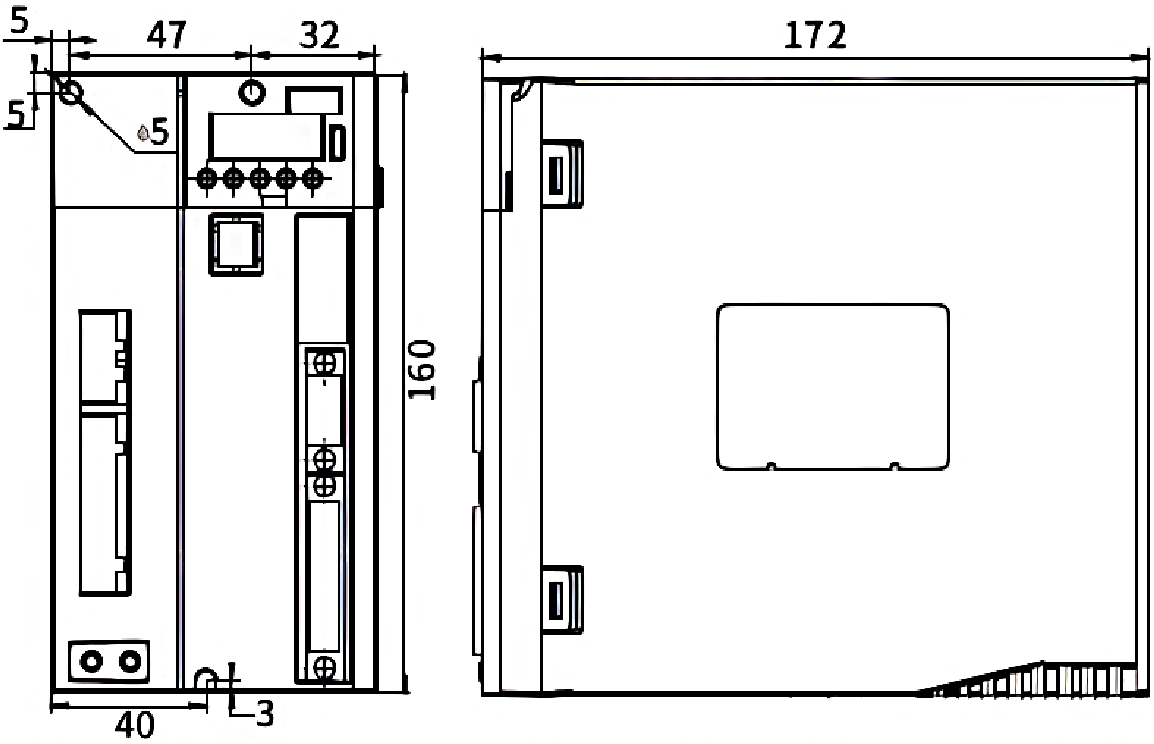
E Structure Profinet Bus

2.1.1 Installation dimensions of E1, E2, E3, EA structure drives

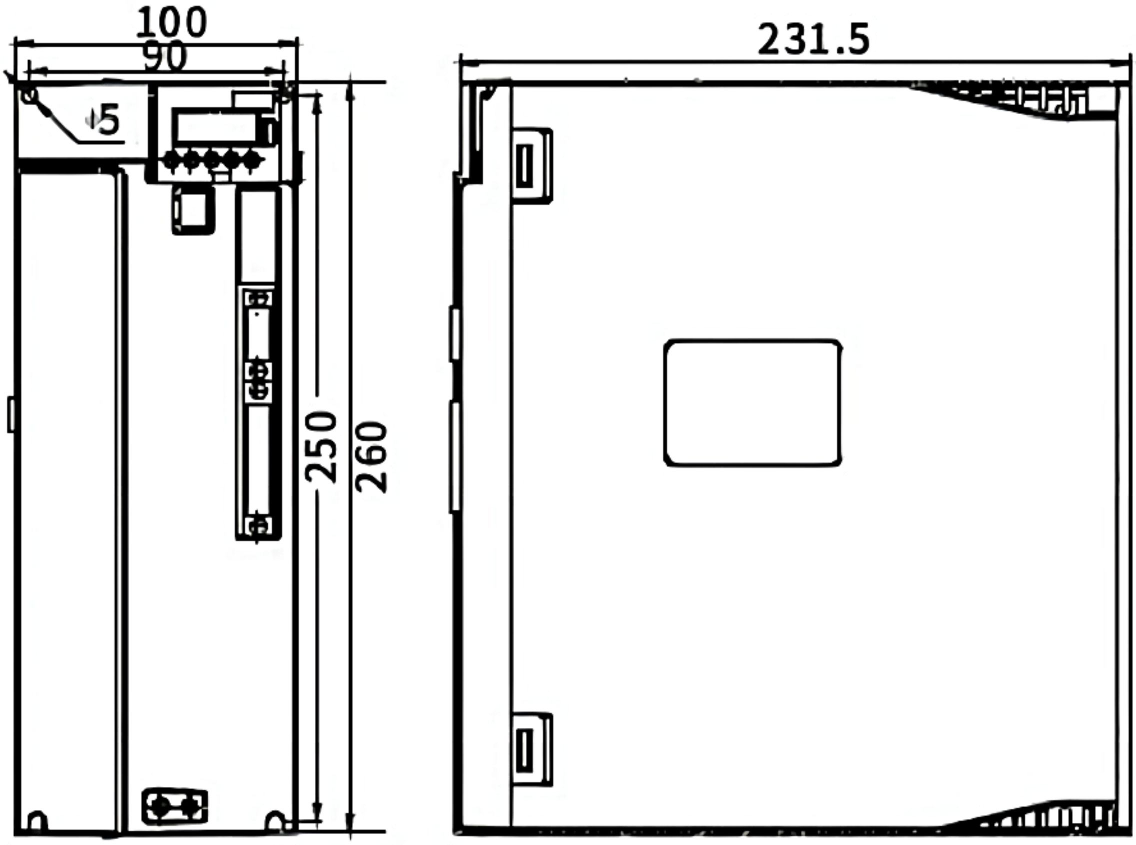
E1 adaptation current (A) 3-6



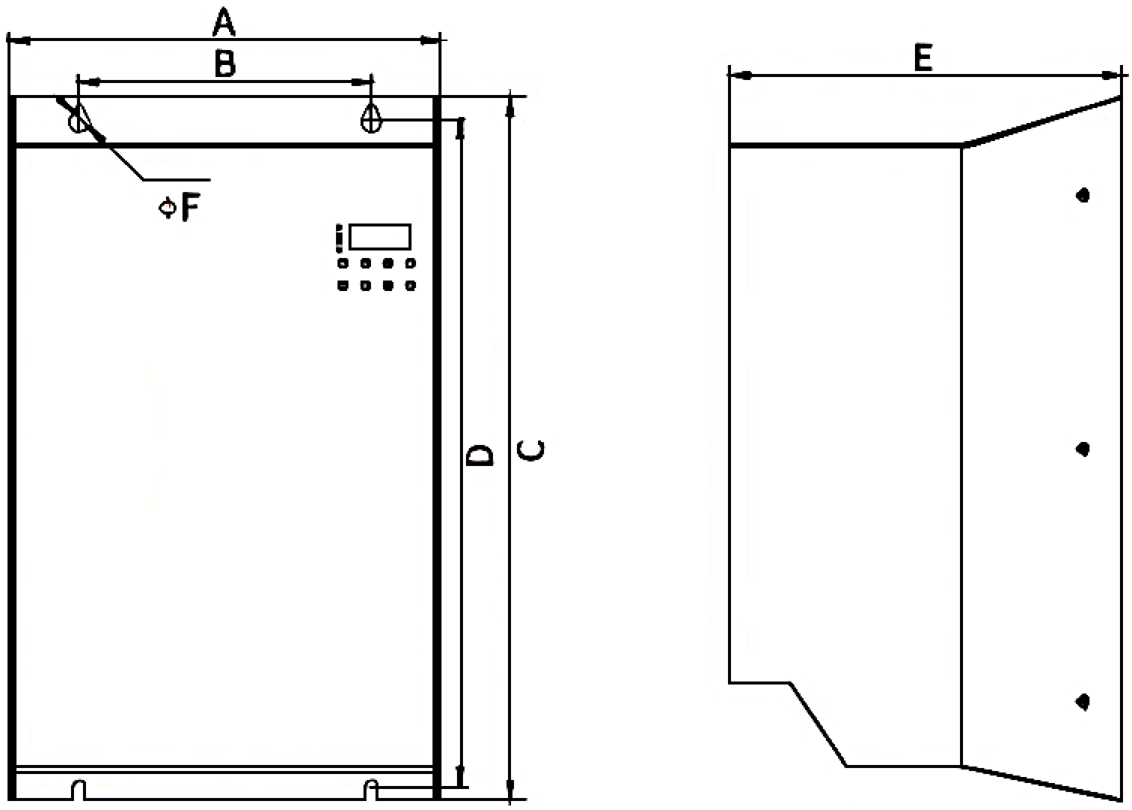
E2 Adapter Current (A) 7-12



E3 adaptation current (A) 16-32



2.1.2 EA/-E installation dimensions



EA installation dimension drawing comparison table

Current (A)	38-45	60	75-90
A	220	226	262
B	149	150	160
C	363	439	499
D	349	428	488
E	200	250	251
F	5.5	6.5	6.5

-E installation dimension drawing comparison table

Current (A)	38-45	60	75-90	110-170
A	220	226		305
B	149	150		160
C	363	439		605
D	349	428		594
E	200	250		236
F	5.5	6.5		6.5

2.2 Nameplate Description

2.2.1 E structure servo drive nameplate

VC series nameplate description:

VEC-VCXXX-00323-E

<table>
<tr><td>VEC</td><td colspan="10">Trademarks</td></tr>
<tr><td>VC</td><td colspan="10">VC-Series</td></tr>
<tr><td>XXX</td><td>Serial No.</td><td>330</td><td colspan="8">Profinet bus servo drive</td></tr>
<tr><td rowspan="4">00323</td><td rowspan="4">Drive rated current and voltage</td><td>Nameplate logo</td><td colspan="2">00323</td><td colspan="2">00623</td><td colspan="2">00733</td><td colspan="2">01243</td></tr>
<tr><td>rated current</td><td>003</td><td>3.0A</td><td>006</td><td>6.0A</td><td>007</td><td>7.0A</td><td>012</td><td>12.0A</td></tr>
<tr><td>Rated voltage</td><td>2</td><td>220V</td><td>2</td><td>220V</td><td>3</td><td>380V</td><td>4</td><td>440V</td></tr>
<tr><td>Single/Dual /Three Phase Electricity</td><td>3</td><td>Three-phase</td><td>3</td><td>Three-phase</td><td>3</td><td>Three-phase</td><td>3</td><td>Three-phase</td></tr>
<tr><td>E</td><td colspan="10">structure type</td></tr>
</table>

2.2.2 Motor nameplate

200FMB-LR4015E33F1-MF2*

<table>
<tr><td>200</td><td colspan="3">Square flange size (mm)</td></tr>
<tr><td rowspan="3">F</td><td rowspan="3">cooling method</td><td>Mark</td><td>cooling method</td></tr>
<tr><td>F</td><td>air cooling</td></tr>
<tr><td>Default</td><td>natural cold</td></tr>
<tr><td rowspan="4">MB</td><td rowspan="4">Product Series</td><td colspan="2">mark</td></tr>
<tr><td colspan="2">ME</td></tr>
<tr><td colspan="2">MB</td></tr>
<tr><td colspan="2">ME1</td></tr>
</table>

		MD				
		MH				
L	Moment of inertia	Mark	inertia			
		L	low inertia			
		M	medium inertia			
		H	high Inertia			
R40	rated power	Mark	Specification			
		R40	0.4KW			
		1R5	1.5KW			
		003	3KW			
		7R5	7.5KW			
		020	20KW			
15	Rated speed	Mark	Rated speed			
		10	1000RPM			
		15	1500RPM			
		20	2000RPM			
		25	2500RPM			
		30	3000RPM			
E	Installation method	Mark	Specification			
		A	IMB5			
		D	IMB3			
		E	IMB35			
33	Voltage level	Mark	Specification			
		23	2	220V	3	Three-phase power
		33	3	380V	3	Three-phase power
		43	4	440V	3	Three-phase power
F	Brake	Mark	Specification			
		F	Without brake, with oil seal			
		B	Built-in holding brake has oil seal			
		A	No holding brake no oil seal			
		C	With holding brake and without oil seal			
1	Shaft connection method	Mark	specification			
		1	Optical axis			
		Default	Keyed threaded hole			
M	Encoder type	Mark	Encoder Signal			
		M	Incremental photoelectric encoder			
		N	Wire-saving photoelectric encoder			

		X	resolver encoder
		B	23-bit multi-turn absolute value photoelectric encoder
		C1A	17-bit single-turn absolute value magnetic encoder
		C2A	17-bit multi-turn absolute value magnetic encoder
		S	24-bit multi-turn absolute value photoelectric encoder
F2	Number of encoder lines	Mark	Specification
		F1	1024C/T
		F2	2500C/T
		F5	5000C/T
		F6	6000C/T
*	Factory logo	Mark	
		M	
		LA	
		Z	
		D	
		U	
		C	
		N	

2.3 Drive Specifications

Project		Description
Voltage	control mode	Single-phase/three-phase full-bridge rectification SVPWM drive (Input voltage range AC 220V/380V±10%)
Encoder	encoder feedback	Wire-saving photoelectric encoder; 17-bit single-turn Tamagawa absolute value encoder; 23-bit single-turn Tamagawa absolute value encoder; 17-bit multi-turn Tamagawa absolute value encoder; 23-bit multi-turn Tamagawa absolute value encoder; 24-bit Nikon absolute value encoder;
Analog input	voltage range	-10V to 10V
	Input impedance	10kΩ
	Maximum frequency	1.5kHz
DI/DO Interface Type		NPN/PNP
Communication method		Profinet

Brake handling		External Brake Resistor
fault response		deceleration stop, freewheel stop
Protective function		Overcurrent, overvoltage, undervoltage, overload, locked rotor, etc.
auxiliary function		Gain adjustment, alarm record, jog operation
position mode	Instruction input method	internal position planning ➢ Plan according to target position, speed, acceleration and deceleration time ➢ Trapezoidal speed curve ➢ cubic velocity curve ➢ Absolute/relative command mode
	command smooth way	low pass filter/median filter
	Electronic gear ratio	N/M;(M=1~2147483647,N=1~2147483647)
	Torque limit	Internal torque limit Analog torque limit
	Feedforward compensation	Speed feedforward/torque feedforward
	Torque compensation	Fixed torque compensation/analog torque compensation/automatic torque compensation;
speed control mode	way of command input	analog input/internal speed planning
	speed control range	1~Maximum speed
	bandwidth	3kHz
	Torque limit	Internal torque limit/analog torque limit
	Command smoothing method	Low-pass filter/median filter
	Feedforward compensation	Torque feedforward
	Torque compensation	Fixed torque compensation/analog torque compensation/automatic torque compensation;
Torque control	Instruction input method	Internal torque given/analog control torque
	Torque compensation	Fixed torque compensation/analog torque compensation/automatic torque compensation;
	speed limit	Internal Speed Limit/Analog Speed Limit
digital input	Up to 4 digital inputs, the function of each digital input can be assigned arbitrarily, the assignable functions include: Enable drive, reset drive, torque command A/B switch, torque command reverse enable, positive torque limit A/B switch, negative torque limit A/B switch, positive speed limit A/B Switch, negative speed limit A/B switch, forward jog, reverse jog, speed command reverse enable,Main speed source A/B switch, speed stop enable, clear position count, zero position fixed in speed mode, multi-speed speed selection 0, multi-speed speed	

	selection 1, multi-speed speed selection 2, multi-speed speed selection 3, position command Prohibit, position command reverse,Electronic gear ratio switch 1, position error reset, zero return, trigger multi-stage position, multi-stage position selection 0, multi-stage position selection 1, multi-stage position selection 2, multi-stage position selection 3, multi-stage position direction selection, return to zero origin switch input, Internal position planning, control mode switching switch 0, control mode switching switch 1,Enable interrupt fixed length input, cancel interrupt fixed length, trigger interrupt fixed length, first set of second set of gain switch, reset fault, forward limit switch in position mode, reverse limit switch in position mode, full closed loop Open and closed loop switching in mode, electronic gear ratio switch 2, motor overheat input, emergency stop input, internal trigger reset, internal trigger reset, internal counter count pulse, internal counter reset, speed mode UPDOWN mode UP signal, Speed mode UPDOWN mode DOWN signal, AI zero drift automatic correction.
digital output	Up to 3 digital outputs, the function of each digital output can be assigned arbitrarily, the assignable functions include: Drive enabling, speed reaching, decelerating, accelerating, zero-speed, speed overrun, forward running, reverse running, fault output, forward speed limit in torque mode Negative speed limit in torque mode, speed limit in torque mode, positioning completion output, positioning approaching output, origin return completion output, position error too large output Interrupt fixed length completion signal output, software limit signal output, brake signal output, input command valid, always OFF, always ON, torque limit signal output, torque arrival signal, internal trigger status, internal counter count arrival, same speed
fault protection	Software overcurrent, hardware overcurrent, overvoltage, undervoltage, current sensor failure, encoder failure, EEPROM verification failure, phase sampling failure,FPGA and ARM communication failure, large current change failure, magnetic encoder failure, current phase sequence learning failure, Z point not scanned during self-learning, and Z point offset not found,Hall code value learning error, over temperature of the drive, no feedback of hall value from the wire-saving encoder when power-on, mismatch of motor encoder types, when the origin is returned to zero, the origin switch INFn.34 is not set,Repeated assignment of INFn.xx, overspeed, position error is too large, interrupt fixed-length trigger signal INFn.40 is not set, no return to zero before absolute point motion, motor overload, software limit, hardware limit, curve planning failure, full closed loop Position error is too large,Forward (reverse) rotation is prohibited, Z point signal is unstable, RPDO reception timeout, motor stall, braking resistor overload, forward travel switch input function bit INFn.43 is not assigned to entity DI, reverse travel switch input function bit INFn .44 not assigned to entity DI,Origin search error, lap overflow in absolute value mode, absolute encoder battery failure, inertia learning failure, when learning full closed-loop parameters, the position value detected by the second encoder is too small, bus error, motor overheating, DI function code no assignment,AI zero drift is too large, zero return timeout, absolute encoder battery failure, wrong motor rotation direction during absolute encoder self-learning, and absolute encoder battery voltage is too low.

Installation Environment Requirements	air pressure	86~106kPa
	ambient temperature	0~40℃,Derating is used when the temperature exceeds 40℃, and derating by 2 % for every 1℃ increase. Up to 50℃.
	environment humidity	0~90%RH（No dew condensation）
	IP level	IP20
	vibration	0~4.9m/s^2

2.4 Drive selection

The parameters of the servo factory default maximum current can be viewed through P05.10~P05.20 parameters. If P05.13 defaults to 300%, it means that the factory default maximum output current of the driver is 3 times the rated current of the driver, but it does not represent the maximum current that the servo can output. If you need to further open the current of the driver, please contact our technical personnel for inquiry.

2.4.1 E-structure 220V driver selection

Drive model	Output rated current A	Output maximum current A	Hardware output maximum current A
VC330-00323	3	9	9
VC330-00623	6	18	18
VC330-01223	12	36	36
VC330-01523	15	36	45
VC330-02723	27	54	67.5

2.4.2 E structure 380V driver selection

Drive model	Output rated current A	Output maximum current A	Hardware output maximum current A
VC330-00733	7	14	21
VC330-01233	12	24	36
VC330-01633	16	32	40
VC330-02033	20	40	50
VC330-02733	27	54	67.5
VC330-03233	32	64	80

2.5 Meet the standards

This product meets the following CE certification standards:

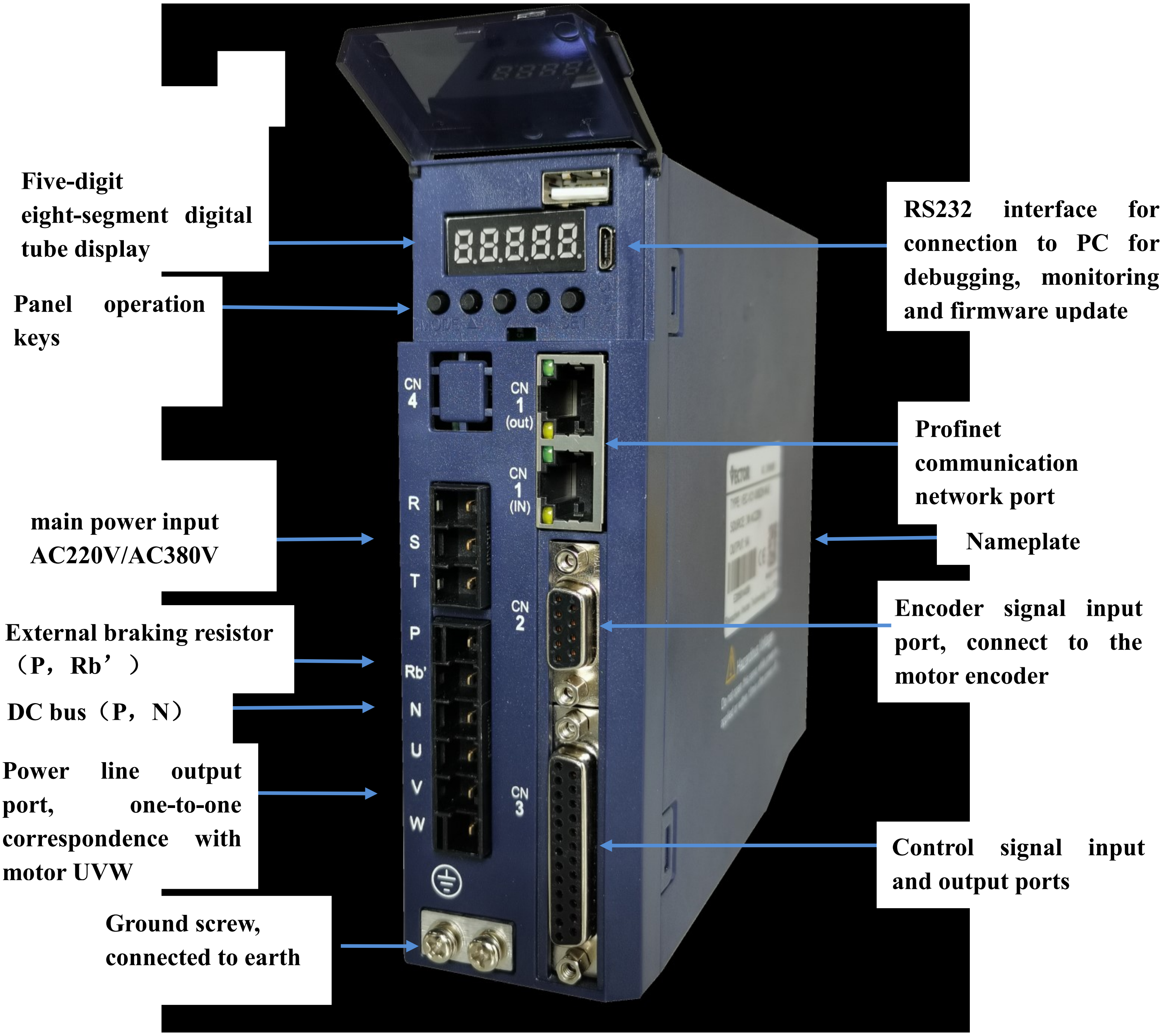
1. EN 61800-5-1:2007+A1:2017 (Part 5-1 Safety Requirements for Electricity, Heat and Energy of Speed Regulating Electric Drive System), the corresponding national standard is GB12668.501-2013;
2. EN IEC 61800-3:2018 (Part 3 Electromagnetic Compatibility Standard and Its Specific Test Methods for Speed-governing Electric Drive Systems), the corresponding national standard is GB12668.3-2012.

Chapter 3 Wiring

This chapter describes the wiring method of the servo drive and the definitions of various signals.

3.1 Drive overview

3.1.1 E structure servo drive



3.2 Main circuit wiring

This section describes the functions of the main circuit terminals, main circuit wiring examples, and main circuit wiring precautions.

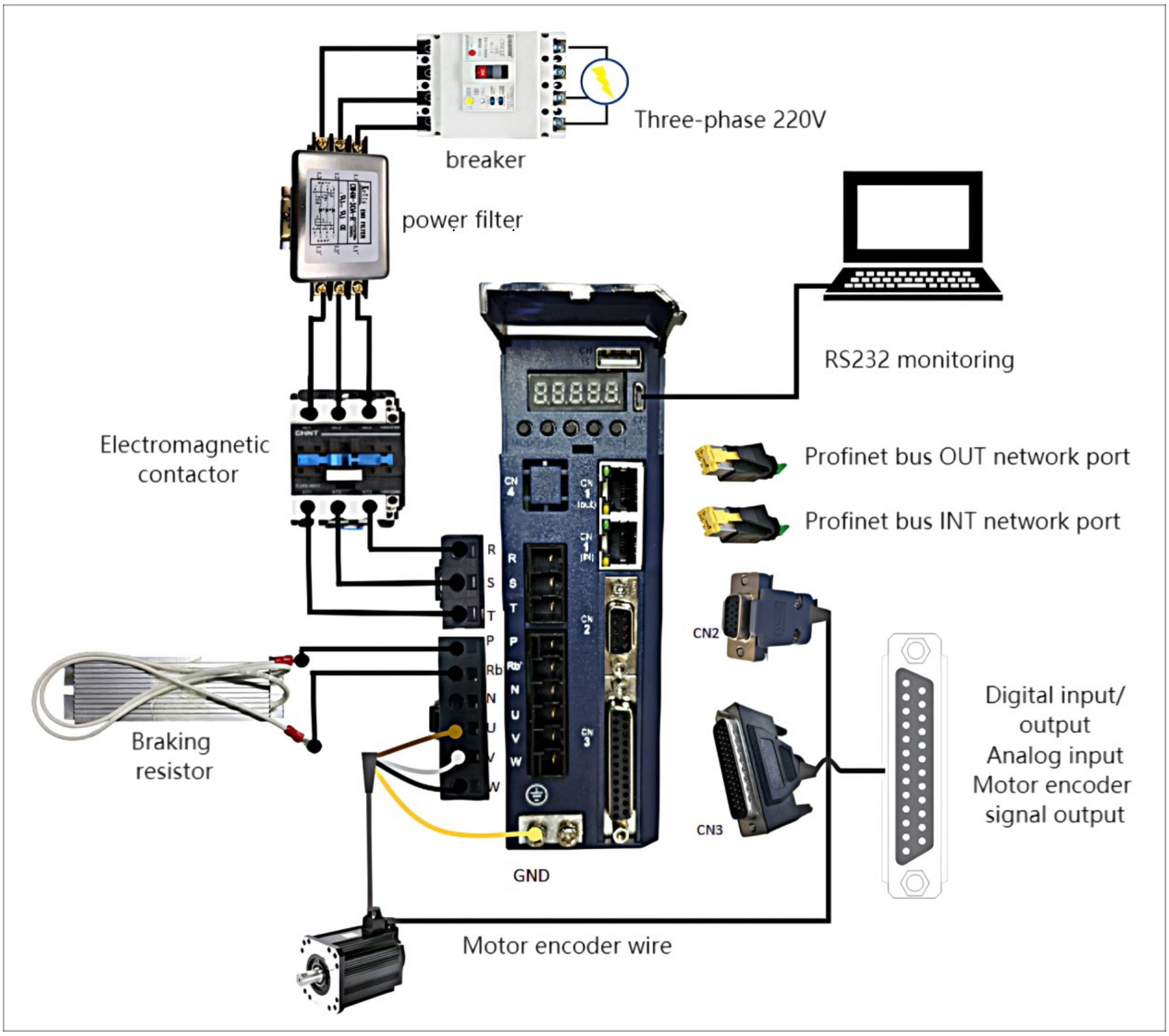
3.2.1 Main circuit terminal names and functions

Terminal symbol	Name	Function
R、S、T	Main circuit power supply input	Three-phase 380V driver: power supply access R, S, T; Three-phase 220V driver: power supply access R, S, T;
U、V、W	Motor Terminals	One-to-one connection with motors U, V, W
P、Rb’	Braking resistor terminal	External braking resistor
P、N	DC bus terminal	External power saving module or shared DC bus
⏚	Earth terminal	Connect to the ground and connect to the ground wire of the motor at the same time

Note when sharing DC bus: 380V driver can only share DC bus with 380V driver, 220V driver can only share DC bus with 220V driver.

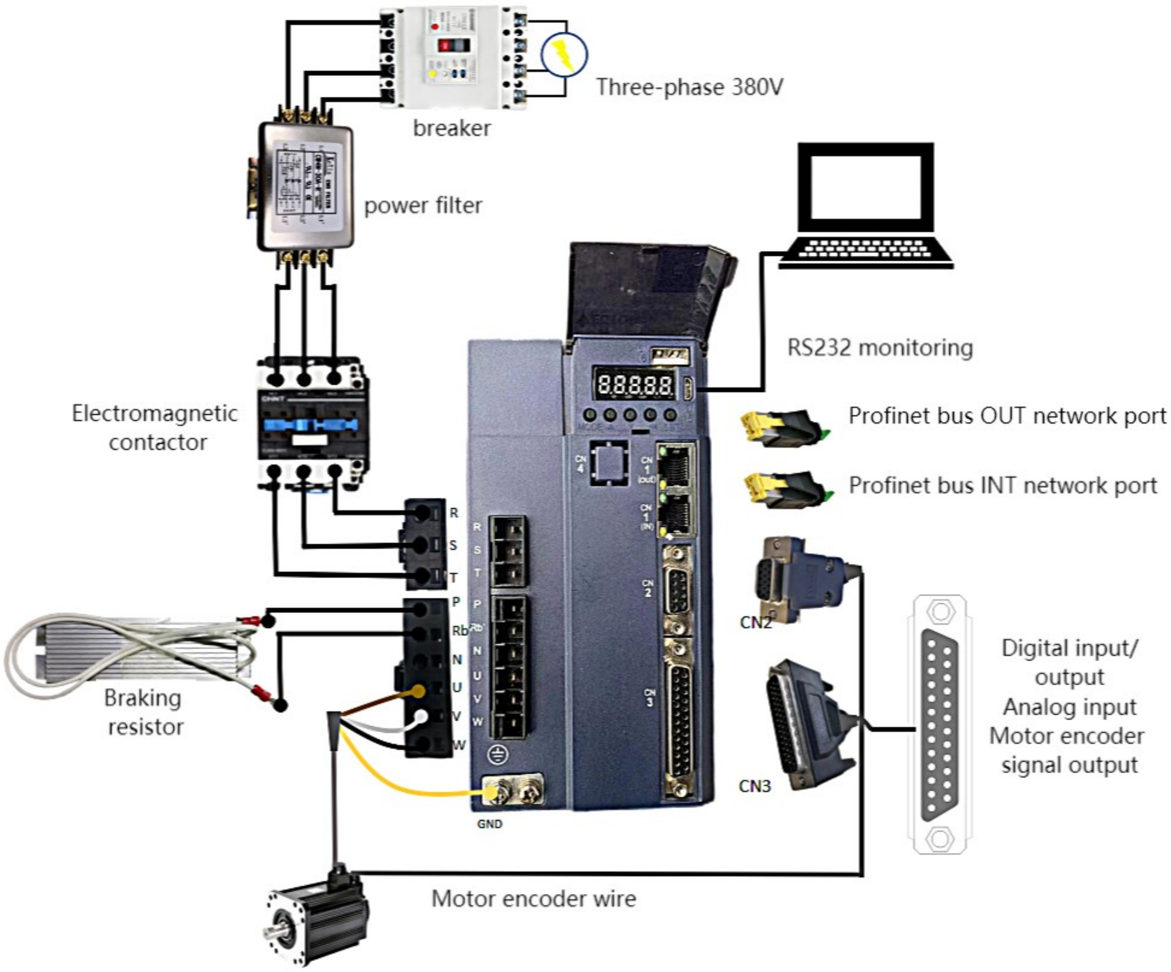
3.2.2 Typical Main Circuit Wiring Example

(1) E structure driver is three-phase 220V



- The +24V power supply of IO needs to be provided by the user.

(2) E structure driver is three-phase 380V



- The +24V power supply of IO needs to be provided by the user.

3.2.3 Main circuit wiring precautions

（1）Do not connect the input power cable to the P, RB', N, U, V, W terminals of the drive, otherwise the servo drive will be damaged.

（2）The U, V, W terminals of the driver and the U, V, W terminals of the motor should be connected one by one according to their names, and the motor will not run normally if they are connected incorrectly.

（3）The braking resistor cannot be connected to the terminals P and N of the DC bus, otherwise it may cause a fire!

（4）The ground terminal of the driver must be connected to the ground to avoid leakage and reduce the interference to the system, and the diameter of the ground wire should be the same or larger than that of the power supply wire.

（5）When wiring, do not pass the power cable and the signal cable through the same pipe, and do not bundle them together. The distance between them should be more than 30cm to avoid interference.

（6）Use twisted-pair shielded cables for signal lines and encoder lines.

（7）For the wiring length, the maximum length of the command input line is 3m, and the maximum length of the encoder line is 20m.

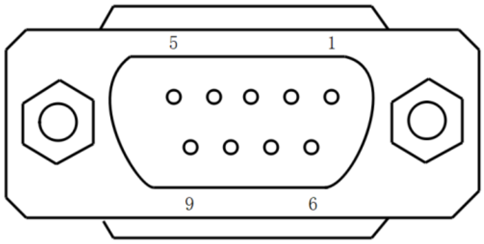
（8）Even if the power is turned off, high voltage may still remain inside the servo drive. Therefore, after turning off the power, do not touch the power terminals for 5 minutes.

（9）Do not turn on the power when the terminal block screws are loose or the cables are loose, otherwise it may cause fire.

（10）Please do not turn on/off the power frequently. When you need to repeatedly turn on/off the power continuously, please control it to less than once a minute. Since there is a capacitor in the power supply part of the servo driver, when the power is turned on, a large charging current will flow (charging time 0.2 seconds). If the power is turned on/off frequently, the performance of the main circuit components inside the servo drive will be degraded and the service life will be shortened.

3.3 Encoder signal wiring

3.3.1 Pin assignment of the encoder connection port (CN2)



9pin pin interface (female)

3.3.2 The pin definition of the encoder connection port (CN2)

The VC330 servo model supports incremental photoelectric encoder/wire-saving photoelectric encoder/absolute encoder. The pin definitions of the encoder connection port are shown in the table below.

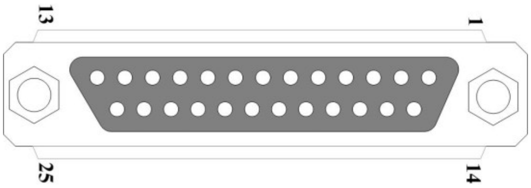
9PIN pin (female header)			
Pin No.	Signal name	Pin No.	Signal name
1	A+ or BISS-C encoder CLK+	2	A- or BISS-C encoder CLK-
3	B+ or BISS-C encoder DATA+	4	B− or BISS-C encoder DATA-
5	Z+or(SD) absolute value encoder signal positive	6	Z-or(SD-) absolute value encoder signal negative
7	+5V	8	0V
9	hold	Case	(FG)Shielded network layer

3.4 Input/Output Signal Wiring

In order to facilitate communication with the host controller, the VC330 servo driver provides 4 groups of digital input terminals and 3 groups of digital output terminals that can be arbitrarily configured. In addition, it also provides encoder differential output signals OA+, OA-, OB+, OB- and analog input signals that can be arbitrarily divided.

3.4.1 Pin assignment of input/output signal port (CN3)

The control signal input and output port CN3 of VC330 adopts 25PIN (female) interface.



25PIN pin (female header)

The control signal input and output port (female) pins of VC330 are defined as follows

25Pin pin definition					
Pin No.	Define	Functional Description	Pin No.	Define	Functional Description
11、12	+24V	External DC24V power supply, for DI, DO work	4	RST	Reset
9、17	COM		24	AGND	Built-in Analog Ground
3	DO1C	Programmable Digital Output	25	AI1	Analog input
2	DO2C		13	AI2	
1	DO3C		10	SW-DI	DI's NPN/PNP jumper
14	DO3E		20	OA+	Select the encoder signal frequency division output or the second encoder input through parameter P03.78
15	DO2E		21	OA-	
16	DO1E		22	OB+	
8	DI1	Programmable digital input	23	OB-	
7	DI2		18	+5V	Built-in +5V power supply
6	DI3		19	0V	
5	DI4		Case	Shielded network layer	Connect to drive ground

3.4.2 Input and output signal type selection

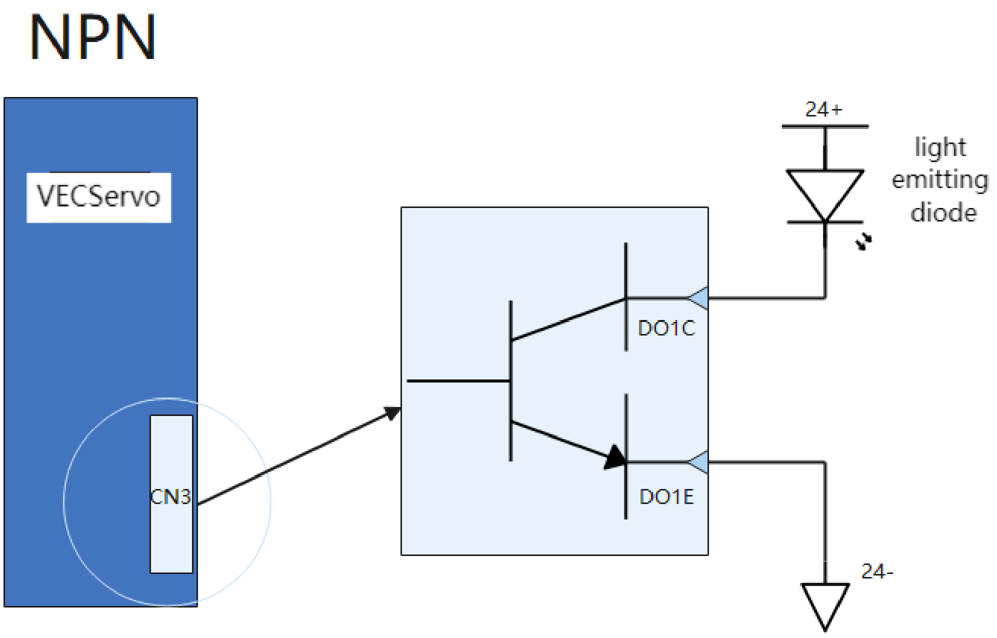
VC330 can select NPN/PNP type DO through wiring, without jumper, select NPN/PNP type DI through jumper.

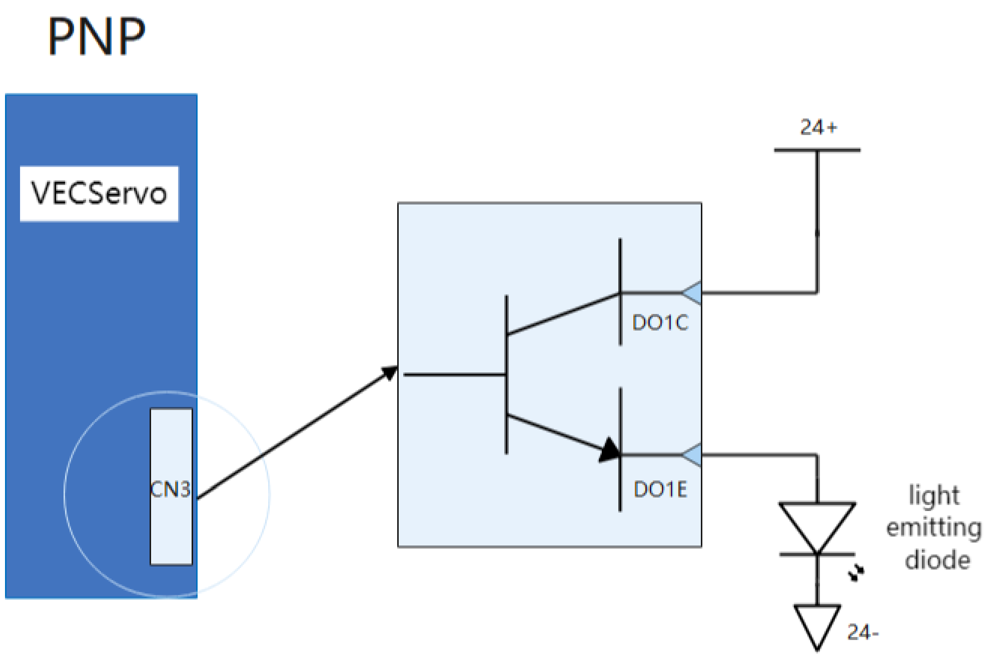
Description of digital output circuit: DO1~DO3 are the same

Example description of DO1C/DO1E in 25Pin of VC330 bus:

When DO1C and DO1E work in NPN/PNP form

Internal expansion diagram of DO1C and DO1E

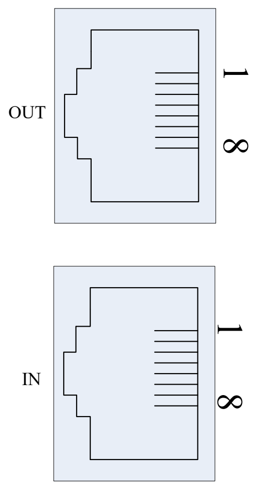




Remarks: Connect external DC24V power supply to pin 9 (COM) and pin 11 (+24V).

3.5 Communication signal wiring

3.5.1 Pin assignment and definition of VC330 servo E structure communication port

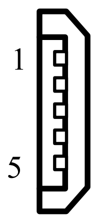
Location and function	Terminal shape	Description
CN1		Both interfaces are defined the same.

Pin.No	Position	Description
1	TX+	send signal+
2	TX-	send signal-
3	RX+	receive signal+
4	NC	dangling
5	NC	dangling
6	RX-	receive signal-
7	NC	dangling
8	NC	dangling

(1) It is necessary to connect the power ground of the controller (PLC) and the power ground of the servo drive

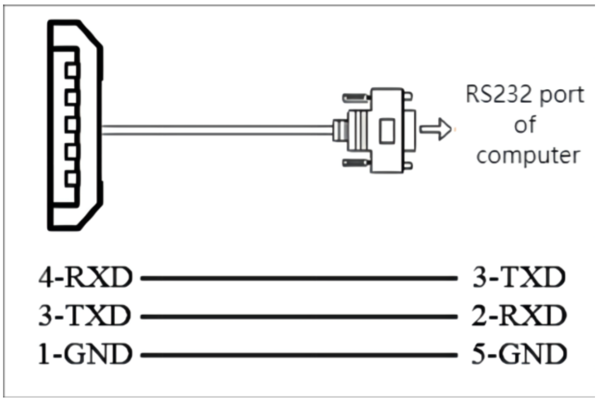
Note: When wiring, please connect the GND terminal of the host device and the GND terminal of the servo drive together.

3.5.2 E structure monitoring port pin assignment and definition

Location and function	Terminal shape	Description
CN5		

Pin No.	Define	Description
1	GND	power ground
2	NC	dangling
3	TXD	RS232 send
4	RXD	RS232 receive
5	NC	dangling

The connection to the computer is as shown below:



The parameters for RS232 baud rate selection are as follows:

parameter no.	Parameter Description	Setting range	Units	Function	Setting method	Effective way	Defaults	read and write method
P08.26	RS232 monitor port baud rate 0- 9600 1- 38400 2- 115200	0~2	bps	Set the baud rate of the RS232 monitor port.	anytime	Immediately	2	RW

3.6 Wiring suggestions and anti-interference countermeasures

3.6.1 Wiring Recommendations

For the safety and stability of the product, please pay attention to the following matters when wiring:

1. For the cables related to the command input and encoder wiring, please select the shortest distance wiring.

2. The ground wire should be as thick as possible (above $2mm^2$).

●All parts of the system (servo driver, servo motor, noise filter, host controller, switching power supply, HMI, etc.) must be grounded, and must be grounded at one point.

●The recommended grounding resistance is 100Ω or less.

●Use shielded cables for motor cables.

3.Do not bend or strain the cable.

●The core wire diameter of the signal cable is only 0.2mm or 0.3mm, please use it carefully.

To prevent radio frequency interference, please use a noise filter.

●Install a noise filter on the input side of the power cord when using it near a home or worrying about radio frequency interference.

In order to prevent malfunction caused by noise, the following processing methods can be adopted:

●Install the host device and noise filter as close to the servo driver as possible.

●Install surge suppressors on the coils of relays and AC contactors.

●When wiring, please separate the strong current line and the weak current line, and keep an interval of more than 30cm, do not put them in the same pipe or bundle them together.

●Do not share the power supply with electric welding machines, electrical discharge machining equipment, etc. Even if the power supply is not shared, install a noise filter on the input side of the wire when there is a high-frequency generator nearby.

6.Protect the power cord with a wiring circuit breaker or fuse.

●Be sure to use a circuit breaker or fuse for wiring in order to prevent cross-electric shock in the servo system.

3.6.2 Anti-interference countermeasures

1. Servo motor housing ground

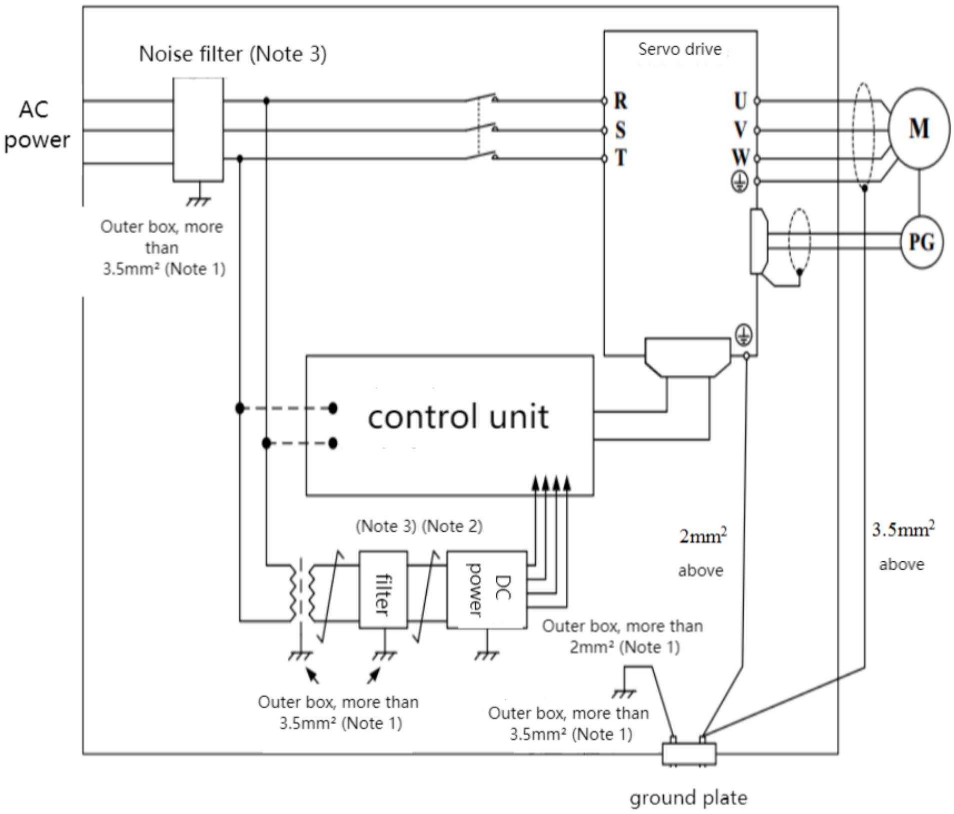
Be sure to connect the ground terminal "⏚" of the servo motor directly with the ground terminal "⏚" of the servo drive. In addition, connect the ground terminal "⏚" of the driver to the ground. Otherwise, when the servo motor is mechanically grounded, the switching disturbance current will flow from the main circuit of the drive through the parasitic capacitance of the servo motor.

2. When there is interference on the command input cable

When there is interference on the command input line, please connect the 0V line of the input line to the ground, the main circuit wiring of the motor passes through the metal conduit, and connect the conduit and the junction box to the ground.

● Please perform the above grounding treatment and ground all of them at one point.

3. Anti-interference wiring example



Note 1: Please use a thick wire of 3.5mm2 or more for the connection wire of the outer box used for grounding (braided copper wire is recommended).

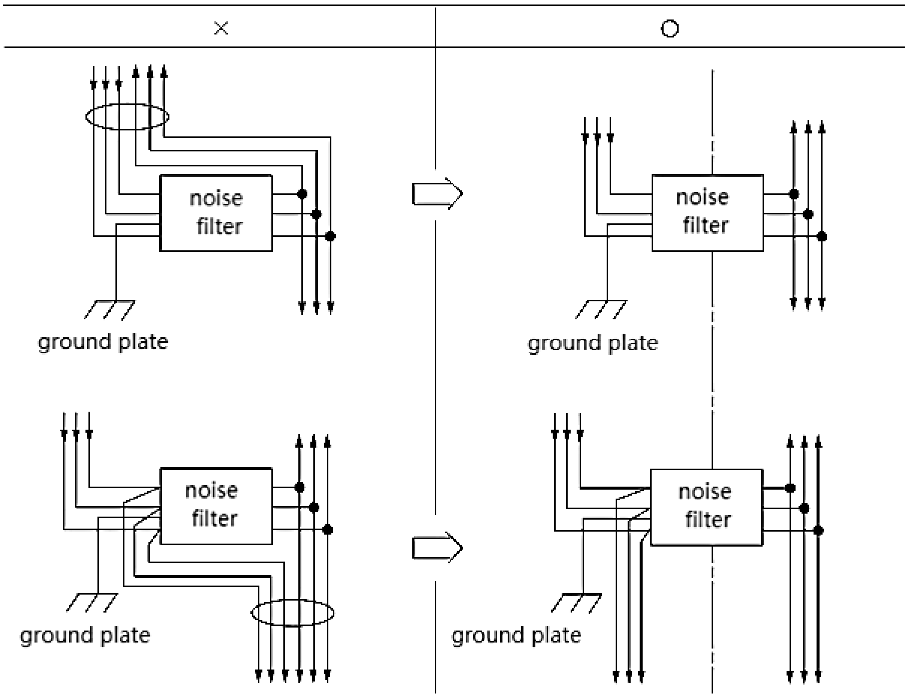
Note 2: Please be sure to use twisted pair shielded wire for some parts。

Note 3: When using a noise filter, please observe the precautions described in the following "How to use the noise filter".

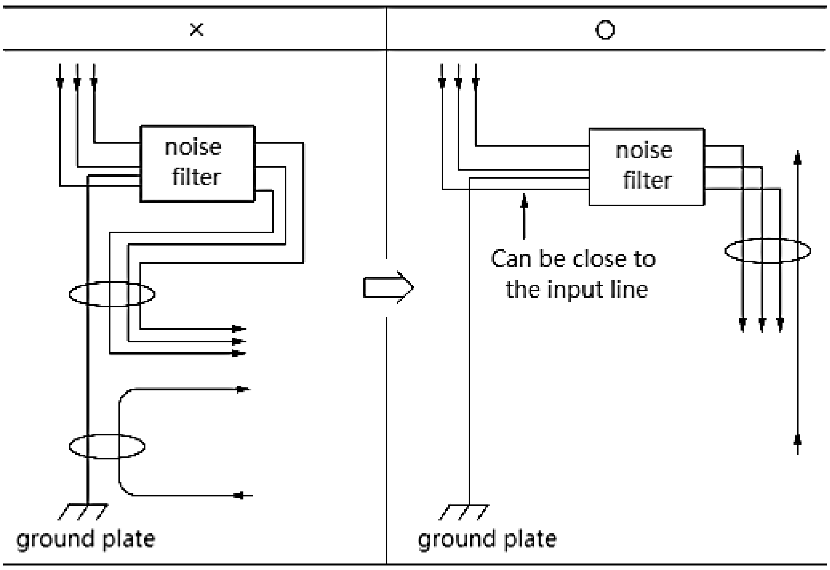
4.How to use the noise filter

In order to prevent the interference of the power line and reduce the influence of the servo drive on other equipment, please select a noise filter that can make the servo system meet the IEC/EN 61800-3 electromagnetic compatibility standard according to the power of the servo drive, and observe the The following notes:

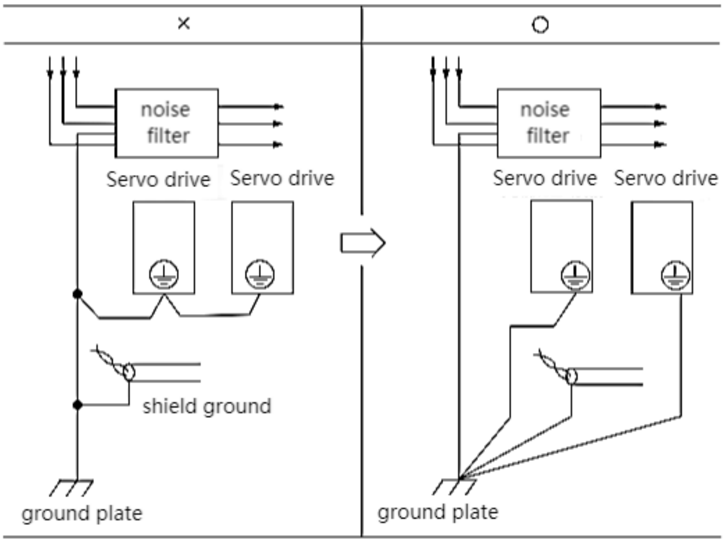
● Please separate the input wiring and output wiring of the noise filter, do not put them in the same bushing, and do not bundle them together.



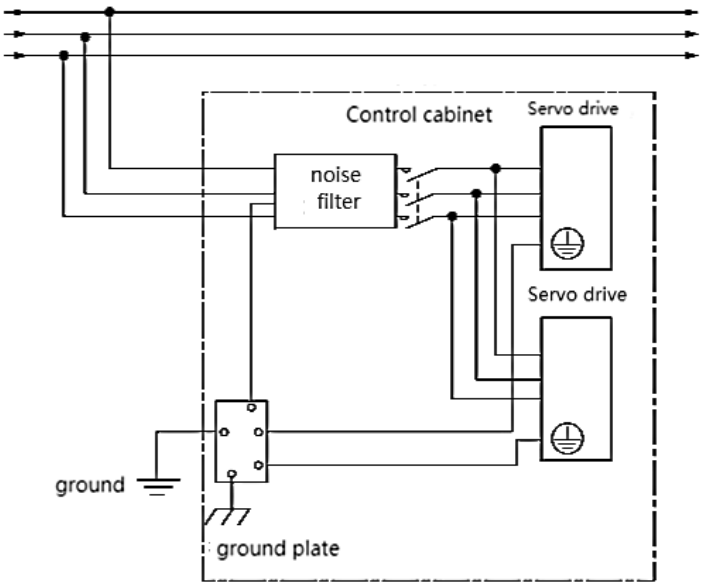
● Please separate the ground wire of the noise filter from the output wiring, do not put them in the same casing, and do not bundle them together.



● Please connect the ground wire of the noise filter to the ground plane separately. Do not connect other ground wires.



●When the noise filter and the servo drive are installed in the same control cabinet, please connect the ground wire of the noise filter and the ground wires of other devices in the control cabinet to the grounding plate of the control cabinet, and then ground.



Chapter 4 Panel Display and Keyboard Operation

4.1 Introduction to panel composition

4.1.1 E Structure Servo Driver Panel

The panel contains 5 buttons and 5 digital tubes. The general functions of the 5 buttons are shown in the table below.

button name	Button function
Mode	Mode switch, return to the previous menu
▲Increase	Increase the value of the blinking digit of the LED nixie tube
▼decrease	Decrease the value of the blinking digits of the LED nixie tube
◀◀Displacement	Move the flashing bit of the LED digital tube to the left; check the high-order value of the data whose length is greater than 5 digits; reset the fault; execute the Fn function
SET	Read/write parameter value, enter Fn function page

4.2 panel operation mode

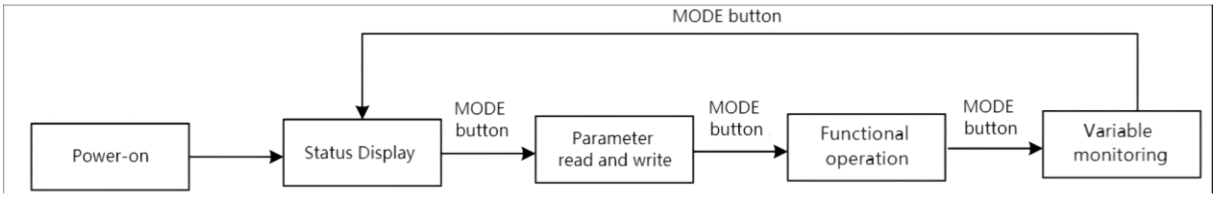
4.2.1 E Structure Servo Driver Panel

There are a total of 4 operating modes, namely status display, parameter reading and writing, variable monitoring, and function operation.

operating mode	Mode introduction
Status Display	Display the status of the drive, such as reset (panel display rst), ready (panel display rdy), running (panel display run), fault (Er.xxx), or monitor a specific variable in operation (such as speed, bus voltage, etc. Wait)
Parameter	read and write all parameters

read and write	
Variable monitoring	Monitor a variable or IO status of the drive
Functional operation	Execute specific functions, such as jog test run, parameter reset to factory value, drive reset

Each mode is switched through the MODE button.



4.3 Pulse servo status display

In this mode, the status of the drive is displayed, and there are several statuses as follows.

Status name	Status introduction	panel display
Reset state	The driver enters this state after power-on initialization or re-reset and restart.	rSt
Ready state	The servo drive is initialized and enters the ready state when there is no fault in the hardware detection.	rdy
running state	When the driver is enabled, the motor is powered on	run
fault state	The drive reports a fault, and the panel displays the reported fault code	Er.xxx

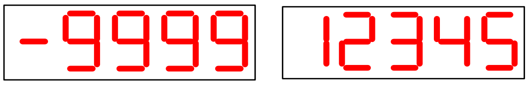
In the non-fault state of state display, the panel can be set to display a specific variable through P02.05. For bus type servo status display, refer to the corresponding bus protocol chapter.

4.4 Parameter read and write

When entering the parameter read/write mode for the first time, Pxx.yy is displayed. Among them, xx is the parameter group, and yy is the parameter number in the group. The parameters of the driver are divided into 0~13 groups, and each group can accommodate up to 99 16-bit parameters. There are four types of parameters, namely unsigned 16-bit parameters, signed 16-bit parameters, unsigned 32-bit parameters, and signed 32-bit parameters. The range of values for the unsigned 16-bit parameter is 0 to 65535. The value range for signed 16-bit parameters is -32767 to 32767. The value range of the unsigned 32-bit parameter is 0 to 4294967295. The value range for signed 32-bit parameters is -2147483647 to 2147483647.

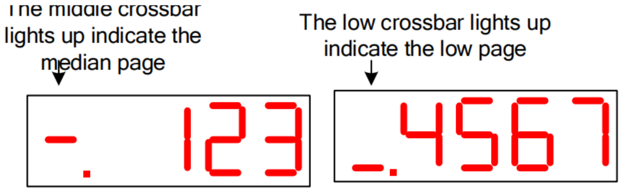
4.4.1 Display rules for numbers of different lengths

Negative numbers less than 4 digits and positive numbers less than 5 digits can be displayed through 5 digital tubes. Such as -9999 and 12345 are displayed as follows.

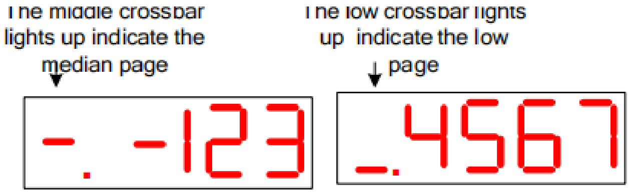


Negative numbers with more than 4 digits or positive numbers with more than 5 digits are displayed on the 2nd or 3rd page. The switching between pages is realized by long pressing the "◄◄" (shift) key. The leftmost nixie tube of each page identifies the number of pages displayed at this time. The high horizontal bar is lit to represent the high page, the middle horizontal bar is lit to represent the middle page, and the low horizontal bar is lit to represent the low page.

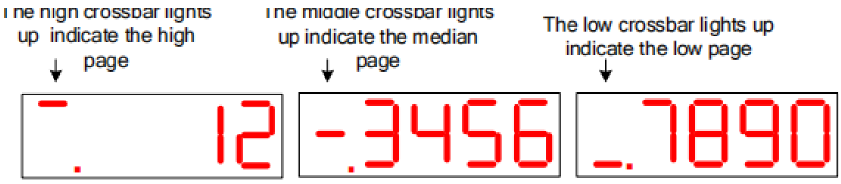
For example, 1234567 is displayed as follows.



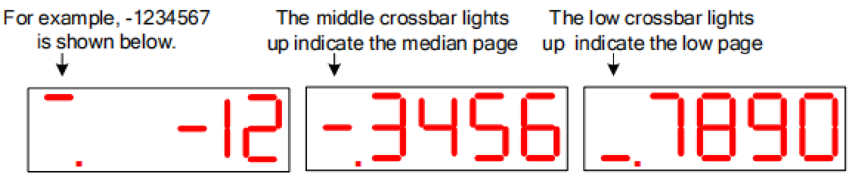
For example, -1234567 is displayed as follows.



1234567890 is displayed as follows.



-1234567890 is displayed as follows.



4.4.2 Parameter setting steps

For example, the process of setting P00.02 to 4000 is as follows.

① Press the MODE button to switch the mode to the parameter reading and writing mode, and the keyboard displays P00.00 at this time;

② Combined with "▲" (increase), "◄◄" (shift), "▼" (decrease) three keys to modify the parameter number to P00.02;

③ Press the SET key, first read the value of P00.02;

④ Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three keys to set the parameter value to 4000;

⑤ Press the SET key to write the set parameter value into P00.02.

For data displayed on multiple pages, you can automatically shift to other pages by "◂◂" (shift), or you can directly shift to other pages by long pressing "◂◂" (shift).

4.5 Functional operation

Currently the servo supports the following functions.

Function No.	Function
Fn000	Reset the drive
Fn001	Jog test run
Fn002	Parameter reset to factory value
Fn003	Update ARM firmware
Fn004	Learning the parameters of asynchronous motors
Fn005	Learn motor pole pairs and encoder parameters
Fn006	Single parameter gain adjustment
Fn007	Learning load inertia
Fn008	Update the FPGA program
Fn009	Restore all factory parameters except P00 and P01 parameter groups
Fn010	Backup all parameters
Fn011	Restoring backed up parameters
Fn012	Restart RS232 communication
Fn013	Self-learning full-closed loop polarity and the number of pulses of the second encoder corresponding to one rotation of the motor
Fn014	Clears the revolution value of the absolute encoder
Fn016	Current loop PI parameters of self-learning synchronous motor

4.5.1 Fn000 reset drive function

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn000;

③ Press the SET key, the drive will be reset directly.

Note: In any state, pressing the "▲" (increase) and "▼" (decrease) keys

simultaneously for 2 seconds can reset the drive.

4.5.2 Fn001 Jog test run function

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn001;

③ Press the SET key, at this time the drive is enabled and the digital tube displays the motor speed in real time.

④ Press the "▲" (increase) key to increase the Jog speed by 10rpm, press the "▼" (decrease) key to reduce the Jog speed by 10rpm, press the "◂◂" (shift) key to set the Jog speed to 0; long Press the "◂◂" (shift) key to change the speed increase rate to 500rpm.

⑤ After the Jog trial run, press the MODE button to exit the Jog mode, and the servo is disabled at this time.

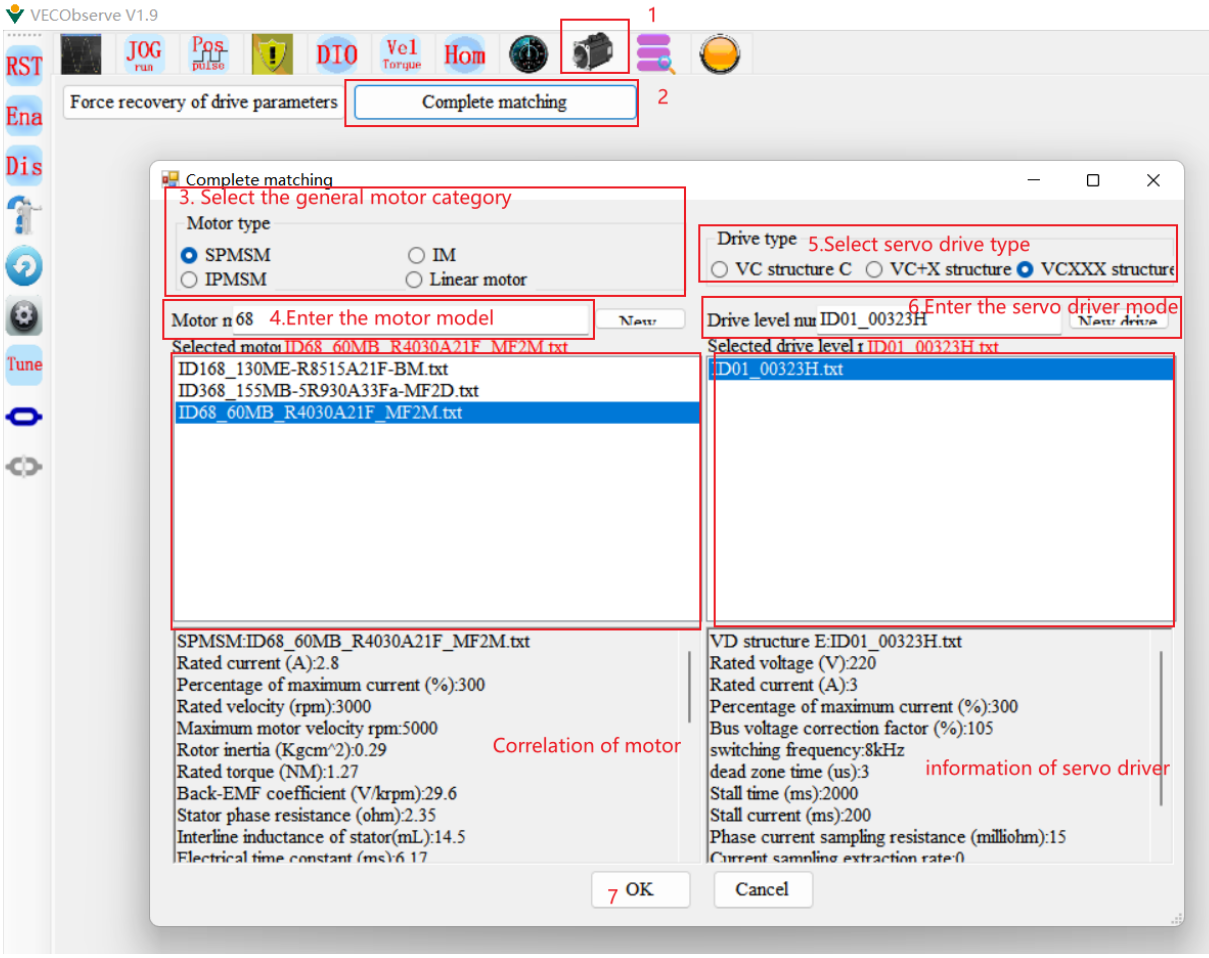
Note: When the drive is enabled, the jog test operation function is invalid.

4.5.3 Fn002 Restore all parameters to factory defaults

All parameters are restored to factory defaults, and the drive will restore its related parameters according to the set motor model P00.06 and drive level P01.15. If Er609 is reported, it means that the drive level P01.15 is set incorrectly, and the servo does not have the drive parameters of this drive level temporarily. If Er610 is reported, it means that the motor model P00.06 is set incorrectly, and the servo does not have the motor parameters of this motor model. When Er609 or Er610 is reported, if you need to forcefully restore a group of drive parameters, you can set P10.33=32767 to shield the above errors, and then restore the factory defaults.

The operation steps are as follows:

① Confirm the motor model P00.06 and drive grade P01.15. Motor models and drive level can be found on the VECObserve Complete Matching page. As shown below.



② Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

③ Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn002;

④ Press the SET key to display rECY;

⑤ Long press the "◂◂" (shift) key;

⑥ If the recovery is successful, it will display donE, and if it fails, it will display Err.

Notice:

When the drive is enabled, the function of parameter restoring to factory default is invalid.

When power on, if you press the "▲", "▼", "◀◀" keys at the same time, the parameters can also be restored to the factory values.

4.5.4 Fn003 Download program reset

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combined with "▲" (increase), "◂◂" (shift), "▼" (decrease) 3 buttons to set the display value of the nixie tube to Fn003;

③ Click SET to display UPd; (Update)
④ Long press the "◂◂" (shift) key to reset the drive;
⑤ At this point, the ARM firmware can be updated via RS232.

4.5.5 Fn004 Learn asynchronous motor encoder parameters

This function can self-learn the relevant parameters of the asynchronous motor. Including P00.05 motor pole pair number, P00.11 motor encoder resolution, P00.47 induction motor stator resistance (Ω), P00.48 induction motor rotor resistance (Ω), P00.49 induction motor total leakage inductance (mH), P00.50 induction motor magnetizing inductance (mH). During the self-learning process, the motor maintains the smooth axis, and the motor rotates to the rated speed.

The operation steps are as follows:

① Set the motor rated frequency P00.51;
② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn004;
③ Click SET to display SEL0; (Self-Learn0)
④ Press the "◂◂" (shift) key to start self-learning. After the self-learning is completed, it will automatically turn off the enable or report a fault.

Note: 1. When the driver is enabled, this function is invalid.
2. The asynchronous motor self-learning encoder can only be realized through this function, and the monitoring software learning is invalid.
3. During the learning process, the motor will run at high speed, please make sure that the motor is fixed and safe to operate.

4.5.6 Fn005 Learn related parameters of synchronous motor encoder

When using motors other than our company, it is necessary to learn the encoder parameters.

Before self-learning, set the self-learning maximum current limit P02.36 (50% of motor rated current), motor maximum speed P00.03, motor rated speed P00.02, motor Rated current P00.01, drive rated current P01.03.

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;
② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn005;
③ Click SET to display SEL1; (Self-Learn1)
④ Press the "◂◂" (shift) key to start self-learning. After the self-learning is completed, it will automatically turn off the enable or report a fault. The main learning parameters are as follows: P00.05 Motor pole pairs, P00.71 Z point offset, P00. 11 Motor encoder resolution, P00.72 Encoder AB phase sequence.

If the overcurrent Er.100 is reported during the learning process, parameters P02.36

(maximum current limit of self-learning), P07.01 (current loop proportional gain) and P07.02 (current loop integral gain) can be appropriately reduced.

Note: When the driver is enabled, this function is invalid.

4.5.7 Fn006 Single parameter gain adjustment

Single parameter gain adjustment refers to adjusting one parameter to achieve the purpose of adjusting servo rigidity. Before single-parameter gain adjustment, the servo load inertia ratio P07.29 must be accurately obtained. For the method of obtaining the load inertia ratio, refer to Fn007.

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn006;

③ Click SET to display the value of rigidity level P07.28;

④ Press the "◂◂" (shift) key, the motor starts to rotate forward and reverse;

⑤ By pressing "▲" or "▼", gradually increase or decrease the value of the rigidity level until the rigidity of the servo meets the actual application. Under normal circumstances, the rigidity level can be gradually increased until the motor has abnormal noise, and then reduce the rigidity level by 1-2.

Note: When the driver is enabled, this function is invalid.

For VC330 series servo, every time the rigidity level is adjusted, the parameters will not be automatically saved in the servo. If the adjustment is completed, the user needs to manually long press the "◂◂" (shift) key to save the adjusted rigidity level in the servo.

4.5.8 Fn007 Learning load inertia

The load inertia is the most important parameter of the servo system. Only when the inertia is matched can the servo perform optimally.

（1）VC330 Servo Load Inertia Learning

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn007;

③ Click SET to display SEL4; (Self-Learn 4)

④ Press the "◂◂" (shift) key to start self-learning. The servo drive enters the state of automatically learning the habit, and the learned inertia will be automatically displayed on the panel.

⑤ Press "▲", the motor rotates forward for 2 circles, and press "▼", the motor rotates reversely for 2 circles. The load inertia value will be updated to the panel every time it rotates. Press continuously for several times until the inertia is stable, the inertia at this time is the learned load inertia. After stabilization, long press "◂◂" (shift) to save the learned value to the servo drive.

If the overcurrent Er.100 is reported during the learning process, P07.01 (current loop proportional gain), P07.02 (current loop integral gain), P07.03 (speed loop proportional gain), P07.04 can be appropriately reduced (speed loop integral gain).

If the load inertia is large, low frequency oscillation may occur during self-learning. At this time, it is necessary to manually increase P07.03 and decrease P07.04 before self-learning.

Notice:

1. **When the drive is enabled, this function is invalid.**
2. **When the load inertia is large, low-frequency oscillation may occur in self-learning, and it is necessary to manually increase P07.03 and decrease P07.04, and then self-learn.**
3. **When the load inertia is small, reduce the inertia self-learning acceleration and deceleration time P07.33.**
4. **When the machine vibrates, the position loop gain P07.05 needs to be reduced.**

4.5.9 Fn008 update FPGA program reset

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn008;

③ Click SET to display FUPd; (FPGA Update)

④ Long press the "◂◂" (shift) key to reset the drive;

⑤ At this point, the FPGA firmware can be updated through the "VECTOR FPGA Firmware Update Tool".

4.5.10 Fn009 restores all factory parameters except P00 and P01 parameter groups

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn009;

③ Click SET to display -rECy; (-Recovery)

④ Long press the "◂◂" (shift) key;

⑤ If the recovery is successful, it will display donE, and if it fails, it will display Err.

4.5.11 Fn010 backup all parameters

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn010;

③ Click SET to display bcuP; (backup Parameter)

④ Long press the "◂◂" (shift) key;

⑤ If the backup is successful, it will display donE, and if it fails, it will display Err.

Note: The drive backup parameters are stored in another address area of the drive memory.

4.5.12 Fn011 restore the parameters that have been backed up

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn011;

③ Click SET to display rESto. (restore)

④ Long press the "◂◂" (shift) key;

⑤ If the restoration is successful, it will display donE, and if it fails, it will display Err.

4.5.13 Fn012 restart RS232 communication

When the servo RS232 does not communicate for a long time, it will automatically turn off. RS232 communication can be restarted via Fn012.

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn012;

③ Click SET to display SEnd;

④ Press the "◂◂" (shift) key;

4.5.14 In Fn013 full-closed loop mode, the polarity of self-learning feedback and the number of pulses of the second encoder corresponding to one rotation of the motor

In full-closed loop mode, it is necessary to set the full-closed loop feedback polarity P03.33 and P03.34. The appropriate value can be automatically calculated through this function operation. When performing this function operation, please ensure that the second encoder measuring wheel can be tightly and The material connection ensures that no slippage occurs between the measuring wheel and the material.

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn013;

③ Click SET to display LFCP. (Learn Full_Close Parameter);

④ Press the "◂◂" (shift) key; the motor will rotate forward 3 times at a speed of 10rpm.

4.5.15 Fn014 clears the absolute value encoder circle value (only for Nikon 24-bit encoder)

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn014;

③ Click SET to display CLrEn. (Clear Encoder);

④ Press the "◂◂" (shift) key; clear the absolute encoder turns.

4.5.16 Fn016 Self-learning synchronous motor current loop PI gain

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn016;

③ Click SET to display SELC.

④ Press the "◂◂" (shift) key; start learning the current loop PI gain.

4.6 Variable monitoring

Press the MODE key several times to switch the mode to variable monitoring mode, and the first two digits of the digital tube display Un. Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to the number that needs to be monitored (for example, Un007 is to monitor the DIDO status). Press SET to display the variables to be monitored.

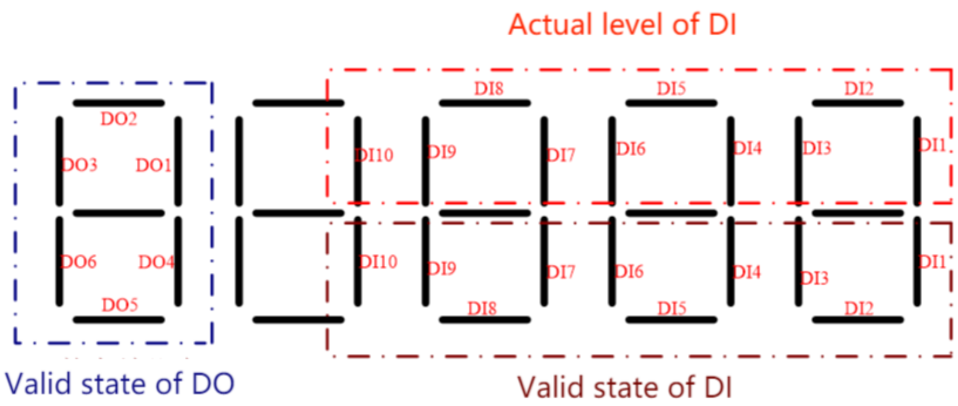
At present, the drive can monitor 13 variables, and the values corresponding to the monitoring numbers are shown in the table below.

Number	corresponding value
Un000	Motor speed rpm
Un001	Bus capacitor voltage V
Un002	temperature ℃
Un003	Current RMS A
Un004	Command pulse count value

Un005	Motor encoder pulse count value
Un006	Second encoder pulse count value
Un007	DIDO status
Un008	Voltage value of AI1
Un009	Voltage value of AI2
Un011	Output motor instantaneous current percentage
Un012	Output motor instantaneous power percentage
Un013	Percentage of output drive rated current
Un014	Motor load rate

It should be noted that, for DIDO status monitoring, the actual level of DI (high level on, low level off), the valid state of DI (valid on, invalid off), DO can be monitored simultaneously on 5 digital tubes Valid state (valid on, invalid off). The meaning of each segment in the digital tube is as follows.

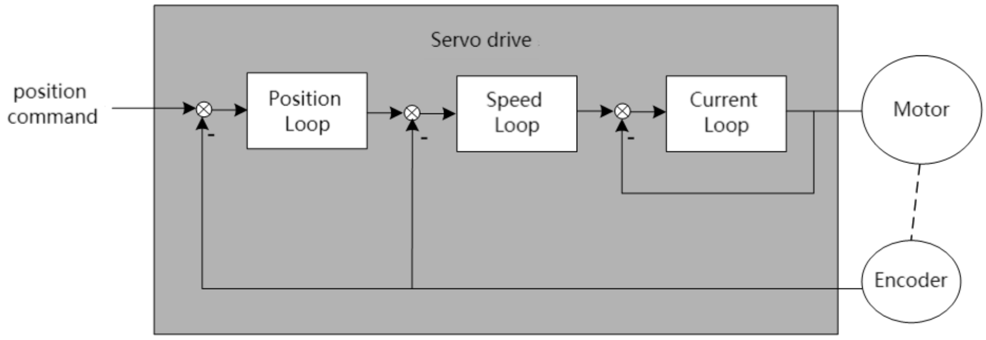
Special attention should be paid to the VC330 servo only 4 DI, 3 DO.



As shown in the figure above, the first digital tube displays the valid states of DO1~DO6, and the state of each DO corresponds to the on-off of the corresponding segment of the digital tube, valid on, invalid off. The upper 3 segments of the last 4-digit digital tubes correspond to the actual levels of DI1~DI10 respectively, high level is on, and low level is off. The lower 3 segments of the last 4-digit digital tubes correspond to the valid states of DI1~DI10 respectively, DIDO is on when valid, and off when invalid.

Chapter 5 VC330 Servo Control Mode

Servo system consists of three main parts: servo driver, motor and encoder.



The servo driver is the control core of the servo system. By processing the input signal and feedback signal, the servo driver can control the precise position, speed and torque of the servo motor, that is, the position, speed, torque and mixed control mode. Among them, position control is the most important and most commonly used control mode of servo system.

Each control mode is briefly described as follows:

Position control refers to controlling the position of the motor through position commands. The target position of the motor is determined by the total number of position commands, and the rotation speed of the motor is determined by the frequency of the position command. The position command can be given by the combination of external pulse input, the total number of internal given position commands + speed limit. Through the internal encoder (the servo motor has its own encoder) or the second encoder (full closed-loop control), the servo drive can realize fast and precise control of the mechanical position and speed. Therefore, the position control mode is mainly used in occasions requiring positioning control, such as manipulators, placement machines, engraving, milling and engraving (pulse sequence commands), CNC machine tools, etc.

Speed control refers to controlling the speed of the machine through the speed command. Through digital, analog voltage or communication given speed command, the servo drive can achieve fast and precise control of the mechanical speed. Therefore, the speed control mode is mainly used to control the rotation speed. If you want to use the host computer to achieve speed control, you can input the output of the host computer as a speed command to the servo drive, such as an analog engraving and milling machine.

Torque control refers to controlling the output torque of the motor through the torque command. The torque command is given by digital, analog voltage or communication. The torque control mode is mainly used in devices that have strict requirements on the force of the material, such as some tension control occasions such as rewinding and unwinding devices. The torque given value should ensure that the force of the material is not affected by the change of the winding radius.

Hybrid control mode refers to a working mode realized by DI terminal, which can switch the control mode in real time under the servo running state.

5.1 Basic parameter setting

5.1.1 control mode

The servo drive has 3 basic control modes, which are position mode, speed mode and torque mode. A variety of hybrid control modes can be derived from the 3 basic control modes. Which mode to use can be set by P02.01 parameter.

<table>
<tr><th>Parameter No.</th><th>Parameter Description</th><th>Set range</th><th>units</th><th>Set method</th><th>Effective way</th><th>Defaults</th><th>read and write method</th></tr>
<tr><td rowspan="2">P02.01</td><td>Drive control mode. Used to select the servo drive control mode.</td><td>0~7</td><td>-</td><td>anytime</td><td>Immediately</td><td>0</td><td>RW</td></tr>
<tr><td colspan="7">0- position mode
1- speed mode
2- torque mode
3- Position/torque mode IO switching, switch through INFn.36, when the signal is valid, it is torque mode
4- Position/speed mode IO switching, switch through INFn.36, when the signal is valid, it is speed mode
5- Torque/speed mode IO switching, switching through INFn.36, when the signal is valid, it is torque mode
6- Position/torque/speed mode IO switching, through INFn.36, INFn.37 switching
7- Specialized Servo Control Mode
<table>
<tr><th>INFn.37</th><th>INFn.36</th><th>working mode</th></tr>
<tr><td>invalid</td><td>invalid</td><td>Speed Mode</td></tr>
<tr><td>invalid</td><td>valid</td><td>Torque Mode</td></tr>
<tr><td>valid</td><td>xx</td><td>position mode</td></tr>
</table>
</td></tr>
</table>

The relevant input function bits are as follows.

Function bits	Bit description
INFn.36	Control mode toggle switch 0
INFn.37	Control mode toggle switch 1

5.1.2 Servo start and stop

When the servo activates the internal input function bit INFn.01 of the drive through IO or communication, the servo is enabled. After OUTFn.25 is output, the command input command is valid, the position/speed/torque command is accepted, and the servo runs.

The servo will perform stop action under the following three working conditions. One is to stop activating the internal input function bit INFn.01; the second is to stop when a fault occurs; the third is to stop when the emergency stop signal INFn.58 is input. The shutdown modes of the 3 working conditions can be set separately. The shutdown mode is set by P02.13. Refer to “7.1.1 Troubleshooting” for fault shutdown mode, and emergency stop shutdown mode is set by P02.14.

The servo has 5 kinds of stopping methods to choose from. The first is free stop; the second is rapid deceleration to stop, the enable is disconnected after stopping, and the motor is powered off; the third is slow deceleration to stop, the enable is disconnected after parking, and the motor is powered off; the fourth is Quickly decelerate to stop, keep the enable after stopping, the user needs to disconnect the enable signal to disable the enable; the fifth is slow deceleration to stop, keep enable after stopping, the user needs to disconnect the enable signal to disable the enable , otherwise it will remain locked and will not accept any command.

Free parking means that the drive is turned off and the motor is free to stop by friction resistance. Deceleration to stop means that the servo drive drives the motor to decelerate, and the motor remains powered on during this process. The deceleration time of rapid deceleration and stop is set by P02.16. The deceleration time of slow deceleration and stop is set by P02.17. Deceleration time refers to the time it takes to decelerate from the rated speed to zero. The actual deceleration time is determined by the speed at the time of failure and the set deceleration time.

$$\text{Actual deceleration time} = \text{set deceleration time} \times \frac{\text{The speed at which the failure occurs}}{\text{Rated speed}}$$

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P02.13	Select the method of enabling shutdown	0~2	-	anytime	Immediately	0	RW
	Set the deceleration mode of the servo motor from rotation to stop and the motor state after stop when the servo is off. 0- Off-enable freewheel stop 1- Turn off enable after fast deceleration and stop 2- Disable enable after slow deceleration and stop						
P02.14	Emergency stop mode selection	0~4	-	anytime	Immediately	0	RW

	Set the deceleration method of the servo motor from rotation to stop and the motor state after stop when the servo is in emergency stop. 0- Off-enable freewheel stop 1- Turn off enable after fast deceleration and stop 2- Disable enable after slow deceleration and stop 3- Quickly decelerate to stop and keep enabled 4- Slowly decelerate to stop and keep enabled						
P02.16	fast stop time Set the stop time when the servo is stopped quickly	0~65535	ms	anytime	Immediately	500	RW
P02.17	Slow stop time Set the stop time when the servo is slow to stop	0~65535	ms	anytime	Immediately	1000	RW

5.1.3 Servo braking method

When the motor decelerates, it will feed back energy to the bus capacitor. When the bus capacitor voltage is too large, an overvoltage fault will be reported. Therefore, a braking resistor needs to be connected to the servo to consume the excess bus voltage on the braking resistor. When the capacitor voltage is high, the dynamic braking circuit is activated. For 220V drives, when the DC bus voltage is greater than 380VDC, the dynamic braking circuit is activated; for 380V drives, when the DC bus voltage is greater than 680VDC, the dynamic braking circuit is activated. The user can select the servo braking mode through P02.20 to release the excess voltage on the bus.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P02.20	Start dynamic braking selection	0~3	-	anytime	Immediately	2	RW
	When the busbar voltage exceeds the limit voltage, select the way to start the dynamic braking circuit. 0- Dynamic braking never starts 1- Dynamic braking can only be activated when decelerating 2- Ready to activate dynamic braking at any time 3- Braking is only possible when the energy is fed back						

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method

P02.21	Braking resistor value	0~3276.7	Ω	anytime	Immediately	0	RW
P02.22	Maximum power of braking resistor	0~3276.7	Kw	anytime	Immediately	0	RW
P02.23	Braking resistor heat dissipation coefficient	0~100	%	anytime	Immediately	50	RW
If P02.23 is set to 100%, it means that the time required to drop from the maximum heat to 0 is 10s.							

5.1.4 command reverse

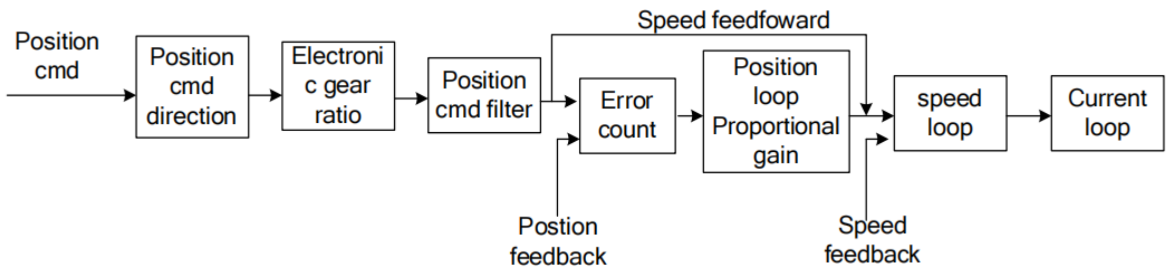
The speed, torque and position commands can be reversed by setting the register P02.50. P02.50 contains 16-bit binary. When the 0th bit is valid, the position command is reversed; when the 1st bit is valid, the speed command is reversed; When 2 bits are valid, the torque command is reversed.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P02.50	command reverse When the 0th bit is valid, the position instruction is reversed; When the 1st bit is valid, the speed command reverses; When the 2nd bit is valid, the torque command reverses	0~7	-	anytime	Immediately	0	RW

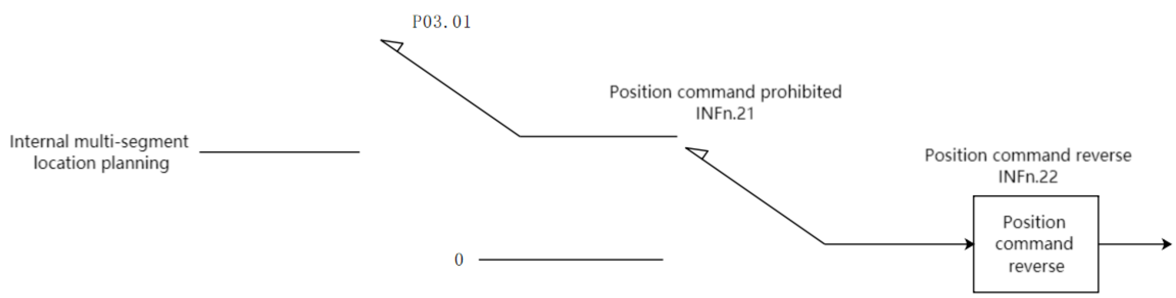
5.2 position mode

The position mode is a control mode in which the motor position is the control target, and is often used to achieve high-precision positioning. The implementation of the location pattern is shown in the following figure.

Note: Since there is no pulse input port on the VC330Profinet bus servo hardware, the position command can only be derived from internal position planning, not from external pulses.



5.2.1 Position command source and direction selection



The position command can come from the internal multi-segment position planning. There is no pulse signal input port on the VC330 hardware, so the position command cannot be derived from the external pulse command.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P03.01	position command source	0~6	-	anytime	Immediately	0	RW
	In position control mode, it is used to select the source of position command. 0- From external pulse command 1- From internal multi-segment location planning 2- Switch between external pulse command and internal position planning command through INFn.35 3- The command pulse superimposes the second encoder pulse as the position command 4- Command pulse superimposed internal position planning as position command 5- Round pressure round sleeve label 6- Sine wave						

Related input function bits.

Function bits	Bit description
INFn.21	Position command prohibited, when valid, the position command is prohibited from being input to the servo
INFn.22	The position command is reversed. When it is valid, the position command is reversed and then input to the servo.

5.2.2 The position command is derived from the multi-segment position command plan

It is derived from the multi-segment position command, which means that the user pre-sets the mechanical position command, speed, acceleration/deceleration time, number of segments and other parameters to be run through the parameters, and then triggers the operation of the multi-segment position, and then the motor moves according to the set rules.

Starting and stopping the multi-segment position is realized by operating INFn.27. When P13.92=0, the rising edge of INFn.27 starts the operation of the multi-segment position, and the falling edge of INFn.27 stops the operation of the multi-segment position; when P13.92=1 , the rising edge of INFn.27 sets the operation of the multi-segment position until the execution of the multi-segment position is completed. The list of relevant parameters is as follows. It should be noted that the set position command refers to the mechanical position command.

Note: The position command of the multi-segment position will be multiplied by the electronic gear ratio, which is the position P00.13 of the motor encoder; but the speed setting of the multi-segment position is not affected by the electronic gear ratio.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P13.01	Multi-segment position working mode 0- Downtime after a single run 1- Cycle run 2- DI switch operation, read the value of INFn.31, INFn.30, INFn.29, INFn.28 as the segment number to run	0~2	-	When the position command comes from a multi-segment position command, it is used to set the multi-segment position operation mode.	Disable settings	Immediately	0	RW
P13.02	total number of segments	1~16	-	Sets the total number of segments for the position instruction.	anytime	Immediately	16	RW
P13.03	idle waiting time unit 0- milliseconds 1-seconds	0~1	-	When using the multi-segment position function, the unit of waiting time.	anytime	Immediately	1	RW
P13.04	surplus processing method	0~1	-	Pause occurs when using	anytime	Immediately	0	RW

	0- Re-jump to the first segment position command to run 1- Start where the previous segment left off			the multi-segment position function to run, and when the multi-segment position function is resumed, set the segment number of the starting segment.				
P13.05	Absolute or relative position command settings 0- absolute position command 1- relative position command	0~1	-	When running with multi-segment position function, set the type of position command.	anytime	Immediately	1	RW
P13.10	Number of pulse commands at the first segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the first segment position	anytime	Immediately	10000	RW
P13.12	The running speed of the first segment of the multi-segment position command	0~32767	rpm	The running speed of the first segment of the multi-segment position command	anytime	Immediately	500	RW
P13.13	The acceleration time of the first segment of the multi-segment position command	0~32767	ms	Set the time for the first segment to accelerate from 0 to rated speed. Actual acceleration	anytime	Immediately	500	RW

				time=change of speed command/rated speed×speed command acceleration time.				
P13.90	The deceleration time of the first segment of the multi-segment position command	0~32767	ms	The deceleration time for the first stage position to decelerate from the rated speed to 0. Actual deceleration time=change of speed command/rated speed×speed command deceleration time.	anytime	Immediately	500	RW
P13.14	Waiting idle time for the end of the first segment of the multi-segment position command The unit of this parameter is determined by P13.03.	0~32767	ms(s)	The waiting time before running the next stage of movement after the first stage of the multi-stage position command is completed.	anytime	Immediately	1	RW
P13.15	Number of pulse commands at the second segment position	-2147483647 ~ 2147483647	User units	The number of position commands for the second segment.	anytime	Immediately	10000	RW

P13.17	The running speed of the second segment of the multi-segment position command	0~32767	rpm	The running speed of the second segment of the multi-segment position.	anytime	Immediately	500	RW
P13.18	The acceleration time of the second segment of the multi-segment position command	0~32767	ms	The time for the second stage position to accelerate from 0 to rated speed.	anytime	Immediately	500	RW
P13.91	The deceleration time of the second segment of the multi-segment position command	0~32767	ms	The deceleration time for the second stage position to decelerate from the rated speed to 0.	anytime	Immediately	500	RW
P13.19	Waiting idle time for the end of the second segment of the multi-segment position command	0~32767	ms(s)	The waiting time before running the next stage of movement after the second stage of the multi-stage position command is completed.	anytime	Immediately	1	RW
P13.20	Number of pulse commands at the third segment position	-2147483647 ~ 2147483647	User units	The number of position commands for the third segment.	anytime	Immediately	10000	RW
P13.22	The running speed of the third segment of the multi-segment position command	0~32767	rpm	The running speed of the third segment of the multi-segment	anytime	Immediately	500	RW

				position.				
P13.23	The acceleration and deceleration time of the third segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the third stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW
P13.24	Waiting idle time for the end of the third segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the third position command of the multi-segment position command ends	anytime	Immediately	1	RW
P13.25	Number of pulse commands at the fourth segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the fourth segment position	anytime	Immediately	10000	RW
P13.27	The running speed of the fourth segment of the multi-segment position command	0~32767	rpm	speed of the fourth segment of the multi-segment position.	anytime	Immediately	500	RW
P13.28	The acceleration and deceleration time of the fourth segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the fourth stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW

P13.29	Waiting idle time for the end of the fourth segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the fourth position command of the multi-segment position command ends	anytime	Immediately	1	RW
P13.30	Number of pulse commands at the fifth segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the fifth segment position	anytime	Immediately	10000	RW
P13.32	The running speed of the fifth segment of the multi-segment position command	0~32767	rpm	speed of the fifth segment of the multi-segment position.	anytime	Immediately	500	RW
P13.33	The acceleration and deceleration time of the fifth segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the fifth stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW
P13.34	Waiting idle time for the end of the fifth segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the fifth position command of the multi-segment position command ends	anytime	Immediately	1	RW

P13.35	Number of pulse commands at the sixth segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the sixth segment position	anytime	Immediately	10000	RW
P13.37	The running speed of the sixth segment of the multi-segment position command	0~32767	rpm	speed of the sixth segment of the multi-segment position.	anytime	Immediately	500	RW
P13.38	The acceleration and deceleration time of the sixth segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the sixth stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW
P13.39	Waiting idle time for the end of the sixth segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the sixth position command of the multi-segment position command ends	anytime	Immediately	1	RW
P13.40	Number of pulse commands at the seventh segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the seventh segment position	anytime	Immediately	10000	RW
P13.42	The running speed of the seventh segment of the multi-segment position command	0~32767	rpm	speed of the seventh segment of the multi-segment position.	anytime	Immediately	500	RW

P13.43	The acceleration and deceleration time of the seventh segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the seventh stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW
P13.44	Waiting idle time for the end of the seventh segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the seventh position command of the multi-segment position command ends	anytime	Immediately	1	RW
P13.45	Number of pulse commands at the eighth segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the eighth segment position	anytime	Immediately	10000	RW
P13.47	The running speed of the eighth segment of the multi-segment position command	0~32767	rpm	speed of the eighth segment of the multi-segment position.	anytime	Immediately	500	RW
P13.48	The acceleration and deceleration time of the eight segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the eight stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW

				Immediately				
P13.49	Waiting idle time for the end of the eight segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the eight position command of the multi-segment position command ends	anytime	Immediately	1	RW
P13.50	Number of pulse commands at the ninth segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the ninth segment position	anytime	Immediately	10000	RW
P13.52	The running speed of the ninth segment of the multi-segment position command	0~32767	rpm	speed of the ninth segment of the multi-segment position.	anytime	Immediately	500	RW
P13.53	The acceleration and deceleration time of the ninth segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the ninth stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW
P13.54	Waiting idle time for the end of the ninth segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the ninth position command of the multi-segment position command ends	anytime	Immediately	1	RW

P13.55	Number of pulse commands at the tenth segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the tenth segment position	anytime	Immediately	10000	RW
P13.57	The running speed of the tenth segment of the multi-segment position command	0~32767	rpm	speed of the tenth segment of the multi-segment position.	anytime	Immediately	500	RW
P13.58	The acceleration and deceleration time of the tenth segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the tenth stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW
P13.59	Waiting idle time for the end of the tenth segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the tenth position command of the multi-segment position command ends	anytime	Immediately	1	RW
P13.60	Number of pulse commands at the eleventh segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the eleventh segment position	anytime	Immediately	10000	RW
P13.62	The running speed of the eleventh segment of the multi-segment position command	0~32767	rpm	speed of the eleventh segment of the multi-segment position.	anytime	Immediately	500	RW

P13.63	The acceleration and deceleration time of the eleventh segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the eleventh stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW
P13.64	Waiting idle time for the end of the eleventh segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the eleventh position command of the multi-segment position command ends	anytime	Immediately	1	RW
P13.65	Number of pulse commands at the twelfth segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the twelfth segment position	anytime	Immediately	10000	RW
P13.67	The running speed of the twelfth segment of the multi-segment position command	0~32767	rpm	speed of the twelfth segment of the multi-segment position.	anytime	Immediately	500	RW
P13.68	The acceleration and deceleration time of the twelfth segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the twelfth stage position; or deceleration time from rated speed to	anytime	Immediately	500	[[[

				0.				
P13.69	Waiting idle time for the end of the twelfth segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the twelfth position command of the multi-segment position command ends	anytime	Immediately	1	RW
P13.70	Number of pulse commands at the thirteenth segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the thirteenth segment position	anytime	Immediately	10000	RW
P13.72	The running speed of the thirteenth segment of the multi-segment position command	0~32767	rpm	speed of the thirteenth segment of the multi-segment position.	anytime	Immediately	500	RW
P13.73	The acceleration and deceleration time of the thirteenth segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the thirteenth stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW
P13.74	Waiting idle time for the end of the thirteenth segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the thirteenth position command of the	anytime	Immediately	1	RW

				multi-segment position command ends				
P13.75	Number of pulse commands at the fourteenth segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the fourteenth segment position	anytime	Immediately	10000	RW
P13.77	The running speed of the fourteenth segment of the multi-segment position command	0~32767	rpm	speed of the fourteenth segment of the multi-segment position.	anytime	Immediately	500	RW
P13.78	The acceleration and deceleration time of the fourteenth segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the fourteenth stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW
P13.79	Waiting idle time for the end of the fourteenth segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the fourteenth position command of the multi-segment position command ends	anytime	Immediately	1	RW
P13.80	Number of pulse commands at the fifteenth segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the fifteenth segment	anytime	Immediately	10000	RW

				position				
P13.82	The running speed of the fifteenth segment of the multi-segment position command	0~32767	rpm	speed of the fifteenth segment of the multi-segment position.	anytime	Immediately	500	RW
P13.83	The acceleration and deceleration time of the fifteenth segment of the multi-segment position command	0~32767	ms	Acceleration time from 0 to rated speed in the fifteenth stage position; or deceleration time from rated speed to 0.	anytime	Immediately	500	RW
P13.84	Waiting idle time for the end of the fifteenth segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the fifteenth position command of the multi-segment position command ends	anytime	Immediately	1	RW
P13.85	Number of pulse commands at the sixteenth segment position	-2147483647 ~ 2147483647	User units	Number of pulse commands at the sixteenth segment position	anytime	Immediately	10000	RW
P13.87	The running speed of the sixteenth segment of the multi-segment position command	0~32767	rpm	speed of the sixteenth segment of the multi-segment position.	anytime	Immediately	500	RW
P13.88	The acceleration and deceleration time of	0~32767	ms	Acceleration time from 0 to	anytime	Immediately	500	RW

	the sixteenth segment of the multi-segment position command			rated speed in the sixteenth stage position; or deceleration time from rated speed to 0.				
P13.89	Waiting idle time for the end of the sixteenth segment of the multi-segment position command	0~32767	ms(s)	The idle time that needs to be waited after the sixteenth position command of the multi-segment position command ends	anytime	Immediately	1	RW
P13.92	Multi-segment position command trigger signal type BIT0-INFn.27 Rising edge triggers to start running multi-segment position; falling edge triggers to stop running multi-segment position BIT1-INFn.27 Rising edge triggers set to run multi-segment position, falling edge does not work	0~3	-	0: The rising edge of INFn.27 triggers the multi-segment position, and the falling edge stops executing the multi-segment position. When the multi-segment position comes from DI, a change in DI automatically triggers the multi-segment position. 1: INFn.27 rising edge trigger, not stop	anytime	Immediately	3	RW

				2: When the multi-segment position comes from DI, the DI change does not automatically trigger the multi-segment position, and the position execution will only be triggered when INFn.27 is re-triggered. 3: INFn.27 rising edge trigger, not stop, when the multi-segment position comes from DI, the DI change does not automatically trigger the multi-segment position, only when INFn.27 is re-triggered will the position execution be triggered.				
P13.93	Condition for sending the next command 0- You must wait for the previous position to	0~1	-	Set the sending conditions of the next command	anytime	Immediately	0	RW

	complete the output and then delay the idle time before sending the next position command 1- After the previous position command is sent, wait for the idle time to directly send the second position command							

The absolute position command refers to the position of the size of the position command relative to the origin, and the relative position command refers to the position of the size of the position command relative to the current position. Therefore, the origin return must be performed before the absolute position command is executed, otherwise a fault will be reported.

For example, suppose that 3 absolute position commands are executed, the size of the first position command is set to 1000, the size of the second position command is set to 2000, and the size of the third position command is set to 0. The zero return operation is performed first, and then the multi-stage position is triggered. The motor first moves forward 1000, then forward 1000, and then reversely moves 2000, and returns to the zero point.

As another example, assuming that three relative position commands are taken, the first position command is set to 1000, the second position command is set to 2000, and the third position command is set to -1000. After triggering the multi-segment position, the motor first moves forward 1000, then forwards 2000, and then reverses 1000.

If you want to use the multi-segment position command, in addition to setting P03.01 and P13.01 first, you also need to configure the DIx function control register and set it to INFn.27 (triggering the multi-segment position function number). Then control the effective level of DIx to trigger the execution of multi-segment position commands at the rising edge, and stop the execution of multi-segment position commands at the falling edge (when P13.92=0). Selecting the segment number is similar, configure the DIx function control register, set the corresponding level, and then trigger.

The relevant input function bits are as follows.

Function bits	Bit description
INFn.27	Trigger multi-segment position command The rising edge triggers the execution of the multi-segment position command, and the falling edge stops the execution of the multi-segment position command Or only the rising edge triggers the execution of multi-segment position commands, and the falling edge does not act. Specific reference P13.92
INFn.28	Multi-segment position command segment number selection 0
INFn.29	Multi-segment position command segment number selection 1
INFn.30	Multi-segment position command segment number selection 2

INFn.31	Multi-segment position command segment number selection 3
INFn.32	Multi-segment position direction selection, when valid, the position command set for multi-segment position is reversed

According to the status of INFn28~31.

Multi-segment running segment number

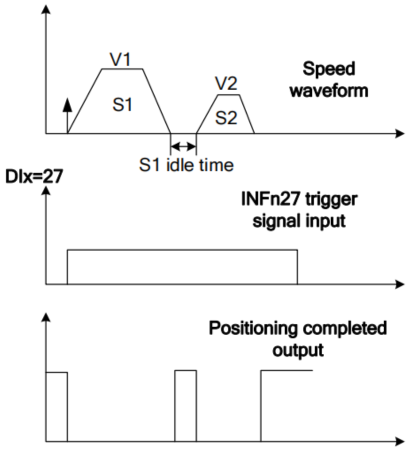
= INFn.31*8 + INFn.30*4 + INFn.29*2 + INFn.28*1 +1

See the table below for details.

INFn.31	INFn.30	INFn.29	INFn.28	run segment number
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	5
0	1	0	1	6
0	1	1	0	7
0	1	1	1	8
1	0	0	0	9
1	0	0	1	10
1	0	1	0	11
1	0	1	1	12
1	1	0	0	13
1	1	0	1	14
1	1	1	0	15
1	1	1	1	16

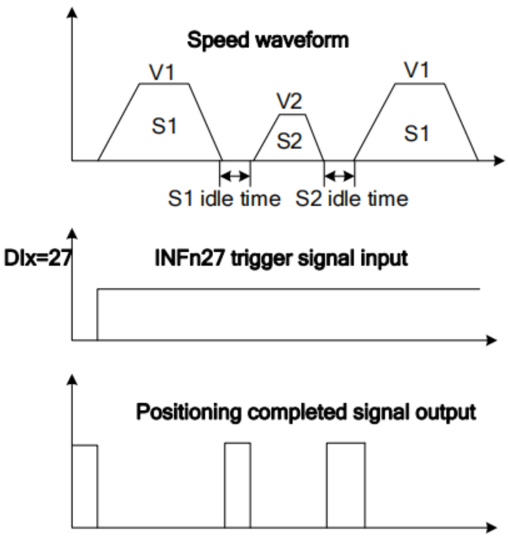
5.2.2.1 Stop after a single run

In this mode, the motor runs n positions of position commands, the idle time of each position command can be set independently, and INFn.27 starts/stops running multi-stage position mode (Note: when P13.92=0, the rising edge of INFn.27 starts multi-stage position mode Position running, the falling edge of INFn.27 stops the running of multi-segment positions; when P13.92=1, the rising edge of INFn.27 starts the running of multi-segment positions, and the falling edge does not act). Its running speed curve is as follows. The total number of segments is assumed to be 2.



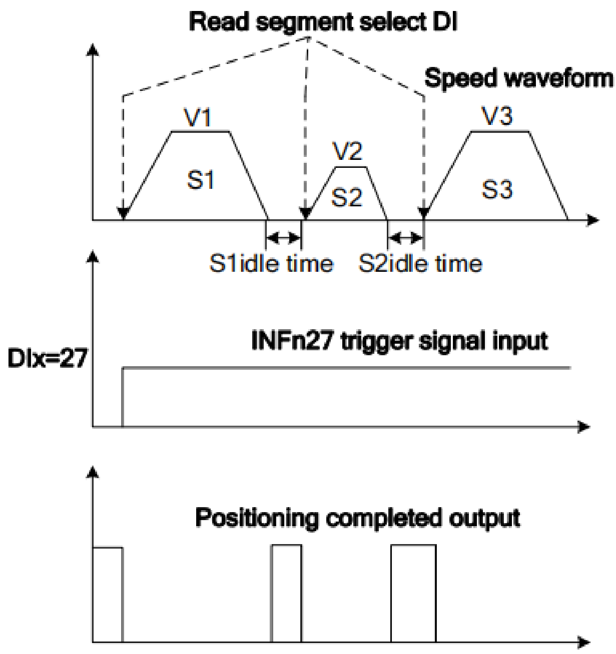
5.2.2.2 Cycle run

In this mode, the motor automatically jumps to the first position command after running the n-stage position command. The idle time of each position command can be set independently. INFn.27 starts/stops the multi-stage position mode (Note: when P13 When .92=0, the rising edge of INFn.27 starts the operation of the multi-segment position, and the falling edge of INFn.27 stops the operation of the multi-segment position; when P13.92=1, the rising edge of INFn.27 sets the operation of the multi-segment position, and the falling edge no action). Its running speed curve is as follows. The total number of segments is assumed to be 2.

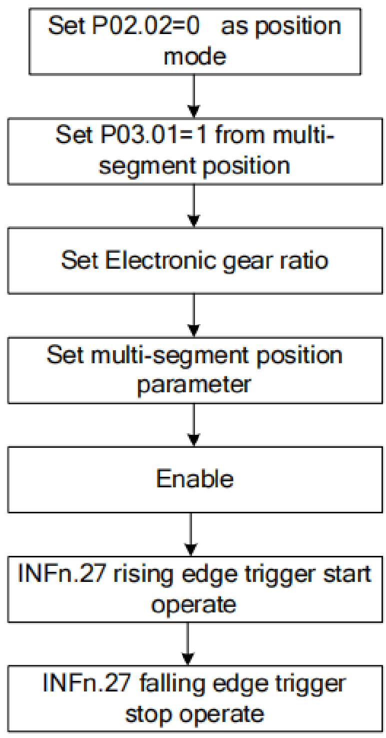


5.2.2.3 DI switch

In this mode, once the multi-segment position is triggered, the driver reads the valid status of INFn.31, INFn.30, INFn.29, and INFn.28 to select a certain position command. , and read the valid state of INFn.31, INFn.30, INFn.29, INFn.28 again to select another position command, if the valid state changes, select another position command to run. This is repeated until it is triggered to stop the operation of the multi-segment position, and then the operation is stopped.



5.2.2.4 The position command comes from the setting steps of the multi-segment position



5.2.3 Electronic gear ratio

The meaning of the electronic gear ratio is that the user position command unit is converted into the coefficient of the motor encoder unit. That is

$$\text{User position command} \times \frac{\text{Electronic gear ratio numerator}}{\text{Electronic gear ratio denominator}} = \text{Location of motor encoder}$$

If the numerator of the electronic gear ratio is set to 0, then how many pulses the motor needs to make one revolution depends on the denominator.

For example, the encoder resolution of the motor is 10000, and the denominator of P03.10 electronic gear ratio 1 is set to 5000. When the motor receives 10000 pulses (the first position command of the internal position), the motor rotates twice.If the numerator of the electronic gear ratio is not 0, the motor encoder position is calculated according to the above formula.

There are two sets of electronic gear ratios to choose from in the system, and the relevant parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P03.08	Electronic gear ratio 1 numerator	1~2147483647	-	Set the numerator of the first group electronic gear ratio for the division/ multiplication frequency of the position command.	anytime	Immediately	0	RW
P03.10	Electronic gear ratio 1 denominator	1~2147483647	-	Set the denominator of the first group of electronic gear ratios for the division/ multiplier	anytime	Immediately	1000	RW

				frequency of the position command.				
P03.12	Electronic gear ratio 2 numerator	1~2147483647	-	Set the numerator of the first group electronic gear ratio for the division/ multiplication frequency of the position command.	anytime	Immediately	0	RW
P03.14	Electronic gear ratio 2 denominator	1~2147483647	-	Set the denominator of the second group of electronic gear ratios for the division/multiplier frequency of the position command.	anytime	Immediately	1000	RW

The system defaults to electronic gear ratio 1. Multiple electronic gear ratios can also be switched through INFn.24 and INFn.56. The switching relationship is as follows.

INFn.56	INFn.24	Actual electronic gear ratio
invalid	invalid	$\frac{\text{Electronic gear ratio 1 numerator}}{\text{Electronic gear ratio 1 denominator}}$
invalid	valid	$\frac{\text{Electronic gear ratio 2 numerator}}{\text{Electronic gear ratio 2 denominator}}$
valid	invalid	$\frac{\text{Electronic gear ratio 1 numerator}}{\text{Electronic gear ratio 2 denominator}}$
valid	valid	$\frac{\text{Electronic gear ratio 2 numerator}}{\text{Electronic gear ratio 1 denominator}}$

5.2.4 Electronic gear ratio smooth switching function

When the electronic gear ratio changes greatly, it is easy to cause sudden changes in the motor speed. The internal electronic gear ratio can be switched smoothly through the P03.16 electronic gear ratio switching filter time constant.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P03.16	Electronic gear ratio switching time constant	0~32767	ms	Set the electronic gear ratio switching time to make the internal electronic gear ratio smoothly switch	anytime	Immediately	0	RW

5.2.5 Position command filter function

The position command filtering is to filter the position command (encoder unit) after frequency or multiplication of the electronic gear ratio.

Consider adding position command filtering in the following situations:

- ◆ The position command output by the host computer is not processed for acceleration and deceleration;
- ◆ Low frequency of pulse command;
- ◆ When the electronic gear ratio (numerator denominator) is 10 times or more.

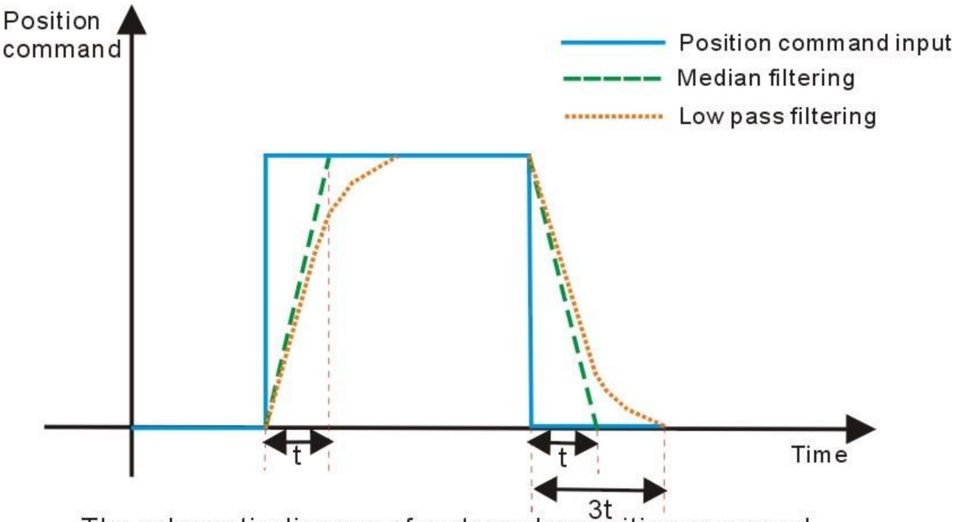
There are two filtering methods to choose from, one is a low-pass filter and the other is a median filter.

The relevant parameters are as follows.

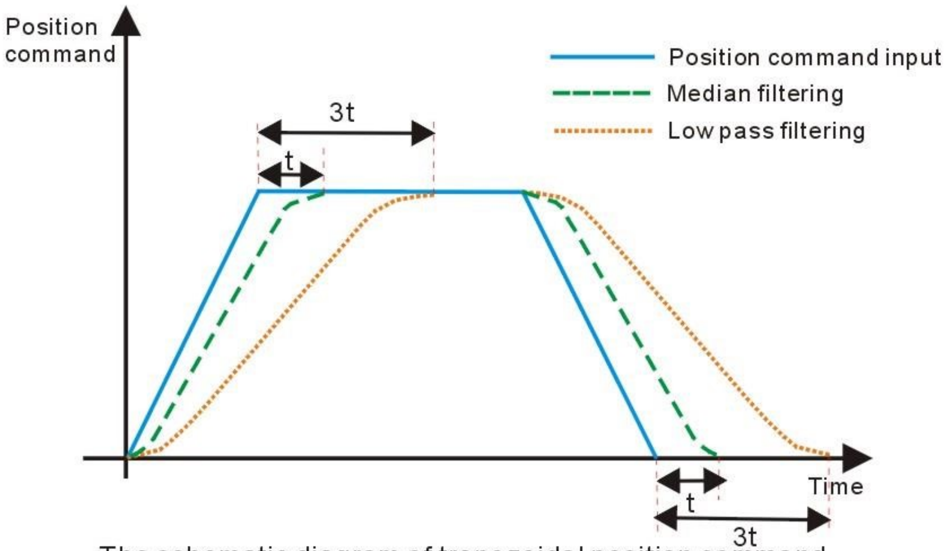
Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P03.06	Position command given median filter time constant	0~128	ms	Set the median filter time constant for the position	set when stop	Immediately	0	RW

				command (encoder unit).				
P03.07	Position command given low-pass filter time constant	0~32767	ms	Set the low-pass filter time constant of the position command (encoder unit).	set when stop	Immediately	20	RW

The larger the filter time constant is set, the more severe the position command lags and the greater the position error during operation. The waveform is as follows.



The schematic diagram of rectangular position command low pass filtering and median filtering

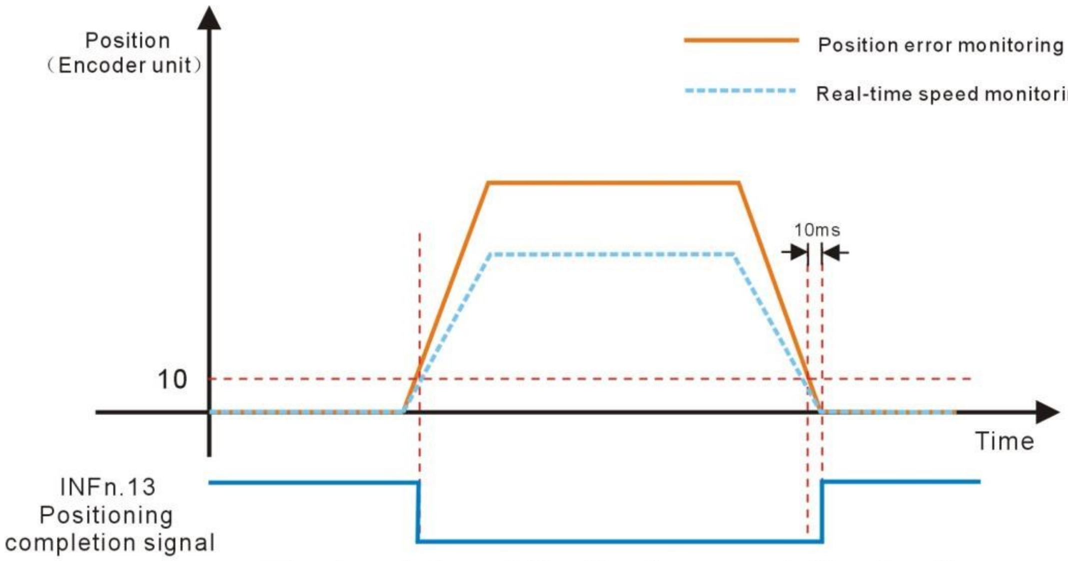


The schematic diagram of trapezoidal position command low pass filtering and median filtering

5.2.6 Positioning complete/proximity function

The positioning completion function means that the absolute value of the position error P03.17 satisfies the user-set condition P03.45 and maintains the time threshold (ms) set by P03.49, and it can be considered that the positioning is completed in the position control mode. At this time, the servo drive can output a positioning completion signal, and the host computer can confirm that the positioning of the servo drive is completed when the signal is received. For the output signal of positioning completion/positioning approaching, you can directly configure the DOx function control register, and the signal is monitored through the DO terminal valid state (P06.49).

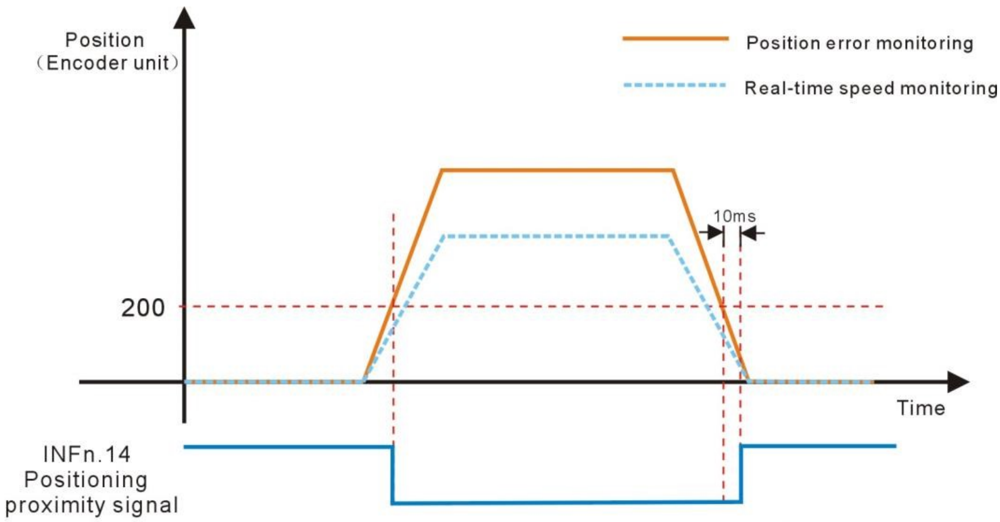
As shown in the figure below, when the positioning completion threshold is set to 10 units (10*0.0001 cycles), and the hold time is set to 10ms, the DO outputs the positioning completion signal.



The description of Positioning completion function

The positioning close function means that the absolute value of the position error P03.17 satisfies the condition P03.47 set by the user, and the time threshold (ms) set by P03.49 is maintained, and the positioning is considered to be close in the position control mode. At this time, the servo driver can output a positioning close signal, and the host constroller receives the signal to confirm that the servo driver is positioned close.

As shown in the figure below, the positioning close threshold is set to 200 pulses, and when the hold time is set to 10 ms, the DO output the positioning signal.



The description of Positioning proximity function

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P03.45	Positioning completion signal output condition	0~4	-	anytime	Immediately	0	RW
	In the position control mode, when the servo is running, the absolute value of the position error P03.17 is within the set value of P03.46 (positioning completion threshold), and after P03.49 (positioning completion/proximity time threshold) is maintained, the servo will be Output positioning completion signal; The output condition of the positioning completion signal can be set by P03.45. 0- Output when the position error is less than the positioning completion threshold, otherwise clear the output; 1- Output when The position error is smaller than the positioning completion threshold and the speed command in position mode P03.95 is zero, otherwise the output is cleared; 2- Output when The position error is less than the positioning completion threshold and the filtered speed command in position mode P03.96 is zero, otherwise the output is cleared; 3- Output when the position error is less than the positioning completion threshold and the speed command in position mode P03.95 is zero. Clear output when speed command in position mode P03.95 is not zero 4- The sending of multi-segment position commands is completed, and the position error is less than the positioning completion threshold						
P03.46	positioning completion threshold	0~32767	0.0001 round	anytime	Immediately	10	RW
	Set the positioning completion threshold (The positioning completion signal is valid only when the servo driver is in position control mode and is in the running state)						
P03.47	Positioning close signal output condition	0~3	-	anytime	Immediately	0	RW
	In the position control mode, when the servo is running, the absolute value of the position error P03.17 is within the set value of P03.48 (positioning proximity threshold), and when P03.49 (positioning completion/proximity time threshold) is maintained, the servo can output Positioning proximity signal; the output conditions of positioning proximity signal can be set through P03.47.						

	0- Output when the position error is less than the positioning close threshold, otherwise clear the output; 1- Output when The position error is smaller than the positioning close threshold and the speed command in position mode P03.95 is zero, otherwise the output is cleared; 2- Output when The position error is less than the positioning close threshold and the filtered speed command in position mode P03.96 is zero, otherwise the output is cleared; 3- Output when the position error is less than the positioning close threshold and the speed command in position mode P03.95 is zero. Clear output when speed command in position mode P03.95 is not zero						
P03.48	positioning close threshold	0~32767	0.0001 round	anytime	Immediately	100	RW
	Set the threshold of the absolute value of the position deviation when the servo drive outputs the positioning approach signal (the positioning approach threshold generally needs to be greater than the positioning completion threshold).						
P03.49	positioning completion/ close time threshold	0~32767	ms	anytime	Immediately	10	RW
	When the position error is less than the positioning completion/proximity threshold, and the time threshold is maintained, the positioning completion/proximity signal is output.						
P03.17	position error	-	0.0001 round	-	-	-	RO
P03.95	the speed command in position mode	-	rpm	-	-	-	RO
P03.96	the filtered speed command in position mode	-	rpm	-	-	-	RO

Related output function bits are as follows.

Function bits	Bit description
OUTFn.13	Positioning completion signal output，active when Positioning completion
OUTFn.14	Positioning close signal output，active when Positioning close

5.2.7 Pulse frequency division output function

Servo pulse frequency division output function is divided into two types: open-collector signal output and differential signal output.

When the output signal is an open-collector signal, the servo can output the motor encoder pulse by setting P06.40, and the motor pulse can be output by dividing the frequency. At this time, the maximum frequency of the motor pulse output is 3KHz, and the output ports are DO1 and DO2. When the output signal is a differential signal, the full-closed loop function needs to be closed (set P03.31=0), and the servo can output command pulse or motor encoder pulse. The output pulse type is set by P03.78, and the output port is 20, 20 of CN3. 21, 22, 23 pins. For differential signals, only motor pulses can be divided and output.

The frequency division coefficient of the motor pulse output can be set by P03.79. The larger the frequency division factor, the lower the output pulse frequency. For example, P03.78 is set to output motor pulse, and P03.79 is set to 2, then when the motor rotates for 2 motor pulses, the terminal outputs 1 pulse.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P03.78	Selection of servo pulse output source	0~2	-	Set the output source of the pulse output port.	anytime	reset valid	0	RW
	0-output motor pulse; 1-output command pulse; 2-no output, as input							
P03.79	The frequency division factor of the output pulse	1~65535	-		anytime	reset valid		RW
	If the encoder type of the motor is incremental, this value indicates the number of pulses output by the motor encoder when the pulse output terminal outputs one pulse. If the encoder type of the motor is an absolute value, the value represents the number of pulses output by the pulse output terminal when the motor rotates once, and the Z point output port outputs a Z point pulse. This value is only valid for motor pulse frequency division, but invalid for command pulse. Incremental encoder is recommended to be 1, which means that the output pulse is equal to the encoder pulse output; absolute encoder is recommended to be set to 10000, which means that the motor rotates once and the pulse output 10000.							
P03.80	Output direction of pulse frequency division	0~1	-		anytime	reset valid	0	RW
	Set the effective level type of the frequency-divided pulse output. Only valid for motor pulses, invalid for command pulses. 0-forward output, 1-reverse output.							
P06.40	DO1DO2 function control register	0~2	-	Set the output parameter type of DO1DO2.	anytime	Immediately	0	RW
	0- DO1 and DO2 are output with the functions configured by P06.41 and P06.42 respectively 1- DO1, DO2 output A and B pulses respectively 2- DO1 outputs the Z point signal, DO2 outputs the function configured by P06.42							

5.2.8 Z point pulse output function

The servo can set DO1 to output the Z point pulse signal through P06.40. The Z point pulse is an open-collector signal output, and its effective level width is 5ms.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P03.81	Z pulse polarity selection 0- forward output 1- reverse output	0~1	-	Set the output level when the pulse output terminal Z pulse is valid.	anytime	Immediately	0	RW

5.2.9 Homing

The servo has multiple home zeroing modes. The user can choose the appropriate origin return mode according to the site conditions and process requirements. The parameters related to zero return are as follows.

Remarks: Before using the zero return function, you need to set the enable software and hardware limit P03.73 to 0 or 2. When it is set to 1, triggering the forward and reverse limit will cause the servo motor to directly enter the fault protection state and cannot continue to complete the zero return. operate.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P03.51	Homing method Set the origin return mode and trigger signal source.	0~99	-	Disable to set	Immediately	0	RW
P03.52	Homing acceleration and deceleration time	0~32767	ms	anytime	Immediately	500	RW
	Set the time for the motor to accelerate from 0 to the rated speed when returning to the origin. Therefore, when the home is running, the actual acceleration time of the motor t = P03.53/rated speed* (P03.52)						
P03.53	The first segment of zero return speed	0~32767	rpm	anytime	Immediately	500	RW
	It is also called the high-speed zero return speed. When the origin is returned to zero, the motor speed when searching for the deceleration point signal is set.						
P03.54	The second segment of	0~32767	rpm	anytime	Immediate	100	RW

	zero return speed				ly		
	Also called low-speed zero return speed, set the motor speed when searching for the origin signal when the origin is returned to zero.						
P03.55	Offset after zero return (set the value of the absolute position of the motor after the zero return.)	-2147483647~2147483647	User units	anytime	Immediately	0	RW
	When BIT9 of P01.46 is set to 1, the motor does not move to the offset position after finding the origin, and directly sets the origin as the offset position. When the BIT9 of P01.46 is set to 0, after the origin is found, the origin is zero, and the motor moves to an offset position.						
P03.57	Origin range(when the position of the motor encoder is within the origin range, and the speed given P09.89=0 in the position loop mode, the time of P03.49 is maintained, and the zero return completion signal is output.)	0~32767	0.0001 Round	anytime	Immediately	5	RW

The associated input function bits are as follows.

Function bits	Bit description
INFn.26	Trigger Homing
INFn.34	Zero point switch input
INFn.43	positive position limit switch
INFn.44	negative position limit switch

The associated output function bits are as follows.

Function bits	Bit description
OUTFn.15	Homing completes output. When the encoder position of the motor is within the Zero point range, and the speed reference in the position mode P09.89=0, the time of P03.49 is also maintained, and the Homing completes output signal is output.

The vec servo has a variety of homing method to choose from, including:

(1) Method 1: Depends on the negative position limit switch and Z index pulse;

(2) Method 2: Depends on the positive position limit switch and Z index pulse;

(3) Method 3-Method 6: Depends on the zero position switch and Z index pulse;

(4) Method 7-Method 10: Depends on the zero position switch, positive position limit switch and Z index pulse;

(5) Method 11 - Method 14: Depends on the zero position switch, negative position limit switch

and Z index pulse

(6) Method 17: Depends on the negative position limit switch

(7) Method 18: Depends on the positive position limit switch

(8) Method 19 - Method 22: Depends on the zero position switch

(9) Method 23 - Method 26: Depends on the zero position switch, positive position limit switch

(10) Method 27 - Method 30: Depends on the zero position switch, negative position limit switch

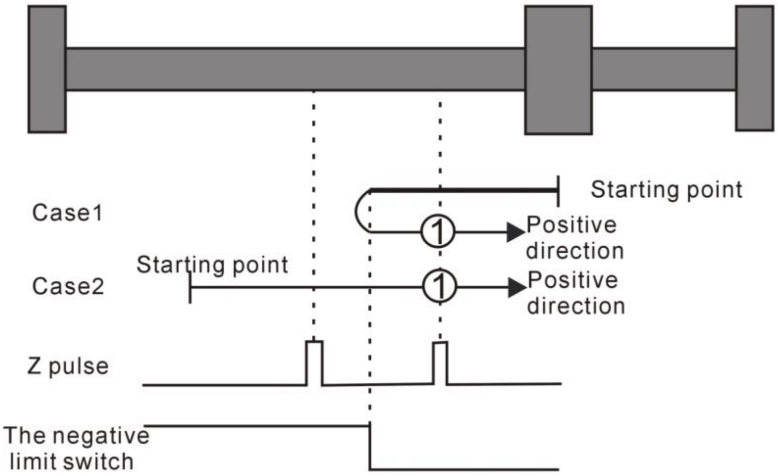
(11) Method 33 - Method 34: Depends on the Z pulse

(12) Method 35: Depends on the current position

Homing method 1: Homing on the negative limit switch and Z index pulse

Case 1: When the user triggers the execution of homing, if the negative limit switch state is in the low level, the axis starts to move in the reverse direction at the first speed. When the negative limit switch is in the high level, the moving direction changes and the starts to move at second speed; the position where the first Z index pulse is encountered when the negative

Case 2: When the user triggers the execution of homing, if the negative limit switch state is at the high level, the axis starts to move in the positive direction at the second speed, and the first Z index pulse is encountered when the negative limit switch state is at the low level. The location is the zero point position.

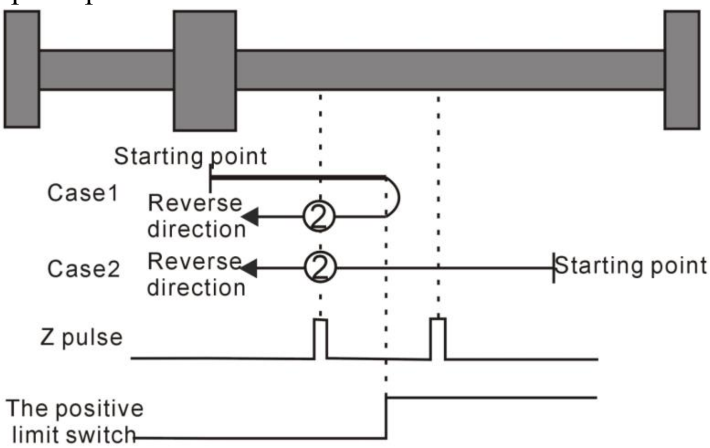


Homing method 1: Homing on the negative limit switch and Z index pulse

Homing method 2: Homing on the positive limit switch and Z index pulse

Case 1: When the user triggers the execution of homing, if the positive limit switch state is in the low level, the axis starts to move forward at the first speed, and when the positive limit switch is in the high level, the moving direction changes and moving speed changes at the second speed, the position where the first Z index pulse is encountered when the positive limit switch state is low is the zero point position.

Case 2: When the user triggers the execution of homing, if the positive limit switch state is at the high level, the axis starts the reverse motion directly at the second speed, and the first Z index pulse is encountered when the positive limit switch state is at the low level. The location is the zero point position.



Homing method 2: Homing on the positive limit switch and Z index pulse

Homing method 3 ~ 6 Homing on the home switch and the Z index pulse

Homing method 3

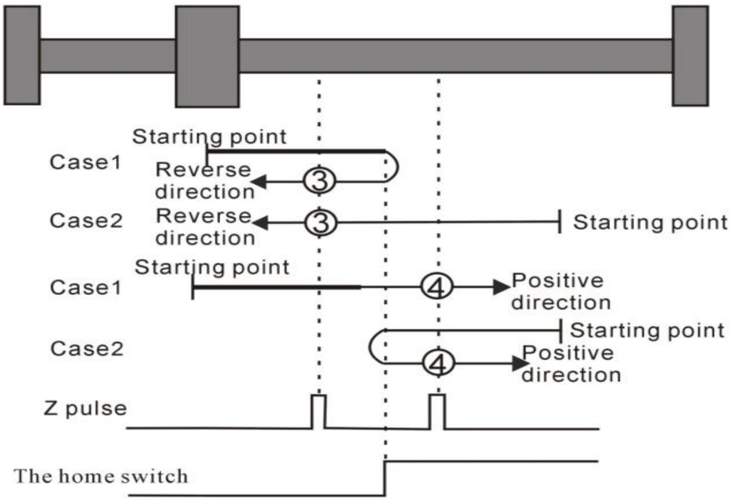
Case 1: When the user triggers the execution of homing, if the home switch state is in the low level, the axis starts to move forward at the first speed. When the origin switch is in the high level, the motion direction changes and starts to move at the second speed. The position where the first Z index pulse is encountered when the home switch state is in the low level is the zero point position.

Case 2: When the user triggers the execution of homing, if the home switch state is at the high level, the axis starts the reverse motion directly at the second speed, and the position where the first Z index pulse is encountered when the home switch state is at the low level is the zero point position.

Homing method 4

Case 1: When the user triggers the execution of homing, if the home switch state is in the low level, the axis starts to move forward at the first speed. When the home switch is in the high level, the second speed is reversed. The position of a Z index pulse is the zero point position.

Case 2: When the user triggers the execution of homing, if the home switch state is at the high level, the axis starts the reverse motion directly at the second speed. When the home switch is in the low level, the motion direction changes and starts to move at the first speed. When the home switch is in the high level again, it moves in the reverse direction at the second speed, and the position where the first Z index pulse is encountered is the zero point position.



Homing method 3 ~ 4 Homing on the home switch and the Z index pulse

Homing method 5

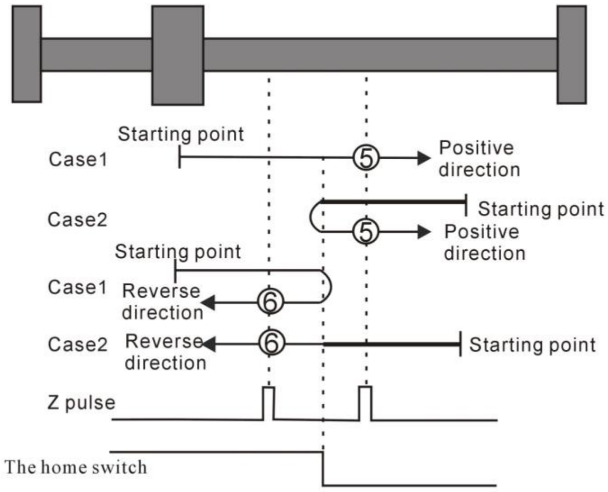
Case 1: When the user triggers the execution of homing, if the home switch state is at the high level, the axis starts to move forward at the second speed, and the position where the first Z index pulse is encountered when the home switch state is low is the zero point position.

Case 2: When the user triggers to perform homing, if the home switch state is in the low level, the axis starts to move in the reverse direction at the first speed. When the home switch is in the high level, the motion direction changes and starts to move at the second speed. The position where the first Z index pulse is encountered when the home switch state is low is the zero point position.

Homing method 6

Case 1: When the user triggers the execution of homing, if the home switch state is in the high level, the axis starts to move forward in the second speed. When the home switch is in the low level, the motion direction changes and starts to move at the first speed. When the home switch is in the high level again, it moves forward in the second speed, and the position where the first Z index pulse is encountered is the zero point position.

Case 2: When the user triggers to perform zero return, if the home switch state is in the low level, the axis starts to move in the reverse direction at the first speed. When the home switch is in the high level, the motion direction changes and starts to move at the second speed. The position where the first Z index pulse is encountered is the zero point position.



Homing method 5 ~ 6 Homing on the home switch and the Z index pulse

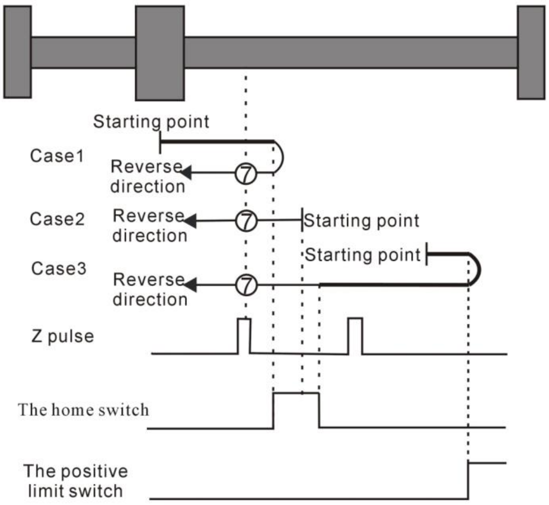
Homing method 7 ~ 10 Homing on the home switch, positive limit switch, and Z index pulse

Homing method 7

Case 1: When the user triggers the execution of homing, if the home switch state is in the low level, the axis starts to move forward at the first speed. When the home switch is in the high level, the motion direction changes and starts to move at the second speed. The position where the first Z index pulse is encountered when the home switch state is low is the zero point position.

Case 2: When the user triggers the execution of the zero return, if the origin switch state is at a high position, the axis directly starts to move in the reverse direction at the second speed. When the origin switch state is at a low level, the position where the first Z pulse is encountered is the origin position.

Case 3: When the user triggers the execution of homing, if the home switch state is in the low level, the axis starts to move forward at the first speed. When the home switch is in the low level and the positive limit switch is in the high level, the moving direction changes. The movement starts at the first speed, and when the home switch is in the high level, the movement starts at the second speed, and the position where the first Z index pulse is encountered when the home switch state is low is the zero point position.



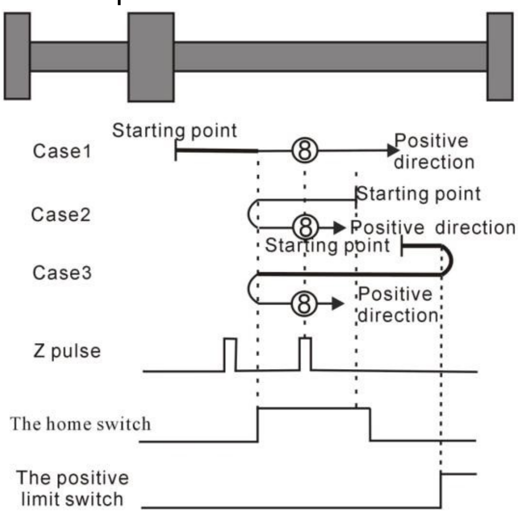
Homing method 7 Homing on the home switch, positive limit switch, and Z index pulse

Homing method 8

Case 1: When the user triggers the execution of homing, if the home switch state is in the low level, the axis starts to move forward at the first speed. When the home switch is in the high level, the second speed starts to move. The position of the first Z index pulse is the zero point position.

Case 2: When the user triggers the execution of homing, if the home switch state is at the high level, the axis directly starts the reverse motion at the second speed. When the home switch is in the low level, the motion direction changes and starts to move at the second speed. When the home switch is in the high level, the position where the first Z index pulse is encountered is the zero point position.

Case 3: When the user triggers the execution of homing, if the home switch state is in the low level, the axis starts to move forward at the first speed. When the home switch is in the low level and the positive limit switch is in the high level, the moving direction changes. When the home switch is in the high level, it still moves at the first speed. The motion direction changes when the home switch state is low, and then starts to move at the second speed. When the home switch in the high level, and the position where the first Z index pulse is encountered is the zero point position.



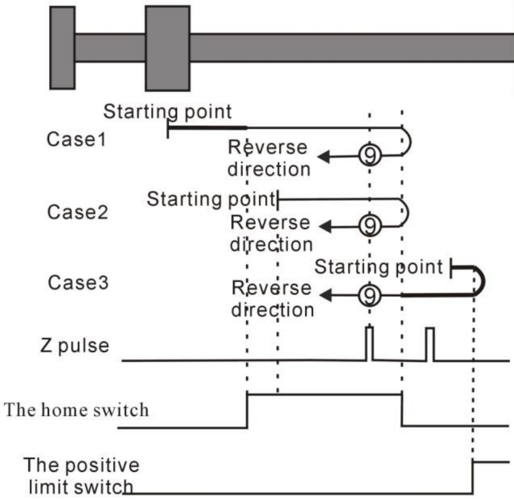
Homing method 8 Homing on the home switch, positive limit switch, and Z index pulse

Homing method 9

Case 1: When the user triggers the execution of homing, if the home switch state is in the low level, the axis starts to move at the first speed. When the home switch is in the high level, the motion starts at the second speed. When the switch is in the low level, the direction of motion changes and continues to move at the second speed. When the home switch is in the high level, the position where the first Z index pulse is encountered is the zero point position.

Case 2: When the user triggers the execution of the zero return, if the origin switch state is at a high level, the axis starts to move forward at the second speed, until when the origin switch is at a low level, the movement direction changes and starts to move at the second speed , when the origin switch is at a high position, the position where the first Z pulse is encountered is the origin position.

Case 3: When the user triggers the execution of zero return, if the state of the origin switch is in the low position, the axis starts to move forward at the first speed. When the origin switch is in the low position and the forward operation limit switch is in the high position, the movement direction changes and Start moving at the first speed, when the origin switch is at a high position, start moving at the second speed, and the position where the first Z pulse is encountered is the home position.



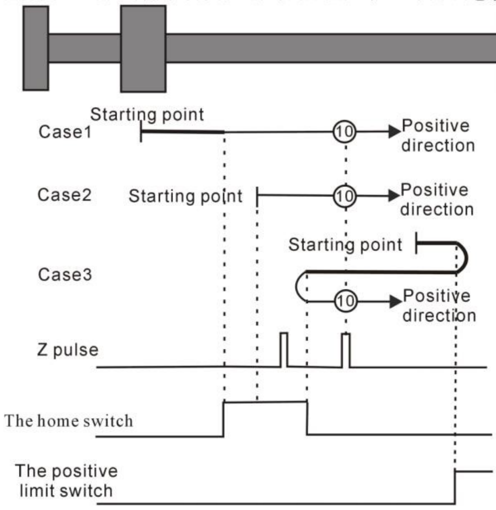
Homing method 9 Homing on the home switch, positive limit switch, and Z index pulse

Homing method 10

Case 1: When the user triggers the execution of the zero return, if the origin switch state is at a low level, the axis starts to move forward at the first speed. When the origin switch is at a high level, it starts to move at the second speed. When the switch is in the low position, the position where the first Z pulse is encountered is the home position.

Case 2: When the user triggers the execution of homing, if the origin switch state is at a high position, the axis starts to move forward at the second speed. When the origin switch is at a low position, the position where the first Z pulse is encountered is the origin position .

Case 3: When the user triggers the execution of zero return, if the state of the origin switch is in the low position, the axis starts to move forward at the first speed. When the origin switch is in the low position and the forward operation limit switch is in the high position, the movement direction changes and Start moving at the first speed, when the origin switch is at a high position, the movement direction changes again and starts moving at the second speed. When the home switch is at a low position, the position where the first Z pulse is encountered is the home position.



Homing method 10 Homing on the home switch, positive limit switch, and Z index pulse

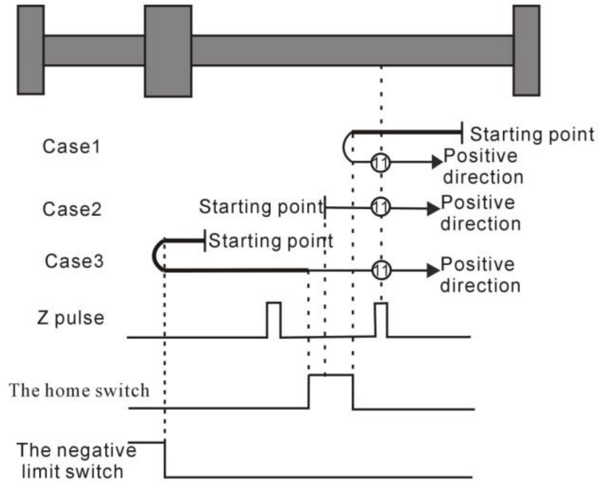
Homing method 11 ~ 14 Homing on the home switch, the negative limit switch and the Z index pulse

Homing method 11

Case 1: When the user triggers the execution of the zero return, if the origin switch state is at a low level, the axis starts to move in the reverse direction at the first speed. When the origin switch is at a high level, the movement direction changes and starts to move at the second speed. The position where the first Z pulse is encountered when the home switch state is low is the home position.

Case 2: When the user triggers the execution of the zero return, if the origin switch state is at a high position, the axis directly starts to move forward at the second speed, and the position where the first Z pulse is encountered when the origin switch state is at a low position is the origin position.

Case3: When the user triggers the execution of the zero return, if the origin switch state is in the low position, the axis starts to move in the reverse direction at the first speed. When the origin switch is in the low position and the reverse operation limit switch is in the high position, the movement direction changes and Start moving at the first speed, when the origin switch is at a high position, start moving at the second speed, and the position where the first Z pulse is encountered when the home switch is at a low state is the home position.



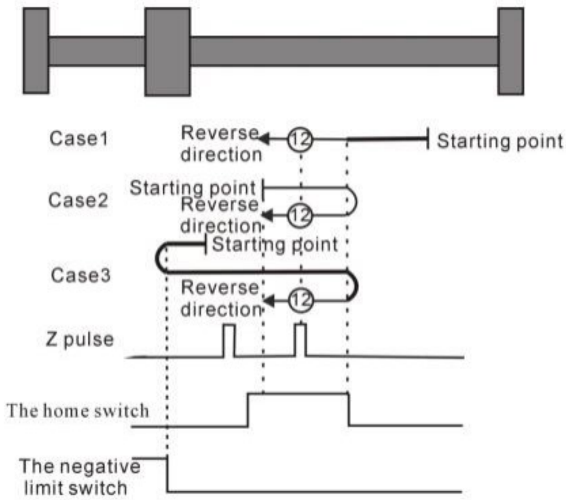
Homing method 11 Homing on the home switch, the negative limit switch and the Z index pulse

Homing method 12

Case 1: When the user triggers the execution of the zero return, if the origin switch state is at a low level, the axis starts to move in the reverse direction at the first speed. When the origin switch is at a high level, it starts to move at the second speed. The position of the Z pulses is the origin position.

Case 2: When the user triggers the execution of the zero return, if the origin switch state is at a high level, the axis directly starts to move forward at the second speed. When the origin switch is at a low level, the movement direction changes and starts to move at the second speed. , when the origin switch is at a high position, the position where the first Z pulse is encountered is the origin position.

Case 3: When the user triggers the execution of zero return, if the state of the origin switch is in the low position, the axis starts to move in the reverse direction at the first speed. When the origin switch is in the low position and the reverse operation limit switch is in the high position, the movement direction changes and It starts to move at the first speed. When the origin switch is at a high position, it still moves at the first speed. When the home switch is at a low state, the movement direction changes and starts to move at the first speed. When it encounters the home switch When it is in the high position, it starts to move at the second speed, and the position where it encounters the first Z pulse is the origin position.



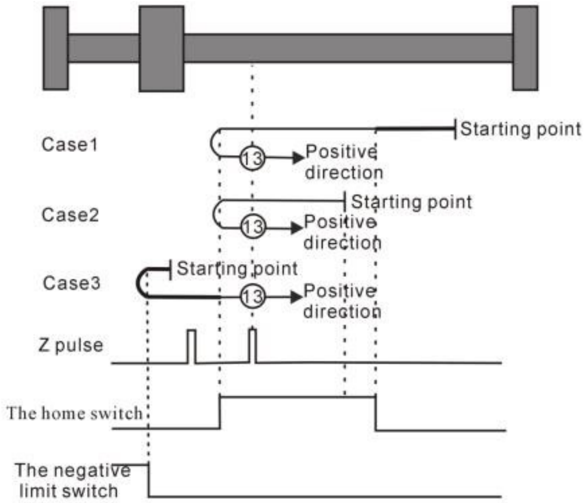
Homing method 12 Homing on the home switch, the negative limit switch and the Z index pulse

Homing method 13

Case 1: When the user triggers the execution of the zero return, if the origin switch state is in the low position, the axis starts to move in the reverse direction at the first stage speed. When the origin switch is in the high position, it starts to move at the second stage speed. When the switch is in the low position, the movement direction changes and starts to move at the second speed. When the origin switch is in the high position, the position where the first Z pulse is encountered is the origin position.

Case 2: When the user triggers the execution of the zero return, if the origin switch state is at a high level, the axis will directly move in the reverse direction at the second speed. When the origin switch is at a high position, the position where the first Z pulse is encountered is the origin position.

Case 3: When the user triggers the execution of zero return, if the state of the origin switch is in the low position, the axis starts to move in the reverse direction at the first speed. When the origin switch is in the low position and the reverse operation limit switch is in the high position, the movement direction changes and Start moving at the first speed, when the origin switch is at a high position, start moving at the second speed, and the position where the first Z pulse is encountered is the home position。



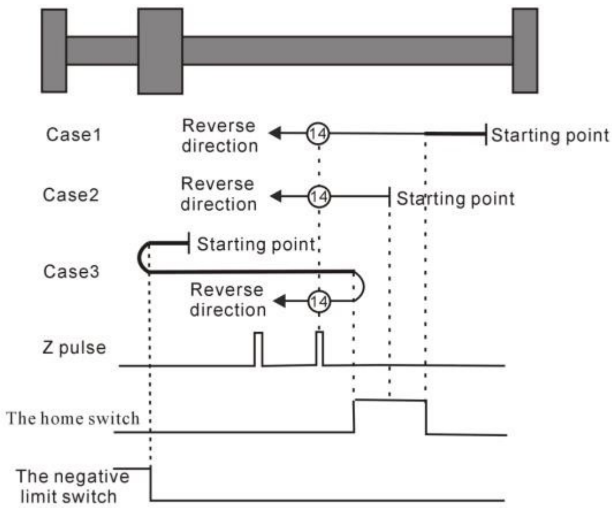
Homing method 13 Homing on the home switch, the negative limit switch and the Z index pulse

Homing method 14

Case 1: When the user triggers the execution of the zero return, if the origin switch state is at a low level, the axis starts to move in the reverse direction at the first speed. When the origin switch is at a high level, it starts to move at the second speed. When the switch is in the low position, the position where the first Z pulse is encountered is the home position.

Case 2: When the user triggers the execution of homing, if the origin switch state is at a high position, the axis starts to move in the reverse direction at the second speed. When the origin switch is at a low position, the position where the first Z pulse is encountered is the origin position .

Case 3: When the user triggers the execution of zero return, if the state of the origin switch is in the low position, the axis starts to move in the reverse direction at the first speed. When the origin switch is in the low position and the reverse operation limit switch is in the high position, the movement direction changes and Start to move at the first speed, when the origin switch is at a high position, the direction of movement changes again and starts to move at the second speed, when the home switch is at a low position, the position where the first Z pulse is encountered is the origin position.



Homing method 14 Homing on the home switch, the negative limit switch and the Z index pulse

Homing method 15 ~ Homing method 16 Reserved

• Homing method 15 and Homing method 16 are reserved as the Homing method for future development.

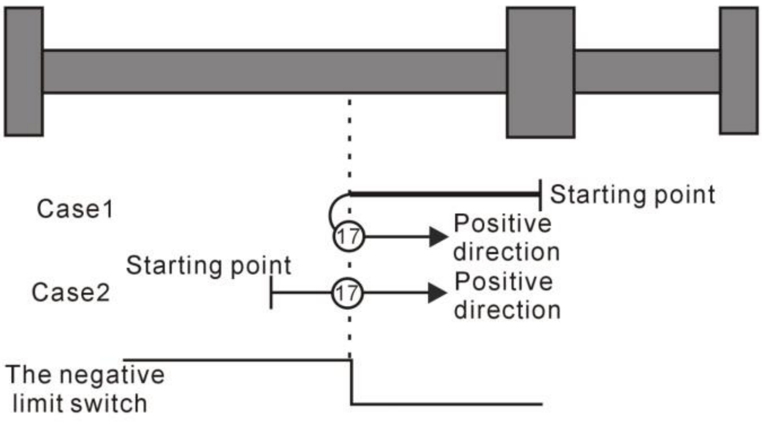
Homing method 17 ~ homing method 30 does not require Z index pulse

Mode 17 to Mode 30 are similar to Mode 1 to Mode 14 mentioned above, except that the positioning of their origin return position no longer requires Z pulses, but only according to the state change of the relevant origin switch and limit switch. Mode 17 is similar to Mode 1, Mode 18 is similar to Mode 2, Mode 19 and Mode 20 are similar to Mode 3, Mode 21 and Mode 22 are similar to Mode 5, Mode 23 and Mode 24 are similar to Mode 7, Mode 25 and Mode 26 are similar to Mode 9 above. Mode 27 and Mode 28 are similar to the previous Mode 11, and Mode 29 and Mode 30 are similar to the previous Mode 13.

Homing method 17：Origin return depending on the reverse operation limit switch

Case 1: When the user triggers the execution of homing, if the negative position limit switch state is in the low level, the axis starts to move in the reverse direction at the first speed. When the negative limit switch is in the high level, the moving direction changes and starts to move at the second speed; the position when the negative limit switch state is in the low level is the zero point position.

Case 2: When the user triggers the execution of zero return, if the state of the reverse operation limit switch is at a high position, the axis starts to move forward at the second speed, and the position when the reverse operation limit switch state is at a low position is the origin position.

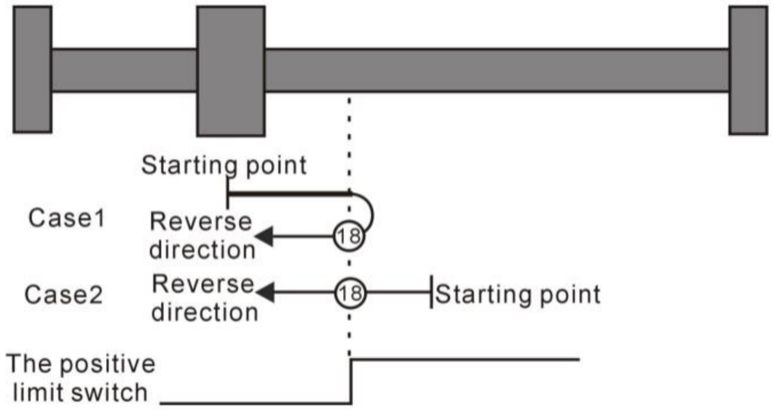


Homing method 17: Homing on the negative limit switch

Homing method 18:Homing on the positive limit switch

Case 1: When the user triggers the execution of homing, if the positive position limit switch state is in the low level, the axis starts to move forward at the first speed, and when the positive position limit switch is in the high level, the moving direction changes and starts to move at second speed, and the position at the time when the positive limit switch state is at the low level is the zero point position.

Case 2: When the user triggers the execution of the zero return, if the forward running limit switch state is at a high position, the axis will directly start reverse movement at the second speed, and the position when the forward running limit switch state is at a low position is the origin position.



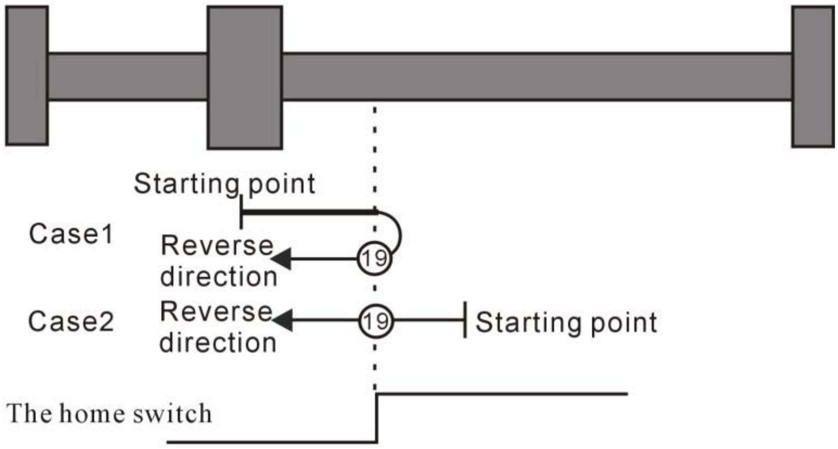
Homing method 18: Homing on the positive limit switch

Homing method 19~ Homing method 20 Depends on the origin return of the origin switch

Homing method 19

Case 1: When the user triggers the execution of the zero return, if the origin switch state is at a low level, the axis starts to move forward at the first speed. When the origin switch is at a high level, the movement direction changes and starts to move at the second speed. The position when the origin switch is in the low position is the origin position.

Case 2: When the user triggers the execution of the zero return, if the origin switch state is in the high position, the axis starts to move in the reverse direction at the second speed, and the position when the origin switch is in the low position is the origin position.

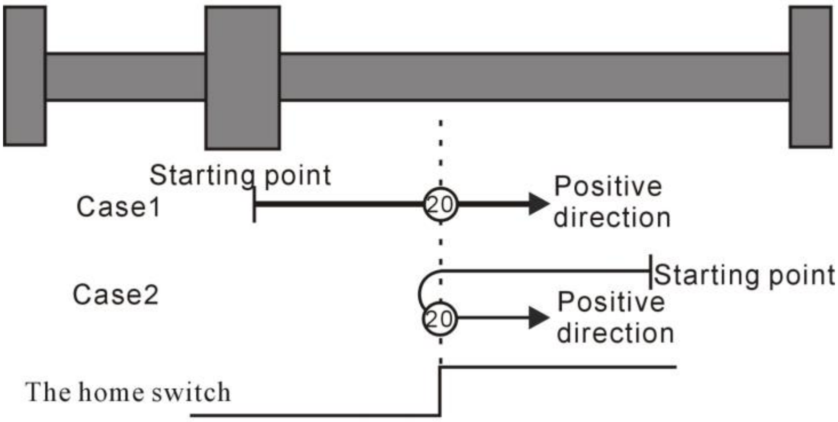


Homing method 19 Homing on the home switch

Homing method 20

Case 1: When the user triggers the execution of the zero return, if the origin switch state is in the low position, the axis starts to move forward at the first speed, and the position when the origin switch is in the high position is the origin position.

Case 2: When the user triggers the execution of the zero return, if the origin switch state is at a high level, the axis starts to move in the reverse direction at the second speed. When the origin switch is at a low level, the movement direction changes and starts at the first speed. , the position when the origin switch is in high position is the origin position.

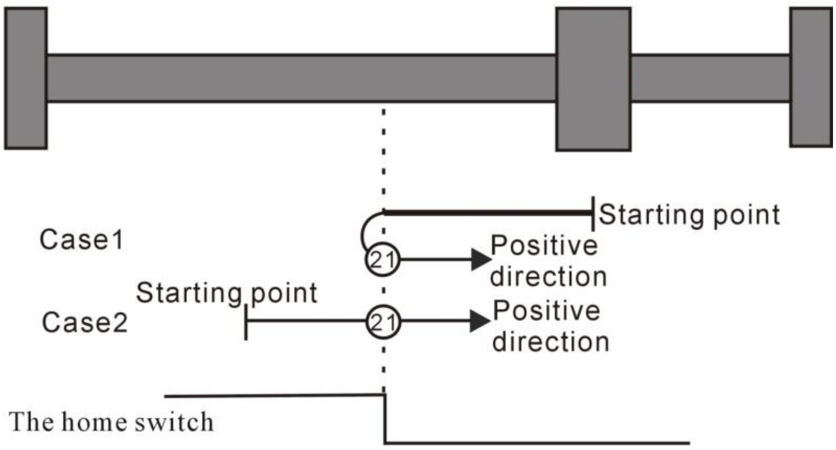


Homing method 20 Homing on the home switch

Homing method 21

Case 1: When the user triggers the execution of the zero return, if the origin switch state is at a low level, the axis starts to move in the reverse direction at the first speed. When the origin switch is at a high level, the movement direction changes and starts to move at the second speed. The position when the origin switch is in the low position is the origin position.

Case 2: When the user triggers the execution of the zero return, if the origin switch state is in the high position, the axis directly starts to move forward at the second speed, and the position when the origin switch is in the low position is the origin position.

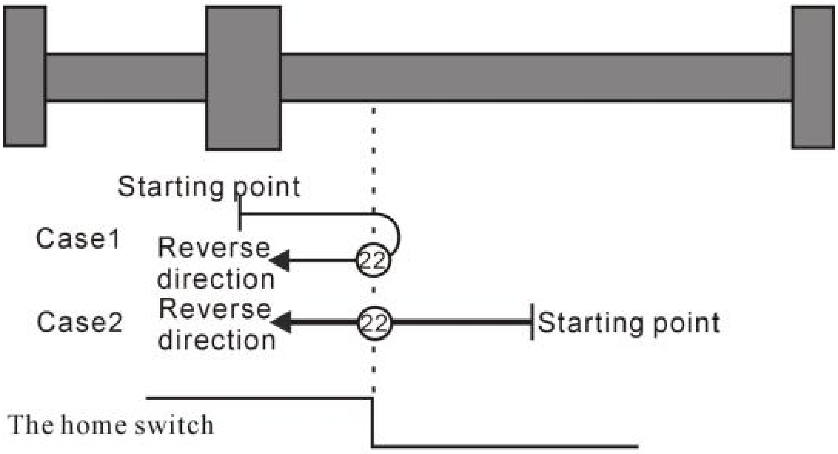


Homing method 21 Homing on the home switch

Homing method 22

Case 1: When the user triggers the execution of zero return, if the origin switch state is at a high level, the axis directly starts to move forward at the second speed. When the origin switch is at a low level, the movement direction changes and starts at the first speed. , the position when the origin switch is in high position is the origin position.

Case 2: When the user triggers the execution of homing, if the state of the origin switch is in the low position, the axis starts to move in the reverse direction at the first speed, and the position when the origin switch is in the high position is the origin position.



Homing method 22 Homing on the home switch

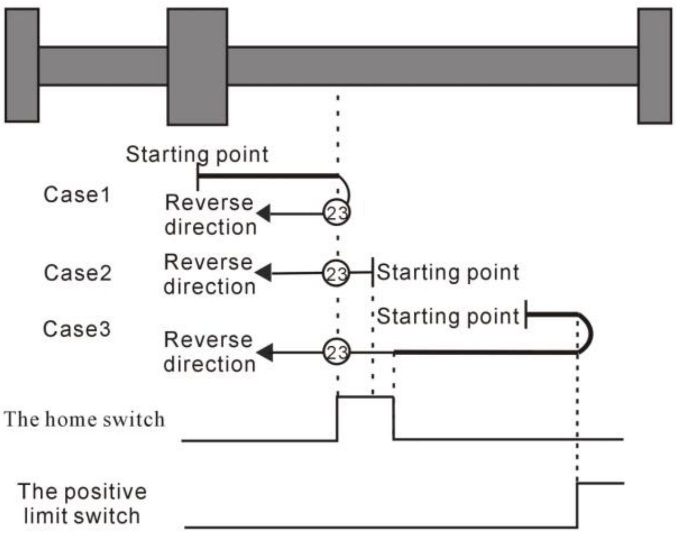
Homing method 23 ~ 26 Origin return depending on origin switch, forward run limit

Homing method 23

Situation 1: When the user triggers the execution of the zero return, if the origin switch state is at a low level, the axis starts to move forward at the first speed. When the origin switch is at a high level, the movement direction changes and starts to move at the second speed. The position when the home switch state is low is the home position.

Scenario 2: When the user triggers the execution of the zero return, if the origin switch state is in the high position, the axis starts to move in the reverse direction at the second speed, and the position when the origin switch state is in the low position is the origin position.

Scenario 3: When the user triggers the execution of zero return, if the state of the origin switch is in the low position, the axis starts to move forward at the first speed. When the origin switch is in the low position and the forward operation limit switch is in the high position, the movement direction changes and Start the movement at the first speed, when the origin switch is in the high position, start the movement at the second speed, and the position when the origin switch is in the low position is the origin position.



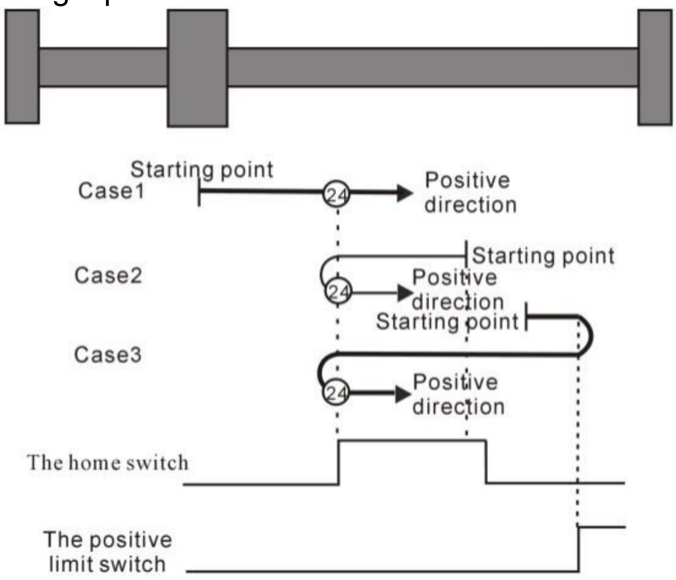
Homing method 23 Homing on the home switch, positive limit switch

Homing method 24

Case 1: When the user triggers the execution of the zero return, if the origin switch state is in the low position, the axis starts to move forward at the first speed, and the position when the origin switch is in the high position is the origin position.

Case 2：When the user triggers the execution of zero return, if the origin switch state is at a high level, the axis directly starts to move in reverse at the second speed. When the origin switch is at a low level, the movement direction changes and starts to move at the second speed. The position when the home switch is in the high position is the home position.

Case 3: When the user triggers the execution of zero return, if the state of the origin switch is in the low position, the axis starts to move forward at the first speed. When the origin switch is in the low position and the forward operation limit switch is in the high position, the movement direction changes and It starts to move at the first speed. When the origin switch is at a high position, it still moves at the first speed. When the home switch is at a low state, the movement direction changes and starts to move at the second speed. When it encounters the home switch The position at the high position is the origin position.



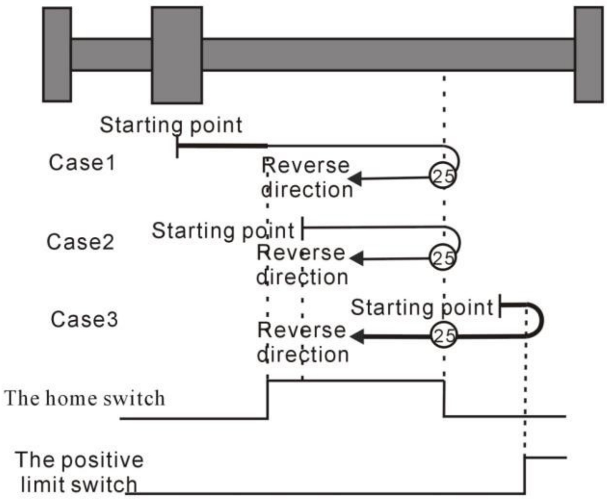
Homing method 24 Homing on the home switch, positive limit switch

Homing method 25

Case 1: When the user triggers the execution of the zero return, if the origin switch state is at a low level, the axis starts to move forward at the first speed. When the origin switch is at a high level, it starts to move at the second speed. When the switch is at the low position, the movement direction changes and starts to move at the second speed. When the home switch is at the high position, the position is the home position.

Case 2: When the user triggers the execution of zero return, if the origin switch state is at a high level, the axis starts to move forward at the second speed. When the origin switch is at a low level, the movement direction changes and starts to move at the second speed. The position when the origin switch is at a high position is the origin position.

Case 3: When the user triggers the execution of zero return, if the state of the origin switch is in the low position, the axis starts to move forward at the first speed. When the origin switch is in the low position and the forward operation limit switch is in the high position, the movement direction changes and Start the movement at the first speed, and the position when the origin switch is at a high position is the origin position.



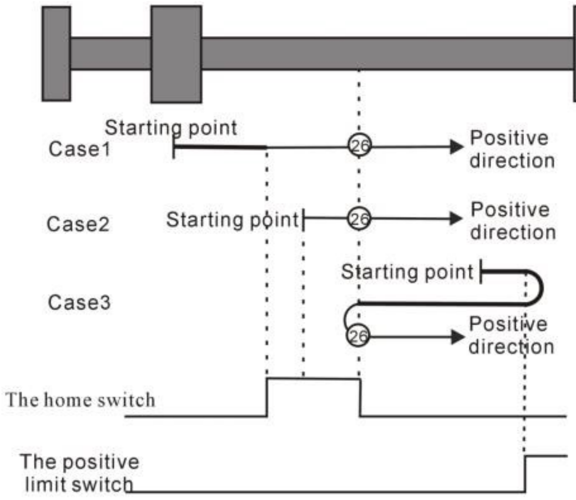
Homing method 25 Homing on the home switch, positive limit switch

Homing method 26

Case 1: When the user triggers the execution of the zero return, if the origin switch state is at a low level, the axis starts to move forward at the first speed. When the origin switch is at a high level, it starts to move at the second speed. The position when the switch is in the low position is the origin position.

Case 2: When the user triggers the execution of zero return, if the state of the origin switch is in the high position, the axis starts to move forward at the second speed, and the position when the origin switch is in the low position is the origin position.

Case 3: When the user triggers the execution of zero return, if the state of the origin switch is in the low position, the axis starts to move forward at the first speed. When the origin switch is in the low position and the forward operation limit switch is in the high position, the movement direction changes and Start moving at the first speed, when the origin switch is at a high position, the movement direction changes again and starts moving at the second speed, and the position when the home switch is at a low position is the home position.



Homing method 26 Homing on the home switch, positive limit switch

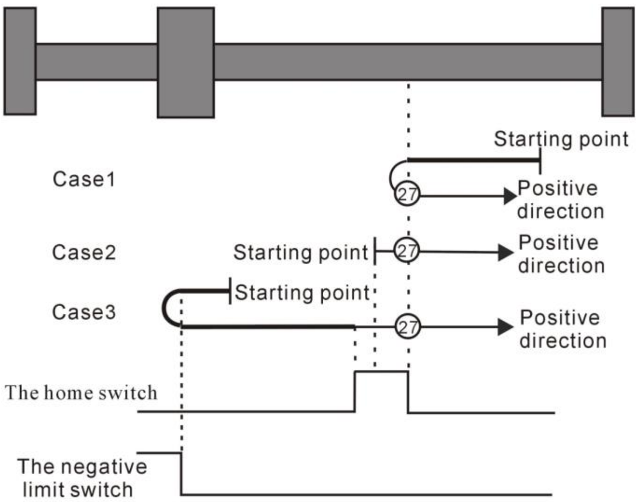
Homing method 27 ~ 30 Origin return depending on origin switch, reverse run limit

Homing method 27

Case 1: When the user triggers the execution of the zero return, if the origin switch state is at a low level, the axis starts to move in the reverse direction at the first speed. When the origin switch is at a high level, the movement direction changes and starts to move at the second speed. The position when the home switch state is low is the home position.

Case 2: When the user triggers the execution of the zero return, if the origin switch state is in the high position, the axis starts to move forward at the second speed, and the position when the origin switch state is in the low position is the origin position.

Case 3: When the user triggers the execution of the zero return, if the origin switch state is in the low position, the axis starts to move in the reverse direction at the first speed. When the origin switch is in the low position and the reverse operation limit switch is in the high position, the movement direction changes and Start to move at the first speed, when the origin switch is at a high position, start to move at the second speed, and the position when the home switch is at a low position is the home position.



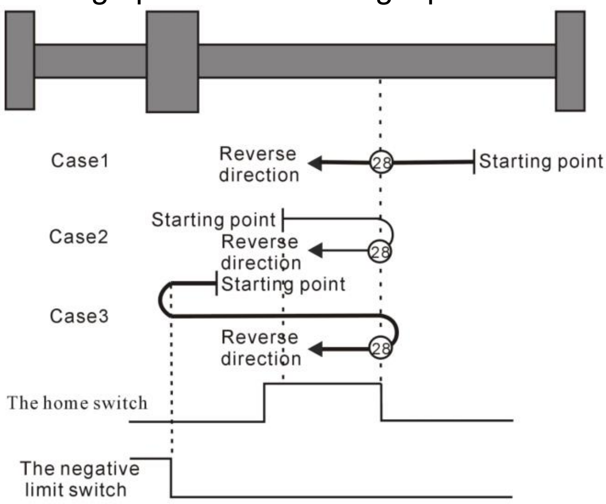
Homing method 27 Homing on the home switch, the negative limit switch

Homing method 28

Case 1: When the user triggers the execution of the zero return, if the origin switch state is in the low position, the axis starts to move in the reverse direction at the first speed, and the position when the origin switch is in the high position is the origin position.

Case 2: When the user triggers the execution of zero return, if the origin switch state is at a high level, the axis directly starts to move forward at the second speed. When the origin switch is at a low level, the movement direction changes and starts to move at the second speed. , the position when the origin switch is in high position is the origin position.

Case 3: When the user triggers the execution of zero return, if the state of the origin switch is in the low position, the axis starts to move in the reverse direction at the first speed. When the origin switch is in the low position and the reverse operation limit switch is in the high position, the movement direction changes and It starts to move at the first speed. When the origin switch is at a high position, it still moves at the first speed. When the home switch is at a low state, the movement direction changes and starts to move at the second speed. When it encounters the home switch The position at the high position is the origin position.



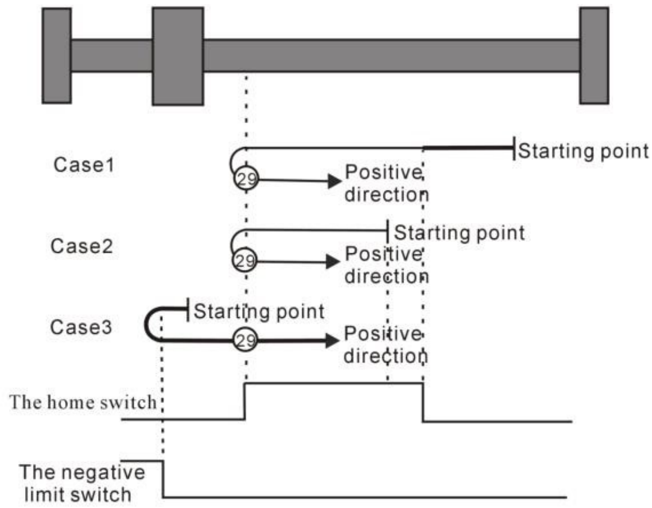
Homing method 28 Homing on the home switch, the negative limit switch

Homing method 29

Case 1: When the user triggers the execution of the zero return, if the origin switch state is in the low position, the axis starts to move in the reverse direction at the first stage speed. When the origin switch is in the high position, it starts to move at the second stage speed. When the switch is at the low position, the movement direction changes and starts to move at the second speed. When the home switch is at the high position, the position is the home position.

Case 2: When the user triggers the execution of the zero return, if the origin switch state is at a high level, the axis will directly move in the reverse direction at the second speed. The position when the origin switch is at a high position is the origin position.

Case 3: When the user triggers the execution of zero return, if the state of the origin switch is in the low position, the axis starts to move in the reverse direction at the first speed. When the origin switch is in the low position and the reverse operation limit switch is in the high position, the movement direction changes and Start the movement at the first speed, and the position when the origin switch is at a high position is the origin position.



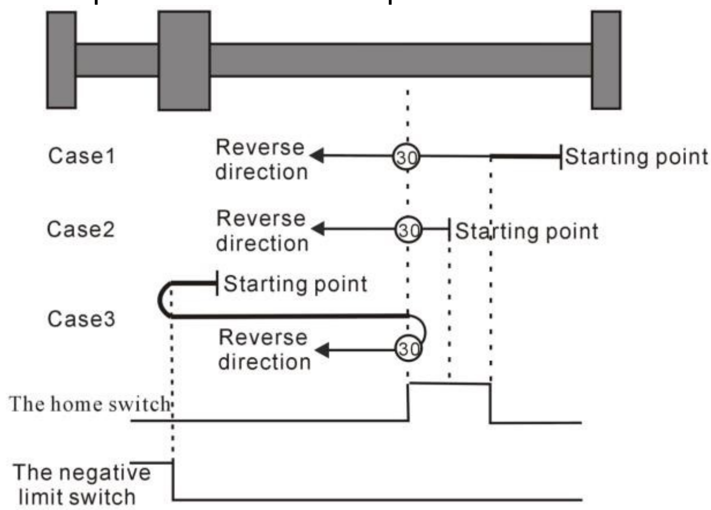
Homing method 29 Homing on the home switch, the negative limit switch

Homing method 30

Case 1: When the user triggers the execution of the zero return, if the origin switch state is at a low level, the axis starts to move in the reverse direction at the first speed. When the origin switch is at a high level, it starts to move at the second speed. The position when the home switch is in the low position is the home position.

Case 2: When the user triggers the execution of homing, if the state of the origin switch is in the high position, the axis starts to move in the reverse direction at the second speed. When the origin switch is in the low position, the position is the origin position.

Scenario 3: When the user triggers the execution of the zero return, if the origin switch state is in the low position, the axis starts to move in the reverse direction at the first speed. When the origin switch is in the low position and the reverse operation limit switch is in the high position, the movement direction changes and Start moving at the first speed, when the origin switch is at a high position, the movement direction changes again and starts moving at the second speed, and the position when the home switch is at a low position is the home position.



Homing method 30 Homing on the home switch, the negative limit switch

Homing method 31 and 32 are reserved.

Homing method 31~32 are reserved as homing modes for later development.

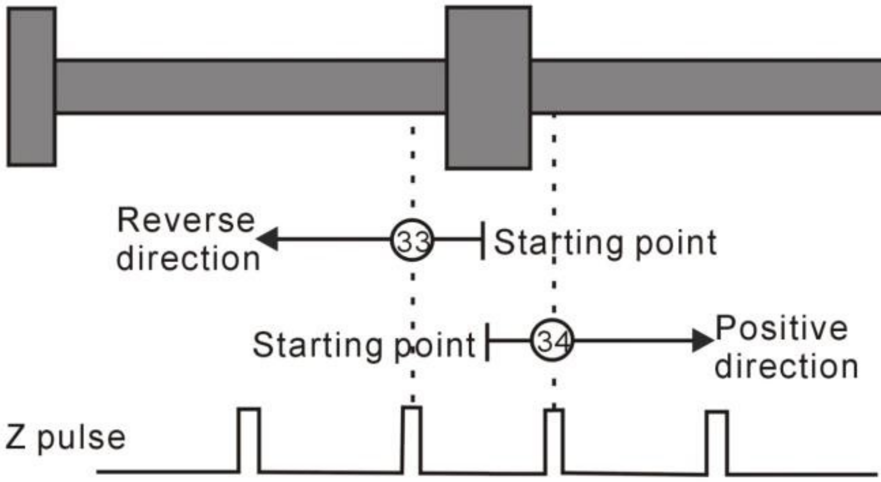
Homing method 33~34 Depends on Z pulse

Homing method 33

In mode 33, when the user triggers the execution of homing, the axis starts to move in the reverse direction at the second speed, and the position where the first Z pulse is encountered is the origin position.

Homing method 34

In mode 34, when the user triggers the execution of homing, the axis starts to move forward at the second speed, and the position where the first Z pulse is encountered is the origin position.



Homing method 33 ~ 34 Homing on the Z index pulse

Homing method 35：depends on current location

In mode 35, when the user triggers the home return, the axis does not move, and the current position of the axis is considered to be the home position.

5.2.10 4th power position curve function

Generally speaking, a trapezoidal velocity curve is used for position planning inside the servo. The trapezoidal speed curve has a certain impact on the machine. In order to reduce the impact of the trapezoidal speed curve on the machine, the 4th power position curve function can be enabled. After enabling, the position curve is planned with a 4th power curve, which can greatly reduce the impact on the mechanical system.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P03.82	Enable 4th power curve planning 0- Use a trapezoidal velocity profile	0~1	-	Set the method of position curve	Stop to setting	Immediately	1	RW

	1- Using a 4th power curve			planning. It can only be modified if the servo is not enabled.				

5.2.11 Full closed loop function

In actual field applications, such as steel plate feeding, due to the sliding between the steel plate and the motor, the displacement of the motor and the displacement of the actual material are inconsistent. Therefore, an external second encoder is required to measure the displacement of the actual material. Servo The driver controls the motor speed according to the given position command and the position signal fed back by the second encoder. That is, closed-loop control is performed on the position of the second encoder, so that the given position command is consistent with the position fed back by the second encoder.

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P03.31	Enable full closed loop 0- Disable fully closed loop 1- Enable full-closed loop (P03.78 setting is invalid, servo pulse port (CN3's 20, 21, 22, 23pins) is used as the second encoder input)	0~1	-	Set whether to enable the full closed loop	Stop to setting	Immediately	0	RW
P03.32	Full closed loop mode 0- semi-closed loop; using electronic gear ratio 1 1- full closed loop; using electronic gear ratio 1 2- Switch full-closed and semi-closed according to IO; IO is	0~2	-	When full closed loop is enabled, set full closed loop mode.	anytime	Immediately	0	RW

	invalid, servo runs in semi-closed loop, adopts electronic gear ratio 1; IO is valid, servo runs in full closed loop, adopts electronic gear ratio 2 Full closed loop feedback polarity							
P03.33	Full closed loop feedback polarity 0- The values of the motor encoder counter and the second encoder counter are incremented or decremented simultaneously 1- The value of the motor encoder counter and the second encoder counter are incremented, one decremented	0~1	-	When the full-closed loop function is set, the internal and external encoders feedback the pulse counting direction during the motor rotation.	anytime	Immediately	0	RW
P03.34	The number of pulses of the second encoder corresponding to one revolution of the motor	0~2147483647	-	Set the number of feedback pulses of the second encoder when the servo motor rotates one revolution.	anytime	Immediately	10000	RW
P03.36	Full closed loop position error excessive threshold, unit is 0.0001 round	0~2147483647	0.0001 round	Set the threshold value of the absolute value of the position deviation when the full-closed loop position	anytime	Immediately	10000	RW

				deviation is too large fault.				

P03.38	Fully closed loop position error, 0.0001 round	-	0.0001 round	The fully closed loop position error refers to (the count value of the motor encoder - the count value of the second encoder reduced to the motor encoder), and the position error represents the relative sliding displacement between the material and the motor.	-	-	-	RO
P03.40	Full closed loop position error clearing cycles	0~32767	-	This value is valid when in full closed loop state. When set to 0, the full-closed loop position error will not be cleared. When set to n, when the motor rotates	anytime	Immediately	0	RW

				every n cycles, if the full-closed loop position error is less than P03.36, the full-closed loop position error will be cleared.				
P03.41	Motor encoder rate in full closed loop mode	-	clk/5 ms	Count and display the speed of the motor encoder under full closed-loop control. The number of pulses per 5ms.	-	-	-	RO
P03.42	Second encoder rate in full closed loop mode	-	clk/5 ms	Statistics and display of the second encoder rate under full closed-loop control. The number of pulses per 5ms.	-	-	-	RO
P00.32	Second encoder software filter time constant	0~32767	ms	Set the second encoder software filter time constant.	anytime	Immediatel y	5	RW

Fn013 Self-learning feedback polarity and the number of second encoder pulses in one revolution of the motor in Fn013 full-closed loop mode

In full-closed loop mode, it is necessary to set the full-closed loop feedback polarity P03.33 and P03.34. The appropriate value can be automatically calculated through this function operation. When performing this function operation, please ensure that the second encoder measuring wheel can be tightly and The material connection ensures that no slippage occurs between the measuring wheel and the material.

The operation steps are as follows:

① Press the MODE button to switch the mode to the functional operation mode, at this time the first two digits of the digital tube display Fn;

② Combine the "▲" (increase), "◂◂" (shift), "▼" (decrease) three buttons to set the display value of the digital tube to Fn013;

③ Click SET to display LFCP. (Learn Full_Close Parameter);

④ Press the "◂◂" (shift) key; the motor will rotate forward 3 times at a speed of 10rpm.

The relevant input function bits are as follows.

Function bits	Bit description
INFn.45	Switch between fully closed loop and semi closed loop When invalid, the servo is in semi-closed loop mode, using electronic gear ratio 1; when valid, servo is in full-closed loop mode, using electronic gear ratio 2

5.2.12 Torque limit function

Position mode torque limit and torque mode torque limit are the same. Refer to (5.4.2 Torque Limit).

5.2.13 Travel limit function

In the position mode, the servo has the software limit function. When the software limit is enabled, it detects that the position value of the encoder is less than the lower limit value of the software limit (P03.74) and the motor moves in the negative direction, and a software limit fault is reported. (Er207). It is detected that the position value of the encoder is greater than the upper limit value of the software limit (P03.76), and the motor moves in the positive direction, and a software limit fault (Er207) is reported.

In position mode, the servo also has hardware limit function. When the hardware limit is enabled, by setting INFn.43 and INFn.44 to a DIx, when the DIx is valid, and the speed is greater than/less than zero (refer to the description of the bits INFn.43 and INFn.44 below), the hardware will be reported to the hardware. Limit fault Er208.

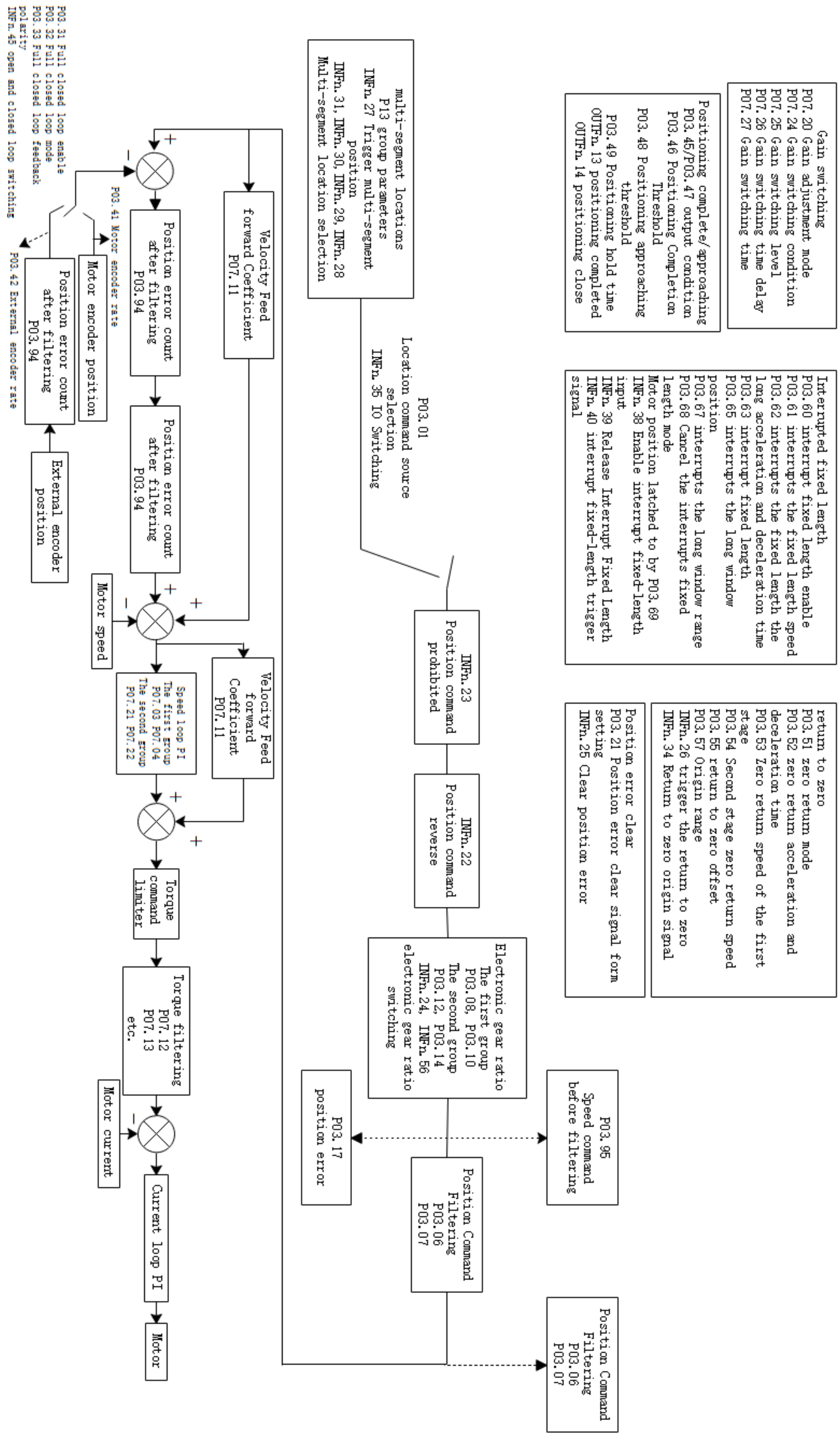
Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P03.73	Enable hardware and software limits 0- Disable hardware and software limits	0~2	-	Set whether to use the hardware and software	anytime	Immediately	0	RW

	1- Directly enable software and hardware limit after power-on 2- Enable software and hardware limit after returning to zero			limit function, and the way to enable the software and hardware limit.				
P03.74	Software limit lower limit value	-2147483647 ~ 2147483647	User units	Set the lower limit value of the software limit	anytime	Immediately	-10000000	RW
P03.76	Software limit upper limit value	-2147483647 ~ 2147483647	User units	Set the upper limit value of software limit	anytime	Immediately	10000000	RW

The relevant input function bits are as follows.

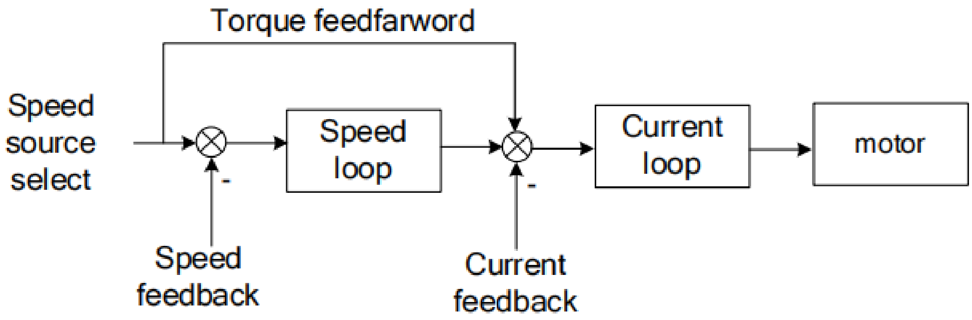
Function bits	Bit description
INFn.43	Forward hardware limit switch in position mode, when the speed is greater than zero and INFn.43 is valid, the hardware limit fault will be reported
INFn.44	Reverse hardware limit switch in position mode, when the speed is less than zero and INFn.44 is valid, a hardware limit fault is reported

5.2.14 Internal implementation block diagram of position mode



5.3 speed mode

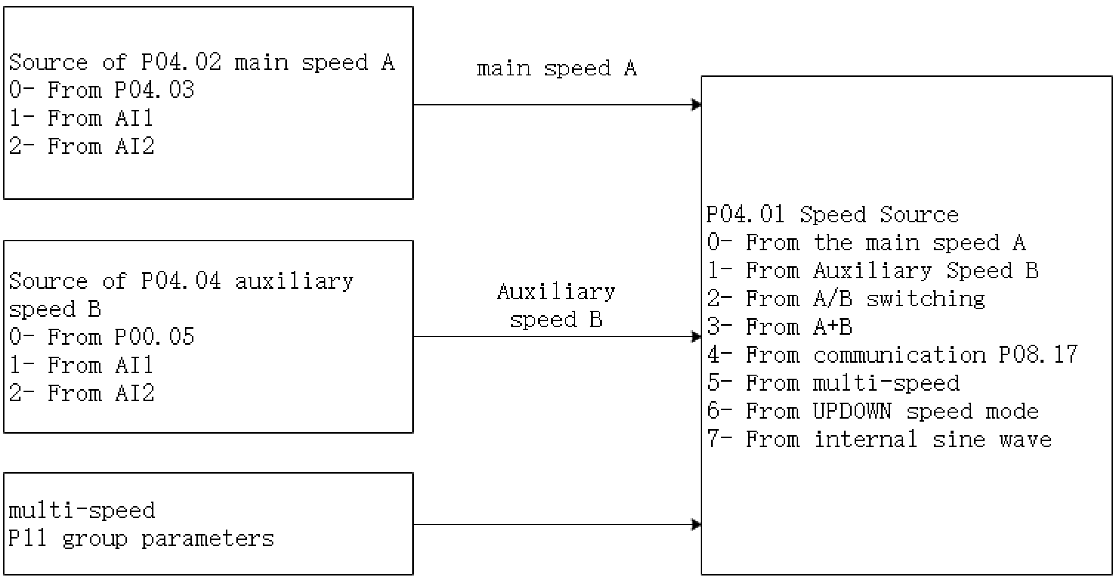
The speed mode is a control mode with the motor speed as the control target, which is often used for the main shaft dragging. The implementation of the speed mode is shown in the figure below.



5.3.1 Speed command source

The servo has two speeds to choose from, namely the main speed A and the auxiliary speed B. These two speeds can be superimposed on each other or can be switched to each other. Both the main speed A and the auxiliary speed B have multiple speed sources. As shown below

（Note: Since AI3 is not supported on VC330 general-purpose servo hardware, the speed cannot be sourced from AI3, and the same is true for others）



Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P04.01	Speed command source 0- main speed A 1- auxiliary speed B 2- INFn.12 switch A/B 3- A+B 4- P08.17 5- mulit speed 6-UP/DOWN speed mode 7- sin wave	0~7	-	Select the source of the speed command.	anytime	Immediately	0	RW
P04.02	main speed A source 0- from P04.03 1- from AI1 2- from AI2 3-from AI3 (The hardware does not support) 4- from pulse frequency (The hardware does not support)	0~4	-	Set the speed command source of the main speed command A source.	anytime	Immediately	0	RW
P04.03	Set value of main speed A	-32767~32767	rpm	When the main speed A source selects the digital given source, set the speed command value through P04.03.	anytime	Immediately	500	RW
P04.04	auxiliary speed B source 0- from P04.05 1- from AI1	0~4	-	Set the speed command source of auxiliary	anytime	Immediately	0	RW

	2- from AI2 3- from AI3 (The hardware does not support) 4-from pulse frequency (The hardware does not support)			speed command B.				
P04.05	Auxiliary speed B set value	-32767~32767	rpm	When the source of auxiliary speed B selects the digital given source, set the speed command value through P04.05.	anytime	Immediately	500	RW
P08.17	Speed communication given	-32767~32767	rpm	In the speed control mode, when the speed command source is communication given, set the speed command value.	anytime	Immediately	0	RW

The relevant input function bits are as follows.

Function bits	Bit description
INFn.12	Switch the main speed A and the auxiliary speed B, and use the auxiliary speed B when it is active.

When the speed command comes from AIx, please refer to "6.3.1 Analog Input AI" for details.

5.3.2 Multi-stage speed mode

Servo supports multi-segment velocity mode. There are 3 modes of multi-stage speed, namely single-run stop, cyclic operation, and IO switching operation.

Single-run stop means that after the motor is enabled, the first stage of speed will be run, and after the operation is completed, the next stage of speed will be run until the running stage number is equal to the total number of stages, and then the machine will stop.

For example, the total number of segments is set to 2, and the single-run stop mode is used. After the motor is enabled, the motor will first run the first stage of speed, and then run the second stage of speed after running, and stop after running.

Cyclic operation is to run the first stage of speed again when a single operation is about to stop, so that the cycle does not stop.

For example, the total number of segments is set to 3, and the cycle operation mode is used. After the motor is enabled, the motor first runs the first stage of speed, then the second stage of speed, then the third stage of speed, and then the first stage of speed, and so on.

IO switching operation means that after the motor is enabled, the driver reads the value of IO to get the segment number, and then runs the speed of the segment. After the IO changes, the driver re-reads the value of IO, gets the segment number again, and then runs the segment speed.

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P11.01	Multi-speed mode 0- single-run stop 1-cycle run 2- IO switch run	0~2	-	In speed control, when the speed command source is multi-speed, set the multi-speed command operation mode.	Stop to setting	Immediately	0	RW
P11.02	The total number of segments of the speed	1~16	-	Set the total number of segments of the speed command. Different speeds and running times can be	anytime	Immediately	16	RW

				set for different segments, and there are 4 sets of acceleration times for selection.				
P11.03	Running time unit 0- ms 1- s	0~1	-	Multi-speed running time unit selection.	anytime	Immediately	1	RW
P11.04	Acceleration time 1	0~32767	ms	For each multi-speed command, 4 sets of acceleration and deceleration time are provided for selection.	anytime	Immediately	500	RW
P11.05	Deceleration time 1	0~32767	ms	-	anytime	Immediately	500	RW
P11.06	Acceleration time 2	0~32767	ms	-	anytime	Immediately	500	RW
P11.07	Deceleration time 2	0~32767	ms	-	anytime	Immediately	500	RW
P11.08	Acceleration time 3	0~32767	ms	-	anytime	Immediately	500	RW
P11.09	Deceleration time 3	0~32767	ms	-	anytime	Immediately	500	RW
P11.10	Acceleration time 4	0~32767	ms	-	anytime	Immediately	500	RW
P11.11	Deceleration time 4	0~32767	ms	-	anytime	Immediately	500	RW
P11.12	1st stage speed command size	-32767~32767	rpm	Set the speed value of the speed command of the 1th stage.	anytime	Immediately	0	RW
P11.13	1st speed command run time This parameter unit is set	0~32767	ms(s)	The running time set by the speed	anytime	Immediately	10	RW

	by P11.03.			command of the 1th stage.				
P11.14	The 1th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4	0~4	-	Acceleration/ deceleration time selected by the 1th speed command	anytime	Immediately	0	RW
P11.15	2st stage speed command size	-32767~32767	rpm	Set the speed value of the 1th speed command.	anytime	Immediately	0	RW
P11.16	2st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.17	The 2th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3	0~4	-	Select the acceleration/ deceleration time of the 2th speed command	anytime	Immediately	0	RW

	4- Using acceleration/ deceleration time 4							
P11.18	3st stage speed command size	-32767~32767	rpm	Set the speed value of the 3th speed command.	anytime	Immediately	0	RW
P11.19	3st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.20	The 3th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4	0~4	-	Select the acceleration/ deceleration time of the 3th speed command	anytime	Immediately	0	RW
P11.21	4st stage speed command size	-32767~32767	rpm	Set the speed value of the 4th speed command.	anytime	Immediately	0	RW
P11.22	4st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.23	The 4th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/	0~4	-	Select the acceleration/ deceleration time of the 4th speed command	anytime	Immediately	0	RW

	deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4							
P11.24	5st stage speed command size	-32767~32767	rpm	Set the speed value of the 5th segment speed command.	anytime	Immediately	0	RW
P11.25	5st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.26	The 5th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4	0~4	-	Select the acceleration/ deceleration time of the 5th speed command	anytime	Immediately	0	RW
P11.27	6st stage speed command size	-32767~32767	rpm	Set the speed value of the 6th speed command.	anytime	Immediately	0	RW
P11.28	6st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.29	The 6th speed	0~4	-	Select the	anytime	Immediately	0	RW

	acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4			acceleration/ deceleration time of the 6th speed command				
P11.30	7st stage speed command size	-32767~32767	rpm	Set the speed value of the 7th speed command.	anytime	Immediately	0	RW
P11.31	7st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.32	The 7th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4	0~4	-	Select the acceleration/ deceleration time of the 7th speed command	anytime	Immediately	0	RW

P11.33	8st stage speed command size	-32767~32767	rpm	Set the speed value of the 8th speed command.	anytime	Immediately	0	RW
P11.34	8st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.35	The 8th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4	0~4	-	Select the acceleration/ deceleration time of the 8th speed command	anytime	Immediately	0	RW
P11.36	9st stage speed command size	-32767~32767	rpm	Set the speed value of the 9th speed command.	anytime	Immediately	0	RW
P11.37	9st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.38	The 9th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/	0~4	-	Select the acceleration/ deceleration time of the 9th speed command	anytime	Immediately	0	RW

	deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4							
P11.39	10st stage speed command size	-32767~32767	rpm	Set the speed value of the 10th speed command.	anytime	Immediately	0	RW
P11.40	10st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.41	The 10th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4	0~4	-	Select the acceleration/ deceleration time of the 10th speed command	anytime	Immediately	0	RW
P11.42	11st stage speed command size	-32767~32767	rpm	Set the speed value of the 11th speed command.	anytime	Immediately	0	RW
P11.43	11st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.44	The 11th speed acceleration and deceleration time selection 0-Use acceleration/deceler	0~4	-	Select the acceleration/ deceleration time of the 11th speed	anytime	Immediately	0	RW

	ation time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4			command				
P11.45	12st stage speed command size	-32767~32767	rpm	Set the speed value of the 12th speed command.	anytime	Immediately	0	RW
P11.46	12st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.47	The 12th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time	0~4	-	Select the acceleration/ deceleration time of the 12th speed command	anytime	Immediately	0	RW
P11.48	13st stage speed command size	-32767~32767	rpm	Set the speed value of the 13th speed command.	anytime	Immediately	0	RW

P11.49	13st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.50	The 13th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4	0~4	-	Select the acceleration/ deceleration time of the 13th speed command	anytime	Immediately	0	RW
P11.51	14st stage speed command size	-32767~32767	rpm	Set the speed value of the 14th speed command.	anytime	Immediately	0	RW
P11.52	14st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.53	The 14th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3	0~4	-	Select the acceleration/ deceleration time of the 14th speed command	anytime	Immediately	0	RW

	4- Using acceleration/ deceleration time 4							
P11.54	15st stage speed command size	-32767~32767	rpm	Set the speed value of the 15th speed command.	anytime	Immediately	0	RW
P11.55	15st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.56	The 15th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/ deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4	0~4	-	Select the acceleration/ deceleration time of the 15th speed command	anytime	Immediately	0	RW
P11.57	16st stage speed command size	-32767~32767	rpm	Set the speed value of the 16th speed command.	anytime	Immediately	0	RW
P11.58	16st speed command run time	0~32767	ms(s)	-	anytime	Immediately	10	RW
P11.59	The 16th speed acceleration and deceleration time selection 0-Use acceleration/deceleration time P04.17 P04.18 1- Using acceleration/	0~4	-	Select the acceleration/ deceleration time of the 16th speed command	anytime	Immediately	0	RW

	deceleration time 1 2- Using acceleration/ deceleration time 2 3- Using acceleration/deceleration time 3 4- Using acceleration/ deceleration time 4							

The relevant input function bits are as follows.

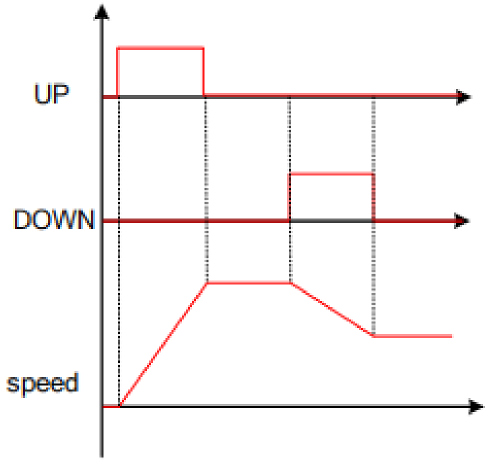
Function bits	Bit description
INFn.17	Select 0 for the speed segment number of multi-step speed
INFn.18	Select 1 for the speed segment number of multi-step speed
INFn.19	Select 2 for the speed segment number of multi-step speed
INFn.20	Select 3 for the speed segment number of multi-step speed

According to the status of INFn17~20, multi-speed speed segment number = INFn.20*8 + INFn.19*4 + INFn.18*2 + INFn.17*1 +1. See the table below for details.

INFn.20	INFn.19	INFn.18	INFn.17	Multi-speed running segment number
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
......				
1	1	1	1	16

5.3.3 UP/DOWN speed mode

When the UP/DOWN speed mode is selected, the speed is controlled by the input detail bits INFn.63 (UP) and INFn.64 (DOWN). When it is detected that INFn.63 is active, the speed raises; when it is detected that INFn.64 is active, the speed decreases; when both signals are deactive, the speed remains unchanged. The timing diagram is shown below.

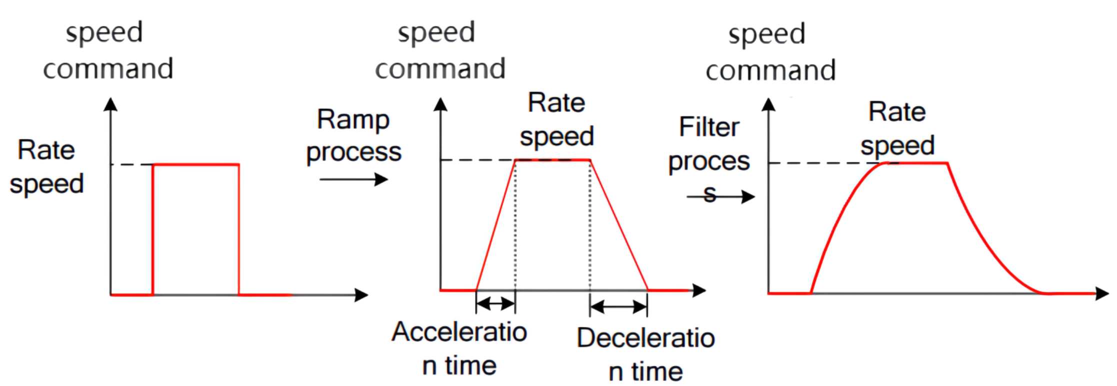


The relevant input function bits are as follows.

Function bits	Bit description
INFn.63	UP signal
INFn.64	DOWN signal

5.3.4 Ramp control and speed command filtering

All speed sources have ramp control to prevent the impact of a given speed on the machine. The ramp control is achieved by setting the acceleration/deceleration time of the speed. The speed command after the ramp processing is then subjected to low-pass filtering to make the speed command smoother. For example, when the set speed is the rated speed, the actual running speed is processed as shown below.



It should be noted that the actual acceleration/deceleration time is related to the change of the given speed. The set acceleration/deceleration time refers to the acceleration time required to accelerate from 0 to the rated speed.

$$\text{Actual acceleration and deceleration time} = \text{Set acceleration and deceleration time} \times \frac{\text{Variation of the input speed command}}{\text{Rated speed}}$$

The advantage of filtering is to make the speed output smoother, but the disadvantage is that the speed command will lag. The larger the set filter time constant, the smoother the speed output and the longer the lag time.

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P04.20	Time const for speed command filter	0~32767	ms	Set the acceleration/ deceleration ramp time constant for the speed command.	anytime	Immediately	20	RW
P04.17	Acceleration time	0~65535	ms	The time for the speed command to accelerate from 0 to the rated speed. The calculation formula of the actual acceleration time is as follows: Actual acceleration time t 1=change of speed command/rated speed× speed command acceleration time	anytime	Immediately	500	RW

P04.18	Deceleration time	0~65535	ms	The time for the speed command to decelerate from the rated speed to 0. Actual deceleration time t2= Change of speed command/rated speed× speed command deceleration time	anytime	Immediately	500	RW

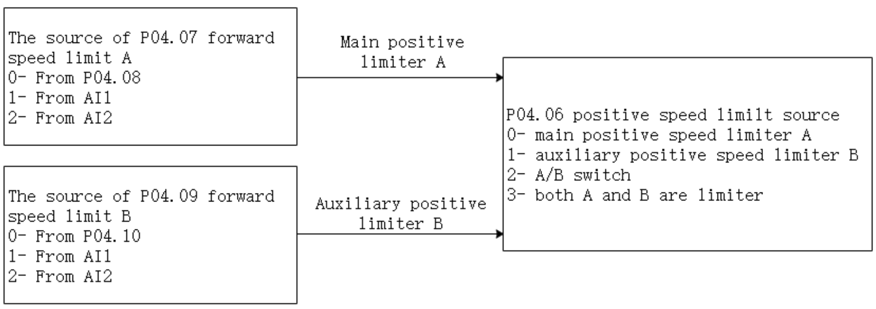
5.3.5 speed limit

Speed limiting includes forward limiting and reverse limiting, each of which has a primary limiting A source and an auxiliary limiting B source. That is, the main positive limiter A, the auxiliary positive limiter B, the main negative limiter A, and the auxiliary negative limiter B.

（Note: Since AI3 is not supported on the VC330Profinet bus servo hardware, the forward speed limit cannot be sourced from AI3）

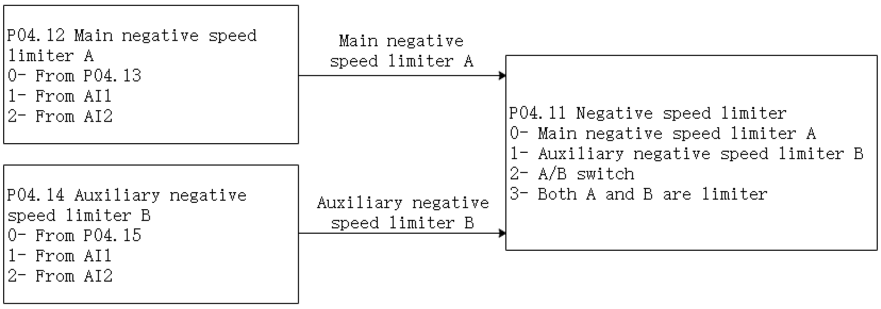
5.3.5.1 Positive speed limiting

The source of the forward speed limit is shown below. There are two types of positive speed limiting, one is the main positive speed limiter A, and the other is the auxiliary positive speed limiter B. Both speed limits have different speed limit sources.



5.3.5.2 Negative speed limiter

The source of the reverse speed limit is shown below. There are two types of reverse speed limiting, one is the main negative speed limiter A, and the other is the auxiliary reverse speed limiter B. Both speed limits have different speed limit sources.



The speed limit related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P04.06	source of positive speed limiting 0-main positive speed limiter A 1-auxiliary reverse speed limiter B 2- A/B switch 3-both A and B are limiter	0~3	-	Set the source of the forward speed command limit.	anytime	Immediately	0	RW
P04.07	Source of main positive speed limiter A 0- from P04.08 1- fromAI1 2- fromAI2 3- fromAI3 (The hardware does not support)	0~3	-	Select the source of the positive speed limit A.	anytime	Immediately	0	RW
P04.08	Set value of positive speed limit A	0~32767	rpm	When the forward speed limit A selects the digital given source, set the required speed limit value through P04.08.	anytime	Immediately	3000	RW

P04.09	Source of auxiliary reverse speed limiter B 0- FromP04.10 1- FromAI1 2- FromAI2 3- FromAI3 (The hardware does not support)	0~3	-	Select the source of the positive speed limiter B.	anytime	Immediately	0	RW
P04.10	Set value of positive speed limiter B	0~32767	rpm	When the positive speed limit B selects the digital given source, set the required speed limit value through P04.10.	anytime	Immediately	3000	RW
P04.11	source of negative speed limiting 0-main negative speed limiter A 1- auxiliary negative speed limiter B 2- A/B switch 3- both A and B are limiter	0~3	-	Set the source of the reverse speed command limiter.	anytime	Immediately	0	RW
P04.12	Source of main negative speed limiter A, 0- FromP04.13 1- FromAI1 2- FromAI2 3- FromAI3 (The hardware does not support)	0~3	-	Select the source of the reverse speed limiter A.	anytime	Immediately	0	RW
P04.13	Digital value of main negative speed limiter A	0~32767	rpm	When the reverse speed limit A selects the	anytime	Immediately	3000	RW

				digital given source, set the required speed limit value through P04.13				
P04.14	Source of auxiliary negative speed limiter B 0- FromP04.15 1- FromAI1 2- FromAI2 3- FromAI3 (The hardware does not support)	0~3	-	Selects the source of reverse speed limiter B.	anytime	Immediately	0	RW
P04.15	Digital value of auxiliary negative speed limiter B	0~32767	rpm	When the reverse speed limit B selects the digital given source, set the required speed limit value through P04..15.	anytime	Immediately	3000	RW

The relevant input function bits are as follows.

Function bits	Bit description
INFn.07	Switch the positive speed limit source A/B, when valid, use positive limit B
INFn.08	Switch the negative speed limit source A/B, when valid, use negative limit B

5.3.6 Torque limit

Please refer to "5.4.2 Torque Limit" in torque mode. Both are shared.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P05.10	Torque limit method 0- Forward and reverse limit are from positive limiting 1- Forward and reverse limit separately	0~1	-	Set the torque limit method.	anytime	Immediately	0	RW
P05.11	Positive torque limiting source 0- Forward Limit A 1- Forward limiter B 2- A/B switching 3- A and B are simultaneously limit	0~3	-	Sets the source of the positive torque limit.	anytime	Immediately	0	RW
P05.12	Source of forward torque limit A 0- from P05.13 1- from AI1 2- from AI2 3- from AI3 (The hardware does not support)	0~3	-	Set the source of the positive torque limit A.	anytime	Immediately	0	RW
P05.13	Set value of forward torque limiter A	0~300.0	%	When P05.12 selects the digital given source, set the required torque percentage through P05.13.	anytime	Immediately	150.0	RW
P05.14	Forward Torque Limit B Source	0~3	-	Set the source of	anytime	Immediately	0	RW

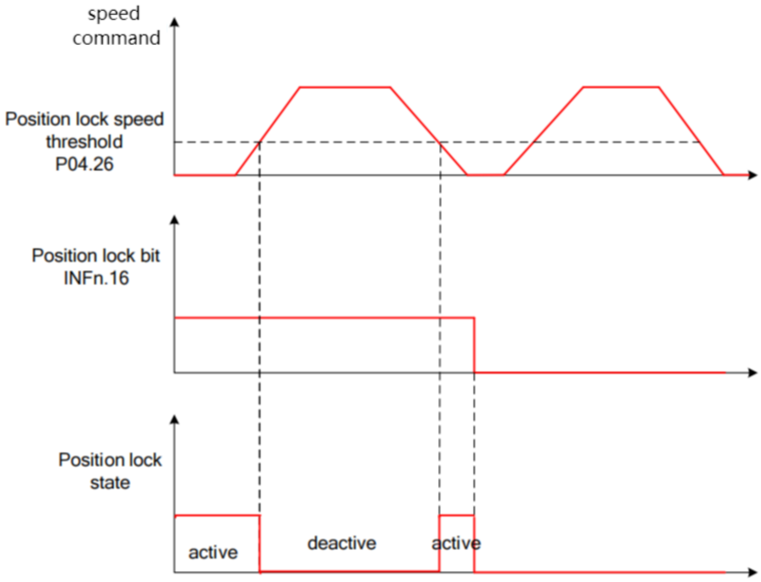
	0- from P05.15 1- from AI1 2- from AI2 3- from AI3 (The hardware does not support)			positive torque limit B.				
P05.15	Set value of forward torque limiter B	0~300.0	%	When P05.14 selects the digital given source, set the required torque percentage through P05.15.	anytime	Immediately	150.0	RW
P05.16	Reverse torque limiting source 0- Reverse Limit A 1- Reverse limit B 2- A/B switching 3-A and B are simultaneously limit	0~3	-	Sets the source of the reverse torque limit.	anytime	Immediately	0	RW
P05.17	Source of reverse torque limit A 0- from P05.18 1- from AI1 2- from AI2 3- from AI3 (The hardware does not support)	0~3	-	Set the source of the reverse torque limit A.	anytime	Immediately	0	RW
P05.18	Set value of reverse torque limiter A	0~300.0	%	When P05.17 selects the digital given source, set the required torque percentage through P05.18.	anytime	Immediately	150.0	RW
P05.19	Reverse Torque	0~3	-	Set the	anytime	Immediate	0	RW

	Limit B Source 0- from P05.20 1- from AI1 2- from AI2 3- from AI3 (The hardware does not support)			source of reverse torque limit B.		ly		
P05.20	Set value of reverse torque limiter B	0~300.0	%	When P05.19 selects the digital given source, set the required torque percentage through P05.20.	anytime	Immediately	150.0	RW

5.3.7 Zero position fixation function

The zero-position fixing function means that in the speed control mode, when the zero-position fixing DI signal INFn.16 is valid, and the speed command amplitude is less than or equal to the set value of P04.26, the servo motor enters the zero-position locking state. At this time, a position loop is built inside the servo drive, and the speed command is invalid; the servo motor is fixed within ±1 pulse of the effective position of the zero-position fixation. Even if it rotates due to external force, it will return to the zero-position fixation. If the amplitude of the speed command is greater than P04.26, the servo motor exits the zero-position lock state, and the servo motor continues to run according to the current input speed command.

If the zero-position fixed DI signal INFn.16 is invalid, the zero-position fixation function is invalid.



Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P04.26	Zero-position fixed speed threshold	0~32767	rpm	In the speed control mode, when the zero-position fixed DI signal is valid, when the amplitude of the speed command is less than or equal to the value set by P04.26, the servo motor enters the zero-position locking state.	anytime	Immediately	5	RW

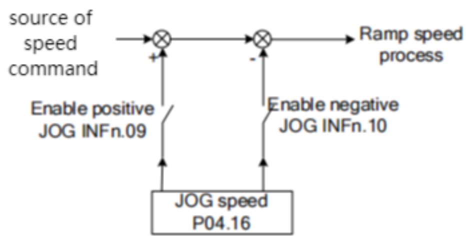
Related input function bits.

Function bits	Bit description
INFn.16	Zero position fixed function enable

5.3.8 Other functions

5.3.8.1 Speed JOG

In the speed mode, there are two kinds of forward jog and reverse jog, which are controlled by INFn.09 and INFn.10 respectively. When INFn.09 or INFn.10 is valid, the speed output will superimpose a jog speed P04.16 on the basis of the current speed command. As shown below.



5.3.8.2 Speed command reverse

When INFn.11 is valid, the speed command will be reversed on the original basis.

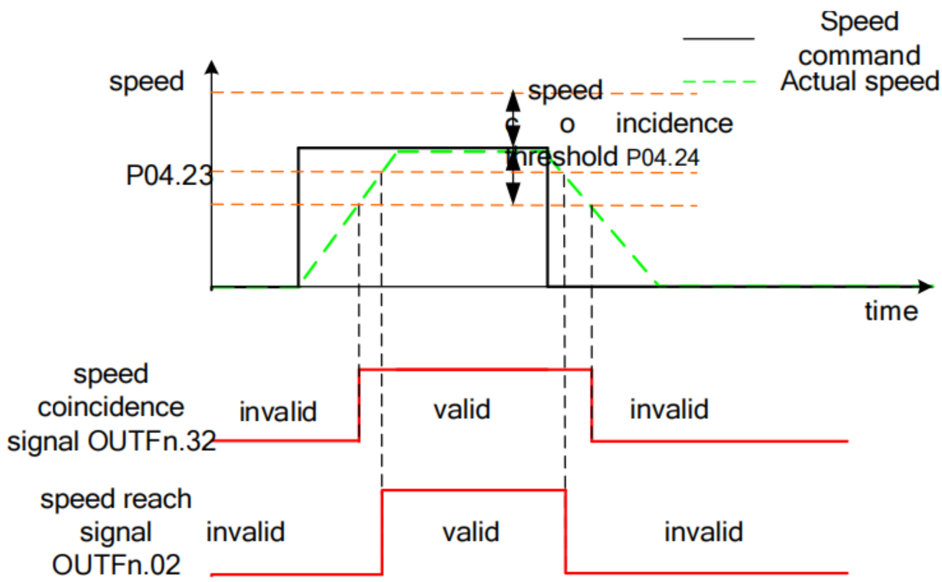
5.3.8.3 Speed pause

When INFn.13 is valid, the speed command is set to zero directly.

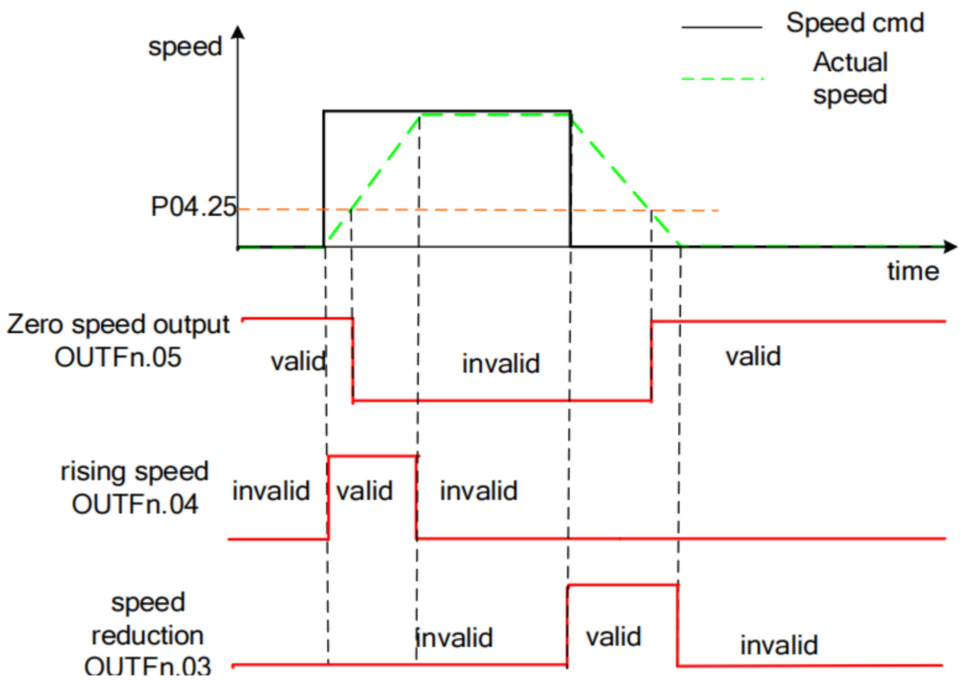
5.3.8.4 Speed related signal output

When the difference between the actual output speed P04.21 and the speed given command is less than the speed consistency threshold P04.24, the speed consistency signal OUTFn.32 is valid. When the absolute value of the actual output speed P04.21 is greater than the speed reaching threshold P04.23, the speed reaching signal OUTFn.02 is valid.

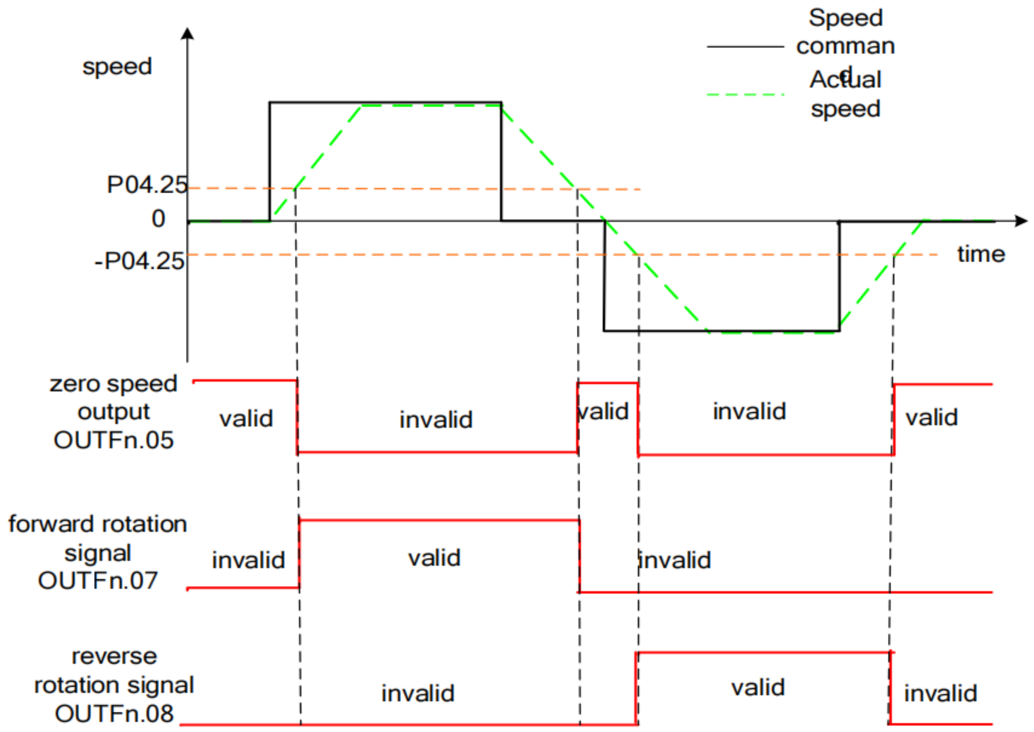
The signal output is shown in the figure below.



When the amplitude of the actual output speed P04.21 is less than the zero-speed threshold P04.25, the zero-speed signal OUTFn.05 is valid. When the amplitude of acceleration is greater than the acceleration threshold P04.27, the acceleration OUTFn.04 is valid. When the amplitude of the deceleration is greater than the acceleration and deceleration threshold P04.27, the deceleration OUTFn.03 is valid. The signal output is shown in the figure below.



When the actual output speed P04.21 is greater than the zero speed threshold, the forward rotation signal OUTFn.07 is valid; when the actual output speed P04.21 is less than the negative zero speed threshold, the reverse rotation signal OUTFn.08 is valid. The signal output is shown in the figure below.



5.3.8.5 Speed feedback filtering and display filtering

Perform low-pass filtering on the speed feedback value by setting the software filtering time constant P00.10. You can also set the speed display filter time constant P04.22 to filter the speed display value.

5.3.8.6 Related parameters

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P04.16	JOG speed	0~32767	rpm	When using the DI jog function, set the jog running speed command value. Note: This value will be modified during	anytime	Immediately	20	RW

				keyboard jog test operation, but will not be saved.				
P04.17	acceleration time	0~65535	ms	The time for the speed command to accelerate from 0 to the rated speed. The calculation formula of the actual acceleration time is as follows: Actual acceleration time t 1=change of speed command/rated speed×speed command acceleration time	anytime	Immediately	500	RW
P04.18	deceleration time	0~65535	ms	The time for the speed command to decelerate from the rated speed to 0. Actual deceleration time t 2=change of speed command/rated speed×speed	anytime	Immediately	500	RW

				command deceleration time				
P04.20	Speed command first-order filtering time constant	0~32767	ms	Set the speed command filter time constant.	anytime	Immediately	20	RW
P04.21	Filtered speed value	-	rpm	Displays the velocity value after velocity filtering.	-	-	-	RO
P04.22	Speed display filter time	0~32767	ms	Set the filter time for speed display.	anytime	Immediately	300	RW
P04.23	Speed arrival threshold	0~32767	rpm	When the absolute value of the actual speed of the servo motor after filtering exceeds P04.23, it is considered that the actual speed of the servo motor reaches the expected value, and the servo drive can output the speed reaching signal at this time.	anytime	Immediately	1000	RW
P04.24	Speed consistent threshold	0~32767	rpm	In the speed control	anytime	Immediately	10	RW

				mode, when the absolute value of the deviation between the actual speed P04.21 of the filtered servo motor and the speed command is less than P04.24, it is considered that the actual speed of the motor reaches the set value of the speed command, and the drive can output a speed consistent signal at this time.				
P04.25	Zero speed threshold	0~32767	rpm	When the absolute value of the actual speed of the servo motor after filtering is less than P04.25, it is considered that the actual speed of the servo motor is	anytime	Immediately	5	RW

				close to static, and the servo drive can output a zero-speed signal at this time.				
P04.27	Lifting speed threshold	0~32767	rpm/s	In the speed control mode, when the absolute value of the motor acceleration is greater than a certain threshold P04.27, the motor is considered to be in the speed-up/down-speed state.	anytime	Immediately	375	RW
P00.10	Motor encoder software filter time	0~32767	ms	Set the time for software filtering.	anytime	reset takes effect	5	RW

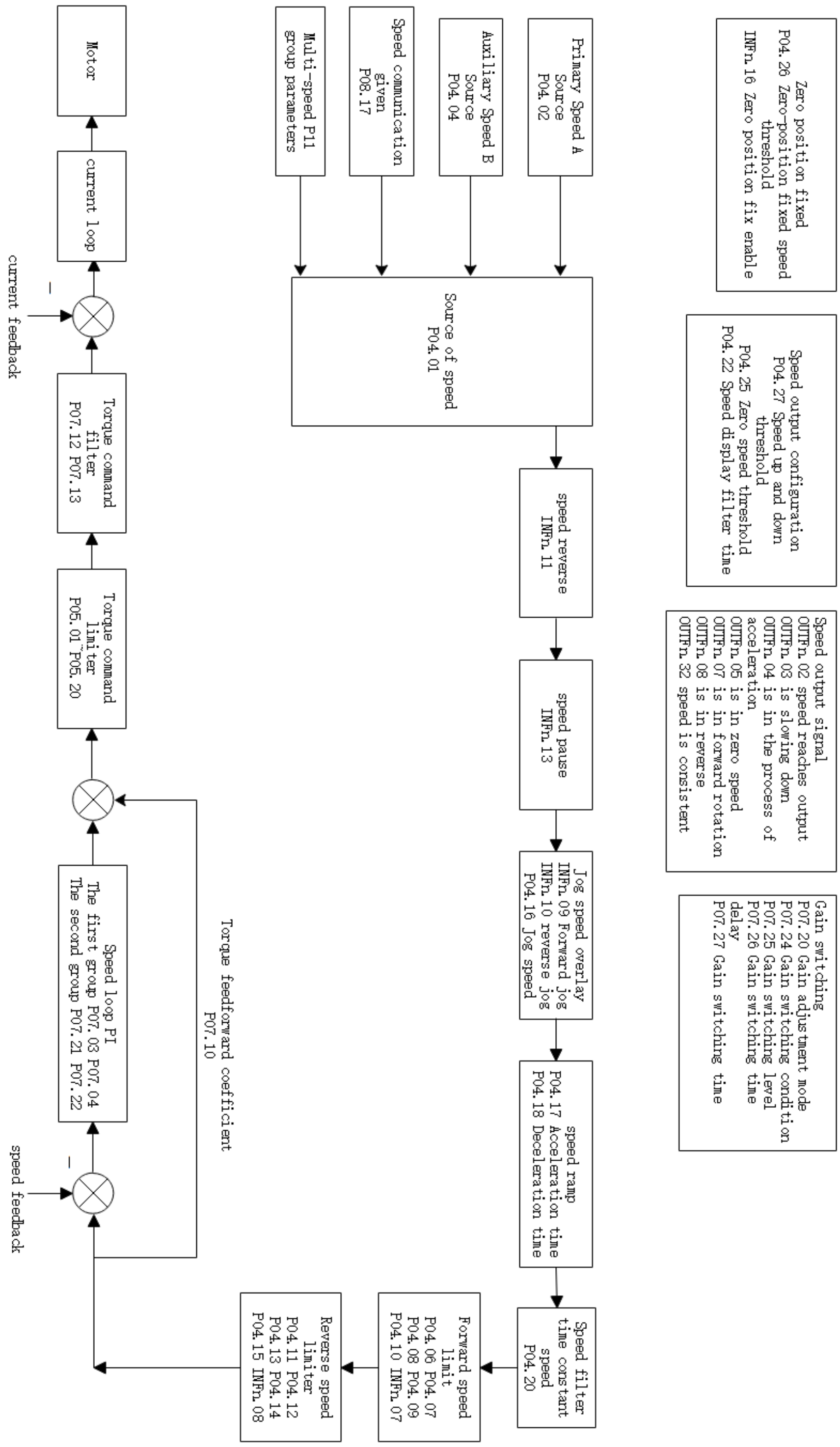
Related input function bits.

Function bits	Bit description
INFn.09	Forward speed jog
INFn.10	Reverse speed jog
INFn.11	Speed reverse
INFn.12	Main speed A/B switching
INFn.13	Speed pause

Related output function bits.

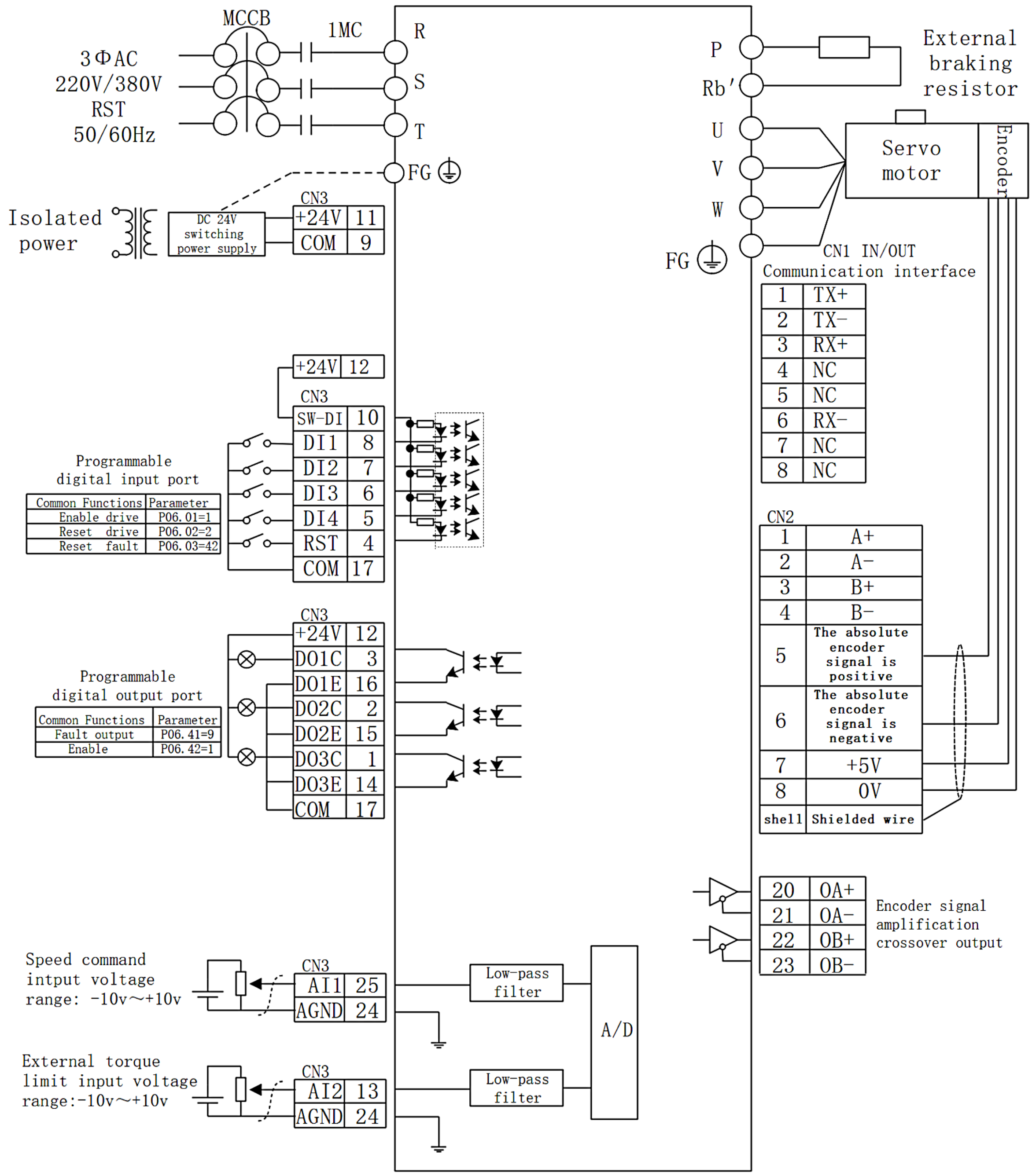
Function bits	Bit description
OUTFn.02	Speed arrives
OUTFn.03	Speed down
OUTFn.04	Speed up
OUTFn.05	Zero speed
OUTFn.06	Speed overrun
OUTFn.07	Forward rotate
OUTFn.08	Reverse rotate
OUTFn.32	Consistent speed

5.3.9 Internal operation block diagram of speed mode

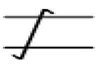


5.3.10 Typical wiring diagram of speed mode

5.3.10.1 NPN jumper for DI/DO

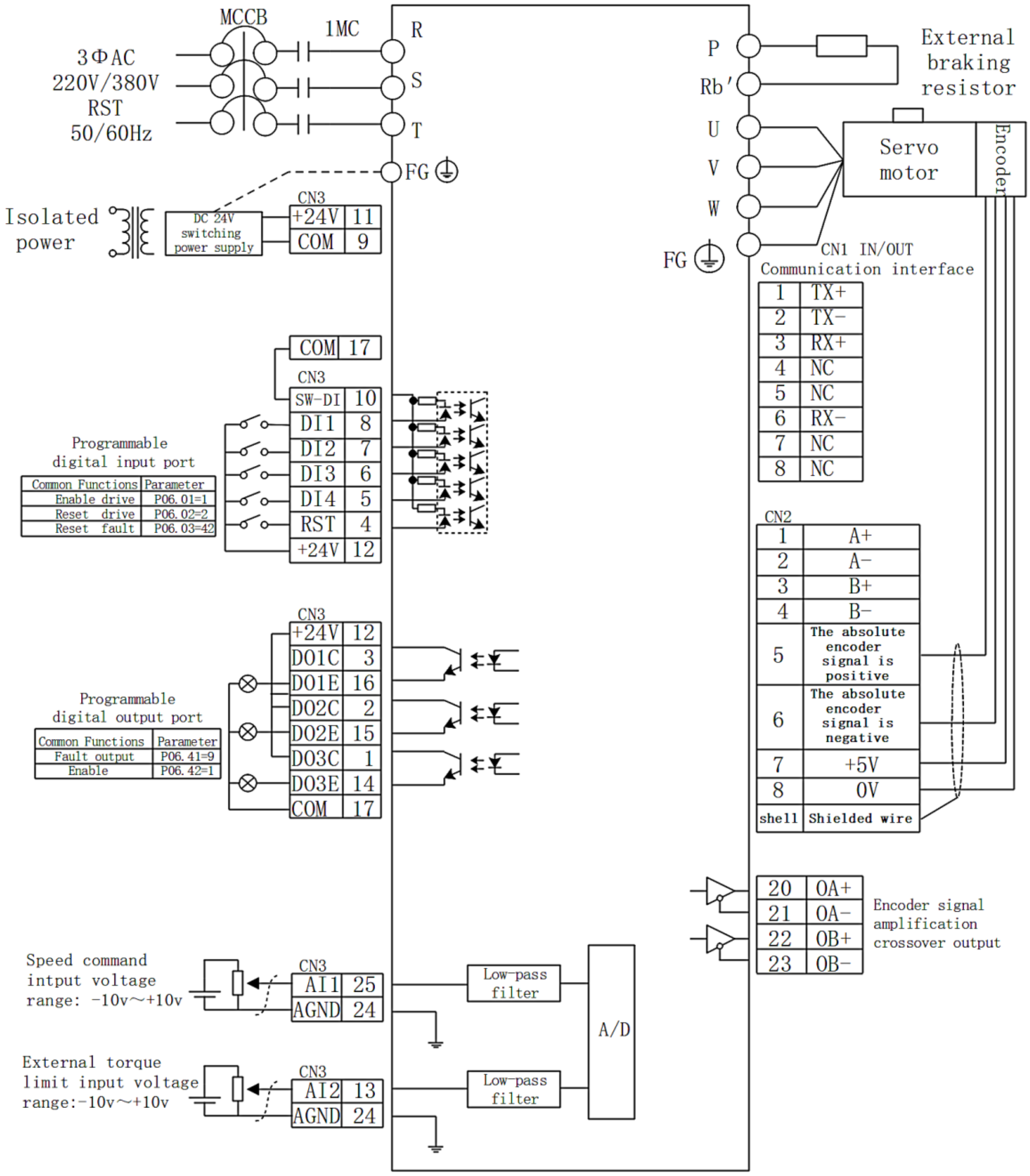


MCCB：air switch　　1MC：AC contactor

1.  Indicates twisted pair shielded wire

2. The DC24V power supply is prepared by the user. The DC24V switching power supply should be powered by an isolation transformer, and its ground terminal should be directly connected to the ground terminal of the driver.

5.3.10.2 PNP jumper for DI/DO



MCCB：air switch　　1MC：AC contactor

1. Indicates twisted pair shielded wire

2. The DC24V power supply is prepared by the user. The DC24V switching power supply should be powered by an isolation transformer, and its ground terminal should be directly connected to the ground terminal of the driver.

5.3.11 VC330 servo uses analog quantity to control the speed

(1) Analog signal wiring

The analog signal can be input from AI1 (pin 25) or AI2 (pin 13). Taking AI1 as an example, the analog signal line is connected to AI1 (pin 25) of CN3, and the analog ground is connected to AGND (pin 24).

(2) Correspondence between analog voltage and actual speed command

Under the default parameters, -10V corresponds to the negative rated speed of the motor and 10V corresponds to the positive rated speed of the motor. Taking the AI1 input command voltage as an example, if you need to change the correspondence, you can modify the AI1 offset (P06.64) and AI1 magnification (P06.66). If the dead band is set to zero, the corresponding relationship between the input voltage and the speed command is:

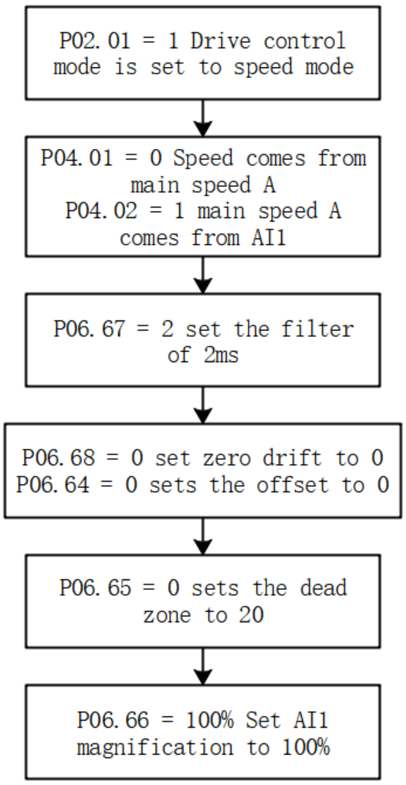
$$\text{actual speed command} = \text{rate speed} \times (\text{AI1 magnification P06.66})\% \times \frac{(\text{AI1 input voltage P06.61}) - (\text{AI1 Zero drift P06.68}) - (\text{AI1 offset P06.64})}{10000}$$

For example:

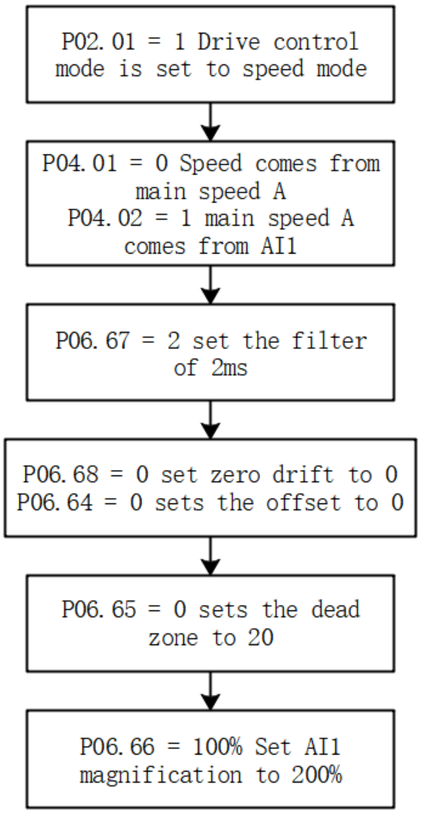
- By default, AI1 magnification=100.0%, AI1 zero drift=0 mV; AI1 offset=0 mV;Then when ±10000mV is input, the actual output speed is = ± rated speed;
- If AI1 magnification=200.0%; AI1 zero drift=0mV; AI1 offset=0mV;Then when ±5000mV is input, the actual output speed is = ± rated speed;
- If AI1 magnification=200.0%; AI1 zero drift=0 mV; AI1 offset=5000mV;When inputting 0-10000mV, the actual output speed is = ± rated speed;

(3) Parameter setting step

a. Input the speed command with AI1, input ±10V corresponding to ± rated speed as an example:



b. Take AI1 input speed command, input ±5V corresponding to ± rated speed as an example:



(4) Enable the motor

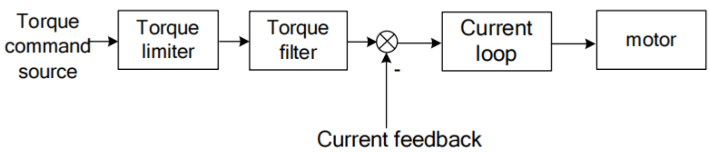
By default, P06.01=1, the enable signal is input from DI1. If P06.21 is set to 1, then the servo can be enabled without receiving any signal when it is powered on.

(5) Zero drift correction

When the analog input is 0mV, set P06.79=4 once to trigger zero drift correction once. Zero drift can also be corrected via DI. Refer to the VC Servo User Manual for details.

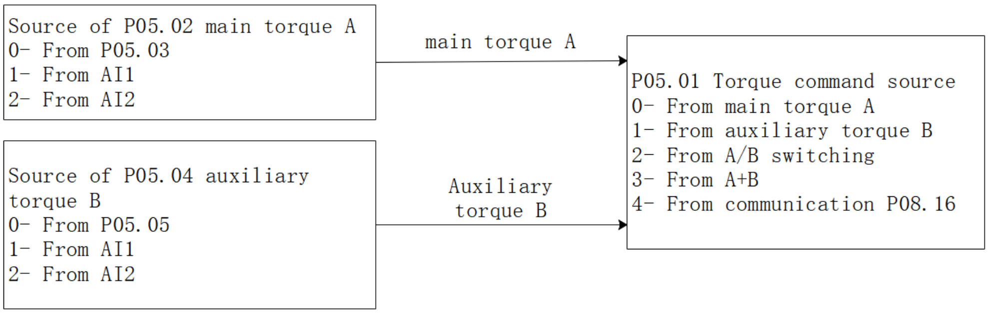
5.4 Torque mode

Torque mode is a control mode in which the output torque of the motor is the control target, such as tension control. The implementation of torque mode is shown in the figure below.



5.4.1 Torque command source

There are two kinds of torque commands for the servo to choose from, namely, the main torque command A and the auxiliary torque command B. These two torques can be superimposed or switched with each other. Both main torque A and auxiliary torque B have multiple torque sources. As shown in the picture below.



Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P05.01	Torque command source 0- main torque command A 1- auxiliary torque command B 2- INFn.03 switching A/B 3- A+B 4- from P08.16	0~5	-	anytime	Immediately	0	RW
P05.02	Source of main torque command A 0- from P05.03 1- from AI1 2- from AI2 3- from AI3 (The hardware does not support)	0~3	-	anytime	Immediately	0	RW
P05.03	Digital value of main torque command A(When the main torque A selects the digital given source, set the required torque percentage through P05.03.)	-300.0~300.0	%	anytime	Immediately	0.0	RW

P05.04	Source of auxiliary torque command B 0- from P05.05 1- from AI1 2- from AI2 3- from AI3 (The hardware does not support)	0~3	-	anytime	Immediately	0	RW
P05.05	Digital value of auxiliary torque command B(When the auxiliary torque B selects the digital given source, set the required torque percentage through P05.05.)	-300.0~300.0	%	anytime	Immediately	0.0	RW
P08.16	Torque communication given(In the torque control mode, when the torque command source is communication given, set the torque percentage with an accuracy of 0.1%.)	-3276.7~3276.7	%	anytime	Immediately	0.0	RW

Related input function bits.

Function bits	Bit description
INFn.03	Switch the main torque command A and the auxiliary torque command B, and use the auxiliary torque command B when valid

When the torque command comes from AIx, please refer to "6.3.1 Analog Input AI" for details.

5.4.2 Torque limiting

5.4.2 Torque limiting

Torque limiting is achieved by limiting the output current of the driver to limit the output torque of the motor. The larger the torque limit value is, the larger the motor output torque is, and the easier the driver is to over-current. There are two kinds of limiting methods for torque limiting. One is that the forward and reverse limiters are from the positive limiter value; the other is the positive and negative limiting separately. Which one depends on P05.10. Both the positive limiting and the reverse limiting have a primary limiter A source and an auxiliary limiter B source, respectively a primary forward torque limiter A, an auxiliary forward torque limiter B, and a primary reverse torque limiter A, auxiliary reverse torque limiter B.

In addition to the above torque limiter, in order to protect the motor, the torque output is limited according to the three values of the rated motor current P00.01, the rated current of the driver P01.03, and the current peak current percentage P00.24.

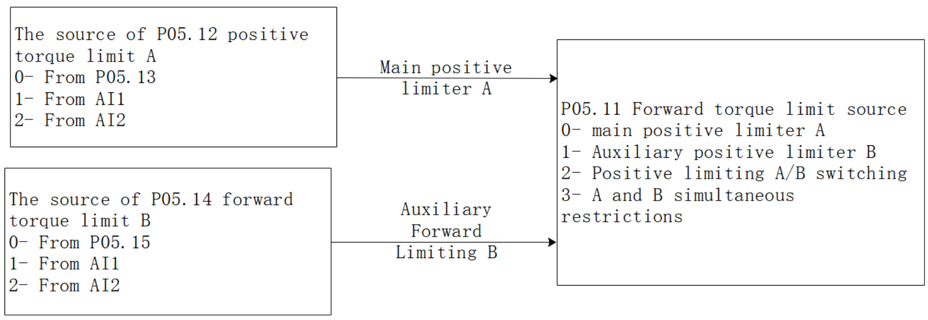
（Note: Since AI3 is not supported on VC330Profinet bus servo hardware, the torque limit cannot be sourced from AI3）

the value of this limit is calculate as follows:

$$\text{Motor torque limiter} = \frac{\text{Motor rated current P00.01}}{\text{Drive rated current P01.03}} \times \text{Motor peak current percentage P00.24}$$

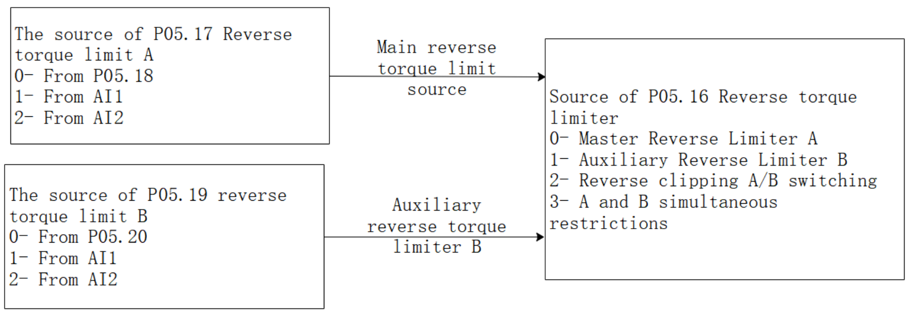
5.4.2.1 Positive torque limiting

The source of the positive torque limit is shown below. There are two types of positive torque limiting, one is the main positive torque limiter A, and the other is the auxiliary positive limiter B. Both torque limits have different sources of torque.



5.4.2.2 Negative torque limiting

The source of the negative torque limit is shown below. There are two types of negative torque limiting, one is the main negative torque limiter A, and the other is the auxiliary negative torque limiter B. Both torque limiters have different sources.



Related parameters are as follows

Parameter	Parameter	Set	units	Function	Set	Effective	Defaults	read

No.	Description	range			method	way		and write method
P05.10	Torque limit method 0- Forward and reverse limit are from positive limiting 1- Forward and reverse limit separately	0~1	-	Select the torque limit method.	anytime	Immediately	0	RW
P05.11	Positive torque limiting source 0- Forward Limit A 1- Forward limiter B 2- A/B switching 3- A and B are simultaneously limit	0~3	-	Select the forward torque limit source.	anytime	Immediately	0	RW
P05.12	Source of forward torque limit A 0- from P05.13 1- from AI1 2- from AI2 3- from AI3 (The hardware does not support)	0~3	-	Set the torque command source of main torque command A.	anytime	Immediately	0	RW
P05.13	Set value of forward torque limiter A	0~300.0	%	When the forward torque limit A selects the digital given source, set the required torque percentage through P05.13.	anytime	Immediately	150.0	RW
P05.14	Forward Torque Limit B Source 0- from P05.15 1- from AI1 2- from AI2 3- from AI3	0~3	-	Set the torque command source of auxiliary torque	anytime	Immediately	0	RW

	(The hardware does not support)			command B.				
P05.15	Set value of forward torque limiter B	0~300.0	%	When the forward torque limiter B selects the digital given source, set the required torque percentage through P05.15.	anytime	Immediately	150.0	RW
P05.16	Reverse torque limiting source 0- Reverse Limit A 1- Reverse limit B 2- A/B switching 3- A and B are simultaneously limit	0~3	-	Select the source of the reverse torque limiter.	anytime	Immediately	0	RW
P05.17	Source of reverse torque limit A 0- from P05.18 1- from AI1 2- from AI2 3- from AI3 (The hardware does not support)	0~3	-	Set the torque command source of the reverse torque limiter A.	anytime	Immediately	0	RW
P05.18	Set value of reverse torque limiter A	0~300.0	%	When the reverse torque limit A selects the digital given source, set the required torque percentage through P05.18.	anytime	Immediately	150.0	RW
P05.19	Reverse Torque Limit B Source	0~3	-	Set the torque	anytime	Immediately	0	RW

	0- from P05.20 1- from AI1 2- from AI2 3- from AI3 (The hardware does not support)			command source of the reverse torque command B.				
P05.20	Set value of reverse torque limiter B	0~300.0	%	When the reverse torque limiter B selects the digital given source, set the required torque percentage through P05.20.	anytime	Immediately	150.0	RW

Related input function bits.

Function bits	Bit description
INFn.05	Forward torque limit source A/B switching, positive limit B is used when valid
INFn.06	Reverse torque limit source A/B switch, when valid, use reverse limit B

5.4.3 speed limit

When there is no load, given a large torque, the motor speed will increase all the time, so it is necessary to limit the speed. The source of speed limit is the same as the speed limit in speed mode. The relevant parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P04.06	source of positive speed limiting 0- main positive speed limiter A 1- auxiliary reverse speed limiter B 2- A/B switch 3-both A and B are limiter	0~3	-	Set the source of forward speed command limiter.	anytime	Immediately	0	RW
P04.07	Source of main positive speed limiter A 0- from P04.08 1- fromAI1 2- fromAI2 3- fromAI3 (The hardware does not support)	0~3	-	Select the source of the positive speed limiter A.	anytime	Immediately	0	RW
P04.08	Digital value of positive speed limiter A	0~32767	rpm	When the forward speed limit A selects the digital given	anytime	Immediately	3000	RW

				source, set the required speed limit value through P04.08.				
P04.09	Source of auxiliary reverse speed limiter B0- fromP04.10 1- fromAI1 2- fromAI2 3- fromAI3 (The hardware does not support)	0~3	-	Select the source of positive speed limiter B.	anytime	Immediately	0	RW
P04.10	Digital value of positive speed limiter B	0~32767	rpm	When forward speed limit B selects digital given source, set the required speed limit value through P04.10.	anytime	Immediately	3000	RW
P04.11	source of negative speed limiting 0- main negative speed limiter A 1- auxiliary negative speed limiter B 2- A/B switch 3- both A and B are limiter	0~3	-	Set the source of the reverse speed command limiter.	anytime	Immediately	0	RW
P04.12	Source of main negative speed limiter A 0- fromP04.13 1- fromAI1 2- fromAI2 3- fromAI3 (The hardware does not support)	0~3	-	Select the source of the reverse speed limiter A.	anytime	Immediately	0	RW

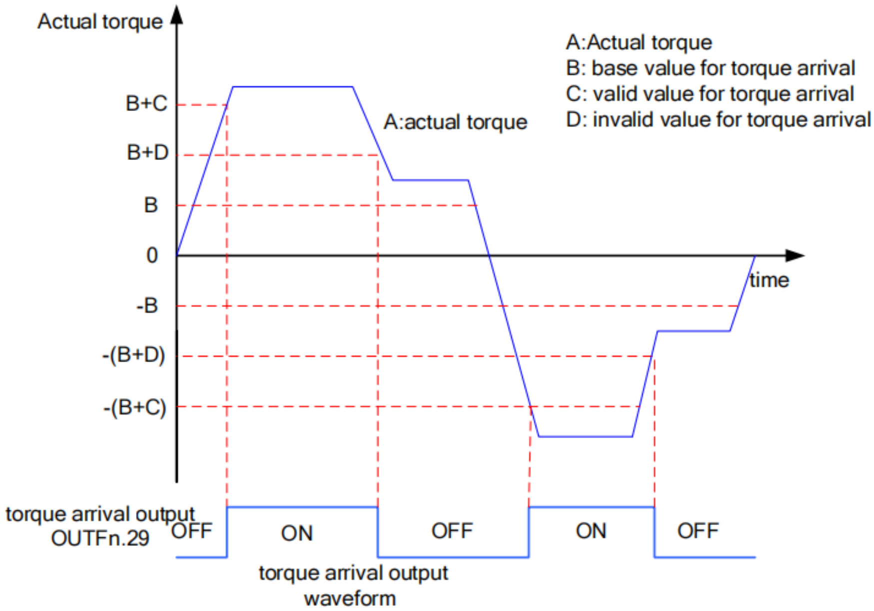
P04.13	Digital value of main negative speed limiter A	0~32767	rpm	When the reverse speed limit A selects the digital given source, set the required speed limit value through P04.13.	anytime	Immediately	3000	RW
P04.14	Source of auxiliary negative speed limiter B 0- fromP04.15 1- fromAI1 2- fromAI2 3- fromAI3 (The hardware does not support)	0~3	-	Selects the source of reverse speed limiter B.	anytime	Immediately	0	RW
P04.15	Digital value of auxiliary negative speed limiter B	0~32767	rpm	When the reverse speed limit B selects the digital given source, set the required speed limit value through P04..15.	anytime	Immediately	3000	RW
P05.25	Time threshold for switching torque mode to velocity mode	0~32767	0.25 ms	When the amplitude of the speed exceeds the speed limit value plus the speed limit speed threshold (P05.26), and the continuous	anytime	Immediately	10	RW

				torque mode is switched to the speed mode time threshold (P05.25), a speed loop is constructed to make the speed converge to the limit Inside.				
P05.26	Speed threshold for speed torque mode switching	0~32767	rpm	When the amplitude of the speed exceeds the speed limit value plus the speed limit speed threshold (P05.26), and the continuous torque mode is switched to the speed mode time threshold (P05.25), a speed loop is constructed to make the speed converge to the limit Inside.	anytime	Immediately	30	RW
P05.27	Time threshold for speed mode to torque mode switch	0~32767	0.25 ms	When the servo runs in the torque mode, but due to the	anytime	Immediately	200	RW

				speed limit, after the speed loop is constructed, the time threshold for switching from the speed mode to the torque mode is determined by P05.27				
P05.28	Speed limit low-pass filter time parameter (unit: ms)	0~32767	ms	When the speed limit is changed, low-pass filtering is performed on the speed limit value, and the filter time is determined by P05.28. The larger the filter time, the slower the speed limit value changes.	anytime	Immediately	500	RW

5.4.4 Torque reaches output

The torque arrival function is used to judge whether the actual torque reaches the set interval. When the actual torque reaches the torque threshold, the drive can output the corresponding DO signal (OUTFn.29: torque reached



Actual torque： A；

Base value for torque arrival P05.31： B；

Valid value for torque arrival P05.32： C；

Invalid value for torque arrival P05.33： D；

where C and D are the biases based on B.

Therefore, when the torque arrival DO signal (OUTFn.29) changes from invalid to valid, the actual torque must satisfy:)

$$|A| \geqslant B+C$$

Otherwise, the torque arrival DO signal remains inactive.

Conversely, when the torque arrival DO signal changes from valid to invalid, the actual torque must meet:

$$|A| < B+D$$

Otherwise, the torque arrival DO signal remains valid.

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P05.31	Base value for torque arrival	0~300.0	%	Set the torque arrival command reference value (100% corresponds to one time	anytime	Immediately	50.0	RW

				of rated torque)				
P05.32	Valid value for torque arrival	0~300.0	%	The set torque reaches the effective offset threshold (100% corresponds to 1 time rated torque)	anytime	Immediately	10.0	RW
P05.33	Invalid value for torque arrival	0~300.0	%	(The set torque reaches the invalid offset threshold (100% corresponds to one time rated torque))	anytime	Immediately	0.0	RW

Related output function bits

Function bits	Bit description
OUTFn.29	Torque arrives; when it is valid, the absolute value of torque reaches the set value; when it is invalid, the absolute value of torque is less than the set value.

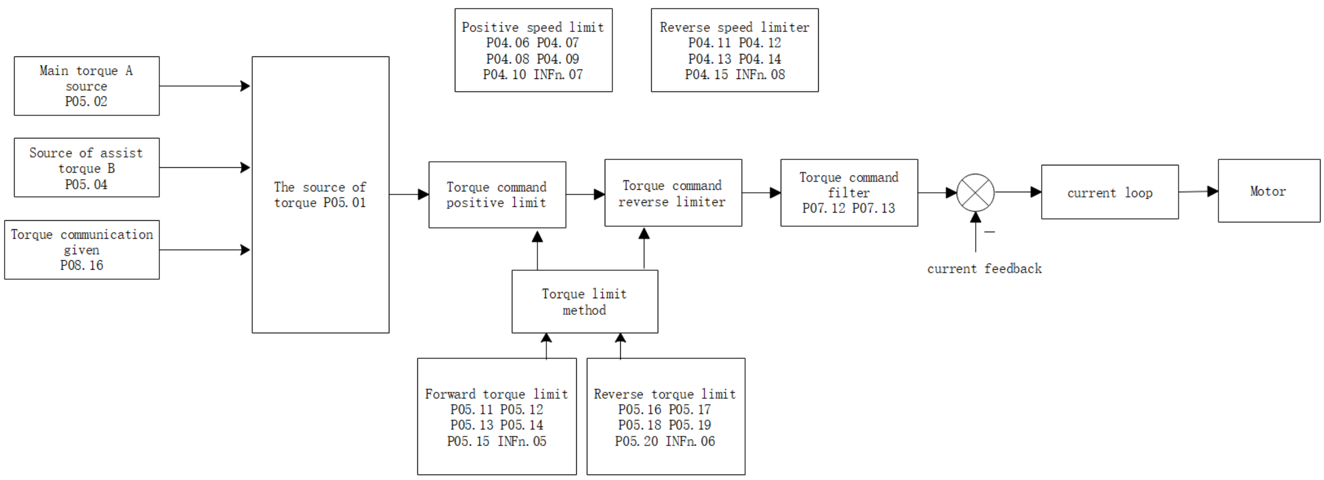
Note: When the torque arrival signal is valid or invalid, the actual torque setting value requirements are different, please refer to the above of this section for details.

5.4.5 Small torque jitter suppression

When the given torque is small, the motor will vibrate due to the uneven distribution of the magnetic poles of the motor. It can be set to make the motor output a certain reverse torque to overcome the motor jitter, so that the motor speed output is uniform. Related parameters are as follows:

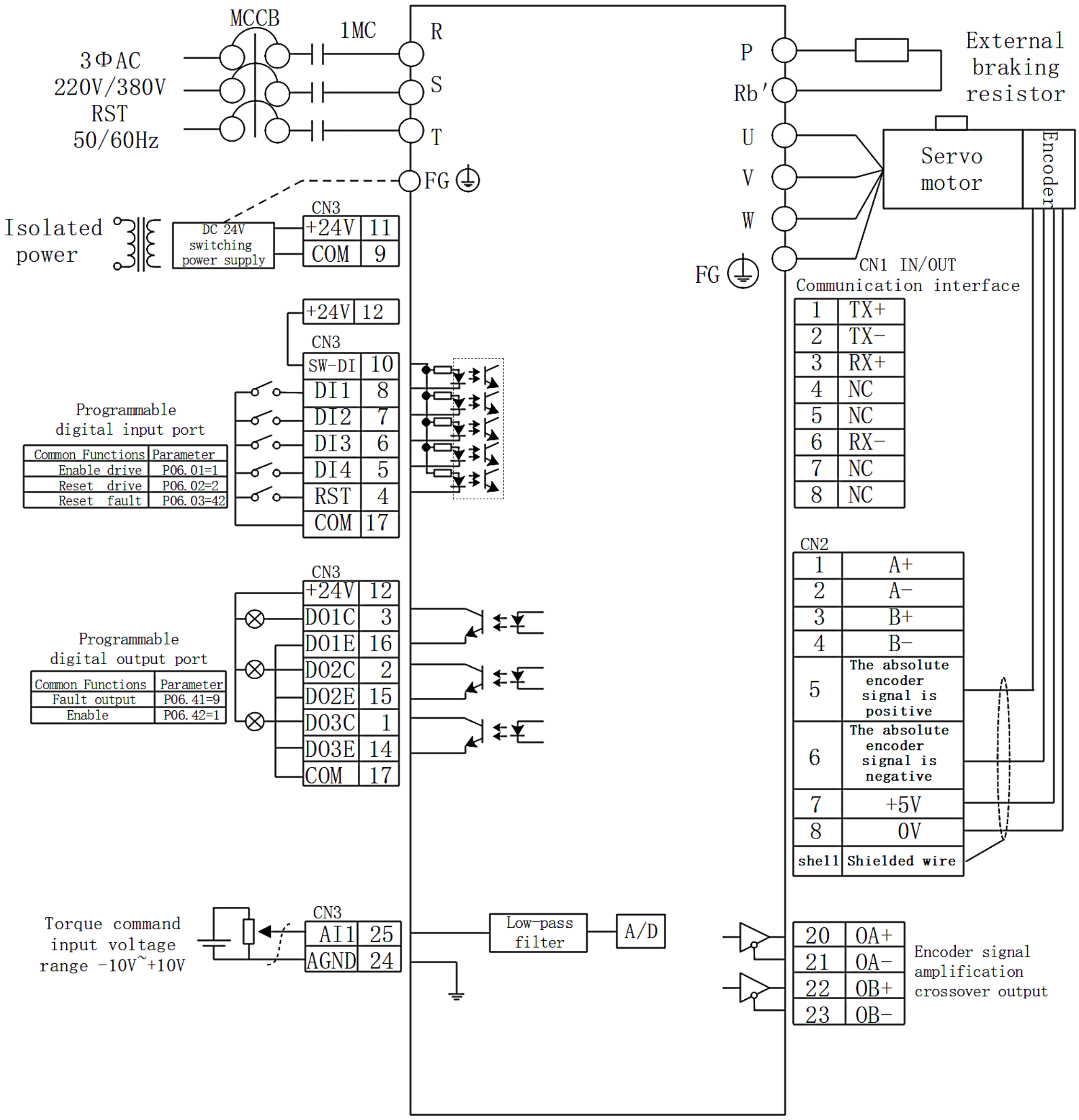
Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P05.35	Maximum output limit of torque that suppresses jitter	0~10.0	%	Limit the output of the anti-shake torque	anytime	Immediately	0	RW
P05.36	Percentage of gain that suppresses jitter	0~300.0	%	The speed of restraining the jitter	anytime	Immediately	100.0	RW
P05.37	time constant for detect Jitter speed	0-32767	ms	Jitter whose period is less than this time will be suppressed	anytime	Immediately	500	RW
P05.38	detected Jitter speed	-	ms	Displays the detected shaking speed	anytime	Immediate	-	RO
P05.39	Torque output that suppresses jitter	-	ms	Displays the output reverse torque that suppresses chattering	anytime	Immediately	-	RO

5.4.6 Internal block diagram of torque mode



5.4.7 Typical wiring diagram of torque mode

5.4.7.1 NPN jumper for DI/DO

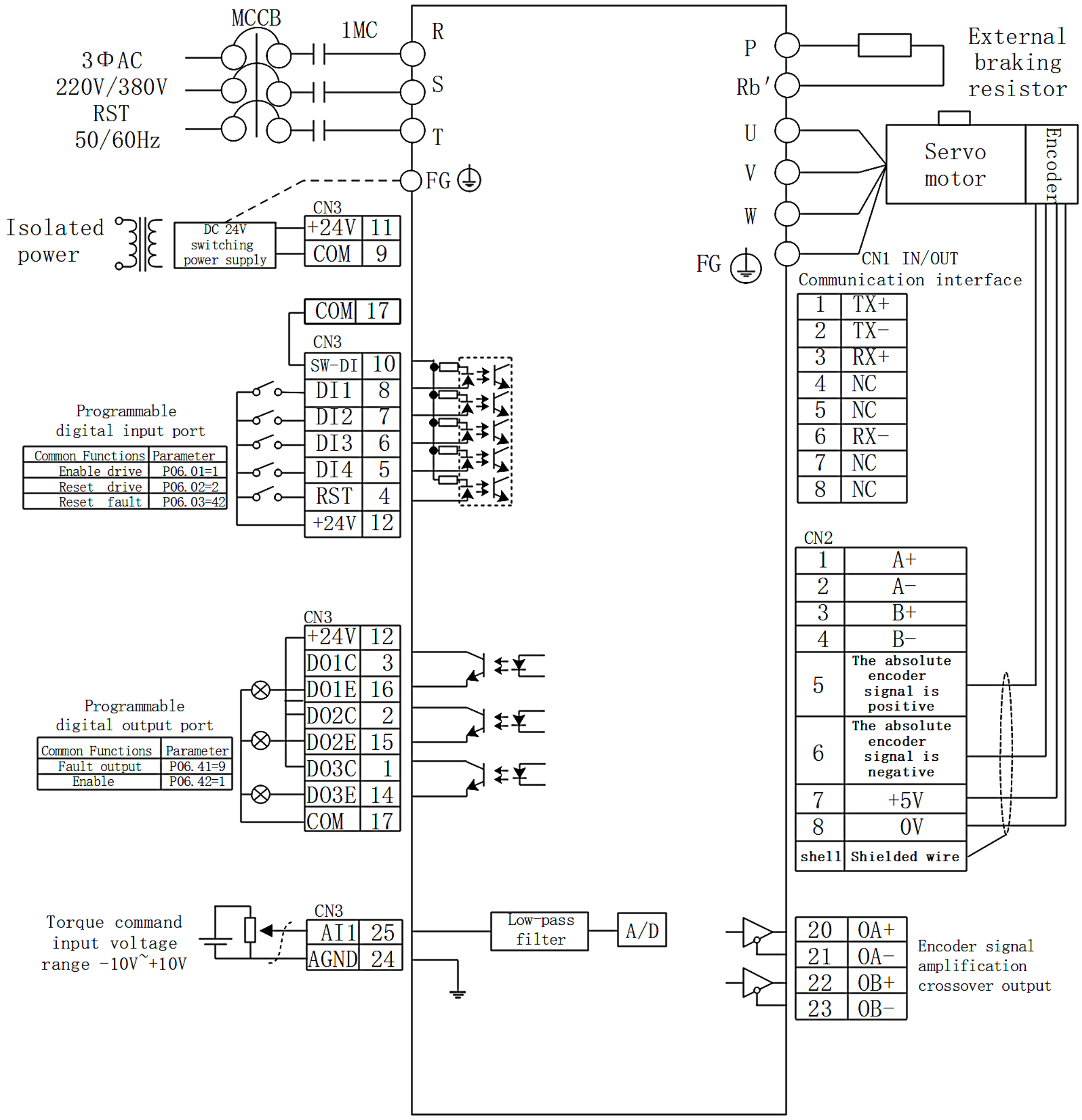


MCCB: air switch 1MC: AC contactor

1. Indicates twisted pair shielded wire.

2. The DC24V power supply is prepared by the user. The DC24V switching power supply should be powered by an isolation transformer, and its ground terminal should be directly connected to the ground terminal of the driver.

5.4.7.2 PNP jumper for DI/DO



MCCB：air switch 1MC：AC contactor

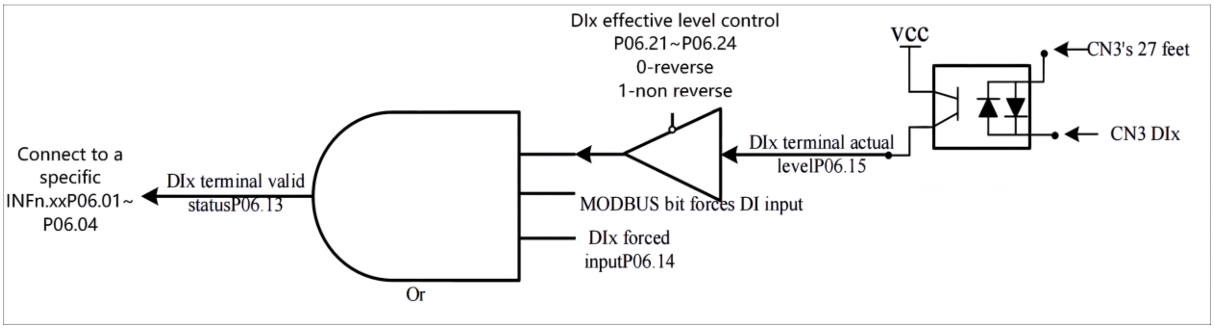
1. Indicates twisted pair shielded wire.

2. The DC24V power supply is prepared by the user. The DC24V switching power supply should be powered by an isolation transformer, and its ground terminal should be directly connected to the ground terminal of the driver.

Chapter 6 Inputs and Outputs Function

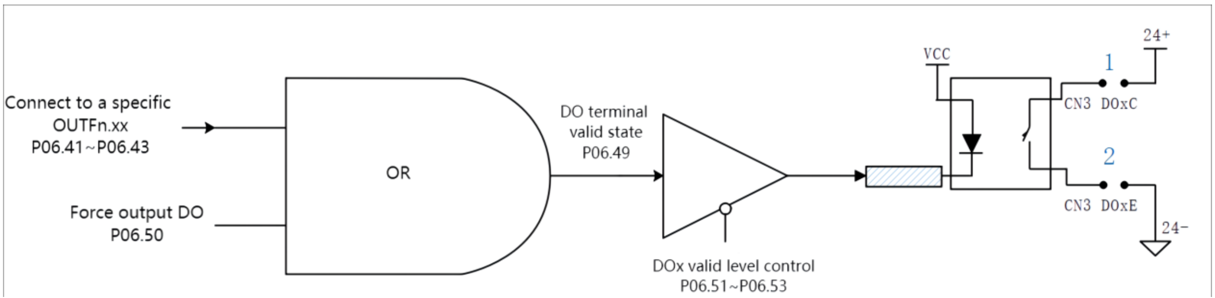
6.1 Entity DI/DO function

The servo has 4 physical DIs, which are DI1~DI10. Each entity DI can be assigned an input function bit INFn.xx. The effective level of each entity DI can be set separately (P06.21-P06.24). Each entity DI can be forced to enter a specific level via P06.14, or a DI input can be forced via the Modbus bit.
The internal logic of servo DI is shown in the figure below.



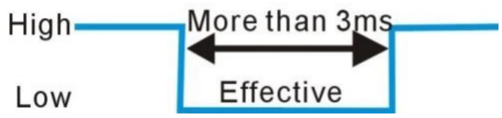
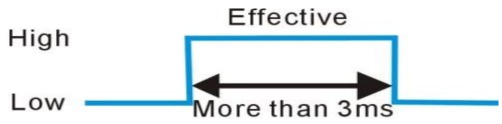
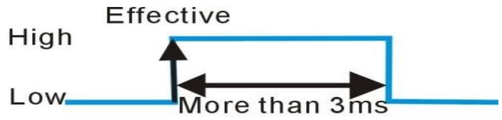
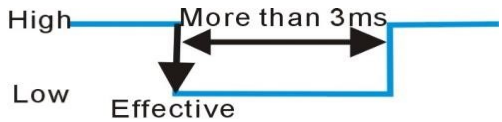
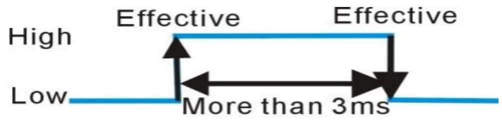
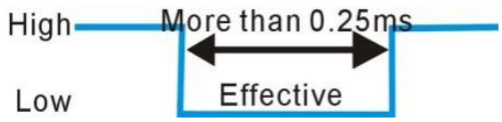
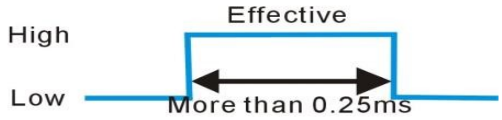
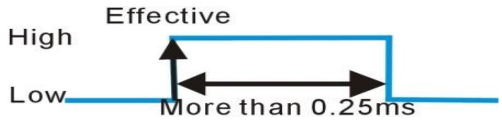
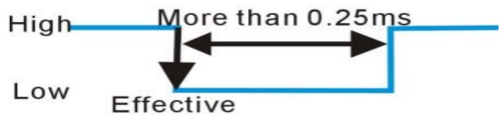
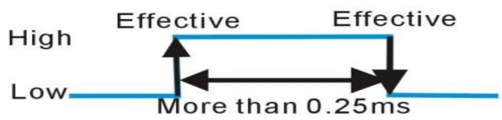
（Remarks: SW-DI: CN3 pin 10 is short-circuited with +24V for NPN mode; short-circuited with COM is PNP mode.）

The servo has three physical DOs, DO1~DO3. Each DO can be assigned an output function bit OUTFn.xx. The effective level of each entity DO can be set individually, or a DO bit can be output through the forced register of P06.50.



（VC330 servo DO can select NPN or PNP by wiring, for example, if the relay is connected to both ends of 1, it is NPN, and if it is connected to both ends of 2, it is PNP.）

Among them, DI1~DI2 is hardware low-speed DI, DI3 and DI4 are hardware high-speed DI, as detailed below:

Hardware low-speed DI description(DI1~D2)	
DI function valid logical state	remark
Low level	
High level	
Rising edge	
Falling edge	
Rising and falling edges	
Hardware high-speed DI description (DI3, DI4)	
DI 功能有效逻辑状态	remark
Low level	
High level	
Rising edge	
Falling edge	
Rising and falling edges	

DO1 and DO2 are set to output the A, B, Z signals of the motor encoder through P06.40. Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P06.01	DI1 function control register	0~99	-	Set the DI function corresponding to the hardware DI1 terminal. For specific functions, see the DI function table.	anytime	Immediately	1	RW
P06.02	DI2 function control register	0~99	-	-	anytime	Immediately	42	RW
P06.03	DI3 function control register	0~99	-	-	anytime	Immediately	0	RW
P06.04	DI4 function control register	0~99	-	-	anytime	Immediately	0	RW
P06.13	DI terminal valid state	-	-	Displayed in decimal format, after conversion to binary format, it contains 0-9 digits, the low-order to high-order indicates the status of digital output terminals DI1~DI10, 0=OFF, 1=ON, the 0th bit corresponds to DI1, …,	anytime	-	-	RO

				the first Bit 9 corresponds to DI10. See "4.6 Variable Monitoring" for details of parameter valid state display.				
P06.14	DI forced input	0~1023	-	When the DI forced input is valid, set the level logic of the DI function through this parameter. Input in decimal (BCD) format and convert it into binary (Binary) to be the correspondin g DIx input signal. For example: P06.14=42(BCD)=0000101010(Binary), it means DI2, DI4 and DI6 terminals are ON.	anytime	Immediately	0	RW
P06.15	DI terminal actual level	-	-	Displayed in decimal format and converted to binary format, it	anytime	-	-	RO

				contains 0-9 digits, and the low-order to high-order indicates the status of digital output terminals DI1~DI10. See "4.6 Variable Monitoring" for details of parameter valid state display.				
P06.16	High-speed DI filter configuration	1~32767	us	When the high-speed pulse input terminal is in the peak interference, you can filter out the peak interference by setting P06.16. INFn.34 and INFn.40 are high-speed DI signals, and their filtering time is determined by P06.16; other input signals are low-speed DI signals, and their filtering time	anytime	Immediately	10	RW

				is determined by P06.17.				
P06.17	Low-speed DI filter configuration	1~32767	us	When there is spike interference at the low-speed pulse input terminal, the spike interference can be suppressed by setting P06.17 to prevent the interference signal from entering the servo drive.	anytime	Immediately	1000	RW
P06.21	DI1 active level 0-active low 1-active high	0~1	-	Set the level logic of the hardware DI1 terminal when the DI function selected by DI1 is valid.	anytime	Immediately	0	RW
P06.22	DI2 active level 0-active low 1-active high	0~1	-	-	anytime	Immediately	0	RW
P06.23	DI3 active level 0-active low 1-active high	0~1	-	-	anytime	Immediately	0	RW
P06.24	DI4 active level 0-active low 1-active high	0~1	-	-	anytime	Immediately	0	RW
P06.40	DO1 and DO2 function configuration registers 0- DO1, DO2	0~2	-	Set the output function of output terminals	anytime	Immediately	0	RW

	function output configured with P06.41P06.42 Respectively 1- DO1, DO2 output A, B pulse respectively 2- DO1 outputs Z point signal, DO2 functions output with P06.42 configuration			DO1 and DO2.				
P06.41	DO1 function control register	0~99	-	Set the DO function correspondin g to the hardware DO1 terminal. For specific functions, please refer to the DO function table.	anytime	Immediatel y	9	RW
P06.42	DO2 function control register	0~99	-	-	anytime	Immediatel y	13	RW
P06.43	DO3 function control register	0~99	-	-	anytime	Immediatel y	0	RW
P06.49	DO terminal valid state	-	-	Displayed in decimal format, after conversion to binary format, it contains 0-5 digits, the low digits to high digits indicate the status of digital output	anytime	-	-	RO

				terminals DO1~DO6 in turn, 0=OFF, 1=ON, the 0th bit corresponds to DO1, ..., the first Bit 5 corresponds to DO6. See "4.6 Variable Monitoring" for details of parameter valid state display.				
P06.50	DO force output	0~63	-	When the DO forced output is valid, this parameter is used to set whether the DO function is valid. Input in decimal (BCD) format and convert it into binary (Binary) to be the corresponding DOx input signal. For example: P06.50=42(BCD)=101010 (Binary), it means DO2, DO4 and	anytime	Immediately	0	RW

				DO6 output ON.				
P06.51	DO1 active level 0-active low 1- active high	0~1	-	Set the output level logic of the hardware DO1 terminal when the DO function selected by DO1 is valid.	anytime	Immediately	0	RW
P06.52	DO2 active level 0-active low 1- active high	0~1	-	-	anytime	Immediately	0	RW
P06.53	DO3 active level 0-active low 1- active high	0~1	-	-	anytime	Immediately	0	RW

DI specific function INFn.xx configuration is shown in the following table, and its effective status can be monitored through P06.13.

DI function number	DI function	effective rules
0	none	-
1	Enable	Valid when the valid state is high
2	reset the drive	Effective state changes from low to high
3	Torque AB selector switch	Valid when the valid state is high
4	Torque reverse switch	Valid when the valid state is high
5	Forward torque limit selection	Valid when the valid state is high
6	Reverse torque limit selection	Valid when the valid state is high
7	Positive speed limit selection	Valid when the valid state is high
8	Reverse speed limit selection	Valid when the valid state is high
9	forward jog	Valid when the valid state is high
10	reverse jog	Valid when the valid state is high
11	Reverse speed reference	Valid when the valid state is high
12	Main speed AB selection	Valid when the valid state is high
13	speed stop input	Valid when the valid state is high
14	Download ARM Program Reset	Effective state changes from low to high
15	Clear the encoder position counter	Effective state changes from low to high
16	Zero position fixed in speed mode	Valid when the valid state is high
17	Multi-speed speed selection switch 0	Valid when the valid state is high

18	Multi-speed speed selection switch 1	Valid when the valid state is high
19	Multi-speed speed selection switch 2	Valid when the valid state is high
20	Multi-speed speed selection switch 3	Valid when the valid state is high
21	Position command prohibition	Valid when the valid state is high
22	Position command reverse	Valid when the valid state is high
23	Prohibition of pulse command	Valid when the valid state is high
24	Electronic gear ratio selector switch 1	Valid when the valid state is high
25	Position error clear	Depends on P03.21
26	Position mode origin return command	Effective state changes from low to high
27	Multi-segment position trigger signal	The rising edge of the valid state triggers the start of the multi-segment position, Falling edge of valid state triggers stop multi-segment position
28	Multi-stage position position selector switch 0	Valid when the valid state is high
29	Multi-stage position position selector switch 1	Valid when the valid state is high
30	Multi-stage position position selector switch 2	Valid when the valid state is high
31	Multi-stage position position selector switch 3	Valid when the valid state is high
32	Position direction in multi-segment position mode	Valid when the valid state is high
34	Return to the origin signal input	Depends on homing mode
35	XY pulse tracking and multi-segment position switching in position mode	Valid when the valid state is high
36	Control mode toggle switch 0	Valid when the valid state is high
37	Control mode toggle switch 1	Valid when the valid state is high
38	Enable detection trigger interrupt fixed length signal INFn.40	Valid when the valid state is high
39	cancel the fixed length	Valid when the valid state is high
40	Trigger interrupts fixed-length input signal	Effective state changes from low to high
41	The first set of the second set of gain selector switches	Valid when the valid state is high
42	reset fault	Valid when the valid state is high
43	Position Mode Positive Limit Switch	Valid when the valid state is high
44	Position Mode Reverse Limit Switch	Valid when the valid state is high
45	Open and closed loop switching in full closed loop mode	Valid when the valid state is high
46	FPGA download program reset	Effective state changes from low to high
47	Tension compensation direction	Valid when the valid state is high
48	Tension Tracking Direction	Valid when the valid state is high
49	Forced to limit at maximum compensation speed	Valid when the valid state is high
50	Prohibit roll diameter calculation	Valid when the valid state is high
51	Change roll	Valid when the valid state is high
52	Initial roll diameter switch	Valid when the valid state is high
53	Clear feed length	Valid when the valid state is high

54	Force fast tightening	Valid when the valid state is high
55	Tension compensation is prohibited in closed-loop speed mode	Valid when the valid state is high
56	Electronic gear ratio selector switch 2	Valid when the valid state is high
57	Motor overheating	Valid when the valid state is high
58	Emergency stop input	Valid when the valid state is high
59	Internal flip-flop reset	Effective state changes from low to high
60	Internal trigger set	Effective state changes from low to high
61	Internal counter counts pulses	Effective state changes from low to high
62	Internal counter cleared	Valid when the valid state is high
63	Speed mode UPDOWN mode UP signal	Valid when the valid state is high
64	Speed mode UPDOWN mode DOWN signal	Valid when the valid state is high
65	Speed mode UPDOWN mode hold signal	Valid when the valid state is high
66	Back to the previous phase (Tension Type: Velocity Superposition Enabled)	Valid when the valid state is high
67	Correct the zero drift of all AI	Valid when the valid state is high to low
68	Go to the specified phase (tension type: closed-loop speed/torque mode switching)	Valid when the valid state is high
69	Positive jog fixed position (tension type: motor rotation direction in closed-loop speed mode)	Effective state changes from low to high
70	Reverse jog fixed position (tension type: motor rotation direction in closed-loop torque mode)	Effective state changes from low to high
71	Rewinding and unwinding control	Valid when the valid state is high
72	Trigger correction current sensor	Effective state changes from low to high
73	Trigger learning phase	Effective state changes from low to high
74	Trigger back to absolute zero	Effective state changes from low to high
75	Activate STO	Valid when the valid state is high

The specific functions of DO OUTFn.xx are shown in the following table.

DO function number	DO function
0	none
1	Drive is enabled
2	Speed arrives
3	slowing down
4	speeding up
5	zero speed
6	overspeed
7	forward rotation
8	Reverse rotation
9	fault output
10	In the forward speed limit in the torque mode

11	Negative speed limit in torque mode
12	Speed limit in torque mode
13	Positioning completion output
14	Positioning close to the output
15	return home completed output
16	Position error too large output
17	Interrupt fixed length output
18	Software limit output
19	feeding output
20	feed output
21	Roll diameter calculation is valid
22	The roll diameter reaches the output
23	length arrives at output
24	Holding brake output
25	Input command is valid
26	Often OFF
27	Always ON
28	Torque limit output
29	Torque arrival
30	Internal trigger state
31	Internal counter count arrives
32	Consistent speed
33	Pulse position command is zero output
34	Roll diameter reaches 2 outputs
35	Speed command is 0 output
36	The speed command is zero and the speed feedback is 0 output
37	Servo ready for output

6.2 Virtual DI/DO function

The servo drive has 16 general virtual DIs (VDIs), and each virtual DI has two types of level, including writing 1 is always valid and rising edge valid. The function of each virtual DI (P12.01 to P12.16) can be configured individually. Simulate the level of VDI by writing a value to the virtual DI input register (P12.20).

The servo driver has 16 general-purpose virtual DOs (VDOs), and each virtual DO has two level types, one is to output 1 when it is valid, and the other is to output 0 when it is valid. The function of each virtual DO (P12.41-P12.56) can be configured individually. The output level of DO can be displayed in P12.60.

The servo drive also has 2 sets of dedicated input and output: VDI20 and VDO20, VDI21 and VDO21. The two VDI/VDOs are directly connected internally.

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P12.01	VDI1 function configuration register	0~99	-	Set the DI function corresponding to VDI1 (virtual input terminal 1). The specific functions of the VDI port are the same as those of the physical DI port.	anytime	Immediately	0	RW
P12.02	VDI2 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.03	VDI3 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.04	VDI4 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.05	VDI5 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.06	VDI6 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.07	VDI7 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.08	VDI8 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.09	VDI9 function configuration	0~99	-	-	anytime	Immediately	0	RW

	register							
P12.10	VDI10 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.11	VDI1 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.12	VDI12 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.13	VDI13 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.14	VDI14 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.15	VDI15 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.16	VDI16 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.17	VDI20 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.18	VDI21 function configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.19	Monitoring values of virtual DI20 and virtual DI2	-	-	Read the virtual value of VDI20 and VDI21 terminals.	-	-	-	RO
P12.20	Virtual DI1-Virtual DI16 input value setting register	0~65535	-	Set the input value of VDI1-16.	anytime	Immediately	0	RW
P12.21	VDI1 level type 0-Write 1 is always valid 1- rising edge is valid	0~1	-	The setting makes the DI function selected by VDI1 valid, and the input	anytime	Immediately	0	RW

				level logic of the VDI1 terminal.				
P12.22	VDI2 level type 0-Write 1 is always valid 1- rising edge is valid	0~1	-	-	anytime	Immediately	0	RW
P12.23	VDI3 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.24	VDI4 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.25	VDI5 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.26	VDI6 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.27	VDI7 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.28	VDI8 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.29	VDI9 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.30	VDI10 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.31	VDI11 level type 0- Write 1 is always	0~1	-	-	anytime	Immediately	0	RW

	valid 1- Rising edge valid							
P12.32	VDI12 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.33	VDI13 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.34	VDI14 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.35	level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.36	VDI16 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.37	VDI20 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.38	VDI21 level type 0- Write 1 is always valid 1- Rising edge valid	0~1	-	-	anytime	Immediately	0	RW
P12.41	VDO1 configuration register	0~99	-	Set the DO function corresponding to VDO1. The specific functions of VDO are the same as the functions of entity DO.	anytime	Immediately	0	RW
P12.42	VDO2 configuration register	0~99	-	-	anytime	Immediately	0	RW

P12.43	VDO3 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.44	VDO4 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.45	VDO5 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.46	VDO6 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.47	VDO7 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.48	VDO8 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.49	VDO9 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.50	VDO10 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.51	VDO11 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.52	VDO12 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.53	VDO13 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.54	VDO14 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.55	VDO15 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.56	VDO16 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.57	VDO20 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.58	VDO21 configuration register	0~99	-	-	anytime	Immediately	0	RW
P12.59	Output level of	-	-	Read the	-	-	-	RO

	virtual DO20 D021			virtual level of the VDO20 and VDO21 terminals.				
P12.60	Virtual DO1-DO16 output level	-	-	Read the virtual level of the VDO1 - VDO16 terminals.	-	-	-	RO
P12.61	Active level of virtual DO1 0-Output 1 when valid 1-Output 0 when valid	0~1	-	When the DO function selected by VDO1 is valid, the output level logic of the VDO1 terminal is set.	anytime	Immediately	0	RW
P12.62	Active level of virtual DO2 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.63	Active level of virtual DO3 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.64	Active level of virtual DO4 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.65	Active level of virtual	0~1	-	-	anytime	Immediately	0	RW

	DO5 0-Output 1 when valid 1-Output 0 when valid							
P12.66	Active level of virtual DO6 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.67	Active level of virtual DO7 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.68	Active level of virtual DO8 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	
P12.69	Active level of virtual DO9 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.70	Active level of virtual DO10 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.71	Active level of virtual DO11	0~1	-	-	anytime	Immediately	0	RW

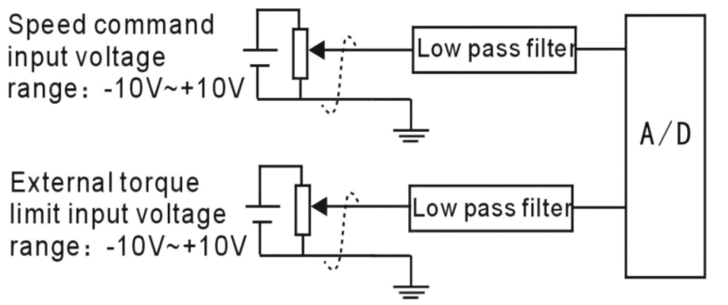
	0-Output 1 when valid 1-Output 0 when valid							
P12.72	Active level of virtual DO12 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.73	Active level of virtual DO13 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.74	Active level of virtual DO14 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.75	Active level of virtual DO15 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.76	Active level of virtual DO16 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.77	Active level of virtual DO20 0-Output 1 when	0~1	-	-	anytime	Immediately	0	RW

	valid 1-Output 0 when valid							
P12.78	Active level of virtual DO21 0-Output 1 when valid 1-Output 0 when valid	0~1	-	-	anytime	Immediately	0	RW
P12.79	Whether the virtual DI1-DI16 input value register P12.20 is cleared when powered on 0 - no zero 1- clear	0~1	-	Set whether the VDI1-VDI16 input value register P12.20 is cleared after power-on.	anytime	Immediately	1	RW

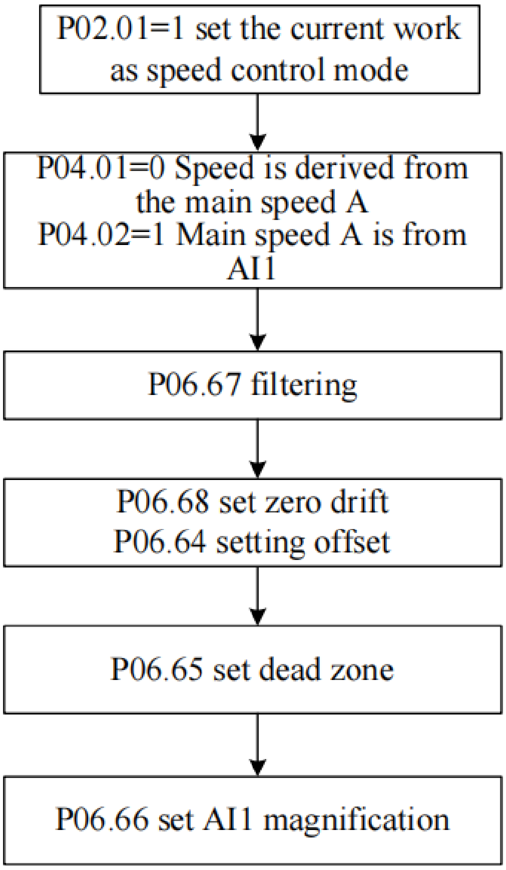
6.3 Analog input AI function

6.3.1 Analog input AI

VC330 servo driver has 2 AI terminals, the input range of AI1-AI2 is ±10V input.
Analog input circuit:



Operation method and steps:
Take AI1 as an example to explain the analog voltage setting speed command method.



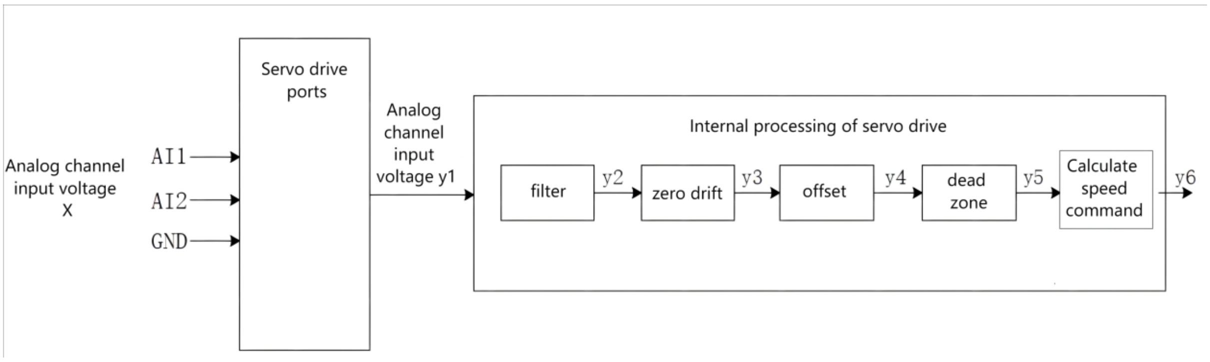
Noun explanation:

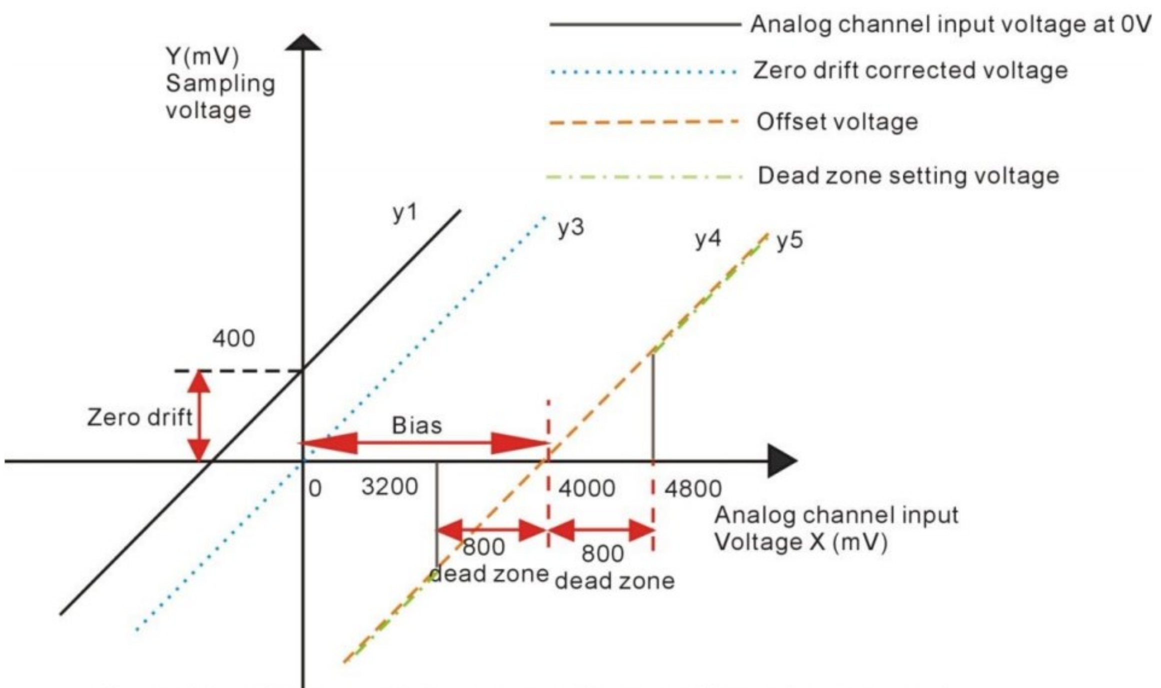
Zero drift: refers to the value of the servo drive sampled voltage value relative to GND when the analog channel input voltage is zero.

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

Dead zone: refers to the input voltage range of the analog channel when the sampling voltage is zero.

The unprocessed analog channel output voltage is shown in Figure y1. After being processed internally by the servo driver, the speed command y6 is finally obtained.





Servo driver AI processing corresponding sampling voltage example

- Filtering:

The servo driver provides analog channel filtering. By setting the filter time constants P06.67, P06.72, and P06.77, it can prevent the motor command fluctuation caused by the unstable analog input voltage, and can also reduce the motor fault caused by the interference signal. The filtering function has no elimination or suppression of zero drift and dead zone.

- Zero drift correction

When the actual input voltage is corrected to 0V, the voltage P06.61 collected by the analog channel AI1 deviates from the value of 0V.

In the figure, the output voltage of the analog channel without the internal processing of the driver is shown as y1. Taking the filtering time constant P06.67= 0.00ms as an example, the sampling voltage y2 after filtering is consistent with y1.

It can be seen that when the actual input voltage x=0, the collected voltage P06.61=y1=400mV, this 400mV is called zero drift.

After zero drift correction, the sampling voltage is shown as y3. y3=y1-400.0

- Offset Correction:

When the sampling voltage is set to 0, the corresponding actual input voltage value.

As shown in the figure, when the preset sampling voltage y4=0, the corresponding actual input voltage x=4000mV, this 4000mV is called offset. Set P06.64=4000.

- Dead zone settings:

Limits the valid input voltage range when the sampling voltage of the driver is not 0.

After the offset setting is completed, when the input voltage x is within 3200mV and 4800mV, the sampling voltage value is 0, and this 800mV is called the dead zone. Set P06.65=800.0, after setting the dead zone, the sampling voltage is shown as y5.

$$y_5 = \begin{cases} 0, 3200 \le x \le 4800 \\ y_4, 4800 \le x \le 10000 \text{or} -10000 \le x \le 3200 \end{cases}$$

● Calculate the percentage of analog commands

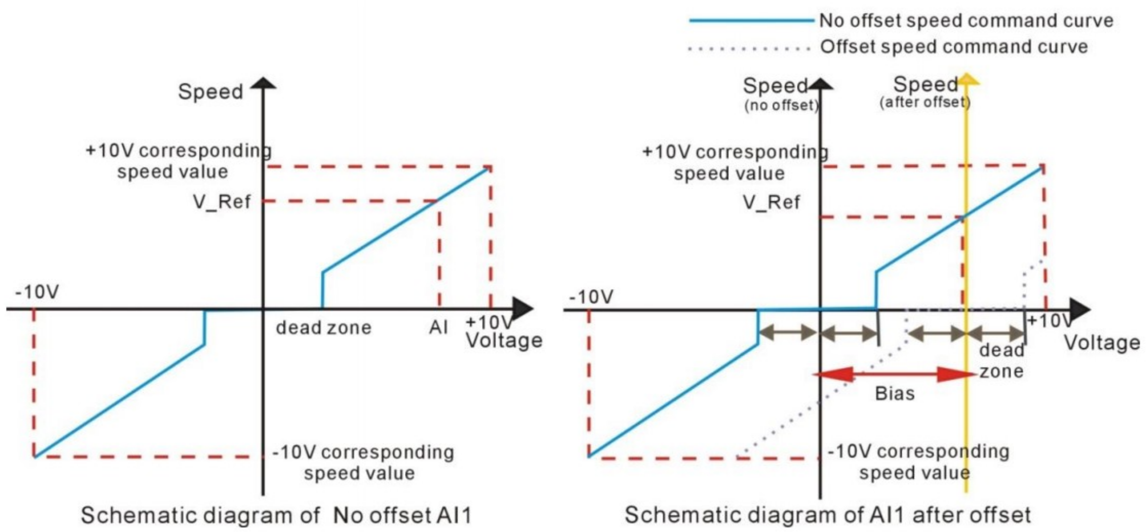
After the zero drift, offset and dead zone settings are completed, divide by 10000mV, and then multiply by the magnification percentage to obtain the final analog command percentage.

$$y_6 = \frac{y_5}{10000} \times (P06.66)\%$$

● Calculate speed command y6 or torque command

$$\text{Speed command (rpm)} = \text{Rated speed (rpm)} \times \text{Analog command percentage}$$
$$\text{Torque command percentage} = \text{Analog command percentage}$$

For example, when there is no offset, it is shown on the left of the following figure, and with an offset, it is shown on the right of the following figure. After completing the correct settings, you can view the AI1 sampling voltage value and the speed command value corresponding to the analog input in real time through the oscilloscope channel.



The relationship between the final speed command value percentage y6 and the input voltage x:

$$y6 = \begin{cases} 0, B - C \le X \le B + C \\ \dfrac{(x-B)}{10000} \times (P06.66\text{or}P06.67\text{or}P06.77)\%, B + C \le X \le 10000, or -10000 \le x \le B - C \end{cases}$$

Among them: B: bias; C: dead zone.

To sum up, assuming that the AI1 filter time constant is 0, the AI1 analog command calculation process is as follows:

（1） Eliminate zero drift and offset

$$b1 = (\text{AI1 input voltage value P06.61}) - (\text{AI1 zero drift P06.68}) - (\text{AI1 bias P06.64})$$

（2） join dead zone

$$b2 = \begin{cases} 0, & |b1| < \text{dead zone P06.65} \\ b1, & |b1| > \text{dead zone P06.65} \end{cases}$$

（3） Calculate the percentage of analog instructions

$$\text{AI1 analog command percentage P06.91} = \frac{b2}{10000} \times (\text{AI1 magnification P06.66})\%$$

（4） Calculate the speed command or torque command

（5）

$$\text{Speed command (rpm)} = \text{AI1 analog command percentage P06.91} \times \text{Rated speed P00.02}$$

$$\text{Torque command\%} = \text{AI1 analog command percentage P06.91}$$

The AI correction method is as follows: write 1 to P06.79 to trigger AI1 zero drift correction; write 2 to P06.79 to trigger AI2 zero drift correction; write 4 to P06.79 to trigger AI1 and AI2 zero drift correction. Or trigger INFn67 through DI, and perform zero drift correction on AI1 and AI2 at the same time.

AI related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P06.61	AI1 input voltage	-	mV	Display AI1 input voltage	-	-	-	RO
P06.62	AI2 input voltage	-	mV	--	-	-	-	RO
P06.64	AI1 bias	-10000~10000	mV	Set the actual input voltage of AI1 when the driver sampling voltage value after zero drift correction is 0.	anytime	Immediately	0	RW
P06.65	AI1 dead zone	0~5000	mV	Set the AI1 input voltage range when the sampling voltage value of the driver is 0.	anytime	Immediately	0	RW
P06.66	AI1 magnification	0~1000.0	%	Set the AI1 magnification	anytime	Immediately	100.0	RW

P06.67	AI1 low pass filter time constant	0~32767	ms	Set the filter time constant of the software for AI1 input voltage signal.	anytime	Immediately	2	RW
P06.68	AI1 zero drift	-32767~32767	mV	Zero drift: When the input voltage of the analog channel is 0, the sampling voltage value of the servo driver is relative to the value of GND.	anytime	Immediately	0	RW
P06.69	AI2 bias	-10000~10000	mV	-	anytime	Immediately	0	RW
P06.70	AI2 dead zone	0~5000	mV	-	anytime	Immediately	0	RW
P06.71	AI2 magnification	0~1000.0	%	-	anytime	Immediately	100.0	RW
P06.72	AI2 low pass filter time constant	0~32767	ms	-	anytime	Immediately	2	RW
P06.73	AI2 zero drift	-10000~10000	mV	-	anytime	Immediately	0	RW
P06.79	Automatic zero drift correction Write 1 trigger to correct AI1 zero drift; Write 2 trigger correction AI2 zero drift; Write 3 trigger correction AI3 zero drift; Write 4 trigger correction AI1-AI3 zero drift; Write 5 trigger	0-7		-	anytime	Immediately	0	RW

	correction current sensor; Write 6 to clear the current sensor zero drift value;							
P06.91	AI1 analog command percentage	-3276.7~3276.7	%	display	-	-	-	RO
P06.92	AI2 analog command percentage	-3276.7~3276.7	%	display	-	-	-	RO

Related input function bits.

Function bits	Bit description
INFn.67	Valid to invalid transition, trigger correction of AI1, AI2 zero drift

Chapter 7 Auxiliary Functions

7.1 Fault protection

7.1.1 Fault Downtime

The failure of the servo drive is divided into three categories.

Class I is a serious fault. Once such a fault is reported, the motor power must be cut off immediately and the motor is free to stop. The fault code range for class I is Er.100-Er.199.

Class II is a general fault. When reporting such a fault, customize can report the running action of the motor after the fault according to parameter P02.10. The fault code range for a Type II fault is Er.200-Er.599.

Class III is not a serious fault. When reporting such a fault, customize can report the running action of the motor after the fault according to parameter P02.11. The fault code range for Class III faults is Er.600-Er.999.

When the hardware/software travel limit occurs, the servo over travel fault stop mode can be set separately by P02.12.

There are five types of downtime. The first type is free stop; the second type is rapid deceleration stop, the drive is disconnected after stop, the motor is powered off; the third is slow deceleration stop, disconnected after parking is enabled, the motor is powered off; the fourth is Quickly decelerate to stop, keep enabling after parking, users need to disconnect the enable signal to disable; the fifth is slow deceleration stop, keep enabled after parking, users need to disconnect the enable signal to disable. Free parking means that the drive is broken and the motor is free to stop by frictional resistance. Deceleration stop means that the servo drive drives the motor to decelerate. In this process, the motor is kept energized. The deceleration time for rapid deceleration stop is set by P02.16. The deceleration time for slow deceleration stop is set by P02.17. The deceleration time refers to the time from the rated speed to the zero speed. The actual deceleration time is determined by the speed at the time of the fault and the set deceleration time.

$$\text{Actual deceleration time} = \text{set deceleration time} \times \frac{\text{failure speed}}{\text{Rated speed}}$$

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P02.10	Servo type 2 failure stop mode selection 0-break enable free parking	0~5	-	Set the deceleration method of the servo motor	anytime	Immediately	0	RW

	1-Fast deceleration and stop after the parking is enabled 2-Slow deceleration stop and enable 3-Fast deceleration stop and keep enabled 4-Slow deceleration stop and keep enabled 5-Braking according to the current set by P02.18			from rotation to stop and the motor state after stop when the servo class II fault occurs.				
P02.11	Servo three types of failure mode selection 0- break enable free parking 1- Fast deceleration and stop after the parking is enabled 2- Slow deceleration stop and enable 3-Fast deceleration stop and keep enabled 4-Slow deceleration stop and keep enabled 5-Braking according to the current set by P02.18	0~5	-	Set the deceleration method of the servo motor from rotation to stop and the motor state after the stop when the servo has a type III fault.	anytime	Immediately	0	RW
P02.12	Over travel stop mode selection 0- break enable free parking 1- Fast deceleration and stop after the parking is enabled 2- Slow deceleration stop and enable 3- Fast deceleration stop and keep enabled 4- Slow deceleration stop and keep enabled 5-Braking according to the current set by	0~5	-	Set the deceleration method of the servo motor from rotation to stop and the motor state after stop when over travel occurs during the servo motor running.	anytime	Immediately	0	RW

	P02.18							
P02.16	Fast stop time	0~65535	ms	Set the deceleration time when the servo is stopped quickly.	anytime	Immediately	500	RW
P02.17	Slow parking time	0~65535	ms	Set the deceleration time when the servo slowly stops.	anytime	Immediately	1000	RW

7.1.2 All faults

Servo supports the following failures.

fault code	Fault description
Er.100	Software overcurrent, when the current percentage P09.31 detected by the software is greater than the value set by P10.01, a software overcurrent fault will be reported, and the fault can be shielded by BIT1 of P10.33.
Er.101	hardware overcurrent
Er.102	Overvoltage, For 220V driver, when the bus voltage P01.08 is greater than 420V, it will report overvoltage. For 380V driver, when the bus voltage P01.08 is greater than 750V, it will report overvoltage.
Er.103	Undervoltage, when the bus voltage P01.08 is less than the rated voltage P01.07*1.414*0.7, it will report undervoltage.
Er.104 or Er.004	The current sensor is faulty. When the power is turned on for the first time, before the relay is closed, the detected current is not 0, and this fault is reported.
Er.105 or Er.005	If the encoder fails and the encoder is not connected, the fault is reported.
Er.106 or Er.006	The EEPROM verify fault, and the fault is reported when the value written to the EEPROM and the value of the read EEPROM are inconsistent.
Er.107	Phase sampling fault, when the phase obtained through the HALL switch and the phase obtained through the encoder are too different, this fault is reported.
Er.108 or Er.008	When the FPGA and ARM communication are faulty, the fault is reported when the values written and read by the ARM are inconsistent.
Er.109	If the current changes greatly, the fault will be reported when the difference between the two sampled currents is 50%.
Er.110	Magnetic encoder failure
Er.111	Current phase sequence learning failure
Er.112	The output is out of phase.
Er.113	Did not scan to Z point during self-learning

Er.114	Z point offset not found
Er.115	Hall code value learning error
Er.116	Great change in rotational speed
Er.117	The drive is overheated, when it is detected that the drive temperature P01.10 is greater than the drive overheating threshold P10.06, the drive over temperature fault will be reported.
Er.118	When powered on, the wire-saving encoder does not feedback hall value
Er.119	Motor encoder type does not match
Er.120	Software is not authorized
Er.121	Phase loss at RST input
Er.122 or Er.022	Use timeout
Er.130	STO (INFn75) alarm input signal is valid
Er.131	There is speed when the provincial encoder starts
Er.132	ARM does not match FPGA
Er.133 or Er.033	The Profinet protocol chip cannot communicate with the ARM motor control chip
Er.200	When returns to home, the home signal INFn.34 is not assigned.
Er.201	INFn.xx repeated allocation, one input function bit is assigned to two or more DI
Er.202	Overspeed, when the speed percentage (actual speed/rated speed) exceeds P10.05, it will report overspeed.
Er.203	The position error is too large. When the position error P03.17 is greater than P03.19 and P03.19 is not equal to 0, the fault is reported. Note that it is easy to report this fault if the position is set to a large filter time.
Er.204	Unassigned interrupt fixed length trigger signal INFn.40
Er.205	No return to home before absolute point motion
Er.206	Motor overload
Er.207	Software limit, after enabling the software limit P03.73, when the encoder position value is less than the lower limit of the software limit or greater than the upper limit of the software limit, this fault will be reported.
Er.208	hardware limit
Er.209	Curve planning failed
Er.210	Excessive tension
Er.211	Breakage failure
Er.212	XY pulse type selection error in tension control mode
Er.213	Fully closed loop position error is too large
Er.214	Prohibit positive (reverse) turn
Er.216	Z point signal is unstable
Er.217	RPDO receive timeout
Er.218	Reserved
Er.219	Motor stall
Er.220	Braking resistor overload
Er.221	The forward stroke switch input function bit INFn.43 is not assigned to the entity DI
Er.222	The reverse stroke switch input function bit INFn.44 is not assigned to entity DI
Er.223	Search home error

Er.224	CAN bus state switching error, switching CiA402 state machine when the bus is in non-Operation state
Er.225	Unsupported CANopen control mode
Er.226	Absolute value mode lap overflow
Er.227	The battery of the absolute encoder is faulty. (After the battery is powered off, the fault will be reported when the power is turned on for the first time, prompting the customer that the encoder has been powered off. Connect the battery, and the fault will be automatically eliminated after reset.)
Er.228	Inertia learning failed, need to reset P07.03 and P07.04
Er.229	When learning fully closed loop parameters, the position value detected by the second encoder is too small
Er.230	reserve
Er.231	Bus error
Er.232	Second encoder battery failure
Er.234	continuous vibration
Er.237	car breakdown
Er.238	Linear motor phase finding failed
Er.239	Linear motor phase finding failed, stuck in forward direction
Er.240	Linear motor phase finding failed, stuck in reverse direction
Er.241	Over-travel error during self-learning
Er.242	Encoder learning error, encoder interference or wrong magnetic pole setting
Er.243	Linear motor phase finding failure (disconnection)
Er.244	Linear motor phase finding failure (large position error)
Er.245	Linear motor phase finding failure (current pulse width is too small)
Er.600	Motor overheating
Er.601	DI function code is not assigned
Er.602	AI zero drift is too large, when AIx zero drift P06.68/P06.73/P06.78 is greater than the threshold value P10.10, it will report zero drift too large fault.
Er.603	The zero return time out, when the zero return time is greater than P10.08, this fault will be reported.
Er.604	When the absolute encoder is self-learning, the rotation direction of the motor is wrong, and the UVW wiring needs to be replaced
Er.605	The battery voltage of the absolute encoder is too low, you need to replace the new battery when the drive is powered on
Er.606	The battery voltage of the second encoder is too low, and it needs to be replaced with a new battery when the driver is powered on.
Er.607	Inertia learning failed, need to increase P07.33 and then learn
Er.608	U disk read and write failed
Er.609	Drive parameters not found during factory reset
Er.610	Motor parameters not found when restoring to factory defaults
Er.611	EEPROM verification error when restoring to factory defaults
Er.612	Self-learning current loop error

Er.613	Phase finding not yet completed
Er.701	EtherCAT bus error
Er.702	EtherCAT bus dropped
Er.703	After the back clearance compensation is increased, two steps are required before returning to zero to eliminate the back clearance

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P09.31	Torque current feedback	-	%	Displays the torque current feedback value.	-	-	-	RO
P10.01	Software Overcurrent Threshold	0~800	%	When the detected current percentage P09.31 is greater than this value, a software overcurrent fault will be reported.	anytime	Reset takes effect	400.0	RW
P10.02	Overload value	0~3276.7	%	Set the overload protection point, generally set as motor rated current/drive rated current*100%	anytime	Immediately	100.0	RW
P10.03	Lock-rotor protection current threshold	0~300.0	%	When set to 0, no stall protection is performed; when the motor is at zero speed, the driver current	anytime	Immediately	100.0 %	RW

				P09.31 is greater than the stall protection current threshold, and when the duration exceeds the stall protection time threshold P10.04, a stall fault is reported.				
P10.04	Lock-rotor protection time threshold	0~65535	ms	-	anytime	Immediately	800	RW
P10.05	Over speed percentage	0~3276.7	%	When the percentage of the actual speed/rated speed is greater than the overspeed percentage, an overspeed fault will be reported.	anytime	Immediately	150.0	RW
P10.06	Drive Overheat Threshold	0~3276.7	℃	When the drive temperature P01.10 is greater than this value, the drive overheating fault will be reported.	anytime	Immediately	80.0	RW
P10.08	Timeout time for returning to zero position	0~32767	s	When the zero return time exceeds this value, a zero timeout fault is reported.	anytime	Immediately	0	RW

				When set to 0, the zero return timeout protection is not performed.				
P10.09	Power-off motor encoder position memory function 0-Power off does not remember motor encoder position 1-Power-off memory motor encoder position	0~1	-	Set whether to memorize the motor encoder position after power off.	anytime	Immediately	0	RW
P10.10	AI zero drift threshold	0~32767	mV	When the zero drift of AIx is greater than this value, it will report the excessive zero drift fault.	anytime	Immediately	500	RW
P10.11	Motor overload curve selection	0~5	-	Select the motor overload curve. When 5 is selected, it is a custom overload curve	anytime	Immediately	0	RW
P10.12	Zero speed command automatically reduces torque limit value	0~3276.7	%	Torque limit value that is automatically reduced when zero-speed command is received	anytime	Immediately	0	RW
P10.13	Custom 1.1 times overload curve time	0~3276.7	s	Custom 1.1 times overload curve time		Immediately	0	RW
P10.14	Custom 1.5 times overload curve time	0~3276.7	s	Custom 1.5 times overload curve time	anytime	Immediately	0	RW
P10.15	Custom 2.0 times	0~3276.7	s	Custom 2.0	anytime	Immediately	0	RW

	overload curve time			times overload curve time				
P10.16	Custom 2.5 times overload curve time	0~3276.7	s	Custom 2.5 times overload curve time	anytime	Immediately	0	RW
P10.17	Custom 3.0 times overload curve time	0~3276.7	s	Custom 3.0 times overload curve time	anytime	Immediately	0	RW
P10.18	Speed detection threshold	0~32767	-	When set to non-zero, the speeding protection is enabled. The smaller the value, the more sensitive	anytime	Immediately	0	RW
P10.20	Current fault code	-	-	Display fault code	-	-	-	RO
P10.21	Selected last x failures	1~5	-	Used to choose to check the last 5 faults of the servo drive, this function code is used to set the number of faults to be checked:	anytime	Immediately	1	RW
P10.22	Fault code for selected x faults	-	-	Display	-	-	-	RO
P10.23	The fault code of the selected x faults	-	min	Display	-	-	-	RO
P10.24	Motor speed of the selected x faults	-	rpm	Display	-	-	-	RO
P10.25	The rms value of the motor current for the selected x faults	-	A	Display	-	-	-	RO
P10.26	Instantaneous value of V-phase motor current for selected x faults	-	A	Display	-	-	-	RO
P10.27	Instantaneous value of	-	A	Display	-	-	-	RO

	W-phase motor current for selected x faults							
P10.28	bus voltage of selected x faults	-	V	Display	-	-	-	RO
P10.29	Drive temperature for selected x faults	-	℃	Display	-	-	-	RO
P10.30	Entity DI state of selected x failures	-	-	Display	-	-	-	RO
P10.31	Entity DO status for selected x failures	-	-		-	-	-	RO
P10.32	Hardware fault cumulative count value	-	-	Display	-	-	-	RO
P10.33	Fault shielding	0~65535	-	BIT0 Shield Overload BIT1 Shield Software Overcurrent BIT2 Shield Phase Fault BIT3 Shield Current Change Large BIT4 Shield Hardware Overcurrent BIT5 Shield Speed Change Large BIT6 Shield Z Point Unstable BIT7 Shield SYNC Loss BIT8 Shield Current Sensor Fault BIT9 Shield Under voltage	anytime	Immediately	12	RW

				BIT10 Shield Encoder malfunction				
P10.34	Hardware failure time threshold	0~65535	20ns	Set the threshold for the number of hardware failures. When the duration of a single hardware failure exceeds this value, Er.101 will be reported.	anytime	Immediately	150	RW
P10.35	Fault minimum duration before responding to reset fault	0~32767	s	When reporting software overcurrent, hardware overcurrent, drive overheating, motor overload, locked rotor, and braking resistor overload, you must wait for P10.35 seconds to reset the fault	anytime	Immediately	60	RW
P10.44	Speed loop reference at last valid fault	-	%	Display	-	-	-	RO
P10.45	Velocity loop feedback at the last valid fault	-	%	Display	-	-	-	RO
P10.46	Torque reference at the last valid fault	-	%	Display	-	-	-	RO
P10.47	Torque feedback at the last valid fault	-	%	Display	-	-	-	RO

P10.48	Filtered position error at the last valid fault	-	-	Display	-	-	-	RO
P10.49	current record index	-	-	Display	-	-	-	RO
P10.50	The fault code of the fault with index 0	-	-	Display	-	-	-	RO
P10.51	failure time for failure with index 0	-	s	Display	-	-	-	RO
P10.52	Rotation speed of fault with index 0	-	rpm	Display	-	-	-	RO
P10.53	The rms value of the current for the fault with index 0	-	A	Display	-	-	-	RO
P10.54	Instantaneous value of the V-phase current for the fault with index 0	-	A	Display	-	-	-	RO
P10.55	Instantaneous value of the W-phase current for the fault with index 0	-	A	Display	-	-	-	RO
P10.56	Capacitor voltage for the fault with index 0	-	V	Display	-	-	-	RO
P10.57	The temperature of the fault with index 0	-	° C	Display	-	-	-	RO
P10.58	The DI status of the fault with index 0	-	-	Display	-	-	-	RO
P10.59	The DO status of the fault with index 0	-	-	Display	-	-	-	RO
P10.60	The fault code of the fault with index 1	-	-	Display	-	-	-	RO
P10.61	failure time for failure with index 1	-	s	Display	-	-	-	RO
P10.62	The speed of the fault with index 1	-	rpm	Display	-	-	-	RO
P10.63	The rms value of the current for the fault with index 1	-	A	Display	-	-	-	RO
P10.64	Instantaneous value of the V-phase current for the fault with	-	A	Display	-	-	-	RO

	index 1							
P10.65	Instantaneous value of the W-phase current for the fault with index 1	-	A	Display	-	-	-	RO
P10.66	Capacitor voltage for the fault with index 1	-	V	Display	-	-	-	RO
P10.67	The temperature of the fault with index 1	-	°C	Display	-	-	-	RO
P10.68	The DI status of the fault with index 1	-	-	Display	-	-	-	RO
P10.69	DO status of fault with index 1	-	-	Display	-	-	-	RO
P10.70	The fault code of the fault with index 2	-	-	Display	-	-	-	RO
P10.71	Failure time of failure with index 2	-	s	Display	-	-	-	RO
P10.72	Rotation speed of the fault with index 2	-	rpm	Display	-	-	-	RO
P10.73	The rms value of the current for the fault with index 2	-	A	Display	-	-	-	RO
P10.74	Instantaneous value of the V-phase current for the fault with index 2	-	A	Display	-	-	-	RO
P10.75	Instantaneous value of W-phase current for fault with index 2	-	A	Display	-	-	-	RO
P10.76	Capacitor voltage of the fault with index 2	-	V	Display	-	-	-	RO
P10.77	The temperature of the fault with index 2	-	°C	Display	-	-	-	RO
P10.78	DI state of the fault with index 2	-	-	Display	-	-	-	RO
P10.79	The DO status of the fault with index 2	-	-	Display	-	-	-	RO
P10.80	The fault code for	-	-	Display	-	-	-	RO

	fault with index 3							
P10.81	Failure time for failure with index 3	-	s	Display	-	-	-	RO
P10.82	Rotational speed of the fault with index 3	-	rpm	Display	-	-	-	RO
P10.83	The rms value of the current of the fault with index 3	-	A	Display	-	-	-	RO
P10.84	Instantaneous value of the V-phase current for the fault with index 3	-	A	Display	-	-	-	RO
P10.85	Instantaneous value of W-phase current for fault with index 3	-	A	Display	-	-	-	RO
P10.86	Capacitor voltage of the fault with index 3	-	V	Display	-	-	-	RO
P10.87	The temperature of the fault with index 3	-	° C	Display	-	-	-	RO
P10.88	DI status of the fault with index 3	-	-	Display	-	-	-	RO
P10.89	The DO status of the fault with index 3	-	-	Display	-	-	-	RO
P10.90	The fault code for the fault with index 4	-	-	Display	-	-	-	RO
P10.91	Failure time for failure with index 4	-	s	Display	-	-	-	RO
P10.92	Rotational speed of the fault with index 4	-	rpm	Display	-	-	-	RO
P10.93	The rms value of the current of the fault with index 4	-	A	Display	-	-	-	RO
P10.94	Instantaneous value of V-phase current for fault index 4	-	A	Display	-	-	-	RO
P10.95	Instantaneous value of W-phase current for fault with index 4	-	A	Display	-	-	-	RO
P10.96	Capacitor voltage for fault with index 4	-	V	Display	-	-	-	RO
P10.97	The temperature of the fault with index 4	-	° C	Display	-	-	-	RO

P10.98	DI state of the fault with index 4	-	-	Display	-	-	-	RO
P10.99	The DO status of the fault with index 4	-	-	Display	-	-	-	RO

7.1.3 Troubleshooting

(1) Er.100 software overcurrent

Fault occurrence conditions:

If the current percentage P09.31 detected by the software is greater than the overcurrent threshold of P10.01, a software overcurrent fault will be reported, which can be shielded by BIT1 of P10.33.

Fault reason	Fault confirmation	Troubleshooting
1.Motor UVW phase sequence reversed or missing phase	➢ Confirm the UVW phase sequence and whether the phase is missing	Adjust the UVW phase sequence or replace the motor
2.P10.01 setting is too small	➢ Check whether the value of parameter P10.01 is too small	Increase P10.01
3.Gain setting is too large	➢ Check P07.01 current loop ratio, P07.02 current loop integral gain,P07.03 speed loop proportional gain, P07.10 torque feedforward coefficient, whether these parameters are set too large	Reduce gain related parameters
4. The motor peak current percentage setting is too large	➢ Check whether P00.24 motor peak current percentage is inconsistent with the actual peak current of the motor	Reduce the percentage of P00.24 motor peak current
5. Motor power is too small	➢ Confirm according to the actual load	Replace the motor with a higher power
6. The motor output current is greater than the motor peak current	➢ Check whether the torque limit value of the drive (the default limit source P05.13) is greater than the motor peak current	Decrease the torque limit value

（2）Er.101 hardware overcurrent

Fault occurrence conditions:

The hardware detects that the driver output current reaches the peak threshold.

Fault reason	Fault confirmation	Troubleshooting
1. The initial phase of the magnetic pole is incorrect	➢ Check UVW Phase Sequence ➢ Whether the servo motor is a non-standard motor	Operate Fn005, re-learn the encoder
2. Abnormal connection of motor UVW power cable	➢ Check whether the driver end and motor end of the UVW cable are in poor contact and the ports are aged. ➢ Unplug the UVW motor cable and check if the wire is short-circuited.	Replace or correctly connect the motor wire
3. Motor power is too small	➢ Determined according to actual load conditions	Replace the motor with a higher power
4. Motor damage	➢ Unplug the motor wire and measure the resistance between the UVW and the motor with a multi meter	Unbalanced replacement motor
5. The braking resistance is too small or short-circuited	➢ Measure whether the resistance across the driver P, Rb' is positive	Replace the braking resistor
6. Drive failure	➢ Unplug the motor cable, then enable the servo drive, but still report this fault	Replace the drive
7. The gain setting is unreasonable	➢ During the rotation of the motor, if the motor vibrates violently or makes a sharp sound, you can also observe the curve of the current loop through VECObserve	Adjust gain
8. The acceleration/	➢ VECObserve observes	Modify the acceleration given

deceleration time is too short	whether the control command is given too violently ➢ Check whether the parameter setting of acceleration and deceleration time is too small	by the control command, increase the filter time of the control command, increase the acceleration and deceleration time
9. Connect the motor UVW line to the capacities load	➢ Check if the motor cable is too long ➢ Check whether the motor UVW is connected to a capacitor	Shorten the motor cable, exclude the UVW terminal and connect the capacitor
10.Excessive mechanical clearance	➢ Check if the mechanical clearance is too large	Reduce mechanical clearance

（3）Er.102 over pressure

Fault occurrence conditions:

When the busbar voltage detection value P01.08 is greater than the overvoltage threshold, it will report overvoltage

For drives whose rated voltage P01.07 is less than 300V, the overvoltage threshold is 420V, and for drives whose rated voltage P01.07 is greater than 300V, the overvoltage threshold is 750V.

Fault reason	Fault confirmation	Troubleshooting
1. The rated voltage of the driver is incorrectly set	➢ Check whether the parameter setting of P01.07 is correct	Modify the drive rated voltage P01.07
2. The bus voltage calibration coefficient is set incorrectly	➢ Check whether the parameter setting of P01.09 is correct	Modify bus voltage calibration coefficient P01.09 (adjustment range 90%~110%)
3. The power supply of the drive RST is unstable	➢ Oscilloscope to check RST power	Adjust the power supply or add a power supply noise filter
4. The DC bus voltage is too high	➢ Use a multi-meter to measure whether the voltages at both ends of the driver P and N are normal	Adjust the bus voltage calibration coefficient P01.09 (the adjustment range is 90%~110%) or adjust the power supply
5. The braking resistor is not working properly	➢ Check the braking resistor for poor contact, short circuit or open circuit ➢ Use a multi-meter to measure whether the	Correct wiring or replace braking resistor

	resistances at both ends of the driver P and Rb' are normal	
6. The parameter setting of the braking resistor is unreasonable	➢ Check whether the parameters of P02.20 for enabling dynamic braking, the resistance value of braking resistor P02.21, and the power of braking resistor P02.22 are set correctly	P02.20 can be selected by users according to their needs, P02.21 should be set correctly, and P02.22 can be set up to 5 times the power of the braking resistor
7. The system is a large inertia load, and the deceleration time is too short	➢ View the actual deceleration time	Properly adjust the deceleration time
8. The gain setting is unreasonable	➢ Check to see if the motor oscillates	Adjust the gain

(4) Er.103 undervoltage

Fault occurrence conditions:

When the busbar voltage detection value P01.08 is less than the undervoltage threshold, it will report undervoltage.

Undervoltage threshold = drive rated voltage P01.07*1.414*0.7

Fault reason	Fault confirmation	Troubleshooting
1. The RST power supply of the driver does not match the rated voltage P01.07 of the driver.	➢ Check whether the parameter setting of P01.07 is correct	Modify the drive rated voltage P01.07
2. The acceleration time is too short	➢ View the actual acceleration time	Decrease acceleration time
3. The grid voltage is too low	➢ Measuring grid voltage	Adjust the drive rated voltage P01.07 to be consistent with the grid voltage
4.Other overloaded devices start	➢ The drive reports this fault as soon as other heavy-duty devices are started	Adjust the RST power supply
5.Charging circuit failure	➢ This fault is reported as soon as the drive is enabled	Replace the drive
6. Braking resistors P, Rb' are short-circuited to ground	➢ Check whether the P and Rb' terminals of the driver are short-circuited with the	Prevent short circuit of braking resistor P, Rb' to ground

	ground ➢ Or remove the braking resistor, whether to report this fault, if not, it means that the braking resistor P and Rb' are short-circuited to ground	
7. Excessive load	➢ When using a single-phase power supply, the actual load is too large	Use three-phase power or derating
8. The three-phase current of the main power supply RST is unbalanced	➢ Measure the three-phase current of the main power supply RST, UVW	Unbalanced, adjust the RST three-phase power supply
9. The cross-sectional area of the RST wire is too small	➢ Check if the RST wire meets the driver current	Replacing the RST power cord with a larger cross-sectional area

（5）Er.104 Current sensor failure

Fault occurrence conditions:

Current sensor failure

Fault reason	Fault confirmation	Troubleshooting
1. Current sensor failure	➢ -	Replace the drive

（6）Er.105 Encoder failure

Fault occurrence conditions:

The encoder has no signal or the signal is unstable

Fault reason	Fault confirmation	Troubleshooting
1. The encoder wire is in poor contact	➢ Check the encoder line	Correct wiring
2. The encoder wire is disconnected	➢ The multi-meter detects the signal line	Replace the encoder wire
3.Subject to electromagnetic interference	➢ Exclude and turn off other equipment that may cause interference	eliminate interference

（7）Er.106 EEPROM failure

Fault occurrence conditions:

EEPROM read data error

Fault reason	Fault confirmation	Troubleshooting
1. EEPROM read data error	➢ -	Replace the drive

(8) Er.107 Phase sampling fault

Fault occurrence conditions:

Phase sampling fault, when the phase obtained through the HALL switch and the phase obtained through the encoder are too different, this fault is reported.

Fault reason	Fault confirmation	Troubleshooting
1. Phase sampling failure	➢ -	Set BIT2 of fault shielding parameter P10.33 to 1 to shield this fault

(9) Er.108 FPGA and ARM communication failure

Fault occurrence conditions:

This fault is reported when the values written by the ARM and read to the FPGA are inconsistent.

Fault reason	Fault confirmation	Troubleshooting
1. When the value written by ARM and read to FPGA is inconsistent	➢ -	Replace the drive

(10) Er.109 Large current change fault

Fault occurrence conditions:

When the two sampled currents differ by 50%, a fault is reported.

Fault reason	Fault confirmation	Troubleshooting
1. When the two sampled currents differ by 50%	➢ -	Set BIT3 of fault shielding parameter P10.33 to 1 to shield this fault

(11) Er.111 Abnormal motor winding

Fault occurrence conditions:

When self-learning the winding direction of the motor, the current changes in the wrong direction

Fault reason	Fault confirmation	Troubleshooting
1. The motor winding is abnormal	➢ Check motor UVW wiring	Connect the UVW motor cable correctly

(12) Er.113 Encoder Z point not detected

Fault occurrence conditions:

When the encoder is self-learning, the Z point signal cannot be detected

Fault reason	Fault confirmation	Troubleshooting
1. The encoder wire is in poor contact	➢ Check encoder wire	Correctly connect the encoder wire
2. The encoder signal is abnormal	➢ Connect the encoder cable correctly, after self-learning three times, it still reports this fault	Replace the motor

（13）Er.114 Z point offset error

Fault occurrence conditions:

When the encoder is self-learning, it is detected that the Z point signal is larger than the encoder resolution

Fault reason	Fault confirmation	Troubleshooting
1. The encoder signal is abnormal	➢ Connect the encoder cable correctly, after self-learning three times, it still reports this fault	Replace the motor

（14）Er.115 HALL encoded value error

Fault occurrence conditions:

When self-learning encoder, the HALL code value is both 0 or 1 at the same time

Fault reason	Fault confirmation	Troubleshooting
1. The encoder signal is abnormal	➢ After three times of self-learning, this fault is still reported	Replace the motor

（15）Er.117 overheating

Fault occurrence conditions:

When the drive temperature P01.10 is greater than the overheating threshold P10.06, an overheating fault will be reported.

Fault reason	Fault confirmation	Troubleshooting
1. The temperature of the drive is overheated	➢ Measuring drive surface temperature	Increase the drive cooling
2. The cooling fan does not work normally	➢ Check the fan operation	Replace the cooling fan
3.The ambient temperature is too high	➢ Thermometer measures the temperature of the site	reduce ambient temperature
4. The motor runs at low frequency and high current for a long time	➢ Monitor the actual load	Increase drive power

（16）Er.118 The HALL encoder value of the wire-saving encoder is wrong when the power is turned on

Fault occurrence conditions:

The HALL code value returned by the wire-saving encoder is wrong when powered on

Fault reason	Fault confirmation	Troubleshooting
1. The signal of the line-saving encoder is abnormal	➢ The drive is powered on again three times, but still reports this fault	Replace the motor

（17）Er.119 Encoder type mismatch

Fault occurrence conditions:

The encoder type recognized by the FPGA is inconsistent with the encoder type set by the driver.

Fault reason	Fault confirmation	Troubleshooting
1. Parameter setting error	➢ Check whether P00.08 and the actual encoder type are consistent.	Modify P00.08
2. The motor type is wrong	➢ Check whether the encoder type identified in the FPGA version (P01.02) is consistent with the actual connected encoder type.	Change motor type or change FPGA program

（18）Er.200 The home switch for return to zero is not assigned

Fault occurrence conditions:

The homing mode needs to be connected to the origin switch, and there is no origin switch assigned in the DI configuration.

Fault reason	Fault confirmation	Troubleshooting
1. The DI is not configured with the origin switch input signal INFn.34.	➢ Check if the DI is configured with the origin switch input signal INFn.34	DI configuration origin switch input signal INFn.34

（19）Er.201 DI repeat assignment

Fault occurrence conditions:

The same INFn function is assigned to two different DI or VDI terminals.

Fault reason	Fault confirmation	Troubleshooting
1. The same INFn function is assigned to two different DI or VDI terminals.	➢ View DI or VDI configuration	Modify DI or VDI configuration

（20）Er.202 overspeed

Fault occurrence conditions:

When the speed percentage (actual speed/rated speed) is greater than the overspeed percentage P10.05, it will report an overspeed fault.

Fault reason	Fault confirmation	Troubleshooting
1. The setting of overspeed percentage P10.05 is too small	➢ Check out P10.05	Increase P10.05 or decrease the speed percentage
2. The gain is too large	➢ Check the parameter settings of P07.03, P07.04 and P07.05	Decrease the gain
3. HALL switch detection error	➢ -	Re-learning the encoder
4. Z point offset P00.71 error	➢ -	For our company's motors, this

		value is set to 0, and P02.35=8421 should be set before setting this value

(21) Er.203 Position error is too large

Fault occurrence conditions:

When the difference between the position command and the actual position is greater than the excessive position error threshold P03.19, it will report that the position error is too large.

Fault reason	Fault confirmation	Troubleshooting
1. Position command filter parameters P03.06 and P03.07 are too large	➢ Check P03.06 and P03.07	Decrease P03.06 and P03.07
2. Gain is too small	➢ Check whether the parameter settings of P07.03, P07.04 and P07.05 are reasonable	Adjust the gain
3. Position command speed is too large	➢ View position command speed	Decrease position command speed
4. The position error is too large and the threshold P03.19 is too small	➢ Check the excessive position error threshold P03.19	Increase the excessive position error threshold P03.19
5. Mechanical stuck motor	➢ Check whether the mechanical transmission part is stuck	Dealing with Mechanical Stuck Issues

(22) Er.204 No interrupt fixed-length trigger signal assigned

Fault occurrence conditions:

The interrupt fixed length function is enabled, but the DI terminal of the interrupt fixed length trigger function number INFn.40 is not allocated.

Fault reason	Fault confirmation	Troubleshooting
1.DI unassigned interrupt fixed-length trigger function number INFn.40	➢ View DI configuration	Configure a DI as interrupt fixed-length trigger function number INFn.40

(23) Er.205 There is no zero return before triggering to go to absolute multi-segment position

Fault occurrence conditions:

There is no homing performed before triggering the absolute multi-segment position.

Fault reason	Fault confirmation	Troubleshooting
1. The zero return is not performed before triggering the absolute multi-segment position.	➢ -	A zero return is required before triggering an absolute multi-segment position.

（24）Er.206 overload

Fault occurrence conditions:

When the motor current works continuously for a certain period of time at a value greater than the rated current, an overload is reported.

Fault reason	Fault confirmation	Troubleshooting
1. Improper parameter setting	➢ Check out P10.02	Please set P10.02 as the percentage of motor rated current and drive rated current.
2. The motor power is not enough	➢ Confirm according to the actual load	Please replace the servo system with a higher power level

（25）Er.207 software limit

Fault occurrence conditions:

After enabling the software limit through P03.73, when the actual user position is less than the lower limit of the position and the speed is negative, the software limit will be reported. When the actual user position is greater than the upper limit of the position and the speed is positive, the software limit will be reported.

Fault reason	Fault confirmation	Troubleshooting
1. Improper parameter setting	➢ Check P03.73	Modify P03.73
2. Improper setting of software limit value	➢ Check P03.74, P03.76	Modify P03.74, P03.76

（26）Er.208 hardware limit

Fault occurrence conditions:

After enabling the hardware limit through P03.73, when the reverse position limit switch is valid and the speed is negative, the hardware limit is reported. When the positive position limit switch is valid and the speed is positive, the hardware limit is reported.

Fault reason	Fault confirmation	Troubleshooting
1. Improper parameter setting	➢ Check P03.73	Modify P03.73
2.Whether the installation position of the position limit switch is appropriate.	➢ Check whether the position limit switch is installed in the proper position.	Adjust the position limit switch installation position

（27）Er.209 4th power position curve planning failed

Fault occurrence conditions:

4th power position curve planning failed

Fault reason	Fault confirmation	Troubleshooting
1. The 4th power position curve planning failed	➢ -	The 4th power position curve planning failed, reset the reasonable speed/position planning value

（28）Er.213 Fully closed loop position error is too large

Fault occurrence conditions:

In a fully closed loop, the detected position of the second encoder is too different from the motor encoder converted to the second encoder value.

Fault reason	Fault confirmation	Troubleshooting
1, the material slips	➢ Observe the movement of the material	Press the material tightly to prevent the material from slipping seriously.
2. The full-closed loop position error is too large and the threshold P03.36 is set too small	➢ Check full closed loop position error too large threshold P03.36	Increase the full-closed loop position error too large threshold P03.36
3. The full closed loop position error clearing cycle number P03.40 is not set	➢ Check the full closed loop position error clearing cycle number P03.40	Set a reasonable full-closed loop position error clearing cycle number P03.40
4. Encoder polarity setting error in full closed loop mode	➢ Check whether the parameters set by encoder polarity P03.33 in full-closed loop mode match the actual situation	Modify P03.33

（29）Er.214　Forward and reverse rotation is prohibited

Fault occurrence conditions:

The forward/reverse rotation is prohibited through P02.03, but the forward/reverse rotation command is actually input

Fault reason	Fault confirmation	Troubleshooting
1. The forward/reverse rotation is prohibited by setting P02.03, but the forward/reverse rotation command is actually input	➢ Check whether the entered command is normal	Modify the command direction

（30）Er.216　The signal at point Z is unstable

Fault occurrence conditions:

The difference between the encoder position detected twice at Z point and the actual encoder resolution is too different

Fault reason	Fault confirmation	Troubleshooting
1. The encoder wire is in poor contact	➢ Check encoder wire	Correct wiring
2. The encoder signal is abnormal	➢ After three times of self-learning encoder, this fault is still reported	Replace the motor

（31）Er.217　SYNC signal timeout

Fault occurrence conditions:

The received SYNC signal exceeds the actual sync period

Fault reason	Fault confirmation	Troubleshooting
1. The received SYNC signal exceeds the actual synchronization period	➢ Check whether the CANopen/EtherCAT communication line is connected normally	Correct wiring

（32）Er.219 locked rotor

Fault occurrence conditions:

When the drive current percentage P09.31 is greater than P10.03, and the speed is close to zero, and lasts for the time of P10.04, it will report stalled rotor.

Fault reason	Fault confirmation	Troubleshooting
1. Improper setting of parameters	➢ Check P10.03, P10.04. Generally, P10.03 and P10.04 use the shortcut button in VECObserve software → the default settings after a complete set of matching.	Modify P10.03, P10.04
2. The machine jams the motor	➢ View Mechanical Structure	Dealing with mechanical structural problems
3. Motor power is too small	➢ Judging by the actual load	Increase motor power

（33）Er.220 Braking resistor overload

Fault occurrence conditions:

When the braking resistor is in the braking state continuously and the braking of the braking resistor is greater than the heat dissipation of the braking resistor, the braking resistor is overloaded.

Fault reason	Fault confirmation	Troubleshooting
1. Improper setting of parameters	➢ Check braking resistor resistance value P02.21, braking resistor power P02.22, braking resistor heat dissipation coefficient P02.23	Set P02.21 according to the resistance value of the braking resistor; set the braking resistor power P02.22; P02.23 is generally set to 50
2. The power of the braking resistor is too small	➢ The braking is frequent, and the heat dissipation of the braking resistor is too small	Choose a braking resistor with higher power

（34）Er.221 Forward travel limit switch not assigned

Fault occurrence conditions:

The return-to-zero mode needs to be connected to the forward travel limit switch, and the forward travel limit switch INFn.43 is not allocated in the DI configuration.

Fault reason	Fault confirmation	Troubleshooting

1. Unassigned forward travel limit switch INFn.43	➢ Check the DI function configuration parameters	DI function assignment Forward travel limit switch INFn.43

（35）Er222 Reverse travel limit switch not assigned

Fault occurrence conditions:

The back-to-zero mode needs to be connected to the reverse stroke limit switch, and the reverse stroke limit switch INFn.44 is not allocated in the DI configuration.

Fault reason	Fault confirmation	Troubleshooting
1. Unassigned reverse travel limit switch INFn.44	➢ Check the DI function configuration parameters	DI function assignment Reverse stroke limit switch INFn.44

（36）Er223 Failed to find origin

Fault occurrence conditions:

During the zero return process, the origin switch was not found

Fault reason	Fault confirmation	Troubleshooting
1. Not connected to the origin switch	➢ Check whether the origin switch is correctly connected to the DI	Correctly wire the origin switch

（37）Er224 CAN bus state switch failed

Fault occurrence conditions:

During the enable process, the CAN bus state machine is switched to the pre-operational mode

Fault reason	Fault confirmation	Troubleshooting
1. During the enabling process, the CAN bus state machine is switched to the pre-operation mode	➢ Check the enable process	It is not possible to switch the CAN bus state machine to the pre-operational mode during the enabling process

（38）Er.225 Unsupported CANopen bus operating mode

Fault occurrence conditions:

Unsupported CANopen bus operating mode

Fault reason	Fault confirmation	Troubleshooting
1. Unsupported CANopen bus operating modes	➢ -	Unsupported CANopen bus operating mode

（39）Er.226 Absolute encoder in absolute mode, the number of turns overflows

Fault occurrence conditions:

Absolute encoder in absolute mode, the number of turns overflows

Fault reason	Fault confirmation	Troubleshooting
1. The number of turns overflows when the absolute encoder is in the absolute value mode.	➢ -	-

（40）Er.227 Absolute encoder battery failure in absolute mode

Fault occurrence conditions:

After the battery is powered off, when the power is turned on for the first time, this fault will be reported, prompting the user that the absolute encoder battery is powered off and the multi-turn position information is lost. After connecting the battery, the fault will be automatically eliminated after reset.

Fault reason	Fault confirmation	Troubleshooting
1. The battery is out of power	➢ Measuring encoder battery voltage	Replace the battery and power on again

（41）Er.228 Inertia learning failed

Fault occurrence conditions:

When the self-learning habit is used, the frictional resistance is too large, and the self-learning current limit P02.36 is too small.

Fault reason	Fault confirmation	Troubleshooting
1. When the self-learning habit is used, the frictional resistance is too large, and the self-learning current limit P02.36 is too small.	➢ Check P02.36	Increase P02.36
2. The inertia of the system is too large, and the acceleration and deceleration time P07.33 of the learning habit is too small	➢ Check P07.33	Increasing P07.33
3. The gain setting is not appropriate	➢ If the motor shakes	Increase P07.03, decrease P07.04

（42）Er.229 Full closed-loop parameter learning failed

Fault occurrence conditions:

During the full-closed-loop parameter learning process, the change of the position value of the second encoder is too small

Fault reason	Fault confirmation	Troubleshooting
1.During the full-closed-loop parameter learning process, the change of the position value of the second encoder is too small	➢ Check the full closed-loop learning process to see if the second encoder is moving normally	Ensure that during the full closed-loop learning process, the motor can drag the second encoder to move, and there is no slippage

（43）Er.600 Motor overheating

Fault occurrence conditions:

Motor temperature is too high

Fault reason	Fault confirmation	Troubleshooting
1. The load is too large, and the motor heats too seriously	➢ Measure motor temperature	Need to replace a larger capacity motor

2. The ambient temperature is too high	➢ Detect the ambient temperature on site	Reduce site ambient temperature

（44）Er.601 DI function code is not assigned

Fault occurrence conditions:

DI function code is not assigned

Fault reason	Fault confirmation	Troubleshooting
1. The speed or torque source AB switching is enabled but the AB switching function bit is not assigned.	➢ Check if the DI configuration is correctly configured	Configure DI correctly

（45）Er.602 AI zero drift is too large

Fault occurrence conditions:

AI1 zero drift setting P06.68 or AI2 zero drift setting P06.73 or AI3 zero drift setting P06.78 is greater than AI zero drift threshold P10.10

Fault reason	Fault confirmation	Troubleshooting
1. AI zero drift is too large	➢ Check whether the input analog quantity is normal	Make sure the analog input is normal

（46）Er.603 Back to zero timeout

Fault occurrence conditions:

The zero return process exceeds the zero return timeout time P10.08

Fault reason	Fault confirmation	Troubleshooting
1. The origin signal is not properly connected	➢ Check whether the origin signal is normal	Normal access to the zero return origin signal

（47）Er.604 Motor rotation direction is wrong during self-learning

Fault occurrence conditions:

Motor rotation direction is wrong during self-learning

Fault reason	Fault confirmation	Troubleshooting
1. The motor rotation direction is wrong during self-learning	➢ During self-learning, check the rotation direction of the motor	Check whether the motor and encoder are normal
2. The UVW phase sequence of the motor is connected incorrectly	➢ Confirm UVW Phase Sequence	Confirm UVW Phase Sequence

（48）Er.605 Absolute encoder battery alarm

Fault occurrence conditions:

Fault reason	Fault confirmation	Troubleshooting
1. The absolute encoder works in absolute value mode, and the battery voltage is too low	➢ Check the battery voltage	The absolute encoder works in absolute value mode, and the battery voltage is too low.

		If the battery is not needed, change the value of P00.41 to 3 to shield the fault.

The absolute encoder works in absolute value mode, and the battery voltage is too low

7.1.4 Motor overload protection

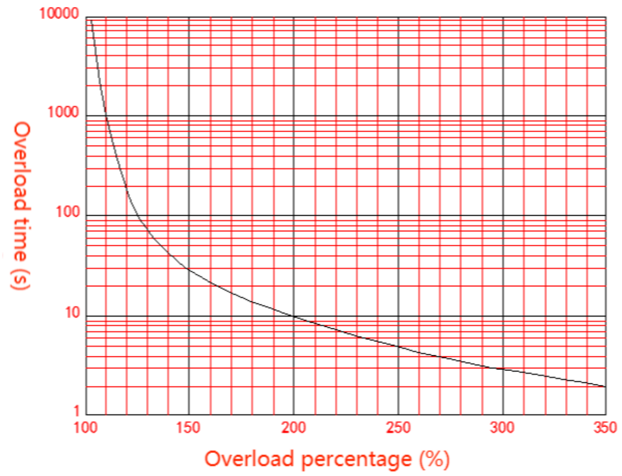
The motor load ratio is defined as (torque output percentage Un013)/(overload value P10.02). The load ratio of the motor output and the time it can run continuously have the following relationship. That is, the larger the motor load ratio, the shorter the continuous running time. Once the continuous running time is exceeded, the motor overload fault will be reported.

$$\text{Motor load proportion} = \frac{\text{Torque output percentage Un013}}{\text{Overload value P10.02}}$$

$$\text{Torque output percentage} = \frac{\text{actual current}}{\text{Drive rated current}} \times 100\%$$

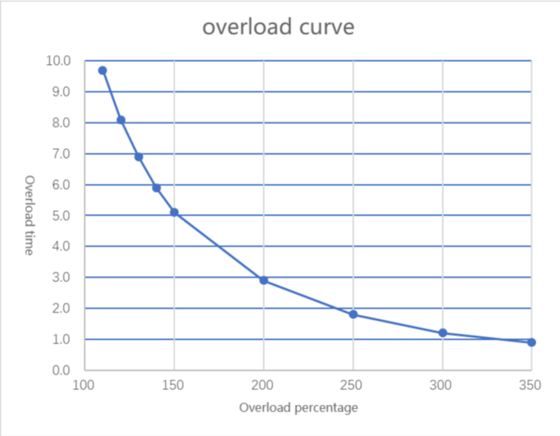
Different overload curves can be selected by parameter overload curve selection P10.11. This function is only valid when the ARM firmware version is 0.104 and above.

- Overload curve 0:



Load proportion	Continuous running time (s)
1.1	1000
1.2	200
1.4	42
1.7	18
2.1	8.4
2.4	5.5
2.7	4.0
3.0	2.9

➢ Overload curve 1:



Load proportion	Continuous running time (s)
1.1	9.7
1.2	8.1
1.4	5.9
1.5	5.1
2.0	2.9
2.5	1.8
3.0	1.2
3.5	0.9

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P10.02	Overload value	0~3276.7	%	Set overload protection point	anytime	Immediately	100	RW

7.1.5 Braking resistor overload protection

According to the actual set resistance value and resistance power, Brake according to the power set in P02.22. For 220V drives, when the DC bus voltage is greater than 380VDC, the dynamic braking circuit can be started by setting parameters. For 380V drives, when the DC bus voltage is greater than 680VDC, the dynamic braking circuit can be activated by setting parameters. It can brake continuously for 33s under the condition of rated power and zero heat dissipation coefficient. If the braking time is exceeded, an overload fault of the braking resistor will be reported. When the braking resistor does not work, if the heat dissipation coefficient is not zero, it will dissipate heat according to the set heat dissipation coefficient. If the heat dissipation coefficient is set to 100%, the heat can be dissipated from the maximum heat to 0 in 10s. In general, please refer to the table below for the selection of braking resistors. The actual resistance used needs to be calculated according to the field conditions.

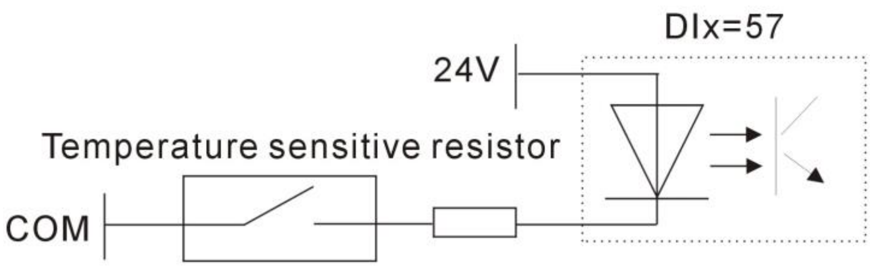
input power	Noise filter (A)	Rated current (A)	Recommended Brake Resistor		
			Resistance value (Ω)	Resistor Power (W)	Minimum automatic resistance (Ω)
Three-phase 220V	5	3	350	150	25
	5	6	150	300	25
	10	12	80	600	45
Three-phase 380V	10	7	250	600	75
	20	12	150	1000	75
	20	16	100	1500	30
	20	20	80	2000	20
	30	27	60	2500	20
	30	32	40	3000	15
	40	38	32	5500	14
	50	45	27	6500	14
	70	60	20	9000	14
	80	75	16	12000	10
	100	90	13	13000	10
	120	110	10	18000	7.5
	120	150	8.2	23000	7.5

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P02.21	Braking resistor resistance	0~3276.7	Ω	It is used to set the resistance value of the braking resistor of the driver.	anytime	Immediately	0	RW
P02.22	Rated power of braking resistor	0~3276.7	KW	Power used to set the braking resistor of the drive	anytime	Immediately	0	RW
P02.23	Braking resistor heat dissipation coefficient	0~100	%	Set the heat dissipation coefficient of the resistor when using a braking resistor. If set to 100%. Then 10s can drop from the maximum heat to 0.	anytime	Immediately	50	RW

7.1.6 Motor overheat protection

Set the DI function bit to INFn.57, and connect an external motor overheat detection circuit. The motor overheat detection circuit adopts PTC protection. The schematic diagram is as follows. When the output of the external motor overheat detection circuit pulls this DI to be valid, the driver reports the motor overheat fault Er.600.



Motor overheat detection circuit

7.1.7 Motor phase loss protection

The servo drive has input phase loss and output phase loss protection functions, and it is determined by P10.07 whether to enable or not. Input phase loss means that the input voltage R, S, T of the servo is connected to one less phase. Output phase loss means that the motor lines U, V and W are connected to one less phase. Parameter P10.07 has 16 bits, from the 0th to the 15th respectively. When the 0th bit is 1, the output phase loss protection is enabled, and when the 1st bit is 1, the input phase loss protection is enabled. That is, when P10.07=0, no phase loss protection is enabled; when P10.07=1, output phase loss protection is enabled; when P10.07=2, input phase loss protection is enabled; when P10.07=1, input phase loss protection is enabled; When 07=3, the input and output phase loss is enabled at the same time.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P10.07	Phase loss protection settings	0~32767	-	When the 0th bit is 1, the output phase loss protection is enabled; when the 1st bit is 1, the input phase loss protection is enabled.	anytime	Immediately	3	RW

7.2 Holding brake output function

The holding brake is a mechanism that prevents the servo motor shaft from moving and keeps the motor locked in position when the servo drive is in a non-operational state, so that the moving part of the machine will not move due to its own weight or external force.

For a servo motor with a brake, if the brake output OUTFn.24 is assigned to a terminal, the brake function will be automatically enabled. It should be noted that the effective level of the brake function terminal can only be set to a low level, otherwise the brake will be released during the power-on process.

The related output function numbers are as follows.

Function bits	Bit description
OUTFn.24	Holding brake output. When it is invalid, the power supply of the brake is disconnected, the brake acts, and the motor is in a position lock state; When it is valid, the brake power is turned on, the brake is released, and the motor can rotate.

7.2.1 Braking process

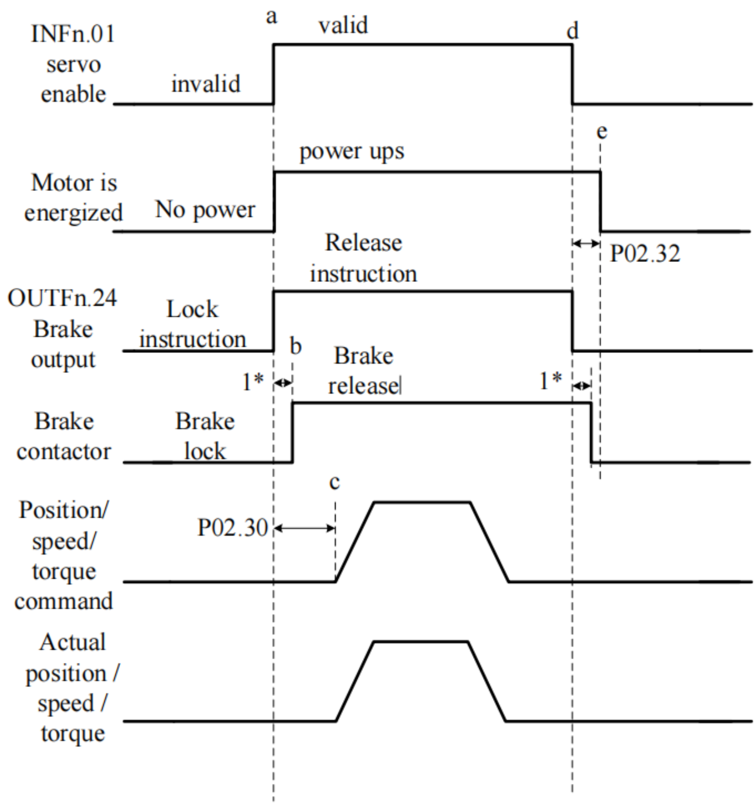
The brake is divided into two situations, the first is the static braking process, and the second is the dynamic braking process.

The braking sequence in static state refers to the braking process when the motor speed is lower than 20rpm at the moment when the off-enable command is input (that is, INFn.01 switches from ON to OFF).

The braking sequence under dynamic conditions refers to the braking process when the motor speed is higher than 20rpm at the moment when the disable enable command is input (that is, INFn.01 switches from ON to OFF).

- Static brake process

The moment when INFn.01 switches from ON to OFF, the brake process when the motor speed is lower than 20rpm is as follows.



Initially, the holding brake is locked. At time a, the PLC gives the servo enable signal (INFn.01), the servo immediately energizes the motor after receiving the enable signal, the motor locks, and issues the brake release command (OUTFn.24) at the same time, waiting for 1* this period of time Then, at time b, the brake contactor action is completed and the brake is released. The servo driver starts to receive the enable signal, and after P02.30 ms to time c, it starts to receive the position/speed/torque command, and the motor starts to rotate. After the motor rotates and reaches time d, the PLC sends out the enable signal. When the servo detects that the motor speed is lower than 20rpm, it executes the static brake process and immediately sends the brake lock signal. After a delay of 1* time, the brake contactor acts. After completion, the brake is locked, and then at time e, the motor is powered off.

Note: 1* is the time from the servo sending the brake signal to the actual brake contactor action.

P02.32 is the power-on time of the driver after the brake is locked to prevent the mechanical moving part from moving due to its own weight or external force after the servo is powered off.

P02.30 is the delay time from when the drive is enabled to when the input position/speed/torque command is valid.

Note: After the drive is enabled, it is forbidden to input any torque or speed command within the time range of P02.30. Likewise, the position/speed/torque commands must brake the motor when the motor is disabled.

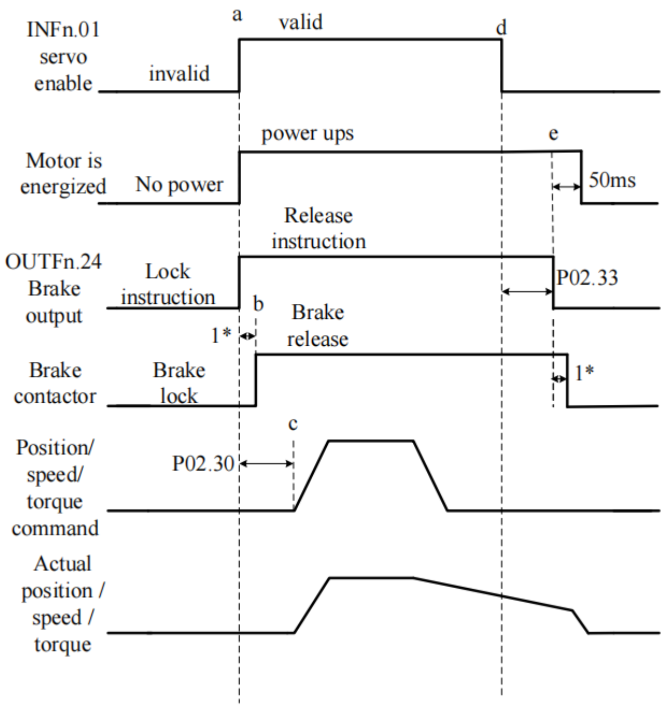
- Brake process under dynamic conditions

When the servo enable is turned from ON to OFF, if the current motor speed is greater than 20rpm, the drive will execute the dynamic brake process. After the servo enable is turned off, the servo always detects the following two conditions, and if any one of the conditions is satisfied, it outputs the brake lock signal.

a. The filtered motor speed (P04.21) is lower than the brake zero speed threshold (P02.31);

b. Start timing when the servo enable turns from ON to OFF, and the time exceeds the effective maximum waiting time of the holding brake (P02.33).

After outputting the brake lock signal, the servo will continue to be powered for 50ms.



Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P02.30	After the brake release command is output, the command input is delayed	0~32767	ms	The servo drive starts to receive the enable signal, and after the time of P02.30, it starts to receive the position/speed/torque command, and the motor starts to rotate.	anytime	Immediately	250	RW
P02.31	Brake zero speed threshold	0~32767	rpm	When the motor speed is lower than P02.31, the brake lock signal is output	anytime	Immediately	30	RW
P02.32	Power-on hold time	0~32767	ms	After outputting the brake lock signal, the servo will continue to maintain the power-on time P02.32. This parameter is only used when the brake output function is valid.	anytime		150	RW

P02.33	The maximum waiting time of the brake signal output	0~32767	ms	When the servo enable is turned from ON to OFF, the timing starts. If the time exceeds P02.33, the brake lock signal is output.	anytime	Immediately	500	RW

7.3 Description of dynamic braking function

The servo driver of VEC E1 and E2 structure types (see 2.1.1 Driver Appearance) has the function of dynamic braking inside. After the driver is powered on, the servo driver will detect the DC bus voltage in real time. When the DC bus voltage reaches a specific value, the servo driver will short-circuit the U and V phases in the motor phase sequence through the pull in and turn off of the relay.

When the servo driver detects that the DC bus voltage is more than 70% of the rated voltage, the relay will be disconnected. At this time, the U and V phases are open circuited. When it detects that 65%~70% of the rated voltage, the relay will remain in the previous working state. If the relay was pulled in before, it will also remain in the pulled in state. If the previous state is disconnected, it will also remain in the disconnected state. When it detects that the DC bus voltage is less than 65% of the rated voltage, The driver will short-circuit the U and V phases of the motor phase sequence through the relay pickup, thus greatly reducing the braking time.

7.4 Introduction of STO safety terminal

Note: The driver with STO function needs to be ordered, and this function is non-standard, but the general servo driver does not have this function.

Pin description of servo STO safety terminal

Pin number	dafult	describe
1	COM	STO reference ground
2	STO2	Control input of STO2
3	STO1	Control input of STO1
4	24V	24V internal power supply

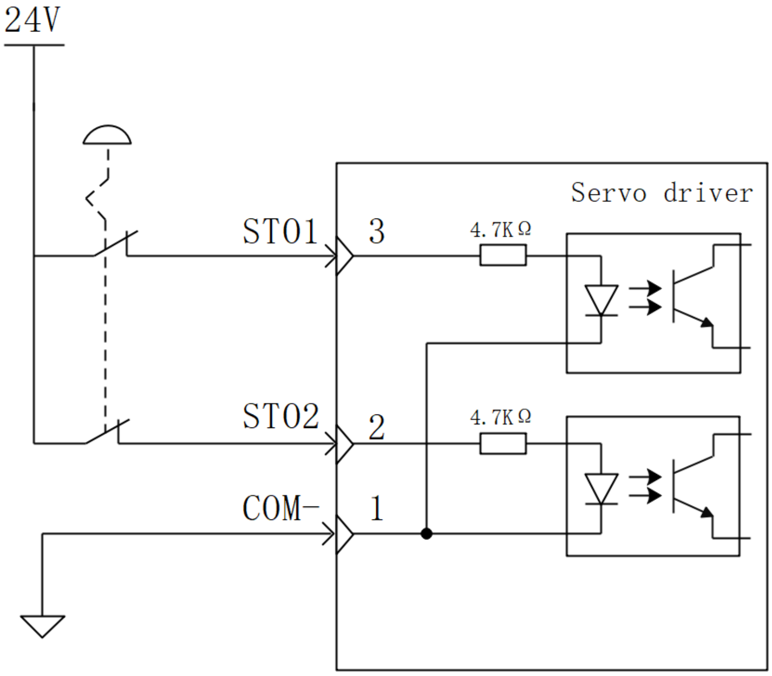
Two independent inputs are configured as two-channel inputs of STO function:

STO1/STO2.

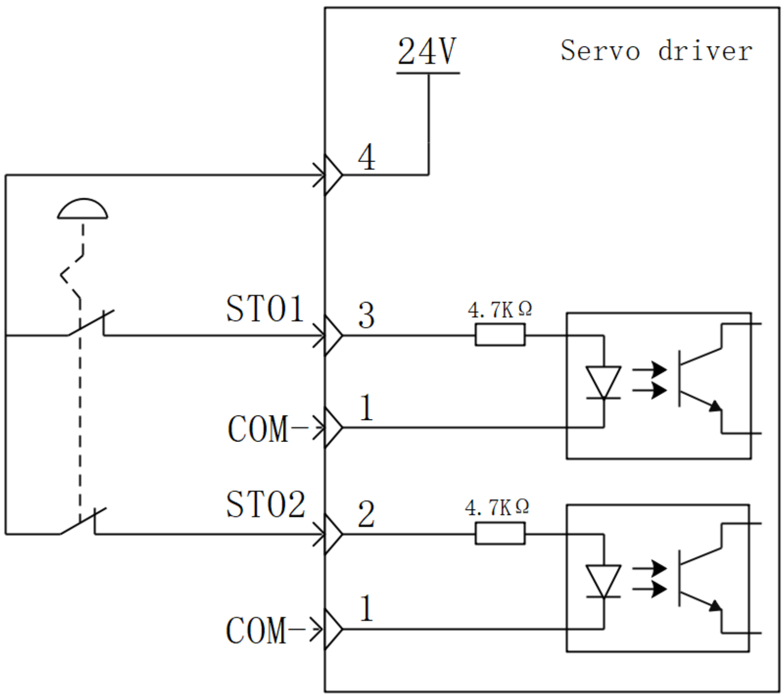
In order to be more humanized in the debugging process, pins with power supply voltage (+24V) are added.

The STO function of CN4 port is turned on by default. If a safety circuit is installed, but STO function is not needed, it is necessary to connect STO1/STO2 to 24V.

Example diagram of external 24 connection:



Example diagram of internal 24V connection:



7.5 Instructions for the use of absolute value encoder

The absolute value encoder not only detects the position of the motor within one rotation, but also counts the number of rotations of the motor. It can memorize 16-bit multi-turn data, and the single-turn resolution has two types: 17-bit and 24-bit. A single revolution with 17-bit resolution produces 131,072 encoded values, and a single revolution with 24-bit resolution produces 16,777,216 encoded values. The absolute value system has incremental use mode and absolute value use mode, which can be modified by P00.18. Incremental use mode uses the absolute encoder as an incremental encoder, without battery, without memorizing the number of turns, and it needs to return to zero every time. In the absolute value mode, the battery needs to be added, and the number of turns will also be memorized. It only needs to perform the zero return once, but the motor stroke is limited. Specifically, after the encoder is connected to the battery for the first time, the motor will be based on this. , the maximum can only be rotated forward 32767 circles, and the maximum can only be reversed 32767 circles, otherwise the encoder overflow fault will be reported.

For the absolute value use mode of the absolute value system, when the battery is powered on for the first time, the drive will report Er.227 (battery power failure fault). Record the mechanical zero offset (that is, the distance between the mechanical zero position and the encoder zero position). At this time, the mechanical position and the encoder position have the following relationship:

Mechanical position = Encoder position - Mechanical zero point offset

It should be noted that when using an incremental encoder, the encoder position will automatically return to zero after returning to zero, that is, the mechanical position and the encoder position are the same after returning to zero. However, using an absolute encoder, after returning to zero, the encoder position does not return to zero. At this time, the mechanical position and the encoder position are different from the mechanical zero offset. The command value in the multi-segment position command mode refers to the mechanical position, and the unit is the user position unit.

When the battery voltage is too low, the driver will report Er.605 (battery voltage is too low fault). At this time, the battery needs to be replaced when the driver is powered on.

Related parameters are as follows:

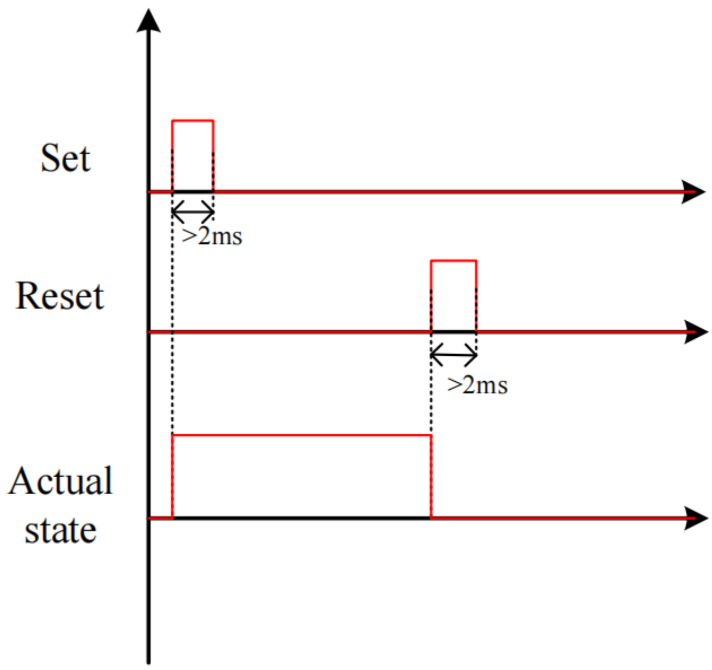
Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P00.08	Encoder type 0:Incremental encoder ABZ with UVW; 1:17-bit absolute value of Tamagawa multi-turn; 2:24-bit Nikon multi-turn absolute	0~12	ms		Stop to setting	Reset takes effect	0	RW

	value; 3:reserve 4:Rotary encoder to incremental; 5:Line-saving encoder; 6:23-bit absolute value of Tamagawa multi-turn; 7:23-bit absolute value of Tamagawa lap; 8:17-bit Tamagawa single lap, absolute value; 9:Incremental encoder ABZ without UVW; 10:12-bit SPI resolver; 11:14-bit resolver; 12:BISS-C							
P00.18	Absolute value system usage patterns 0:Incremental mode 1:Absolute value mode	0~1	-		anytime	Immediately	0	RW
P00.37	Mechanical zero offset low 32 bits	0~4294967296	-		/	/	/	RO
P00.39	Mechanical zero offset high 32 bits	0~4294967296	-		/	/	/	RO
P00.41	Absolute encoder battery failure alarm shield BIT0: Shield battery alarm BIT1: Shield battery failure	0~ 3	-		/	/	/	RO
P03.90	actual mechanical position	-2147483648~2147483648	user position unit		/	/	0	RO

7.6 Other auxiliary functions

7.6.1 Internal flip-flop function

There is a software trigger inside the servo. The software trigger is realized by MCU software scanning. The trigger has a reset (clear) input function bit INFn.59, a set input function bit INFn.60, and a status output function bit. OUTFn.30. The timing of the three is shown in the figure below. It should be noted that the internal trigger is implemented by software scanning, therefore, the pulse width of all trigger signals must be greater than 2ms.



Related input function bits.

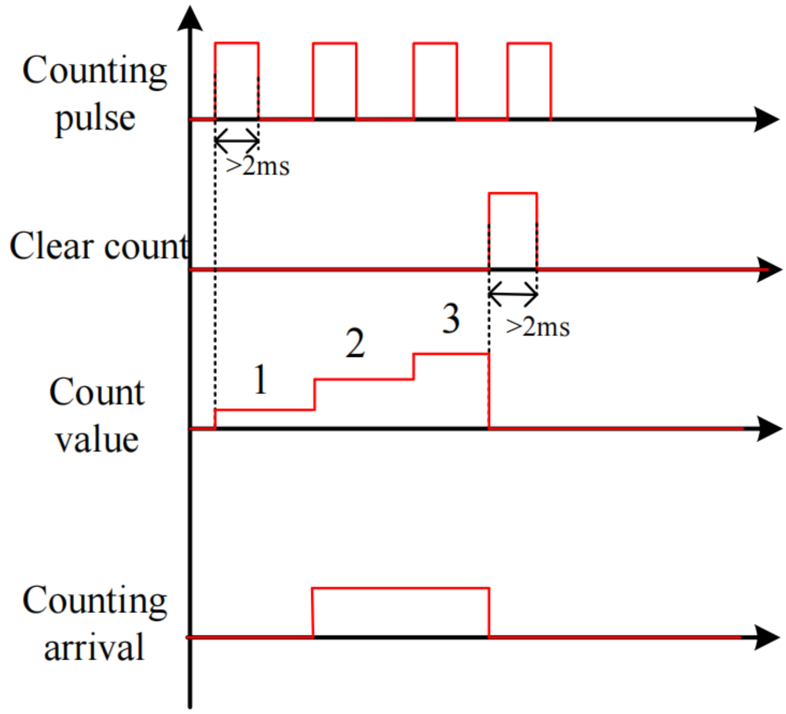
Function bits	Bit description
INFn.59	The rising edge resets the output OUTFn.30 of the internal flip-flop
INFn.60	The rising edge sets the output OUTFn.30 of the internal flip-flop

Related output function bits.

Function bits	Bit description
OUTFn.30	The output of the internal flip-flop

7.6.2 Software counter function

A software counter is implemented inside the servo. The software counter is realized by MCU software scanning. The counter has a count pulse input bit INFn.61, a count clear input function bit INFn.62, and a status output function bit OUTFn.31. The timing of the three is shown in the figure below, where the count arrival register P02.39 is set to 2. The count value P02.37 counts the pulse signal. When the count value P02.37 reaches the count reach value P02.39, the count reach signal OUTFn.31 is valid. The count value clear pulse INFn.62 clears the count value. It should be noted that the internal counter is implemented by software scanning, therefore, the pulse width of all trigger signals must be greater than 2ms.



Related input function bits.

Function bits	Bit description
INFn.61	Count pulse input of internal software counter
INFn.62	Rising edge clears the count value of the internal software counter

Related output function bits.

Function bits	Bit description
OUTFn.31	Internal counter counts up to output

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Function	Set method	Effective way	Defaults	read and write method
P02.37	Internal software counter count value	0~2147483647	-	This value is read-only. Double-byte	-	-	-	RO

				parameter, and power-down retention				
P02.39	Internal software counter reached value	0~2147483647	-	Double-byte parameter. When the count value P02.37 reaches the count reach value P02.39, the count reach signal OUTFn.31 is valid.	anytime	Immediately	0	RW

7.6.3 U disk update/save parameter function

The servo can save all the parameters inside the servo to the U disk through the USB interface, or update the parameters in the U disk to the servo through the USB interface.

The operation steps for saving parameters to the U disk are:

① Set the startup option P02.09=1.xx (save the servo parameters to the U disk before startup, the file name is xx, xx can be any number)

② Insert U disk

③ After restarting the servo again, the parameters will be saved to the U disk, and the file name is fixed as PARAxx.CSV. If there is a PARAxx.CSV file in the U disk, it will be automatically replaced. The servo will enter the rdy state only after the file is saved.

The operation steps for updating parameters from the U disk are:

① First set the startup option P02.09=2.xx (update the parameters in the U disk to the servo before startup, the file name is xx, and xx is the number in the parameter file name).

② Insert U disk

③ After restarting the servo again, the parameters in the PARAxx.CSV file in the U disk will be updated to the servo, and the servo will enter the rdy state after completion.

<u>Note: U disk must be formatted as FAT32 file system to operate</u>

Chapter 8 Adjustment

8.1 Control loop gain adjustment

Control loop gains include velocity loop proportional gain, velocity loop integral gain, and position loop proportional gain. There are six types of control loop gain adjustment modes. The gain can be adjusted by selecting one of the modes. The first type, the first set of gains is fixed. The second type, the first set of gain and the second set of gain are switched. The third is to automatically calculate a suitable set of gains for normal mode according to the set stiffness level. Fourth, according to the set rigidity level, a set of suitable gains for positioning mode is automatically calculated. The fifth type is to automatically calculate the gain by setting the speed loop and position loop bandwidth. The sixth type, adjust according to the adjustment-free parameter P07.78.

The first type, the first set of gains is fixed: in this mode, the user can manually modify the three values of P07.03, P07.04, and P07.05 to optimize the control performance.

The second type, switching between the first set and the second set of gains: switch between the first set of gains and the second set of gains according to the switching condition P07.24 and other switching related parameters.

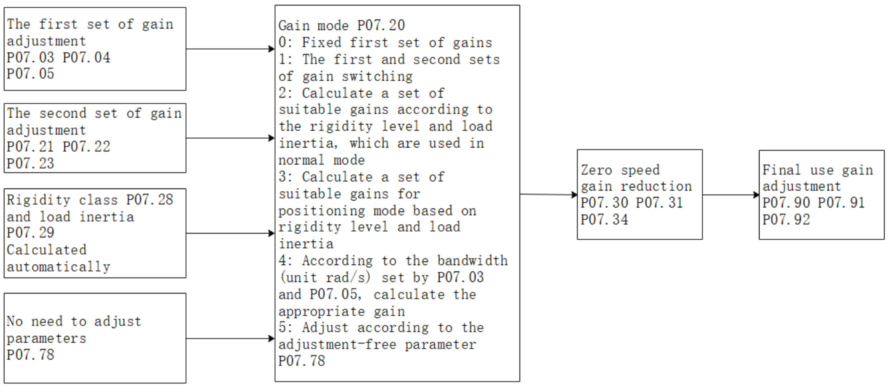
The third and fourth modes automatically calculate a set of suitable gains according to the set rigidity level and the self-learned load inertia. The difference between the two is that the gain calculated by the third mode is mainly used for ordinary mode, the gain calculated in the 4th mode is mainly used in the positioning mode.

The fifth type is to automatically calculate the gain by setting the speed loop and position loop bandwidth.

The sixth type, the adjustment-free function. Adjust the gain according to the adjustment-free parameter P07.78.

When using the 3rd/4th/5th/6th gain adjustment method, you must set the motor rated current P00.01, the motor rated torque P00.25, the motor rotor inertia P00.27, the load inertia ratio 07.29, and the drive rated current P01. 03.

In addition, the servo driver has a zero-speed gain attenuation/amplification function, that is, when the motor speed is less than the zero-speed attenuation threshold P07.32, the speed loop proportional gain/integral gain, position loop proportional gain, and current loop proportional/integral gain can be reduced or increased. up to a certain percentage. The zero-speed gain attenuation can effectively avoid the high-frequency vibration of the motor at zero speed. The zero-speed gain amplification can effectively speed up the positioning time at low speed.



Gain switching example: when the gain switching condition P07.24=2, the gain switching level P07.25=2000, and the gain switching time lag P07.26=100, the gain switching conditions are: take the speed command as the basic switching condition, the speed command When rising, when the speed command is greater than 2100 (P07.25+P07.26), switch to the second set of gains; when the speed command decreases, when the speed command is less than 1900 (P07.25-P07.26), switch back to the first set of gains gain.

Remarks: The units of parameters P07.25 and P07.26 change according to the selection of P07.24 (gain switching condition).

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P07.01	Current loop proportional gain	-767	-	anytime	Immediately	100	RW
P07.02	Current loop integral gain	0~32767	-	anytime	Immediately	20	RW
P07.03	Speed loop proportional gain	0~32767	-	anytime	Immediately	600	RW
	Set the proportional gain of the speed loop. This parameter determines the response of the speed loop. The larger the value, the faster the response of the speed loop. However, if it is set too large, it may cause vibration, so attention should be paid to it. In position mode, if you want to increase the position loop gain, you need to increase the speed loop gain at the same time.						
P07.04	Speed loop integral gain	0~32767	-	anytime	Immediately	50	RW
P07.40	Speed loop differential gain	0~32767	-	anytime	Immediately	0	RW
P07.05	Position loop proportional gain	0~32767	-	anytime	Immediately	200	RW
	Sets the proportional gain of the position loop. This parameter determines the responsiveness of the position loop. Setting a larger position loop gain can shorten the positioning time. But be careful: setting too large may cause vibration.						

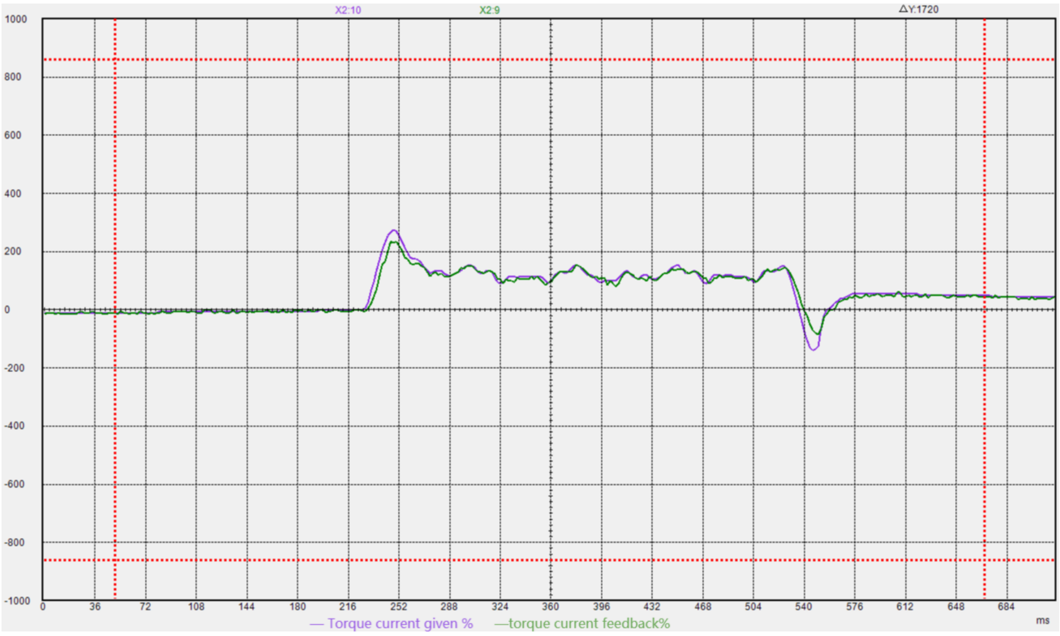
P07.06	Percentage of position loop maximum output speed	0~100.0%	-	anytime	Immediately	100%	RW
	Sets the maximum speed percentage for the position loop output						
P07.07	Output voltage filter time	0~32767	-	anytime	Immediately	0	RW
	Set the filter time of the voltage output to the motor						
P07.08	Torque feedforward filter time constant	0-63		anytime	Immediately	10	RW
	Set the torque feedforward filter time constant, the greater the inertia, the greater the value						
P07.09	Speed feedforward filter time constant	0-63		anytime	Immediately	10	RW
	Set the speed feedforward filter time constant. The larger the inertia, the larger the value.						
P07.10	Torque feedforward coefficient	0~32767	-	anytime	Immediately	0	RW
	In non-torque control mode, the torque feedforward signal is multiplied by P07.10, and the result is called torque feedforward, which is used as a part of the torque command.						
P07.11	Speed feed forward coefficient	0~300.0	-	anytime	Immediately	50.0	RW
	In position control mode and full closed loop function, multiply the speed feedforward signal by P07.11, and the result obtained is called speed feedforward, which is a part of the speed command.						
P07.12	Torque filter type 0-low pass filtering 1-notch filter 2-No filtering 3-Low pass and notch cascade 4-Automatic calculation of filter parameters	0~4	-	anytime	Immediately	0	RW
P07.20	Gain adjustment mode	0~5	-	anytime	Immediately	0	RW
	0-Fixed first set of gains: P07.03 to P07.05 1-First and second set gain switching 2-Determined according to rigidity level P07.28 and load inertia P07.29, used in normal mode 3-Determined according to rigidity level P07.28 and load inertia P07.29, used in positioning mode 4-Gain is automatically calculated based on the set bandwidth and inertia ratio 5-No adjustment required, control according to parameter P07.78						
P07.21	The second set of speed loop proportional gain	0~32767	-	anytime	Immediately	800	RW
P07.22	The second set of speed loop integral gain	0~32767	-	anytime	Immediately	10	RW
P07.23	The second set of position loop	0~32767	-	anytime	Immediately	200	RW

	proportional gain						
P07.24	Gain switching condition	0~7	-	anytime	Immediately	0	RW
	0-IO switching; INFn.41 switching, use the second set of gains when valid 1-When the torque command is large, switch to the second set of gains; when the torque command is greater than (gain switching level P07.25 + gain switching delay P07.26), switch to the second set of gains; torque command is less than (P07.25- P07.26), switch back to the first set of gains. 2-Switch to the second set of gains when the speed command is large; switch to the second set of gains when the speed command is greater than (P07.25+P07.26); switch back to the first set of gains when the speed command is less than (P07.25-P07.26) gain. 3-Switch to the second set of gains when the acceleration command is large; switch to the second set of gains when the acceleration command is greater than (P07.25+P07.26); switch back to the first set of gains when the acceleration command is less than (P07.25-P07.26) . 4-Switch to the second set of gains when the speed error is large; switch to the second set of gains when the speed error is greater than (P07.25+P07.26); switch back to the first set of gains when the speed error is less than (P07.25-P07.26) 5-Switch to the second set of gains when the position error after filtering is large; switch to the second set of gains when the position error after filtering is greater than (P07.25+P07.26); Switch back to the first set of gains 6-If positioning is completed, switch to the second set of gains, and switch to the first set of gains if no positioning is completed. 7-Motor phase switching gain; when the motor phase is in the range of (gain switching level ± gain switching time lag), switch to the second set of gains, and other phases switch to the first set of gains; the motor phase can be viewed through P09.39						
P07.25	Gain switching level	0~32767	-	anytime	Immediately	0	RW
	Set the level that satisfies the gain switching condition. The actual switching action is affected by the two conditions of level and time delay. According to the different gain switching conditions, the unit of switching level will change accordingly.						
P07.26	Gain switching time delay	0~32767	-	anytime	Immediately	0	RW
	Set the time delay that satisfies the gain switching condition. The generation of the actual switching action is jointly affected by the two conditions of level and time delay. According to the different gain switching conditions, the unit of the switching time delay will change accordingly.						
P07.27	Gain switching time constant	0~32767	ms	anytime	Immediately	10	RW
	In position control mode, if P07.23 (second position loop gain) is much larger than P07.05 (first position loop gain), set the time for switching from P07.05 to P07.23 after the switching action is generated.						
P07.28	Rigidity level	1~31	-	anytime	Immediately	10	RW
P07.29	Load inertia, obtained through inertia			anytime	Immediately	400	RW

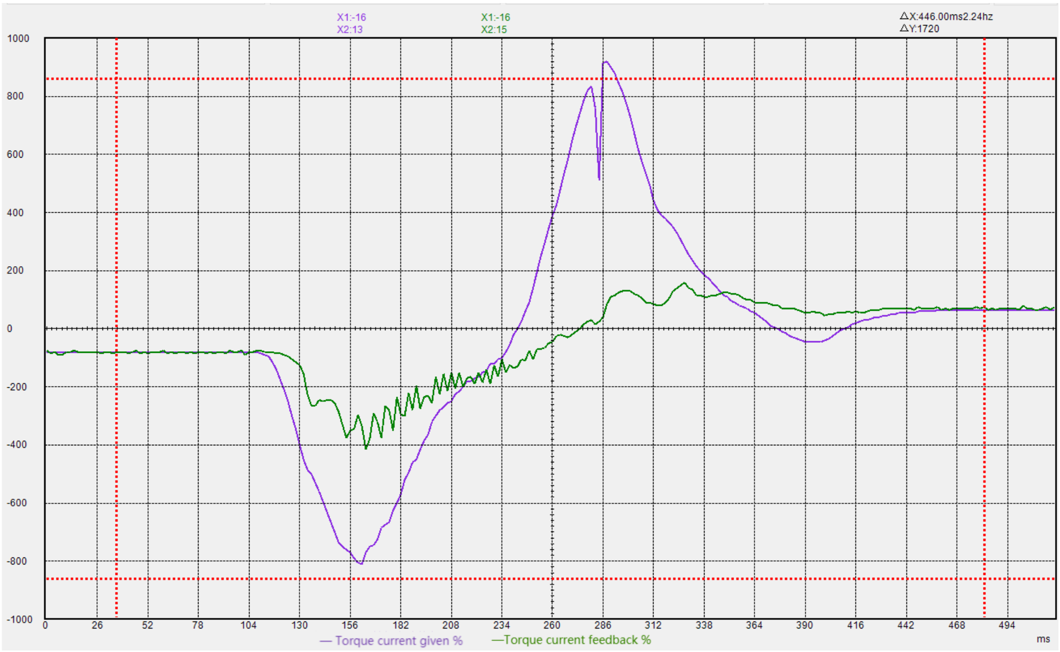
	self-learning						
P07.30	Zero speed speed gain reduction/amplification	0~3276.7	%	anytime	Immediately	50.0	RW
P07.31	Zero-speed position gain reduction/amplification	0~3276.7	%	anytime	Immediately	100.0	RW
P07.34	Zero-speed current gain reduction/amplification	0~3276.7	%	anytime	Immediately	100.0	RW
P07.32	Zero speed decay threshold	0~32767	rpm	anytime	Immediately	10	RW
	When the rotation speed is less than this value, the actual active speed loop proportional gain integral gain, position loop proportional gain, and current loop proportional gain integral gain are attenuated/amplified according to P07.30, P07.31, and P07.34 respectively.						
P07.33	Inertia self-learning acceleration and deceleration time	0~32767	ms	anytime	Immediately	500	RW
P07.35	Inertia learning option 0-After the inertia learning is completed, the speed and position loop gains are not automatically matched 1-After the inertia learning is completed, match a set of gains according to the rigidity level P07.28	0~1	-	anytime	Immediately	0	RW
P07.38	Vibration Monitoring Threshold Percentage	0~32767	%	anytime	Immediately	100	RW
P07.39	Vibration monitor value	-	-	-	-	-	RO
P07.78	No need to adjust parameters	0.0-3276.7	-	anytime	Immediately	4.1	RW
	A. B format A represents the stiffness, the setting range is 0-7. The larger the value, the greater the stiffness, generally set below 4. B represents the size of the load inertia, the setting range is 0-7. The larger the load inertia, the larger the value that needs to be set.						
P07.90	Actual speed loop proportional gain	-	-	-	-	-	RO
P07.91	Actual speed loop integral gain	-	-	-	-	-	RO
P07.92	Actual position loop proportional gain	-	-	-	-	-	RO

8.1.1 Current loop PI gain adjustment

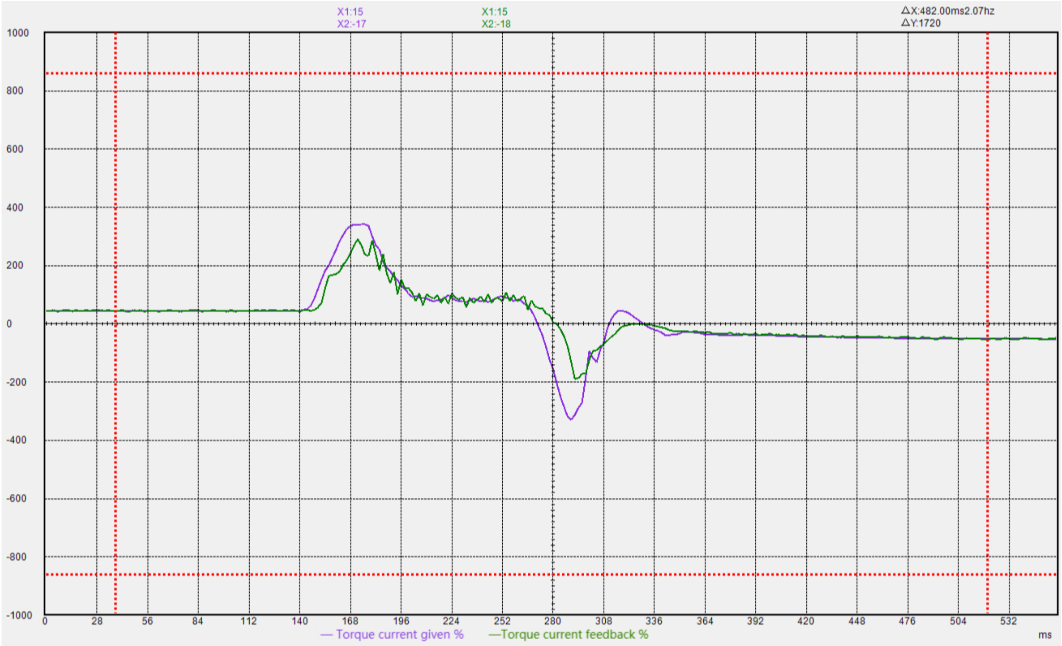
When the proportional gain of the current loop is too large, the motor will make a rattling sound, and the torque current feedback has high frequency oscillation, which often reports overcurrent. As shown in the picture below. (The more obvious is the current sound)



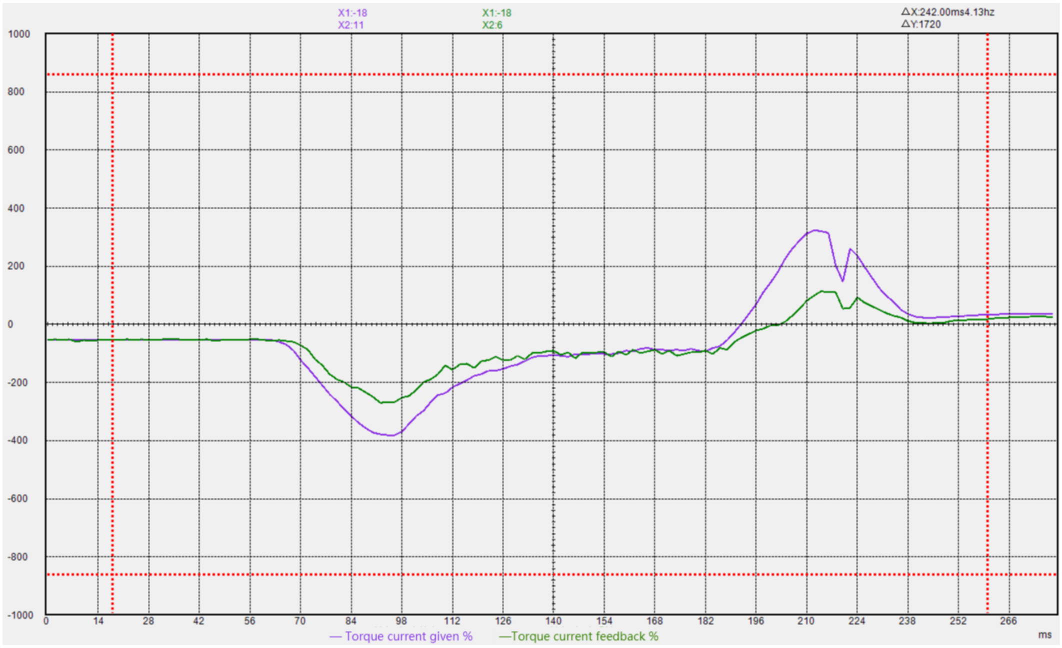
If the current loop proportional gain is too small, the motor current response is slow, and the output is not enough in the process of rapid acceleration and deceleration.



When the current loop integral gain is too large, the torque current is prone to low frequency oscillation, and overcurrent is likely to be reported during acceleration and deceleration.

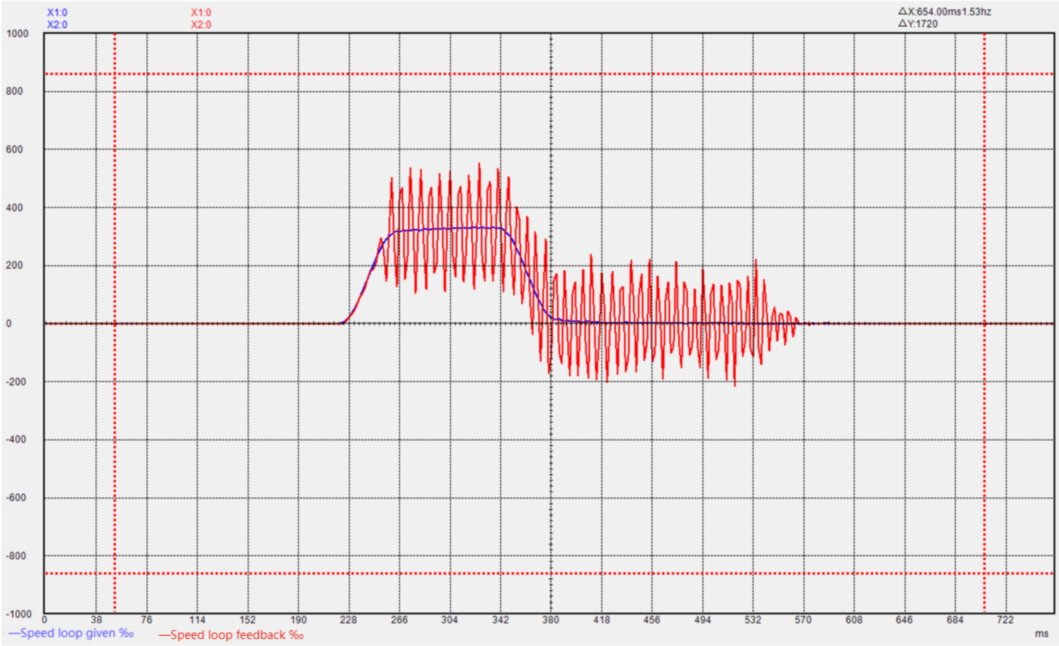


If the current loop integral gain is too small, the motor current response is slow, and the output is not enough in the process of rapid acceleration and deceleration.

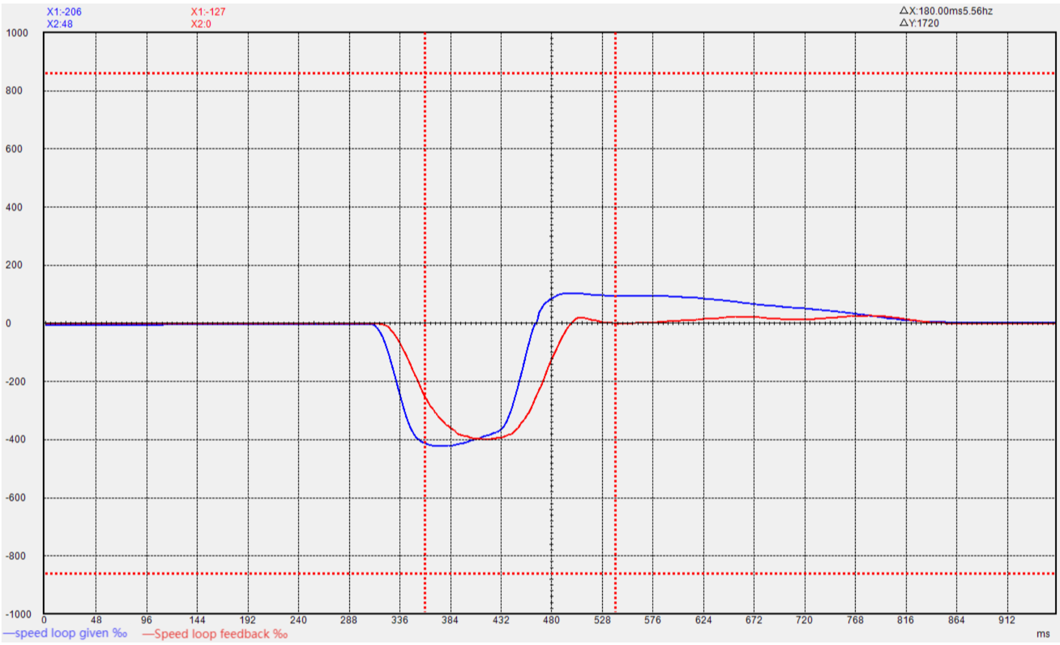


8.1.2 Speed loop PI gain adjustment

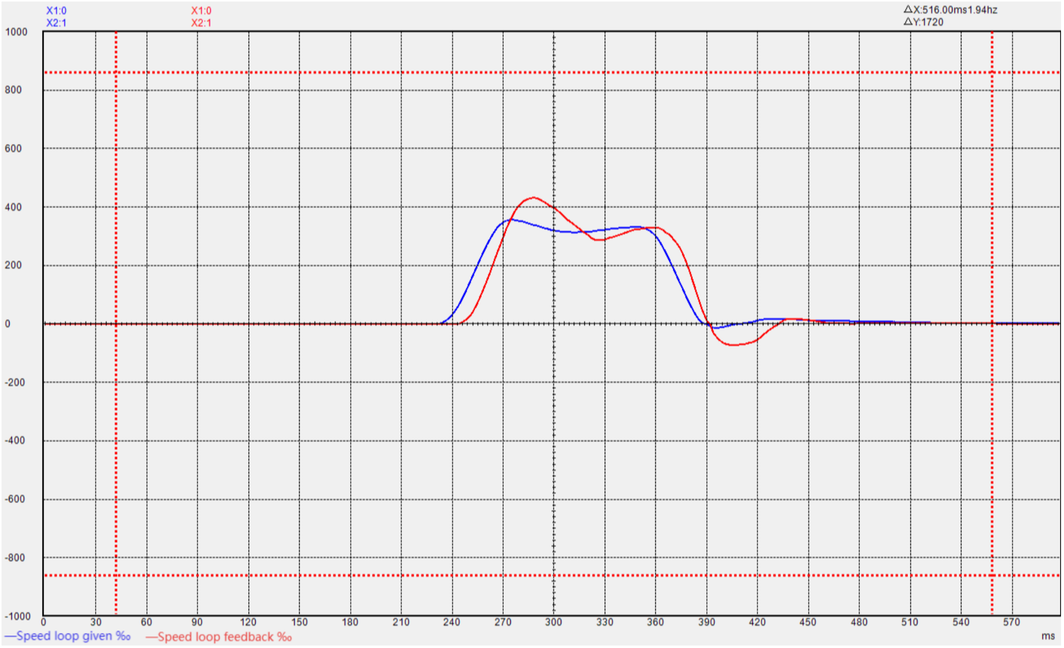
When the proportional gain of the speed loop is too large, the motor is prone to whistling, and the feedback of the speed loop has high frequency oscillation.



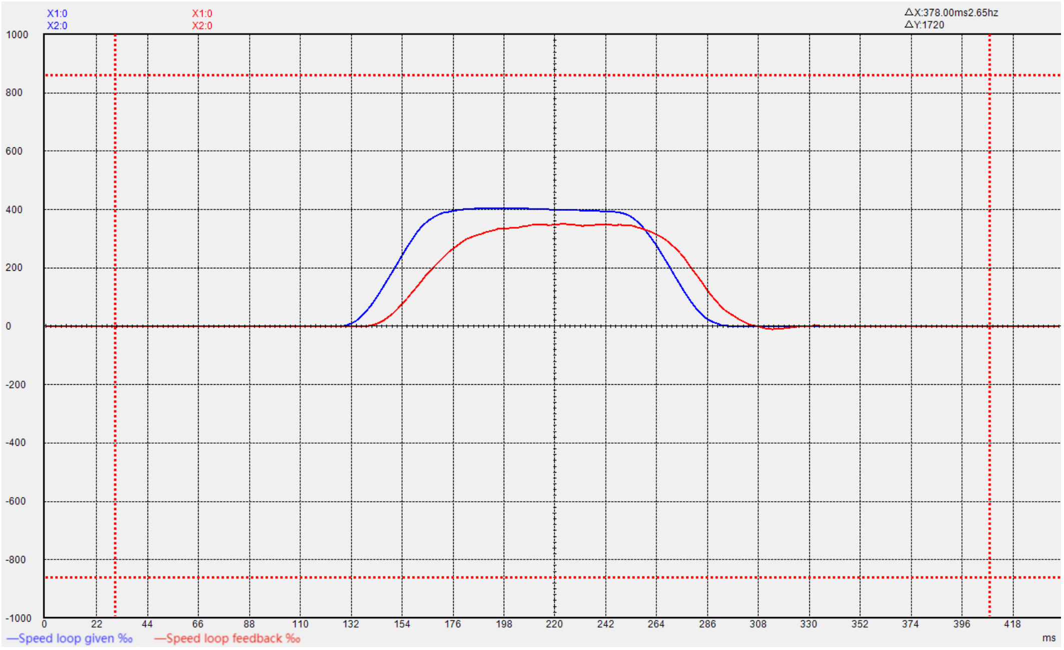
If the proportional gain of the speed loop is too small, the rigidity of the motor is very weak and the speed cannot follow.



When the integral gain of the speed loop is too large, the rigidity of the motor is enhanced, and the speed is prone to low-frequency fluctuations.

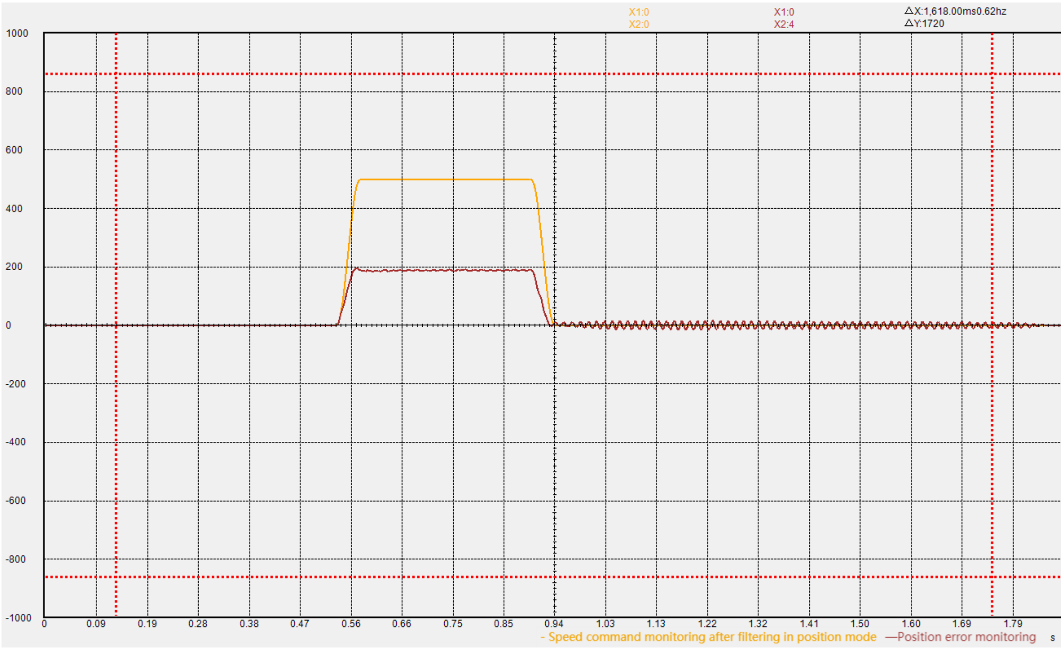


If the integral gain of the speed loop is too small, the rigidity of the motor is very weak and the speed cannot follow.

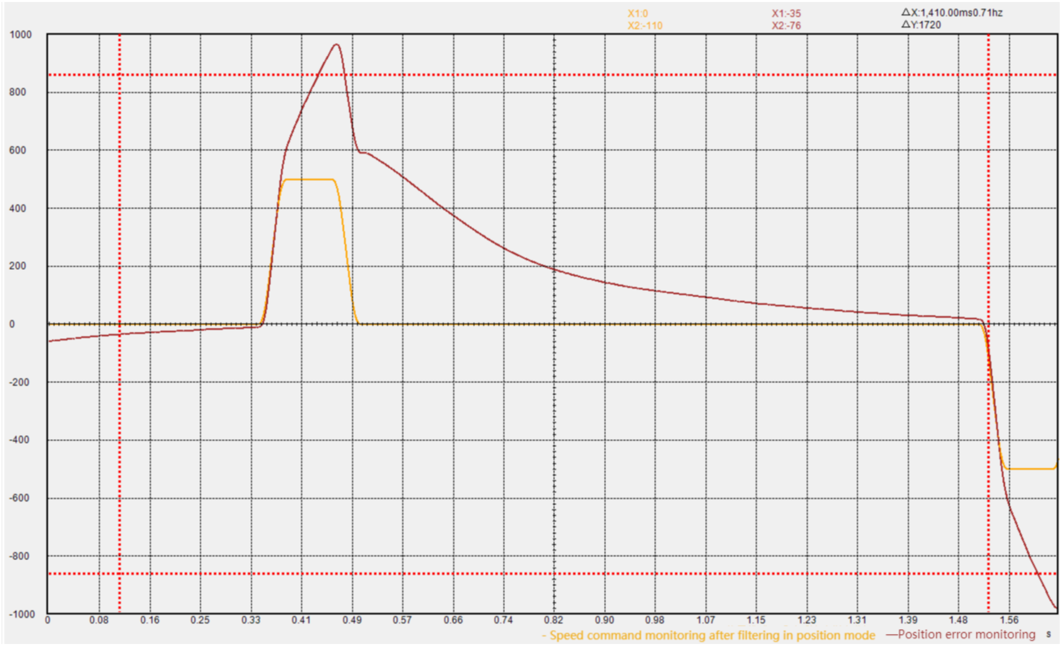


8.1.3 Position loop P gain adjustment

When the proportional gain of the position loop is too large, the motor speed is unstable and it is easy to shake.



When the proportional gain of the position loop is too small, the position arrives very slowly.



8.1.4 List of parameters that need to be adjusted in different gain gain adjustment modes

Gain adjustment mode	Adjustable speed loop/position loop parameters
P07.20=0	P07.03 （Speed loop proportional gain）P07.04（Speed loop integral gain） P07.05（Position loop proportional gain） P07.08 P07.10（Torque feedforward） P07.09 P07.11 （speed feedforward）
P07.20=1	P07.03 P07.04 P07.05P07.08 P07.09 P07.10 P07.11（First set of gains ） P07.21 P07.22 P07.23 P07.24 P07.25 P07.26 P07.27（Second set of gains）
P07.20=2/3	P07.28（Rigidity level） P07.29（ratio of load inertia） P07.08 P07.10 P07.41（Torque feedforward） P07.09 P07.11 （speed feedforward）
P07.20=4	P07.29（ratio of load inertia） P07.03（speed loop bandwidth）P07.04（Speed loop integral gain） P07.05（position loop bandwidth） P07.08 P07.10 P07.41（Torque feedforward） P07.09 P07.11 （speed feedforward）
P07.20=5	P07.78 （No need to adjust parameters） P07.11 P07.09（speed feedforward）

P07.20=0 or P07.20=4, these two modes have the highest adjustability, and the performance that can be adjusted is also the best, which requires a higher degree of user expertise. P07.20=5 This mode has the lowest adjustability and can only meet the general application requirements, and has low requirements for the user's professional level. P07.20=2 is used for Fn006 single parameter self-adjustment.

P07.11 sets the speed feedforward coefficient. If the system requires the follow-up error to be 0, that is, the position error needs to converge to 0 at constant speed, then the value needs to be set to 100.0%. Under normal circumstances, it is sufficient to set it to 50.0%.

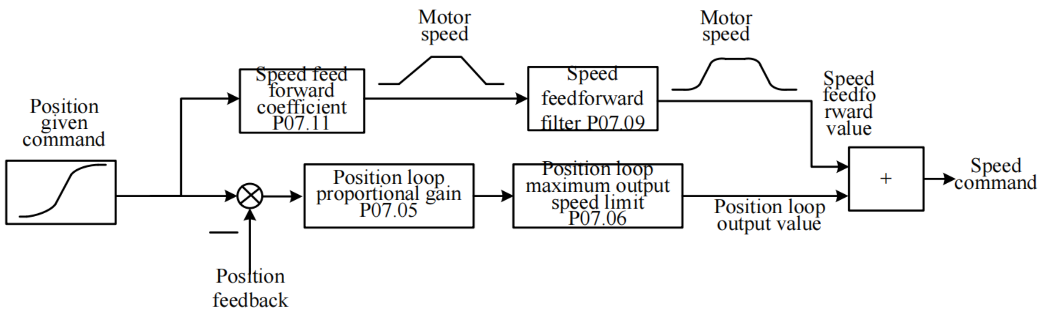
After self-learning the rigidity level through Fn006, if further fine-tuning is required, the bandwidth parameter corresponding to the rigidity level at this time can be set to P07.03, P07.04, P07.05, and P07.20 is set to 4, and then further Adjust P07.03-P07.05 for fine adjustment. When the rigidity level is converted into the corresponding speed loop bandwidth, integral gain, position loop when P07.20=4

Bandwidth is shown in the table below.

Rigidity level P07.28	Speed loop bandwidth (rad/s) P07.03	Speed loop integral gain P07.04	Position Loop Bandwidth (rad/s) P07.05		Rigidity level P07.28	Speed loop bandwidth (rad/s) P07.03	Speed loop integral gain P07.04	Position Loop Bandwidth (rad/s) P07.05
0	9	1	2		16	314	31	62
1	12	1	2		17	376	38	75
2	15	2	3		18	471	47	94
3	18	2	4		19	562	56	112
4	22	2	4		20	722	72	144
5	28	3	6		21	879	88	176
6	38	4	8		22	1067	106	213
7	47	5	9		23	1318	131	263
8	57	6	11		24	1570	157	314
9	69	7	14		25	1758	175	351
10	88	8	17		26	1964	196	392
11	113	11	23		27	2135	213	427
12	157	16	31		28	2323	232	464
13	188	19	38		29	2512	251	502
14	219	22	44		30	2826	282	565
15	251	25	50		31	3140	314	628

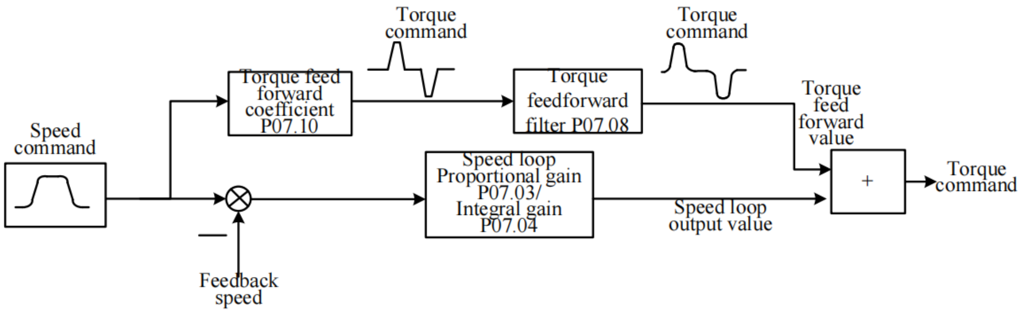
8.2 Feedforward gain adjustment

8.2.1 speed feedforward



Speed feedforward refers to the mathematical operation of the given position command to obtain the speed required by the motor, which is directly given to the speed loop. As shown in the figure above, the position command is input into the servo, and it is directly converted into the speed required by the motor. After filtering, it is superimposed on the speed command. Generally speaking, the speed feedforward coefficient is directly set to 50%, and the speed feedforward filter value is set according to the inertia, generally set to 0-20ms. The maximum output speed limit of the position loop means that the output of the position loop is limited within plus or minus percent P07.06. When the speed feedforward is set to 100%, the position error can converge to 0 when the speed is constant. When it is less than 100%, the position error will occur when the motor is moving.

8.2.2 Torque feedforward



Torque feedforward refers to the mathematical operation of the given speed command, combined with the load inertia, to obtain the torque that the motor needs to output, and directly superimpose it into the torque command. As shown in the figure above, the speed command is input into the servo, and is directly converted into the torque required by the motor according to the torque feedforward coefficient. After filtering, it is superimposed on the torque command. Generally speaking, the torque feedforward coefficient is determined by the load inertia. The larger the load inertia is, the larger the value will be. This value can be obtained through Fn007 to learn the habit. The torque feedforward filter is also determined by the load inertia, which is generally set to 5-20ms.

When P07.20=0 or 1, the torque feedforward coefficient is equal to the value set by P07.10. When P07.20=2 or 3 or 4, the torque feedforward coefficient adopts the value set by P07.10*P07.41/100. When P07.20=5, the torque feedforward is invalid.

8.3 Filter time adjustment

There are three filter times related to loop control, one is the torque filter time. Under normal circumstances, the torque filter is set to a low-pass filter (P07.12=0). At this time, the larger the torque filter time constant P07.13, the smoother the torque command, which can reduce the high-frequency noise of the motor and bring about The side effect is easy to produce low frequency vibration. This value needs to be increased when the inertia is large.

The second is the speed feedforward filter time. When in position mode, if the position command pulse frequency is low, and the position command filter parameters P03.06 and P03.07 are both 0, the speed feedforward filter needs to be added. It can reduce the speed pulsation of the position command and reduce the noise of the motor. The speed feedforward filter time P07.09 is generally set at about 0-20.

The third one is the torque feedforward filter time P07.08. When there are too many high-frequency components of the torque command, this value needs to be increased, generally set at around 5-20.

8.4 Load torque compensation function

VC330 servo provides 3 kinds of load torque compensation modes, and 3 kinds of compensation modes are set by P07.50. When P07.50 is set to 0, the load torque compensation is derived from the fixed value of P07.53. When P07.50 is set to 1, the servo automatically observes the load torque value according to the relevant variables (focusing on stability). When P07.50 is set to 2, the servo automatically observes the load torque value according to the relevant variables (focusing on the response), and then to compensate.

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P07.50	Torque Compensation Mode	0~2	-	anytime	Immediately	0	RW
	0-Torque compensation is derived from the fixed value P07.53 1-Automatic compensation (focus on stability, adjust P07.43, P07.54, P07.51, P07.52) 2-Automatic compensation (focus on response, adjust P07.43, P07.54)						
P07.43	Torque compensation gain 1	10~1000	-	anytime	Immediately	100	RW
P07.89	Torque compensation gain 2	10~1000	-	anytime	Immediately	100	RW
P07.51	Torque Compensation Frequency Compensation	-1000.0~1000.0	%	anytime	Immediately	0	RW
P07.52	Torque Compensation Inertia Compensation	1~1000	-	anytime	Immediately	100	RW
P07.53	Fixed torque compensation value	-3276.7~3276.7	%	anytime	Immediately	0	RW
P07.54	Torque Compensation Percentage	0~100	%	anytime	Immediately	100%	RW
P07.93	Final calculated torque compensation value	-	%	-	-	0	RO

8.5 Mechanical resonance suppression function

If the mechanical characteristics of the equipment have a resonance point at a certain frequency, when the gain is increased, it may cause the motor to resonate, and the resonance frequency is generally above 200Hz. In this case, the servo notch filter + torque low-pass filter can be used to solve the problem. The servo provides 4 sets of notch filters (acting on the position loop) and a set of torque low-pass filters to suppress the resonance signal. When P07.12 is set to 0, a low-pass filter is used alone to suppress resonance. When P07.12 is set to 1, a notch filter is used alone to suppress resonance. When P07.12 is set to 3, a low-pass filter and a notch filter are used for resonance suppression. When P07.12 is set to 4, once the servo detects oscillation greater than 200Hz, it will automatically turn on a low-pass filter and a notch filter to suppress the resonance. The vibration detection threshold is set by P07.38. The smaller the value is, the more sensitive it is to vibration and the easier it is to detect vibration. When high-frequency mechanical resonance occurs, it is preferred to use the method of automatically inputting the notch filter (P07.12 is set to 4). If it cannot be solved, P07.13-P07.19 and P07.44-P07.49 can be manually set.

Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P07.12	Torque filter type 0-low pass filtering 1-notch filter 2-No filtering 3-Low pass and notch cascade 4-Automatic calculation of filter parameters	0~4	-	anytime	Immediately	0	RW
P07.13	Torque low-pass filter time constant	0~327.67	ms	anytime	Immediately	0.80	RW
P07.14	The frequency of notch filter 1, when it is 0, the notch filter is invalid	0~32767	Hz	anytime	Immediately	0	RW
P07.15	notch filter 1 depth	0~100.0	%	anytime	Immediately	10.0	RW
P07.16	notch filter 1 width	0~1000.0	%	anytime	Immediately	50.0	RW
P07.17	The frequency of notch filter 2, when it is 0, the notch filter is invalid	0~32767	Hz	anytime	Immediately	0	RW
P07.18	notch filter 2 depth	0~100.0	%	anytime	Immediately	10.0	RW
P07.19	notch filter 2 width	0~1000.0	%	anytime	Immediately	50.0	RW
P07.44	The frequency of notch	0~32767	HZ	anytime	Immediately	0	RW

	filter 3, when it is 0, the notch filter is invalid						
P07.45	notch filter 3 depth	0~100.0	%	anytime	Immediately	10.0	RW
P07.46	notch filter 3 width	0~1000.0	%	anytime	Immediately	50.0	RW
P07.47	The frequency of notch filter 4, when it is 0, the notch filter is invalid	0~32767	HZ	anytime	Immediately	0	RW
P07.48	notch filter 4 depth	0~100.0	%	anytime	Immediately	10.0	RW
P07.49	notch filter 4 width	0~1000.0	%	anytime	Immediately	50.0	RW

8.6 Low frequency vibration suppression

When the motor drives a large inertia flexible load for high-speed positioning, if there is continuous low-frequency vibration below 50Hz. It can be processed by the low frequency vibration suppression function of the servo and the position command filter function. The servo provides 1 set of low frequency suppression notch filter (acting on the speed loop), 1 set of position command notch filter and 1 set of position command low pass filter to deal with the relevant low frequency vibration. The frequency of the low frequency resonance can be analyzed by VECObserver.

It should be noted that if the filter of the position command is increased, the motor motion will lag, thereby increasing the position error during tracking, and it may report that the position error is too large Er203. At this time, the position error threshold needs to be appropriately increased.

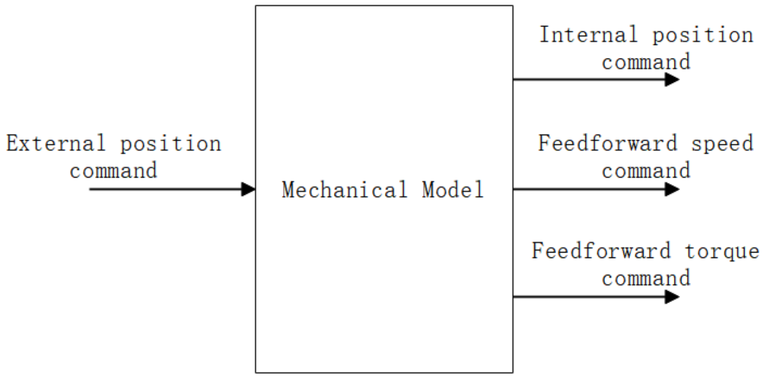
Related parameters are as follows.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P07.55	The frequency of the notch filter for low frequency suppression. When it is 0, the notch filter is invalid.	0~100.0	-	anytime	Immediatel y	0	RW
P07.56	Low Frequency Rejection Notch Width	0~1000.0	-	anytime	Immediatel y	50.0	RW
P07.57	Low Frequency Rejection Notch Depth	0~100.0	-	anytime	Immediatel y	10.0	RW
P07.58	Position command notch filter frequency, when it is 0, the notch filter is	0~100.0	-	anytime	Immediatel y	0	RW

	invalid						
P07.59	Position command notch filter width	0~1000.0	-	anytime	Immediately	0.0	RW
P07.60	Position command notch filter depth	0~100.0	-	anytime	Immediately	0.0	RW
P03.07	Position given low pass filter time constant	0~100.0	-	anytime	Immediately	10	RW
P03.19	Excessive position error value, when set to 0, there is no excessive position error protection	0~2147483648		anytime	Immediately	10	RW

8.7 Model Predictive Control Capability

Model predictive control means that the system directly calculates the new position command, speed command, and torque command feed forward to the position loop, speed loop, and torque loop according to the external position command, combined with the built-in mechanical model.



Under position mode control, the servo presets 4 model predictive control methods, namely single inertia model predictive control, dual inertia model predictive control, single inertia model predictive control (no model predictive position command filtering), dual inertia model predictive control (model-free predicted position command filtering). Single inertia system refers to the rigid connection between the motor and the load, such as screw connection. The dual inertia system refers to the connection between the motor and the load with less rigidity, such as the pulley connection. The 4 model control modes are selected by the first bit of P07.61. The factory default does not use model predictive control, but uses ordinary feedforward control. When the model predictive control is enabled, the ordinary speed feedforward P07.10 and torque feedforward P07.11 are invalid. The relevant parameters of model predictive control are as follows.

Parameter No.	Parameter Description	Set range	units	Set method	Effective way	Defaults	read and write method
P07.61	Advanced control function selection	0.0~3276.7	-	anytime	Immediately	0	RW
	AAA.B format When AAA=0, the common feedforward control is adopted, and the feedforward is controlled by P07.10, P07.11, etc. When AAA=1, single-inertia model predictive control is used. When AAA=2, dual inertia model predictive control is adopted. When AAA=3, single-inertia model predictive control (no model predictive position command filtering) is used. When AAA=4, the dual-inertia model predictive control (without model predictive position command filtering) is used. When B=0, there is no continuous vibration suppression function. When B=1, the continuous vibration suppression function is enabled.						
P07.62	Model prediction gain	1.0~2000.0	-	anytime	Immediately	50.0	RW
P07.63	Model Prediction Compensation	50.0~200.0	-	anytime	Immediately	100.0	RW
P07.64	Model predicts positive gain	0~1000.0	-	anytime	Immediately	100.0	RW
P07.65	Model predicts inverse gain	0~1000.0		anytime	Immediately	100.0	RW
P07.66	Model predicts suppression frequency 1	1.0~250.0	-	anytime	Immediately	50.0	RW
P07.67	Model predicts suppression frequency 2	1.0~250.0		anytime	Immediately	70.0	RW
P07.68	Model predicts feedforward velocity	0~1000.0		anytime	Immediately	100.0	RW
P07.69	Model predicts 2 gain	1.0~2000.0	-	anytime	Immediately	50.0	RW
P07.70	Model Prediction 2 Compensation	50.0~200.0	-	anytime	Immediately	100.0	RW

Chapter 9 Parameter List

function code group	Summary of parameter groups
Group P00	Motor and Encoder Parameters
Group P01	Drive hardware parameters
Group P02	Basic control parameters
Group P03	position mode parameter
Group P04	Parameters related to the speed mode
Group P05	Related parameters of torque mode
Group P06	DIDO AIAO's related parameters
Group P07	loop control parameters
Group P08	Communication parameters
Group P09	Advanced debugging parameters
Group P10	Fail safe parameters
Group P11	Multi-speed parameters
Group P12	Virtual DI DO parameters
Group P13	Multi-segment position parameters

●Explanation of parameter setting method and effective method:

Zero speed setting: This parameter can only be modified when the motor is in zero speed state.

Stop to setting: Indicates that this parameter is read-only when enabled, and can only be modified when disabled.

anytime: Indicates that this parameter can be set at any time after power-on.

Immediately : Indicates that the parameter can be modified when the machine is running, that is, such parameters can be modified in any state, and will take effect immediately after the modification is completed.

Reset effective: Indicates that after the parameter is modified, the drive needs to be reset to take effect.

9.1 P00 group parameters - motor and encoder parameters

P00.01	Name	Rated current of motor			Set Moment	Stop to set	Access	RW
	Range	0~3276.7	Unit	A	active moment	Immediately	default	6.0
This parameter is password protected.								

P00.02	Name	Rated speed of the motor	Set method	Stop to set	Access	RW

	Range	1~32767	Unit	rpm	active moment	Immediately	default	3000

P00.03	Name	Maximum speed of the motor			Set method	Stop to set	Access	RW
	Range	1~32767	Unit	rpm	active moment	Immediately	default	3000

P00.04	Name	The direction of motor rotation			Set method	Stop to set	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	1

Setting	Direction of rotation
0	The positive speed of the motor is defined as the clockwise rotation direction of the motor (looking at the motor shaft)
1	The positive speed of the motor is defined as the counterclockwise rotation direction of the motor (looking at the motor shaft)

After setting this parameter, the encoder must be re-learned before it can run. Please connect the UVW power cable of the motor according to the manufacturer's standard, otherwise the rotation direction of the motor may be reversed.

P00.05	Name	Number of pole pairs of the motor			Set method	Stop to set	Access	RW
	Range	1~32767	Unit	-	active moment	Immediately	default	4

P00.06	Name	Motor ID			Set method	Stop to set	Access	RW
	Range	1~32767	Unit	-	active moment	Immediately	default	0

P00.08	Name	Type of motor encoder			Set method	Stop to set	Access	RW
	Range	0~12	Unit	-	active moment	Immediately	default	0

Setting	Type of motor encoder
0	Incremental encoder ABZ with UVW
1	17-bit absolute value of Tamagawa multi-turn

2	24-bit Nikon multi-turn absolute value
3	reserve
4	Rotary encoder to incremental
5	Line-saving encoder
6	23-bit absolute value of Tamagawa multi-turn
7	23-bit absolute value of Tamagawa lap
8	17-bit Tamagawa single lap, absolute value
9	Incremental encoder ABZ without UVW
10	12-bit SPI resolver
11	14-bit resolver
12	BISSC

P00.09	Name	Motor encoder hardware filter settings			Set method	Stop to set	Access	RW
	Range	1~32767	Unit	20ns	active moment	Immediately	default	20

P00.10	Name	Motor encoder software filter time			Set method	Stop to set	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	5

P00.11	Name	Motor encoder resolution			Set method	Stop to set	Access	RW
	Range	100~2147483647	Unit	-	active moment	Immediately	default	10000

P00.13	Name	Motor encoder position (encoder unit)			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P00.15	Name	The detected encoder resolution			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

P00.17	Name	Motor encoder Hall code value			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P00.18	Name	Absolute value system mode			Set method	Stop to set	Access	RW
	Range	0-Increment 1-absolute value	Unit	-	active moment	Take effect after power on	default	0

P00.19	Name	Motor encoder speed sampling period			Set method	Stop to set	Access	RW
	Range	0-7	Unit	-	active moment	Take effect after power on	default	0
	0- incremental 250us , Tamagawa 300us , Nikon 200us; 1- incremental 500us , Tamagawa 360us , Nikon 240us; 2- incremental 750us , Tamagawa 420us , Nikon 280us; 3- incremental 1000us , Tamagawa 480us , Nikon 320us; 4- incremental 50us , Tamagawa 60us , Nikon 40us; 5- incremental 100us , Tamagawa 120us , Nikon 80us; 6- incremental 150us , Tamagawa 180us , Nikon 120us; 7- incremental 200us , Tamagawa 240us , Nikon 160us							

P00.20	Name	Stator resistance			Set method	Stop to set	Access	RW
	Range	0~327.67	Unit	Ω	active moment	Take effect after power on	default	-

P00.21	Name	D- axis inductance			Set method	Stop to set	Access	RW
	Range	0~327.67	Unit	mH	active moment	Take effect after power on	default	-

P00.22	Name	Q- axis inductance			Set method	Stop to set	Access	RW
	Range	0~327.67	Unit	mH	active moment	Take effect after power on	default	-

<table>
<tr><td rowspan="2">P00.23</td><td>Name</td><td colspan="3">Line back electromotive force</td><td>Set method</td><td>Stop to set</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~3276.7</td><td>Unit</td><td>V/ krpm</td><td>active moment</td><td>Take effect after power on</td><td>default</td><td>-</td></tr>
</table>

<table>
<tr><td rowspan="2">P00.24</td><td>Name</td><td colspan="3">Motor peak current percentage</td><td>Set method</td><td>Stop to set</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~3276.7</td><td>Unit</td><td>%</td><td>active moment</td><td>Take effect after power on</td><td>default</td><td>-</td></tr>
<tr><td colspan="9">This parameter is password protected.</td></tr>
</table>

<table>
<tr><td rowspan="2">P00.25</td><td>Name</td><td colspan="3">Motor rated torque</td><td>Set method</td><td>Stop to set</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~21474 836.47</td><td>Unit</td><td>NM</td><td>active moment</td><td>Take effect after power on</td><td>default</td><td>-</td></tr>
</table>

<table>
<tr><td rowspan="2">P00.27</td><td>Name</td><td colspan="3">Motor rotor inertia</td><td>Set method</td><td>Stop to set</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~21474 836.47</td><td>Unit</td><td>$Kgcm^2$</td><td>active moment</td><td>Take effect after power on</td><td>default</td><td>-</td></tr>
</table>

<table>
<tr><td rowspan="2">P00.29</td><td>Name</td><td colspan="3">Type of motor</td><td>Set method</td><td>Stop to set</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~2</td><td>Unit</td><td>-</td><td>active moment</td><td>Take effect after power on</td><td>default</td><td>0</td></tr>
</table>

Setting	Motor encoder type
0	Synchronous motor
1	Asynchronous motor
2	Linear motor

<table>
<tr><td rowspan="2">P00.30</td><td>Name</td><td colspan="3">Second encoder type</td><td>Set method</td><td>Stop to set</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~2</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Second encoder type

	0	Incremental encoder	
	1	Single-turn absolute encoder	
	2	Multi-turn absolute encoder	

P00.31	Name	Second encoder hardware filter setting			Set method	Stop to set	Access	RW
	Range	1~32767	Unit	20ns	active moment	Immediately	default	20

P00.32	Name	Second encoder software filter time constant			Set method	Stop to set	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	5

P00.33	Name	Second encoder resolution			Set method	Stop to set	Access	RW
	Range	100~ 2147483647	Unit	-	active moment	Immediately	default	1000 0

P00.35	Name	Second encoder position (Encoder Units)			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P00.37	Name	Mechanical origin offset lower 32 bits			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P00.39	Name	Mechanical zero point offset high 32 bits			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P00.41	Name	Absolute value system fault shielding			Set method	Stop to set	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0
The 0th bit shields the battery alarm; the 1st bit shields the battery failure								

P00.42	Name	Motor instantaneous current percentage	Set method	-	Access	RO

	Range	-	Unit	%	active moment	-	default	0

P00.43	Name	Motor instantaneous power percentage			Set method	-	Access	RO
	Range	-	Unit	%	active moment	-	default	0

P00.44	Name	Average load rate			Set method	-	Access	RO
	Range	-	Unit	%	active moment	-	default	0

P00.45	Name	Maximum motor current percentage in 1s			Set method	-	Access	RO
	Range	-	Unit	%	active moment	-	default	0

P00.46	Name	Maximum motor power percentage in 1s			Set method	-	Access	RO
	Range	-	Unit	%	active moment	-	default	0

P00.47	Name	Induction motor stator resistance			Set method	-	Access	RW
	Range	0-327.67	Unit	ohm	active moment	Take effect after power on	default	0

P00.48	Name	Induction motor rotor resistance			Set method	-	Access	RW
	Range	0-327.67	Unit	ohm	active moment	Take effect after power on	default	0

P00.49	Name	Total leakage inductance of induction motor			Set method	-	Access	RW
	Range	0-3276.7	Unit	mH	active	Take	default	0

					moment	effect after power on		

P00.50	Name	Induction motor magnetizing inductance			Set method	-	Access	RW
	Range	0-3276.7	Unit	mH	active moment	Take effect after power on	default	0

P00.51	Name	Induction motor rated frequency			Set method	-	Access	RW
	Range	0-3276.7	Unit	Hz	active moment	Take effect after power on	default	0

P00.52	Name	Induction motor output torque			Set method	-	Access	RO
	Range	0-3276.7	Unit	NM	active moment	-	default	0

P00.53	Name	Induction motor output power			Set method	-	Access	RO
	Range	0-327.67	Unit	Kw	active moment	-	default	0

P00.54	Name	Induction motor percentage of magnetizing current, unit is the percentage of motor rated current			Set method	-	Access	RW
	Range	0-3276.7	Unit	%	active moment	Take effect after power on	default	0

P00.55	Name	Induction motor output torque 2			Set method	-	Access	RO
	Range	0-3276.7	Unit	NM	active moment	-	default	0

P00.57	Name	Motor encoder fastest acceleration			Set method	Stop to set	Access	RW
	Range	0-3276.7	Unit	rpm/ms	active moment	Take effect after power on	default	0

P00.58	Name	Speed Watch Gain			Set method	Stop to set	Access	RW
	Range	0-32767	Unit	-	active moment	Take effect after power on	default	0

P00.59	Name	Observation method of flux linkage of induction motor			Set method	Stop to set	Access	RW
	Range	0~1	Unit	-	active moment	Take effect after power on	default	1

Setting	Observation method of flux linkage of induction motor
0	Compatible with the flux observation algorithm of the old VC servo driver
1	New flux linkage observation algorithm

P00.60	Name	Enable absolute encoder Z offset			Set method	Stop to set	Access	RW
	Range	0~1	Unit	-	active moment	Take effect after power on	default	0

Setting	Enable absolute encoder Z offset
0	The absolute value encoder Z point offset

<table>
<tr><td rowspan="2"></td><td></td><td>P00.71 is invalid, and the encoder phase will be reset when the encoder is self-learning.</td><td rowspan="2"></td></tr>
<tr><td>1</td><td>Absolute encoder Z-point offset P00.71 is valid, and the encoder phase will not be reset when the encoder is self-learning</td></tr>
</table>

<table>
<tr><td rowspan="2">P00.61</td><td>Name</td><td colspan="3">Permanent magnet synchronous motor field weakening percentage</td><td>Set method</td><td>Stop to set</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0-50</td><td>Unit</td><td>%</td><td>active moment</td><td>Take effect after power on</td><td>default</td><td>0</td></tr>
</table>

<table>
<tr><td rowspan="2">P00.62</td><td>Name</td><td colspan="3">Linear motor pole pitch</td><td>Set method</td><td>Stop to set</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0-3276.7</td><td>Unit</td><td>0.1mm</td><td>active moment</td><td>Take effect after power on</td><td>default</td><td>0</td></tr>
</table>

<table>
<tr><td rowspan="2">P00.64</td><td>Name</td><td colspan="3">Linear motor grating scale resolution, that is, the distance corresponding to one pulse</td><td>Set method</td><td>Stop to set</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0-3276.7</td><td>Unit</td><td>0.1um</td><td>active moment</td><td>Take effect after power on</td><td>default</td><td>0</td></tr>
</table>

<table>
<tr><td rowspan="2">P00.66</td><td>Name</td><td colspan="3">Current Loop Limiting Amplitude Parameters</td><td>Set method</td><td>Stop to set</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~32767</td><td>Unit</td><td>-</td><td>active moment</td><td>Take effect after power on</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">A total of 5 bits, ABCDE, when the highest bit A is set to 1, the voltage limit amplitude is not enabled, and when it is set to 0, the voltage limit amplitude is enabled. The B bit is the field weakening regulator KP, the C bit is the field weakening regulator KI, the D bit is to set the limit</td></tr>
</table>

amplitude of ud, set it to 0-9, representing 10% to 100%, and the E bit sets the multiple of the high-speed phase compensation.

P00.70	Name	Motor UVW phase sequence			Set method	Stop to set	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	1

Setting	motor UVW phase sequence
0	positive sequence
1	reverse sequence

This parameter is password protected and can be obtained by self-learning.

P00.71	Name	Z point offset (encoder unit)			Set method	Stop to set	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	0

The offset of the Z point relative to the magnetic pole. This parameter is password protected.

P00.72	Name	AB phase sequence of the encoder			Set method	Stop to set	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	AB phase sequence of the encoder
0	positive sequence
1	reverse sequence

This parameter is password protected and can be obtained by self-learning.

P00.73	Name	When the Hall code value is 1 , the corresponding electrical angle			Set method	Stop to set	Access	RW
	Range	0~1023	Unit	-	active moment	Immediately	default	425

This parameter is password protected and can be obtained by self-learning.

P00.74	Name	When the Hall code value is 2 , the corresponding electrical angle			Set method	Stop to set	Access	RW
	Range	0~1023	Unit	-	active moment	Immediately	default	85

This parameter is password protected and can be obtained by self-learning.

P00.75	Name	When the Hall code value is 3, the corresponding electrical angle			Set method	Stop to set	Access	RW
	Range	0~1023	Unit	-	active moment	Immediately	default	255
This parameter is password protected and can be obtained by self-learning.								

P00.76	Name	When the Hall code value is 4 , the corresponding electrical angle			Set method	Stop to set	Access	RW
	Range	0~1023	Unit	-	active moment	Immediately	default	765
This parameter is password protected and can be obtained by self-learning.								

P00.77	Name	When the Hall code value is 5 , the corresponding electrical angle			Set method	Stop to set	Access	RW
	Range	0~1023	Unit	-	active moment	Immediately	default	595
This parameter is password protected and can be obtained by self-learning.								

P00.78	Name	When the Hall code value is 6 , the corresponding electrical angle			Set method	Stop to set	Access	RW
	Range	0~1023	Unit	-	active moment	Immediately	default	935
This parameter is password protected and can be obtained by self-learning.								

P00.79	Name	Z point window enable			Set method	Stop to set	Access	RW
	Range	0~255	Unit	-	active moment	Immediately	default	22
This parameter is password protected.								

9.2 P01 group parameters - driver hardware parameters

P01.01	Name	ARM software version			Set method	-	Access	RO
	Range	0~65.535	Unit	-	active	-	default	-

					moment			

P01.02	Name	FPGA software version			Set method	-	Access	RO
	Range	0~65535	Unit	-	active moment	-	default	-

P01.03	Name	Driver rated current			Set method	Stop to set	Access	RW
	Range	0~3276.7	Unit	A	active moment	Immediately	default	6.0
This parameter is password protected.								

P01.04	Name	Driver rated current			Set method	-	Access	RO
	Range	0~3276.7	Unit	A	active moment	-	default	-

P01.05	Name	U phase current instantaneous value			Set method	-	Access	RO
	Range	-3276.7~3276.7	Unit	A	active moment	-	default	-

P01.06	Name	V phase current instantaneous value			Set method	-	Access	RO
	Range	-3276.7~3276.7	Unit	A	active moment	-	default	-

P01.07	Name	Rated voltage of the drive			Set method	anytime	Access	RW
	Range	100~32767	Unit	V	active moment	Immediately	default	220

P01.08	Name	Bus voltage monitoring value			Set method	-	Access	RO
	Range	0~32767	Unit	V	active moment	-	default	-

P01.09	Name	Bus voltage calibration coefficient			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	%	active moment	Immediately	default	100.0

P01.10	Name	Drive temperature			Set method	-	Access	RO
	Range	0~3000	Unit	0.1℃	active moment	-	default	-

P01.11	Name	PWM frequency setting register			Set method	Stop to set	Access	RW
	Range	0~4	Unit	-	active moment	Take effect after power on	default	3

Setting	Frequency
0	1.5K
1	2K
2	4K
3	8K
4	10K

This register is password protected.

P01.12	Name	IGBT dead time			Set method	Stop to set	Access	RW
	Range	3~10	Unit	us	active moment	Take effect after power on	default	3

This register is password protected.

P01.13	Name	Driver type			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	0

The first two digits represent the drive communication type, and the last three digits represent the drive function type.

The communication type is 5, representing general-purpose servo, RS485-Modbus communication;

The communication type is 6, which represents CANopen bus servo with CiA402 protocol;

The communication type is 7, which represents EtherCAT bus servo with CiA402 protocol;

The communication type is 9, which means PROFINET bus servo;

The function type is 1, which represents a general-purpose servo with tension control function;

The function type is 2, which represents a general-purpose servo with the function of round pressing;

The function type is 3, which represents a general-purpose servo with wheel cutting function;

The function type is 5, which represents a general-purpose servo with flying shear function;

The function type is 7, which represents a general-purpose servo with a fully closed-loop pressure

function;

P01.15	Name	Driver level number			Set method	-	Access	RW
	Range	0~32767	Unit	-	active moment	-	default	0

When restoring the factory defaults, the parameters related to the drive level will be restored. The numbers and corresponding levels are as follows:

E-structure servo driver class number		
Drive class	Current (A)	Voltage (V)
1	3A	220V
2	6A	220V
3	12A	220V
4	7A	380V
5	12A	380V
40	15A	220V

P01.16	Name	The multiple of the speed loop execution frequency and the PWM frequency			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Take effect after power on	default	0

Setting	The multiple of the speed loop execution frequency and the PWM frequency
0	2 x
1	1 x
2	2 x
3	4 x

Only Nikon 24-bit encoders allow setting bits 4 times, and the switching frequency must be less than or equal to 8k

P01.17	Name	Resistance value of sampling current			Set method	Stop to set	Access	RW
	Range	0~65.535	Unit	-	active moment	Take effect after power on	default	0

This register is password protected.

P01.18	Name	The current loop execution frequency is a	Set method	anytime	Access	RW

		multiple of the PWM frequency						
	Range	0~4	Unit	-	active moment	Take effect after power on	default	0

Setting	The current loop execution frequency is a multiple of the PWM frequency
0	2 x
1	1 x
2	2 x
3	4 x
4	8 x

P01.19	Name	Current sampling decimation rate			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Take effect after power on	default	0

Setting	Current sampling decimation rate
0	Decimation rate is 32 and avoids PWM spikes
1	Decimation rate is 32 to avoid PWM spikes
2	Decimation rate is 64, do not avoid PWM spikes
3	Decimation rate is 128, do not avoid PWM spikes
4	Decimation rate is 256, do not avoid PWM spikes

P01.21	Name	Allow PWM to update immediately			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Take effect after power on	default	0

Setting	Current sampling decimation rate
0	PWM up and down update
1	PWM is updated immediately

P01.22	Name	Deadband Compensation Percentage			Set method	Allow setting	Access	RW
	Range	0~100	Unit	%	active moment	Take effect after power on	default	0

P01.30	Name	C-phase current sampling offset value			Set method	-	Access	RO
	Range	0~32767	Unit	AD	active moment	-	default	0
This parameter is password-protected and automatically calculated when power is turned on.								

P01.31	Name	B-phase current sampling offset value			Set method	-	Access	RO
	Range	0~32767	Unit	AD	active moment	-	default	0
This parameter is password protected.								

P01.32	Name	C-phase current AD sampling value			Set method	-	Access	RO
	Range	0~32767	Unit	AD	active moment	-	default	-

P01.33	Name	B-phase current AD sampling value			Set method	-	Access	RO
	Range	0~32767	Unit	AD	active moment	-	default	-

P01.34	Name	Capacitor voltage AD sampling value			Set method	-	Access	RO
	Range	0~32767	Unit	AD	active moment	-	default	-

P01.36	Name	Motor temperature AD sample value			Set method	-	Access	RO
	Range	0~32767	Unit	AD	active moment	-	default	-

P01.37	Name	continuous run time from last restore factory value			Set method	-	Access	RO
	Range	-	Unit	Ms	active moment	-	default	-

P01.39	Name	Driver ID			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	0

P01.44	Name	Driver ID2			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	0

P01.46	Name	Multi-function parameter 1			Set method	anytime	Access	RW
	Range	0~65535	Unit	-	active moment	Immediately	default	220
Multi-function setting BIT0 enables AI automatic correction, BIT1 does not enable DO output protection, when BIT11=1, the voltage is low (less than 0.65*1.1414 of the rated voltage), the relay is disconnected, and when BIT11=0, the relay will not be disconnected when it is closed. When the BIT9 universal servo is set to 1, the offset will not be performed when returning to zero, and the origin will be directly set as the offset position.								

P01.51	Name	Multi-function parameter 2			Set method	anytime	Access	RW
	Range	0~65535	Unit	-	active moment	Immediately	default	2
When BIT0=0, use the torque feedforward to calculate the torque feedforward according to the position command. When BIT0=1, use the old torque feedforward to calculate the torque feedforward according to the velocity command. When BIT1=0, enable, torque feedforward when P07.20=0/1. When BIT1=1, disabled. Torque feedforward when P07.20=0/1. When BIT2=1, power-on triggers the phase finding of the linear motor incremental encoder When BIT3=1, Fn004 does not learn the motor encoder parameters, only VVVF speed regulation When BIT4=1, the resolver FREQ SEL1 When BIT5=1, resolver AMCD When BIT6=1, the resolver automatically resets the fault When BIT7=1, select the high-speed pulse command as the pulse position command. BIT7=0, select the low-speed pulse command as the pulse position command.								

9.3 P02 group parameters - basic control parameters

<table>
<tr><td rowspan="2">P02.01</td><td>Name</td><td colspan="3">Drive Control Mode</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~7</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

<table>
<tr><th>Setting</th><th>Control mode</th></tr>
<tr><td>0</td><td>Position mode</td></tr>
<tr><td>1</td><td>Speed mode</td></tr>
<tr><td>2</td><td>Torque mode</td></tr>
<tr><td>3</td><td>Position/torque mode IO switching, select Torque mode when INFn.36 is active</td></tr>
<tr><td>4</td><td>Position/speed mode IO switching, select speed mode when INFn.36 is active</td></tr>
<tr><td>5</td><td>Torque/speed mode IO switching, select torque mode when INFn.36 is active</td></tr>
<tr><td>6</td><td>Position/torque/speed mode IO switching, through INFn.36, INFn.37 switching
<table>
<tr><th>INFn.37</th><th>INFn.36</th><th>working mode</th></tr>
<tr><td>invalid</td><td>invalid</td><td>Speed mode</td></tr>
<tr><td>invalid</td><td>valid</td><td>Torque mode</td></tr>
<tr><td>valid</td><td>xx</td><td>Position mode</td></tr>
</table></td></tr>
<tr><td>7</td><td>Dedicated control mode</td></tr>
</table>

<table>
<tr><td rowspan="2">P02.02</td><td>Name</td><td colspan="3">Current Mode of operation display</td><td>Set method</td><td>-</td><td>Access</td><td>RO</td></tr>
<tr><td>Range</td><td>0~2</td><td>Unit</td><td>-</td><td>active moment</td><td>-</td><td>default</td><td>-</td></tr>
</table>

Setting	control mode
0	position mode
1	speed mode
2	torque mode

<table>
<tr><td rowspan="2">P02.03</td><td>Name</td><td colspan="3">Forward and reverse rotation is prohibited</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~2</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Forward/reverse setting
0	No forward and reverse restrictions
1	Forward rotation is prohibited
2	Reverse prohibited

P02.04	Name	Drive status			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

Setting	Drive status
1	Self-check (nordy)
8	ready (rdy)
16	running(run)
32	emergency stop(run)
64	Responding to failures (run)
128	Fault (Er.xxx)

P02.05	Name	LED display content in running or rdy state			Set method	anytime	Access	RW
	Range	0~10	Unit	-	active moment	Immediately	default	0

Setting	Display content
0	Display state
1	Display speed
2	Display capacitor voltage
3	Display temperature
4	Display current
5	Display DI level value
6	Display DO level value
7	AI1 voltage value
8	AI2 voltage value
10	Torque percentage

P02.07	Name	Parameter write protection			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	1

Setting	Parameter write setting
0	write prohibited
1	writable

P02.08	Name	Parameter save selection			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Parameter save settings
0	The parameters are saved in EEPROM and saved when power off
1	Parameters are saved to RAM, lost when power off
2	The parameters written by communication are saved to RAM, and lost when power off, the parameters written by the panel are saved to EEPROM, and saved when power off

P02.09	Name	Startup options			Set method	anytime	Access	RW
	Range	0.00~5.00	Unit	-	active moment	Take effect after power on	default	0

a.bb format. When a=0, it starts normally. When a=1, all parameters are read to the U disk at startup, and the name in the U disk is <PARA + 'bb'.csv>. For example, if P02.09=1.05 is set, all parameters will be saved to the U disk when the system is started next time, and the file name is 'PARA05.csv'. When a=2, all parameters with the parameter name <PARA + 'bb'.csv> in the U disk will be updated to the servo at startup. For example, when P02.09=2.99, all parameters with the parameter name 'PARA99.csv' in the U disk will be updated to the servo at the next startup. When a=3, all non-motor drive parameters with the parameter name <PARA + 'bb'.csv> in the U disk will be updated to the servo at startup. 13. All parameters except P10.01, P1003, P10.04, and P10.06; when a=4, update all control parameters with the parameter name <PARA + 'bb'.csv> in the U disk to the servo , the control parameters refer to all parameters except P00, P01 group, P05.13, P10.01, P1003, P10.04, P10.06, P07 group; when a=5, record the curve in real time to U plate.

P02.10	Name	Selection of Servo Type II Fault Shutdown Mode			Set method	anytime	Access	RW
	Range	0~5	Unit	-	active moment	Immediately	default	0

Setting	Selection of Servo Type II Fault Shutdown Mode
0	free to rotate
1	rapid deceleration stop and disable driver
2	slow deceleration stop and disable driver
3	rapid deceleration stop and keep enable driver
4	slow deceleration stop and keep enable driver
5	Braking according to the current set by P02.18

P02.11	Name	fault type 3 stop mode selection			Set method	anytime	Access	RW
	Range	0~5	Unit	-	active moment	Immediately	default	0

Setting	fault type 3 stop mode selection
0	free to rotate
1	rapid deceleration stop and disable driver
2	slow deceleration stop and disable driver
3	rapid deceleration stop and keep enable driver
4	slow deceleration stop and keep enable driver
5	Braking according to the current set by P02.18

P02.12	Name	Over travel stop mode selection			Set method	anytime	Access	RW
	Range	0~5	Unit	-	active moment	Immediately	default	0

Setting	Over travel stop mode selection
0	free to rotate
1	rapid deceleration stop and disable driver
2	slow deceleration stop and disable driver
3	rapid deceleration stop and keep enable driver
4	slow deceleration stop and keep enable driver
5	Braking according to the current set by P02.18

P02.13	Name	Disable driver stop mode selection			Set method	anytime	Access	RW
	Range	0~2	Unit	-	active moment	Immediately	default	0

Setting	Disable driver stop mode selection
0	free to rotate
1	rapid deceleration stop and disable driver
2	slow deceleration stop and disable driver

P02.14	Name	Emergency stop selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Emergency stop mode selection
0	free to rotate
1	rapid deceleration stop and disable driver
2	slow deceleration stop and disable driver
3	rapid deceleration stop and keep enable driver
4	slow deceleration stop and keep enable driver

P02.16	Name	rapid stop time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P02.17	Name	slow stop time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	1000

P02.18	Name	Drive dynamic braking current			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	%	active moment	Immediately	default	50

P02.19	Name	Enable hardware dynamic braking			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Reset takes effect	default	0

P02.20	Name	Servo braking option			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	2

Setting	Braking method
0	Never start the brake
1	Braking is possible only when decelerating
2	ready to brake at any time

3	Braking is only possible when the energy is fed back

For 220V drives, when the DC bus voltage is greater than 380VDC, the dynamic braking circuit is activated;
For 380V drives, when the DC bus voltage is greater than 680VDC, the dynamic braking circuit is activated.

P02.21	Name	Braking resistor value			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	Ω	active moment	Immediately	default	0

P02.22	Name	Maximum power of braking resistor			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	KW	active moment	Immediately	default	0

P02.23	Name	Heat dissipation coefficient of braking resistor			Set method	anytime	Access	RW
	Range	0~100	Unit	%	active moment	Immediately	default	50
If it is set to 100%, it means that it takes 10s to drop from the maximum heat to 0.								

P02.30	Name	After the brake release command is output, the command input is delayed			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	250

P02.31	Name	Brake zero speed threshold			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	30

P02.32	Name	Power up hold time			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	150

P02.33	Name	Max brake hold time after disable driver			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	500
After the enable is turned off, when the motor is rotating, the maximum waiting time for the brake to be effective.								

P02.35	Name	Driver password			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	0

P02.36	Name	Self-learning maximum current limit			Set method	anytime	Access	RW
	Range	0~100	Unit	-	active moment	Immediately	default	30
Setting 30 is 30% of the rated current of the motor								

P02.37	Name	Internal software counter count value			Set method	-	Access	RO
	Range	0~2147483647	Unit	-	active moment	-	default	-
This parameter is a double-byte parameter; the value is retained after power failure.								

P02.39	Name	Internal software counter arrival value			Set method	anytime	Access	RW
	Range	0~2147483647	Unit	-	active moment	Immediately	default	0
This parameter is a double-byte parameter.								

P02.41	Name	VVVF maximum voltage output			Set method	anytime	Access	RW
	Range	0~1000	Unit	V	active moment	Immediately	default	30

P02.42	Name	Linear motor parameter			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Reset takes effect	default	0
The linear motor parameter defaults to 0, a total of 5 digits, the lower two digits set the linear								

motor phase self-learning gain, generally set to 5-30, when it is set to 0, the gain is automatically set, and the second digit encoder self-learns the most laps. Number, that is to say, the number of encoder pulses that the self-learning takes the most = the second bit * resolution, the third bit is the speed level of the encoder self-learning encoder, the high bit is set to 1, the encoder does not have a hall, set to 0, the encoder has hall.

P02.50	Name	Instruction reversal			Set method	anytime	Access	RW
	Range	0-7	Unit	-	active moment	Immediately	default	0

When the 0th bit is valid, the position command is reversed;
When the first bit is valid, the speed command is reversed;
When the second bit is valid, reverse the torque command

9.4 P03 Group parameter - position mode parameter

P03.01	Name	Source of position cmd			Set method	anytime	Access	RW
	Range	0~6	Unit	-	active moment	Immediately	default	0

Setting	position command source
0	Sourced from external XY pulse commands
1	From internal multi-segment location planning
2	Switch between external pulse command and internal position planning command through INFn.35
3	The command pulse superimposes the second encoder pulse as the position command
4	Command pulse superimposed internal position planning as position command
5	Round pressure round sleeve label
6	sine wave

P03.02	Name	pulse pattern			Set method	Stop to set	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	2

Setting	Command pulse count mode
0	Pulse plus direction &positive logic
1	Pulse plus direction &negative logic
2	AB pulse

	3	CW+CCW positive logic
	4	CW+CCW negative logic

P03.03	Name	Command pulse hardware filtering			Set method	Stop to set	Access	RW
	Range	0~32767	Unit	20ns	active moment	Immediately	default	50

P03.04	Name	Command pulse count value			Set method	-	Access	RO
	Range	-2147483647~ 2147483647	Uni t	-	active moment	-	default	-

P03.06	Name	Position command given median filter time constant			Set method	set when stop	Access	RW
	Range	0~128	Unit	ms	active moment	Immediately	default	0

P03.07	Name	Position command given low-pass filter time constant			Set method	set when stop	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	20

P03.08	Name	Electronic gear ratio 1 numerator			Set method	anytime	Access	RW
	Range	1~2147483647	Unit	-	active moment	Immediately	default	0

P03.10	Name	Electronic gear ratio 1 denominator			Set method	anytime	Access	RW
	Range	1~2147483647	Unit	-	active moment	Immediately	default	1000

P03.12	Name	Electronic gear ratio 2 numerator			Set method	anytime	Access	RW
	Range	1~2147483647	Unit	-	active moment	Immediately	default	0

P03.14	Name	Electronic gear ratio 2 denominator	Set method	anytime	Access	RW

	Range	1~2147483647	Unit	-	active moment	Immediately	default	1000

P03.16	Name	Electronic gear ratio switching time constant			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	0

P03.17	Name	Position error（0.0001round）			Set method	-	Access	RO
	Range	-	Unit	0.0001 round	active moment	-	default	-

P03.19	Name	Maximum position error threshold（0.0001round）			Set method	anytime	Access	RW
	Range	0~2147483647	Unit	-	active moment	Immediately	default	30000
Excessive position error threshold, when it is set to 0, no excessive position error protection will be performed.								

P03.21	Name	Form setting of position deviation clear signal INFn.25			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Position deviation clear signal form setting
0	Clear deviation when INFn.25 is valid
1	Clear the deviation when INFn.25 changes from invalid to valid
2	INFn.25 Invalid clear deviation
3	Clear the deviation when INFn.25 is changed from valid to invalid

P03.22	Name	Position deviation clearing options			Set method	anytime	Access	RW
	Range	0~6	Unit	-	active moment	Immediately	default	0

Setting	Position deviation clearing options
0	Clear position error and clear velocity
1	reserve
2	reserve
3	reserve
4	Clear the position error, and at the same time,

	the speed drops to zero in a straight line, and the falling time is set by P02.16
5	reserve
6	Clear the position error, at the same time the speed drops to zero with a quadratic curve, the drop time is set by P02.16

P03.23	Name	Position command speed is 0, output confirmation time		Set method	anytime	Access	RW
	Range	0~32767	Unit ms	active moment	Immediately	default	0

This parameter is used in conjunction with OUTFn.33.

P03.31	Name	Enable full closed loop			Set method	Stop to set	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Full closed loop option
0	Disable fully closed loop
1	Enable full closed loop

P03.32	Name	Fully closed loop encoder feedback mode			Set method	anytime	Access	RW
	Range	0~2	Unit	-	active moment	Immediately	default	0

Setting	Full closed loop mode
0	half closed loop
1	fully closed loop
2	Switch between full closed loop and semi closed loop according to IO

When P03.32 = 2, electronic gear ratio 1 is used for semi-closed loop, and electronic gear ratio 2 is used for full-closed loop.

P03.33	Name	Fully closed loop feedback polarity			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Fully closed loop feedback polarity
0	The values of the motor encoder counter and the second encoder counter are incremented or decremented simultaneously
1	The values of the motor encoder counter and the second encoder counter are incremented and decremented

P03.34	Name	The number of pulses of the second encoder corresponding to one revolution of the motor			Set method	anytime	Access	RW
	Range	1~2147483647	Unit	-	active moment	Immediately	default	10000

P03.36	Name	Full closed loop position error is too large threshold (unit is 0.0001 round)			Set method	anytime	Access	RW
	Range	0~2147483647	Unit	-	active moment	Immediately	default	10000

The fully closed loop position error refers to (the count value of the motor encoder - the count value of the second encoder reduced to the motor encoder), and the position error represents how much the relative sliding between the material and the motor is.
When this parameter is set to 0, the full-closed loop position error excessive protection will not be performed.

P03.38	Name	Full closed loop position error			Set method	-	Access	RO
	Range	-	Unit	0.0001 round	active moment	-	default	-

P03.40	Name	Full closed loop position error clearing cycles			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	20

This value is valid when in full closed loop state. When set to 0, the full-closed loop position error will not be cleared; when set to n, when the motor rotates every n cycles, if the absolute value of the full-closed loop position error is less than P03.36, the full-closed loop position error will be cleared.

P03.41	Name	Fully closed loop motor encoder rate			Set method	-	Access	RO
	Range	-	Unit	clk/5ms	active	-	default	-

					moment			

P03.42	Name	Fully closed loop second encoder rate			Set method	-	Access	RO
	Range	-	Unit	clk/5ms	active moment	-	default	-

P03.45	Name	Positioning complete output condition			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Positioning complete output condition
0	When the position error is less than the positioning completion threshold, it will be output directly, otherwise, the output will be cleared.
1	When the position error is less than the positioning completion threshold, and the speed command P03.95 in the position mode is zero, the output is output, otherwise the output is cleared.
2	When the position error is less than the positioning completion threshold, and the filtered speed command P03.96 in the position mode is zero, the output is output, otherwise the output is cleared.
3	When the position error is less than the positioning completion threshold, and the speed command P03.95 in the position mode is zero, the output is output. When the speed command P03.95 in the position mode is not zero, the output is cleared.
4	The multi-segment position command is sent and the position error is less than the positioning completion threshold

P03.46	Name	positioning completion threshold （unit is 0.0001 round）			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10

P03.47	Name	Positioning close to output conditions			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Positioning close to output conditions
0	Output when the position error is less than the positioning proximity threshold, otherwise clear the output;

	1	The output is when the position error is less than the positioning approach threshold and the speed command P03.95 in the position mode is zero, otherwise the output is cleared;
	2	Output when the position error is less than the positioning approach threshold and the filtered speed command P03.96 in position mode is zero, otherwise clear the output
	3	The output is when the position error is less than the positioning approach threshold and the speed command P03.95 in the position mode is zero, and the output is cleared when the speed command P03.95 in the position mode is not zero

P03.48	Name	positioning close threshold（unit is 0.0001round）			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	100

P03.49	Name	positioning completion/close time threshold			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	10
When the position error is less than the positioning completion/proximity threshold, and the time threshold is maintained, the positioning completion/proximity signal is output.								

P03.51	Name	Homing method			Set method	Stop to set	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	1

P03.52	Name	Homing acceleration and deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P03.53	Name	First homing speed			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P03.54	Name	Second homing speed			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active	Immediately	default	100

					moment			

P03.55	Name	Homing offset			Set method	anytime	Access	RW
	Range	-2147483647~2147483647	Unit	User units	active moment	Immediately	default	0

P03.57	Name	Zero point range			Set method	anytime	Access	RW
	Range	0~32767	Unit	0.0001 round	active moment	Immediately	default	5

P03.60	Name	Interrupt fixed-length function enable			Set method	Stop to set	Access	RW
	Range	0~2	Unit	-	active moment	Immediately	default	0

Setting	Interrupt fixed-length function settings
0	Disable interrupt fixed-length function
1	Enable IO trigger interrupt fixed-length function
2	Enable Z point trigger interrupt fixed length

P03.61	Name	Interrupt fixed length speed			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	3000

P03.62	Name	Interrupt fixed long acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	500

P03.63	Name	Interrupt fixed length (user unit)			Set method	anytime	Access	RW
	Range	0~2147483647	Unit	-	active moment	Immediately	default	10000

P03.65	Name	Interrupt fixed-length window position (User units)			Set method	anytime	Access	RW
	Range	0~2147483647	Unit	-	active	Immediate	default	0

					moment	ly		

P03.67	Name	Interrupt fixed-length window range (User units)			Set method	anytime	Access	RW
	Range	0~65535	Unit	-	active moment	Immediately	default	0

Interrupt fixed-length window range (user unit), when it is 0, no window will be added, and the interrupt fixed-length trigger enable signal is derived from INFn.38.

P03.68	Name	Cancel the fixed length mode			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Cancel fixed-length mode
0	After the interrupt fixed length is completed, directly cancel the interrupt fixed length
1	Release interrupt fixed length through IO

P03.69	Name	Interrupt the long latched motor position			Set method	-	Access	RO
	Range	-2147483647 ~ 2147483647	Unit	-	active moment	-	default	-

P03.73	Name	Enable hardware and software limits			Set method	anytime	Access	RW
	Range	0~2	Unit	-	active moment	Immediately	default	0

Setting	Software and hardware limit function selection
0	Disable software and hardware limit
1	Enable hardware and software limits
2	Enable software and hardware limit after origin return

P03.74	Name	Software limit lower limit value			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	-	active moment	Immediately	default	-10000000

P03.76	Name	Software limit upper limit value			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	-	active moment	Immediately	default	10000000

P03.78	Name	Selection of servo pulse output source			Set method	anytime	Access	RW
	Range	0~2	Unit	-	active moment	Immediately	default	0

Setting	Type of output pulse
0	output motor pulse
1	Output command pulse
2	No output, do input

P03.79	Name	Motor pulse frequency division factor			Set method	anytime	Access	RW
	Range	1~65535	Unit	-	active moment	Reset takes effect	default	-

If the motor type is an incremental encoder, the default is 1,
The number of pulses output by the pulse output port = the number of motor pulses/P03.79;
If the motor type is an absolute encoder, the default value is 10000,
Indicates that the motor rotates once, and the number of pulses output by the pulse output port is P03.79.

P03.80	Name	Frequency division pulse output direction			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Reset takes effect	default	0

Setting	Frequency division pulse output direction
0	positive output
1	reverse output

P03.81	Name	Z pulse polarity selection			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Z pulse polarity selection
0	positive output
1	reverse output

P03.82	Name	Enable 4th power curve			Set method	Stop to set	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	1

Setting	Curve planning settings
0	Use a trapezoidal velocity profile
1	Using a 4th power curve

P03.83	Name	Position curve planning error			Set method	-	Access	RO
	Range	-32767~32767	Unit	-	active moment	-	default	-

P03.84	Name	Position command sampling interval			Set method	anytime	Access	RW
	Range	0~32768	Unit	-	active moment	Re-enable to take effect	default	1

P03.90	Name	Mechanical position (user position unit)			Set method	-	Access	RO
	Range	-2147483647 ~ 2147483647	Unit	-	active moment	-	default	-

P03.92	Name	Mechanical position (encoder unit)			Set method	-	Access	RO
	Range	-2147483647 ~ 2147483647	Unit	-	active moment	-	default	-

P03.94	Name	Filtered position error			Set method	-	Access	RO
	Range	-32767~32767	Unit	clk	active moment	-	default	-

P03.95	Name	Speed command monitoring in position mode			Set method	-	Access	RO
	Range	-	Unit	rpm	active moment	-	default	-
Speed command monitoring in position mode.								

P03.96	Name	Velocity command monitoring after filtering in position mode			Set method	-	Access	RO
	Range	-	Unit	rpm	active moment	-	default	-
The filtered velocity command monitoring in position mode.								

9.5 P04 group parameter - speed mode related parameters

P04.01	Name	Speed source			Set method	anytime	Access	RW
	Range	0~7	Unit	-	active moment	Immediately	default	0

Setting	Speed source
0	main speed A
1	Auxiliary speed B
2	A/B switching through IO-INFn.12
3	A+B
4	Communication (P08.17)
5	Multi-speed
6	UP/DOWN pattern
7	Internal sine wave

P04.02	Name	Source of main speed A			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Source of main speed A
0	Sourced from P04.03
1	from AI1
2	from AI2
3	Sourced from AI3 (not supported on hardware)
4	from pulse rate

P04.03	Name	Value of main speed A			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	500

P04.04	Name	Auxiliary Speed B Source			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Auxiliary Speed B Source
0	From P04.05
1	from AI1
2	from AI2
3	Sourced from AI3 (not supported on hardware)
4	from pulse rate

P04.05	Name	The value of the auxiliary speed B			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	500

P04.06	Name	Source of speed positive clipping			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Source of positive speed limit
0	Forward Limit A
1	Positive Limit B
2	A/B switching
3	A and B are restricted at the same time

P04.07	Name	Source of speed positive limit A			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Source of positive speed limit A
0	from P04.08
1	from AI1
2	from AI2
3	from AI3 (hardware not supported)

P04.08	Name	The value of speed positive limit A			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	3000

P04.09	Name	Source of velocity positive limit B			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Source of positive speed limit B
0	from P04.10
1	from AI1
2	from AI2
3	from AI3 (hardware not supported)

P04.10	Name	Value of speed positive limit B			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	3000

P04.11	Name	Source of velocity reverse limiter			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Source of reverse velocity limiter
0	Reverse limiter A
1	Reverse limiter B
2	A/B switch
3	Both A and B are restricted

P04.12	Name	Source of velocity reverse limiter A			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Source of reverse velocity limiter A
0	from P04.13
1	from AI1
2	from AI2
3	from AI3(hardware not supported)

P04.13	Name	Velocity reverse limiter A			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	3000

P04.14	Name	Source of velocity reverse limiter B			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Source of reverse velocity limiter B
0	from P04.15
1	from AI1
2	from AI2
3	from AI3(hardware not supported)

P04.15	Name	Velocity reverse limiter B			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	3000

P04.16	Name	Jog speed			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Reset takes effect	default	20
Note that this value is modified but not saved during keyboard tap trials.								

P04.17	Name	Accelerate time			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	500

P04.18	Name	Deceleration time			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	500

P04.20	Name	Speed instruction first order filtering time constant			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	20

P04.21	Name	Display speed filtered values			Set method	-	Access	RO
	Range	0~32767	Unit	rpm	active moment	-	default	-

P04.22	Name	Speed display filtering time			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	300

P04.23	Name	Speed reaches the threshold			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	1000

P04.24	Name	Speed consistency threshold			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	10

P04.25	Name	Zero speed threshold			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	5

P04.26	Name	Zero speed threshold for position lock			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	5

P04.27	Name	Lifting speed threshold			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm/s	active moment	Immediately	default	375
When the acceleration/deceleration is greater than the threshold, the acceleration/deceleration signal will be output, and the unit is rpm per second.								

9.6 P05 group parameter - torque mode related parameters

P05.01	Name	source of torque	Set method	anytime	Access	RW

	Range	0~5	Unit	-	active moment	Immediately	default	0

Setting	source of torque
0	main torque A
1	Auxiliary torque B
2	Perform A/B switchover through I/O
3	A+B
4	Communications (P08.16)
5	Internal sine wave

P05.02	Name	The source of the main torque A			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Source of main torque A
0	From P05.03
1	From AI1
2	From AI2
3	From AI3(hardware not supported)

P05.03	Name	The value of the main torque A			Set method	anytime	Access	RW
	Range	-300.0~300.0	Unit	%	active moment	Immediately	default	0.0

P05.04	Name	The source of assist torque B			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Source of assist torque B
0	From P05.05
1	From AI1
2	From AI2
3	From AI3(hardware not supported)

P05.05	Name	The value of the assist torque B			Set method	anytime	Access	RW
	Range	-300.0~300.0	Unit	%	active moment	Immediately	default	0.0

<table>
<tr><td rowspan="2">P05.10</td><td>Name</td><td colspan="3">Torque limit method</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Torque limit method
0	Both positive and negative limits come from positive limiting
1	Positive and negative restrictions are restricted separately

<table>
<tr><td rowspan="2">P05.11</td><td>Name</td><td colspan="3">Source of torque positive limiting</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~3</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Source of forward torque limiting
0	Forward limiter A
1	Forward limiter B
2	A/B switch
3	Both A and B are restricted

<table>
<tr><td rowspan="2">P05.12</td><td>Name</td><td colspan="3">Source of torque forward limiting A</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~3</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	The source of the positive torque limit A
0	From P05.13
1	From AI1
2	From AI2
3	From AI3(hardware not supported)

<table>
<tr><td rowspan="2">P05.13</td><td>Name</td><td colspan="3">The value of torque positive limit A</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~300.0</td><td>Unit</td><td>%</td><td>active moment</td><td>Immediately</td><td>default</td><td>150.0</td></tr>
</table>

P05.14	Name	Source of torque forward limiting B			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Source of forward torque limiting B
0	From P05.15
1	From AI1
2	From AI2
3	From AI3(hardware not supported)

P05.15	Name	Torque positive limiting B value			Set method	anytime	Access	RW
	Range	0~300.0	Unit	%	active moment	Immediately	default	150.0

P05.16	Name	Source of torque reverse limiting			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Source of reverse torque limiting
0	Reverse limiter A
1	Reverse limiter B
2	A/B switch
3	Both A and B are restricted

P05.17	Name	Source of torque reverse limiter A			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	0

Setting	Source of reverse torque limiting A
0	From P05.18
1	From AI1
2	From AI2
3	From AI3(hardware not supported)

P05.18	Name	Source of torque reverse limiter A			Set method	anytime	Access	RW
	Range	0~300.0	Unit	%	active moment	Immediately	default	150.0

<table>
<tr><td rowspan="3">P05.19</td><td>Name</td><td colspan="3">Source of torque reverse limiter B</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~3</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="8">

Setting	Source of reverse torque limiting B
0	From P05.20
1	From AI1
2	From AI2
3	From AI3(hardware not supported)

</td></tr>
</table>

P05.20	Name	The value of torque reverse limiting B			Set method	anytime	Access	RW
	Range	0~300.0	Unit	%	active moment	Immediately	default	150.0

<table>
<tr><td rowspan="2">P05.25</td><td>Name</td><td colspan="3">Time threshold for switching from torque mode to speed mode</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~32767</td><td>Unit</td><td>0.25ms</td><td>active moment</td><td>Immediately</td><td>default</td><td>10</td></tr>
<tr><td colspan="9">When the amplitude of the speed exceeds the speed limit plus the speed limit speed threshold (P05.26), and the time threshold of continuous torque mode switching to speed mode (P05.25), a speed ring is constructed to make the speed convergence within the limit.</td></tr>
</table>

<table>
<tr><td rowspan="2">P05.26</td><td>Name</td><td colspan="3">Speed threshold for speed torque mode switchover</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~32767</td><td>Unit</td><td>rpm</td><td>active moment</td><td>Immediately</td><td>default</td><td>30</td></tr>
<tr><td colspan="9">When the amplitude of the speed exceeds the speed limit plus the speed limit speed threshold (P05.26), and the time threshold of continuous torque mode switching to speed mode (P05.25), a speed ring is constructed to make the speed convergence within the limit.</td></tr>
</table>

<table>
<tr><td rowspan="2">P05.27</td><td>Name</td><td colspan="3">Time threshold for speed mode to switch to torque mode</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~32767</td><td>Unit</td><td>0.25ms</td><td>active moment</td><td>Immediately</td><td>default</td><td>200</td></tr>
<tr><td colspan="9">When the servo is running in torque mode but the speed loop is constructed due to speed limitation, the time threshold for switching from speed mode to torque mode is determined by P05.27</td></tr>
</table>

P05.28	Name	Speed limit low pass filter time parameter			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Reset takes effect	default	500
When the speed limit changes, low-pass filtering is performed on the speed limit value, and the filtering time is determined by P05.28. The longer the filtering time is, the slower the speed limit value changes								

P05.31	Name	Torque reached the reference value			Set method	anytime	Access	RW
	Range	0~300.0	Unit	%	active moment	Immediately	default	50.0

P05.32	Name	The torque reaches an effective value			Set method	anytime	Access	RW
	Range	0~300.0	Unit	%	active moment	Immediately	default	10.0

P05.33	Name	Torque reached invalid value			Set method	anytime	Access	RW
	Range	0~300.0	Unit	%	active moment	Immediately	default	0.0

P05.34	Name	Torque sampling interval			Set method	anytime	Access	RW
	Range	0~300	Unit	-	active moment	Reset takes effect	default	0

P05.35	Name	Maximum output limit of shaking suppression torque			Set method	anytime	Access	RW
	Range	0~10.0	Unit	%	active moment	Immediately	default	0.0

P05.36	Name	Percentage of flutter suppression gain			Set method	anytime	Access	RW
	Range	0~10.0	Unit	%	active moment	Immediately	default	0.0

P05.37	Name	Jitter speed detection time constant			Set method	anytime	Access	RW
	Range	0~10.0	Unit	%	active moment	Immediately	default	0.0

	The jitter is suppressed only when the period is shorter than this time

P05.38	Name	Jitter speed detection value			Set method	anytime	Access	RO
	Range	-	Unit	Rpm	active moment	Immediately	default	-

P05.39	Name	Flutter suppression torque output value			Set method	anytime	Access	RO
	Range	-	Unit	%	active moment	Immediately	default	-

9.7 P06 group parameter -Inputs and Outputs Function

P06.01	Name	DI1 Function control register			Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	1

Setting	DI Function Selection
0	None
1	Enable the driver
2	Reset the drive
3	Switch AB switch
4	Torque reverse switch
5	Forward torque limit switch
6	Negative torque limit selector switch
7	Forward speed limit selection
8	Negative speed limit selection
9	forward jog
10	reverse jog
11	Speed reference reverse
12	Main speed AB switching
13	Stop of speed
14	Reset drive before downloading ARM program
15	Clear encoder position count
16	Zero position fixed in speed mode
17	Multi-speed speed selection 0
18	Multi-speed speed selection 1
19	Multi-speed speed selection 2
20	Multi-speed speed selection 3
21	Position command prohibition

	22	Position command reverse	
	23	Prohibition of pulse command	
	24	Electronic gear ratio switching 1	
	25	clear position error	
	26	Trigger back to zero	
	27	Trigger multi-segment positions	
	28	Multi-segment position selection 0	
	29	Multi-segment position selection 1	
	30	Multi-segment position selection 2	
	31	Multi-segment position selection 3	
	32	Direction selection for multi-segment locations	
	33	reserve	
	34	Home switch input	
	35	Command pulse and internal position planning switching	
	36	Control mode switch 0	
	37	Control mode switch 1	
	38	Enable interrupt fixed-length input	
	39	release interrupt fixed length	
	40	Trigger interrupt fixed length	
	41	The first set of the second set of gain switch	
	42	reset fault	
	43	Positive limit switch in position mode	
	44	Reverse limit switch in position mode	
	45	Switching between open and closed loop in full closed loop mode	
	46	Reset before FPGA program update	
	47	Tension compensation direction	
	48	tracking direction	
	49	Force maximum JOG compensation	
	50	Roll diameter calculation is prohibited	
	51	change roll	
	52	Initial roll diameter switch	
	53	Clear the length of feed	
	54	Force fast tightening	
	55	Closed loop speed mode disables tension compensation	
	56	Electronic gear ratio switch 2	
	57	Motor overheating	
	58	Emergency stop input	
	59	Internal flip-flop reset	

	60	Internal trigger set
	61	Internal counter counts pulses
	62	Clear the internal counter
	63	Speed mode UPDOWN mode UP signal
	64	Speed mode UPDOWN mode DOWN signal
	65	Speed mode UPDOWN mode hold signal
	66	Return to previous Phase (Tension special: Enable Speed Overlay)
	67	AI zero drift automatic correction
	68	Go to the specified phase (Tension special type: closed-loop speed/torque mode switch)
	69	Jog a fixed position in the positive direction (Tension type: motor rotation direction in closed-loop speed mode)
	70	Reverse jog fixed position (Tension special type: motor rotation direction in closed-loop torque mode)
	71	reserve
	72	Trigger correction current sensor
	73	Trigger learning phase
	74	return to zero
	75	STO activation

P06.02	Name	DI2 Function control register			Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	42
For the specific functions of the DI port, see P06.01.								

P06.03	Name	DI3 Function control register			Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
For the specific functions of the DI port, see P06.01.								

P06.04	Name	DI4 Function control register			Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
For the specific functions of the DI port, see P06.01.								

<table>
<tr><td rowspan="2">P06.13</td><td>Name</td><td colspan="3">DI terminal valid state</td><td>Set method</td><td>-</td><td>Access</td><td>RO</td></tr>
<tr><td>Range</td><td>0~1023</td><td>Unit</td><td>-</td><td>active moment</td><td>-</td><td>default</td><td>-</td></tr>
<tr><td colspan="9">Displayed in decimal format, after conversion to binary format, it contains 0-9 digits, the low-order to high-order indicates the status of digital output terminals DI1~DI10, 0=OFF, 1=ON, the 0th bit corresponds to DI1, …, the first Bit 9 corresponds to DI10.</td></tr>
</table>

<table>
<tr><td rowspan="2">P06.14</td><td>Name</td><td colspan="3">DI forced input</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1023</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">Input in decimal (BCD) format and convert it into binary (Binary), which is the corresponding DIx input signal. For example: P06.14=42(BCD)=0000101010(Binary), it means DI2, DI4 and DI6 terminals are ON.</td></tr>
</table>

<table>
<tr><td rowspan="2">P06.15</td><td>Name</td><td colspan="3">DI terminal actual level</td><td>Set method</td><td>-</td><td>Access</td><td>RO</td></tr>
<tr><td>Range</td><td>0~1023</td><td>Unit</td><td>-</td><td>active moment</td><td>-</td><td>default</td><td>-</td></tr>
<tr><td colspan="9">Displayed in decimal format, after conversion to binary format, it contains 0-9 digits, the low-order to high-order indicates the status of digital output terminals DI1~DI10, 0=OFF, 1=ON, the 0th bit corresponds to DI1, …, the first Bit 9 corresponds to DI10.</td></tr>
</table>

<table>
<tr><td rowspan="2">P06.17</td><td>Name</td><td colspan="3">Low-speed DI filter configuration</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>1~32767</td><td>Unit</td><td>us</td><td>active moment</td><td>Immediately</td><td>default</td><td>1000</td></tr>
</table>

<table>
<tr><td rowspan="2">P06.21</td><td>Name</td><td colspan="3">DI1 valid level</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Type of level
0	Active when low level
1	Active when high level

<table>
<tr><td rowspan="2">P06.22</td><td>Name</td><td colspan="3">DI2 valid level</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Type of level
0	Active when low level
1	Active when high level

P06.23	Name	DI3 valid level			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Type of level
0	Active when low level
1	Active when high level

P06.24	Name	DI4 valid level			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Type of level
0	Active when low level
1	Active when high level

P06.40	Name	DO1/DO2 function control register			Set method	anytime	Access	RW
	Range	0~2	Unit	-	active moment	Immediately	default	0

Setting	Type of function
0	DO1 and DO2 are output with the functions configured by P06.41 and P06.42 respectively
1	DO1, DO2 output A and B pulses respectively
2	DO1 outputs the Z point signal, DO2 outputs the function configured by P06.42

P06.41	Name	DO1 function control register			Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	9

Setting	DO function
0	None
1	The drive is being enabled
2	The speed reaches a given value

3	Slow down
4	Rising speed
5	at zero speed
6	overspeed
7	Forward rotation
8	Reverse rotation
9	fault output
10	Forward speed limit in torque mode
11	Negative speed limit in torque mode
12	Speed limit in torque mode
13	Positioning complete output
14	positioning proximity output
15	Origin zero return complete output
16	Position error is too large output
17	Interrupt fixed length completion output
18	Software limit output
24	Holding brake output
25	The input command is valid
26	Always OFF
27	Always ON
28	Torque limit output
29	Torque arrives
30	Internal trigger state
31	Internal counter counts arrival
32	Speed is consistent
33	The pulse position command is zero output
34	Roll diameter reaches 2 output
35	The speed command is 0 output.
36	The speed command is 0 and the speed feedback is 0 output
37	Servo is ready to output

P06.42	Name	DO2 function control register			Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	13
Please refer to P06.41 for the specific functions of the DO port.								

P06.43	Name	DO3 function control register			Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0

Please refer to P06.41 for the specific functions of the DO port.

<table>
<tr><td rowspan="2">P06.49</td><td>Name</td><td colspan="3">DO terminal valid state</td><td>Set method</td><td>-</td><td>Access</td><td>RO</td></tr>
<tr><td>Range</td><td>-</td><td>Unit</td><td>-</td><td>active moment</td><td>-</td><td>default</td><td>-</td></tr>
<tr><td colspan="9">Displayed in decimal format, after conversion to binary format, it contains 0-5 digits, the low digits to high digits indicate the status of digital output terminals DO1~DO6 in turn, 0=OFF, 1=ON, the 0th bit corresponds to DO1, ..., the first Bit 5 corresponds to DO6.</td></tr>
</table>

<table>
<tr><td rowspan="2">P06.50</td><td>Name</td><td colspan="3">DO force output</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~63</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">Displayed in decimal format, after converting to binary format, it contains 0-5 digits, the low-order to high-order indicates the state of digital output terminals DO1~DOI6, 0=OFF, 1=ON, the 0th bit corresponds to DO1, ..., the first Bit 2 corresponds to DO3.</td></tr>
</table>

<table>
<tr><td rowspan="2">P06.51</td><td>Name</td><td colspan="3">DO1 valid level</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Level validity
0	Active low level
1	Active high level

<table>
<tr><td rowspan="2">P06.52</td><td>Name</td><td colspan="3">DO2 valid level</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Level validity
0	Active low level
1	Active high level

<table>
<tr><td rowspan="2">P06.53</td><td>Name</td><td colspan="3">DO3 valid level</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Level validity
0	Active low level
1	Active high level

P06.61	Name	AI1 input voltage			Set method	-	Access	RO
	Range	0~10000	Unit	mV	active moment	-	default	-

P06.62	Name	AI2 input voltage			Set method	-	Access	RO
	Range	0~10000	Unit	mV	active moment	-	default	-

P06.64	Name	AI1 offset			Set method	anytime	Access	RW
	Range	-10000~10000	Unit	mV	active moment	Immediately	default	0

P06.65	Name	AI1 Deadband			Set method	anytime	Access	RW
	Range	-5000~5000	Unit	mV	active moment	Immediately	default	0

P06.66	Name	AI1 magnification			Set method	anytime	Access	RW
	Range	-3276.7~3276.7	Unit	%	active moment	Immediately	default	100.0

P06.67	Name	AI1 low-pass filter time constant			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	2

P06.68	Name	AI1 Zero Drift			Set method	anytime	Access	RW
	Range	-10000~10000	Unit	mV	active moment	Immediately	default	0

P06.69	Name	AI2 offset			Set method	anytime	Access	RW
	Range	-10000~10000	Unit	mV	active moment	Immediately	default	0

P06.70	Name	AI2 Deadband			Set method	anytime	Access	RW
	Range	0~5000	Unit	mV	active moment	Immediately	default	0

P06.71	Name	AI2 magnification			Set method	anytime	Access	RW
	Range	-3276.7~3276.7	Unit	%	active moment	Immediately	default	100.0

P06.72	Name	AI2 low pass filter time constant			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	2

P06.73	Name	AI2 zero drift			Set method	anytime	Access	RW
	Range	-10000~10000	Unit	mV	active moment	Immediately	default	0

P06.79	Name	Automatic zero drift correction			Set method	anytime	Access	RW
	Range	0~6	Unit	-	active moment	Immediately	default	0

Setting	AI automatic correction of zero drift
0	reserve
1	Immediately automatically correct AI1 zero drift once
2	Immediately automatically correct AI2 zero drift once
3	Immediately automatically correct AI3 zero drift once (hardware is not supported)
4	Immediately automatically correct AI1 AI2 AI3 zero drift once
5	Immediately automatically correct the zero drift of the current sensor once
6	Immediately clear the calibration current sensor

P06.86	Name	Internal amplifier tension input AD minimum			Set method	anytime	Access	RW
	Range	0~4095	Unit	-	active moment	Immediately	default	0

P06.87	Name	Internal amplifier tension input AD maximum			Set method	anytime	Access	RW
	Range	0~4095	Unit	-	active moment	Immediately	default	4095

P06.88	Name	Internal amplifier tension input filtering time			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	20

P06.89	Name	Internal amplifier tension input AD value			Set method	-	Access	RO
	Range	0~4095	Unit	-	active moment	-	default	-

P06.91	Name	Percentage of final AI1 input value			Set method	-	Access	RO
	Range	-3276.7~3276.7	Unit	%	active moment	-	default	-

P06.92	Name	Percentage of final AI2 input value			Set method	-	Access	RO
	Range	-3276.7~3276.7	Unit	%	active moment	-	default	-

9.8 P07 group parameters - loop control parameters

P07.01	Name	Current loop proportional gain			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	100

P07.02	Name	Current loop integral gain			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	20

P07.03	Name	Speed loop proportional gain			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	600

P07.04	Name	Speed loop integral gain			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	50

P07.40	Name	Speed loop differential gain			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	50

P07.41	Name	Forward torque feed forward percentage			Set method	anytime	Access	RW
	Range	0~100	Unit	%	active moment	Immediately	default	0

P07.81	Name	Reverse torque feedforward percentage			Set method	anytime	Access	RW
	Range	0~100	Unit	%	active moment	Immediately	default	0

P07.42	Name	Speed loop proportional gain percentage			Set method	anytime	Access	RW
	Range	0~100	Unit	%	active moment	Immediately	default	0

P07.05	Name	Position loop proportional gain			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	200

P07.06	Name	Percentage of position loop maximum output speed			Set method	anytime	Access	RW
	Range	0~300.0	Unit	%	active moment	Immediately	default	100.0

P07.07	Name	Output voltage filtering			Set method	anytime	Access	RW
	Range	0~300.0	Unit	ms	active moment	Immediately	default	0

P07.08	Name	Torque feedforward filter time constant			Set method	anytime	Access	RW
	Range	0~63	Unit	ms	active moment	Immediately	default	10
This value is the angular acceleration filter time during torque feedforward.								

P07.09	Name	Speed feedforward filter time constant			Set method	anytime	Access	RW
	Range	0~63	Unit	-	active moment	Immediately	default	10

P07.10	Name	Torque feedforward coefficient		Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	0

P07.11	Name	Speed feed forward coefficient		Set method	anytime	Access	RW
	Range	0~300.0	Unit	-	active moment	Immediately	default	50.0

P07.12	Name	Torque filter type		Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Torque filter type
0	low pass filtering
1	notch filter
2	No filtering
3	Combined low-pass filtering and notch filter
4	Automatic calculation of filter parameters

P07.13	Name	Torque low-pass filter time constant		Set method	anytime	Access	RW
	Range	0~327.67	Unit	ms	active moment	Immediately	default	0.80

P07.14	Name	Notch Filter 1 Notch Frequency		Set method	anytime	Access	RW
	Range	0~1000	Unit	Hz	active moment	Immediately	default	0

P07.15	Name	notch filter 1 notch depth		Set method	anytime	Access	RW
	Range	0~100.0	Unit	%	active moment	Immediately	default	10.0

P07.16	Name	Notch filter 1 notch width			Set method	anytime	Access	RW
	Range	0~100.0	Unit	%	active moment	Immediately	default	50.0

P07.17	Name	notch filter 2 notch frequency			Set method	anytime	Access	RW
	Range	0~1000	Unit	ms	active moment	Immediately	default	0

P07.18	Name	notch filter 2 notch depth			Set method	anytime	Access	RW
	Range	0~100.0	Unit	%	active moment	Immediately	default	50.0

P07.19	Name	notch filter 2 notch width			Set method	anytime	Access	RW
	Range	0~100.0	Unit	%	active moment	Immediately	default	50.0

P07.44	Name	Notch filter 3 Notch frequencies			Set method	anytime	Access	RW
	Range	0~1000	Unit	Hz	active moment	Immediately	default	0

P07.45	Name	Notch Filter 3 Notch Depth			Set method	anytime	Access	RW
	Range	0~100.0	Unit	%	active moment	Immediately	default	10.0

P07.46	Name	Notch filter 3 Notch width			Set method	anytime	Access	RW
	Range	0~100.0	Unit	%	active moment	Immediately	default	50.0

P07.47	Name	Notch Filter 4 Notch Frequency			Set method	anytime	Access	RW
	Range	0~1000	Unit	Hz	active moment	Immediately	default	0

P07.48	Name	Notch Filter 4 Notch Depth			Set method	anytime	Access	RW
	Range	0~100.0	Unit	%	active moment	Immediately	default	10.0

P07.49	Name	Notch filter 4 notch width			Set method	anytime	Access	RW
	Range	0~100.0	Unit	%	active moment	Immediately	default	50.0

P07.20	Name	Gain adjustment mode			Set method	anytime	Access	RW
	Range	0~5	Unit	-	active moment	Immediately	default	0

Setting	Gain adjustment mode
0	fixed first set of gain: P07.03 to P07.05
1	First or second set of gain switching
2	Automatically calculate a set of gains based on rigidity level and load inertia (normal mode)
3	Automatically calculates a set of gains based on rigidity level and load inertia (positioning mode)
4	The first set of gains is fixed and the proportional gain is in units of bandwidth times 6.28
5	No adjustment required, control according to parameter P07.78

P07.21	Name	The second set of speed loop proportional gain			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	800

P07.22	Name	The second set of speed loop integral gain			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10

P07.23	Name	The second set of position loop proportional gain			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	200

<table>
<tr><td rowspan="2">P07.24</td><td>Name</td><td colspan="3">Gain switching condition</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~6</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Gain switching condition
0	IO switching; INFn.41 switching, use the second set of gains when valid.
1	Switch to the second set of gains when the torque command is large; When the torque command is greater than (gain switching level P07.25 + gain switching delay P07.26), switch to the second set of gains; when the torque command is less than (gain switching level - gain switching delay), switch back to the first set of gains gain.
2	Switch to the second set of gains when the speed given command is large; When the speed command is greater than (gain switching level (rpm) + gain switching delay (rpm)), switch to the second set of gains; if the speed command is less than (gain switching level - gain switching delay time), switch back to the first set of gains.
3	Switch to the second set of gains when the acceleration command is large; When the acceleration command (rpm/s) is greater than (gain switching level + gain switching delay), switch to the second set of gains; when the acceleration command (rpm/s) is less than (gain switching level - gain switching delay), switch back to the first set of gains set of gains.
4	Switch to the second set of gains when the speed error is large; When the speed error (rpm) is greater than (gain switching level + gain switching time delay), switch to the second set of gains; when the speed error (rpm) is less than (gain switching level - gain switching delay time), switch back to the first set of gains.
5	Switch to the second set of gains when the position error after filtering is large; When the filtered position error (unit is motor encoder pulse) is greater than (gain switching level + gain switching delay), switch to the second set of gains; the filtered position error (unit is motor encoder pulse) is less than (gain switching level - gain switch time delay), switch back to the first set of gains.
6	When positioning is completed, switch to the second set of gains, and switch to the first set of gains without positioning.

<table>
<tr><td rowspan="2">P07.25</td><td>Name</td><td colspan="3">Gain switching level</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~32767</td><td>Unit</td><td>-</td><td>active</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

					moment			

P07.26	Name	Gain switching time delay			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	0

P07.27	Name	Gain switching time			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	10
The two gain switching are smooth switching, and this parameter is the smoothing time parameter.								

P07.28	Name	rigid setting			Set method	anytime	Access	RW
	Range	0~31	Unit	-	active moment	Immediately	default	10
Set rigidity of the motor								

P07.29	Name	Load inertia coefficient			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	400
Load inertia coefficient								

P07.30	Name	Zero speed speed gain reduction/amplification			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	%	active moment	Immediately	default	50.0

P07.31	Name	Zero-speed position gain reduction/amplification			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	%	active moment	Immediately	default	100.0

P07.32	Name	Zero speed decay threshold			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	10
When the speed rpm is less than this value, the gain of the speed loop, position loop and current loop will be attenuated/amplified according to P07.30, P07.31 and P07.34 respectively.								

P07.33	Name	Inertia self-learning acceleration and deceleration time			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	500

P07.34	Name	Zero-speed current gain reduction			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	%	active moment	Immediately	default	0.0

P07.35	Name	Inertia self-learning option			Set method	anytime	Access	RW
	Range	0~1	Unit	%	active moment	Immediately	default	0

Setting	Inertia self-learning option
0	After learning the inertia, only learn the torque feedforward coefficient
1	After learning the inertia, automatically calculate a set of gains according to the rigidity setting and the learned inertia coefficient and write to P07.03 P07.04 P07.05

P07.38	Name	Vibration Monitoring Threshold Percentage			Set method	anytime	Access	RW
	Range	0~32767	Unit	%	active moment	Immediately	default	100

P07.39	Name	Vibration monitoring value			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	0

P07.50	Name	torque compensation mode			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediatel y	default	0

Setting	torque compensation mode
0	Compensate a fixed value P07.53
1	Compensation via AI1
2	Compensation via AI2
3	Compensation via AI3 (not supported on hardware)
4	Automatic compensation through compensation coefficient

P07.43	Name	Torque compensation gain 1			Set method	anytime	Access	RW
	Range	10~1000	Unit	-	active moment	Immediately	default	100

P07.89	Name	Torque compensation gain			Set method	anytime	Access	RW
	Range	10~1000	Unit	-	active moment	Immediately	default	100

P07.51	Name	Torque compensation filter time			Set method	anytime	Access	RW
	Range	0~32767	Unit	ms	active moment	Immediately	default	10

P07.52	Name	Torque Compensation Inertia Coefficient			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	0

P07.53	Name	Torque compensation fixed value			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P07.54	Name	Torque compensation gain			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	%	active moment	Immediately	default	100

P07.55	Name	low frequency rejection notch filter frequency			Set method	anytime	Access	RW
	Range	0~1000	Unit	Hz	active moment	Immediately	default	0

P07.56	Name	Low frequency rejection notch depth			Set method	anytime	Access	RW
	Range	0~100.0	Unit	%	active moment	Immediately	default	10.0

P07.57	Name	Low frequency rejection			Set	anytime	Access	RW

		notch width			method			
	Range	0~100.0	Unit	%	active moment	Immediately	default	50.0

P07.58	Name	position command notch filter frequency			Set method	anytime	Access	RW
	Range	0~1000	Unit	Hz	active moment	Immediately	default	0

P07.59	Name	Position command notch filter depth			Set method	anytime	Access	RW
	Range	0~100.0	Unit	%	active moment	Immediately	default	10.0

P07.60	Name	Position command notch filter width			Set method	anytime	Access	RW
	Range	0~100.0	Unit	%	active moment	Immediately	default	50.0

P07.61	Name	Advanced control function selection			Set method	anytime	Access	RW
	Range	0~9999	Unit	-	active moment	Immediately	default	0.0
AAA.B format. Ordinary feedforward control when AAA=0; single-inertia model prediction when AAA=1; double-inertia model prediction when AAA=2; single-inertia model prediction when AAA=3 (no model prediction position filter), double-inertia model when AAA=4 Model prediction (no model prediction position filter), when B=0, the continuous vibration suppression function is invalid, and when B=1, the continuous vibration suppression function is valid.								

P07.62	Name	Model prediction gain			Set method	anytime	Access	RW
	Range	1.0~2000.0	Unit	-	active moment	Re-enable takes effect	default	50.0

P07.63	Name	Model Predicted Compensation			Set method	anytime	Access	RW
	Range	50.0~200.0	Unit	-	active moment	Re-enable takes effect	default	100.0

P07.64	Name	The model predicts			Set	anytime	Access	RW

		forward gain		method				
	Range	0~3000.0	Unit	-	active moment	Re-enable takes effect	default	100.0

P07.65	Name	Model predicts inverse gain		Set method	anytime	Access	RW	
	Range	0.0~3000.0	Unit	-	active moment	Re-enable takes effect	default	100.0

P07.66	Name	Model predicts frequency of suppression 1		Set method	anytime	Access	RW	
	Range	1.0~250.0	Unit	-	active moment	Re-enable takes effect	default	50.0

P07.67	Name	Model predicts frequency of suppression 2		Set method	anytime	Access	RW	
	Range	1.0~250.0	Unit	-	active moment	Re-enable takes effect	default	50.0

P07.68	Name	The model predicts the feedforward velocity		Set method	anytime	Access	RW	
	Range	0~3000	Unit	-	active moment	Re-enable takes effect	default	100

P07.69	Name	Model predicts 2 gain		Set method	anytime	Access	RW	
	Range	1.0~2000.0	Unit	-	active moment	Re-enable takes effect	default	50.0

P07.70	Name	Model Prediction 2 Compensation		Set method	anytime	Access	RW	
	Range	50.0~200.0	Unit	-	active moment	Re-enable takes effect	default	100.0

P07.71	Name	continuous vibration	Set	anytime	Access	RW

		suppression frequency			method			
	Range	1~2000	Unit	-	active moment	Immediately	default	100

P07.72	Name	Continuous vibration suppression inertia compensation			Set method	anytime	Access	RW
	Range	1~1000	Unit	-	active moment	Immediately	default	100

P07.73	Name	Continuous Vibration Suppression Speed Feedback Compensation Percentage			Set method	anytime	Access	RW
	Range	0~300	Unit	%	active moment	Immediately	default	0

P07.74	Name	Continuous Vibration Suppression Low Pass Filter Time Constant Compensation			Set method	anytime	Access	RW
	Range	-10~10	Unit	-	active moment	Immediately	default	0

P07.75	Name	Continuous vibration suppression high-pass filtering time constant compensation			Set method	anytime	Access	RW
	Range	-10~10	Unit	-	active moment	Immediately	default	0

P07.76	Name	Continuous vibration suppression speed feedback compensation percentage 2			Set method	anytime	Access	RW
	Range	0~300	Unit	%	active moment	Immediately	default	0

P07.77	Name	Continuous vibration suppresses higher vibration frequencies			Set method	anytime	Access	RW
	Range	1~5000	Unit	-	active moment	Immediately	default	2000

P07.78	Name	No adjustment parameters			Set method	anytime	Access	RW
	Range	0.0~7.7	Unit	-	active moment	Immediately	default	0.0
A.B format. A refers to the rigidity level, the setting range is 0-7, generally 4 or less. B refers to the inertia level, the setting range is 0-7, generally about 4								

P07.79	Name	Position mode acceleration compensation coefficient			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P07.80	Name	Position mode acceleration compensation time constant			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P07.90	Name	Actual speed loop proportional gain			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

P07.91	Name	Actual speed loop integral gain			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

P07.92	Name	Actual position loop proportional gain			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

P07.93	Name	Final value of torque compensation	Set method	-	Access	RO

	Range	0~3276.7	Unit	-	active moment	-	default	-

P07.95	Name	Proportional gain of recommended current loop			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

P07.96	Name	Recommended integral gain of current loop			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

9.9 P08 group parameters - communication parameters

P08.16	Name	Torque communication given			Set method	anytime	Access	RW
	Range	-3276.7~3276.7	Unit	-	active moment	Immediately	default	0.0

P08.17	Name	Speed communication given			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P08.18	Name	position communication given			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	-	active moment	Immediately	default	0

P08.20	Name	Modbus baud rate registers			Set method	anytime	Access	RW
	Range	0~5	Unit	bps	active moment	Immediately	default	1

Setting	Modbus baud rate
0	4800
1	9600
2	19200
3	38400
4	57600

5	115200

P08.21	Name	Modbus data format registers		Set method	anytime	Access	RW
	Range	0~3	Unit -	active moment	Reset takes effect	default	1

Setting	Modbus data format
0	No parity, 2 stop bits
1	No parity, 1 stop bit
2	Even parity, 1 stop bit
3	Odd parity, 1 stop bit

This parameter is valid when reset.

P08.22	Name	32-bit address access high and low byte order			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	1

Setting	Byte order when 32-bit address is accessed
0	High 16 bits first
1	Low 16 bits first

P08.23	Name	Modbus slave address			Set method	anytime	Access	RW
	Range	1~255	Unit	-	active moment	Immediately	default	1

P08.24	Name	Modbus fault register			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

P08.25	Name	Transmit FIFO bytes			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

P08.26	Name	Monitor port baud rate			Set method	anytime	Access	RW
	Range	0~2	Unit	bps	active moment	Reset takes effect	default	2

Setting	RS232 monitor port baud rate
0	9600
1	38400
2	115200

P08.27	Name	MODBUS response delay character cycle (character time)			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Reset takes effect	default	0

P08.29	Name	RS232 monitoring port to send curve or send text			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	RS232 monitoring port to send curve or send text
0	sending curve
1	Send a text

P08.30	Name	Choose ARM serial port or PN serial port			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Reset takes effect	default	0

Setting	Choose ARM serial port or PN serial port
0	ARM
1	PN

P08.31	Name	Initial value of PN servo P930			Set method	anytime	Access	RW
	Range	0~10	Unit	-	active moment	Immediately	default	0

P08.32	Name	PN communication position compensation			Set method	anytime	Access	RW
	Range	0~1000	Unit	-	active moment	Immediately	default	0

P08.40	Name	CAN bus baud rate			Set method	anytime	Access	RW
	Range	125~1000	Unit	Kbps	active moment	Immediately	default	500

P08.41	Name	CAN node number			Set method	anytime	Access	RW
	Range	0~127	Unit	-	active moment	Immediately	default	0

P08.42	Name	Enable custom 402 protocol			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Enable custom 402 protocol
0	Use the standard 402 protocol
1	Do not use the standard 402 protocol, use the modified 402 protocol

P08.44	Name	SDO byte order			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	SDO byte order
0	Standard SDO byte order
1	Standard SDO byte order reverse

P08.49	Name	CANopen bus restart times or Profinet servo encoder status			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P08.50	Name	CANopen bus transmit buffer occupies space or Profinet servo encoder G1STW			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P08.51	Name	CANopen/Profinet bus send frame count	Set method	-	Access	RO

	Range	-	Unit	-	active moment	-	default	-

P08.52	Name	CANopen/Profinet bus receive frame count			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P08.53	Name	CANopen bus receive frame error count or encoder status value G1ZSW			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P08.54	Name	CANopen bus JITTER or encoder command G1CMD			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P08.55	Name	Extrapolation speed			Set method	-	Access	RO
	Range	-	Unit	User Units/Sec	active moment	-	default	-

P08.57	Name	Interpolation speed			Set method	-	Access	RO
	Range	-	Unit	User Units/Sec	active moment	-	default	-

P08.59	Name	filtered speed			Set method	-	Access	RO
	Range	-	Unit	User Units/Sec	active moment	-	default	-

P08.61	Name	Extrapolation position			Set method	-	Access	RO
	Range	-	Unit	User Units	active moment	-	default	-

P08.63	Name	interpolated position			Set method	-	Access	RO
	Range	-	Unit	User Units	active moment	-	default	-

P08.65	Name	Extrapolation error			Set method	-	Access	RO
	Range	-	Unit	User Units	active moment	-	default	-

P08.67	Name	interpolation error			Set method	-	Access	RO
	Range	-	Unit	User Units	active moment	-	default	-

P08.69	Name	control error			Set method	-	Access	RO
	Range	-	Unit	User Units	active moment	-	default	-

P08.71	Name	true error			Set method	-	Access	RO
	Range	-	Unit	User Units	active moment	-	default	-

P08.73	Name	Predicted position error			Set method	-	Access	RO
	Range	-	Unit	User Units	active moment	-	default	-

P08.74	Name	Status word of the CANopen402 protocol			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P08.75	Name	ECAT PDI JITTER	Set	-	Access	RO

				method				
	Range	-	Unit	3.556	active moment	-	default	-

P08.76	Name	ECAT BIT STATE			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P08.77	Name	Control word of CANopen402 protocol			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P08.78	Name	CANSENDERR			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P08.79	Name	ECAT DEBUG			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

9.10 P09 group parameters - advanced debugging parameters

P09.01	Name	Debug parameter 1			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P09.02	Name	Debug parameter 2			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P09.03	Name	Debug parameter 3			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P09.04	Name	Debug parameter 4			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P09.05	Name	Debug parameter 5			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P09.06	Name	Debug parameter 6			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P09.07	Name	Debug parameter 7			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P09.08	Name	Debug parameter 8			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active	Immediately	default	0

					moment			

P09.09	Name	Real time speed monitoring			Set method	-	Access	RO
	Range	-	Unit	rpm	active moment	-	default	-

P09.10	Name	UD output monitoring			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.11	Name	UQ output monitoring			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.12	Name	A Compares the value of A register			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.13	Name	B compares the value of the register			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.14	Name	C compare the value of the register			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.16	Name	Z-Point Count			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.19	Name	Electrical angle value Q10			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.20	Name	Speed loop given			Set method	-	Access	RO
	Range	-	Unit	‰	active moment	-	default	-

P09.21	Name	Speed loop feedback			Set method	-	Access	RO
	Range	-	Unit	‰	active moment	-	default	-

P09.22	Name	Speed loop forward limiter			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.23	Name	Speed loop reverse limiter			Set	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.24	Name	The output value of the speed loop			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.25	Name	D-axis current loop given			Set method	-	Access	RO
	Range	-	Unit	‰	active moment	-	default	-

P09.26	Name	D-axis current loop feedback			Set method	-	Access	RO
	Range	-	Unit	‰	active moment	-	default	-

P09.27	Name	D-axis current loop positive limiting			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.28	Name	D-axis current loop reverse limiting	Set method	-	Access	RO

	Range	-	Unit	-	active moment	-	default	-

P09.29	Name	D-axis current loop output			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.30	Name	Q-axis current loop given			Set method	-	Access	RO
	Range	-	Unit	‰	active moment	-	default	-

P09.31	Name	Q-axis current loop feedback			Set method	-	Access	RO
	Range	-	Unit	‰	active moment	-	default	-

P09.32	Name	Q-axis current loop positive limiting			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.33	Name	Q-axis current loop reverse limiting			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.34	Name	Q-axis current loop output			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.39	Name	original phase			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.41	Name	Braking resistor PWM duty cycle			Set method	-	Access	RO
	Range	-	Unit	%	active moment	-	default	-

P09.45	Name	Before Q-axis current filtering			Set method	-	Access	RO
	Range	-	Unit	‰	active moment	-	default	-

P09.47	Name	Hardware self-test fault codes			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.48	Name	Start time of current loop control			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.49	Name	Start time of speed loop control			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.59	Name	Sine wave generator amplitude	Set method	anytime	Access	RW
	Range	-32767~32767	Unit	Speed Mode: Motor Rated Speed % Torque mode: drive rated current %		
	active moment	Immediately	default	0		

P09.60	Name	Sine wave generator frequency			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	-	active moment	Immediately	default	0

P09.62	Name	Bits that need to be monitored			Set method	anytime	Access	RW
	Range	0~65535	Unit	-	active moment	Immediately	default	0

P09.63	Name	The value of the bit to monitor	Set method	-	Access	RO

	Range	-	Unit	-	active moment	-	default	-

P09.75	Name	Number of speed loop interruptions			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.76	Name	Number of current loop interruptions			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.85	Name	Speed loop execution cycle			Set method	-	Access	RO
	Range	-	Unit	us	active moment	-	default	-

P09.86	Name	Speed loop execution time			Set method	-	Access	RO
	Range	-	Unit	us	active moment	-	default	-

P09.87	Name	Current loop execution cycle			Set method	-	Access	RO
	Range	-	Unit	us	active moment	-	default	-

P09.88	Name	Current loop execution time			Set method	-	Access	RO
	Range	-	Unit	us	active moment	-	default	-

P09.89	Name	Speed reference in position mode			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.90	Name	Position error in position mode			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.91	Name	Brake resistor heat percentage			Set method	-	Access	RO
	Range	-	Unit	%	active moment	-	default	-

P09.93	Name	1ms task execution cycle			Set method	-	Access	RO
	Range	-	Unit	us	active moment	-	default	-

P09.94	Name	UD feedforward voltage			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.95	Name	UQ feedforward voltage			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.96	Name	Absolute encoder communication error			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P09.98	Name	Absolute encoder communication error 2			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

9.11 P10 group parameters - fault protection parameters

P10.01	Name	Overcurrent Threshold			Set method	anytime	Access	RW
	Range	0~800.0	Unit	%	active moment	Reset takes effect	default	400.0
When the detected current percentage P09.31 is greater than this value, a software overcurrent fault will be reported.								

<table>
<tr><td rowspan="2">P10.02</td><td>Name</td><td colspan="3">Overload value</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~3276.7</td><td>Unit</td><td>%</td><td>active moment</td><td>Immediately</td><td>default</td><td>100.0</td></tr>
<tr><td colspan="9">This value is recommended to be set to $\frac{\text{Motor rated current}}{\text{Drive rated current}}$ 。</td></tr>
</table>

<table>
<tr><td rowspan="2">P10.03</td><td>Name</td><td colspan="3">Lock-rotor protection current threshold</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~300.0</td><td>Unit</td><td>%</td><td>active moment</td><td>Immediately</td><td>default</td><td>100</td></tr>
<tr><td colspan="9">When the drive current percentage P09.31 exceeds this value and lasts for the time of P10.04, and the speed is less than 5rpm, a fault will be reported. This value is recommended to use the shortcut button in the VECObserve software → the default value after a full set of matching.</td></tr>
</table>

<table>
<tr><td rowspan="2">P10.04</td><td>Name</td><td colspan="3">Lock-rotor protection time threshold</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~65535</td><td>Unit</td><td>ms</td><td>active moment</td><td>Immediately</td><td>default</td><td>800</td></tr>
<tr><td colspan="9">When the drive current percentage P09.31 exceeds P10.03, and lasts for the time of P10.04, and the speed is less than 5rpm, a fault will be reported. This value is recommended to use the shortcut button in the VECObserve software → the default value after a full set of matching.</td></tr>
</table>

<table>
<tr><td rowspan="2">P10.05</td><td>Name</td><td colspan="3">Over speed percentage</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~3276.7</td><td>Unit</td><td>%</td><td>active moment</td><td>Immediately</td><td>default</td><td>150.0</td></tr>
<tr><td colspan="9">Speed percentage: The percentage of actual speed relative to rated speed. When the speed percentage is greater than the over-speed percentage, an over-speed fault is reported.</td></tr>
</table>

<table>
<tr><td rowspan="2">P10.06</td><td>Name</td><td colspan="3">Drive Overheat Threshold</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~3276.7</td><td>Unit</td><td>℃</td><td>active moment</td><td>Immediately</td><td>default</td><td>80.0</td></tr>
</table>

<table>
<tr><td rowspan="2">P10.07</td><td>Name</td><td colspan="3">Phase loss protection settings</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~32767</td><td>Unit</td><td></td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">When the 0th bit is 1, the output phase loss protection is enabled; when the 1st bit is 1, the input phase loss protection is enabled.</td></tr>
</table>

P10.08	Name	Return to origin time-out time			Set method	anytime	Access	RW
	Range	0~32767	Unit	s	active moment	Immediately	default	0

P10.09	Name	Motor encoder position memory function when power is off			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Power-off motor encoder position memory selection
0	The position of the motor encoder is not memorized when the power is turned off
1	Power-off memory motor encoder position

P10.10	Name	AI zero drift threshold			Set method	anytime	Access	RW
	Range	0~32767	Unit	mV	active moment	Immediately	default	500

P10.11	Name	Overload curve selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

P10.12	Name	Zero speed command automatically reduces torque limit value			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	%	active moment	Immediately	default	0

P10.13	Name	Custom 1.1 times overload curve time			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	s	active moment	Immediately	default	0

P10.14	Name	Custom 1.5 times overload curve time			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	s	active moment	Immediately	default	0

P10.15	Name	Custom 2.0 times overload curve time			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	s	active moment	Immediately	default	0

P10.16	Name	Custom 2.5 times overload curve time			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	s	active moment	Immediately	default	0

P10.17	Name	Custom 3.0 times overload curve time			Set method	anytime	Access	RW
	Range	0~3276.7	Unit	s	active moment	Immediately	default	0

P10.18	Name	Speed monitoring value			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	0

P10.20	Name	current fault code			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

fault code	Fault description
Er.100	Software overcurrent
Er.101	hardware overcurrent
Er.102	Overvoltage
Er.103	Undervoltage
Er.104 or Er.004	The current sensor is faulty
Er.105 or Er.005	If the encoder fails and the encoder is not connected, the fault is reported.
Er.106 or Er.006	The EEPROM verify fault
Er.107	Phase sampling fault, when the phase obtained through the HALL switch and the phase obtained through the encoder are too different, this fault is reported.
Er.108 or Er.008	When the FPGA and ARM communication are faulty
Er.109	If the current changes greatly
Er.110	Magnetic encoder failure
Er.111	Current phase sequence learning failure
Er.112	The output is out of phase.
Er.113	Did not scan to Z point during self-learning
Er.114	Z point offset not found
Er.115	Hall code value learning error

Er.116	Great change in rotational speed
Er.117	The drive is overheated
Er.118	When powered on, the wire-saving encoder does not feedback hall value
Er.119	Motor encoder type does not match
Er.120	Software is not authorized
Er.121	Phase loss at RST input
Er.122 or Er.022	Use timeout
Er.130	STO (INFn75) alarm input signal is valid
Er.131	There is speed when the provincial encoder starts
Er.132	ARM does not match FPGA
Er.133 or Er.033	The Profinet protocol chip cannot communicate with the ARM motor control chip
Er.200	When returns to home, the home signal INFn.34 is not assigned.
Er.201	INFn.xx repeated allocation, one input function bit is assigned to two or more DI
Er.202	Overspeed
Er.203	The position error is too large
Er.204	Unassigned interrupt fixed length trigger signal INFn.40
Er.205	No return to home before absolute point motion
Er.206	Motor overload
Er.207	Software limit
Er.208	hardware limit
Er.209	Curve planning failed
Er.210	Excessive tension
Er.211	Breakage failure
Er.212	XY pulse type selection error in tension control mode
Er.213	Fully closed loop position error is too large
Er.214	Prohibit positive (reverse) turn
Er.216	Z point signal is unstable
Er.217	RPDO receive timeout
Er.218	Reserved
Er.219	Motor stall
Er.220	Braking resistor overload
Er.221	The forward stroke switch input function bit INFn.43 is not assigned to the entity DI
Er.222	The reverse stroke switch input function bit INFn.44 is not assigned to entity DI
Er.223	Search home error
Er.224	CAN bus state switching error
Er.225	Unsupported CANopen control mode
Er.226	Absolute value mode lap overflow
Er.227	The battery of the absolute encoder is faulty
Er.228	Inertia learning failed, need to reset P07.03 and P07.04
Er.229	When learning fully closed loop parameters
Er.230	reserve

Er.231	Bus error
Er.232	Second encoder battery failure
Er.234	continuous vibration
Er.237	car breakdown
Er.238	Linear motor phase finding failed
Er.239	Linear motor phase finding failed, stuck in forward direction
Er.240	Linear motor phase finding failed, stuck in reverse direction
Er.241	Over-travel error during self-learning
Er.242	Encoder learning error, encoder interference or wrong magnetic pole setting
Er.243	Linear motor phase finding failure (disconnection)
Er.244	Linear motor phase finding failure (large position error)
Er.245	Linear motor phase finding failure (current pulse width is too small)
Er.600	Motor overheating
Er.601	DI function code is not assigned
Er.602	AI zero drift is too large
Er.603	The zero return time out, when the zero return time is greater than P10.08, this fault will be reported.
Er.604	When the absolute encoder is self-learning
Er.605	The battery voltage of the absolute encoder is too low
Er.606	The battery voltage of the second encoder is too low
Er.607	Inertia learning failed, need to increase P07.33 and then learn
Er.608	U disk read and write failed
Er.609	Drive parameters not found during factory reset
Er.610	Motor parameters not found when restoring to factory defaults
Er.611	EEPROM verification error when restoring to factory defaults
Er.612	Self-learning current loop error
Er.613	Phase finding not yet completed
Er.701	EtherCAT bus error
Er.702	EtherCAT bus dropped
Er.703	After the back clearance compensation is increased, two steps are required before returning to zero to eliminate the back clearance

P10.21	Name	Selected fault code count			Set method	anytime	Access	RW
	Range	1~5	Unit	-	active moment	Immediately	default	5

P10.22	Name	Selected trouble code			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

P10.23	Name	Selected failure point in time			Set method	-	Access	RO
	Range	0~32767	Unit	min	active moment	-	default	-

P10.24	Name	Motor speed at selected fault			Set method	-	Access	RO
	Range	-32767~32767	Unit	rpm	active moment	-	default	-

P10.25	Name	RMS value of motor current at selected fault			Set method	-	Access	RO
	Range	0~3276.7	Unit	A	active moment	-	default	-

P10.26	Name	Motor V-phase current at selected fault			Set method	-	Access	RO
	Range	-3276.7~3276.7	Unit	A	active moment	-	default	-

P10.27	Name	Motor W-phase current at selected fault			Set method	-	Access	RO
	Range	-3276.7~3276.7	Unit	A	active moment	-	default	-

P10.28	Name	Bus voltage at selected fault			Set method	-	Access	RO
	Range	0~32767	Unit	V	active moment	-	default	-

P10.29	Name	Electric drive temperature at selected fault			Set method	-	Access	RO
	Range	0~3276.7	Unit	℃	active moment	-	default	-

P10.30	Name	Entity DI state at the time of the selected failure			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.31	Name	Entity DO state at the time of the selected fault	Set method	-	Access	RO

	Range	-	Unit	-	active moment	-	default	-

P10.32	Name	Hardware fault cumulative count value			Set method	-	Access	RO
	Range	0~32767	Unit	-	active moment	-	default	-

P10.33	Name	fault shield			Set method	anytime	Access	RW
	Range	0~65535	Unit	-	active moment	Immediately	default	12
Displayed in decimal format, after conversion to binary format, the 0th digit shields the overload, the 1st digit shields the overcurrent, the 2nd digit shields the phase fault, the 3rd digit shields the large current change fault, the 4th digit shields the hardware overcurrent major fault, The 5th bit shields the large speed change fault, the 6th bit shields the Z point instability, the 7th bit shields the SYNC loss, and the 8th bit shields the current sensor fault. Bit 9 masks undervoltage faults. The 10th bit shields the encoder fault, the 12th bit shields the stall fault								

P10.34	Name	Hardware failure time threshold			Set method	anytime	Access	RW
	Range	0~32767	Unit	20ns	active moment	Immediately	default	250
After the IGBT fault exceeds this time, the fault will be reported								

P10.35	Name	Fault minimum duration to respond to reset faults			Set method	anytime	Access	RW
	Range	0~32767	Unit	s	active moment	Immediately	default	60

P10.44	Name	Speed loop reference at last valid fault			Set method	-	Access	RO
	Range	-	Unit	%	active moment	-	default	-

P10.45	Name	Speed loop feedback at last valid fault			Set method	-	Access	RO
	Range	-	Unit	%	active moment	-	default	-

P10.46	Name	Torque reference at the last valid fault			Set method	-	Access	RO

	Range	-	Unit	%	active moment	-	default	-

P10.47	Name	Torque feedback at the last valid fault			Set method	-	Access	RO
	Range	-	Unit	%	active moment	-	default	-

P10.48	Name	Filtered position error at the last valid fault			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.49	Name	Index of current record			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.50	Name	The fault code of the fault with index 0			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.51	Name	failure time for failure with index 0			Set method	-	Access	RO
	Range	-	Unit	s	active moment	-	default	-

P10.52	Name	Rotation speed of fault with index 0			Set method	-	Access	RO
	Range	-	Unit	rpm	active moment	-	default	-

P10.53	Name	The rms value of the current for the fault with index 0			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.54	Name	Instantaneous value of the V-phase current for the fault with index 0			Set method	-	Access	RO
	Range	-	Unit	A	active	-	default	-

					moment			

P10.55	Name	Instantaneous value of the W-phase current for the fault with index 0			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.56	Name	Capacitor voltage for the fault with index 0			Set method	-	Access	RO
	Range	-	Unit	V	active moment	-	default	-

P10.57	Name	temperature of fault with			Set	-	Access	RO
	Range	-	Unit	℃	active moment	-	default	-

P10.58	Name	The DI status of the fault with index 0			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.59	Name	DO status of fault with index 0			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.60	Name	The fault code of the fault with index 1			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.61	Name	failure time for failure with index 1			Set method	-	Access	RO
	Range	-	Unit	s	active moment	-	default	-

P10.62	Name	The speed of the fault with index 1			Set method	-	Access	RO
	Range	-	Unit	rpm	active moment	-	default	-

P10.63	Name	The rms value of the current for the fault with index 1			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.64	Name	Instantaneous value of the V-phase current for the fault with index 1			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.65	Name	Instantaneous value of the W-phase current for the fault with index 1			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.66	Name	Capacitor voltage for the fault with index 1			Set method	-	Access	RO
	Range	-	Unit	V	active moment	-	default	-

P10.67	Name	temperature of fault with index 1			Set method	-	Access	RO
	Range	-	Unit	℃	active moment	-	default	-

P10.68	Name	The DI status of the fault with index 1			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.69	Name	DO status of fault with index 1			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.70	Name	The fault code for fault with index 2			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.71	Name	Failure time of failure with index 2			Set method	-	Access	RO
	Range	-	Unit	s	active moment	-	default	-

P10.72	Name	Rotation speed of the fault with index 2			Set method	-	Access	RO
	Range	-	Unit	rpm	active moment	-	default	-

P10.73	Name	The rms value of the current for the fault with index 2			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.74	Name	Instantaneous value of the V-phase current for the fault with index 2			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.75	Name	W-phase current instantaneous value for fault with index 2			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.76	Name	Capacitor voltage for fault with index 2			Set method	-	Access	RO
	Range	-	Unit	V	active moment	-	default	-

P10.77	Name	temperature of fault with index 2			Set method	-	Access	RO
	Range	-	Unit	℃	active moment	-	default	-

P10.78	Name	DI state of the fault with index 2			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.79	Name	DO status of fault with index 2		Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.79	Name	DO status of fault with index 2			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.80	Name	The fault code for fault with index 3			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.81	Name	Failure time for failure with index 3			Set method	-	Access	RO
	Range	-	Unit	s	active moment	-	default	-

P10.82	Name	Rotational speed of the fault with index 3			Set method	-	Access	RO
	Range	-	Unit	rpm	active moment	-	default	-

P10.83	Name	The rms value of the current of the fault with index 3			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.84	Name	Instantaneous value of the V-phase current for the fault with index 3			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.85	Name	Instantaneous value of W-phase current for fault with index 3			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.86	Name	Capacitor voltage of the fault with index 3			Set method	-	Access	RO
	Range	-	Unit	V	active moment	-	default	-

P10.87	Name	The temperature of the fault with index 3			Set method	-	Access	RO
	Range	-	Unit	℃	active moment	-	default	-

P10.88	Name	DI status of the fault with index 3			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.89	Name	The DO status of the fault with index 3			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.90	Name	The fault code for the fault with index 4			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.91	Name	Failure time for failure with index 4			Set method	-	Access	RO
	Range	-	Unit	s	active moment	-	default	-

P10.92	Name	Rotational speed of the fault with index 4			Set method	-	Access	RO
	Range	-	Unit	rpm	active moment	-	default	-

P10.93	Name	The rms value of the current of the fault with index 4			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.94	Name	Instantaneous value of V-phase current for fault index 4			Set method	-	Access	RO
	Range	-	Unit	A	active moment	-	default	-

P10.95	Name	Instantaneous value of the			Set	-	Access	RO

		W-phase current for the fault with index 4			method			
	Range	-	Unit	A	active moment	-	default	-

P10.96	Name	Capacitor voltage of the fault with index 4			Set method	-	Access	RO
	Range	-	Unit	V	active moment	-	default	-

P10.97	Name	The temperature of the fault with index 4			Set method	-	Access	RO
	Range	-	Unit	℃	active moment	-	default	-

P10.98	Name	DI state of the fault with index 4			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P10.99	Name	The DO status of the fault with index 4			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

9.12 P11 group parameters - multi-speed parameters

P11.01	Name	Multi-speed running mode			Set method	Stop to set	Access	RW
	Range	0~2	Unit	-	active moment	Immediately	default	0

Setting	Multi-speed running mode
0	run once
1	Cycle run
2	IO switch running

P11.02	Name	total segment count			Set method	anytime	Access	RW
	Range	1~16	Unit	-	active moment	Immediately	default	16

P11.03	Name	running time unit			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	1

Setting	running time unit
0	ms
1	s

P11.04	Name	Acceleration time 1			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P11.05	Name	Deceleration time 1			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P11.06	Name	Acceleration time 2			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P11.07	Name	Deceleration time 2			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P11.08	Name	Acceleration time 3			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P11.09	Name	Deceleration time 3			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P11.10	Name	Acceleration time 4	Set method	anytime	Access	RW

	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P11.11	Name	Deceleration time 4			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P11.12	Name	The size of the speed command of the first stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.13	Name	The first speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set in P11.03.								

P11.14	Name	The first section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

P11.15	Name	The size of the speed command of the second stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.16	Name	The second speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active	Immediately	default	10

					moment			
The unit of this parameter is set on P11.03.								

P11.17	Name	The second section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

P11.18	Name	The size of the speed command of the third stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.19	Name	The third speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set on P11.03.								

P11.20	Name	The third section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

P11.21	Name	The size of the speed	Set	anytime	Access	RW

		command of the fourth stage			method			
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.22	Name	The fourth speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set on P11.03.								

P11.23	Name	The fourth section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

P11.24	Name	The size of the speed command of the fifth stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.25	Name	The fifth speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set on P11.03.								

P11.26	Name	The fifth section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

P11.27	Name	The size of the speed command of the sixth stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.28	Name	The sixth speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set on P11.03.								

P11.29	Name	The sixth section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

P11.30	Name	The size of the speed command of the seventh stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.31	Name	The seventh speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set on P11.03.								

P11.32	Name	The seventh section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

P11.33	Name	The size of the speed command of the eighth stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

<table>
<tr><td rowspan="2">P11.34</td><td>Name</td><td colspan="3">The eighth speed command running time</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~32767</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>10</td></tr>
<tr><td colspan="9">The unit of this parameter is set on P11.03.</td></tr>
</table>

<table>
<tr><td rowspan="2">P11.35</td><td>Name</td><td colspan="3">The eighth section speed acceleration and deceleration time selection</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~4</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

<table>
<tr><td rowspan="2">P11.36</td><td>Name</td><td colspan="3">The size of the speed command of the ninth stage</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>-32767~32767</td><td>Unit</td><td>rpm</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

<table>
<tr><td rowspan="2">P11.37</td><td>Name</td><td colspan="3">The ninth speed command running time</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~32767</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>10</td></tr>
<tr><td colspan="9">The unit of this parameter is set on P11.03.</td></tr>
</table>

<table>
<tr><td rowspan="2">P11.38</td><td>Name</td><td colspan="3">The ninth section speed acceleration and deceleration time selection</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~4</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2

	3	Use acceleration and deceleration time 3
	4	Use acceleration and deceleration time 4

P11.39	Name	The size of the speed command of the tenth stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.40	Name	The tenth speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set on P11.03.								

P11.41	Name	The tenth section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

P11.42	Name	The size of the speed command of the eleventh stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.43	Name	The eleventh speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set on P11.03.								

<table>
<tr><td rowspan="2">P11.44</td><td>Name</td><td colspan="3">The eleventh section speed acceleration and deceleration time selection</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~4</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

</td></tr>
</table>

P11.45	Name	The size of the speed command of the twelfth stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

<table>
<tr><td rowspan="2">P11.46</td><td>Name</td><td colspan="3">The twelfth speed command running time</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~32767</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>10</td></tr>
<tr><td colspan="9">The unit of this parameter is set on P11.03.</td></tr>
</table>

<table>
<tr><td rowspan="2">P11.47</td><td>Name</td><td colspan="3">The twelfth section speed acceleration and deceleration time selection</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~4</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

</td></tr>
</table>

P11.48	Name	The size of the speed command of the thirteenth stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.49	Name	The thirteenth speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set on P11.03.								

P11.50	Name	The thirteenth section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

P11.51	Name	The size of the speed command of the fourteenth stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.52	Name	The fourteenth speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set on P11.03.								

P11.53	Name	The fourteenth section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active	Immediately	default	0

					moment			

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

P11.54	Name	The size of the speed command of the fifteenth stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.55	Name	The fifteenth speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set on P11.03.								

P11.56	Name	The fifteenth section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

P11.57	Name	The size of the speed command of the sixteenth stage			Set method	anytime	Access	RW
	Range	-32767~32767	Unit	rpm	active moment	Immediately	default	0

P11.58	Name	The sixteenth speed command running time			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	10
The unit of this parameter is set on P11.03.								

P11.59	Name	The sixteenth section speed acceleration and deceleration time selection			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

Setting	Acceleration and deceleration time selection
0	Use universal speed mode acceleration and deceleration time
1	Use acceleration and deceleration time 1
2	Use acceleration and deceleration time 2
3	Use acceleration and deceleration time 3
4	Use acceleration and deceleration time 4

9.13 P12 group parameters - virtual DI DO parameters

P12.01	Name	Virtual DI1 function configuration			Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.								

P12.02	Name	Virtual DI2 function configuration			Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.								

P12.03	Name	Virtual DI3 function configuration			Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.								

P12.04	Name	Virtual DI4 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.05	Name	Virtual DI5 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.06	Name	Virtual DI6 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.07	Name	Virtual DI7 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.08	Name	Virtual DI8 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.09	Name	Virtual DI9 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.10	Name	Virtual DI10 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.11	Name	Virtual DI11 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.12	Name	Virtual DI12 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.13	Name	Virtual DI13 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.14	Name	Virtual DI14 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.15	Name	Virtual DI15 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.16	Name	Virtual DI16 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.17	Name	Virtual DI20 function configuration		Set method	anytime	Access	RW
	Range	0~99	Unit -	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.							

P12.18	Name	Virtual DI21 function configuration			Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The specific function of the VDI port is the same as the DI port function. For details, see P06.01.								

P12.19	Name	The monitoring value of virtual DI20 and virtual DI21			Set method	-	Access	RO
	Range	-	Unit	-	active moment	-	default	-

P12.20	Name	Virtual DI1-DI16 input value setting register			Set method	anytime	Access	RW
	Range	0~65535	Unit	-	active moment	Immediately	default	0

P12.21	Name	Virtual DI1 level type			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

P12.22	Name	Virtual DI2 level type			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

P12.23	Name	Virtual DI3 level type			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

<table>
<tr><td rowspan="2">P12.24</td><td>Name</td><td colspan="3">Virtual DI4 level type</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

<table>
<tr><td rowspan="2">P12.25</td><td>Name</td><td colspan="3">Virtual DI5 level type</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

<table>
<tr><td rowspan="2">P12.26</td><td>Name</td><td colspan="3">Virtual DI6 level type</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

<table>
<tr><td rowspan="2">P12.27</td><td>Name</td><td colspan="3">Virtual DI7 level type</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

<table>
<tr><td rowspan="2">P12.28</td><td>Name</td><td colspan="3">Virtual DI8 level type</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
</table>

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

P12.29	Name	Virtual DI9 level type		Set method	anytime	Access	RW
	Range	0~1	Unit -	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

P12.30	Name	Virtual DI10 level type		Set method	anytime	Access	RW
	Range	0~1	Unit -	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

P12.31	Name	Virtual DI11 level type		Set method	anytime	Access	RW
	Range	0~1	Unit -	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

P12.32	Name	Virtual DI12 level type		Set method	anytime	Access	RW
	Range	0~1	Unit -	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

P12.33	Name	Virtual DI13 level type	Set method	anytime	Access	RW

	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

P12.34	Name	Virtual DI14 level type			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

P12.35	Name	Virtual DI15 level type			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

P12.36	Name	Virtual DI16 level type			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

P12.37	Name	Virtual DI20 level type			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

<table>
<tr><td rowspan="2">P12.38</td><td>Name</td><td colspan="3">Virtual DI21 level type</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~1</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">

Setting	Level type
0	Write 1 is always valid
1	Valid on rising edge

</td></tr>
</table>

<table>
<tr><td rowspan="2">P12.41</td><td>Name</td><td colspan="3">Virtual DO1 configuration register</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~99</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">The VDO port function is the same as the DO port function. For details, please refer to P06.41.</td></tr>
</table>

<table>
<tr><td rowspan="2">P12.42</td><td>Name</td><td colspan="3">Virtual DO2 configuration register</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~99</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">The VDO port function is the same as the DO port function. For details, please refer to P06.41.</td></tr>
</table>

<table>
<tr><td rowspan="2">P12.43</td><td>Name</td><td colspan="3">Virtual DO3 configuration register</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~99</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">The VDO port function is the same as the DO port function. For details, please refer to P06.41.</td></tr>
</table>

<table>
<tr><td rowspan="2">P12.44</td><td>Name</td><td colspan="3">Virtual DO4 configuration register</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~99</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">The VDO port function is the same as the DO port function. For details, please refer to P06.41.</td></tr>
</table>

<table>
<tr><td rowspan="2">P12.45</td><td>Name</td><td colspan="3">Virtual DO5 configuration register</td><td>Set method</td><td>anytime</td><td>Access</td><td>RW</td></tr>
<tr><td>Range</td><td>0~99</td><td>Unit</td><td>-</td><td>active moment</td><td>Immediately</td><td>default</td><td>0</td></tr>
<tr><td colspan="9">The VDO port function is the same as the DO port function. For details, please refer to P06.41.</td></tr>
</table>

P12.46	Name	Virtual DO6 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.47	Name	Virtual DO7 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.48	Name	Virtual DO8 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.49	Name	Virtual DO9 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.50	Name	Virtual DO10 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.51	Name	Virtual DO11 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.52	Name	Virtual DO12 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.53	Name	Virtual DO13 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.54	Name	Virtual DO14 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.55	Name	Virtual DO15 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.56	Name	Virtual DO16 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.57	Name	Virtual DO20 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.58	Name	Virtual DO21 configuration register		Set method	anytime	Access	RW
	Range	0~99	Unit	-	active moment	Immediately	default	0
The VDO port function is the same as the DO port function. For details, please refer to P06.41.								

P12.59	Name	Output level of virtual DO20 D021			Set method	-	Access	RO
	Range	0~3	Unit	-	active moment	-	default	-

P12.60	Name	Virtual DO1-DO16 output level			Set method	anytime	Access	RW
	Range	0~65535	Unit	-	active moment	Immediately	default	0

P12.61	Name	Active level of virtual DO1			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.62	Name	Active level of virtual DO2			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.63	Name	Active level of virtual DO3			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.64	Name	Active level of virtual DO4			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.65	Name	Active level of virtual DO5			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.66	Name	Active level of virtual DO6			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.67	Name	Active level of virtual DO7			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.68	Name	Active level of virtual DO8			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.69	Name	Active level of virtual DO9			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active	Immediately	default	0

					moment			

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.70	Name	Active level of virtual DO10			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.71	Name	Active level of virtual DO11			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.72	Name	Active level of virtual DO12			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.73	Name	Active level of virtual DO13			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.74	Name	Active level of virtual DO14			Set method	anytime	Access	RW

	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.75	Name	Active level of virtual DO15			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.76	Name	Active level of virtual DO16			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.77	Name	Active level of virtual DO20			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.78	Name	Active level of virtual DO21			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Level type
0	Output 1 when valid
1	Output 0 when valid

P12.79	Name	Whether the virtual DI1-DI16 input value register P12.20 is powered on is cleared.			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	1

Setting	Clear type
0	Virtual DI input value P12.20, not cleared when power is turned on
1	Virtual DI input value P12.20, clear at power-on

9.14 P13 group parameters - multi-segment position parameters

P13.01	Name	Multi-segment position mode			Set method	Stop to set	Access	RW
	Range	0~2	Unit	-	active moment	Immediately	default	0

Setting	Multi-segment position working mode
0	Stop after a single run
1	Cycle operation
2	DI switching operation

When DI is switched to run, the value read (INFn.31, INFn.30, INFn.29, INFn.28) is run as the segment number.

P13.02	Name	Total number of segments			Set method	anytime	Access	RW
	Range	1~16	Unit	-	active moment	Immediately	default	16

P13.03	Name	Idle waiting time unit			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	1

Setting	Idle waiting time unit
0	ms
1	s

P13.04	Name	remainder processing method			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	remainder processing method
0	Re-jump to the first position command to run
1	From the last stop section

Margin processing method selection: when triggering multi-segment position again, whether to jump to the first position command to run again, or to start from the position command that was stopped last time.

P13.05	Name	Absolute or relative position command setting			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	1

Setting	Absolute or relative position command setting
0	Absolute command
1	relative command

P13.10	Name	Number of position commands in the first position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.12	Name	Speed of first position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.13	Name	acceleration time of first position segment			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.14	Name	idle time of first position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active	Immediately	default	1

					moment			
The unit of this parameter is set in P13.03.								

P13.15	Name	Number of position commands in the second position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	100 00

P13.17	Name	Speed of second position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.18	Name	acceleration time of second position segment			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.19	Name	idle time of second position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.20	Name	Number of position commands in the third position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.22	Name	Speed of third position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.23	Name	The 3th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active	Immediately	default	500

					moment			

P13.24	Name	idle time of third position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.25	Name	Number of position commands in the fourth position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.27	Name	Speed of fourth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.28	Name	The 4th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.29	Name	idle time of fourth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.30	Name	Number of position commands in the fifth position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.32	Name	Speed of fifth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active	Immediately	default	500

					moment			

P13.33	Name	The 5th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.34	Name	idle time of fifth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.35	Name	Number of position commands in the sixth position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.37	Name	Speed of sixth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.38	Name	The 6th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.39	Name	idle time of sixth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.40	Name	Number of position commands in the seventh position segment			Set method	anytime	Access	RW
	Range	-2147483647	Unit	User	active	Immediately	default	10000

		~ 2147483647		units	moment			

P13.42	Name	Speed of seventh position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.43	Name	The 7th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.44	Name	idle time of seventh position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.45	Name	Number of position commands in the eighth position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.47	Name	Speed of eighth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.48	Name	The 8th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.49	Name	idle time of eighth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.50	Name	Number of position commands in the ninth position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.52	Name	Speed of ninth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.53	Name	The 9th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.54	Name	idle time of ninth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.55	Name	Number of position commands in the tenth position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.57	Name	Speed of tenth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.58	Name	The 10th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.59	Name	idle time of tenth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.60	Name	Number of position commands in the eleventh position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.62	Name	Speed of eleventh position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.63	Name	The 11th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.64	Name	idle time of eleventh position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.65	Name	Number of position commands in the twelfth position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.67	Name	Speed of twelfth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.68	Name	The 12th acceleration/deceleration time		Set method	anytime	Access	RW
	Range	0~65535	Unit ms	active moment	Immediately	default	500

P13.69	Name	idle time of twelfth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.70	Name	Number of position commands in the thirteenth position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.72	Name	Speed of thirteenth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.73	Name	The 13th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.74	Name	idle time of thirteenth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.75	Name	Number of position commands in the fourteenth position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~	Unit	User units	active moment	Immediately	default	10000

		2147483647						

P13.77	Name	Speed of fourteenth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.78	Name	The 14th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.79	Name	idle time of fourteenth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.80	Name	Number of position commands in the fifteenth position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.82	Name	Speed of fifteenth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.83	Name	The 15th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.84	Name	idle time of fifteenth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.85	Name	Number of position commands in the sixteenth position segment			Set method	anytime	Access	RW
	Range	-2147483647 ~ 2147483647	Unit	User units	active moment	Immediately	default	10000

P13.87	Name	Speed of sixteenth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	rpm	active moment	Immediately	default	500

P13.88	Name	The 16th acceleration/deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.89	Name	idle time of sixteenth position segment			Set method	anytime	Access	RW
	Range	0~32767	Unit	-	active moment	Immediately	default	1
The unit of this parameter is set in P13.03.								

P13.90	Name	The 1st Deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.91	Name	The 2st Deceleration time			Set method	anytime	Access	RW
	Range	0~65535	Unit	ms	active moment	Immediately	default	500

P13.92	Name	Multi-segment position command trigger signal type			Set method	anytime	Access	RW
	Range	0~3	Unit	-	active moment	Immediately	default	1
When BIT0=0, the rising edge of INFn27 triggers the multi-segment position, and the falling edge stops executing the multi-segment position. When BIT0=1, the rising edge triggers and does not stop. When BIT1=0, when the multi-segment position comes from DI, a change of DI								

automatically triggers the multi-segment position. When BIT1=1, when the multi-segment position comes from DI, the DI change does not automatically trigger the multi-segment position, and only when INFn27 is re-triggered will the position execution be triggered.

P13.93	Name	Condition for the next command to be sent			Set method	anytime	Access	RW
	Range	0~1	Unit	-	active moment	Immediately	default	0

Setting	Selection of acceleration and deceleration time
0	It is necessary to wait for the previous position to complete the output and then delay the idle time before sending the next position command
1	After the previous position command is sent, wait for the idle time to directly send the second position command

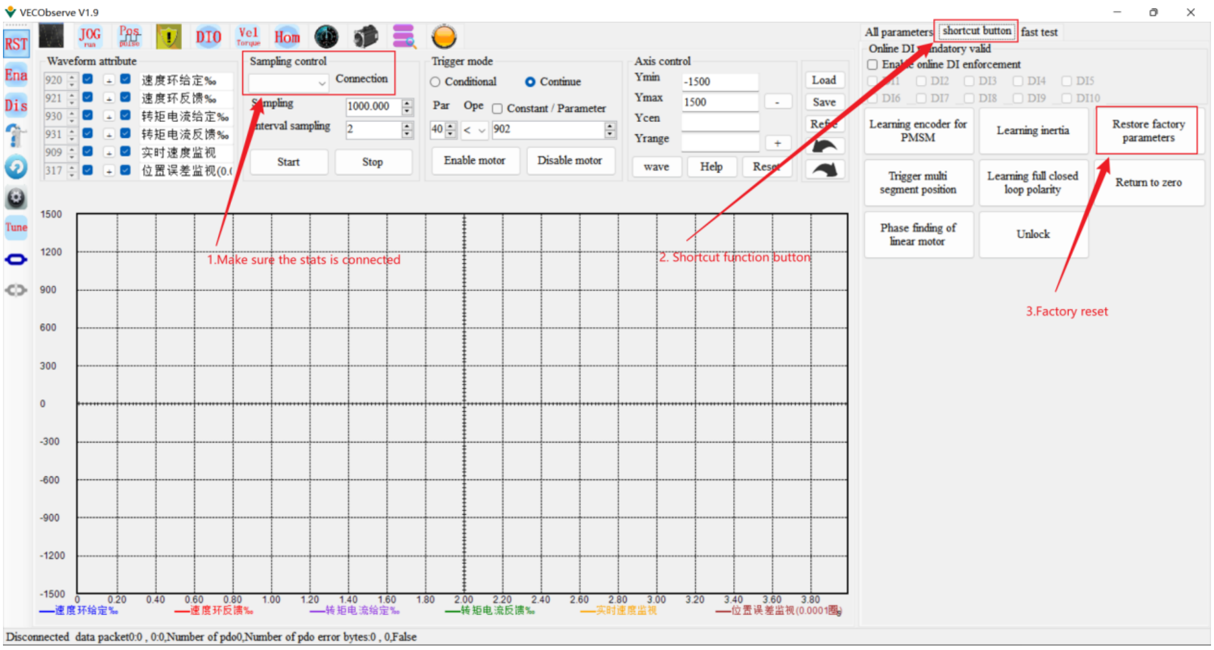
P13.94	Name	The source of the speed of the first position command			Set method	anytime	Access	RW
	Range	0~4	Unit	-	active moment	Immediately	default	0

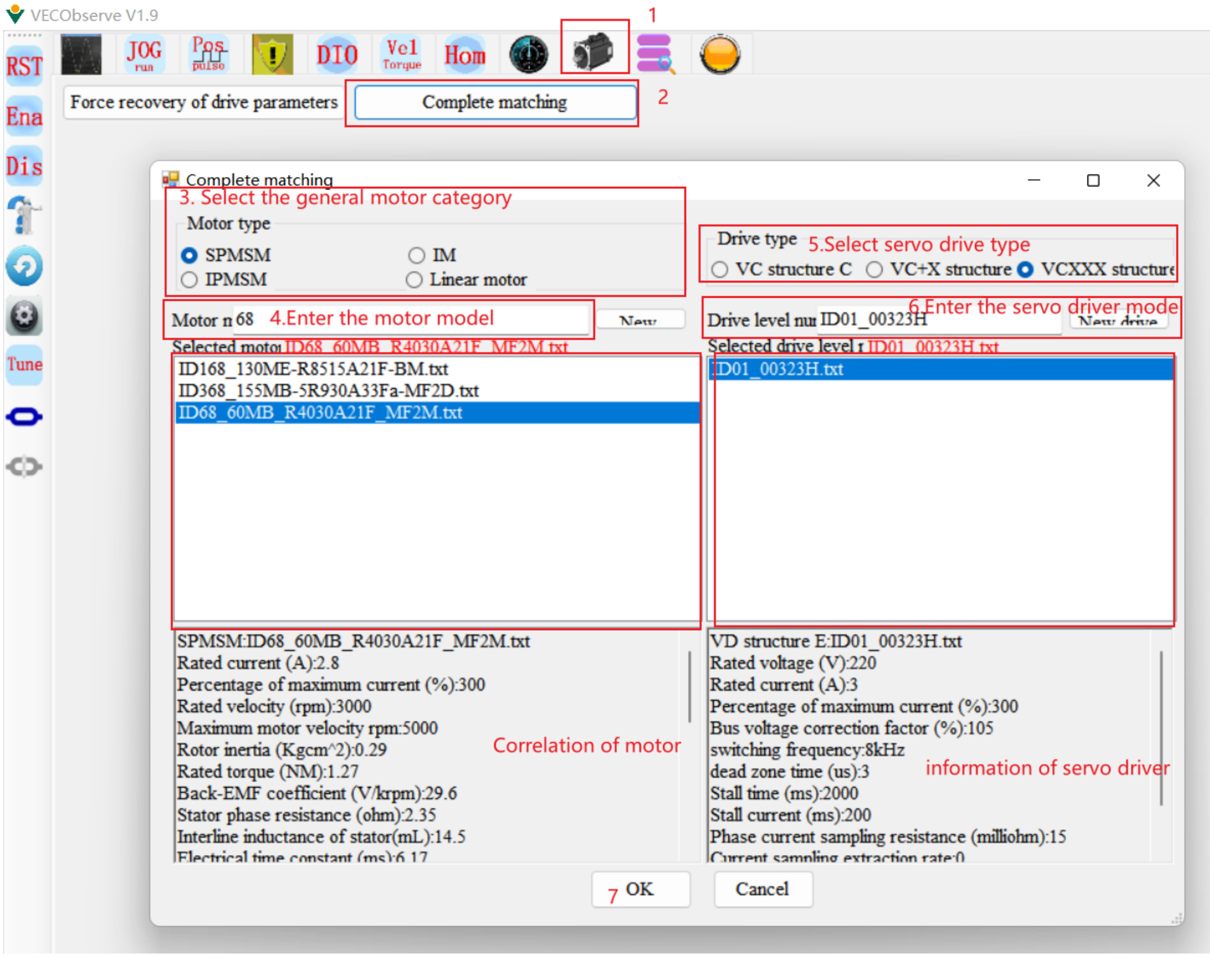
Setting	Parameter Description
0	From P13.12
1	From AI1
2	From AI2
3	From AI3(Hardware not supported)
4	from pulse rate

Chapter 10 Commissioning

10.1 Factory debugging matching motor steps

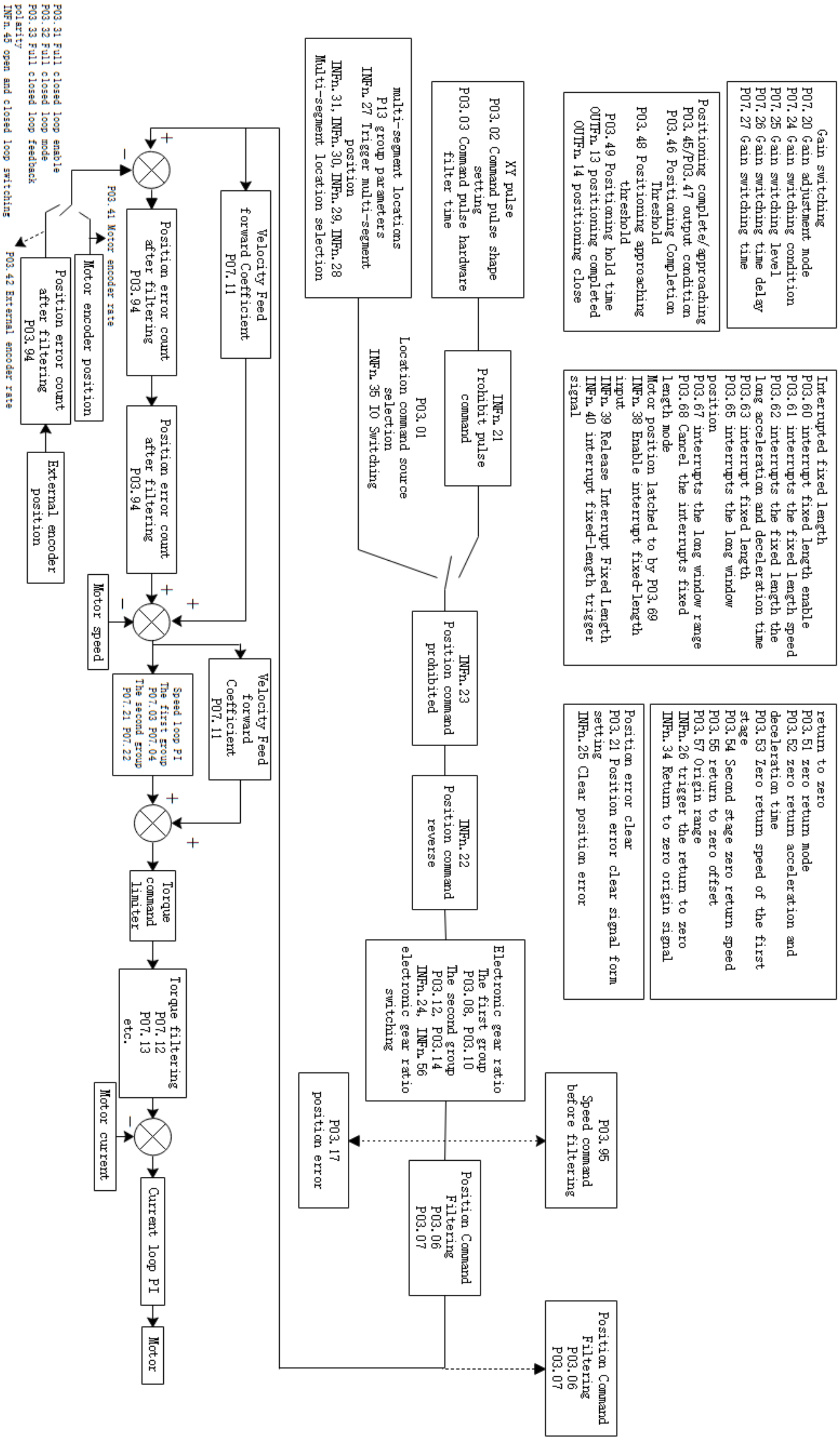
1. Connect the motor power cable and encoder cable, and connect the RS232 monitoring cable;
2. Open VECObserve and follow the steps below.




VECObserve V1.9
1
RST
Ena
Dis
Tune
JOG run
Pos pulse
DIO
Vel Torque
Hom
Force recovery of drive parameters
Complete matching
2
Complete matching
3. Select the general motor category
Motor type
SPMSM
IM
IPMSM
Linear motor
Drive type
5.Select servo drive type
VC structure C
VC+X structure
VCXXX structure
Motor n 68
4.Enter the motor model
6.Enter the servo driver mode
Drive level nu ID01_00323H
Selected motor ID68_60MB_R4030A21F_MF2M.txt
Selected drive level ID01_00323H.txt
ID168_130ME-R8515A21F-BM.txt
ID368_155MB-5R930A33Fa-MF2D.txt
ID68_60MB_R4030A21F_MF2M.txt
ID01_00323H.txt
SPMSM:ID68_60MB_R4030A21F_MF2M.txt
Rated current (A):2.8
Percentage of maximum current (%):300
Rated velocity (rpm):3000
Maximum motor velocity rpm:5000
Rotor inertia (Kgcm^2):0.29
Rated torque (NM):1.27
Back-EMF coefficient (V/krpm):29.6
Stator phase resistance (ohm):2.35
Interline inductance of stator(mL):14.5
Correlation of motor
VD structure E:ID01_00323H.txt
Rated voltage (V):220
Rated current (A):3
Percentage of maximum current (%):300
Bus voltage correction factor (%):105
switching frequency:8kHz
dead zone time (us):3
Stall time (ms):2000
Stall current (ms):200
Phase current sampling resistance (milliohm):15
information of servo driver
7 OK
Cancel

10.2 Location Mode Debugging Guidelines

10.2.1 Position Mode Block Diagram



10.2.2 Preliminary analysis of the curve

Set the servo drive to position mode, the position comes from multiple positions, run one of the positions, and record the waveform, as shown in Figure 1, the first curve is the planned speed command curve, after filtering, the filtered speed command curve is obtained , the larger the filter time constant, the more serious the lag of the filtered speed command, but the softer. Ideally, the actual velocity curve should coincide with the filtered velocity curve, which is the control target of the position loop. The position error is the accumulated value of the speed command minus the actual speed. Obviously, due to the lag of the filtering, the position error will become larger, and in the later stage of the filtering, the position error curve should coincide with the filtered position error curve. The filtered position error refers to the accumulated value of the filtered speed command minus the actual speed. As mentioned above, ideally, the actual speed curve should be coincident with the filtered speed curve, which means that the filtered speed The position error is always 0 under ideal conditions, but in fact, in the early stage of acceleration, the actual speed will lag behind the filtered speed command, that is to say, in the early stage of acceleration, the filtered position error will continue to increase, and after reaching a constant speed , the filtered position error gradually converges to zero, the speed of convergence depends on the gain of the position loop, the greater the gain, the faster the convergence. As shown in Figure 2 below.

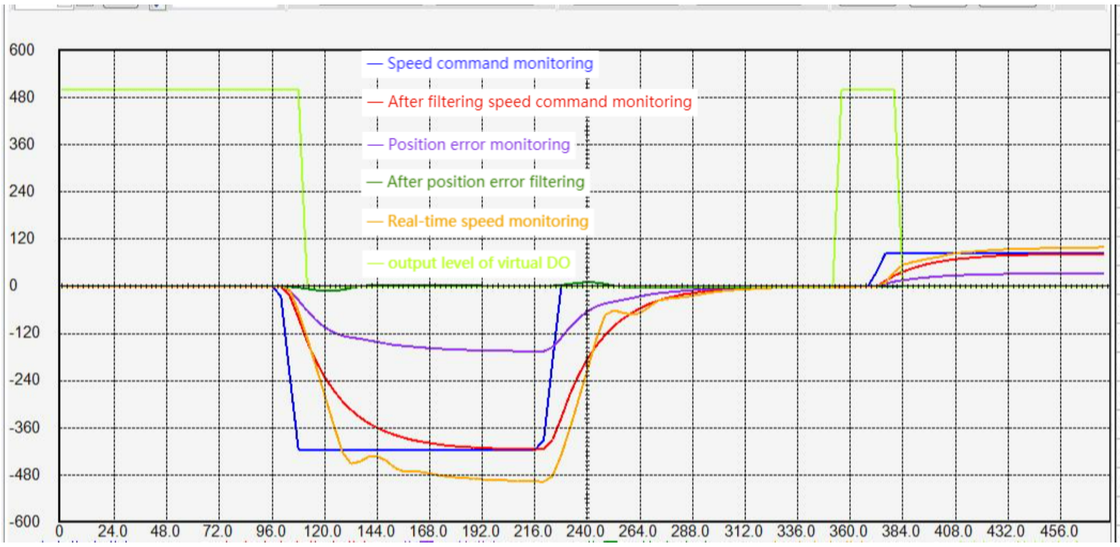


Figure 1 All curves

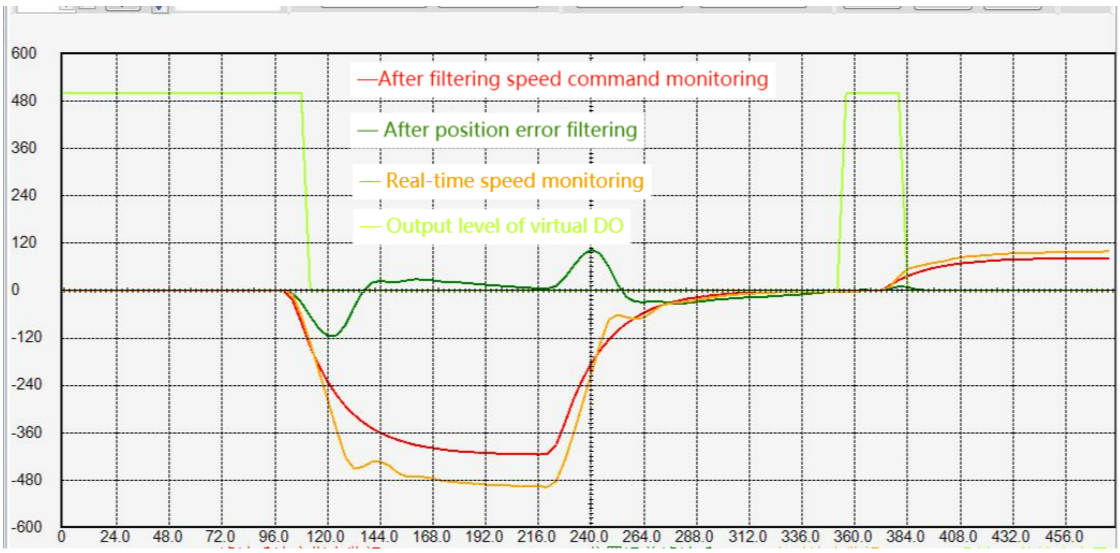
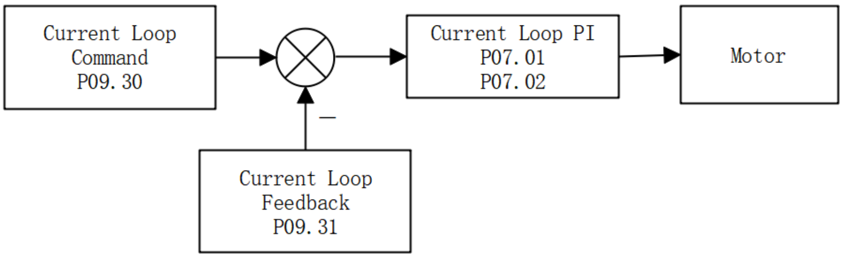


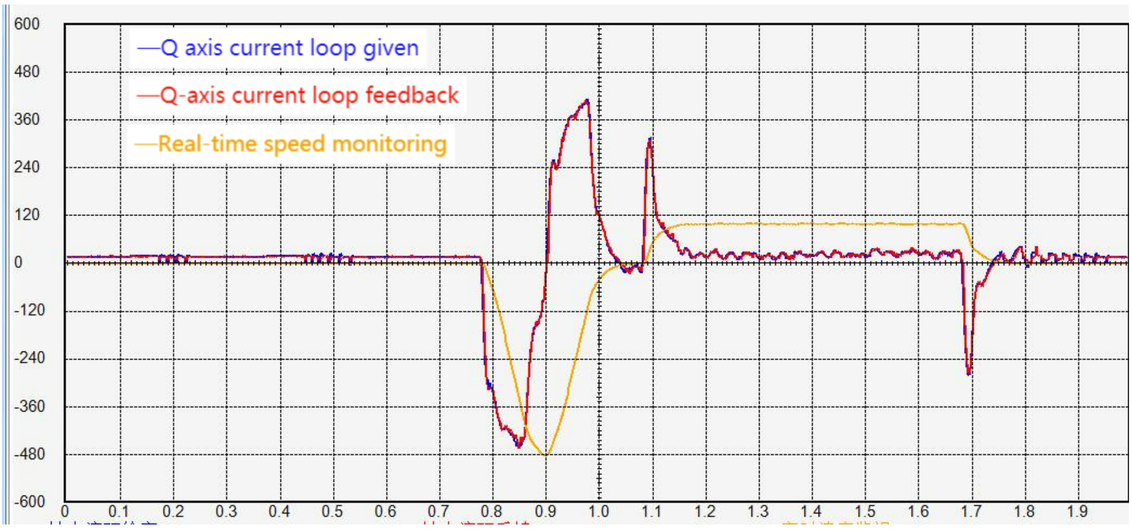
Figure 2 The filtered position error curve will increase during the acceleration process, converge during the constant speed process, and increase during the deceleration process, and eventually converge to 0. The contour of the actual speed curve is equal to the value of the filtered speed command curve. Contour plus the contour of the filtered position error curve

10.2.3 Current loop understanding and tuning

For brushless DC motors, under the condition of no excitation, the greater the current, the greater the output torque. The two are in a proportional relationship. The magnitude of output torque can be monitored through P09.31.

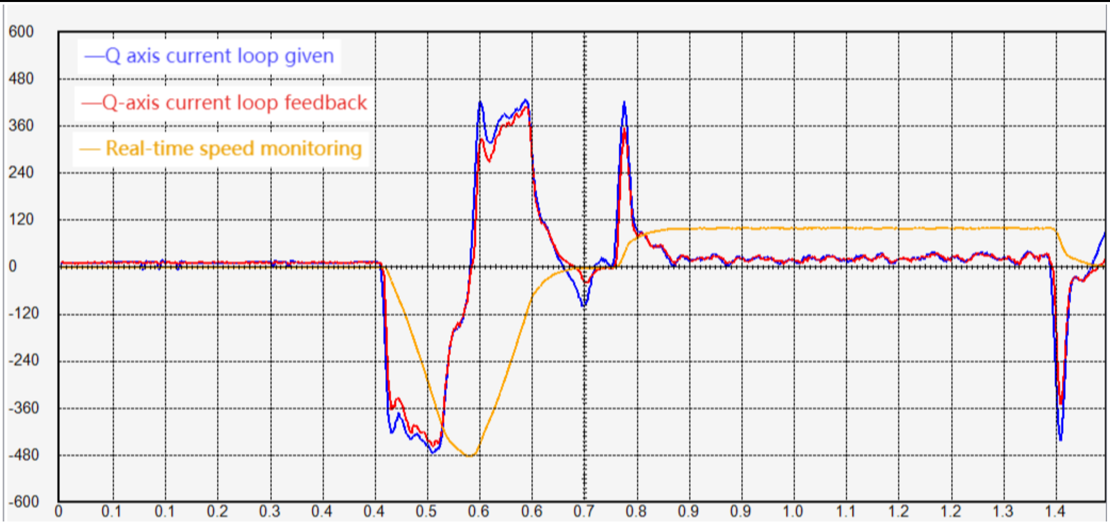


The control goal of the current loop PI is to ensure that the actual motor current (Q-axis current loop feedback) tracks the current command (Q-axis current loop given). As shown in the picture below. The Q-axis current loop feedback tracks the Q-axis current loop reference.

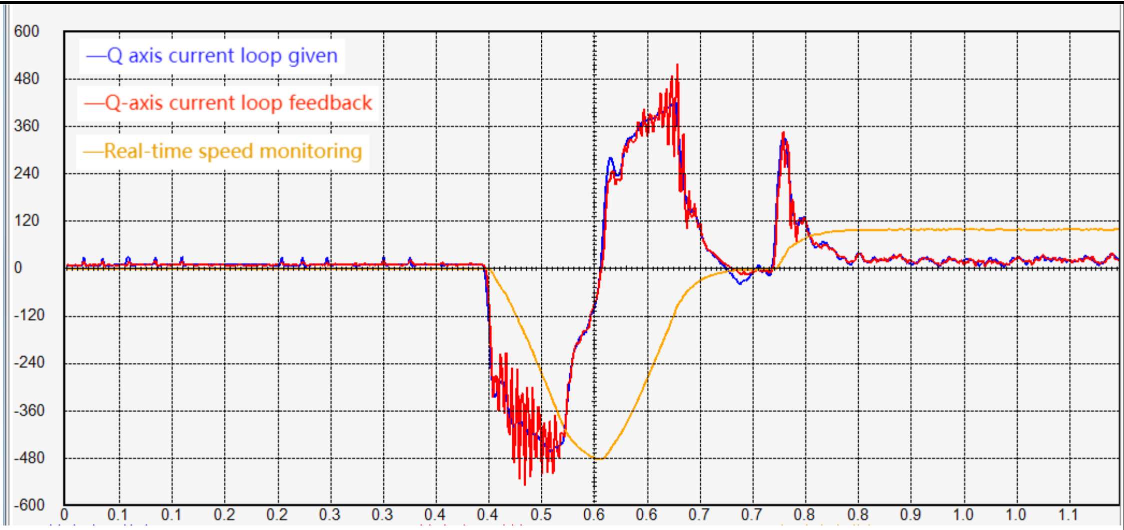


If these two curves are not tracked well, P07.01 and P07.02 need to be adjusted manually. The principle of current loop adjustment is，**Increase the proportional gain and integral gain as much as possible. However, if the current feedback has high frequency oscillation, the proportional gain P07.01 should be appropriately reduced. If the current feedback has low frequency oscillation, the current loop integral gain P07.02 should be reduced. If the two curves are not close, increase P07.01 and P07.02 appropriately. P07.01 and P07.02 are generally adjusted between 100-300, and the integral gain is generally smaller than the proportional gain.**

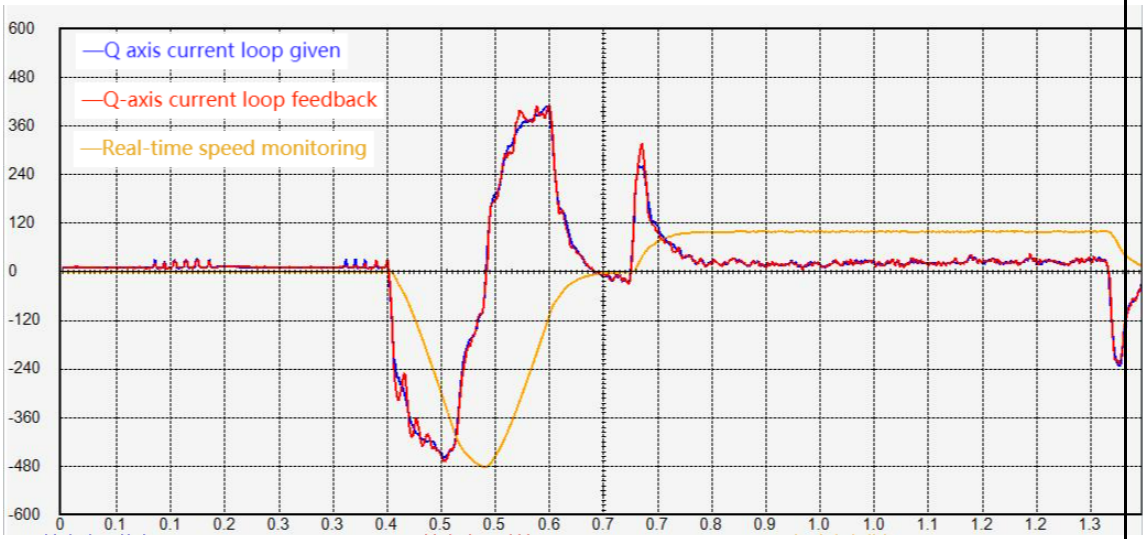
There are two kinds of current oscillations, one is high frequency oscillation and the other is low frequency oscillation. High frequency oscillation is caused by too large proportional gain P07.01. Low frequency oscillation is caused by too large integral gain P07.02.



Q-axis current setting and feedback are not close, and there is a static error, then appropriately increase P07.01 and P07.02

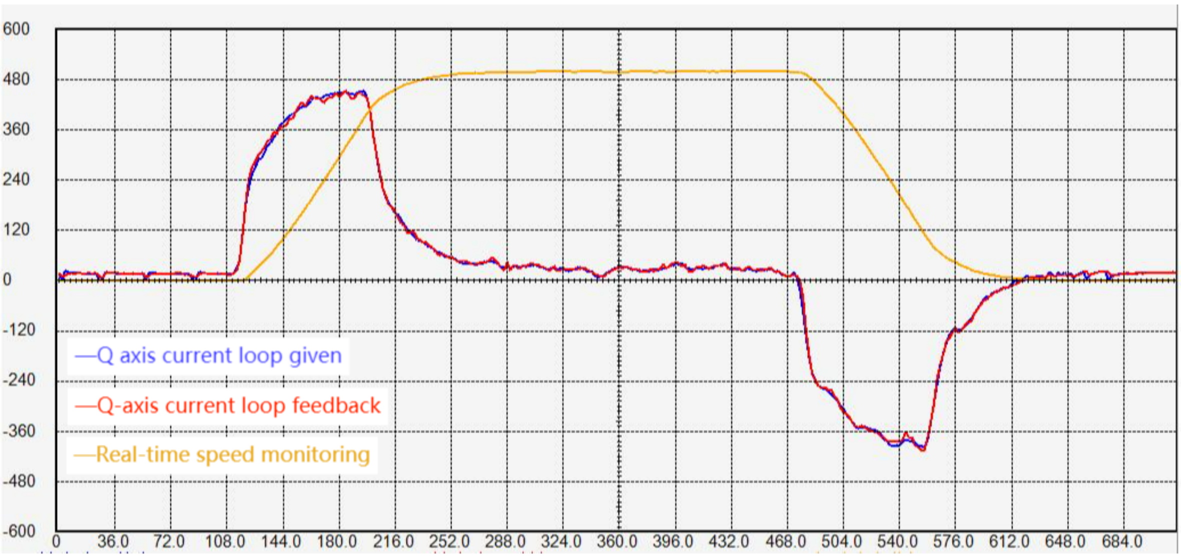


The Q-axis current has high frequency oscillation, so it is necessary to reduce the current loop proportional gain P07.01 and integral gain P07.02

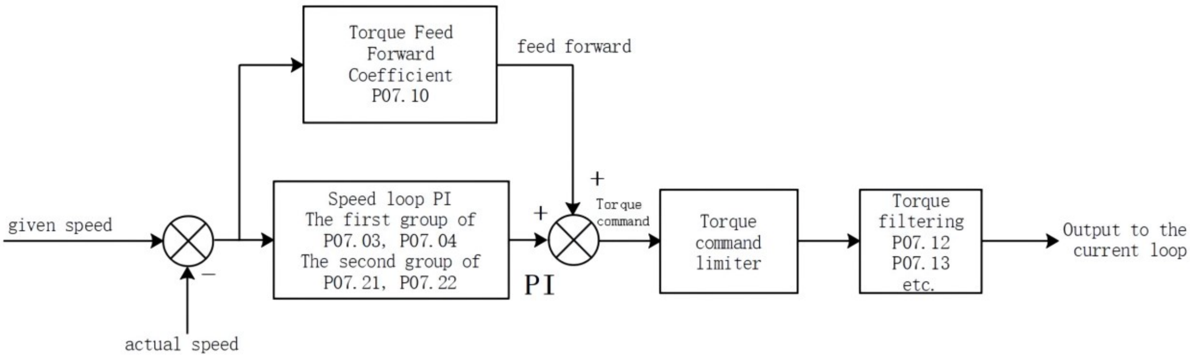


The Q-axis current has low frequency oscillation, and it is necessary to reduce the current loop integral gain P07.02

The larger the current command amplitude, the larger the output torque. Specifically, the greater the forward current command (more positive), the greater the output forward torque; the greater the reverse current command (more negative), the greater the output reverse torque. When the current command is close to 0, the output torque is also close to zero. As shown in the figure below, the motor speed is 0 at the beginning, and the motor torque is close to 0. After that, the motor torque increases in the positive direction, and the motor starts to accelerate. The greater the motor forward torque, the greater the motor acceleration, and then the forward torque is slow. Slowly reduce to zero, the motor speed remains constant and does not increase. After that, the motor torque gradually decreases to negative, and the motor begins to decelerate. The greater the negative motor torque, the greater the motor deceleration. The final motor torque is 0, and the motor speed remains unchanged.



10.2.4 Speed loop understanding and tuning



The input of the speed loop is the given speed and the feedback actual speed, and the output is the torque command. The goal is to make the feedback actual speed track the given speed by adjusting the torque. The torque command consists of two parts, one is feedforward and the other is speed loop PI output. The torque feedforward is obtained by multiplying the acceleration of the given speed by a torque feedforward coefficient, and the speed loop PI can quickly eliminate the error between the given speed and the actual speed.

There is a filter after the torque command output, usually low-pass filter (P07.12=0). The function of low-pass filtering is to reduce torque jump and reduce motor noise. Generally speaking, the larger the torque filter time constant P07.13, the smaller the motor noise, but it may cause low-frequency fluctuations in the torque. Generally speaking, the larger the load inertia is, the larger the required torque filter time constant P07.13, and the larger the speed loop proportional gain.

Torque feedforward coefficient P07.10 and torque filter time constant P07.13 can be obtained through inertia self-learning, and generally do not need to be adjusted. It is mainly necessary to adjust the proportional gain and integral gain of the speed loop PI.

The adjustment principles of speed loop proportional gain P07.03 and integral gain P07.04 are:

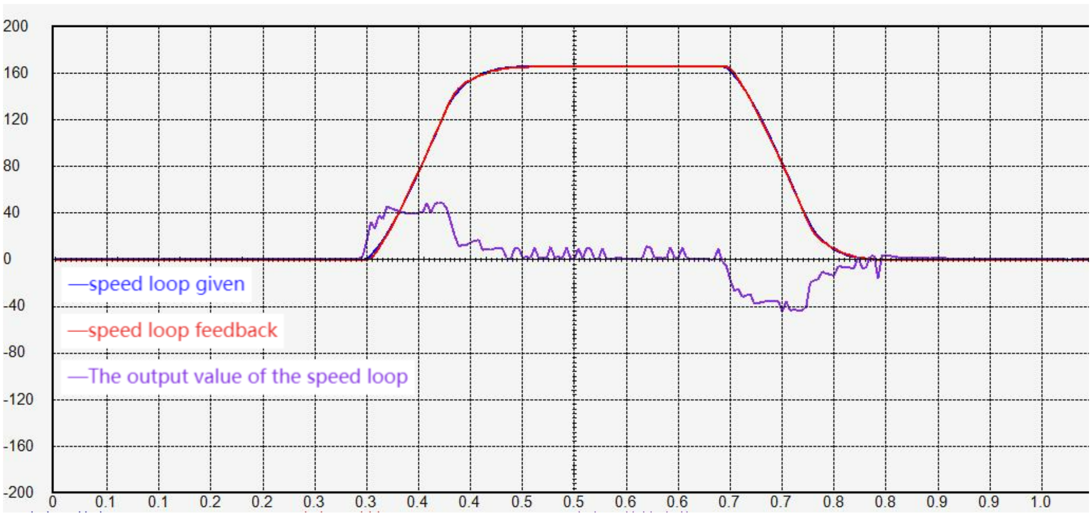
1、 **The speed loop proportional gain is generally more than 10 times greater than the integral gain, and the speed loop proportional gain is adjusted between 1000-10000, and the speed loop integral gain is generally adjusted between 20-500. If the integral gain is too large relative to the proportional gain, it is easy to cause low-frequency fluctuation of the rotational speed. The specific performance is that the speed has been reversed and cannot converge.**

2、 **When the inertia is large, the proportional gain of the speed loop needs to be increased.**

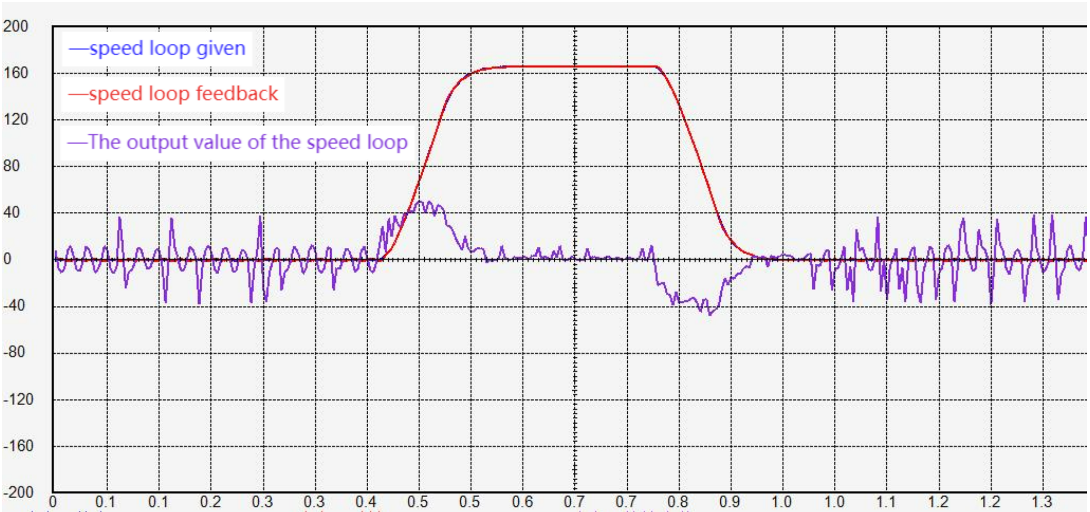
3、 **When the proportional gain of the speed loop is too large, abnormal noise will occur during the static process of the motor.**

4、 **When the integral gain of the speed loop is too large, the motor speed is always forward and reverse, and it cannot converge.**

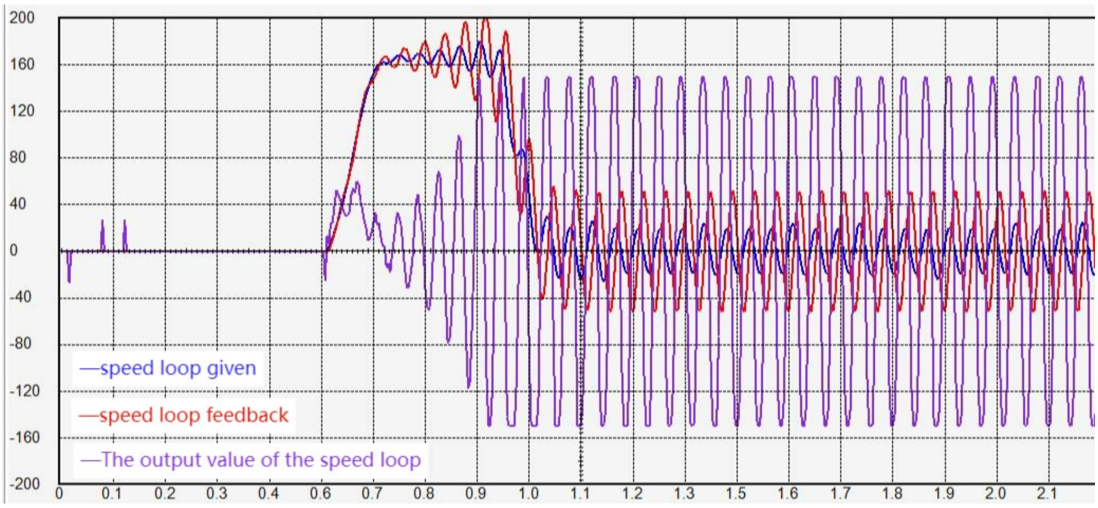
5、 **The speed loop proportional gain and integral gain are too small, the given speed and the feedback speed cannot be coincident, the motor rigidity is very small, especially soft.**



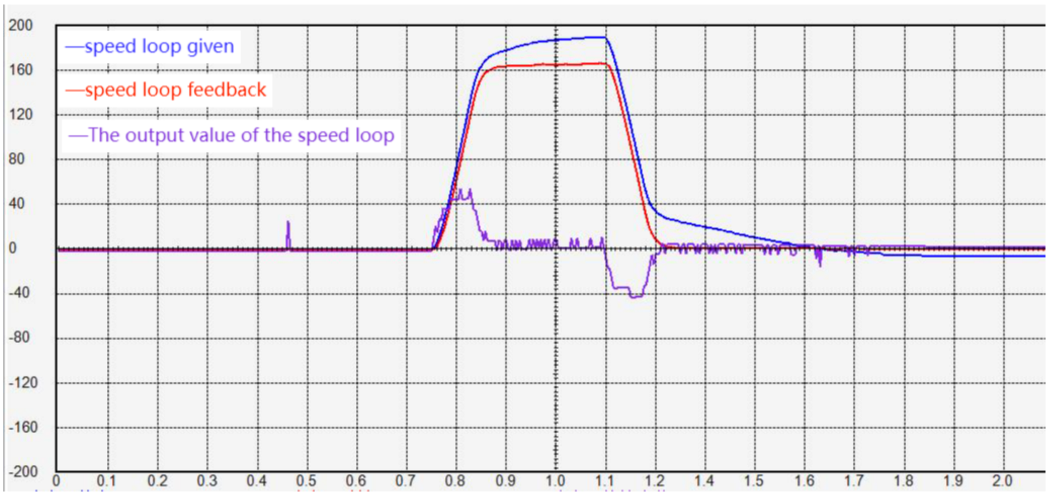
Adjust for better speed reference and feedback.



If the proportional gain of the speed loop is too large, the motor will generate noise, and the output of the speed loop will fluctuate when it is static.



The integral gain of the speed loop is too large, the motor cannot stop all the time, and the forward and reverse rotations shake.



The speed loop gain is too small, the speed loop reference and feedback cannot be coincident, and the motor has no rigidity and is particularly soft.

10.2.5 Position loop understanding and adjustment

The position loop gain is generally set to 100-500. If the position loop proportional gain is too large, it is easy to cause the motor to shake. If it is too small, the convergence rate of the position error is slow.

Chapter 11 Introduction to the Profinet Protocol

11.1 Introduction to Profinet

Profinet is an industrial bus standard designed to collect and transmit data in industrial systems and enables real-time data transmission and reception (1ms or less). The Profinet standardization organization is part of Profibus&Profinet international (PI), located in Karlsruhe, Germany. Since 2003, PROFINET is part of the IEC 61158 and IEC 61784 standards. PROFINET=PROFIbus+Ethernet, transplant the master-slave structure of Profibus to Ethernet, so profinet will have Controller and Device, and their relationship can simply correspond to the Master and Slave of profibus. In addition, because profinet is based on Ethernet, it can have topological structures such as Ethernet, while profibus has only bus type. So profinet is the product of combining the master-slave structure of profibus and the topology of ethernet.

11.2 Introduction to PROFIdrive

The Profinet bus defines 3 standard profiles for drive technology applications (PROFIenergy, PROFIdrive, PROFIsafe), of which PROFIdrive is the application profile for motion control.

PROFIdrive defines 6 application classes, the most important of which are the following 3 application classes:

（1）AC1 Simple Drive

The drive is controlled by the speed setpoint delivered by the controller. The entire speed control is carried out during the drive. The acceleration/deceleration time is also realized in the drive. Typical applications for AC1: Simple frequency converters for controlling water pumps and fans.

（2）AC3 Single-axis positioning drive with local position control

In addition to speed control in the application of AC3, the drive also has functions such as position closed-loop control and position curve planning. Therefore, the servo drive works as a self-controlled simple positioning drive when the process is run on the controller. Positioning tasks can be transferred to the drive controller via PROFINET and started. Typical applications of AC3: single-axis positioning, simple machines that perform point-to-point movements.

（3）AC4 Multi-axis synchronous motion control with central interpolation and speed setting interface

AC4 defines a speed setpoint interface, the speed closed-loop control is in the servo, and the position closed-loop control is in the controller. It is usually used in robots and machine tools, because this application usually requires multiple drives to coordinate operation. The motion control is mainly realized by the central numerical control system (NC). The position loop is connected via a bus, ie the communication between the control system and the drive must be isochronous.

11.3 IP address and device name of PN bus servo

The Profinet bus determines the specific servo through the IP address and device name. When P08.41=0, the IP address and device name need to be set through the controller software. When P08.41=X, and 0<X<255, the servo will automatically set the servo device name to vc1pnX, automatically set the IP address to 192.168.0.X, and set the subnet mask to vc1pnX when the servo is powered on. Set it to 255.255.0.0 and set the gateway to 192.168.0.X.

11.4 PN bus servo

11.4.1 Support message

VC330 servo (PN servo for short) supports AC1, AC3 and AC4 applications, and supports standard telegrams and Siemens telegrams in speed control mode and basic positioner control mode. Auxiliary telegrams can only be used together with the main telegram, not alone. use. From the point of view of the driving device, the received process data is the receive word, the process data to be sent is the transmit word, and a PZD is a 16-bit word. The detailed description is shown in the following table:

message	Number of received PZDs	Number of sent PZDs
Standard message 1	2	2
Standard message 3	5	9
Siemens message 102	6	10
Siemens message 111	12	12
Siemens message 105	10	10
Siemens message 750 (Auxiliary telegram)	3	1

11.4.2 Telegram for speed control mode

<table>
<tr><th>message</th><th colspan="2">1</th><th colspan="2">3</th><th colspan="2">102</th><th colspan="2">105</th></tr>
<tr><td>Application level</td><td>1</td><td>1</td><td>1、4</td><td>1、4</td><td>1、4</td><td>1、4</td><td>4</td><td>4</td></tr>
<tr><td>PZD1</td><td>STW1</td><td>ZSW1</td><td>STW1</td><td>ZSW1</td><td>STW1</td><td>ZSW1</td><td>STW1</td><td>ZSW1</td></tr>
<tr><td>PZD2</td><td>NSOLL_A</td><td>NIST_A</td><td rowspan="2">NSOLL_B</td><td rowspan="2">NIST_B</td><td rowspan="2">NSOLL_B</td><td rowspan="2">NIST_B</td><td rowspan="2">NIST_B</td><td rowspan="2">NIST_B</td></tr>
<tr><td>PZD3</td><td></td><td></td></tr>
<tr><td>PZD4</td><td></td><td></td><td>STW2</td><td>ZSW2</td><td>STW2</td><td>ZSW2</td><td>STW2</td><td>ZSW2</td></tr>
<tr><td>PZD5</td><td></td><td></td><td>G1_STW</td><td>G1_ZSW</td><td>MOMRED</td><td>MELDW</td><td>MOMRED</td><td>MELDW</td></tr>
<tr><td>PZD6</td><td></td><td></td><td></td><td rowspan="2">G1_XIST1</td><td>G1_STW</td><td>G1_ZSW</td><td>G1_STW</td><td>G1_ZSW</td></tr>
<tr><td>PZD7</td><td></td><td></td><td></td><td></td><td rowspan="2">G1_XIST1</td><td rowspan="2">XERR</td><td rowspan="2">G1_XIST1</td></tr>
<tr><td>PZD8</td><td></td><td></td><td></td><td rowspan="2">G1_XIST2</td><td></td></tr>
<tr><td>PZD9</td><td></td><td></td><td></td><td></td><td>G1_XIST2</td><td>KPC</td><td>G1_XIST2</td></tr>
</table>

PZD10								

11.4.3 Auxiliary message

When the 750 message is used, PZDM_LIMIT_POS must set the upper limit of the forward torque, and it must be a positive value. PZDM_LIMIT_NEG must set the lower limit value of negative torque, and must be negative.

message	750	
Application level	-	
PZD1	M_ADD1	M_ACT
PZD2	M_LIMIT_POS	-
PZD3	M_LIMIT_NEG	

11.4.4 Messages of Basic Locator Mode

message	111	
Application level	3	3
PZD1	STW1	ZSW1
PZD2	POS_STW1	POS_ZSW1
PZD3	POS_STW2	POS_ZSW2
PZD4	STW2	ZSW2
PZD5	OVERRIDE	MELDW
PZD6	MDI_TARPOS	XIST_A
PZD7		
PZD8	MDI_VELOCITY	NIST_B
PZD9		
PZD10	MDI_ACC	FAULT_CODE
PZD11	MDI_DEC	WARN CODE
PZD12	None	None

11.4.5 I/O data signal

Signal	description	Receive word/Send word	type of data	Description
STW1	Control word 1	receive word	U16	
STW2	Control word	receive word	U16	
ZSW1	Status word 1	send word	U16	
ZSW2	Status word 2	send word	U16	
NSOLL_A	Speed setting value A	receive word	I16	4000hex ÷ Rated speed
NSOLL_B	Speed setting value B	receive word	I32	40000000hex ÷ Rated speed
NIST_A	Actual speed value A	send word	I16	4000hex ÷ Rated speed
NIST_B	Actual speed value B	send word	I32	40000000hex ÷ Rated speed

G1_STW	Encoder 1 control word	receive word	U16	
G1_ZSW	Encoder 1 Status word	send word	U16	
G1_XIST1	Encoder 1 actual position 1	send word	U32	
G1_XIST2	encoder 1 actual position 2	send word	U32	
MOMRED	torque deceleration	receive word	I16	4000hex ÷maximum torque
MELDW	message word	send word	U16	
MDI_TARPOS	MDI position	receive word	I32	1hex =1LU
MDI_VELOCITY	MDI speed	receive word	I32	1hex= 1000 LU/min
MDI_ACC	MDI acceleration override	receive word	I16	4000hex = 100%
MDI_DEC	MDI deceleration override	receive word	I16	4000hex ÷ 100%
XIST_A	Actual position value A	send word	I32	1hex = 1LU
OVERRIDE	Position speed override	receive word	I16	4000hex = 100%
FAULT_CODE	fault code	send word	U16	
WARN_CODE	Warning Code	send word	U16	
None	User-defined Receive Word 0 - no function	receive word	I16	
None	User-defined sending word 0 - no function	send word	I16	

11.4.6 Definition of control word

(1) STW1 control word (for telegrams 1, 3)

Signal	description
STW1.0	1=ON(can enable pulse) 0=OFF1(ramp stop, pulse elimination, ready to switch on)
STW1.1	1=non OFF2(allow enable) 0=OFF2(Coasting stop, eliminate pulse, prohibit switch-on)
STW1.2	1=non OFF3(allow enable) 0=OFF3(quick stop, eliminate pulses, prohibit switching on)
STW1.3	1=allow to run 0=run prohibited
STW1.4	1=Operating Conditions (Ramp-Function Generators can be enabled) 0=Freeze command disables ramp-function generator (sets ramp-function generator output to zero)
STW1.5	1=Operating conditions continue ramp-function generator 0=Freeze command freezes ramp-function generator, AC4 not applicable
STW1.6	1=Enable set value 0=Disable the set point (set ramp-function generator input to zero)
STW1.7	0-1 Rising edge, acknowledge fault
STW1.8	reserve
STW1.9	reserve
STW1.10	1=Controlled by PLC 0=non-PLC control

STW1.11	reserve
STW1.12	reserve
STW1.13	reserve
STW1.14	reserve
STW1.15	reserve

（2） STW1 Control Word (for telegrams 102, 105)

Signal	description
STW1.0	1=ON(pulse can be enabled) 0=OFF1(ramp stop, pulse elimination, ready to switch on)
STW1.1	1=non OFF2(allow enable) 0=OFF2(Coasting to stop, eliminating pulses, prohibiting switching on)
STW1.2	1=non OFF3(allow enable) 0=OFF3(quick stop, eliminate pulses, prohibit switching on)
STW1.3	1=allow to run 0=run prohibited
STW1.4	1=Operating Conditions (Ramp Function Generator can be enabled) 0=Disable the ramp-function generator (set the output of the ramp-function generator to zero)
STW1.5	1=continue ramp-function generator 0=Freeze ramp-function generator, AC4 not applicable
STW1.6	1=Enable set value 0=Disable the set point (set ramp-function generator input to zero)
STW1.7	0-1 Rising edge, acknowledgment fault
STW1.8	reserve
STW1.9	reserve
STW1.10	1=Controlled by PLC 0=Non-PLC control
STW1.11	1=Ramp-function generator in effect
STW1.12	1=Unconditionally open the brake, release the brake
STW1.13	reserve
STW1.14	1=Torque control takes effect 0=Speed control takes effect
STW1.15	reserve

（3） STW1 Control Word (for telegram 111)

Signal	description
STW1.0	1=ON(pulse can be enabled) 0=OFF1(ramp stop, pulse elimination, ready to switch on)
STW1.1	1=non OFF2(allow enable) 0=OFF2(Coasting stop, eliminate pulse, prohibit switch-on)
STW1.2	1=non OFF3(allow enable) 0=OFF3(quick stop, eliminate pulses, prohibit switching on)
STW1.3	1=allow to run 0=run prohibited
STW1.4	1=Do not refuse to perform the task 0=refuse to perform the task
STW1.5	1=Do not suspend task execution 0=Pause task execution
STW1.6	0-1Rising edge, activates the running task
STW1.7	0-1Rising edge, acknowledgment fault
STW1.8	1=Start forward jog 0=Close forward jog

STW1.9	1=Start negative jog 0=Turn off negative jog
STW1.10	1=Controlled by PLC 0=Non-PLC control
STW1.11	1=start zero return 0=stop returning to zero
STW1.12	reserve
STW1.13	reserve
STW1.14	reserve
STW1.15	reserve

（4） STW2 Control Word (for telegrams 1, 3, 111)

Signal	description
STW2.0~STW2.7	reserve
STW2.8	reserve
STW2.9~STW2.11	reserve
STW2.12	Master sign of life, bit 0
STW2.13	Master sign of life, bit 1
STW2.14	Master sign of life, bit 2
STW2.15	Master sign of life, bit 3

（5） STW2 Control Word (for telegrams 102, 105)

Signal	description
STW2.0~STW2.3	reserve
STW2.4	1=Ignore the ramp-function generator
STW2.5	reserve
STW2.6	reserve
STW2.7	reserve
STW2.8	reserve
STW2.9~STW2.11	reserve
STW2,12	Master sign of life, bit 0
STW2.13	Master sign of life, bit 1

（6） POS_STW1 positioning control word

Signal	description
POS_STW1.0	reserve
POS_STW1.1	reserve
POS_STW1.2	reserve
POS_STW1.3	reserve
POS_STW1.4	reserve
POS_STW1.5	reserve
POS_STW1.6	reserve
POS_STW1.7	reserve
POS_STW1.8	1 = Absolute positioning 0 = Relative positioning
POS_STW1.9 POS_STW1.10	1 = Positive speed positioning 2 = Negative speed positioning
POS_STW1.11	reserve
POS_STW1.12	reserve
POS_STW1.13	reserve
POS_STW1.14	0 = Target by location 1 = Position by speed
POS_STW1.15	0 = Disable MDI

	1 = Activate MDI

(7) POS_STW2 Position control word

Signal	description
POS_STW2.0	reserve
POS_STW2.1	1 = Set reference point
POS_STW2.2	1 = Reference stop/home switch forced activation
POS_STW2.3	reserve
POS_STW2.4	reserve
POS_STW2.5	1 = Activate jog
POS_STW2.6	reserve
POS_STW2.7	reserve
POS_STW2.8	reserve
POS_STW2.9	reserve
POS_STW2.10	reserve
POS_STW2.11	reserve
POS_STW2.12	reserve
POS_STW2.13	reserve
POS_STW2.14	1 = activate the software limit switch 0 = Close the software limit switch
POS_STW2.15	1 = Activate hardware limit switch 0 = Close the hardware limit switch

Note: The hardware limit and software limit are controlled by POS_STW2.14/15 and parameter P03.73 at the same time. Only when both parameters enable the hardware/software limit, the hardware/software limit is valid.

11.4.7 Definition of status word

(1) ZSW1 Status word (for telegrams 1, 3)

Signal	description
ZSW1.0	1 = Ready to switch on 0 = Not connected ready
ZSW1.1	1 = Ready for operation 0 = Not ready for operation
ZSW1.2	1 = Operation enabled 0 = Operation disabled
ZSW1.3	1 = Fault exists 0 = No fault
ZSW1.4	1 = Coasting stop is invalid 0 = Coasting stop is valid
ZSW1.5	1 = Quick stop disabled 0 = Quick stop enabled
ZSW1.6	1 = Prohibit to connect to take effect 0 = Disable connection is invalid
ZSW1.7	1 = warning exists 0 = no warning
ZSW1.8	1 = The speed error is within the tolerance (P04.24) 0 = The speed error exceeds the tolerance (P04.24)
ZSW1.9	1 = there is a control request 0 = No control request
ZSW1.10	1=Reach or exceed the speed comparison value (P04.23) 0=The speed comparison value is not reached or exceeded (P04.23)

ZSW1.11	reserve
ZSW1.12	reserve
ZSW1.13	reserve
ZSW1.14	reserve
ZSW1.15	reserve

（2） ZSW1 Status word (for telegrams 102, 105)

Signal	description
ZSW1.0	1 = Ready to switch on 0 = not ready to switch on
ZSW1.1	1 = ready for operation 0 = Not ready to operate
ZSW1.2	1 = Operation enabled 0 = Operation disabled
ZSW1.3	1 = fault exists 0 = No fault
ZSW1.4	1 = Coasting stop is invalid 0 = Coasting stop is valid
ZSW1.5	1 = Quick stop disabled 0 = Quick stop enabled
ZSW1.6	1 = Prohibit to connect to take effect 0 = Disable connection is invalid
ZSW1.7	1 = warning exists 0 = no warning
ZSW1.8	1 = The speed error is within the tolerance (P04.24) 0 = The speed error exceeds the tolerance (P04.24)
ZSW1.9	1 = there is a control request 0 = no control request
ZSW1.10	1 = reach or exceed the speed comparison value (P04.23) 0 = Unreached or exceeded the speed comparison value (P04.23)
ZSW1.11	reserve
ZSW1.12	reserve
ZSW1.13	reserve
ZSW1.14	Closed-loop torque control takes effect
ZSW1.15	reserve

（3） ZSW1 status word (for telegram 111)

Signal	description
ZSW1.0	1 = Ready to switch on 0 = Not ready for connection
ZSW1.1	1 = Ready for operation 0 = Not ready for operation
ZSW1.2	1 = Operation enabled 0 = Operation disabled
ZSW1.3	1 = Fault exists 0 = No fault
ZSW1.4	1 = Coasting stop is invalid 0 = Coasting stop is valid
ZSW1.5	1 = Quick stop disabled 0 = Quick stop enabled
ZSW1.6	1 = Prohibit to connect to take effect 0 = Disable connection is invalid
ZSW1.7	reserve
ZSW1.8	1 = Position tracking error is within tolerance (P03.19/2)

	0 = Position tracking error is out of tolerance (P03.19/2)
ZSW1.9	1 = there is a control request 0 = no control request
ZSW1.10	1 = The target position has been reached 0 = The target position has not been reached
ZSW1.11	1 = The reference point has been set, and the zero return is completed 0 = The reference point is not set, and the zero return is not completed
ZSW1.12	0-1 Rising edge, positioning activated, move task confirmed
ZSW1.13	1 = Drive has stopped 0 = Drive is running
ZSW1.14	reserve
ZSW1.15	reserve

（4） ZSW2 Status Word

Signal	description
ZSW2.0~ZSW2.7	reserve
ZSW2.8	reserve
ZSW2.9	reserve
ZSW2.10	reserve
ZSW2.11	reserve
ZSW2.12	Slave sign of life, bit 0
ZSW2.13	Slave sign of life, bit 1
ZSW2,14	Slave sign of life, bit 2
ZSW2.15	Slave sign of life, bit 3

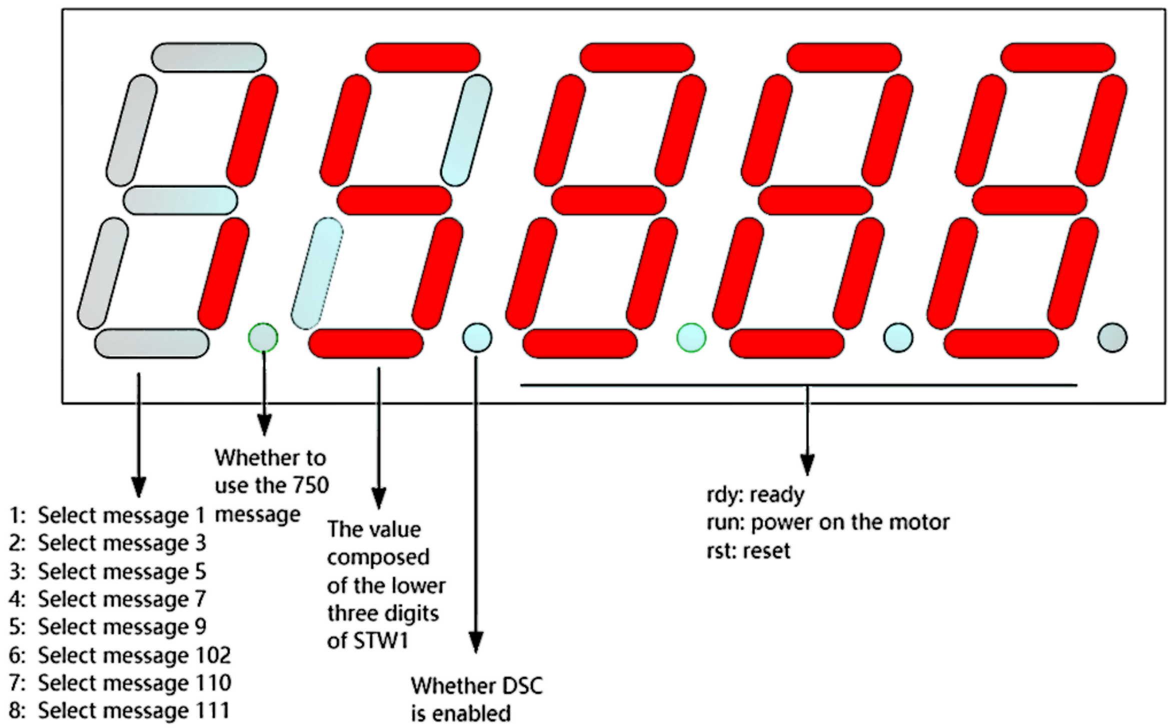
（5） POS_ZSW1 Status Word

Signal	description
POS_ZSW1.0	reserve
POS_ZSW1.1	reserve
POS_ZSW1.2	reserve
POS_ZSW1.3	reserve
POS_ZSW1.4	reserve
POS_ZSW1.5	reserve
POS_ZSW1.6	reserve
POS_ZSW1.7	reserve
POS_ZSW1.8	1 = Negative hardware limit active 0 = Negative hardware limit not active
POS_ZSW1.9	1 = Positive hard limit active 0 = Positive hard limit is not active
POS_ZSW1.10	1 = JOG mode active 0 = JOG mode is not active
POS_ZSW1.11	1 = Reference point return active 0 = referencing is not active
POS_ZSW1.12	reserve
POS_ZSW1.13	reserve
POS_ZSW1.14	reserve
POS_ZSW1.15	1=MDI activation 0=MDI not activated

(6) POS_ZSW2 status word

Signal	description
POS_ZSW2.0	reserve
POS_ZSW2.1	reserve
POS_ZSW2.2	reserve
POS_ZSW2.3	reserve
POS_ZSW2.4	1 = axis moves forward 0 = axis not moving
POS_ZSW2.5	1 = axis moves backwards 0 = axis not moving
POS_ZSW2.6	1 = Negative software limit switch active 0 = Negative software limit switch is not active
POS_ZSW2.7	1 = Positive software limit switch active 0 = Positive software limit switch is not active
POS_ZSW2.8	reserve
POS_ZSW2.9	reserve
POS_ZSW2.10	reserve
POS_ZSW2.11	reserve
POS_ZSW2.12	reserve
POS_ZSW2.13	reserve
POS_ZSW2.14	reserve
POS_ZSW2.15	reserve

11.5 Status indication of Profinet bus servo drive



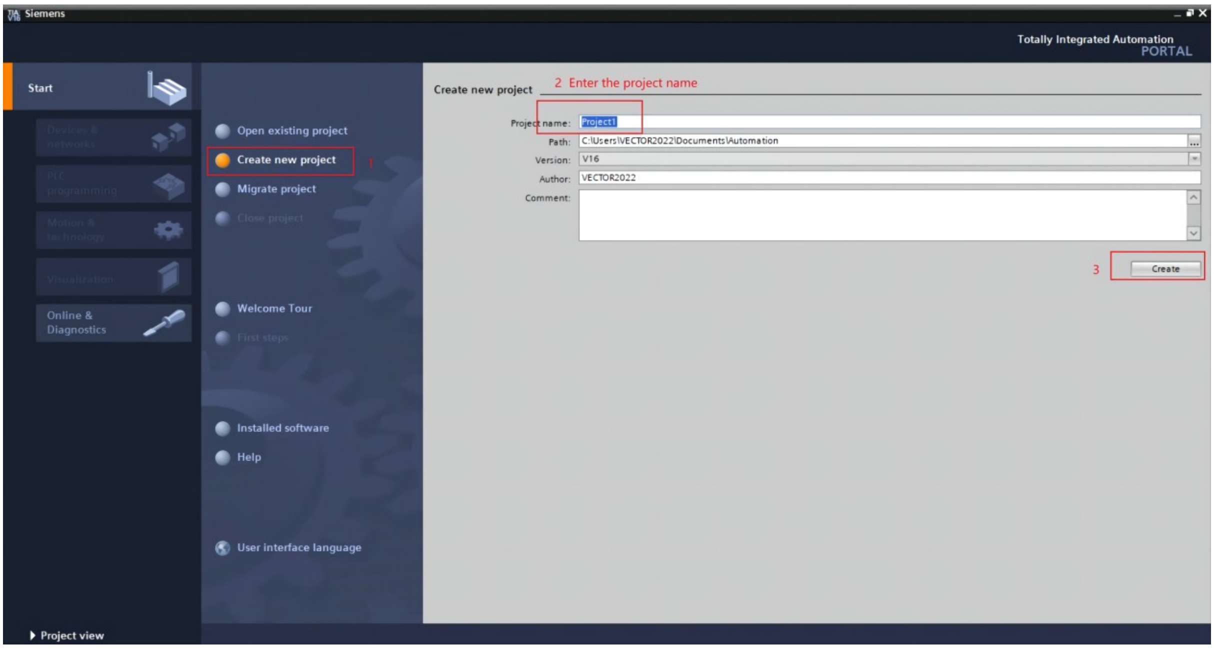
Chapter 12 PN Servo Application Example

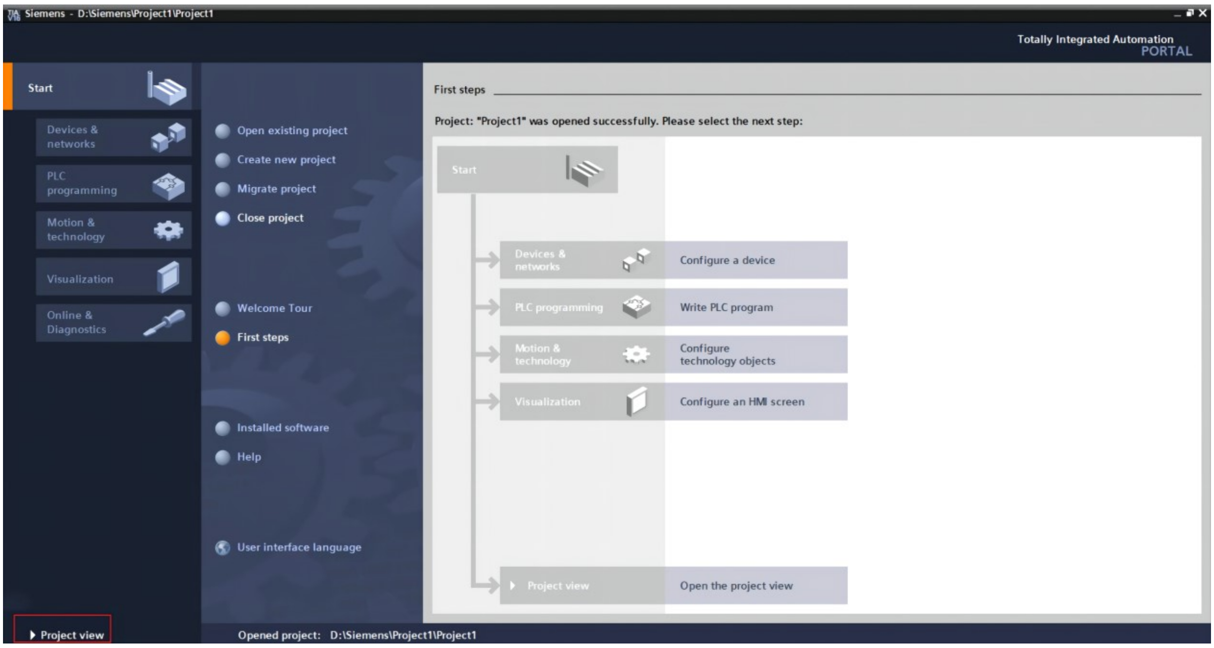
This chapter combines Siemens' mainstream PLC master station (S7-1500, S7-200 SMART) with VC330 (PN) servo to realize common motor motion functions.

12.1 TIA V16 project creation, GSDML import, device addition, online modification of IP and name

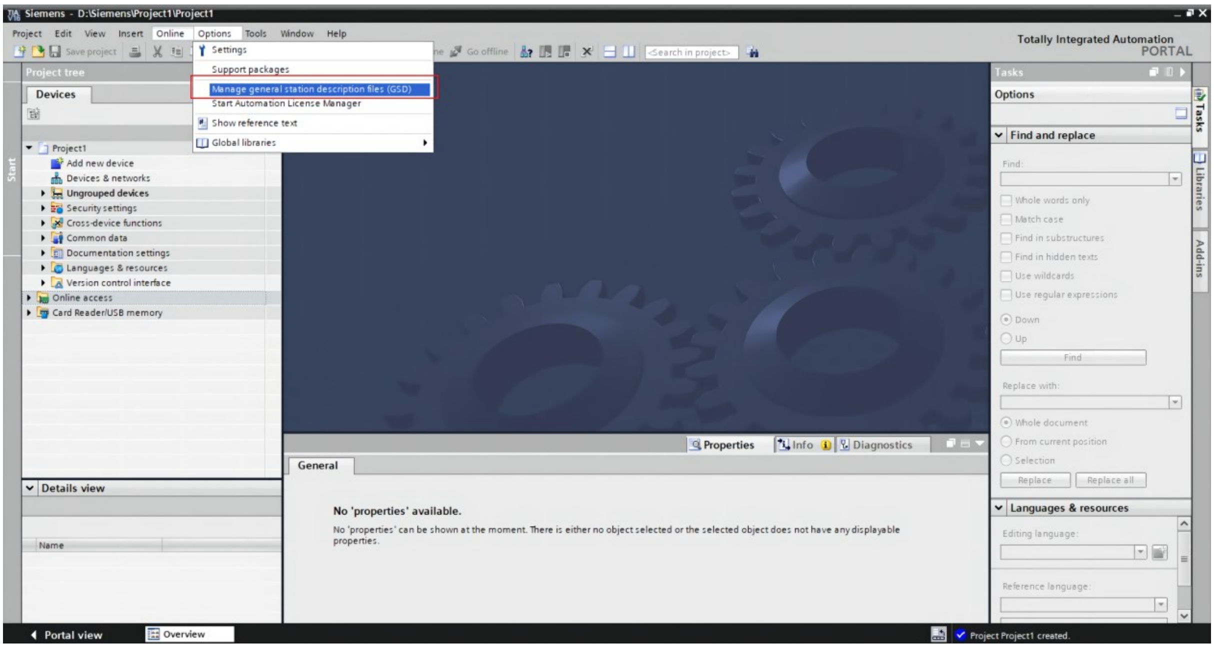
Take the S7-1500 master as an example.

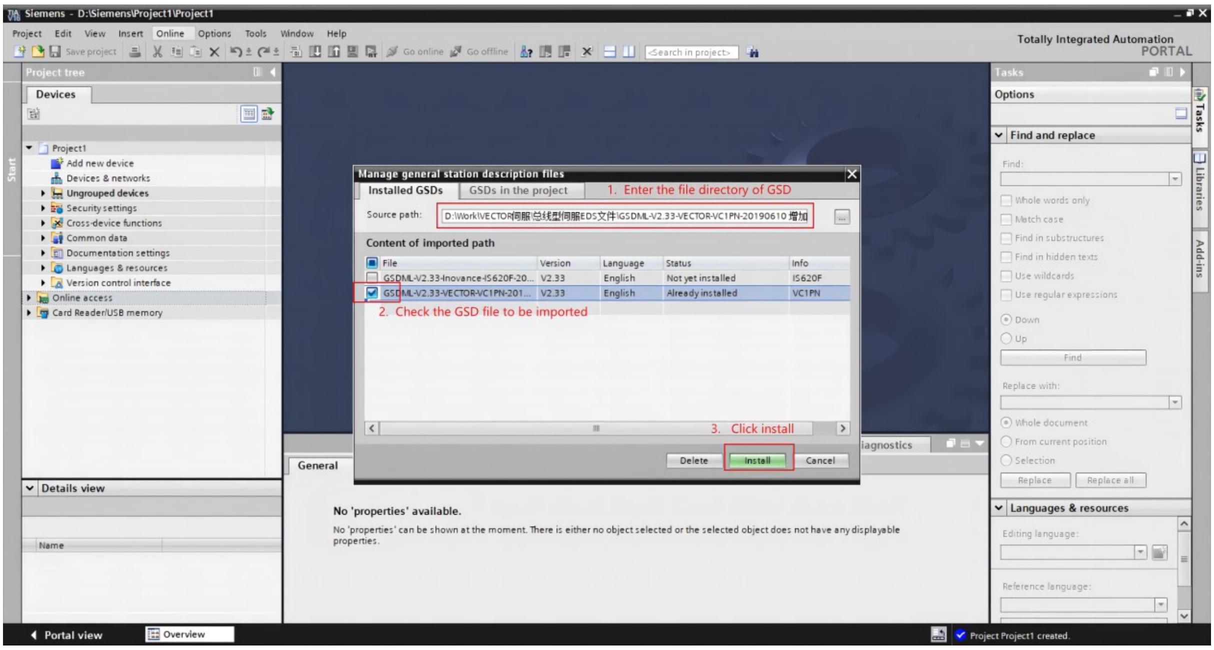
12.1.1 Open the TIA V16 software and create a project



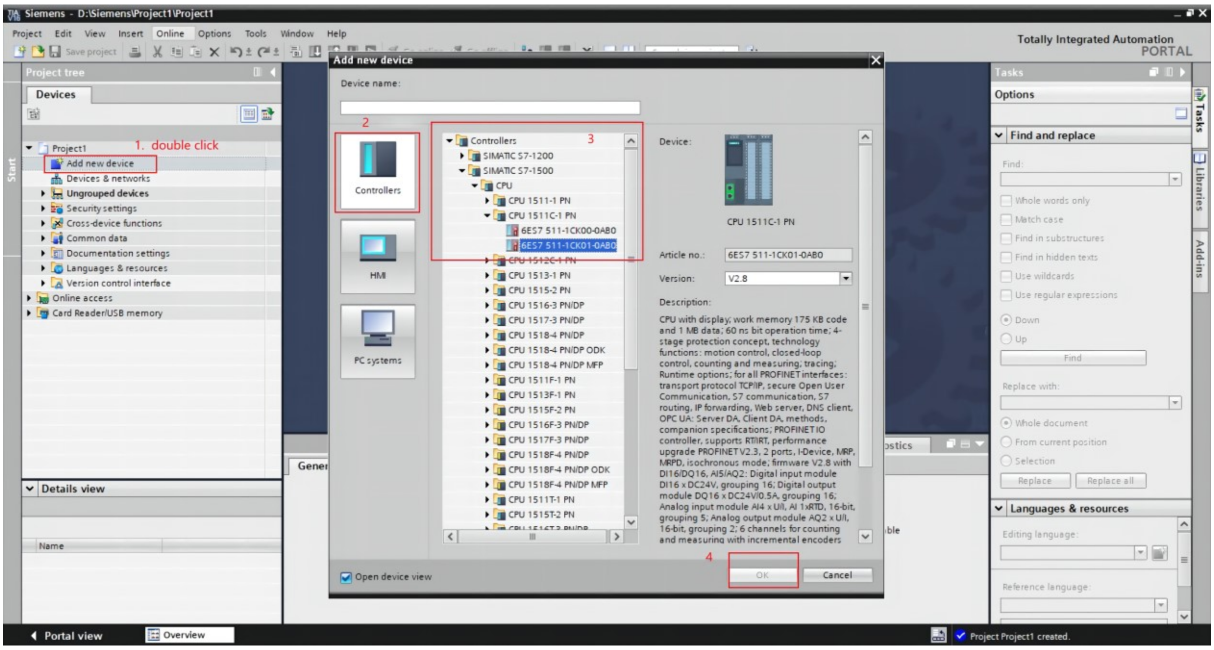


12.1.2 Import GSD files

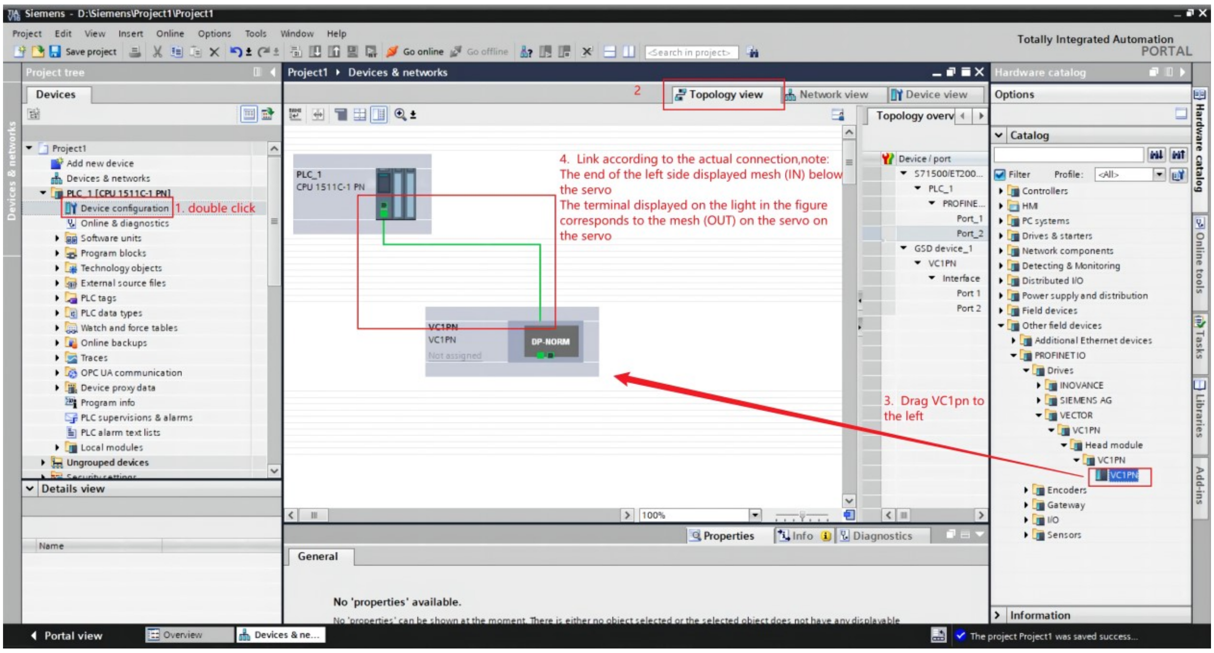




12.1.3 Add the device S7-1500

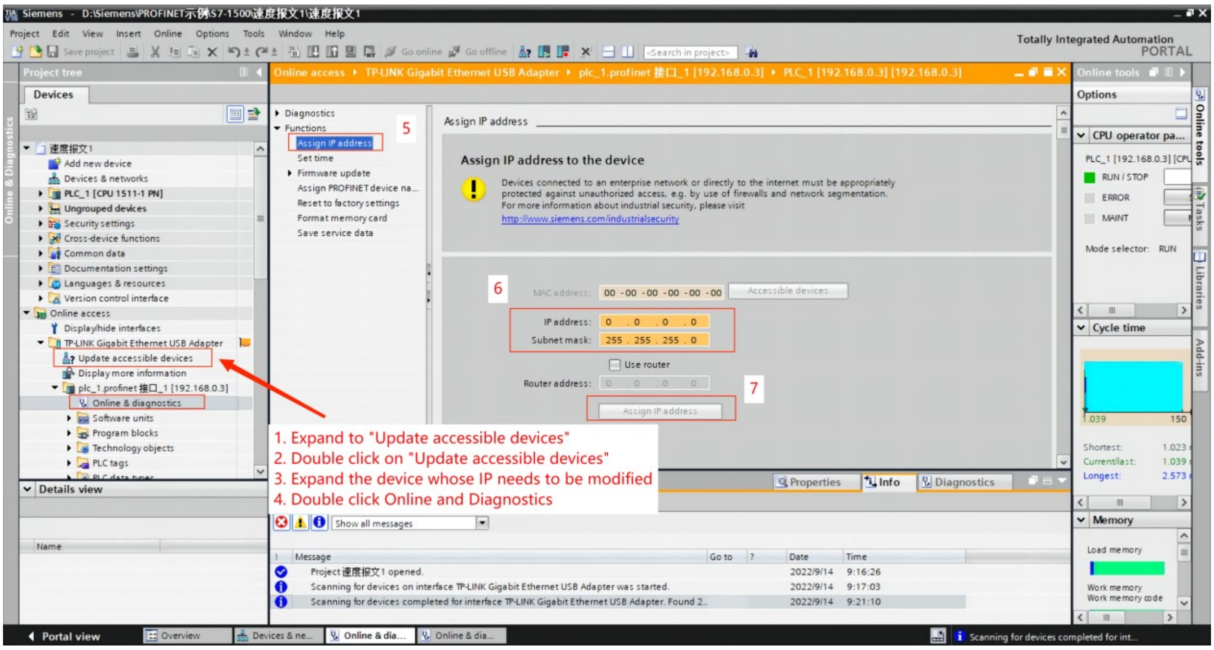


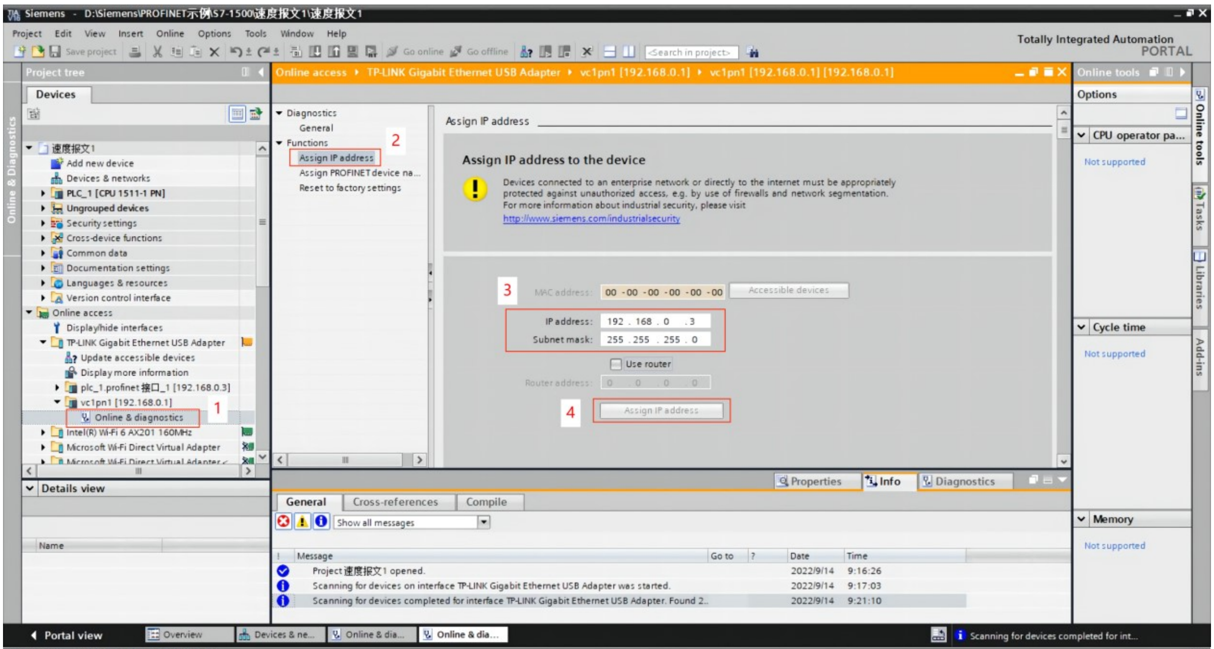
12.1.4 Add servo drive

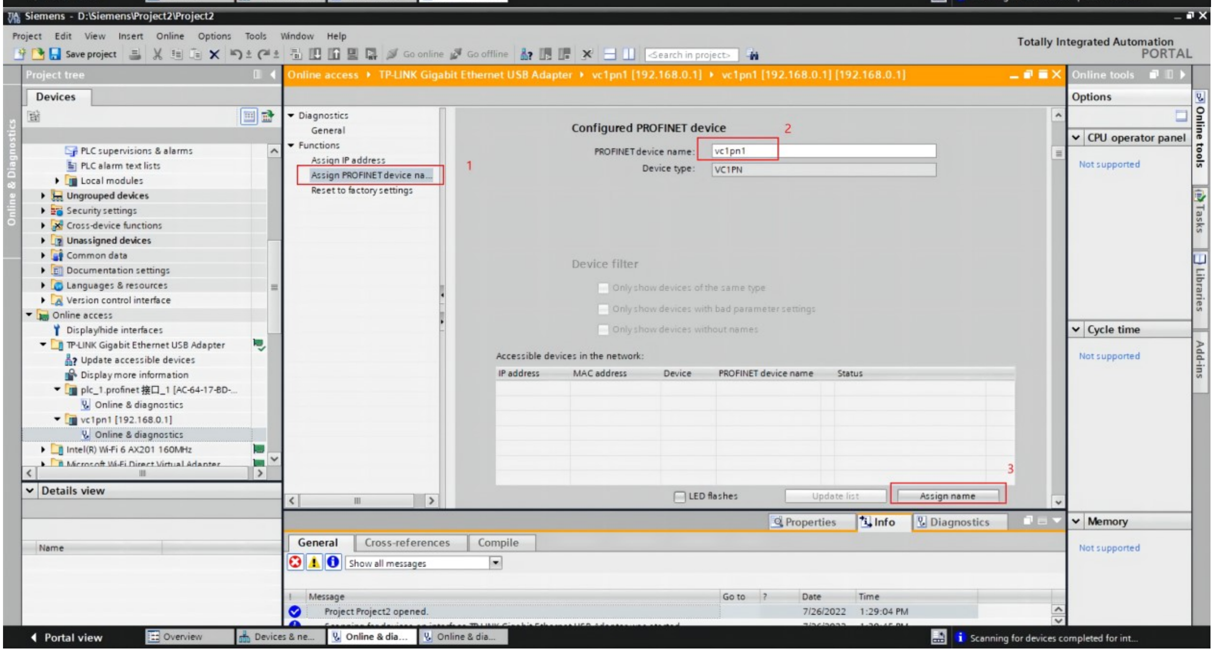


12.1.5 Modify IP and name online

The Profinet bus determines the specific servo through the IP address and device name. When P08.41=0, the IP address and device name need to be set through the controller software (such as TIA Portal software). When P08.41=X, and 0<X<255, the servo will automatically set the servo device name to vc1pnX, automatically set the IP address to 192.168.0.X, and set the sub net mask to vc1pnX when the servo is powered on. Set it to 255.255.0.0 and set the gateway to 192.168.0.X. This section describes setting the IP address and device name through the controller software.




Online access ▸ TP-LINK Gigabit Ethernet USB Adapter ▸ vc1pn1 [192.168.0.1] ▸ vc1pn1 [192.168.0.1] [192.168.0.1]
Project tree
Devices
Online & diagnostics
1
Diagnostics
General
Functions
Assign IP address
Assign PROFINET device na...
Reset to factory settings
2
Assign IP address to the device
Devices connected to an enterprise network or directly to the internet must be appropriately protected against unauthorized access, e.g. by use of firewalls and network segmentation.
For more information about industrial security, please visit
http://www.siemens.com/industrialsecurity
3
MAC address: 00 -00 -00 -00 -00 -00
Accessible devices
IP address: 192 . 168 . 0 . 3
Subnet mask: 255 . 255 . 255 . 0
Use router
Router address: 0 . 0 . 0 . 0
4
Assign IP address
Scanning for devices completed for interface TP-LINK Gigabit Ethernet USB Adapter. Found 2...


Online access ▸ TP-LINK Gigabit Ethernet USB Adapter ▸ vc1pn1 [192.168.0.1] ▸ vc1pn1 [192.168.0.1] [192.168.0.1]
Diagnostics
General
Functions
Assign IP address
Assign PROFINET device na...
Reset to factory settings
1
Configured PROFINET device
2
PROFINET device name: vc1pn1
Device type: VC1PN
Device filter
Only show devices of the same type
Only show devices with bad parameter settings
Only show devices without names
Accessible devices in the network:
IP address
MAC address
Device
PROFINET device name
Status
LED flashes
Update list
3
Assign name

12.2 Simple speed control with telegram 1 based on S7-1500

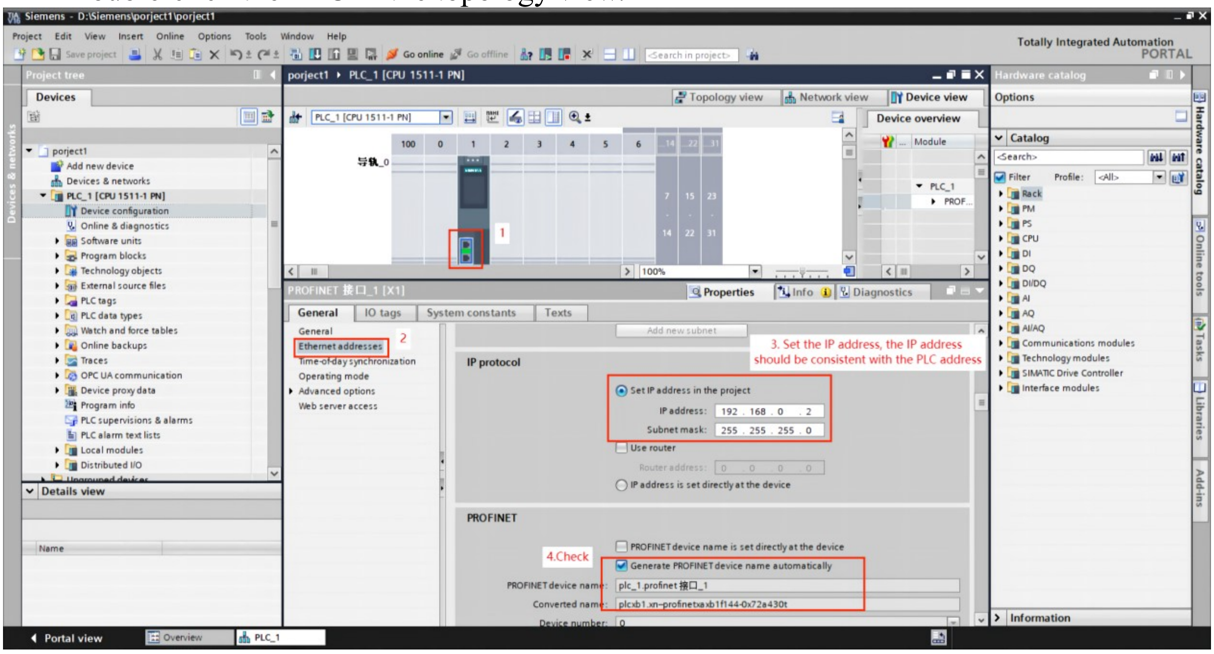
In general, when using telegram 1, only simple speed control can be achieved. IRT is not required. The PLC sends the speed command to the servo, and the servo controls the speed of the motor according to the speed command after the acceleration and deceleration processing. Change the acceleration/deceleration time by modifying the servo parameters P04.17 and P04.18. The PLC also needs to send commands such as enable and stop to the servo.

12.2.1 Add device

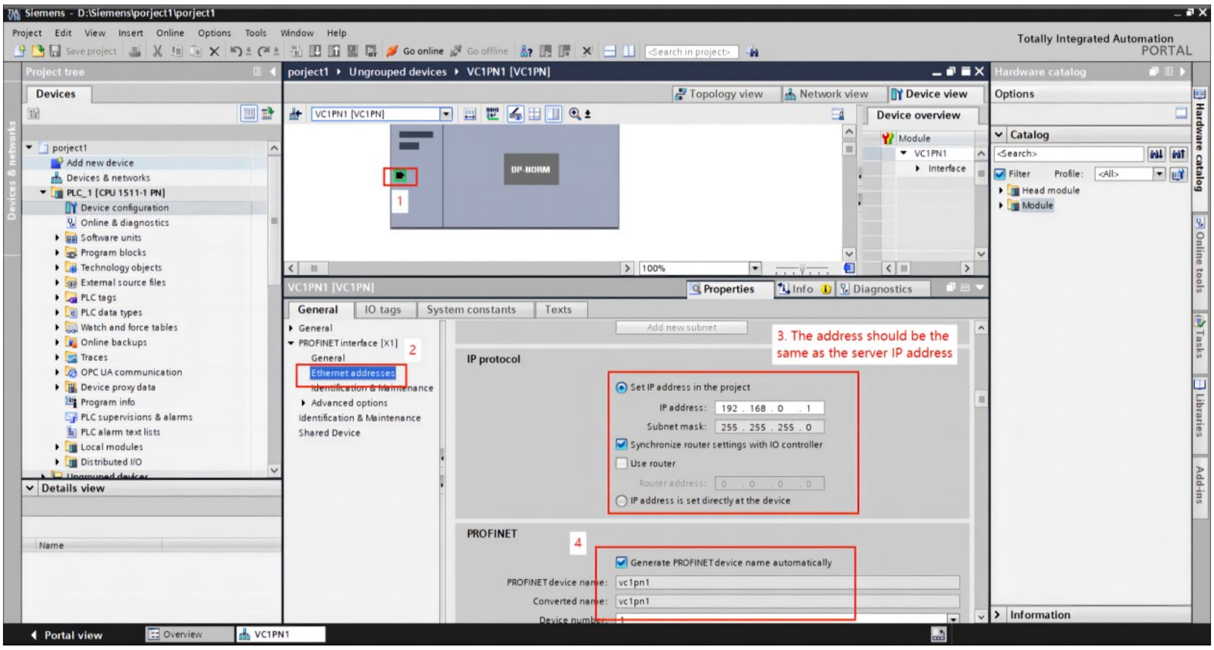
Follow section 12.1 to add devices.

12.2.2 Device configuration

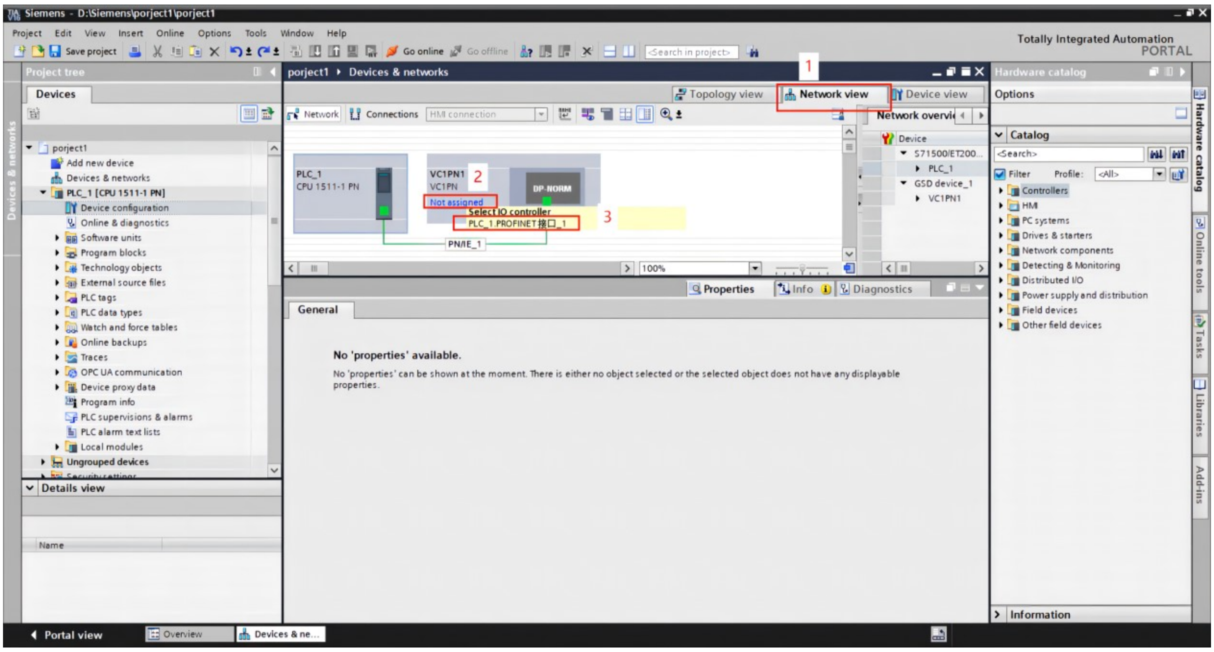
Double-click the PLC in the topology view.



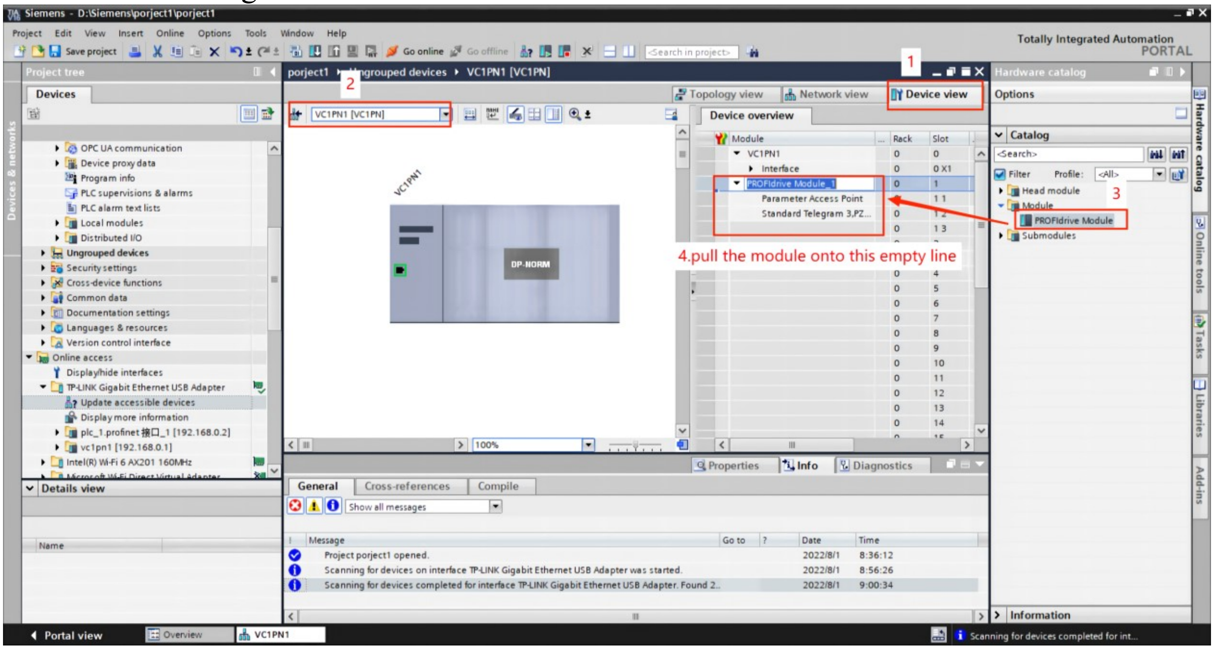
Double-click the servo in the topology view.

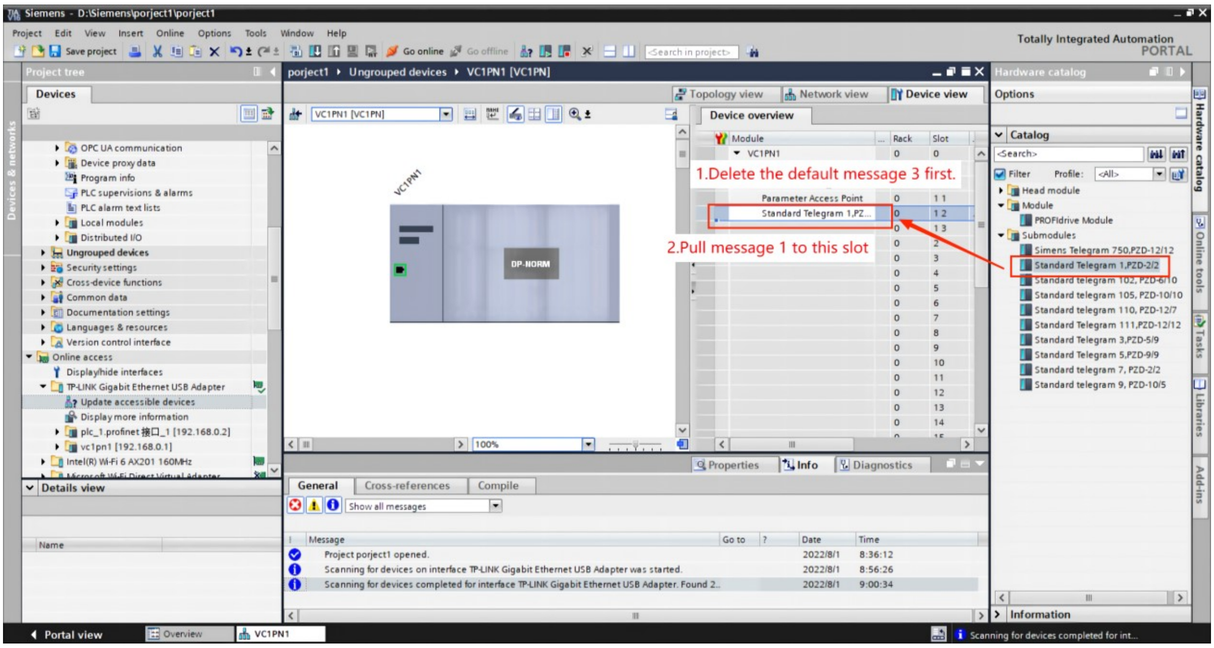


Click on the web view



Set the message of the servo

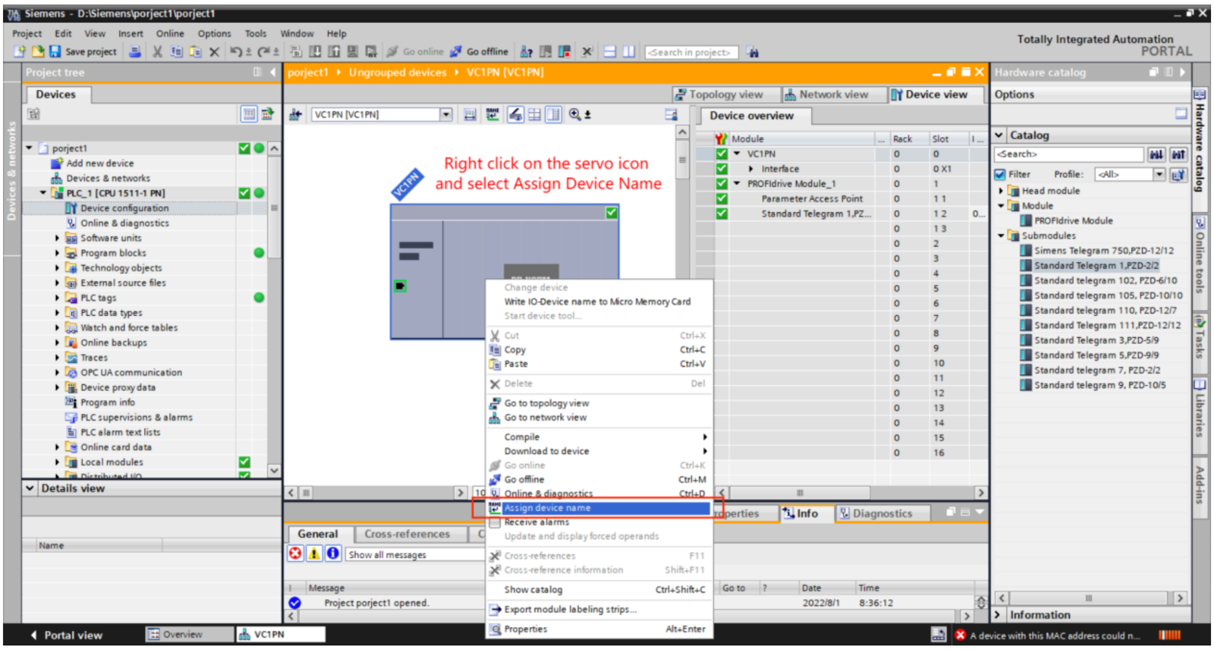


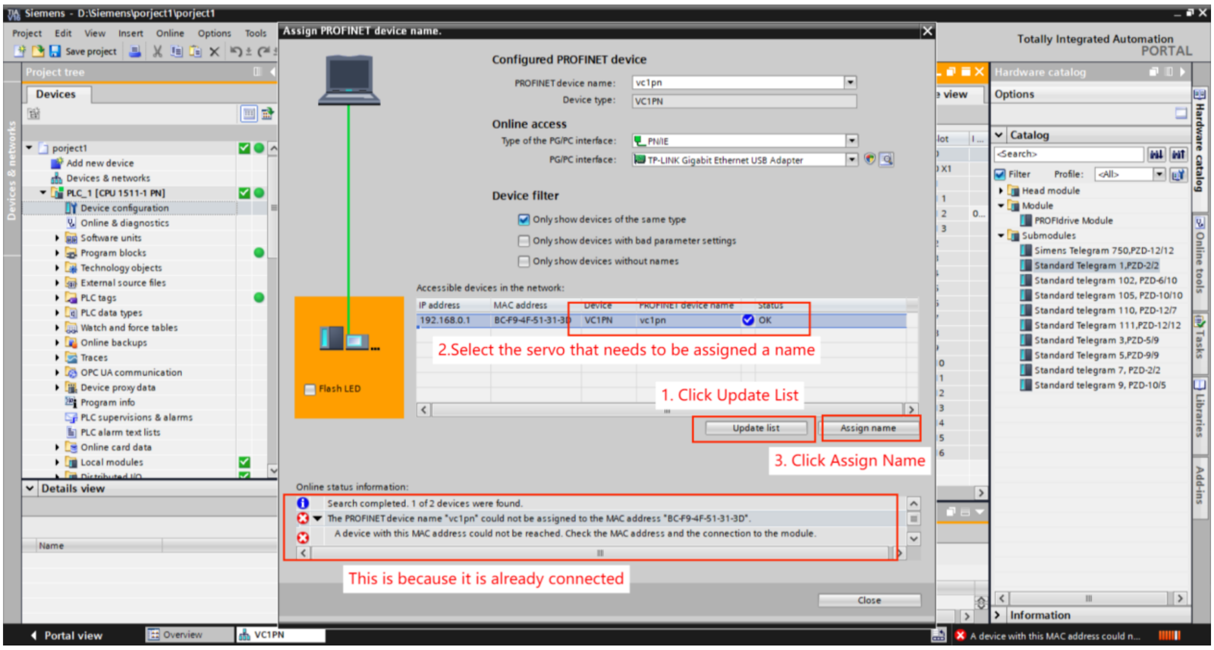


Assign the name of the servo online. As shown in the picture below.

It should be noted that if the name and IP address are assigned through TIA software, P08.41 must be set to 0.

Otherwise, the servo will automatically set the name according to the value of P08.41.

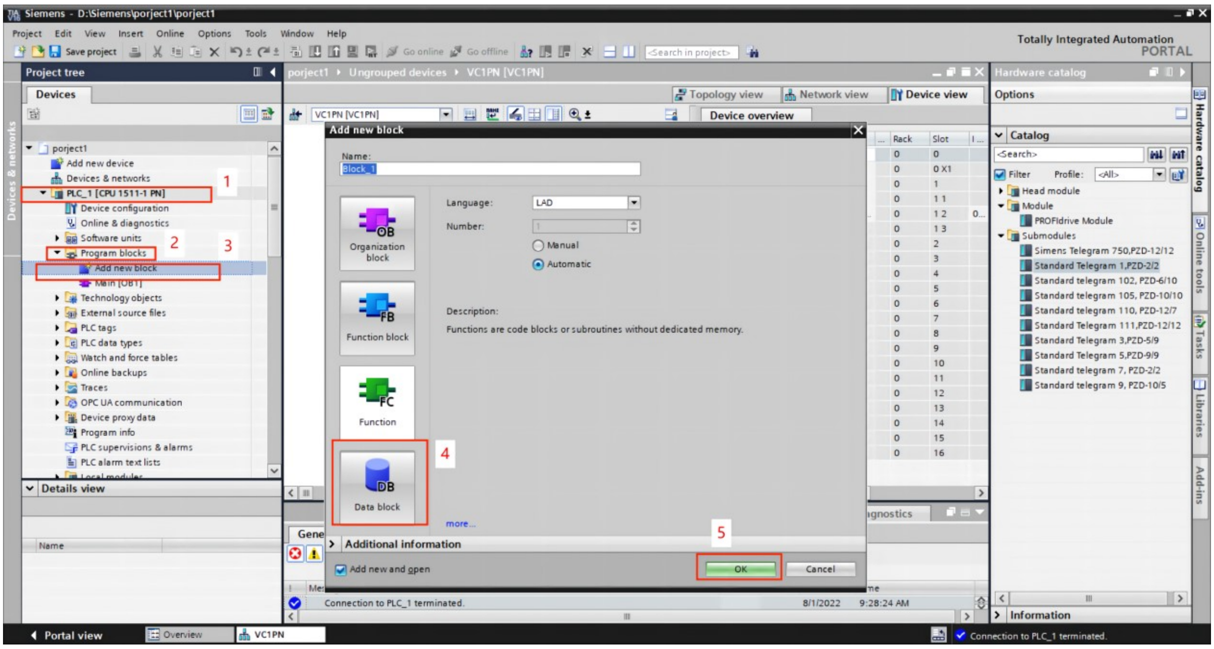


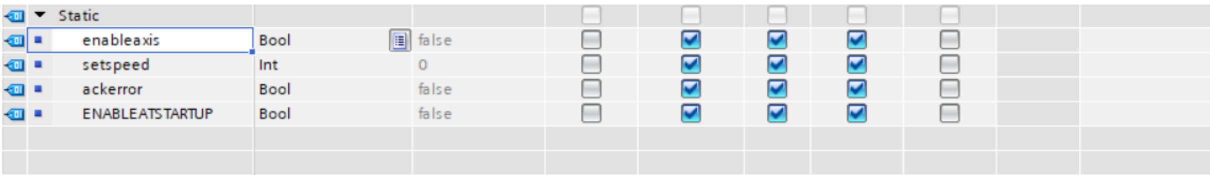


Note: If the names are inconsistent, please refer to Section 12.1.5 to modify the names.

12.2.3 new variable

In the "PLC_1->Program Block" drop-down menu, double-click "Add New Block" and select the data block. Add the following variables inside.

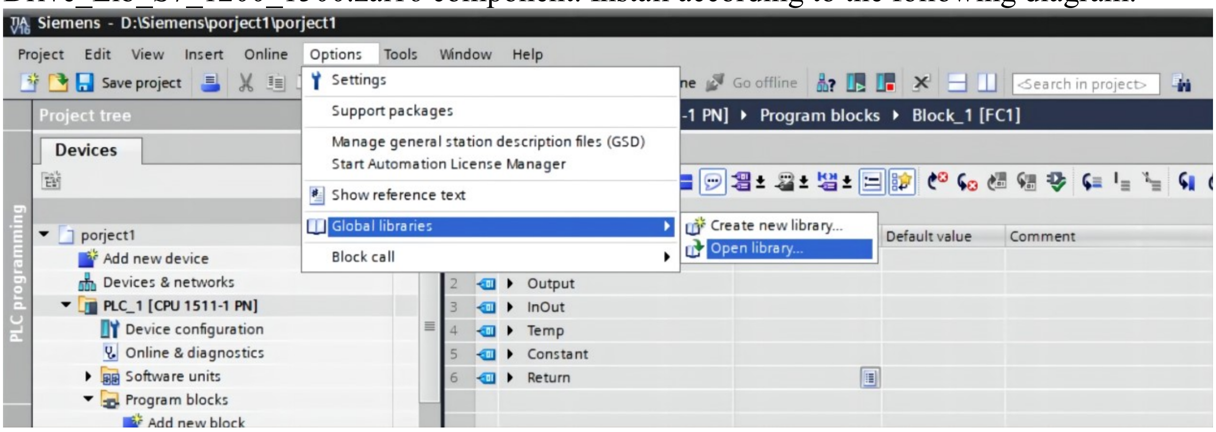




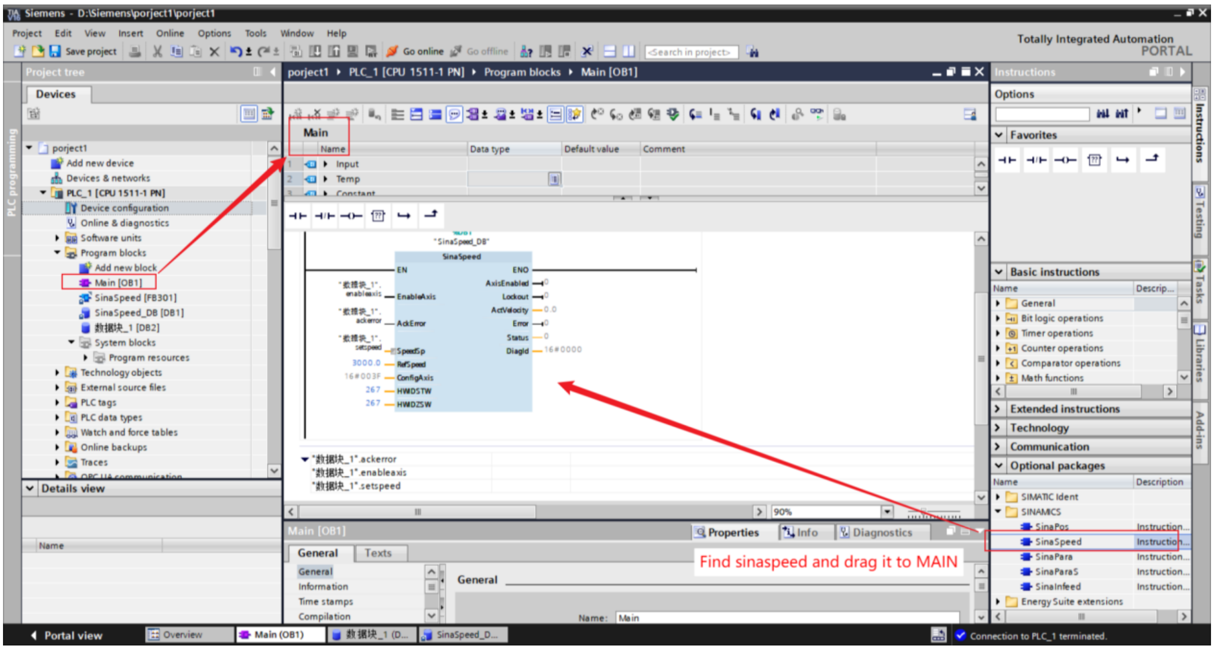
Static							
enableaxis	Bool	false	☐	☑	☑	☑	☐
setspeed	Int	0	☐	☑	☑	☑	☐
ackerror	Bool	false	☐	☑	☑	☑	☐
ENABLEATSTARTUP	Bool	false	☐	☑	☑	☑	☐

12.2.4 Program with SINA_SPEED in Main

The first use of the SINA_SPEED command requires the installation of the Siemens Drive_Lib_S7_1200_1500.zal16 component. Install according to the following diagram.



Find the SINA_SPEED command in the option package, drag it to the program, and write the program.



The SINA_SPEED block input parameters are described as follows:

EnableAxis: Enable the axis

ACKERROR: Rising edge reset error

Speedsp: Set speed, unit rpm

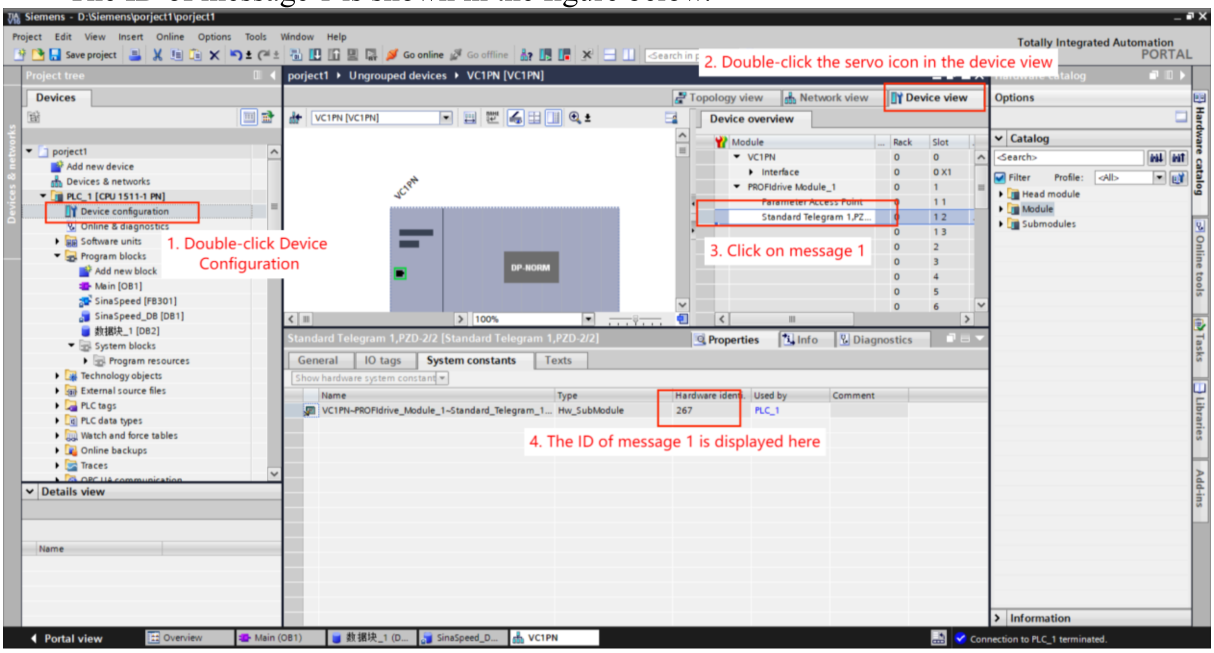
Refspeed: Rated speed, unit rpm, this value must be consistent with servo parameter P00.02.

ConfigAxis: By default.

HWIDSTW: This value must be the same as the ID of packet 1.

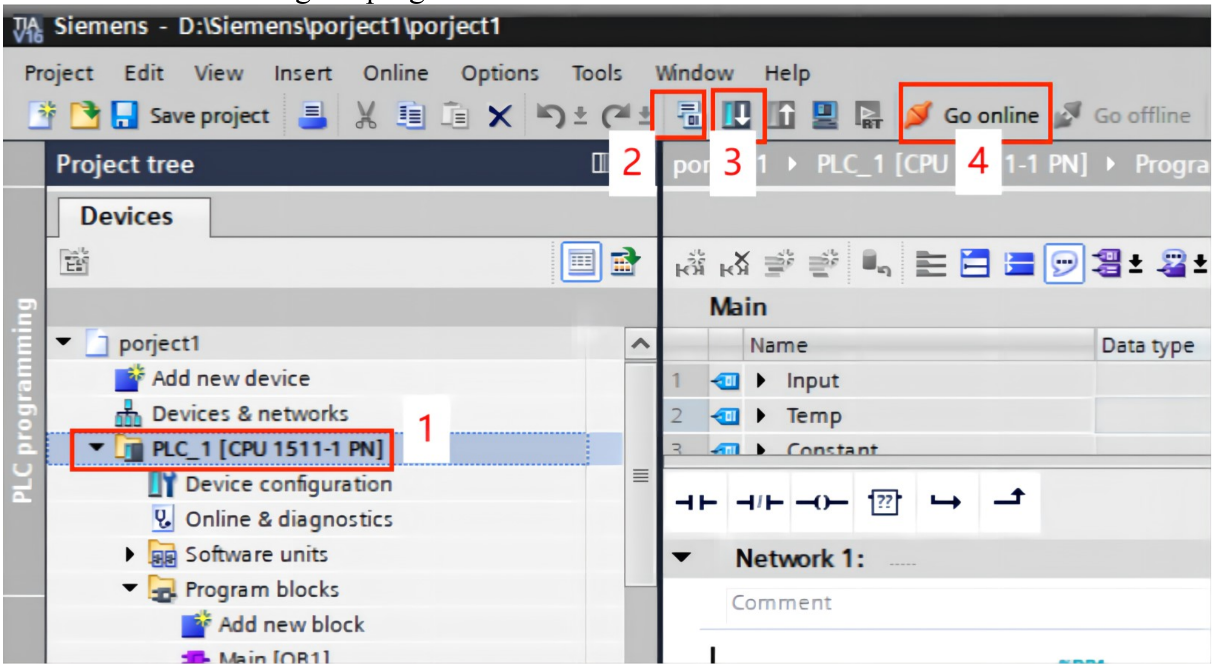
HWIDZSW: This value must be consistent with the ID of packet 1.

The ID of message 1 is shown in the figure below.

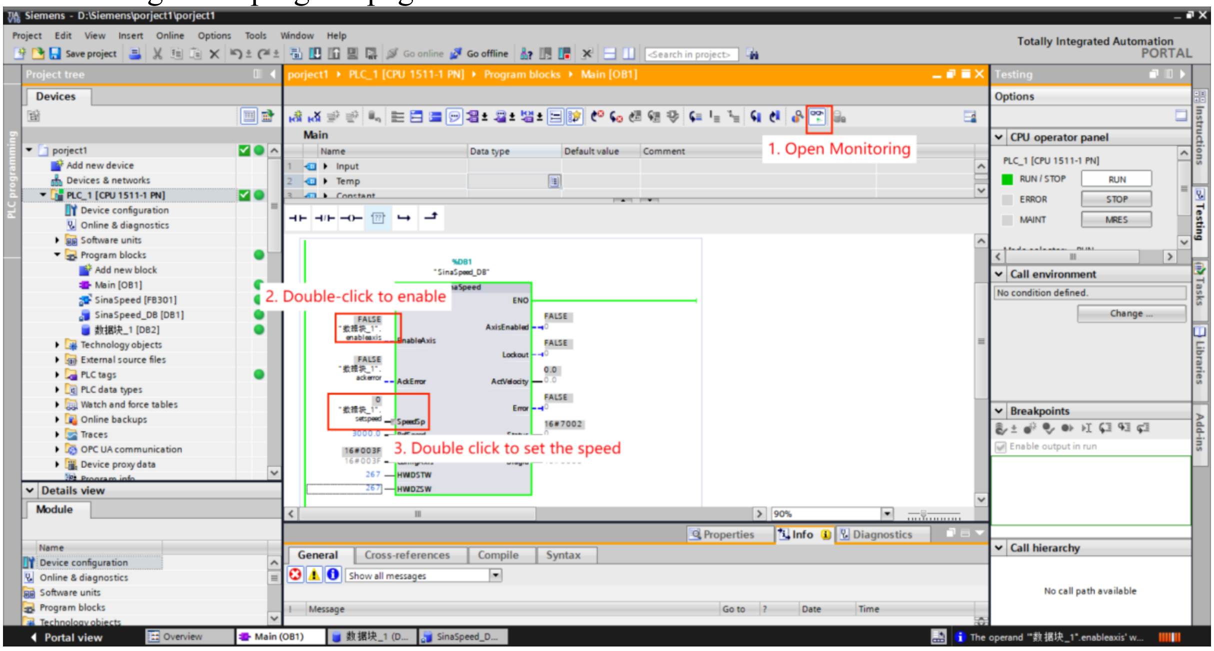


12.2.5 Compile and download the program for testing.

Note that if the message of the servo is changed, the servo needs to be powered on again after downloading the program.



Debug in the program page.



12.2.6 Precautions for use of message 1.

（1）The acceleration/deceleration time is controlled by parameters P04.17 and P04.18, the unit is ms, which refers to the acceleration/deceleration time from 0 to rated speed. The actual acceleration time is related to the difference between the target speed and the current speed.

$$\text{Actual acceleration and deceleration time}$$
$$= \text{Set acceleration and deceleration time} \times \frac{\text{Variation of input speed command}}{\text{Rated speed}}$$

（2）The input parameter Refspeed of the SINA_SPEED block must be consistent with the rated speed of the servo P00.02.
（3）After changing the message, the servo and PLC must be powered on again to take effect.

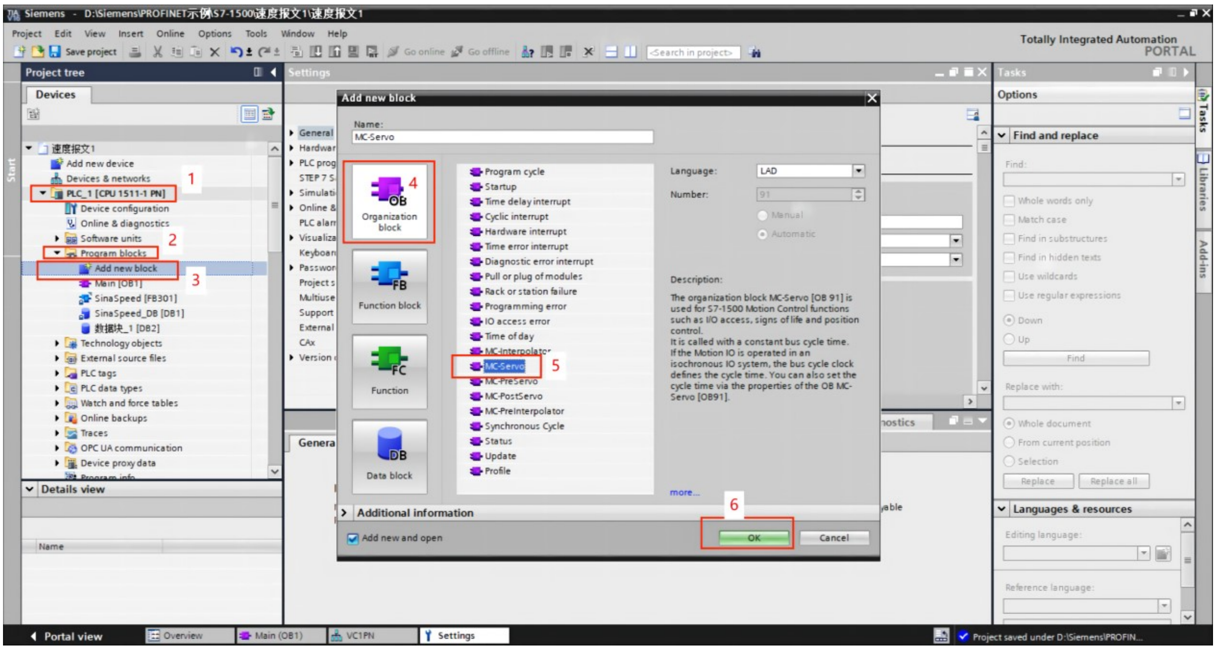
12.3 Based on S7-1500, use message 3 to realize positioning control, speed control, and zero return control

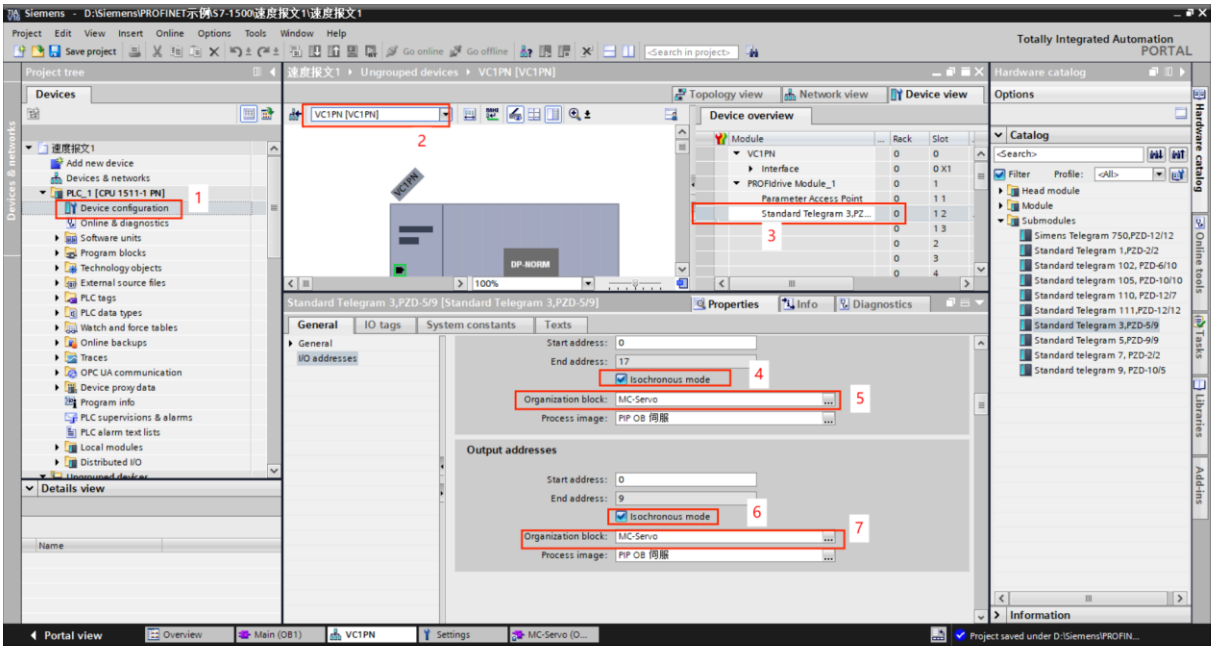
Generally speaking, when using message 3, the position control is realized in the PLC, and the output of the position control loop is sent to the servo as a speed command through message 3. After the server receives the speed command, it runs at the set speed. . Because the position loop is connected by bus, its real-time performance must be guaranteed, so IRT must be enabled. At the same time, the acceleration and deceleration time P04.17 and P04.18 of the servo need to be set to 0. Otherwise, when the acceleration and deceleration time of the position command is less than the acceleration and deceleration time of the servo speed, the position loop will have low frequency oscillation.

12.3.1 Create a new project

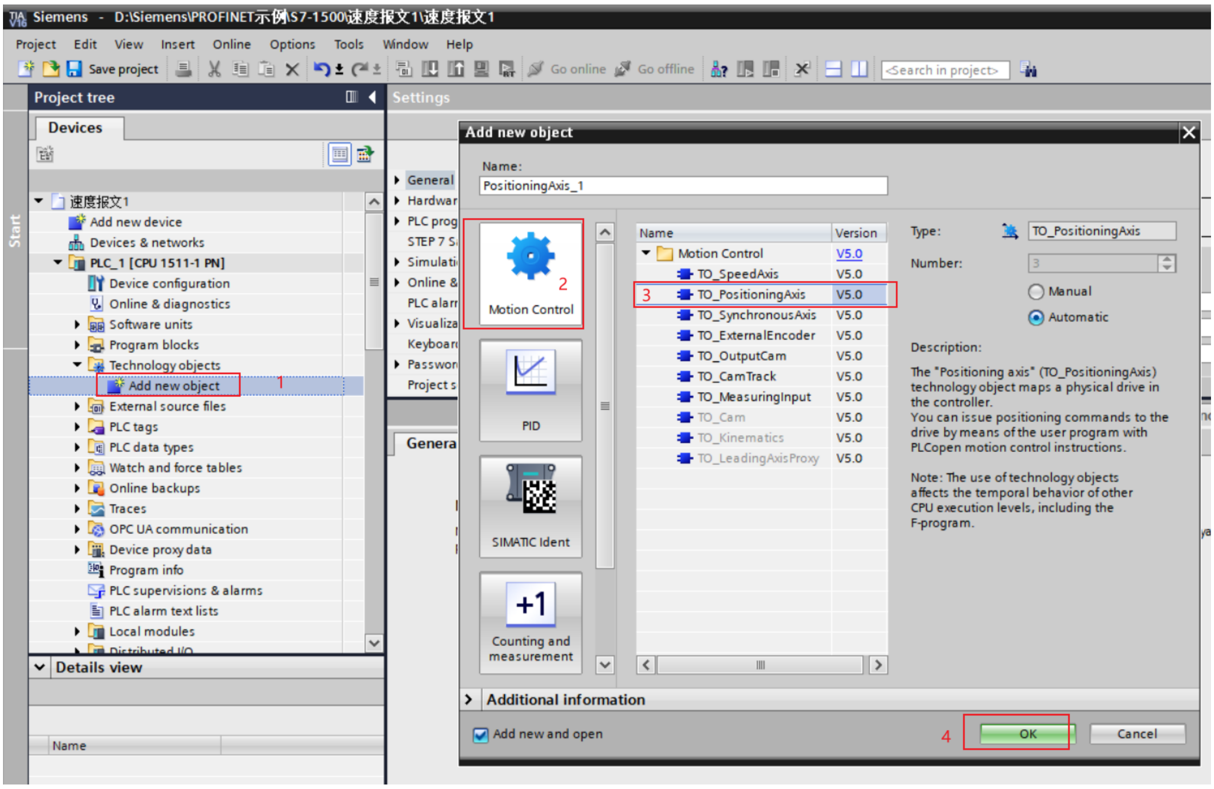
Follow the introduction in section 12.1 to create a new project, add equipment, and configure the equipment.

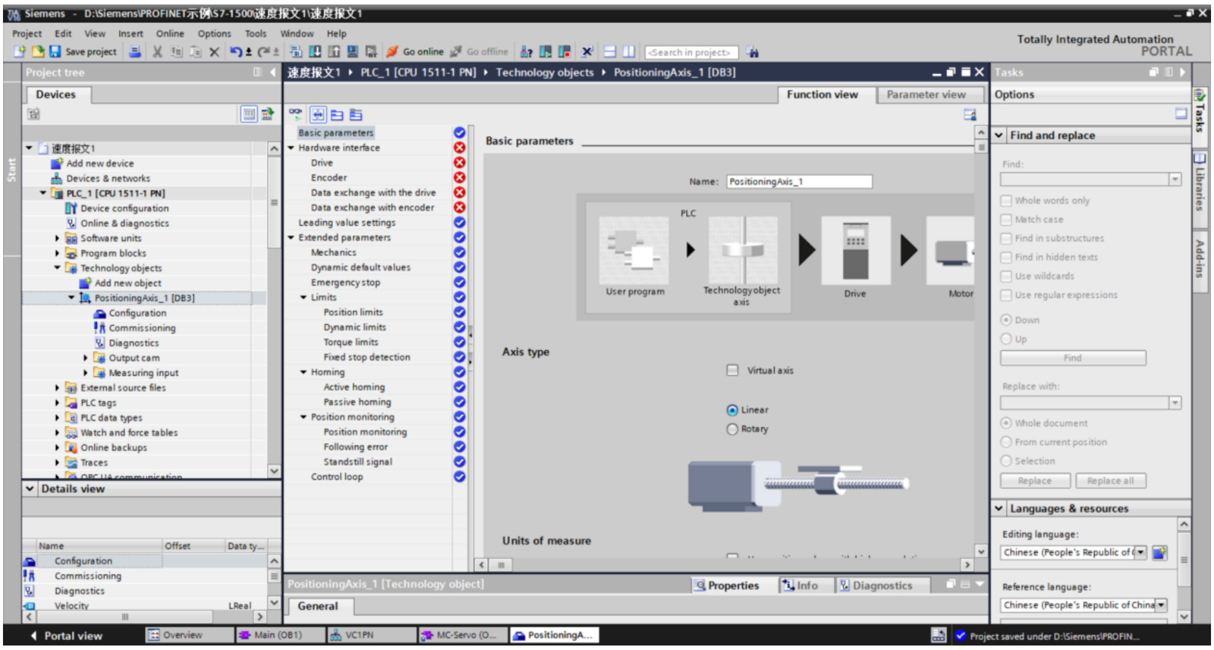
12.3.2 Configuration message 3



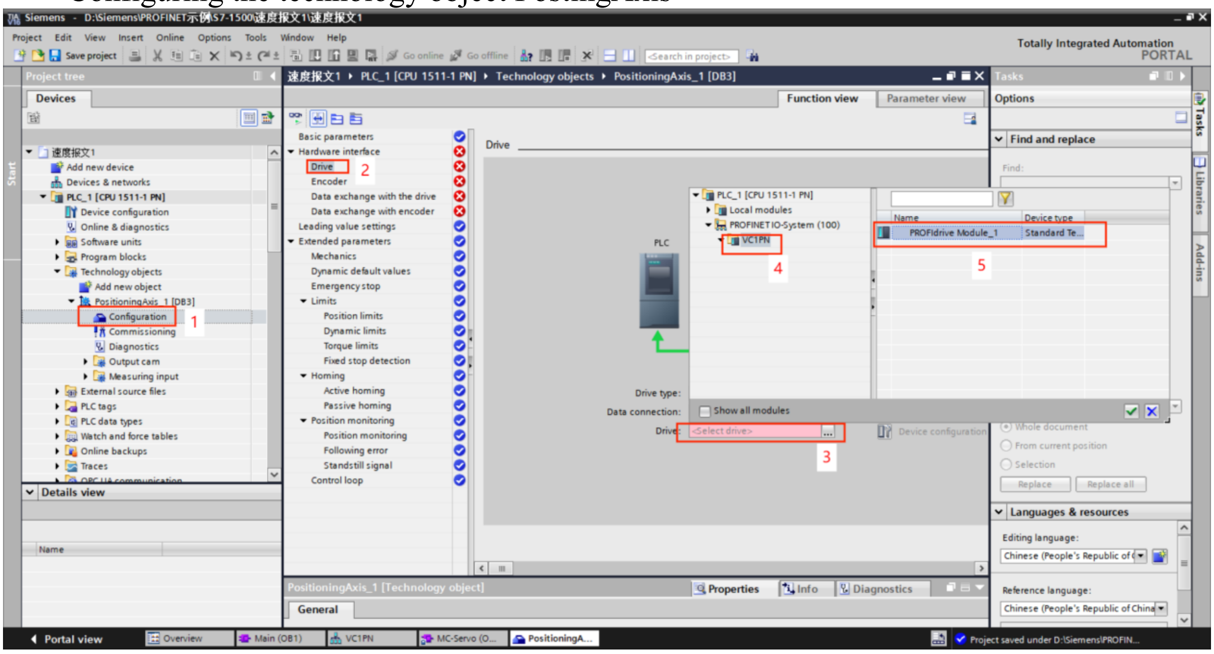


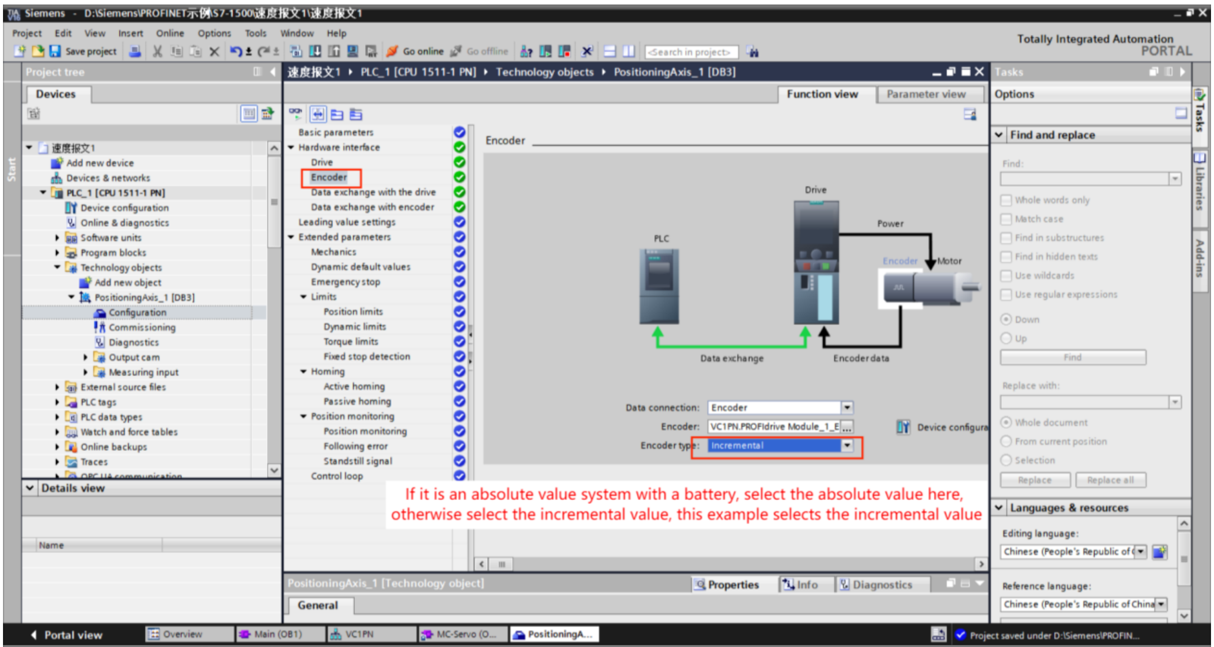
12.3.3 Create a new technology object, configure the technology object

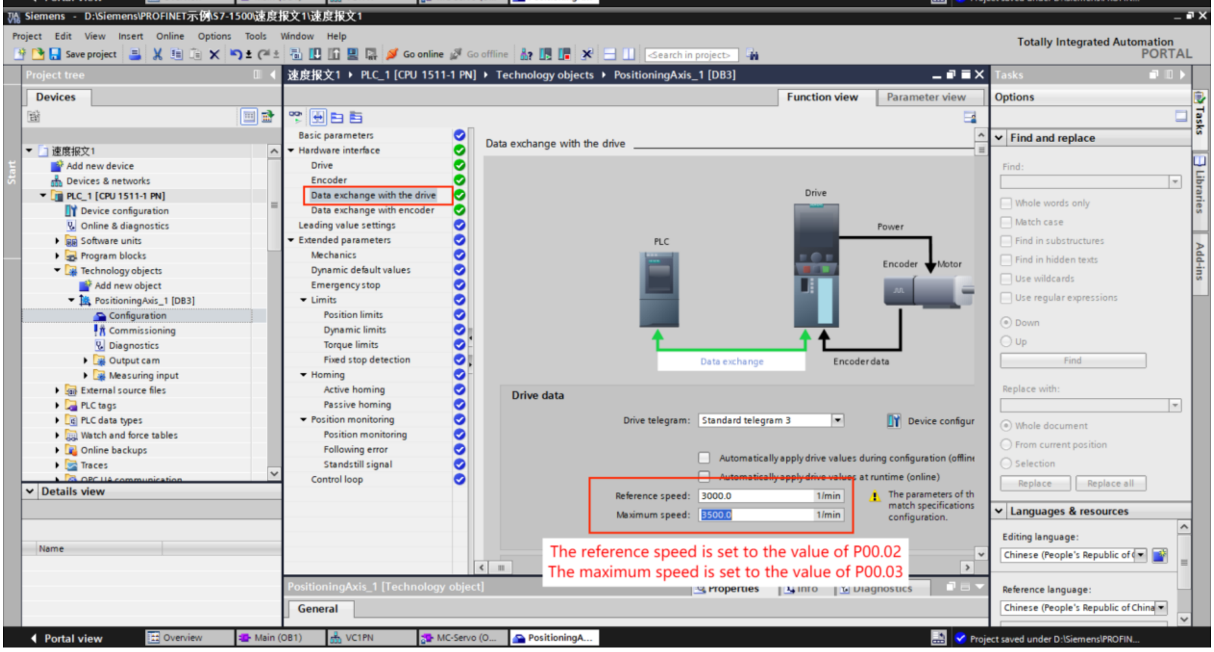


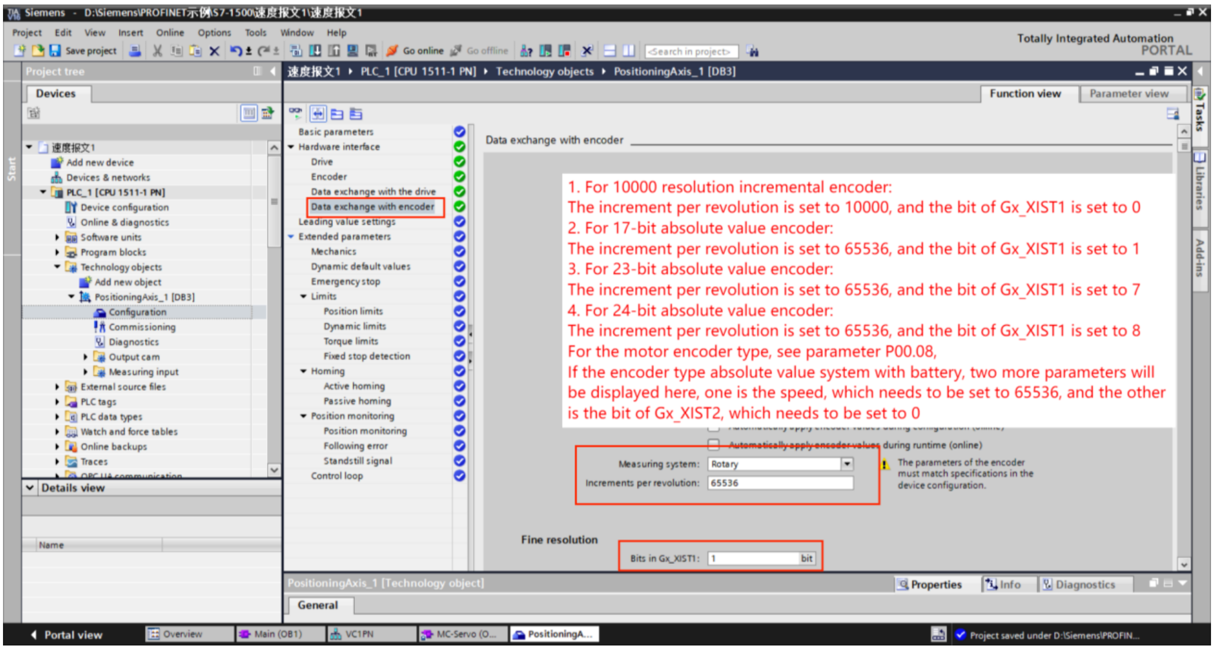


Configuring the technology object PostingAxis



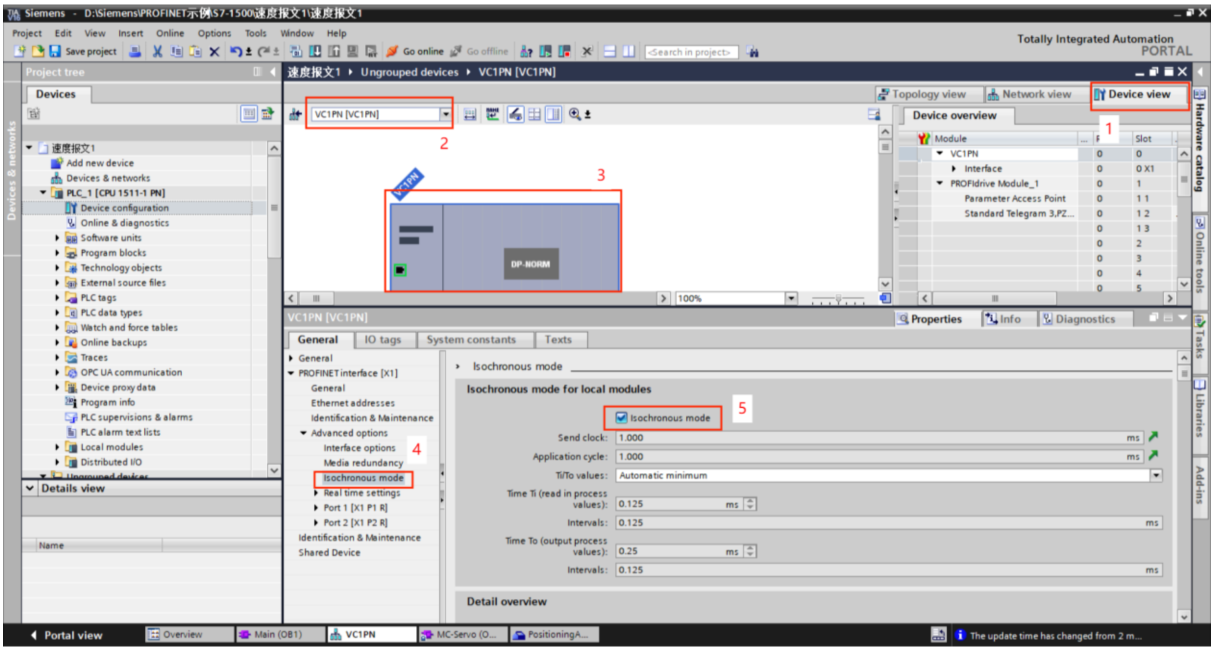

If it is an absolute value system with a battery, select the absolute value here,
otherwise select the incremental value, this example selects the incremental value


The reference speed is set to the value of P00.02
The maximum speed is set to the value of P00.03

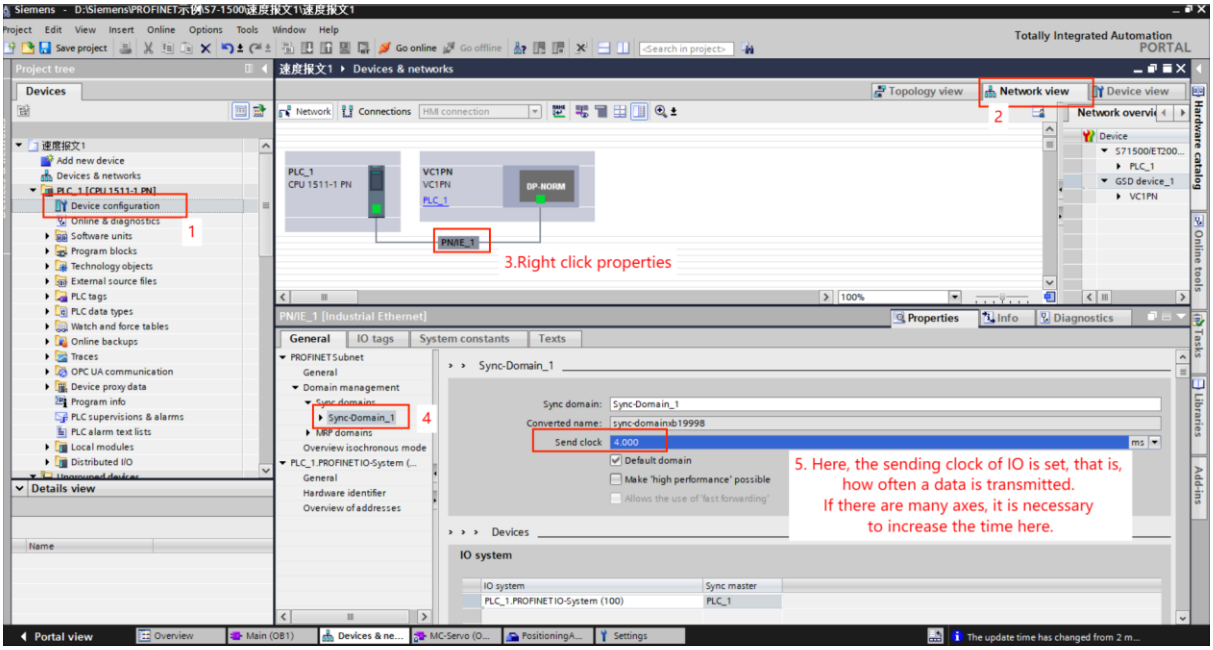


12.3.4 Configure Sync Domain

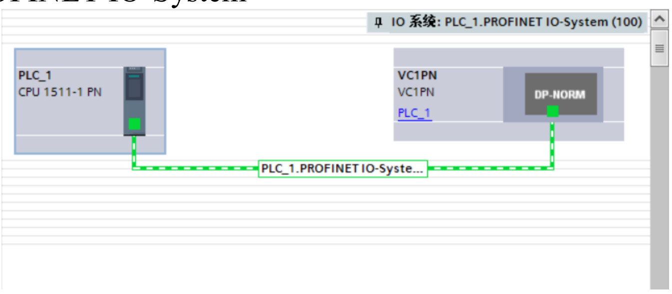
Check "Isochronous Mode"



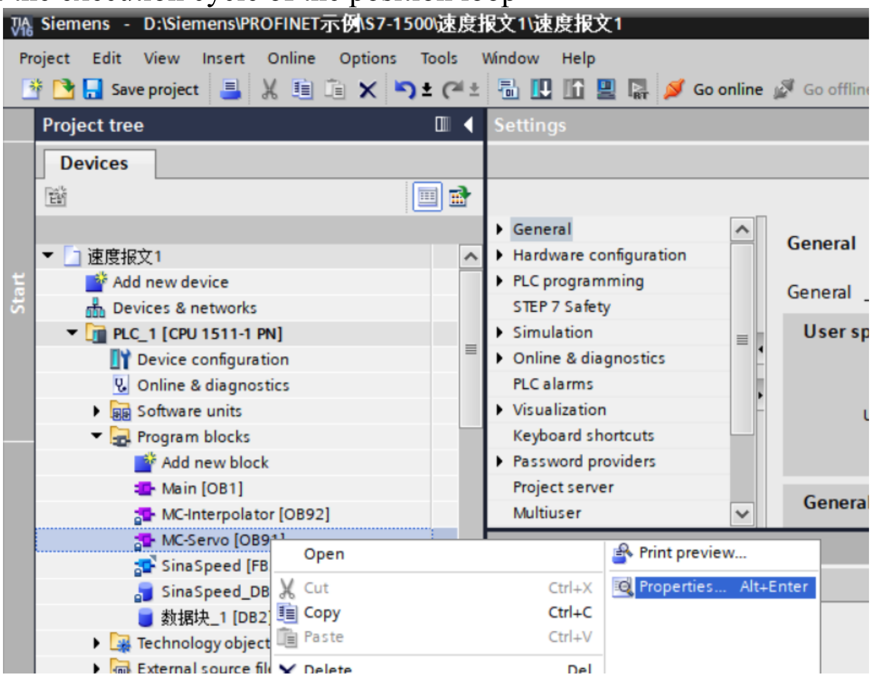
Set the send clock

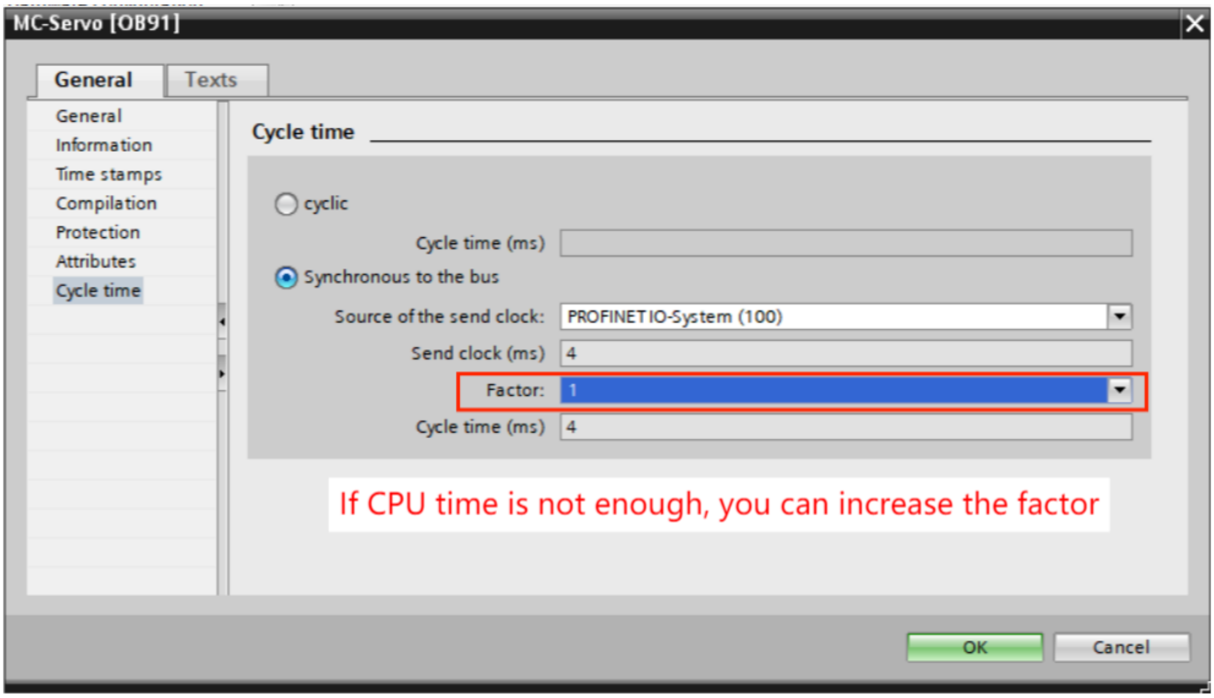


Select PLC_1.PROFINET IO-System



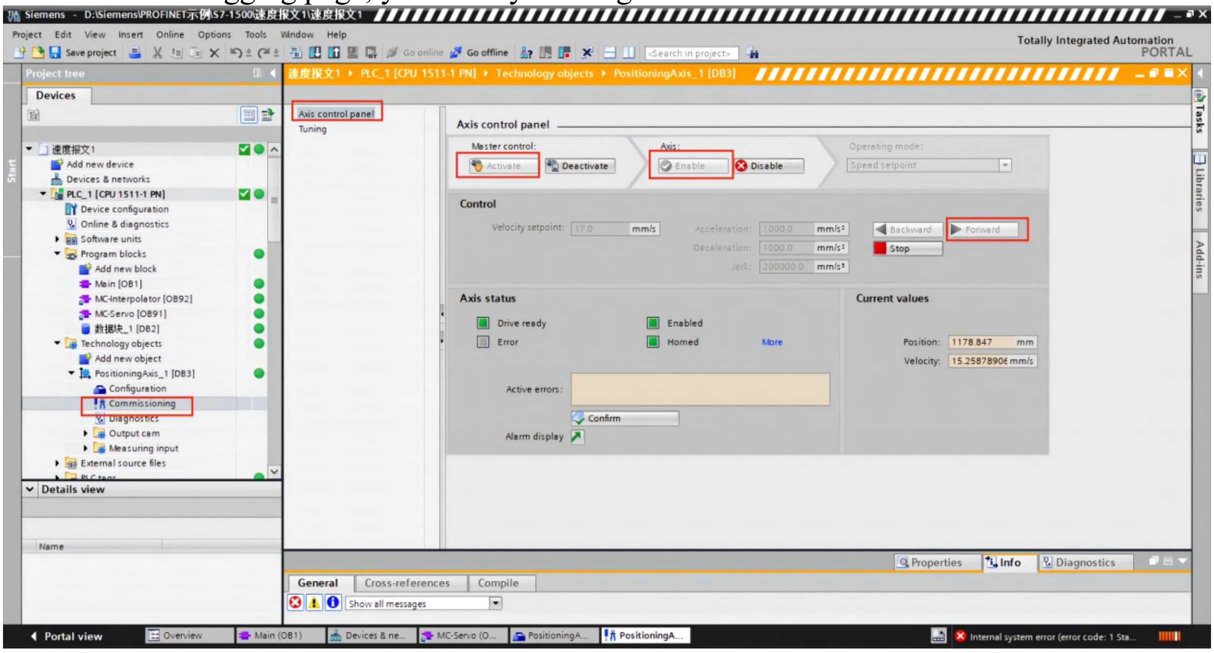
Then set the execution cycle of the position loop





12.3.5 Trial run

On the debugging page, you can try running the motor.



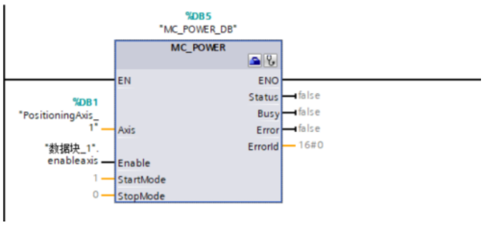
12.3.6 Create new data blocks, write PLC program

数据块_1

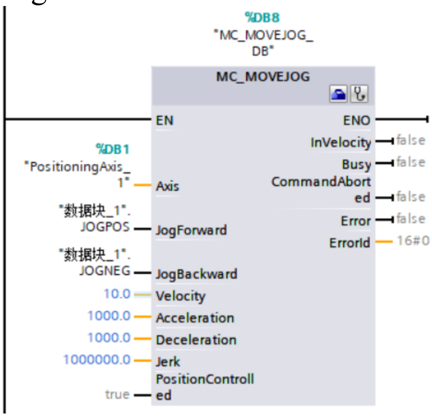
	名称	数据类型	起始值	保持	从 HMI/OPC...	从 H...	在 HMI ...	设定值	监控
1	▼ Static			☐	☐	☐	☐	☐	
2	trigmoveabs	Bool	false	☐	☑	☑	☑	☐	
3	homepos	Real	0.0	☐	☑	☑	☑	☐	
4	homemode	Int	3	☐	☑	☑	☑	☐	
5	JOGNEG	Bool	false	☐	☑	☑	☑	☐	
6	JOGPOS	Bool	false	☐	☑	☑	☑	☐	
7	enableaxis	Bool	false	☐	☑	☑	☑	☐	
8	setspeed	Int	0	☐	☑	☑	☑	☐	
9	ackerror	Bool	false	☐	☑	☑	☑	☐	
10	ACC	Real	2000.0	☐	☑	☑	☑	☐	
11	DEC	Real	2000.0	☐	☑	☑	☑	☐	
12	SPED	Real	300.0	☐	☑	☑	☑	☐	
13	DISTANCE	Real	300.0	☐	☑	☑	☑	☐	
14	bit1	Bool	false	☐	☑	☑	☑	☐	
15	bit3	Bool	false	☐	☑	☑	☑	☐	
16	bit2	Bool	false	☐	☑	☑	☑	☐	
17	bit0	Bool	false	☐	☑	☑	☑	☐	
18	trigmove1	Bool	false	☐	☑	☑	☑	☐	
19	NEGTORQUE_LIMIT	Int	500	☐	☑	☑	☑	☐	
20	POSTORQUE_LIMIT	Int	500	☐	☑	☑	☑	☐	
21	ENABLEATSTARTUP	Bool	false	☐	☑	☑	☑	☐	

Instructions can be found in Craft->Motion Control.

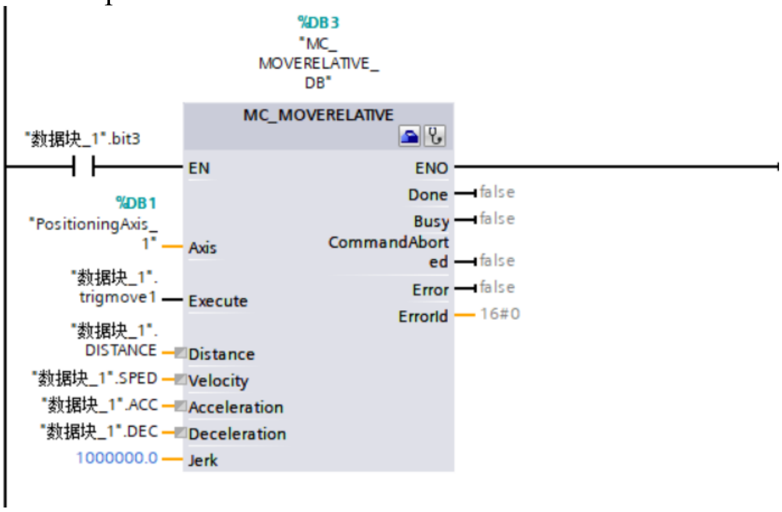
Enable the axis



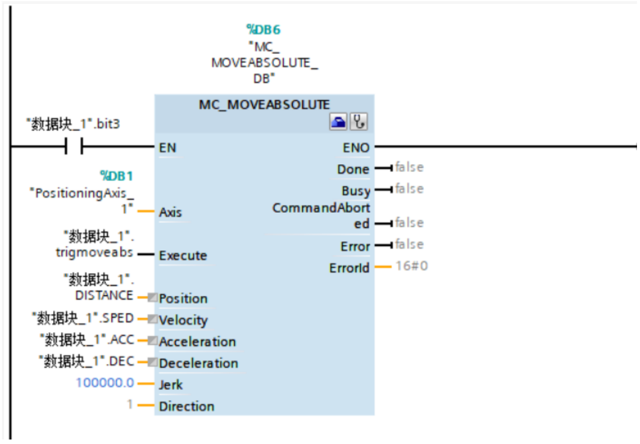
Jog



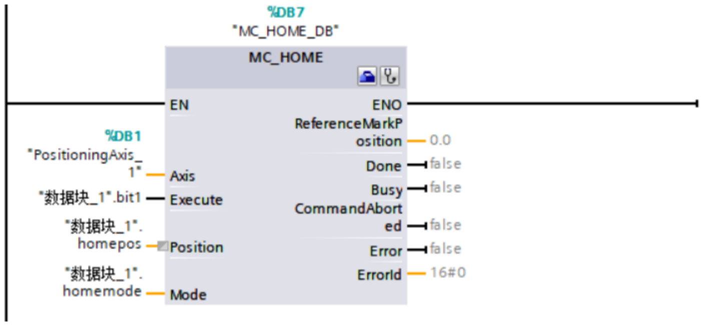
relative point movement



Absolute point movement



return to zero



A brief introduction to returning to zero.

Mode = 0：The absolute type directly returns to the zero point, and the position value of the axis is set to the value of the parameter "Position".

Mode = 1： The relative type directly returns to the zero point, and the position value of the axis is equal to the current axis position + the value of the parameter "Position".

Mode = 2：Passive zero return, that is to say, the motor will not move after triggering the zero return module, but by other commands. Let the motor move to achieve zero return. After zero return, the position value of the axis is the value of the parameter "Position".

Mode = 3： Active zero return, the position value of the axis is the value of the parameter "Position".

Modes 2 and 3 only configure the encoder type as: Incremental.

Mode = 6： Absolute encoder regulation (relative). The position value of the axis is equal to the current axis position + the value of the parameter "Position". This is for the zero return of the multi-turn absolute encoder with battery, and the power-down position is not lost.

Mode = 7： Absolute encoder regulation (absolute). The position value of the axis is the value of the parameter "Position". This is for the zero return of the multi-turn absolute encoder with battery, this is for the zero return of the multi-turn absolute encoder with battery, and the power-down position is not lost.

It is recommended to use mode 3, which needs to be reset to zero after power-on, and only need to return to the absolute value of zero once when using mode 6/7.

12.3.7 Introduction to the relevant command parameters

Axis：Parameter is the axis technology object configured by the Motion Control Wizard.

Status：The parameter reflects the enable state of the motion axis. When it is 0, it means that the motion axis is disabled, and the axis will not execute motion control instructions; when it is 1, it means that the motion axis is enabled, and the motion axis is ready to execute motion control instructions.

Busy：TRUE to reflect that the instruction is active.

Error：When it is TRUE, it reflects that an error occurs in the instruction or related technological objects. The specific cause of the error can be explained in combination with the parameters of ErrorID and ErrorInfo.

MC_POWER command:

①Enable：When the parameter is "TRUE", the axis is enabled, and when the parameter is "FALSE", all current motion is interrupted according to the configured StopMode, stopping and disabling the motion axis.

②StartMode：When the parameter is 0, the positioning axis/synchronous axis is not controlled by the position, and when the parameter is 1, the positioning axis/synchronous axis is controlled by the position. If the configured motion axis adopts pulse train control, this parameter is invalid.

③StopMode：When the parameter is 0, it is an emergency stop; when the parameter is 1, it stops immediately; when the parameter is 2, it is an emergency stop with acceleration change rate control.

MC_MOVEJOG command:

①JogForward: When the parameter is "TRUE", the axis moves in the positive direction at the speed specified in the parameter "Velocity".

②JogBackward：When the parameter is "TRUE", the axis moves in the negative direction of the velocity specified in the parameter "Velocity".

③Velocity：When the parameter is "TRUE", the axis moves in the negative direction of the velocity specified in the parameter "Velocity".

④Acceleration：Acceleration, parameter > 0.0 uses specified value; parameter = 0.0 not allowed; parameter < 0.0 uses acceleration configured in "Technical Objects > Configuration > Extended Parameters > Dynamic Defaults".

⑤Deceleration：Deceleration, when parameter > 0.0 use the specified value; when parameter = 0.0 not allowed; when parameter < 0.0 use the deceleration configured in "Technical Objects > Configuration > Extended Parameters > Dynamic Defaults".

⑥Jerk：Jerk, parameter > 0.0 for constant acceleration velocity profile use specified values; parameter = 0.0 for trapezoidal velocity profile; < 0.0 jerk is configured with "Technical Objects > Configuration > Extended Parameters > Use Dynamic Defaults".

Relative point movement MC_MOVERELATIVE instruction:

①Distance：The distance relative to the current position (positive and negative is the direction), the unit is (mm).

②Velocity：Movement speed, in millimeters per second.

Absolute point movement MC_MOVEABSOLUTE command:

①Position：Absolute motion position target, unit is (mm).

②Velocity：The running speed, the unit is (mm per second).

③Direction：Running direction, parameter 1-3, the direction is the direction closest to the target position (the direction of the shortest moving distance).

12.3.8 Precautions for use of message 3

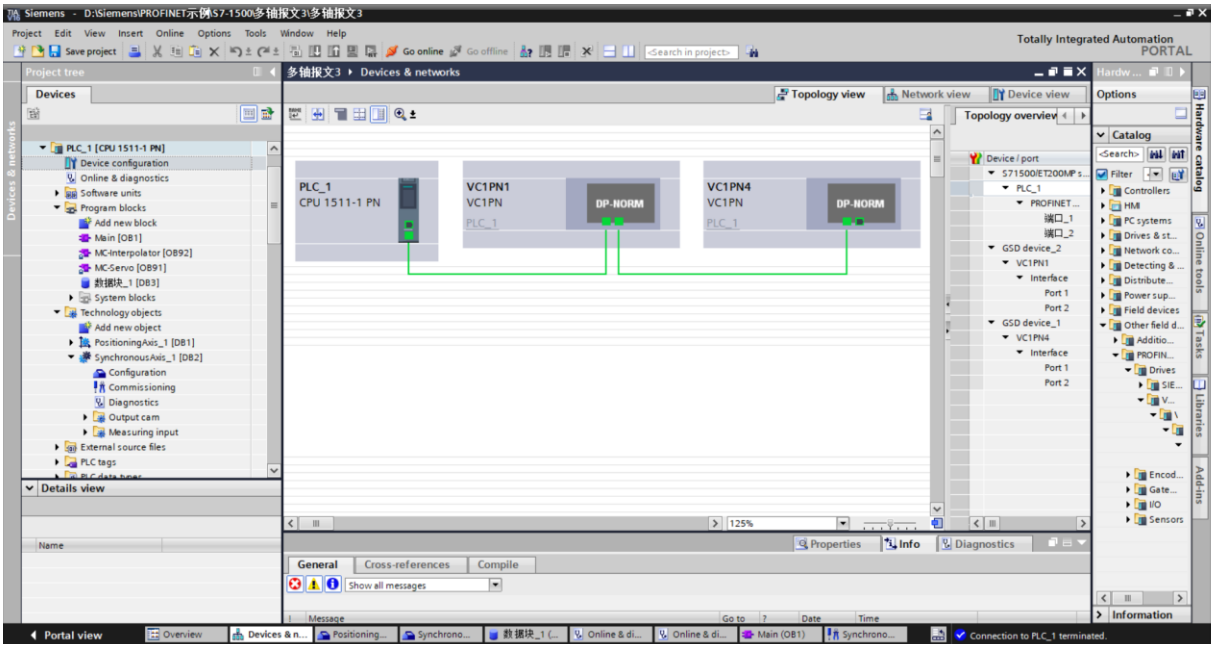
(1) If the positioning technology object is used, the acceleration and deceleration time P04.17 and P04.18 of the servo need to be set to 0.

12.4 Using message 3 to realize multi-axis synchronous control based on S7-1500

12.4.1 Create a new project

Follow the introduction in Section 12.1 to create a new project, add equipment, and configure equipment.

Because the function of this implementation is multi-axis synchronous control, multiple servo drives need to be added. This section takes two-axis synchronous control as an example, so two servo drives need to be added.



12.4.2 Configuration message 3

Configuration telegram 3 is required for each servo drive added.
For specific steps, refer to Section 12.3.2.

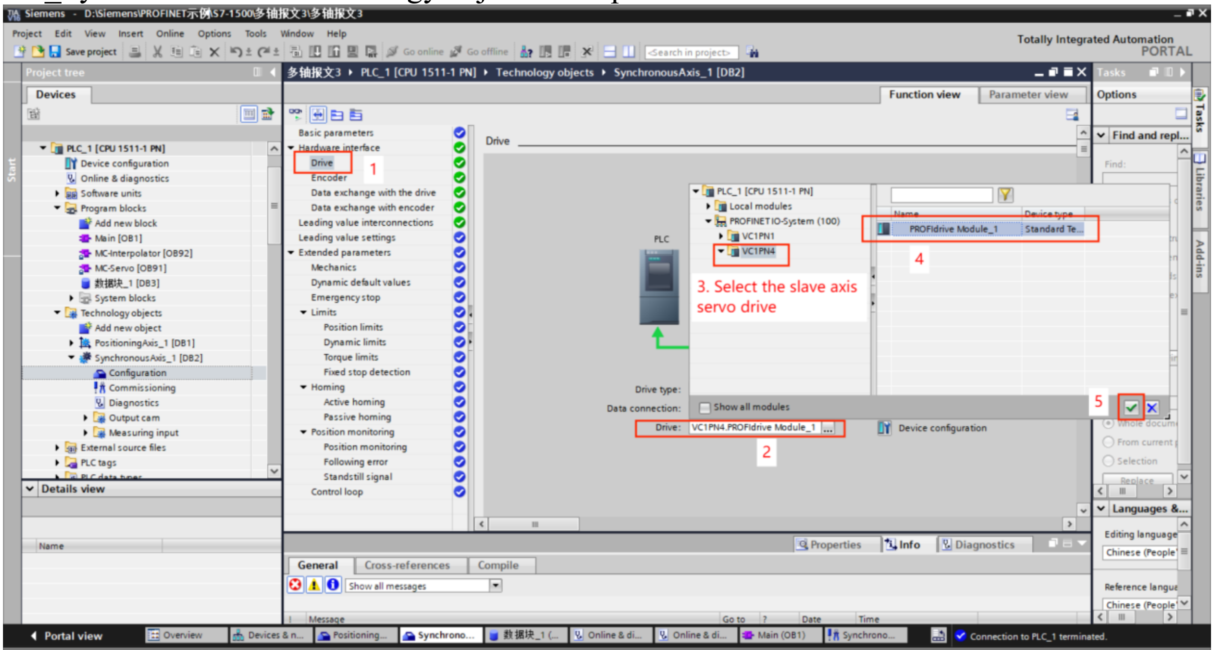
12.4.3 Create a new technology object, configure the technology object

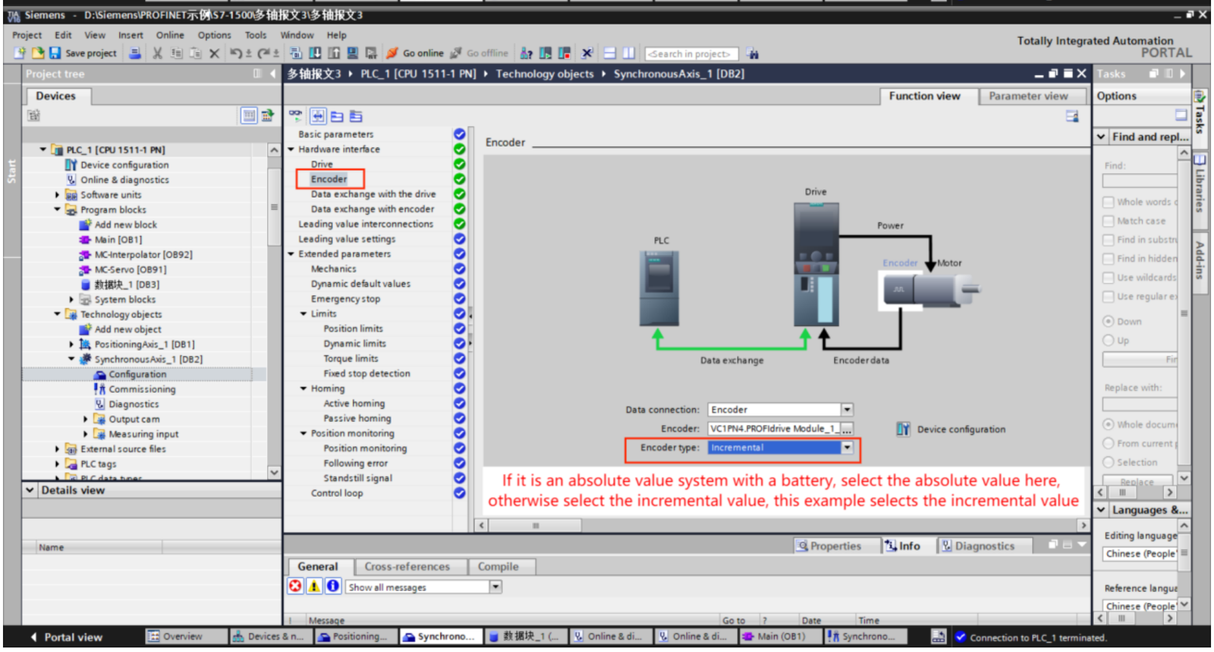
A new TO_PositioningAxis and several TO_SynchronousAxis technology objects are required. If there are several slave axes, several TO_SynchronousAxis technology objects need to be created. In this example, there is only one slave axis, so it is only necessary to create a new TO_SynchronousAxis technology object.

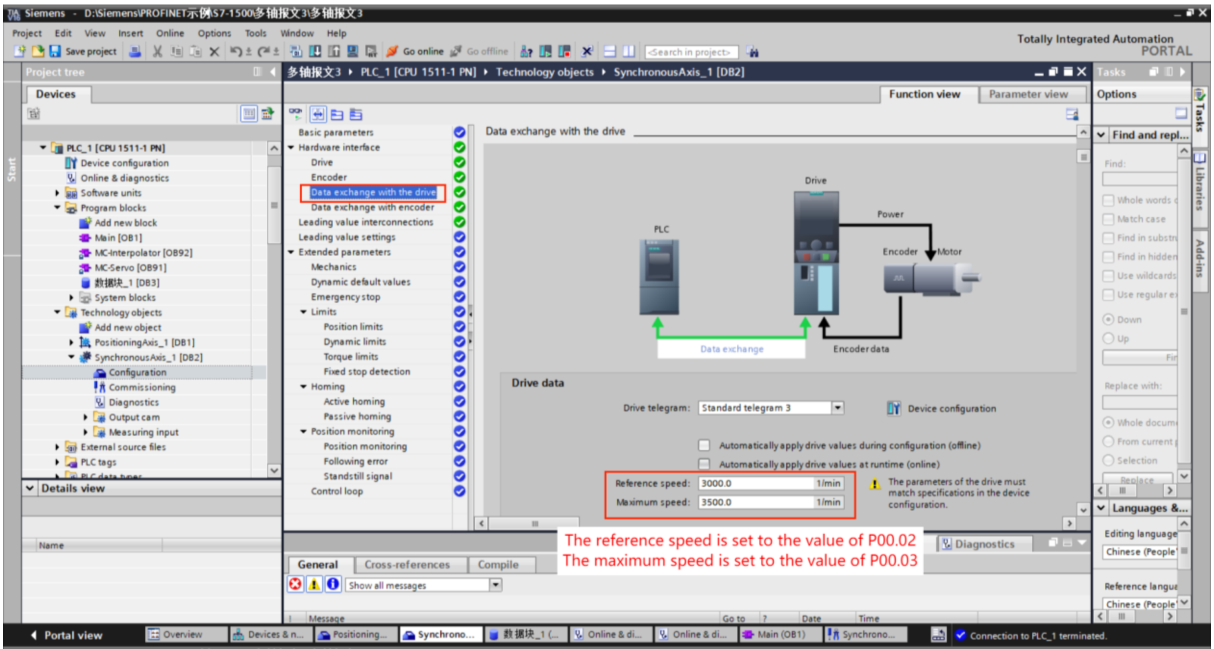
For the setting of TO_PositioningAxis technology object parameters, please refer to Section 12.3.3.

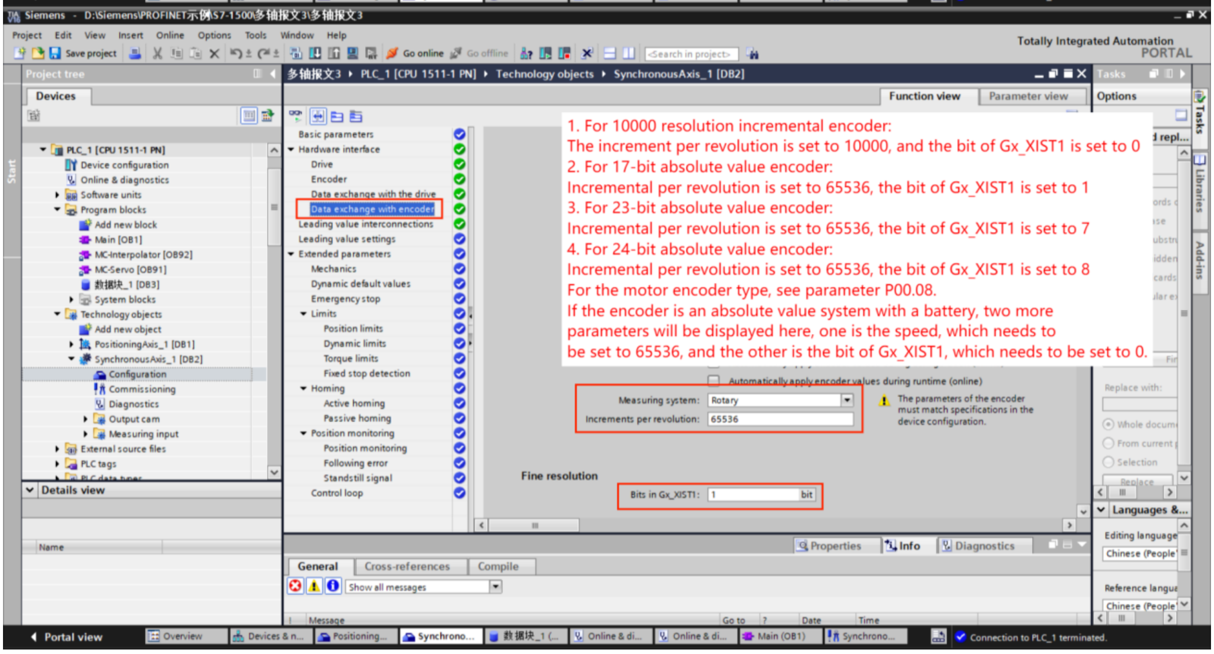
Below are the settings for some TO_SynchronousAxis technology object parameters.

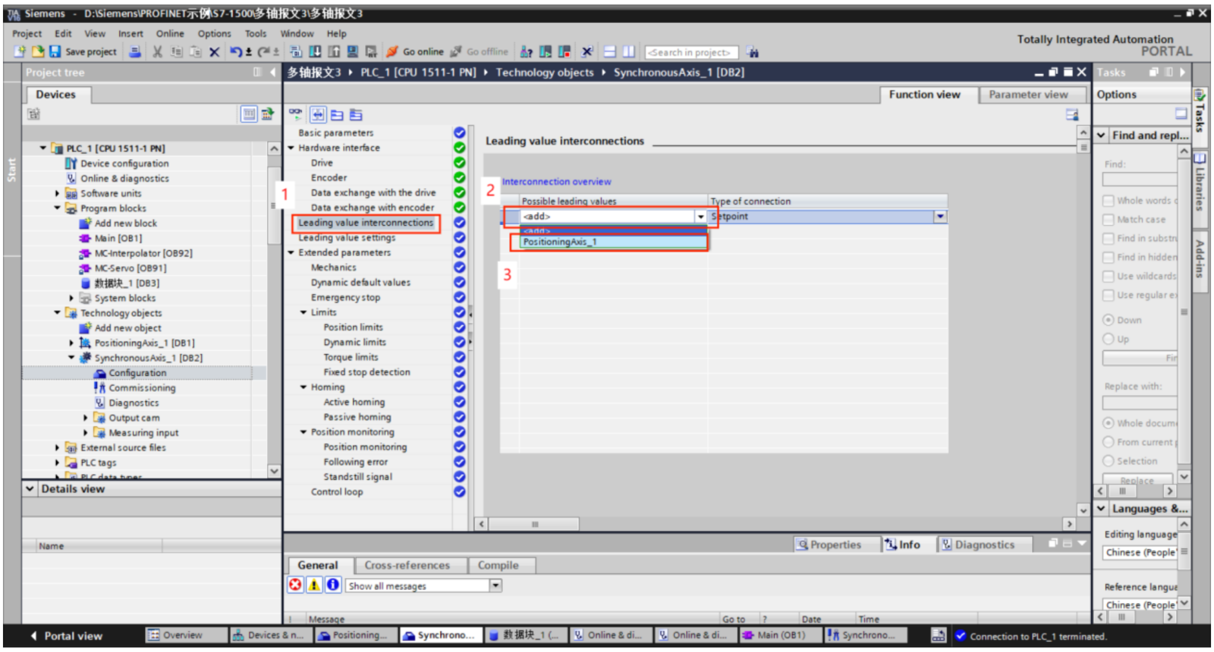
Configure the drives of the TO_SynchronousAxis technology object, each TO_SynchronousAxis technology object corresponds to a slave axis servo drive.





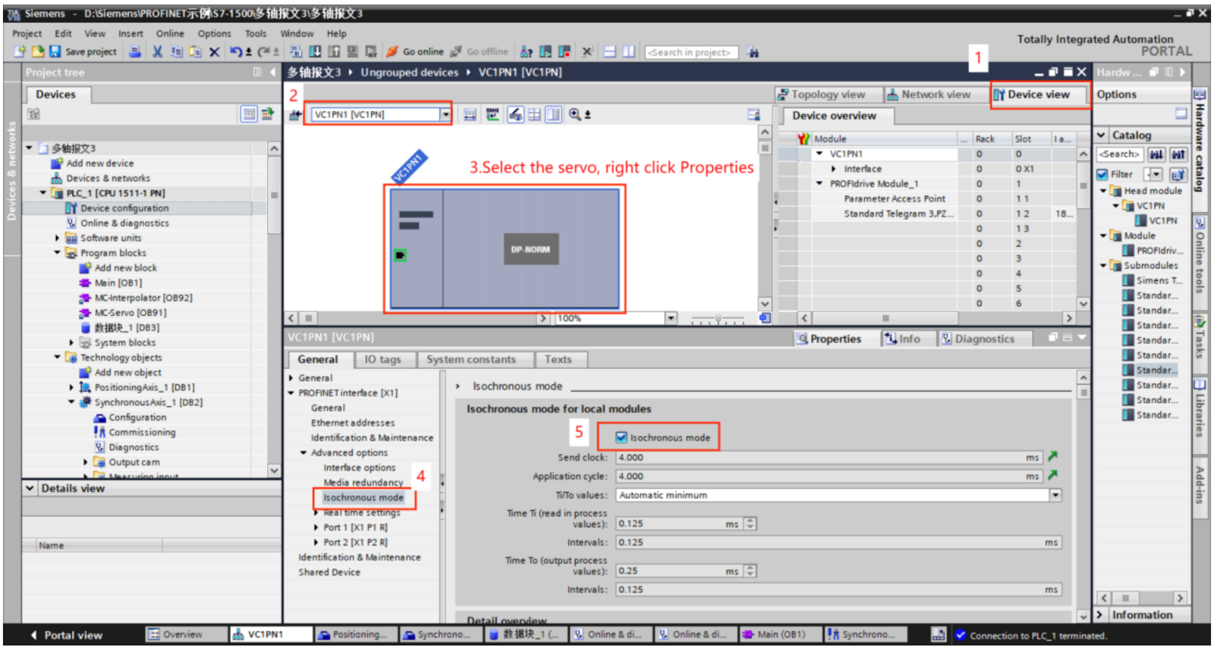

Data exchange with the drive
Drive data
Drive telegram: Standard telegram 3
Reference speed: 3000.0 1/min
Maximum speed: 3500.0 1/min
The reference speed is set to the value of P00.02
The maximum speed is set to the value of P00.03


1. For 10000 resolution incremental encoder:
The increment per revolution is set to 10000, and the bit of Gx_XIST1 is set to 0
2. For 17-bit absolute value encoder:
Incremental per revolution is set to 65536, the bit of Gx_XIST1 is set to 1
3. For 23-bit absolute value encoder:
Incremental per revolution is set to 65536, the bit of Gx_XIST1 is set to 7
4. For 24-bit absolute value encoder:
Incremental per revolution is set to 65536, the bit of Gx_XIST1 is set to 8
For the motor encoder type, see parameter P00.08.
If the encoder is an absolute value system with a battery, two more
parameters will be displayed here, one is the speed, which needs to
be set to 65536, and the other is the bit of Gx_XIST1, which needs to be set to 0.
Measuring system: Rotary
Increments per revolution: 65536
Fine resolution
Bits in Gx_XIST1: 1 bit

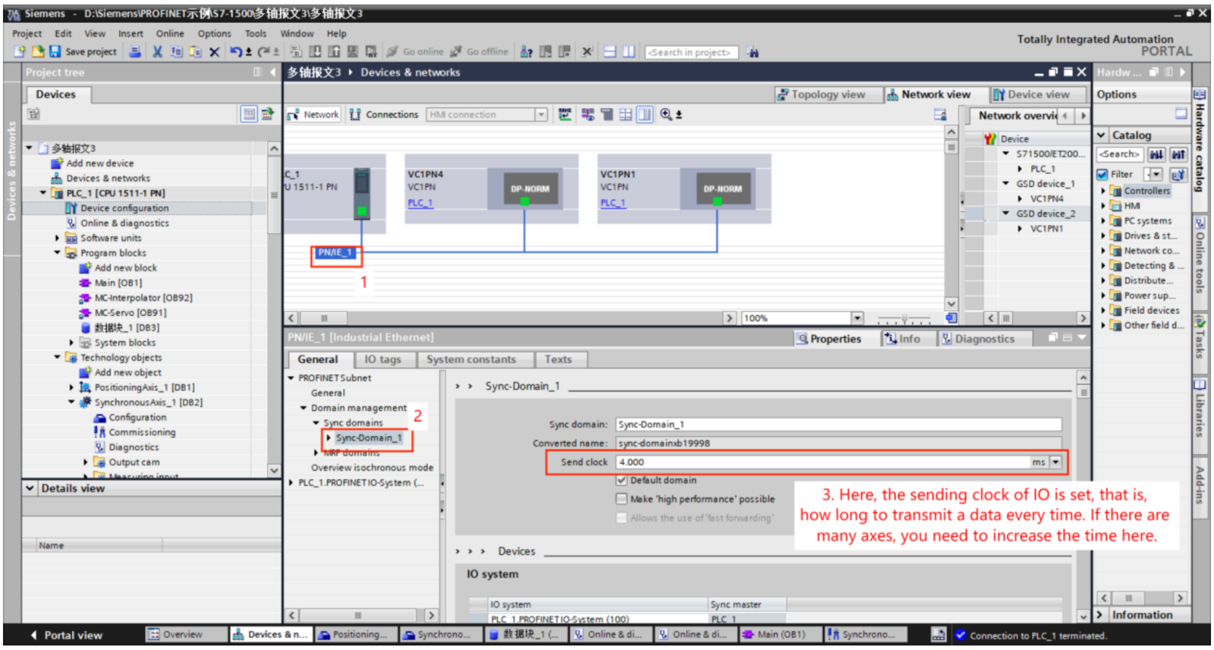


12.4.4 Configure a sync domain

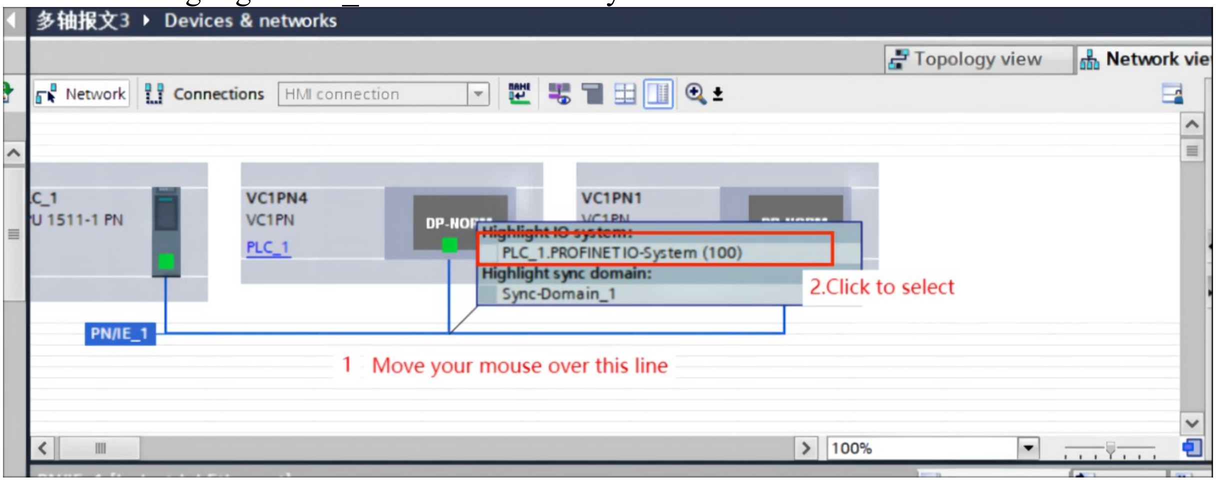
Tick "Isochronous Mode" for each servo drive



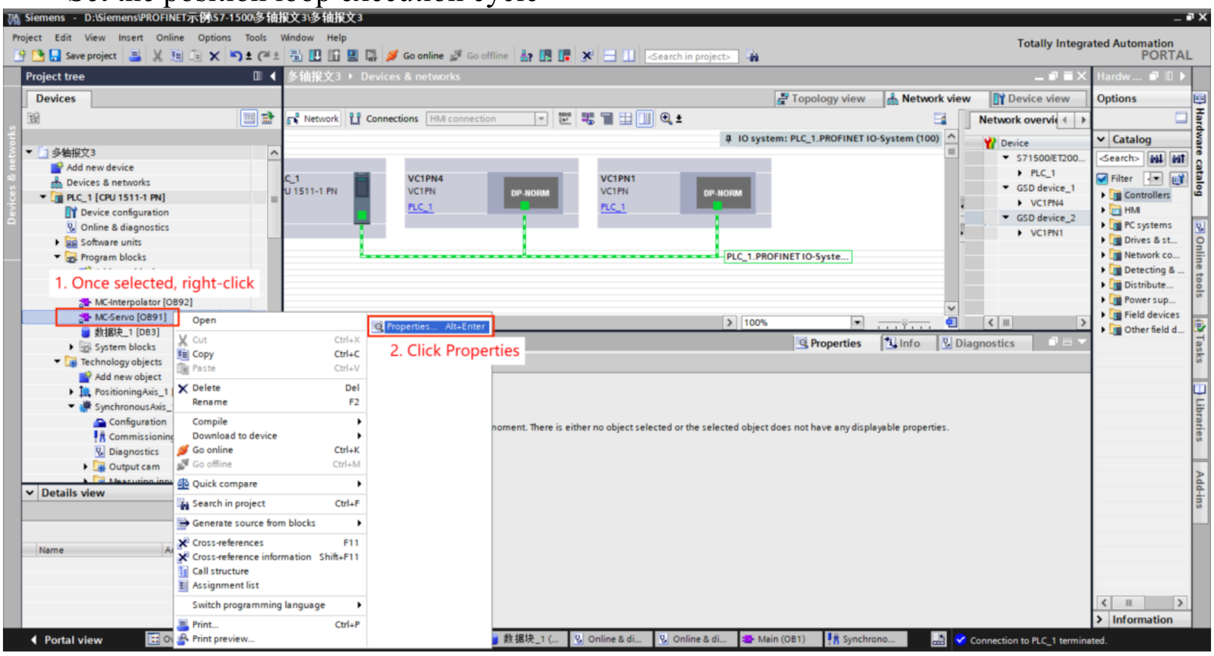
Set the send clock

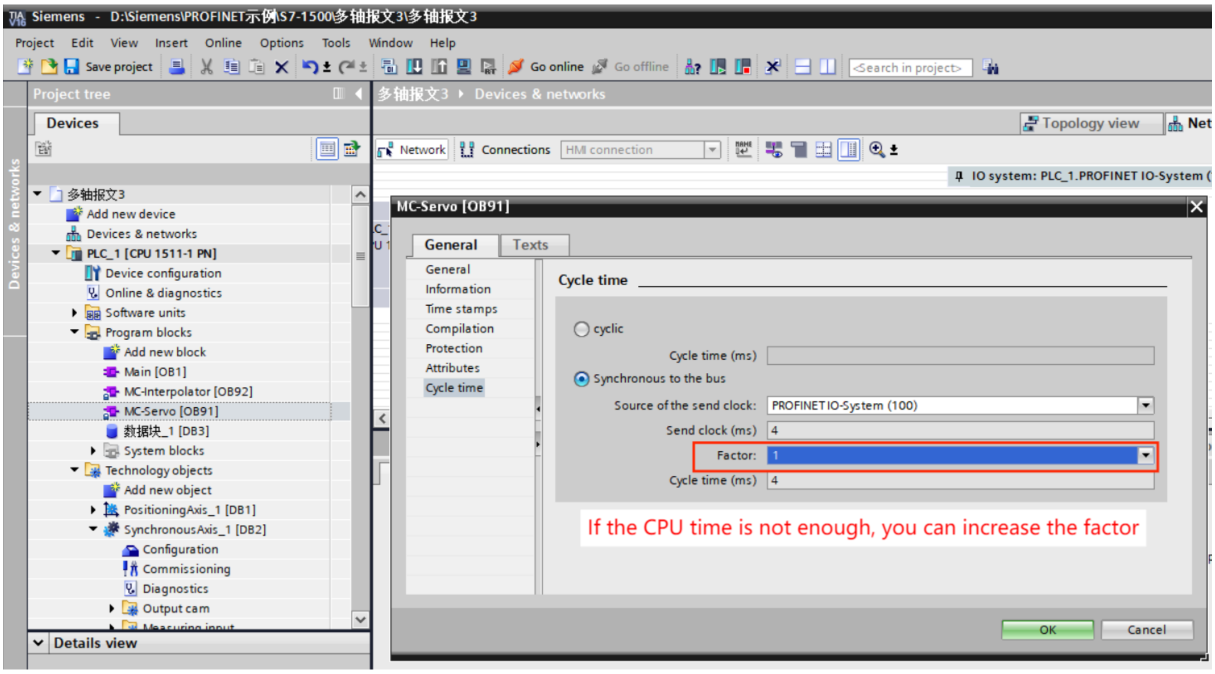


Select Highlight PLC_1.PROFINET IO-System

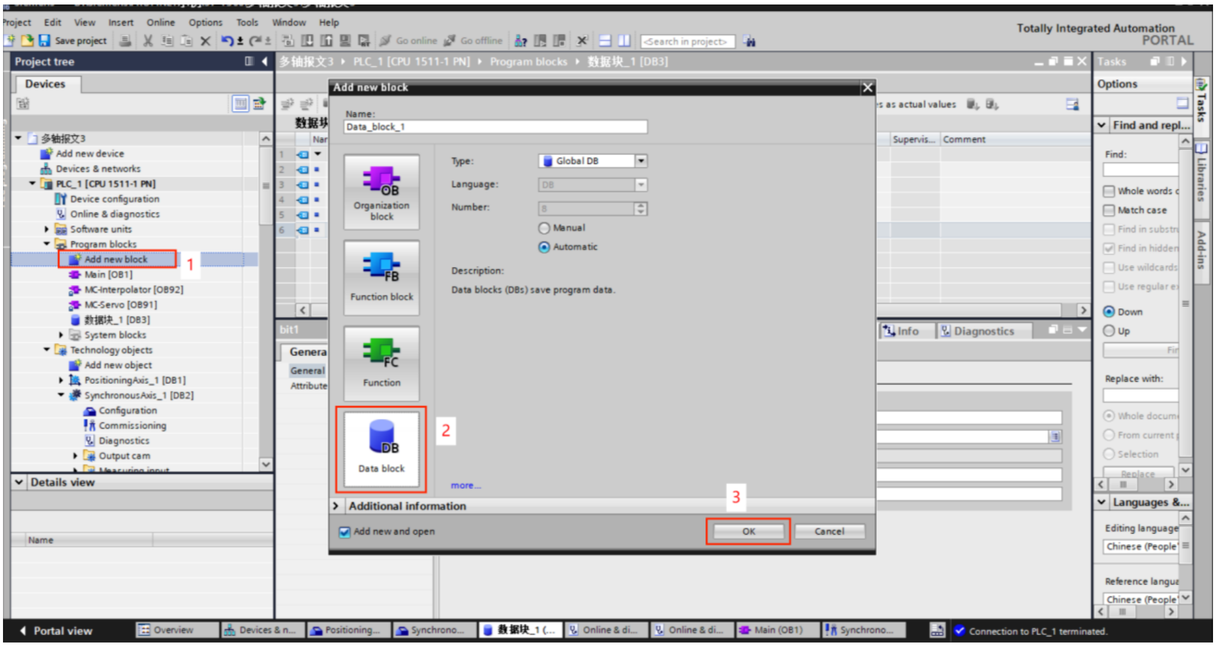


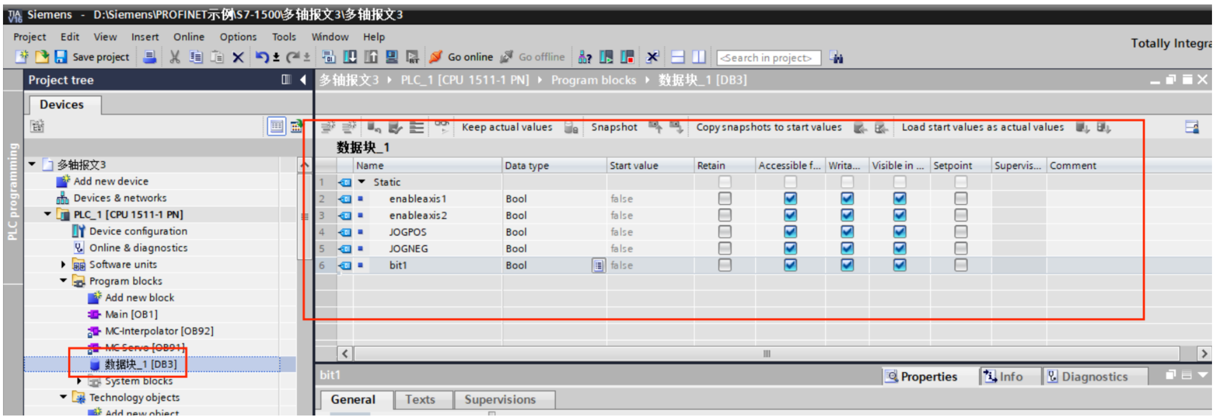
Set the position loop execution cycle





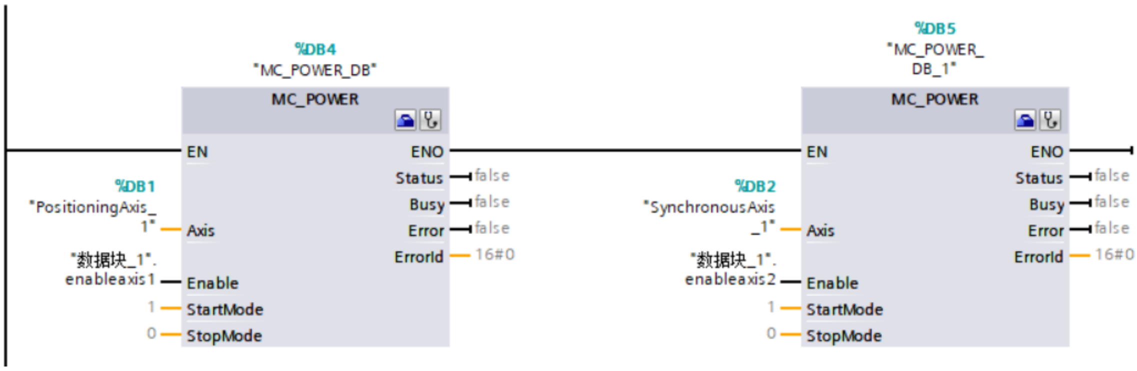
12.4.5 Create a new data block and write a PLC program



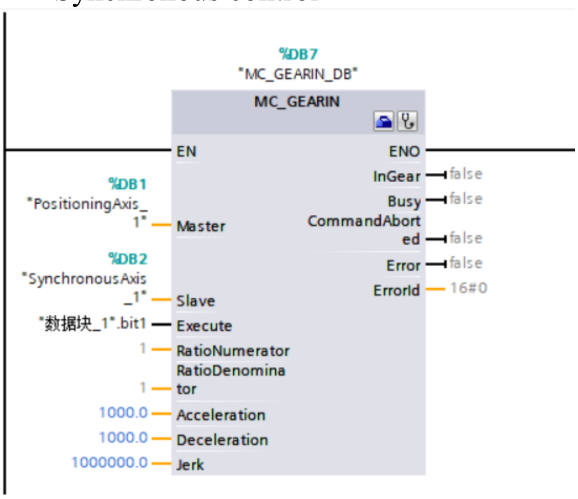


Instructions can be found in Craft->Motion Control.

Enable the axis



Synchronous control



12.4.6 Synchronous control instruction parameter description

Use the parameters "RatioNumerator" "RatioDenominator" to specify the electronic gear ratio as the relationship between the two axes (numerator/denominator)

Instructions are as follows:

①The values in each coupled motion cycle vary as follows:

Distance traveled by the following axis from the coupled position = distance traveled by the leading axis from the coupled position × gear ratio.

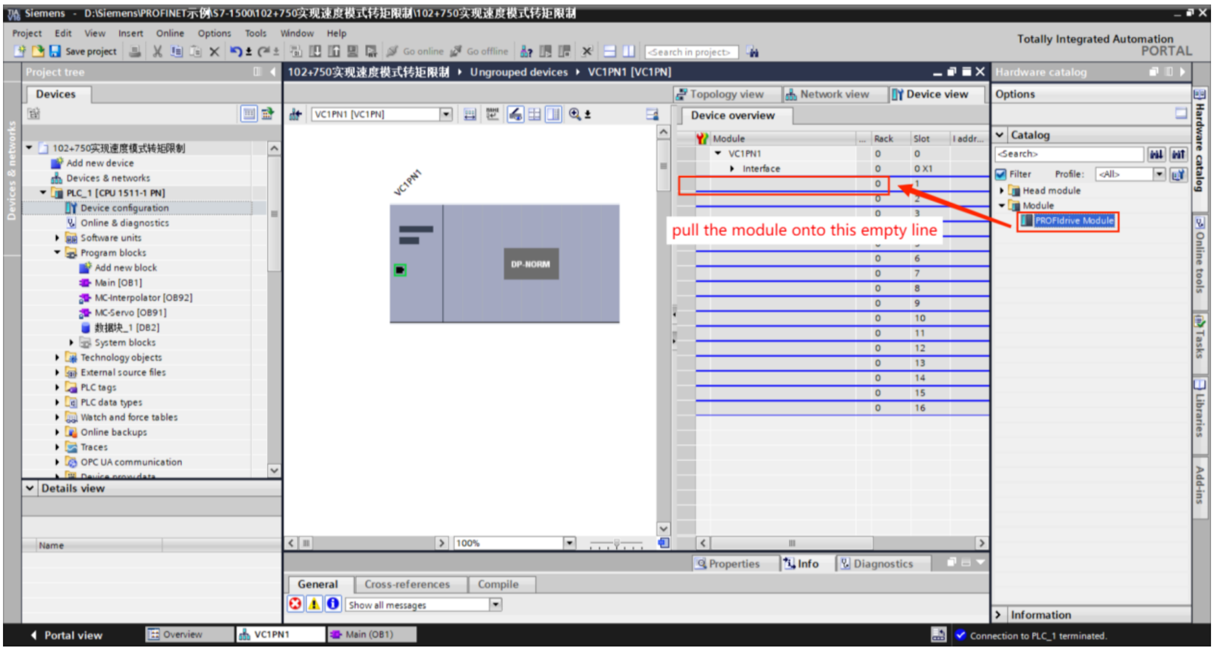
Speed of following axis = speed of leading axis × gear ratio.
Acceleration of the following axis = acceleration of the leading axis × gear ratio
Shaft deceleration = lead shaft deceleration × gear ratio.
②For the input acceleration and deceleration: the input value is valid when >0. =0 is not allowed. <0 uses the TO object's configuration default.

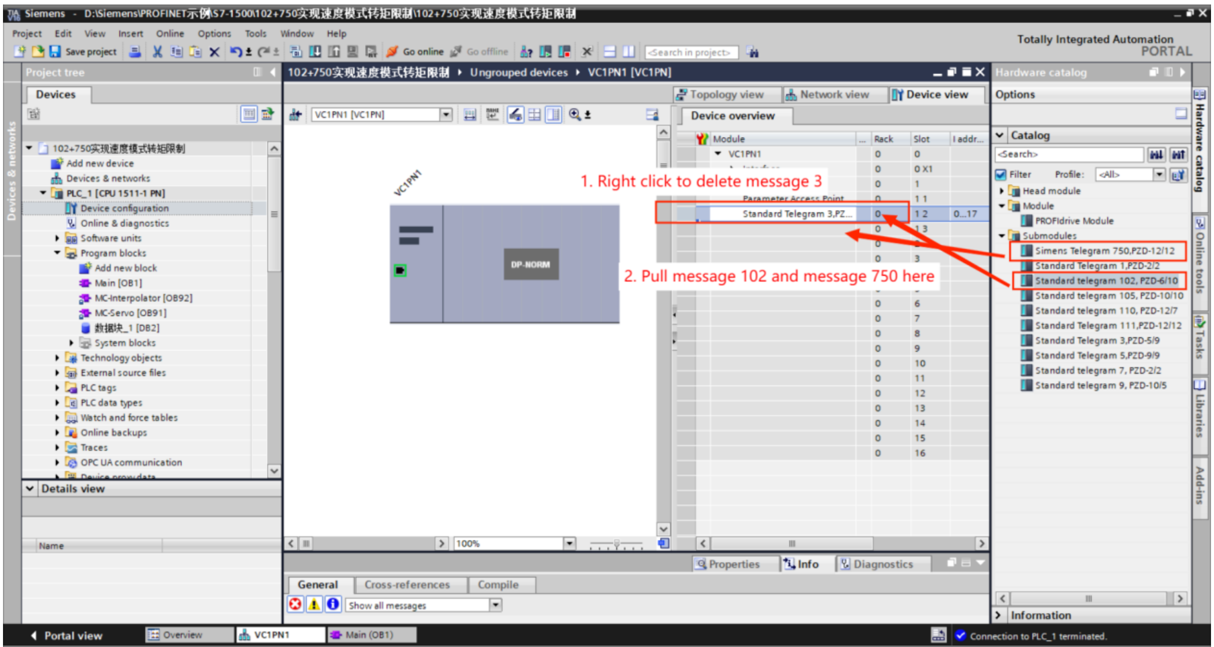
12.5 Based on S7-1500 using telegram 102+750 to realize torque limit in speed mode

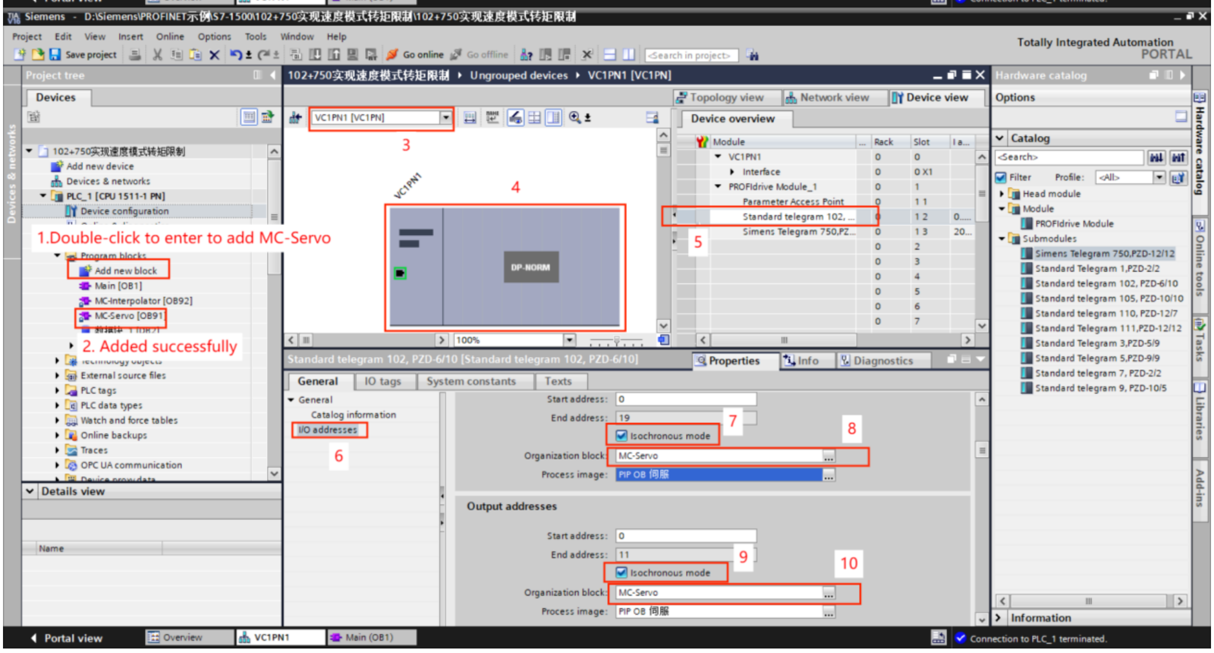
12.5.1 Create a new project

Follow the introduction in Section 12.1 to create a new project, add equipment, and configure equipment.

12.5.2 Configure telegrams 102 and 750

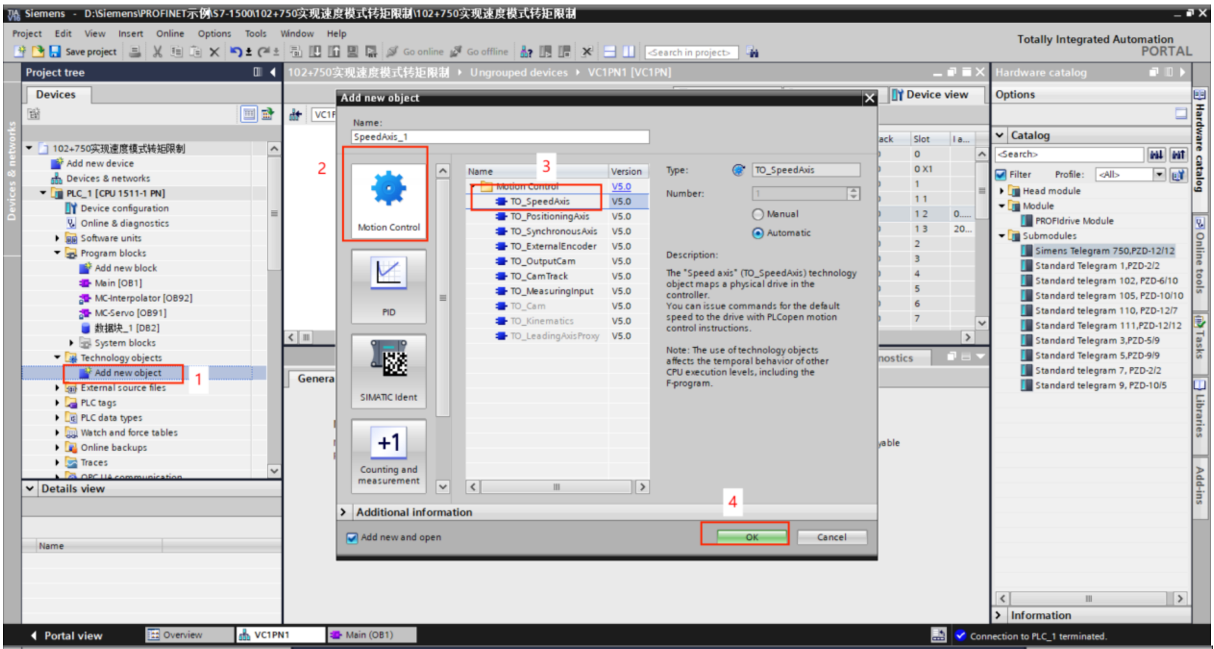


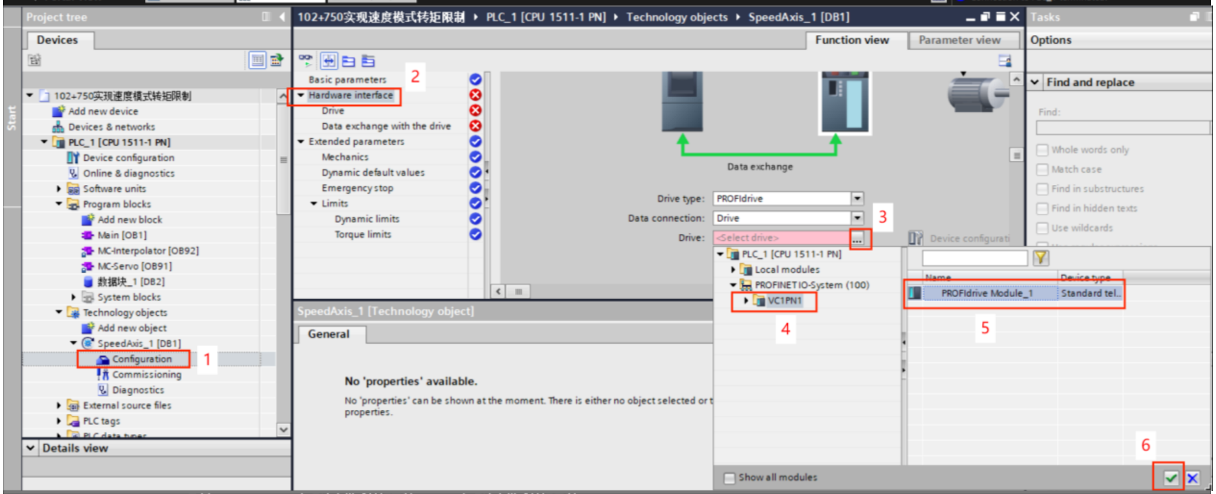


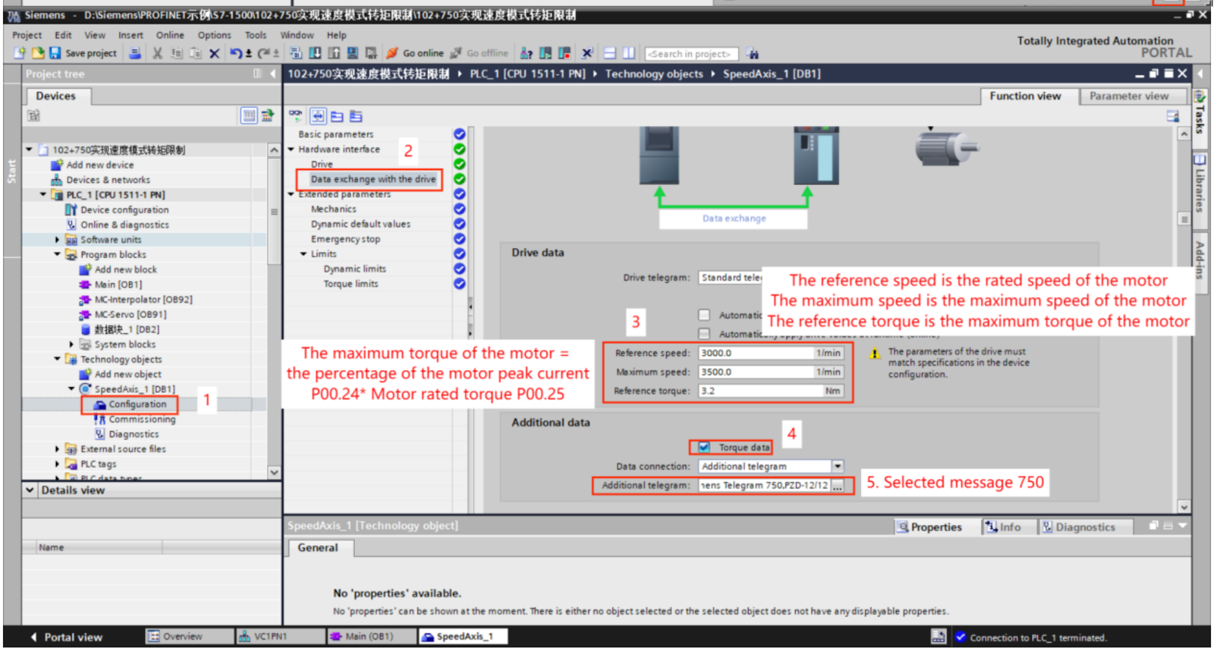


12.5.3 Create a new technology object, configure the technology object

Create a new TO_SpeedAxis technology object

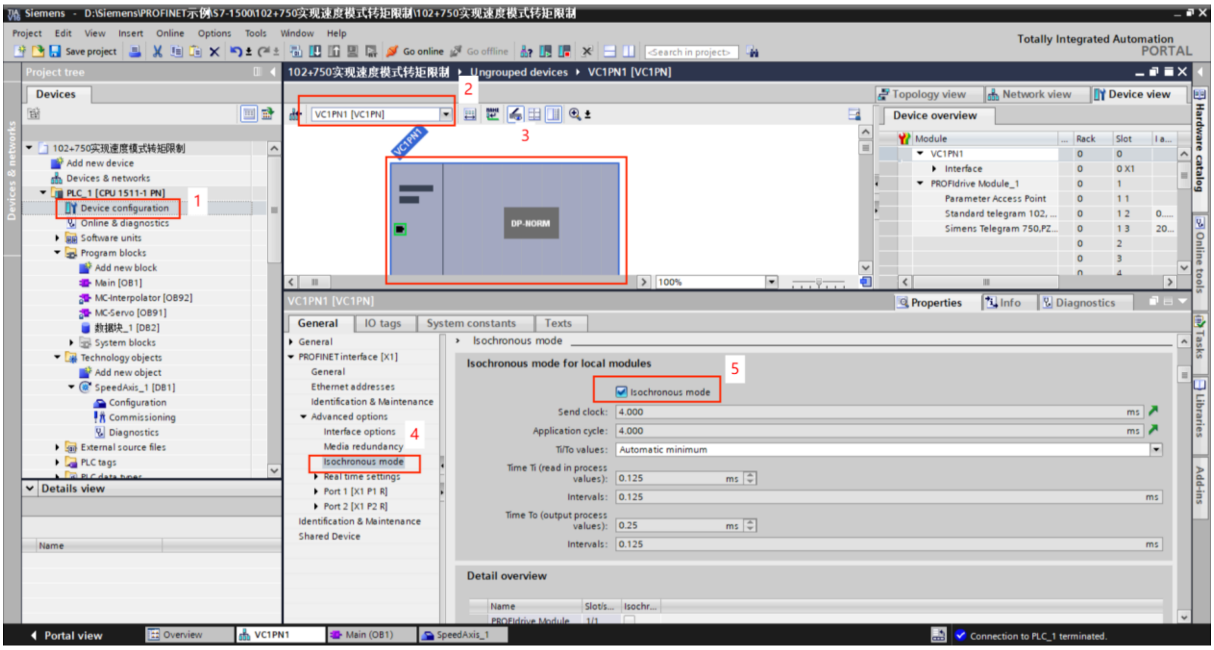




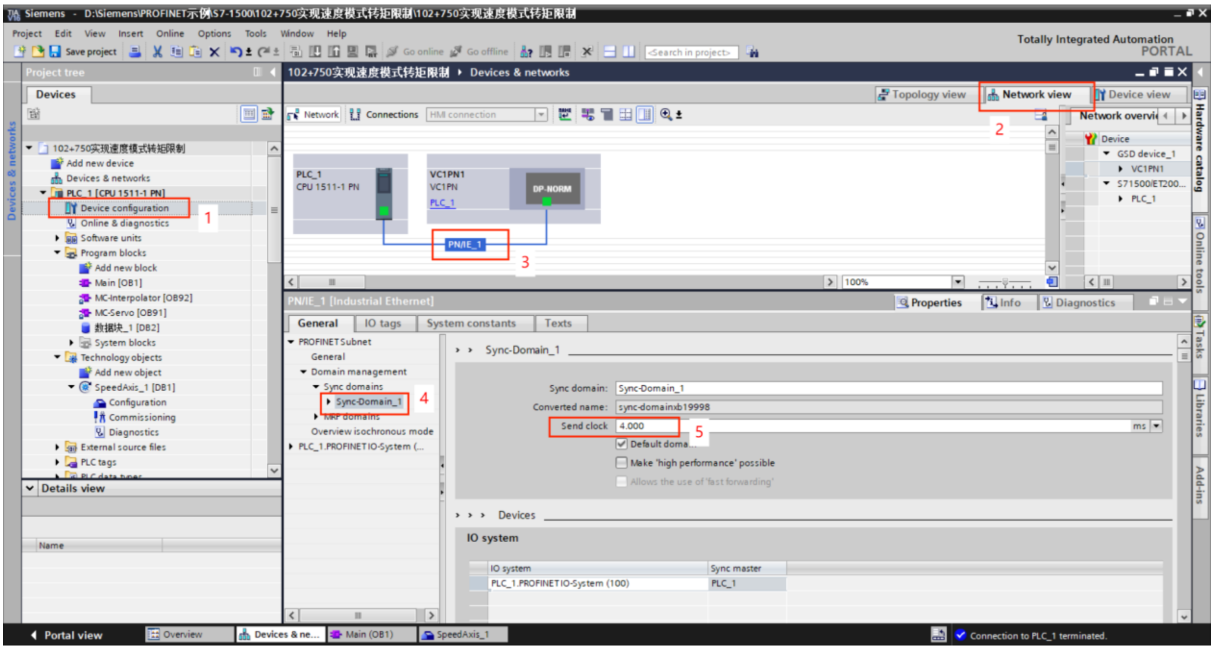

The reference speed is the rated speed of the motor
The maximum speed is the maximum speed of the motor
The reference torque is the maximum torque of the motor
The maximum torque of the motor = the percentage of the motor peak current P00.24* Motor rated torque P00.25
5. Selected message 750

12.5.4 Configure a sync domain

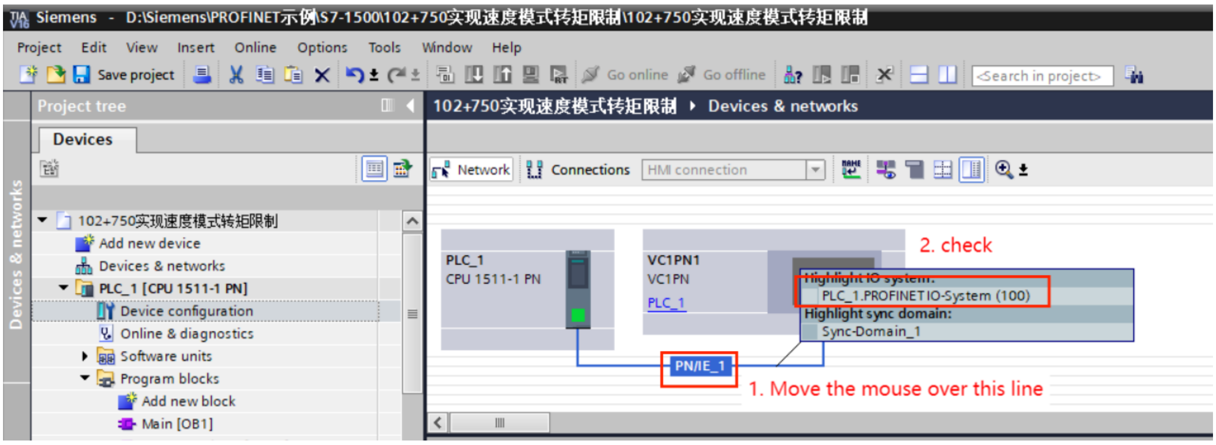
Check the "isochronous mode" for the servo drive



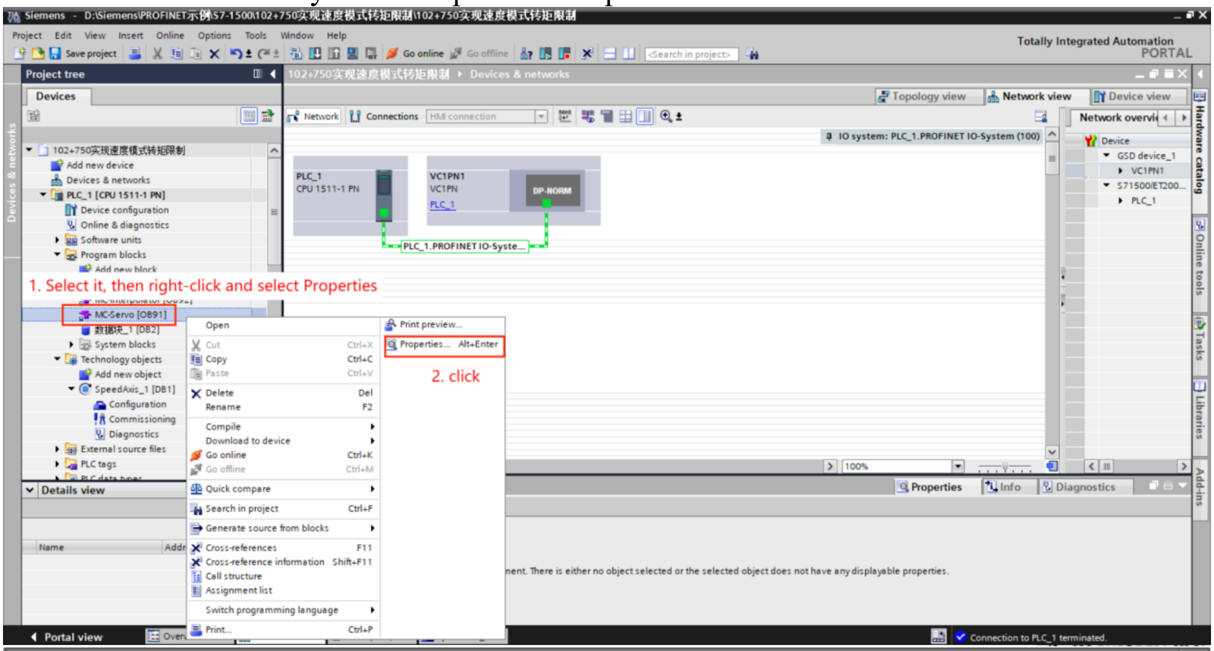
Set the send clock

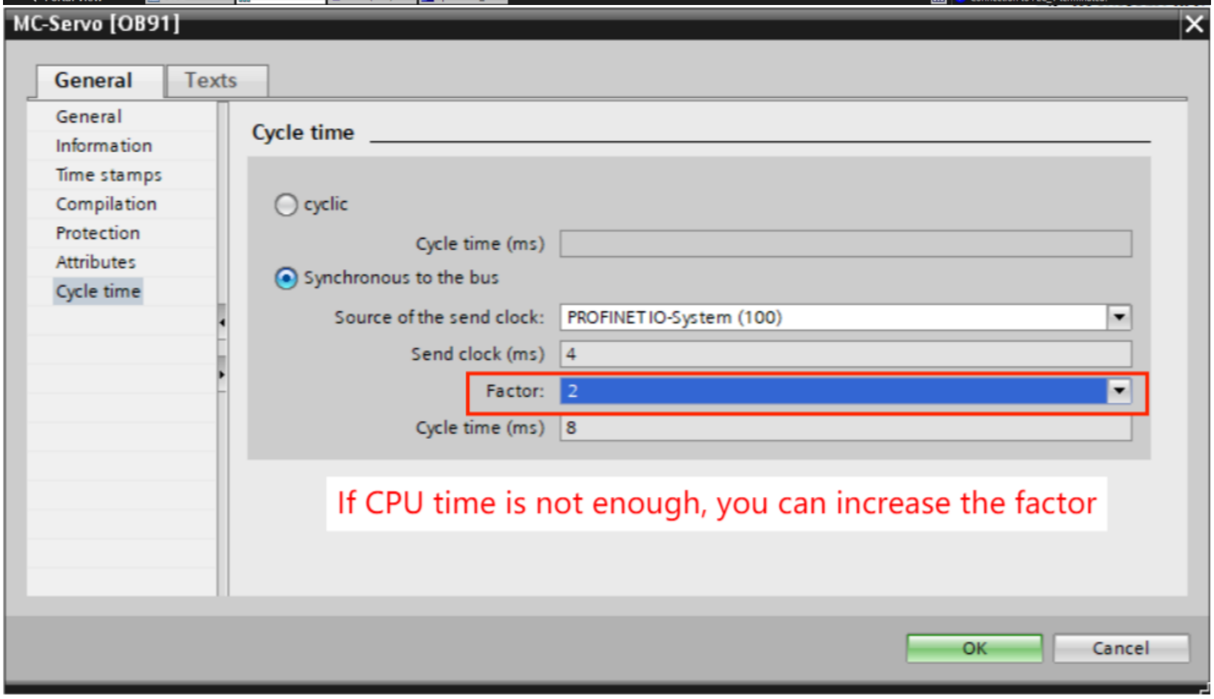


Select Highlight PLC_1.PROFINET IO-System

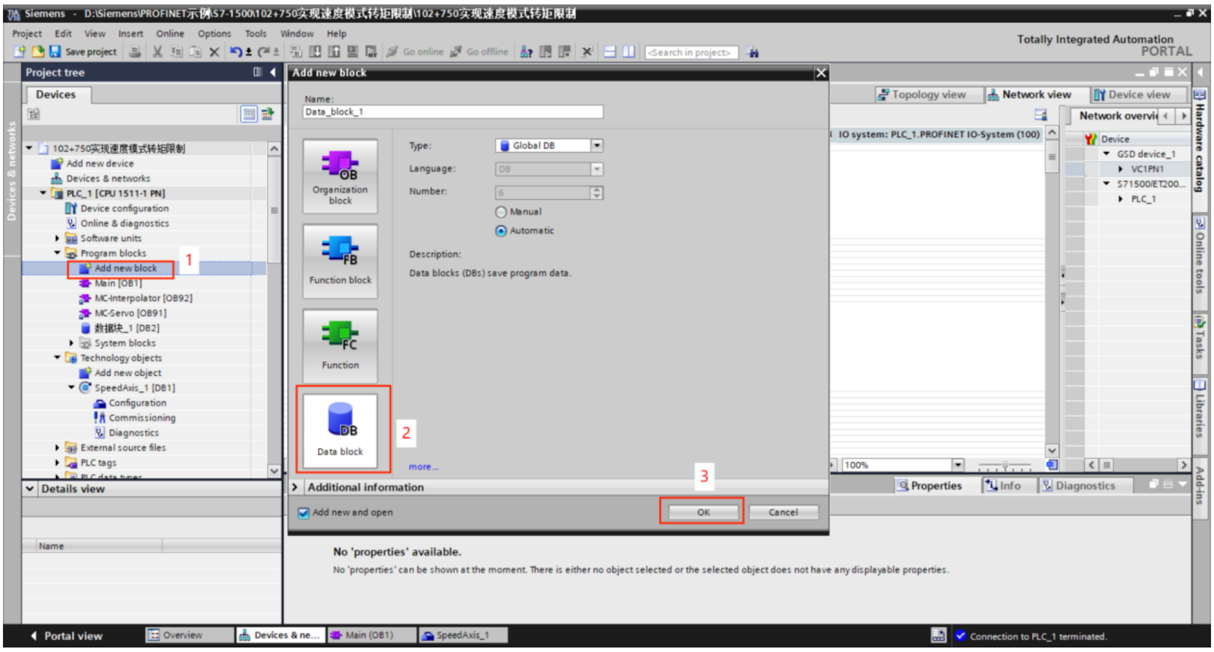


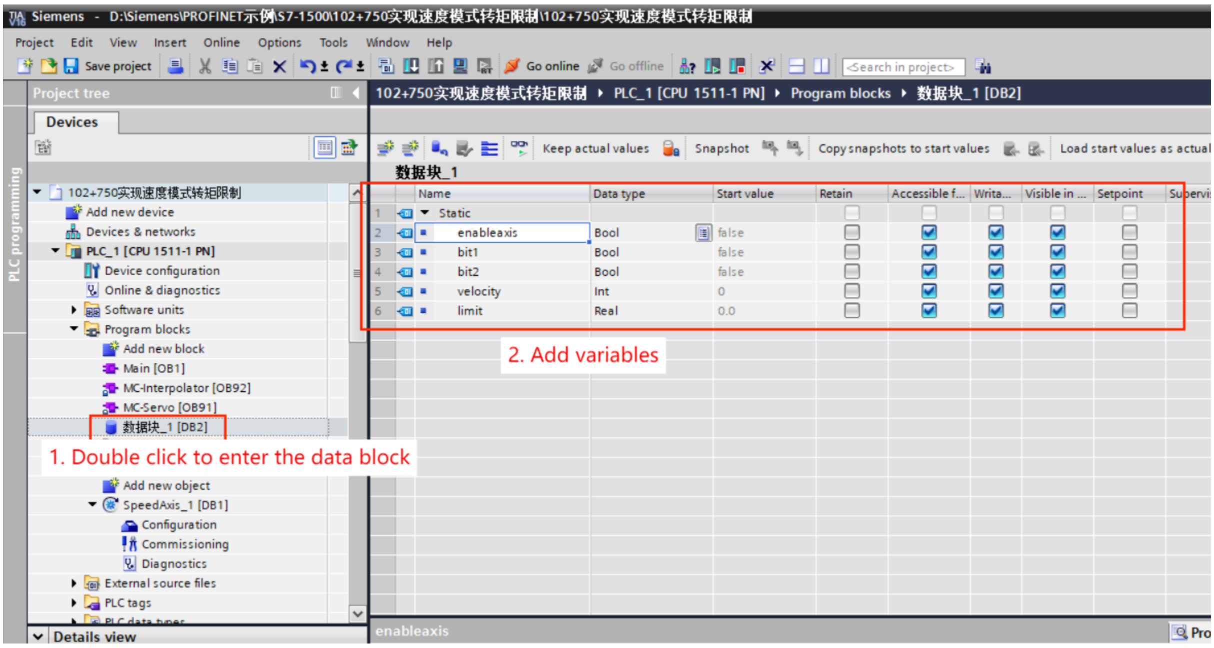
Set the execution cycle of the position loop



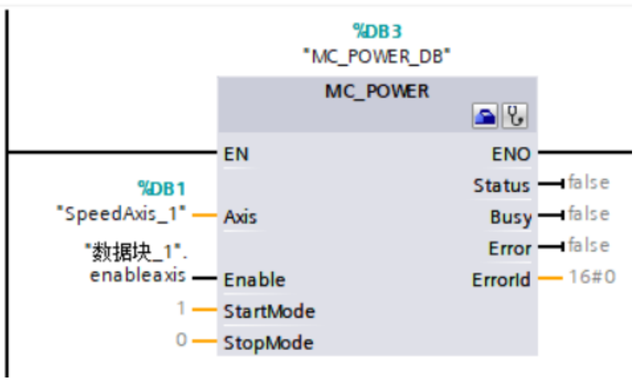


12.5.5 Create a new data block and write a PLC program

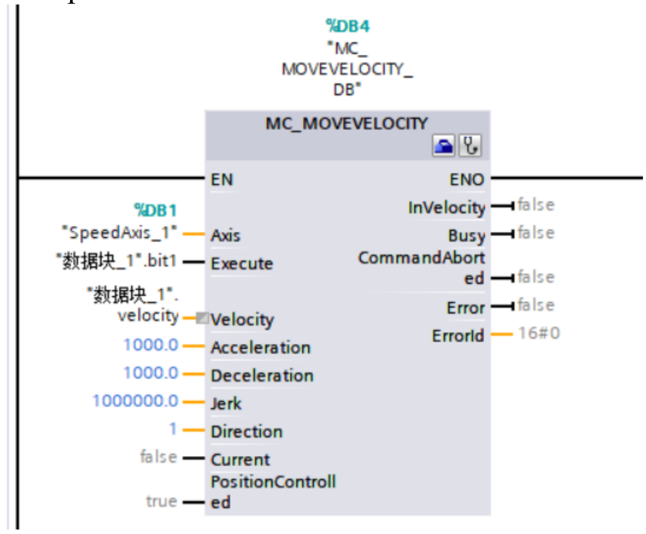




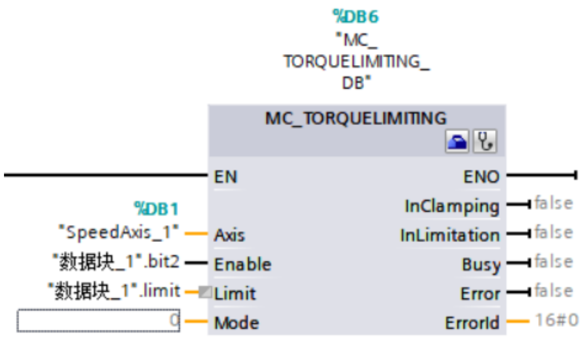
Command can be found in Craft->Motion Control.
Enable the axis



speed command



Torque limit



12.5.6 Description of related command parameters

Speed command MC_MOVEVELOCITY:

①Velocity：The parameter is the specified speed of the motion axis. If the TO object is a speed axis, the unit is (RPM); if the TO object is a positioning axis, the unit is (millimeters per second).

②Direction：The parameter is the direction of the specified motion. When it is 0, the speed is determined according to the sign of the parameter Velocity value; when it is 1, it rotates in the forward and reverse directions; when it is 2, it rotates in the negative direction.

③Current：When the parameter is 0, the motion speed will be determined according to the values of Velocity and Direction; when it is 1, the current speed will be maintained without reference to the values of Velocity and Direction.

④PositionControlled：When the parameter is 0, it means non-position control operation; when it is 1, it means position control operation. This parameter applies as long as the "MC_MoveVelocity" job is executing. Note: When using a velocity axis, this parameter will be ignored.

⑤Invelocity：When the parameter is 1, it means that the current speed has reached the value specified by Velocity.

⑥CommandAborted：The parameter "TRUE" indicates that the job was aborted by another job during execution.

Torque limit command MC_TORQUELIMITING:

①Limit：Torque limit value (calculated in the configured unit of measure), the specified value is irrelevant if the drive and telegram do not support torque limit. When the parameter is ≥ 0.0, the value specified in the parameter is used; when the parameter is < 0.0, the value configured in the TO object "torque limit" configuration window is used, and the unit is (Nm).

②Mode：When the parameter is 0, the torque is limited; when the parameter is 1, the fixed stop detection, which is applicable if the drive and the telegram support the torque limit. (parameter not applicable here is 1)

12.6 Realize torque control based on S7-1500 using message 102+750

12.6.1 Create a new project

Follow the introduction in Section 12.1 to create a new project, add equipment, and configure equipment.

12.6.2 Configure message 102 and 750

Configure packets 102 and 750 as described in Section 12.5.2.

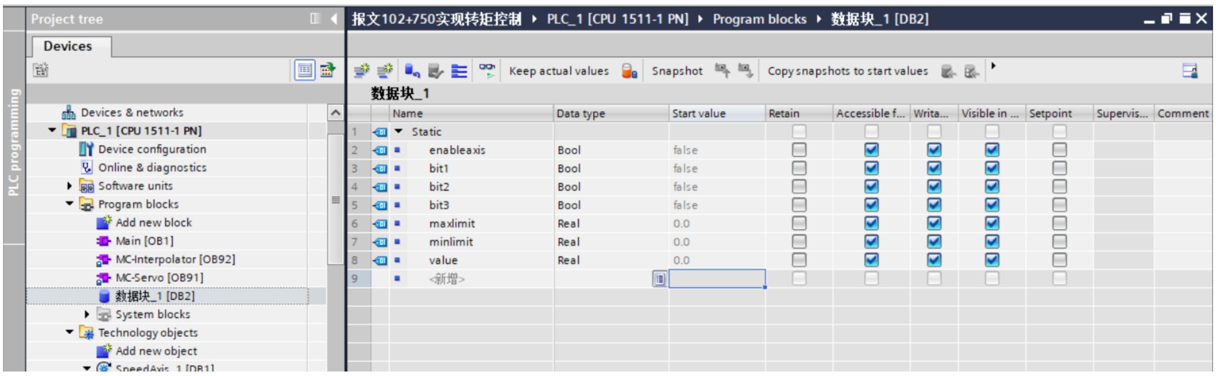
12.6.3 Create a new technology object, configure the technology object

Create a new technology object and configure the technology object according to the introduction in section 12.5.3.

12.6.4 Configure a sync domain

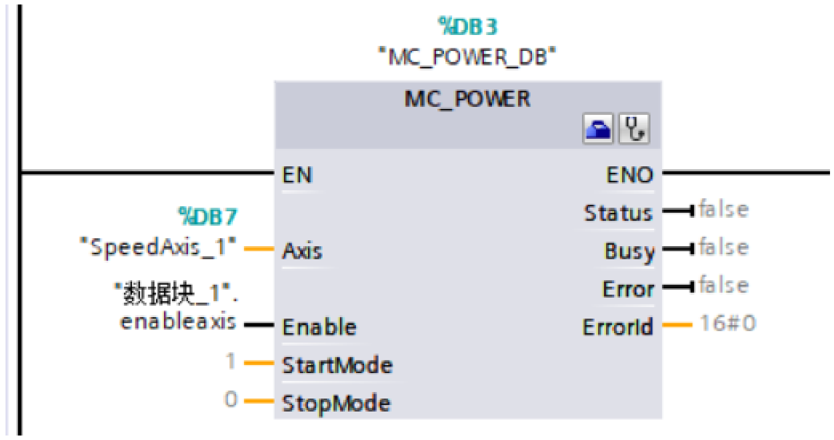
Configure the synchronization domain as described in Section 12.5.4.

12.6.5 Create a new data block and write a PLC program

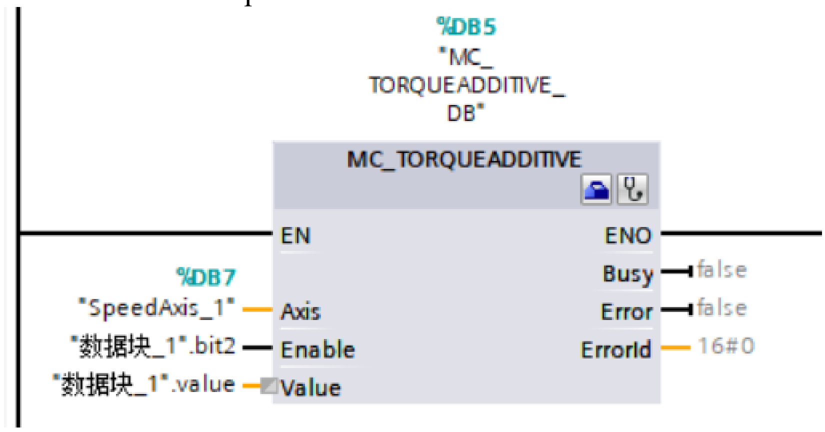


Command can be found in Craft->Motion Control.

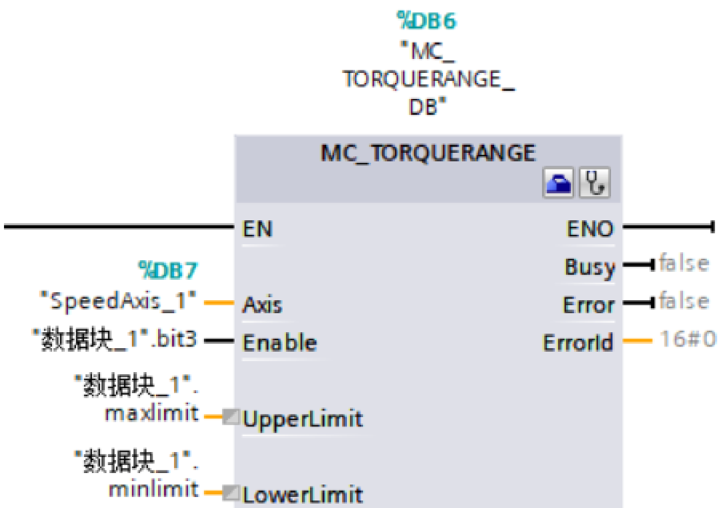
Enable the axis



Additional torque



Torque upper and lower limiter



12.6.6 Description of related command parameters

Value： Additional torque setting value in Nm.

The motion control instruction "MC_TorqueAdditive" allows additional torque to be applied in the drive. For example, additional setpoint torque is used in the specification of torque feedforward control or tensile torque for winding applications.

To set the additional torque setpoint, the following requirements must be met: SINAMICS drive; SINMENS additional telegram 750 for transferring torque data to the drive.

UpperLimit: Torque upper limit (in the configuration unit), the parameter value cannot be less than the value of the parameter "LowerLimit", the unit is Nm.

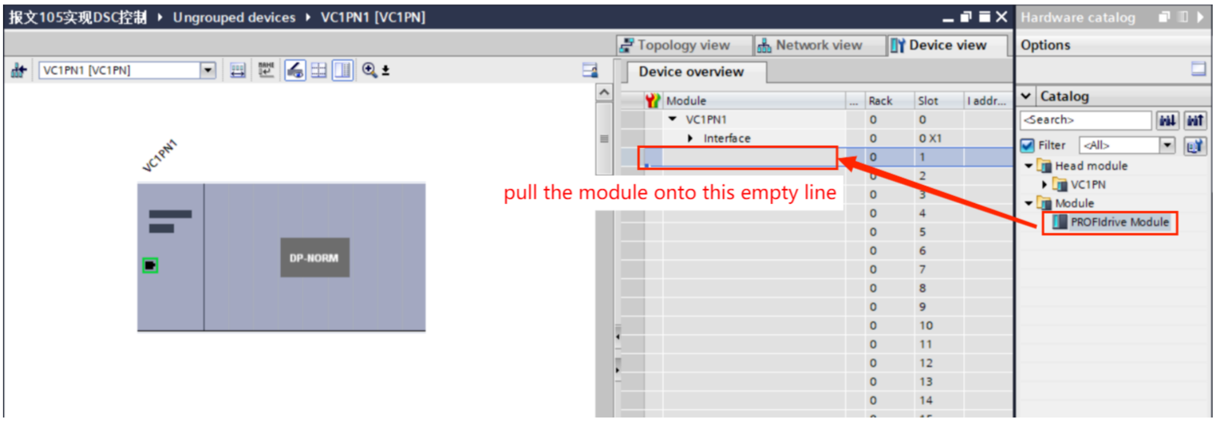
LowerLimit: The lower limit of torque (in the configuration unit), the parameter value cannot be greater than the value of the parameter "UpperLimit", the unit is Nm.

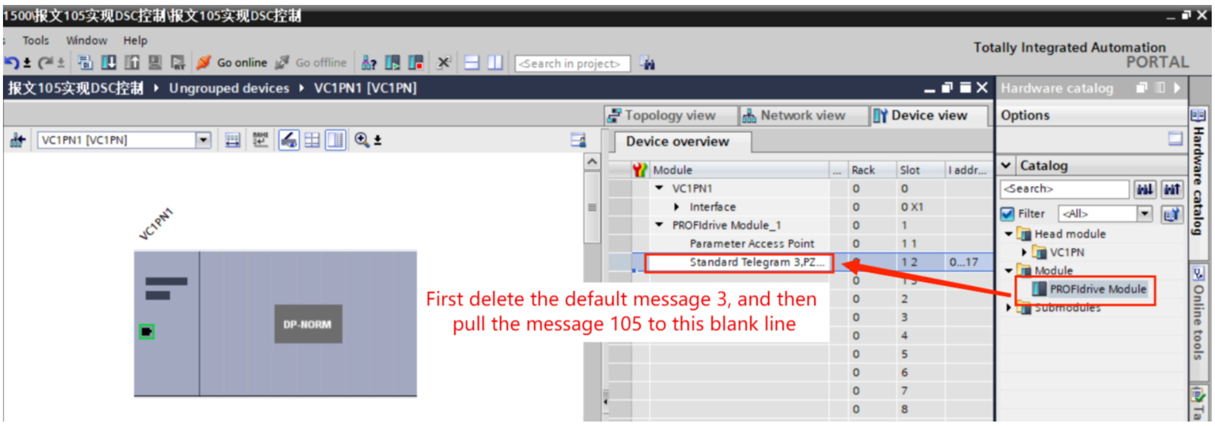
12.7 DSC control based on S7-1500 using message 105

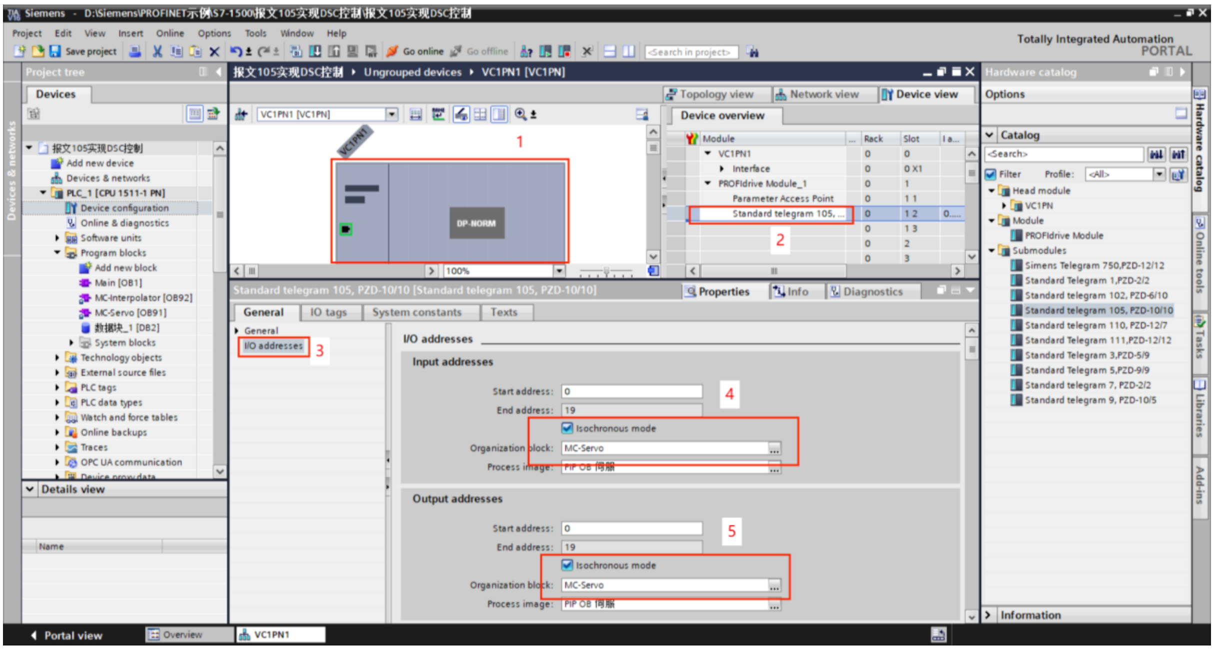
12.7.1 Create a new project

Follow the introduction in Section 12.1 to create a new project, add equipment, and configure equipment.

12.7.2 Configuration message 105

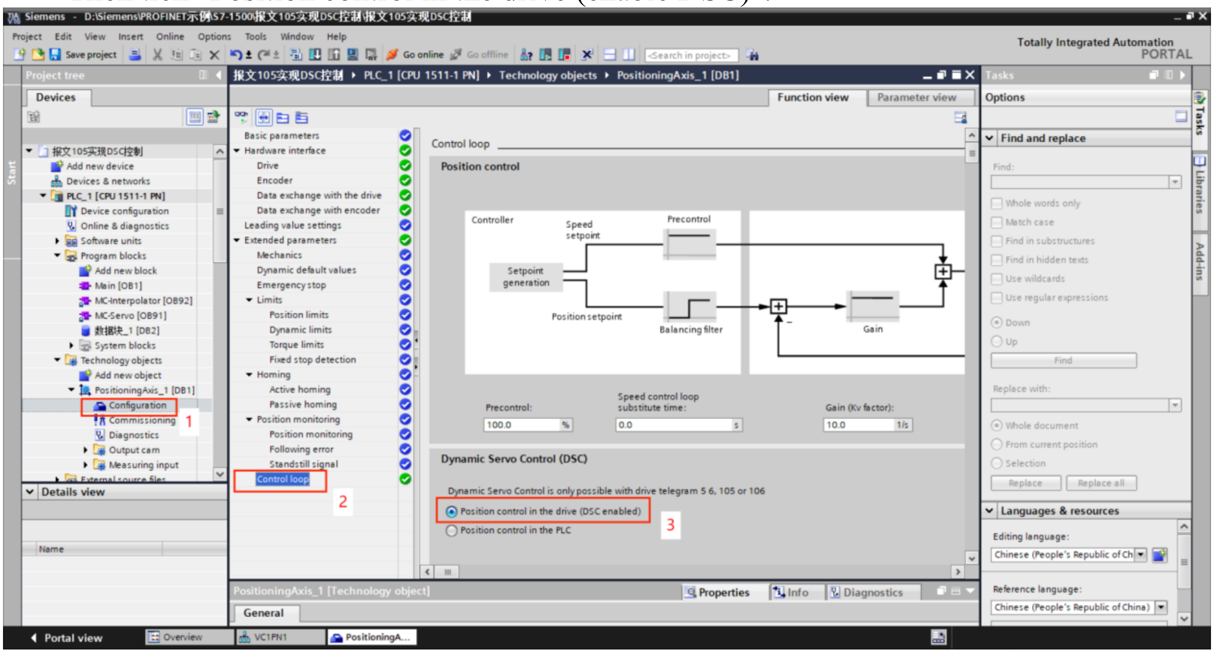






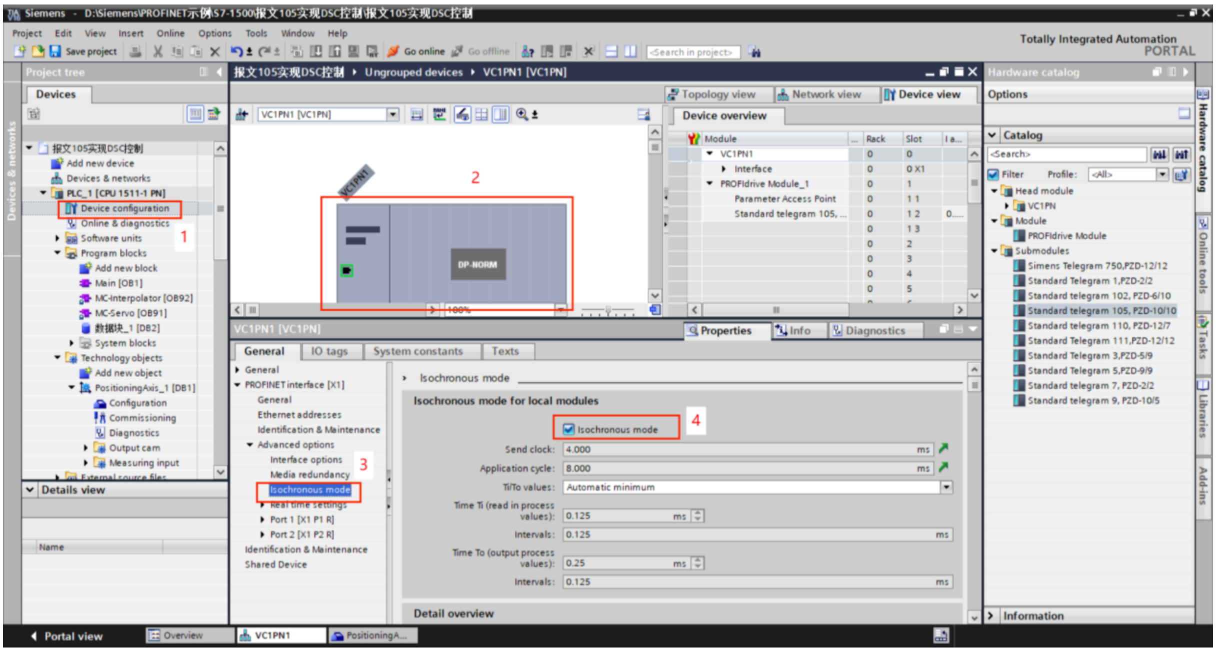
12.7.3 Create a new technology object, configure the technology object

Create a new TO_PositioningAxis technology object.
Please refer to Section 12.3.3 for related configuration.
Then tick "Position control in the drive (enable DSC)".

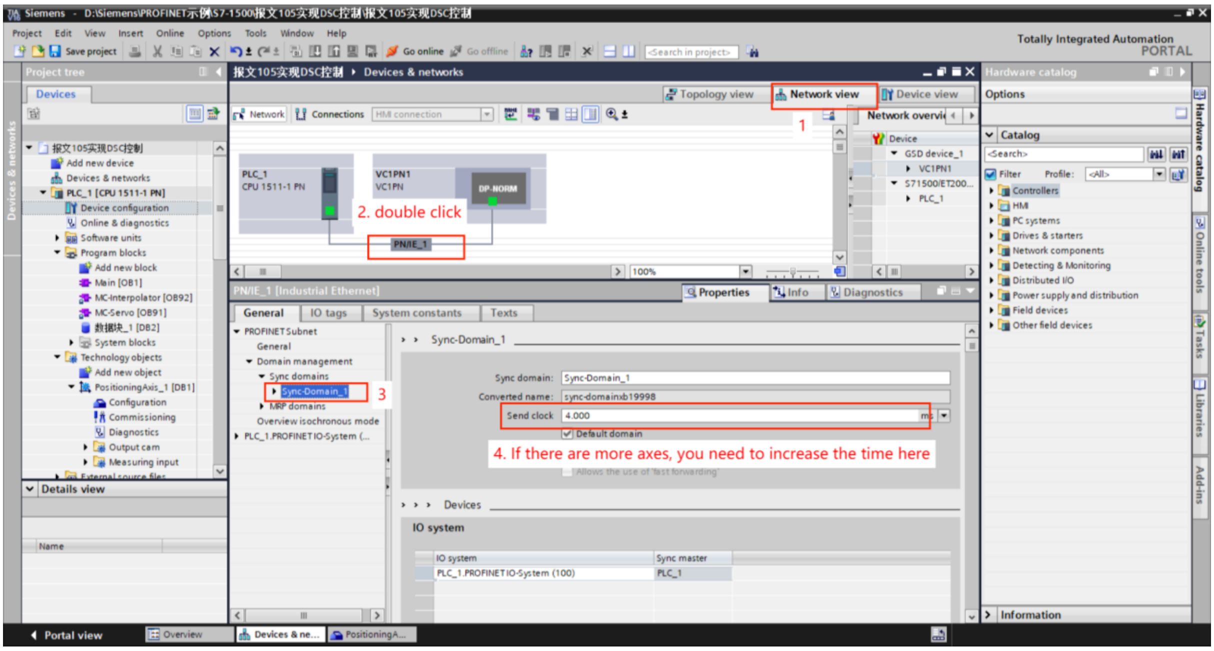


12.7.4 Configure a sync domain

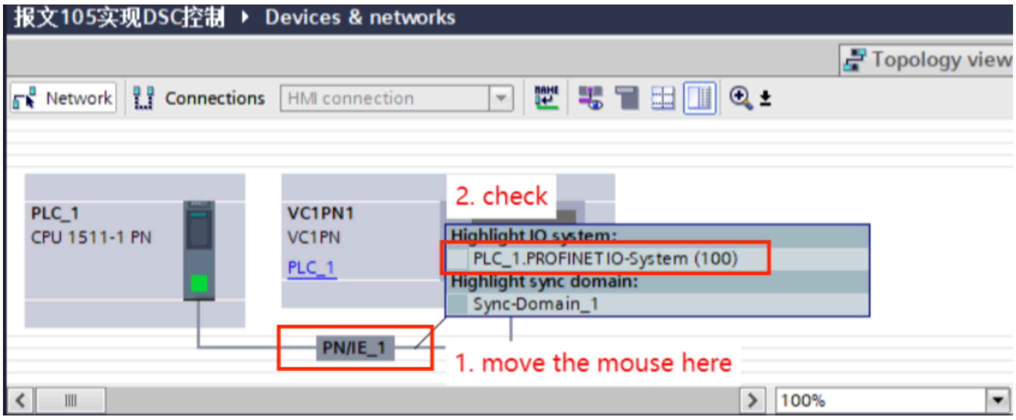
Tick "Isochronous Mode" for the servo drive



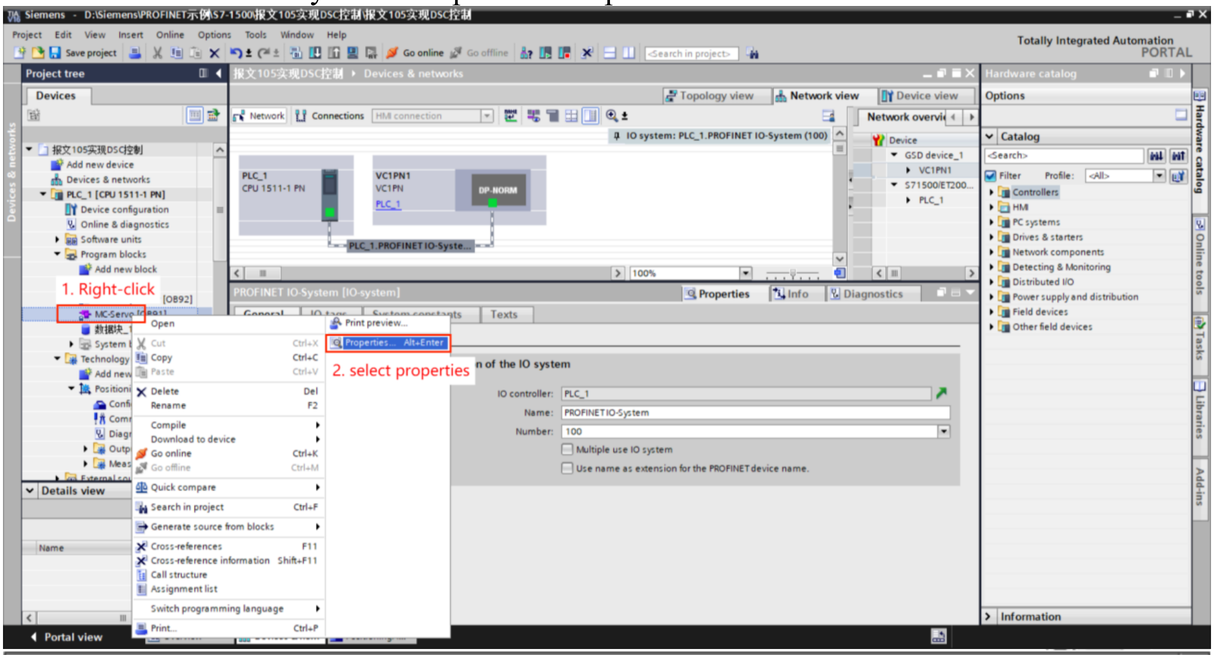
Set the send clock

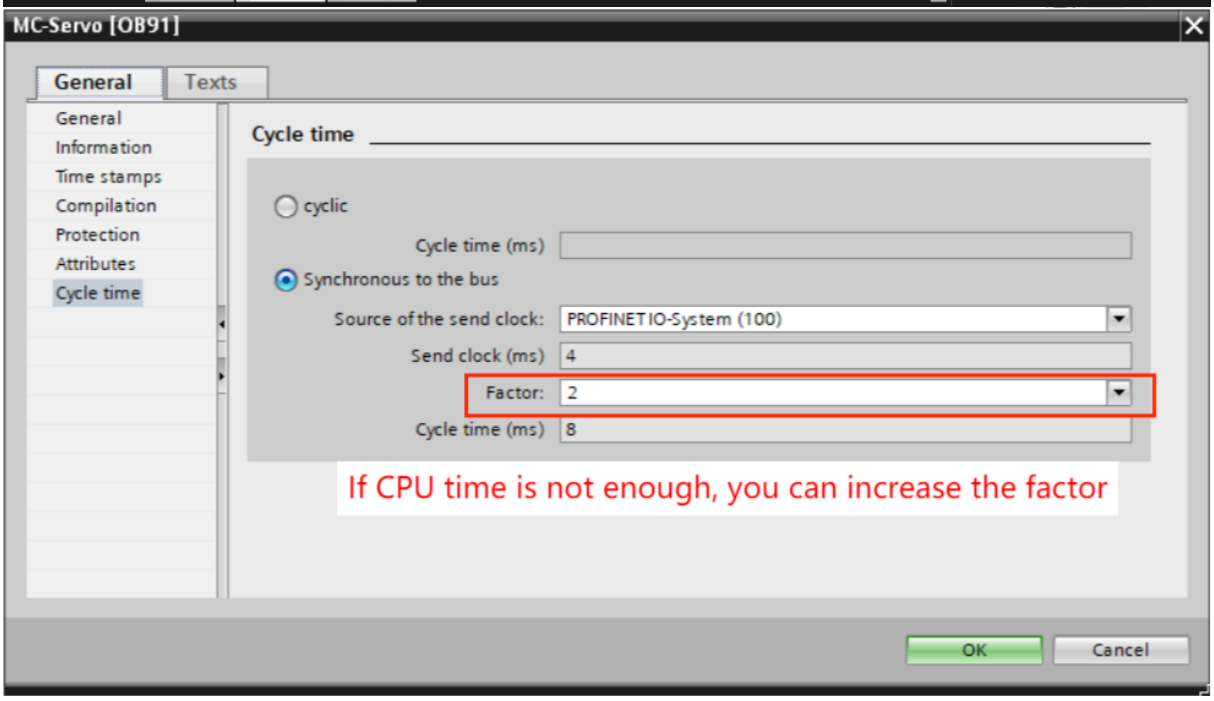


Select Highlight PLC_1.PROFINET IO-System



Set the execution cycle of the position loop





12.7.5 Create a new data block and write a PLC program

For related data blocks and program instructions, please refer to Section 12.3.6.

12.7.6 DSC related instructions

If the position loop (we often say TO) is calculated cyclically in the PLC, the update time of the position loop will depend on the bus cycle time of the communication. If the cycle time of the bus is shortened, it will inevitably increase the load of the CPU or affect the normal cycle time of OB1.

DSC (Dynamic Servo Control) is a control method that moves the position loop calculation and interpolation to the drive through a specific message, and uses the speed of the drive to control the clock quickly, which improves the quality and performance of positioning.

Without the DSC function, a step change in the speed reference due to a longer position control period would result in a large torque or current ripple.

When the DSC function is activated, the position loop calculation is moved to the drive, the calculation cycle is greatly shortened, and the torque or current ripple becomes smaller.

Using the DSC function (Dynamic Servo Control), the following benefits can be obtained:

①The position controller is in the speed control loop cycle (for example, 125μs or 250μs). The shorter the cycle is, the bandwidth of the system will be greatly improved.

②With a higher gain factor Kv of the position controller, drives with high dynamic performance can perform a faster reference response to the setpoint.

③The dynamic anti-interference ability is strong, and the disturbance can be quickly suppressed for the mechanical rigid system.

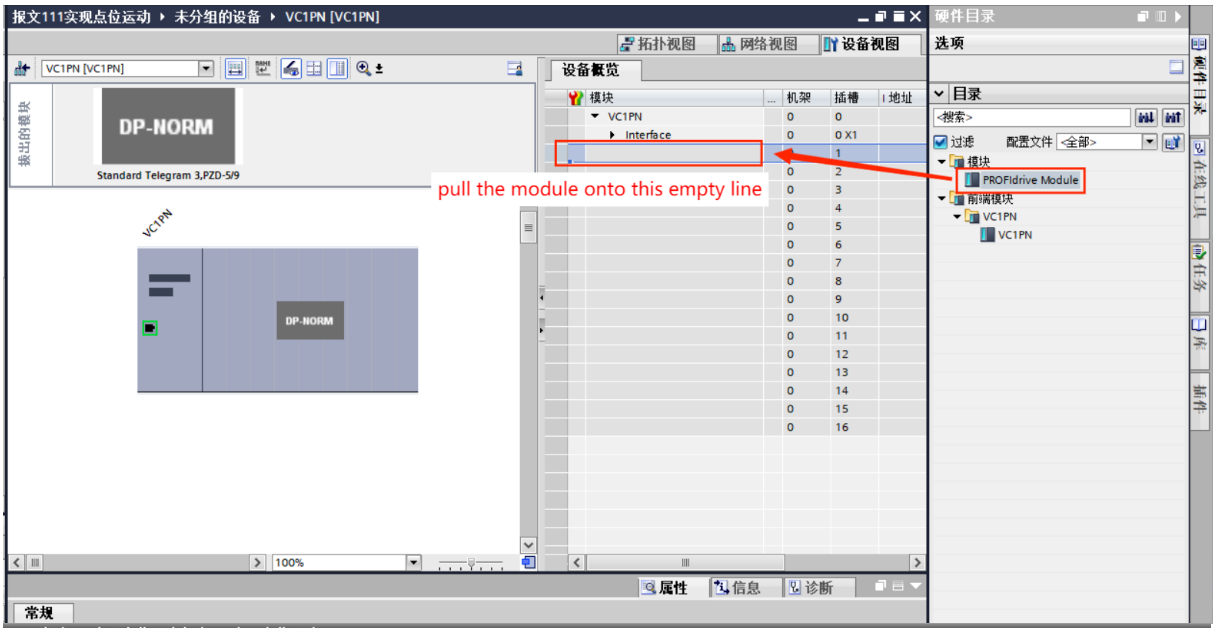
④The load on the controller can be reduced by using longer motion control cycle times.

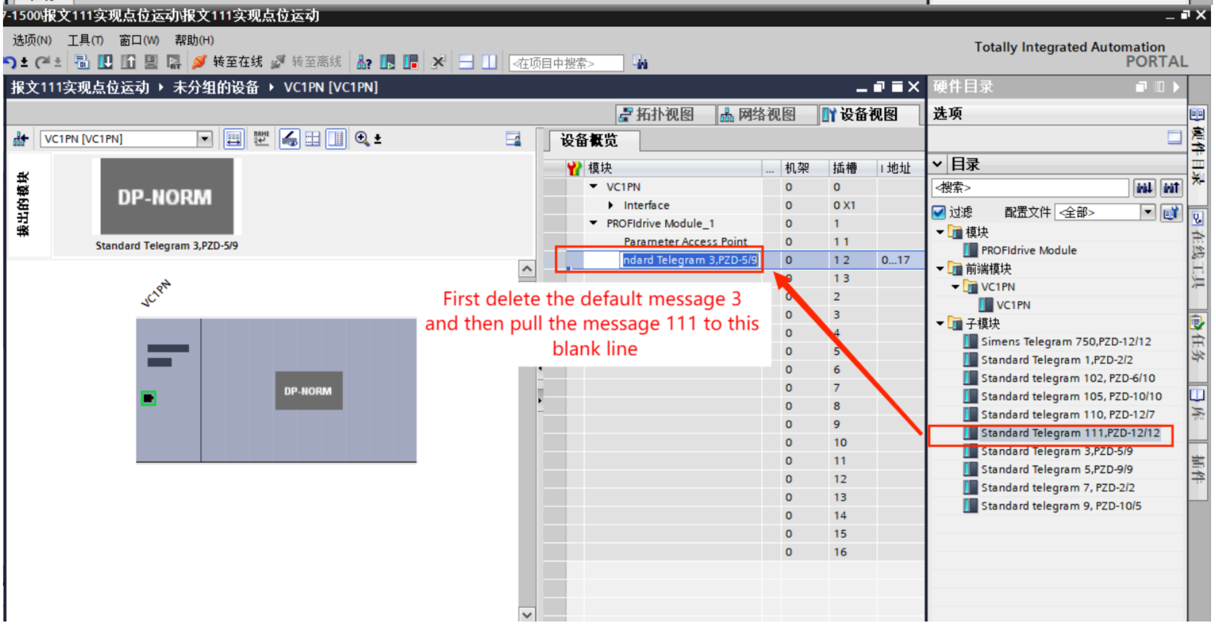
12.8 Based on S7-1500 using message 111 to realize point movement

12.8.1 Create a new project

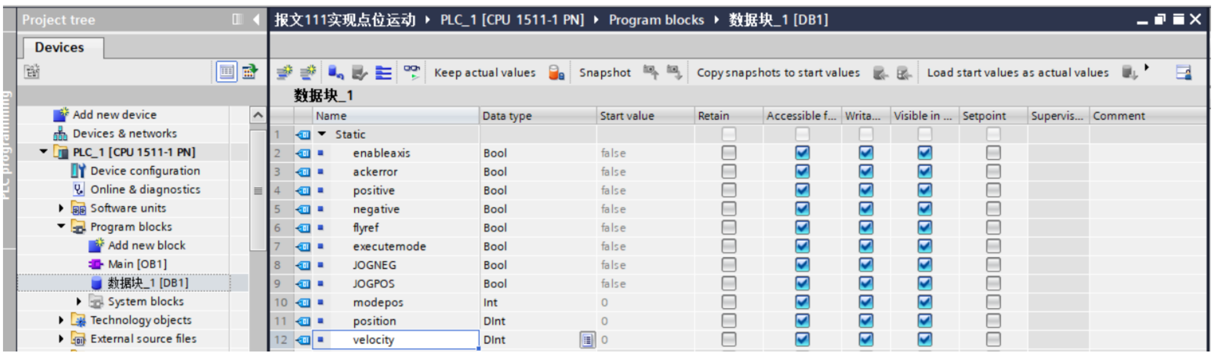
Follow the introduction in Section 12.1 to create a new project, add equipment, and configure equipment.

12.8.2 Configuration message 111

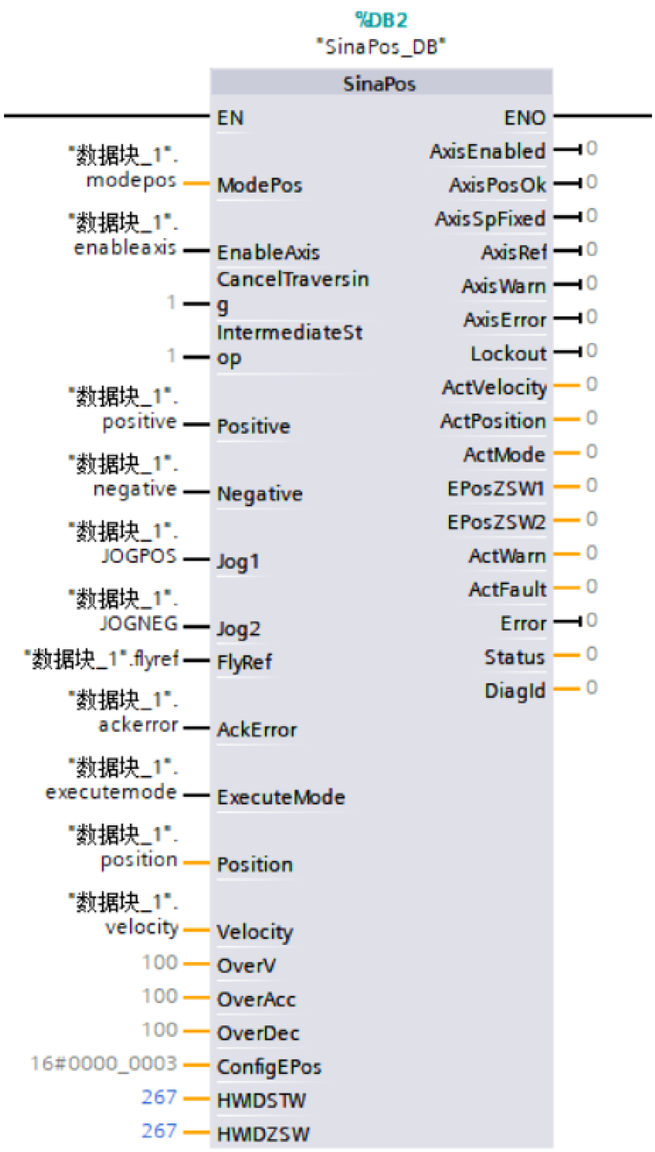




12.8.3 Create a new data block and write a PLC program

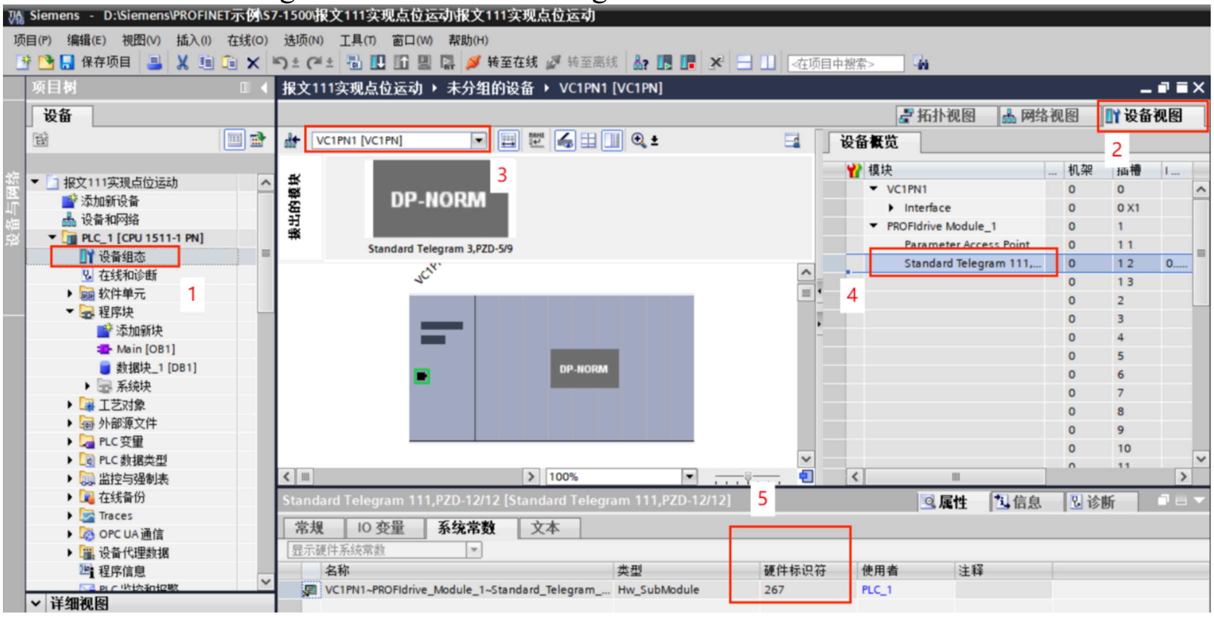


The command can be found in the option package -> SINAMICS.



HWIDSTW： This value must be the same as the ID of packet 111.
HWIDZSW： This value must be the same as the ID of packet 111.

The ID of message 111 is shown in the figure below.



12.8.4 Description of related parameters

Input parameters of SinaPos:

input signal	type	Defaults	meaning
ModePos	INT	0	Operation mode: 1 = MDI relative positioning (support) 2 = MDI absolute positioning (supported) 3 = Continuous operation at the specified speed (supported) 4 = Back to reference point operation (supported) 5 = Set back to reference point position (support) 6 = Run block 0 - 15 (not supported) 7 = Jog at a specified speed (supported) 8 = Jog by specified distance (not supported)
EnableAxis	BOOL	0	Switch command: 0 = OFF1， 1 = ON
CancelTraversing	BOOL	1	0 = Refuse to run jobs in active state 1 = not refuse
IntermediateStop	BOOL	1	0 = Active run command interrupted 1 = stop without interruption
Positive	BOOL	0	Positive direction
Negative	BOOL	0	negative direction
Jog1	BOOL	0	forward jog
Jog2	BOOL	0	reverse jog
FlyRef	BOOL	0	0 = Cancel active reference point return 1 = Select active reference point return
AckError	BOOL	0	fault response
ExecuteMode	BOOL	0	Activate run job/accept setpoint/activate referencing function

Position	DINT	0[LU]	Position set point (unit [LU]) for operating mode "direct set point specification/MDI" or traversing block number for operating mode "traversing block"
Velocity	DINT	0[LU/min]	Speed applicable to MDI operation mode (unit [LU/min])
OverV	INT	100[%]	The speed override for all operating modes is valid: 0 ~ 199%
OverAcc	INT	100[%]	The acceleration magnification is valid 0 ~ 100%
OverDec	INT	100[%]	Deceleration multiplier is valid 0 ~ 100%
ConfigEPos	DWORD	3h	The control bit of the transmission message 111 can be used to transmit signals such as hardware limit enable and origin switch. If a variable is assigned to this pin in the program, it must be ensured that both ConfigEPos.%X0 and ConfigEPos.%X1 are 1 to enable the drive to run.
HWIDSTW	HW_IO	0	Hardware identifier of message111
HWIDZSW	HW_IO	0	Hardware identifier of message111

Output parameters of SinaPos:

output signal	type	default	meaning
AxisEnabled	BOOL	0	The drive is ready to switch on
AxisPosOk	BOOL	0	The axis target position has been reached
AxisRef	BOOL	0	Return to the reference point position completed
AxisWarn	BOOL	0	Drive alarm is valid
AxisError	BOOL	0	drive failure
Lockout	BOOL	0	Forbid to connect
ActVelocity	DINT	0	current velocity
ActPosition	DINT	0[LU]	Current position (unit LU)
ActMode	INT	0	currently active operating mode
EPosZSW1	WORD	0	EPOS ZSW1(binary grain matrix) status
EPosZSW2	WORD	0	EPOS ZSW2(binary grain matrix) status
ActWarn	WORD	0	Current alarm number
ActFault	WORD	0	Current fault number
Error	BOOL	0	1 = faulty
Status	INT	0	16#7002： No fault - the block is running 16#8401： drive fault 16#8402： Forbid to connect 16#8403：Floating reference point function cannot be started 16#8600： DPRD_DAT error 16#8601： DPWR_DAT error 16#8202： The selected operating mode is incorrect 16#8203： The set point parameter is incorrect 16#8204： The selected traversing block number is incorrect
DiagID	WORD	0	Extended communication error

Relevant parameter description:

① Motor speed (RPM) = (Velocity pin * OverV% * 1000 * gear ratio) ÷ encoder resolution.

② The number of turns of the relative positioning motor = (Position pin * gear ratio) ÷ encoder resolution.

③ CancelTraversin and IntermediateStop are in effect for all run modes except jog and must be set to 1 at run time.

④ The currently running command can be replaced by a new command on the rising edge of ExecuteMode, but only for running modes ModPOS=1, 2, 3.

⑤ Set CancelTraversin = 0, the axis will decelerate and stop at the maximum speed, discarding the working data, if you set CancelTraversin = 1 again, the axis will not continue to run.

⑥ Set IntermediateStop = 0, use the currently applied deceleration value to stop on a ramp without discarding the working data, if you set IntermediateStop = 1 again, the axis will continue to run, which can be understood as the suspension of the axis, and the running mode can be performed after the axis is stationary. switch.

⑦ The modification of the acceleration/deceleration ratio (OverAcc, OverDec) in JOG mode is ineffective.

12.9 SinaPos function description

12.9.1 relative positioning

Relative positioning operation mode: It can be realized by driving the relative positioning function. It adopts the internal position controller driven by SINAMICS to realize relative position control.

Request:

① Use ModePos=1 to select this operating mode.

② Start the device with "EnableAxis".

③ The axis does not have to be referenced and the encoder does not have to be adjusted (absolute encoders can be left uncorrected).

④ If the switching mode is greater than 3, the axis must be stationary. Switching between MDI operating modes (1, 2, 3) can be done at any time.

sequence:

① Specify the travel path and dynamic response by entering Position, Velocity, OverV (Velocity Override), OverAcc (Acceleration Override), OverDec (Deceleration Override).

② The run conditions "CancelTraversing" and "IntermediateStop" must be set to "1". "Jog1" and "Jog2" are invalid and must be set to "0" (not).

③ In relative positioning, the running direction is determined according to the positive or negative value of the value set in "Position".

④ The run is started with a positive edge in "ExecuteMode". The current status of valid instructions can be monitored via "EPosZSW1/EPosZSW2" (see Section 12.4 for details on status word assignment).

⑤ The function block confirms that the end point of the traversing path has been successfully reached and the "AxisPosOk" bit is 1. If an error occurs during operation, the "Error" output signal is active.

illustrate:

A currently running instruction can be replaced in real time with a new instruction via "ExecuteMode". This only applies to "ModePos" 1, 2, 3 operating modes.

12.9.2 absolute positioning

Absolute positioning operating mode: The "absolute positioning" operating mode is executed with the drive function "MDI absolute positioning". In this mode, the absolute position can be approached in a position-controlled manner via the integrated position controller of the SINAMICS drive.

Request:

① Use ModePos=2 to select this operating mode.

② Start the device with "EnableAxis".

③ The axis must be referenced, or the encoder must be adjusted (the encoder must be calibrated).

④ If the switching mode is greater than 3, the axis must be at rest. It is possible to switch between MDI operating modes (1, 2, 3) at any time.

sequence:

① Specify the travel path and dynamic response by entering Position, Velocity, OverV (Velocity Override), OverAcc (Acceleration Override), OverDec (Deceleration Override) .

② The run conditions "CancelTraversing" and "IntermediateStop" must be set to "1". Jog1 and Jog2 are invalid and must be set to "0".

③ In absolute positioning, the direction of travel is basically determined based on the shortest path to the target position. Input "Positive" and "Negative" as "0".

④ The run is started with a positive edge in "ExecuteMode". The current status of valid instructions can be monitored via "EPosZSW1/EPosZSW2" (see Section 12.4 for details on status word assignment).

⑤ The function block uses Busy to indicate the current command processing situation, and confirms the successful arrival of the target position AxisPosOk through Done. If a fault occurs during operation, the Error output signal is active.

illustrate:

When both Positive and Negative are selected at the same time, the axis stops immediately. If it is a linear axis, the selection is invalid and can be ignored.

A currently running instruction can be replaced in real time with a new instruction via "ExecuteMode". This only applies to "ModePos" 1, 2, 3 operating modes.

12.9.3 Continuous running mode (running at specified speed)

Continuous operation mode: Continuous operation mode allows the axis to run at a constant speed in forward or reverse. In continuous operation mode, the axis can be traversed with constant speed and position control in the positive or negative traversing direction without specifying the target position via the "MDI setting" function.

Request:

① Use ModePos=3 to select this operating mode.

② Start the device with "EnableAxis".

③ The axis does not have to be referenced and the encoder does not have to be adjusted (absolute encoders can be left uncorrected).

④ If the switching mode is greater than 3, the axis must be at rest. It is possible to switch between MDI operating modes (1, 2, 3) at any time.

sequence:

① Specify the travel path and dynamic response by entering Velocity, OverV (velocity override), OverAcc (acceleration override), and OverDec (deceleration override).

② The run conditions "CancelTraversing" and "IntermediateStop" must be set to "1".

Jog1 and Jog2 are invalid and must be set to "0".

③ The running direction is determined by "Positive" and "Negative". Both directions cannot be selected at the same time.

④ The run is started with a positive edge in "ExecuteMode". The current status of valid instructions can be monitored via "EPosZSW1/EPosZSW2" (see Section 12.4 for details on status word assignment).

⑤ If a fault occurs during operation, the Error output signal is active.

illustrate:

A currently running instruction can be replaced in real time with a new instruction via "ExecuteMode". This only applies to "ModePos" 1, 2, 3 operating modes.

12.9.4 Reference point return operation

Reference point approach - reference point approach mode: In this operating mode, the referencing process of the axis can be carried out in the positive or negative traversing direction with the help of the preconfigured velocity and referencing mode, which can be carried out via the drive function "Active Reference point approach" to activate this operating mode.

Request:

① Use ModePos=4 to select this operating mode.

② Start the device with "EnableAxis".

③ The axis is at a standstill.

sequence:

① The required speed characteristics are saved in the SINAMICS drive as a speed profile. In addition, preset acceleration and deceleration are applied to the axis's operating profile. The speed override "OverV" affects the preconfigured operating speed.

② The run conditions "CancelTraversing" and "IntermediateStop" must be set to "1". Jog1 and Jog2 are invalid and must be set to "0".

③ The running direction is determined by "Positive" and "Negative". Both directions cannot be selected at the same time.

④ The run is started with a positive edge in "ExecuteMode". The current status of valid instructions can be monitored via "EPosZSW1/EPosZSW2" (see Section 12.4 for details on status word assignment).

⑤ The "Error" output signal is output if a fault occurs during operation.

12.9.5 Set back to reference point position

Set reference point position: This mode ensures that the axis is referenced at any position and is executed by the "set reference point" drive function.

Request:

① Use ModePos=5 to select this operating mode.

② The axis can be closed-loop controlled, but the axis must be stationary.

sequence:

① The axis is at standstill and the reference point position is set with the rising edge of "ExecuteMode".

② If a fault occurs during reference point position setting, the Error output signal is output.

12.9.6 JOG

Jog: The Jog operating mode is executed by driving the function "Jog". In this mode, the axis can be operated in a position-controlled and velocity-based manner via the integrated position controller of the SINAMICS drive.

Request:

① Use "ModePos"=7 to select this operating mode.

② Start the device with "EnableAxis".

③ The axis is at a standstill.

④ The axis does not have to come back referenced and the encoder does not have to be adjusted (absolute encoders can be left uncorrected).

sequence:

① The jog speed is set in the drive, and the speed override is also valid in this operating mode, and should be set by "OverV".

② The operating conditions "CancelTraversing" and "IntermediateStop" are irrelevant conditions in this operating mode and can be set to "1" by default.

③ Inputs "Positive" and "Negative" are irrelevant parameters in this run mode and can be set to "0" by default.

④ The current status of valid instructions can be monitored via "EPosZSW1/EPosZSW2" (see Section 12.4 for details on status word assignment).

⑤ The function block uses Busy to indicate the current command processing status, and confirms the end of the jog function (Jog1 or Jog2 = 0) with AxisPosOK when the axis reaches a standstill. If a fault occurs during operation, the Error output signal is active.

illustrate:

① Jog1 and Jog2 are signal sources for jog mode in EPOS. The direction is set by default for Jog1 to be positive and Jog2 to be negative.

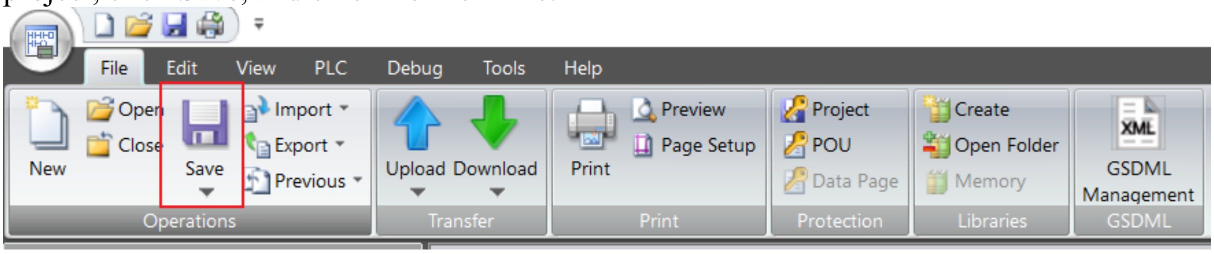
② Through Jog1 or Jog2, a new command can be used to actively replace the currently running command. Only valid while still in one of the jog modes.

12.10 Based on S7-200 SMART using message 111 to realize point movement

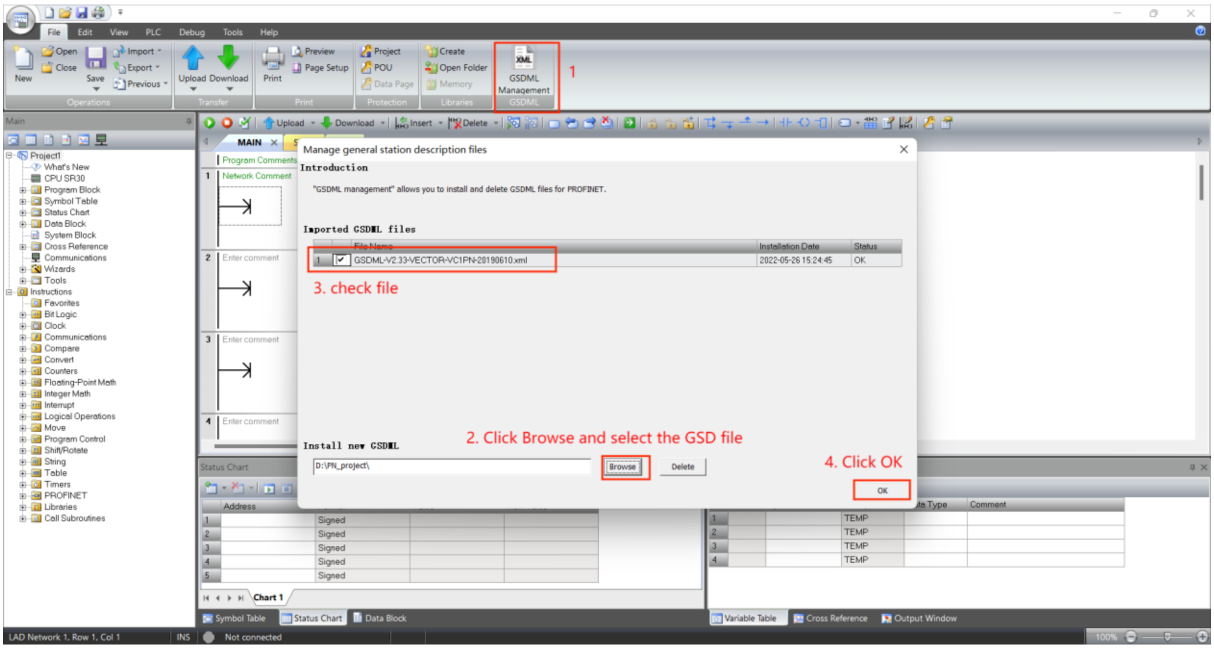
12.10.1 Create a new project

The S7-200 uses STEP 7-MicroWIN SMART software.

Open STEP 7-MicroWIN SMART software, the software will automatically create a new project, click Save, and enter the file name.

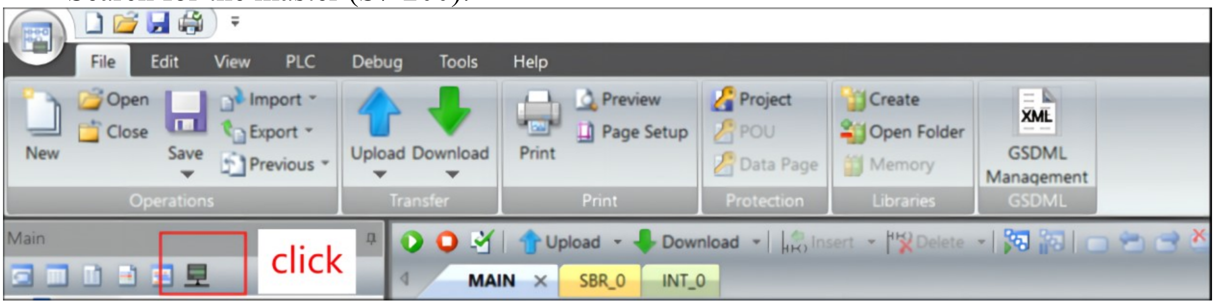


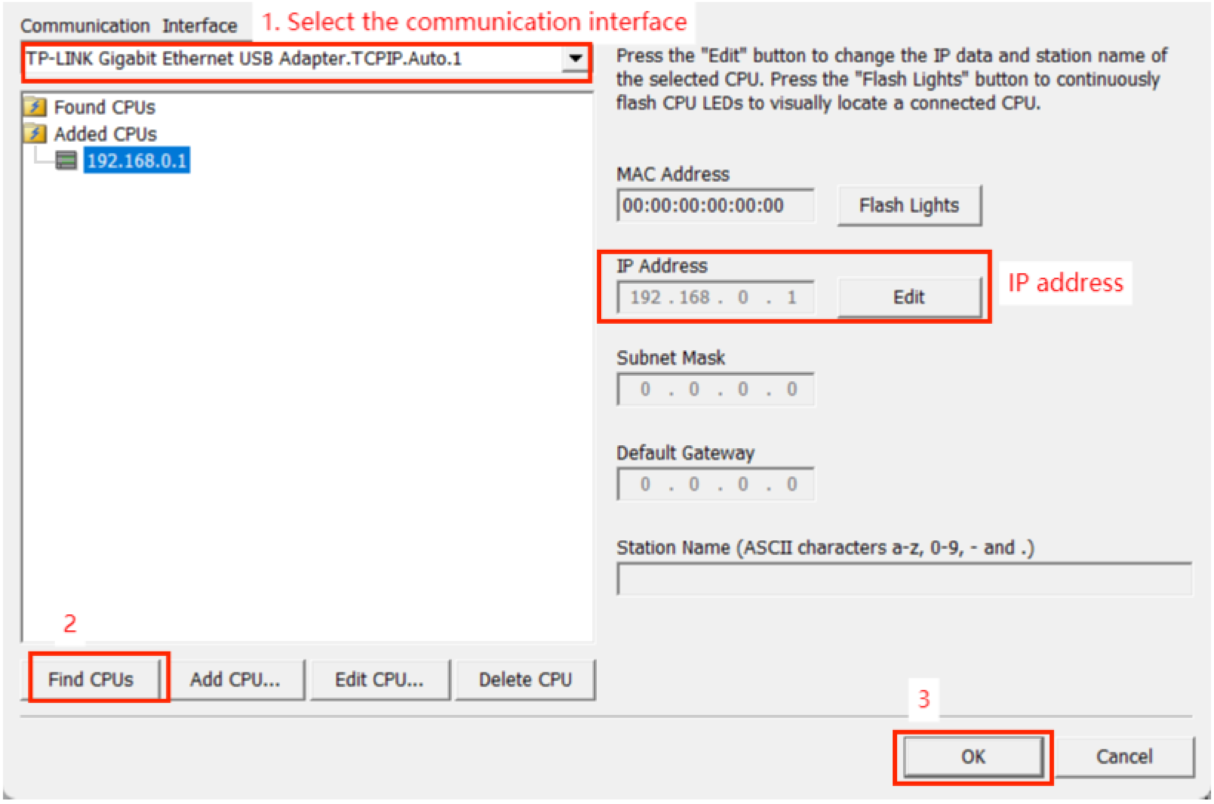
12.10.2 Import GSD files



12.10.3 Search for master and slave devices

Search for the master (S7-200):

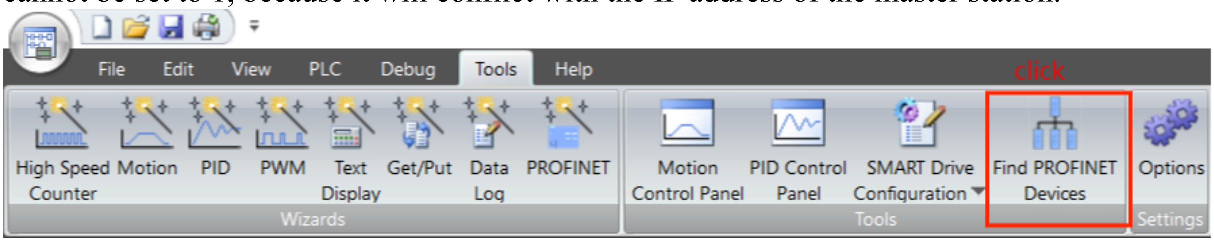


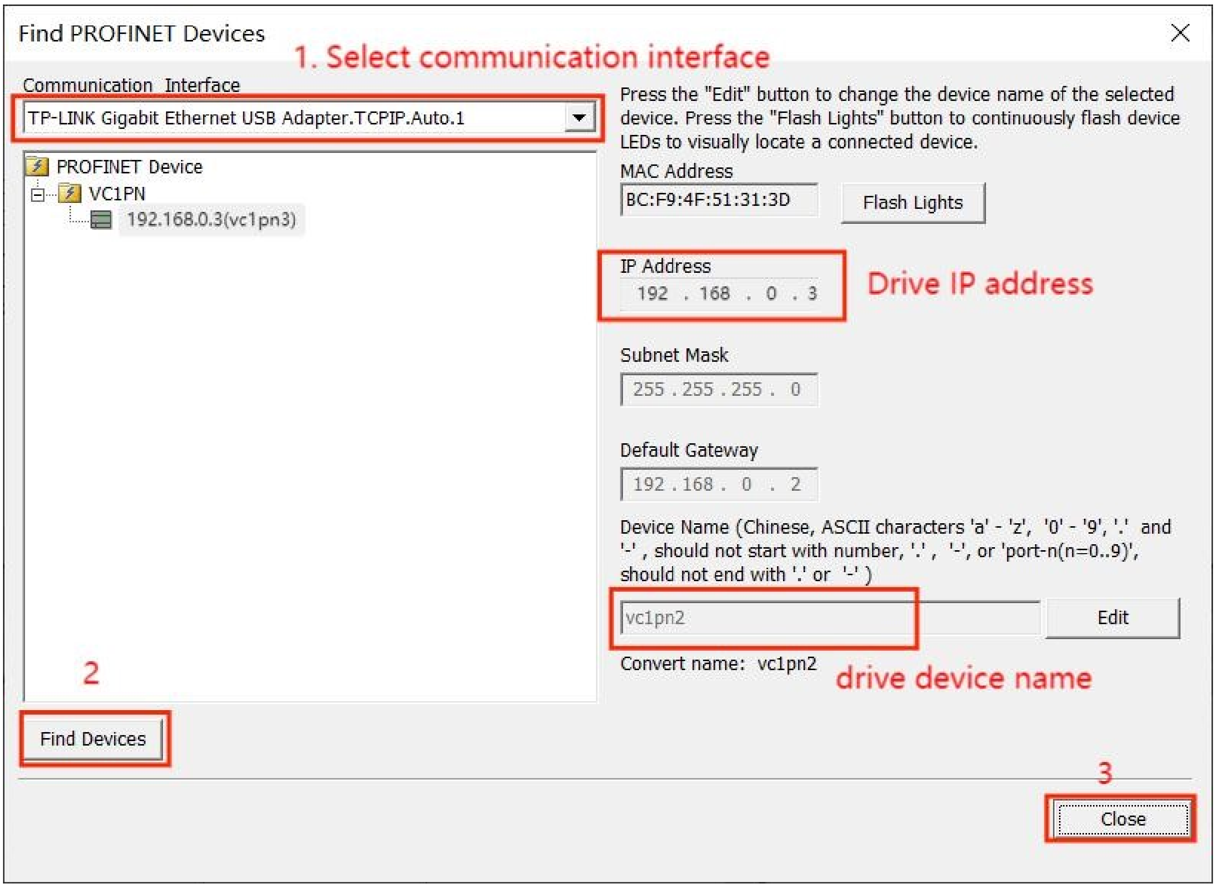


Search for slaves (VC330 drives):

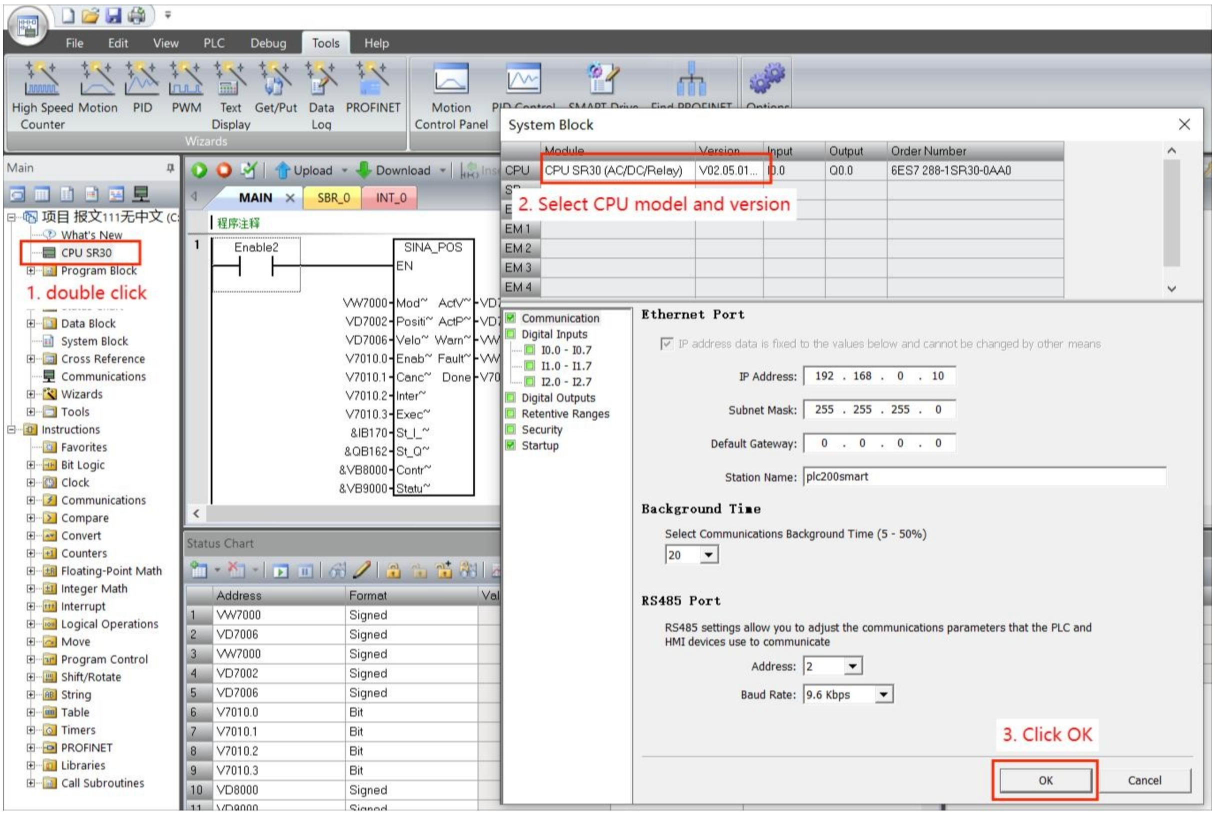
The Profinet bus determines the specific servo through the IP address and device name. When P08.41=0, the IP address and device name need to be set through the controller software (such as TIA Portal software). When P08.41=X, and 0<X<255, the servo will automatically set the servo device name to vc1pnX, automatically set the IP address to 192.168.0.X, and set the subnet mask to vc1pnX when the servo is powered on. Set it to 255.255.0.0 and set the gateway to 192.168.0.X. Here is the introduction of setting IP address and device name through P08.41.

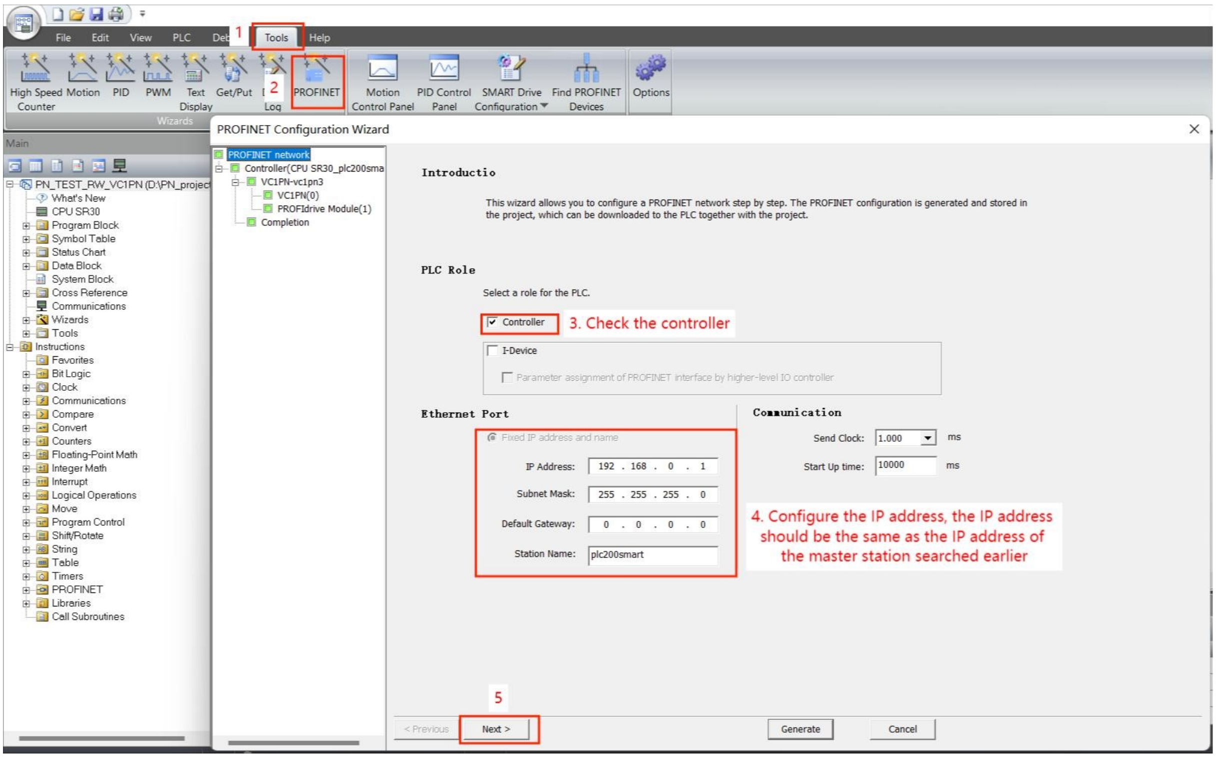
First set P08.41 to 2, reset the drive, and then search for slaves. Note that P08.41 here cannot be set to 1, because it will conflict with the IP address of the master station.



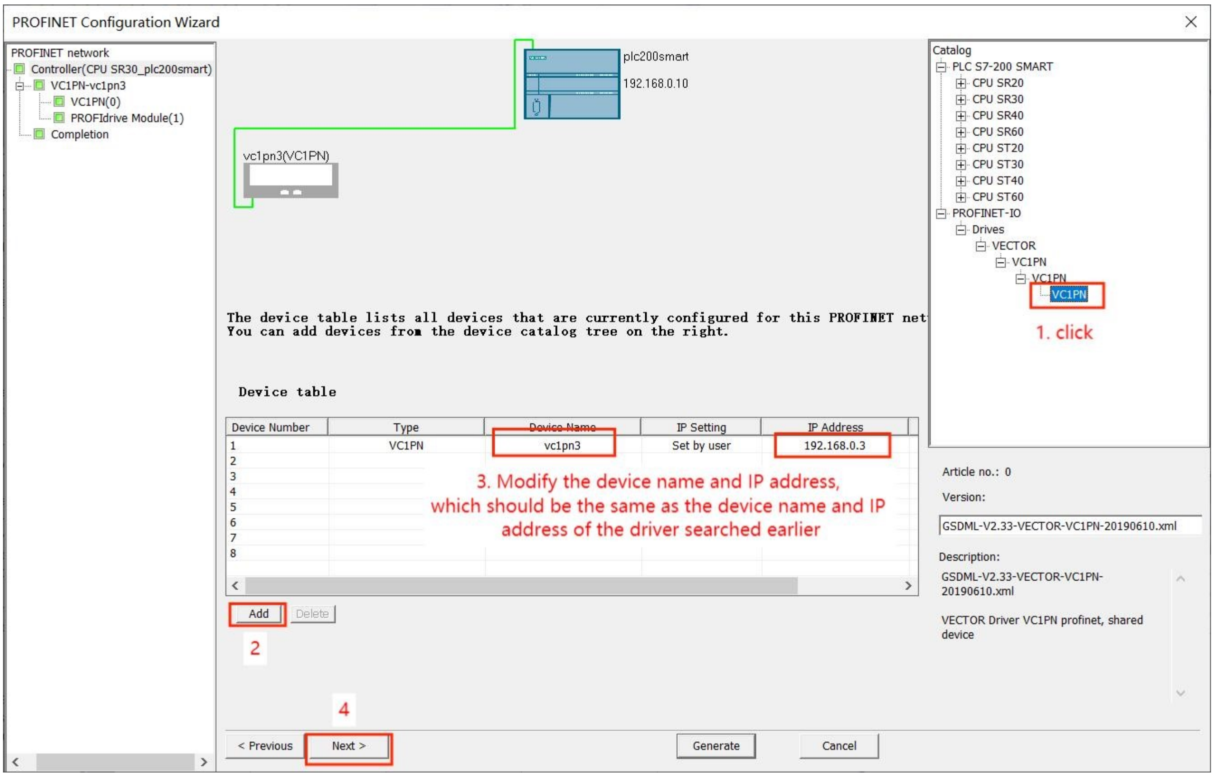


12.10.4 Add device S7-200, configure IP address

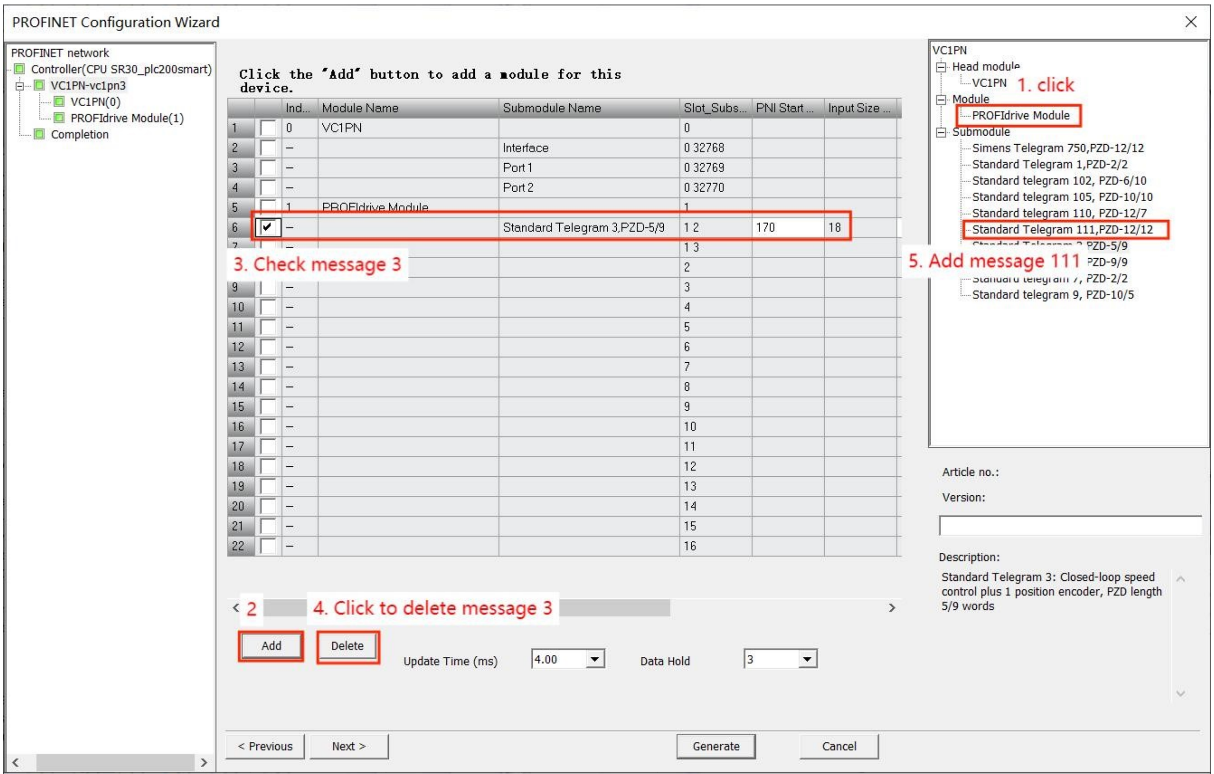


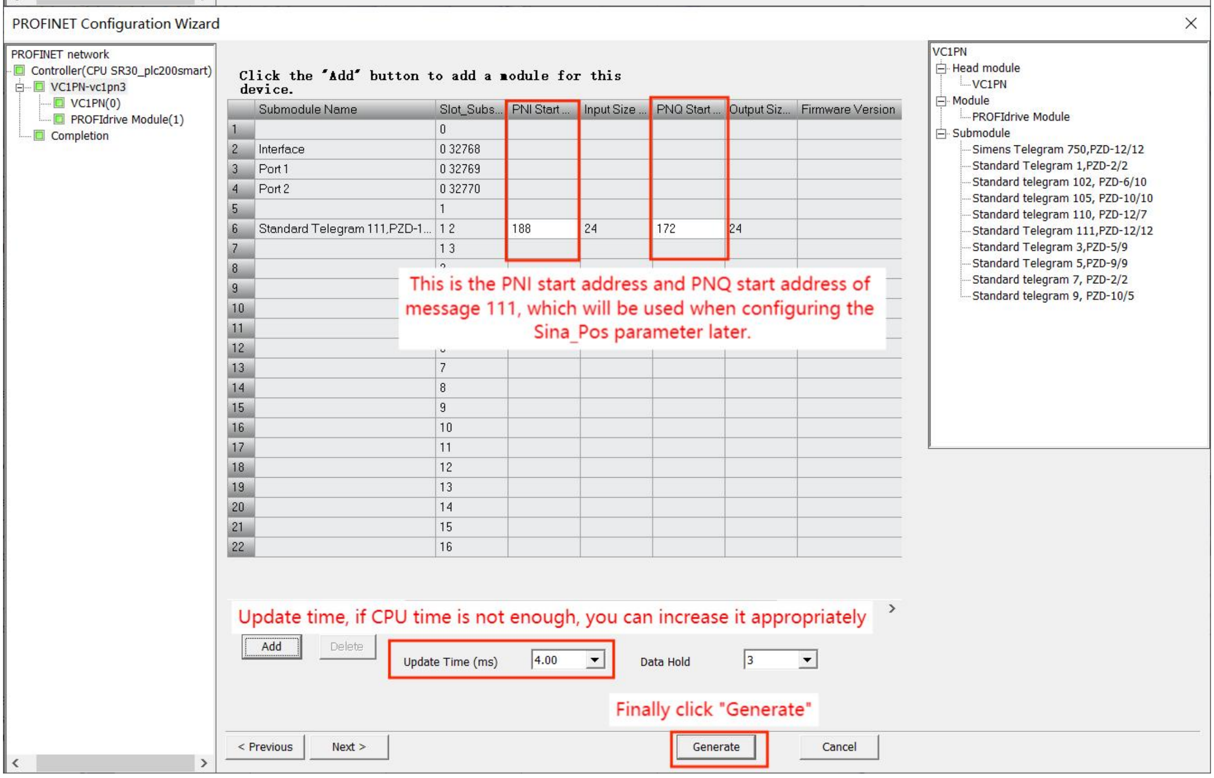


12.10.5 Add drive servo, configure IP address

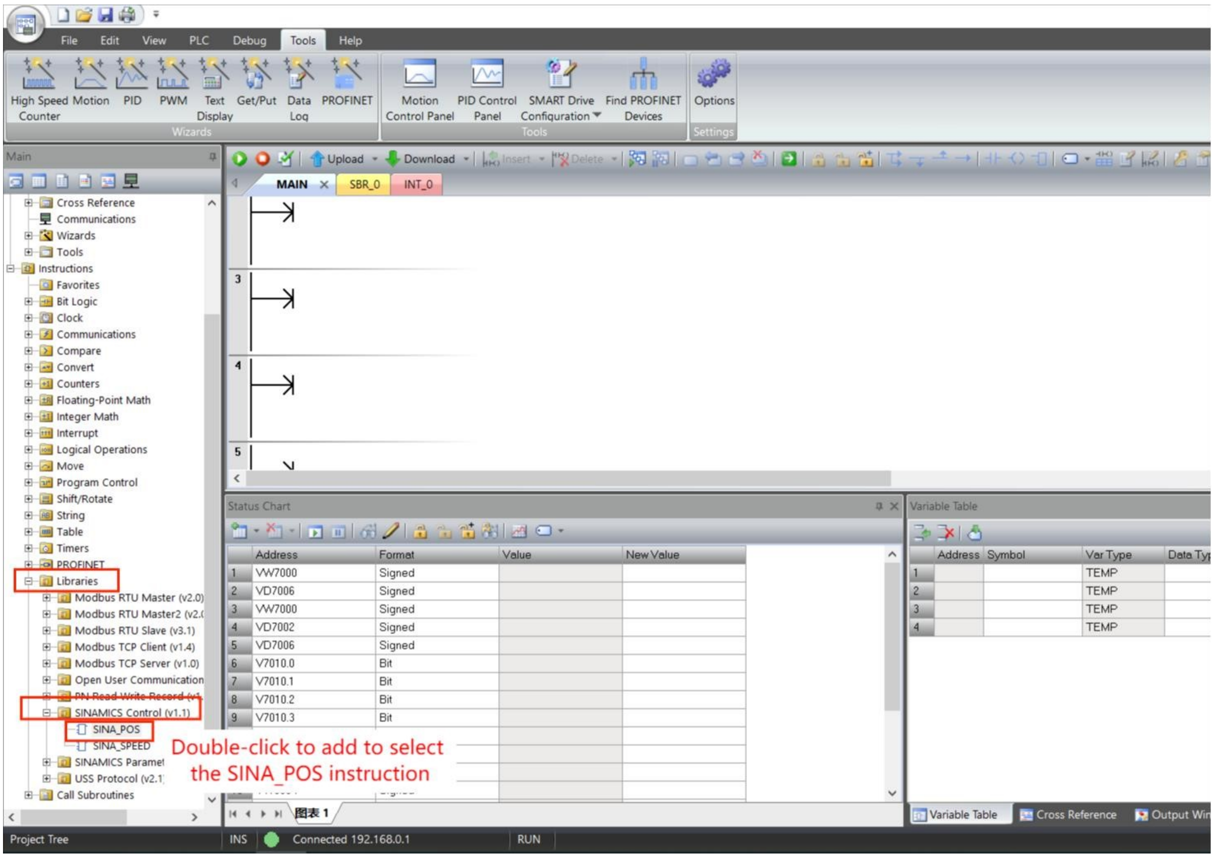


12.10.6 Configuration message 111



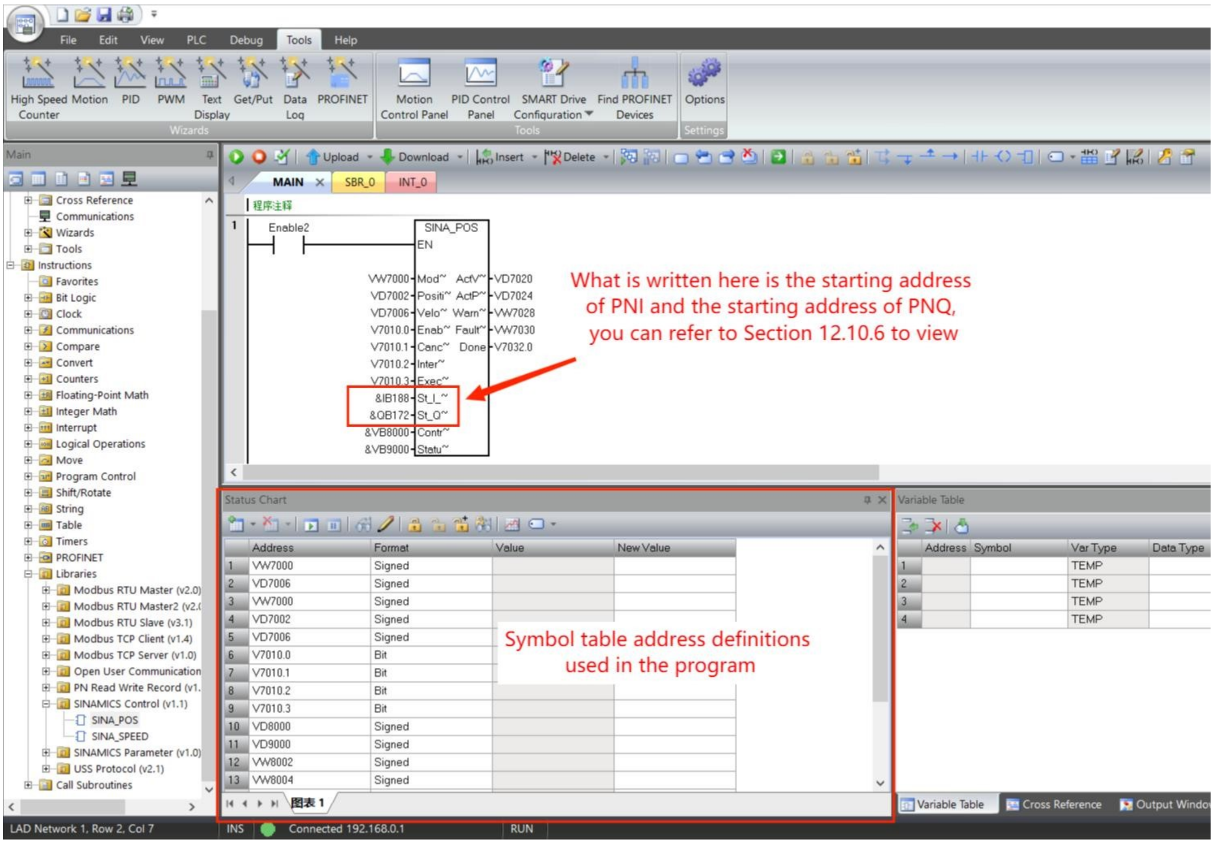


12.10.7 Write PLC program

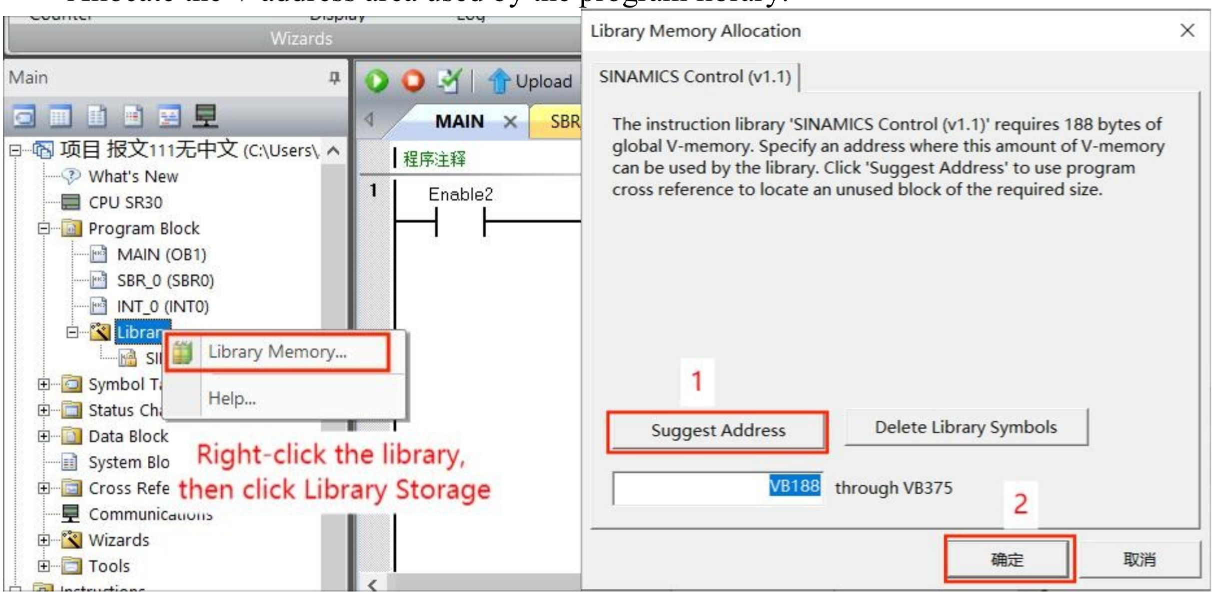


In the main program, write the following program, note that the addresses of St_I_add and St_Q_add must correspond to the IO address of message 111:

For the four input parameters "St_I_add", "St_Q_add", "Control_table" and "Status_table", the addressing instruction operand mode is indirect addressing. The & sign must be entered at the beginning of the input operand and the offset must be the same as in the PROFINET wizard.

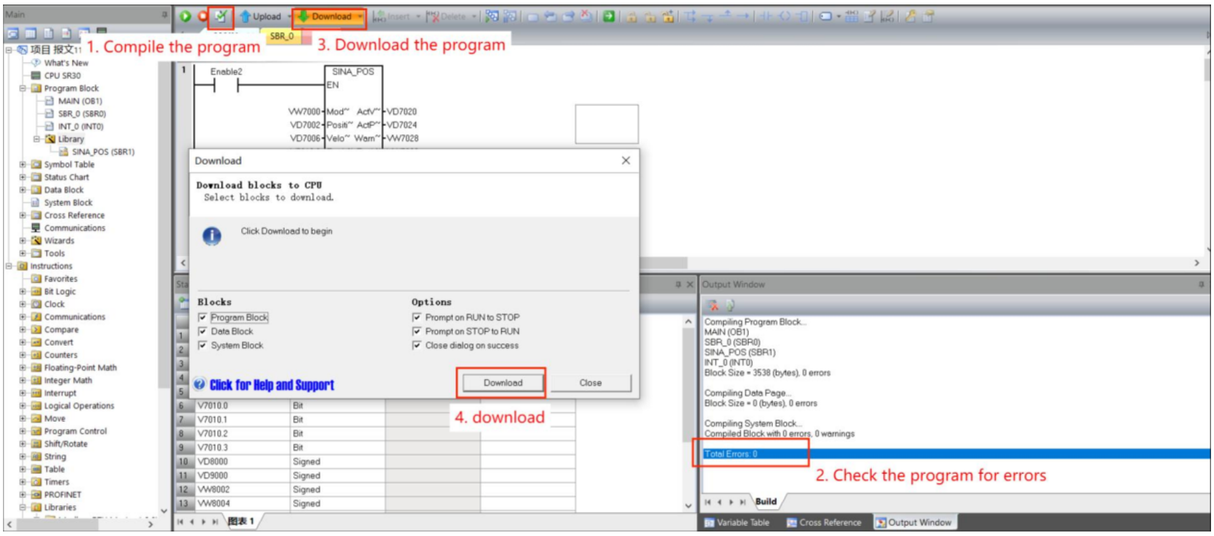


Allocate the V address area used by the program library:

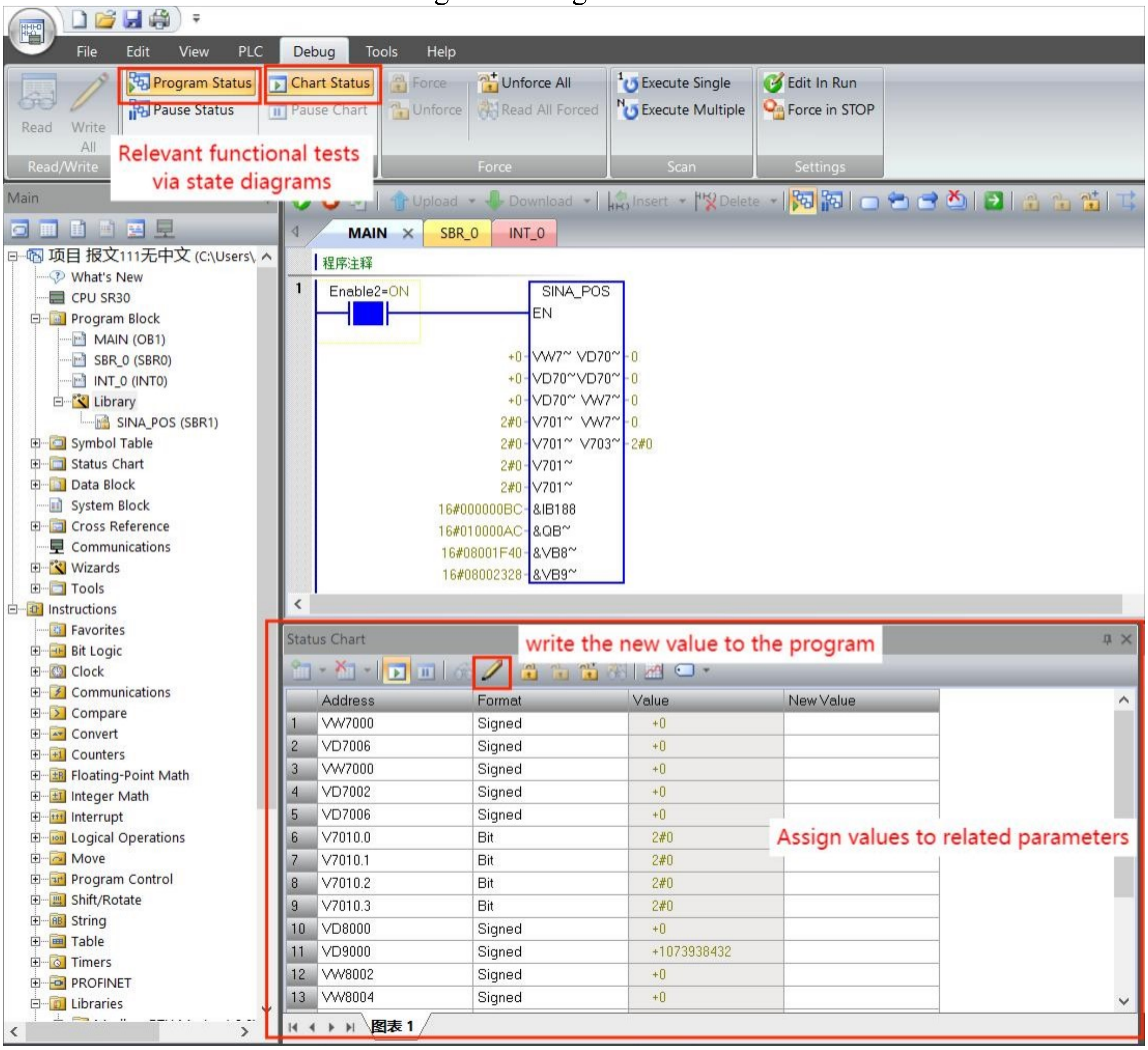


12.10.8 Compile and download the program for testing

Note that if the message of the servo is changed, the servo and PLC need to be powered on again after downloading the program to take effect.



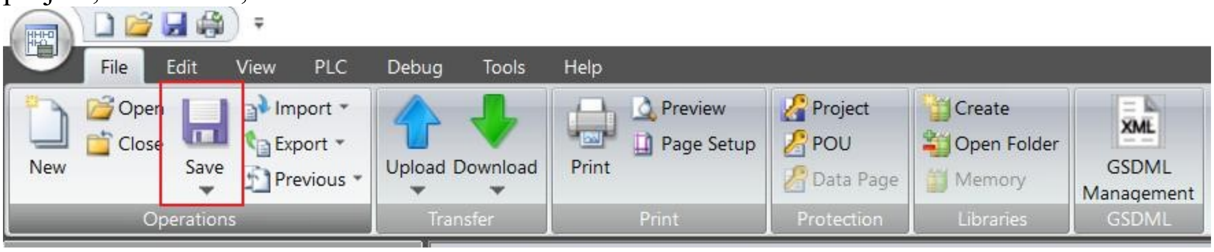
Relevant functional tests through state diagrams:



12.11 Simple speed control using telegram 1 based on S7-200 SMART

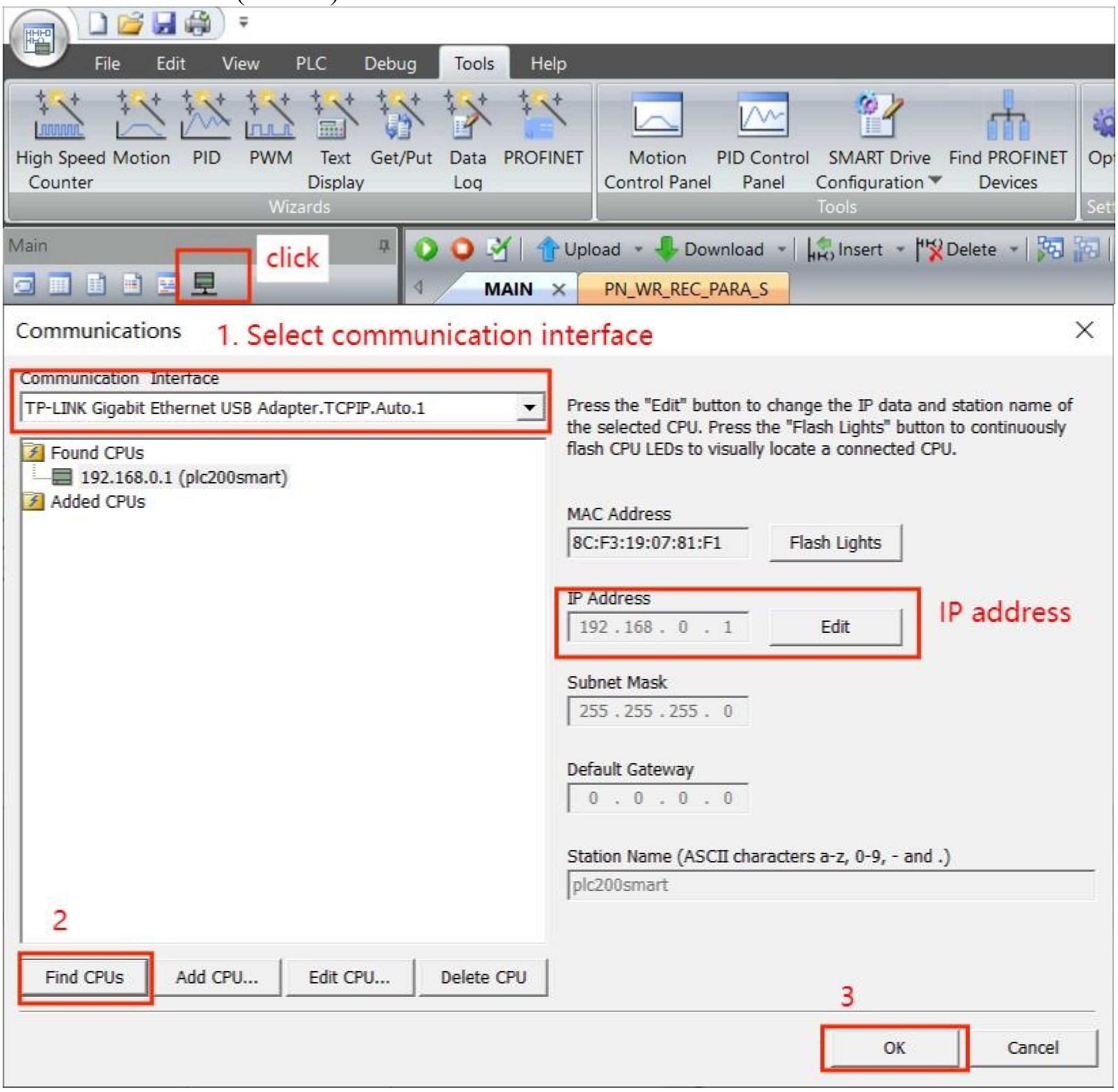
12.11.1 Create a new project

Open STEP 7-MicroWIN SMART software, the software will automatically create a new project, click Save, and enter the file name.



12.11.2 Search for master and slave devices

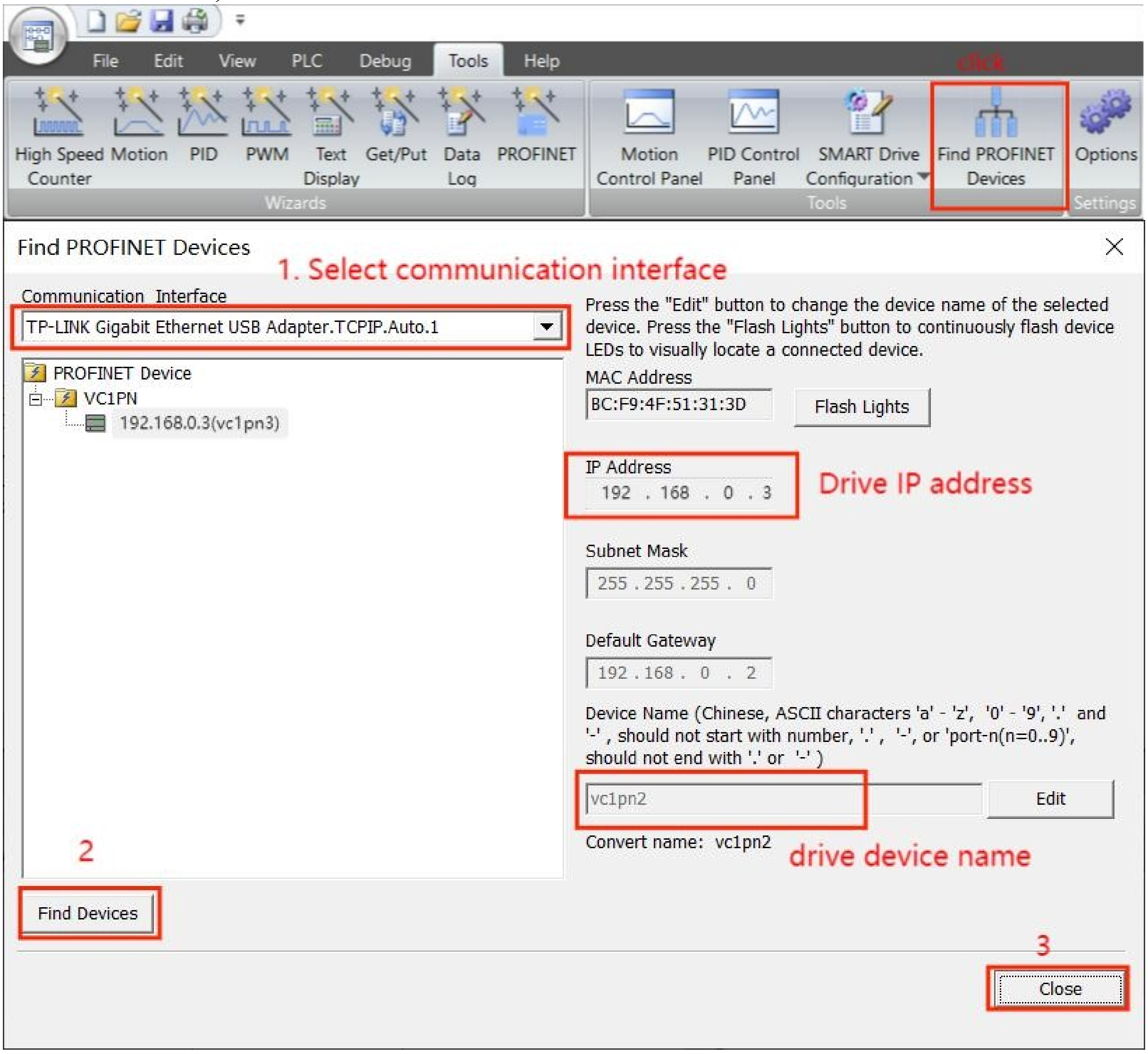
Search master (S7-200):



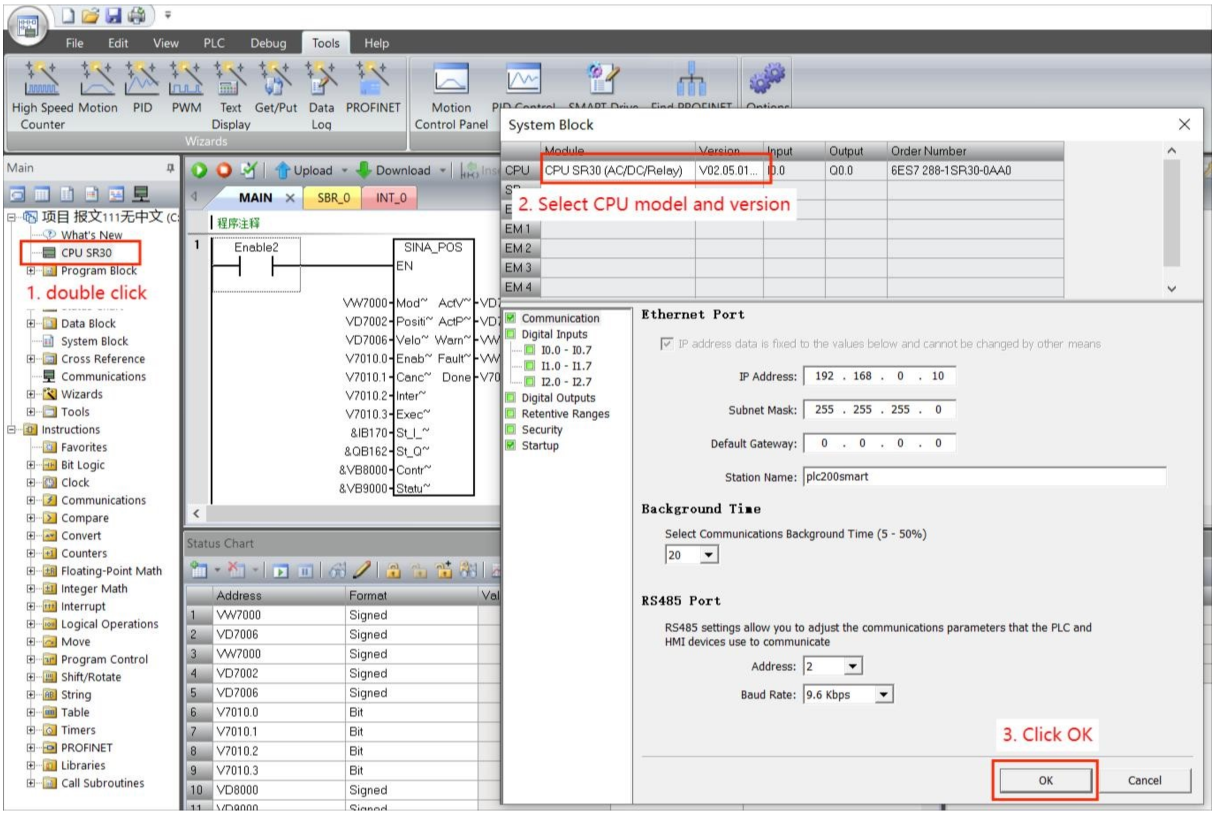
Search Slave (VC330 Drive):

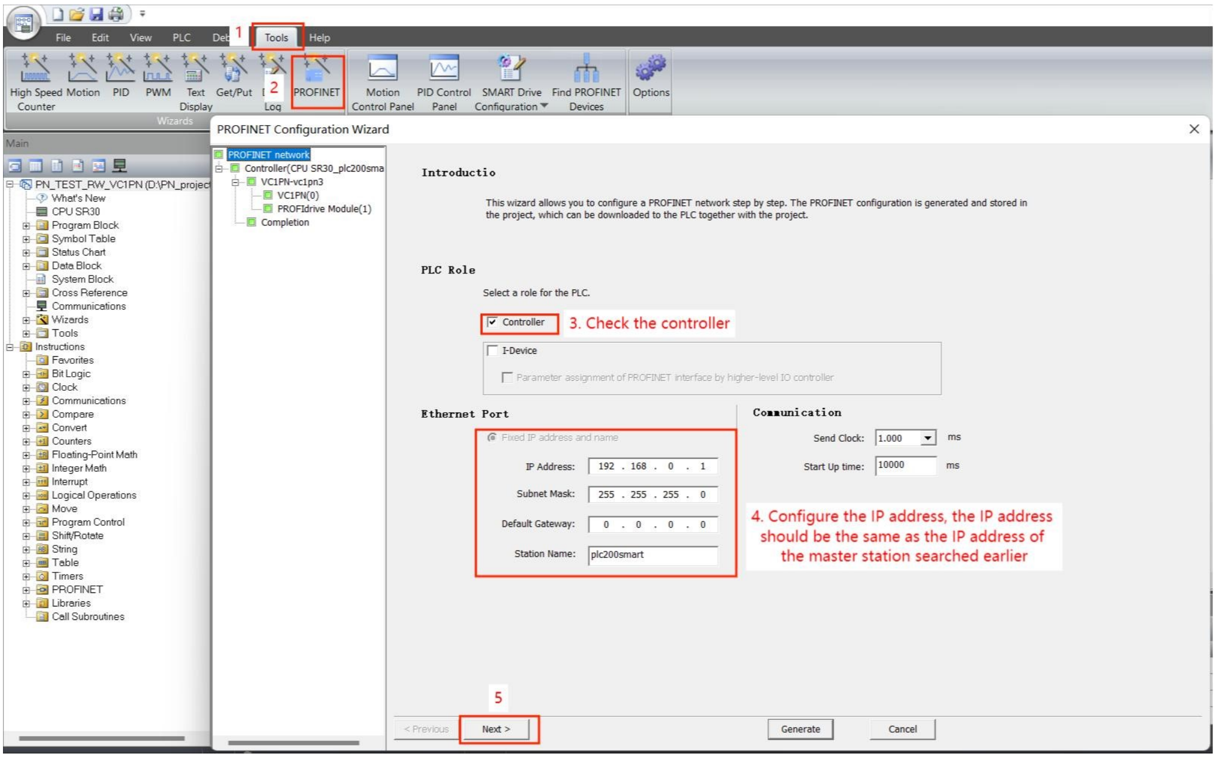
The Profinet bus determines the specific servo through the IP address and device name. When P08.41=0, the IP address and device name need to be set through the controller software (such as TIA Portal software). When P08.41=X, and 0<X<255, the servo will automatically set the servo device name to vc1pnX, automatically set the IP address to 192.168.0.X, and set the subnet mask to vc1pnX when the servo is powered on. Set it to 255.255.0.0 and set the gateway to 192.168.0.X. Here is an introduction to setting the IP address and device name through P08.41.

First, set P08.41 to 2, reset the drive, and then search for the slave. Note that P08.41 here cannot be set to 1, because it will conflict with the IP address of the master station.

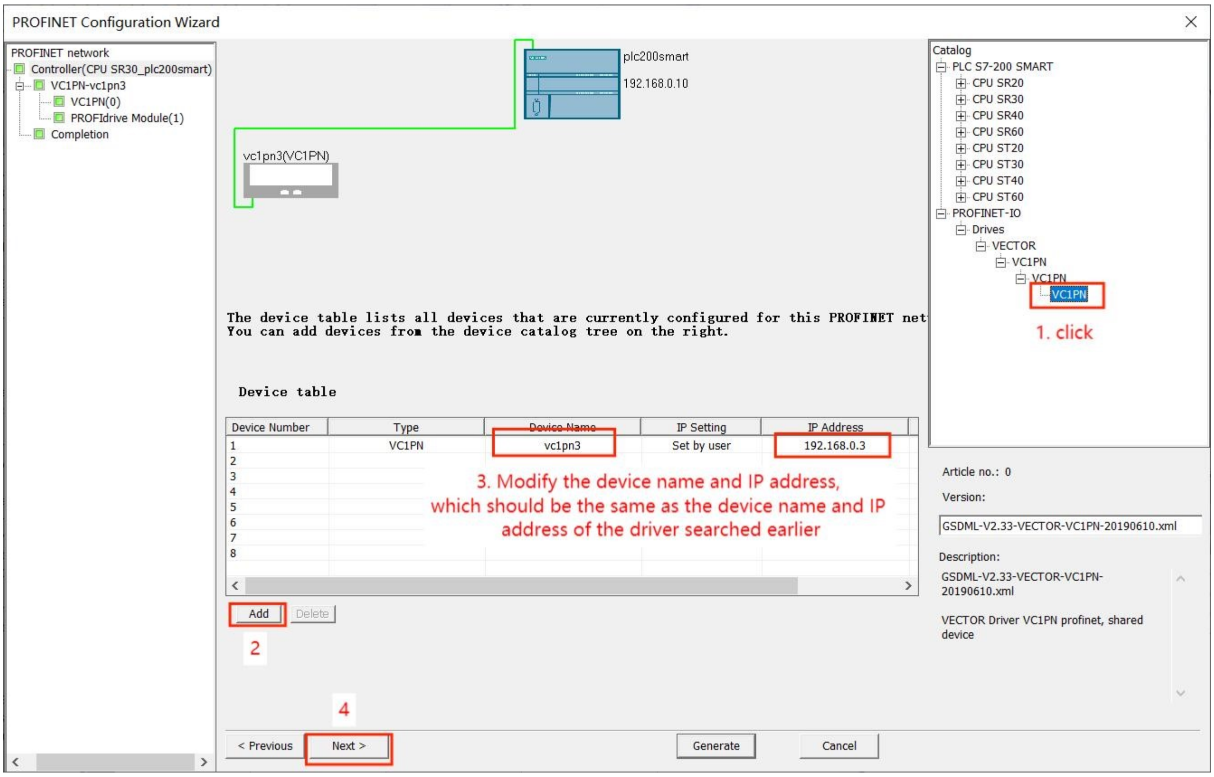


12.11.3 Add device S7-200, configure IP address

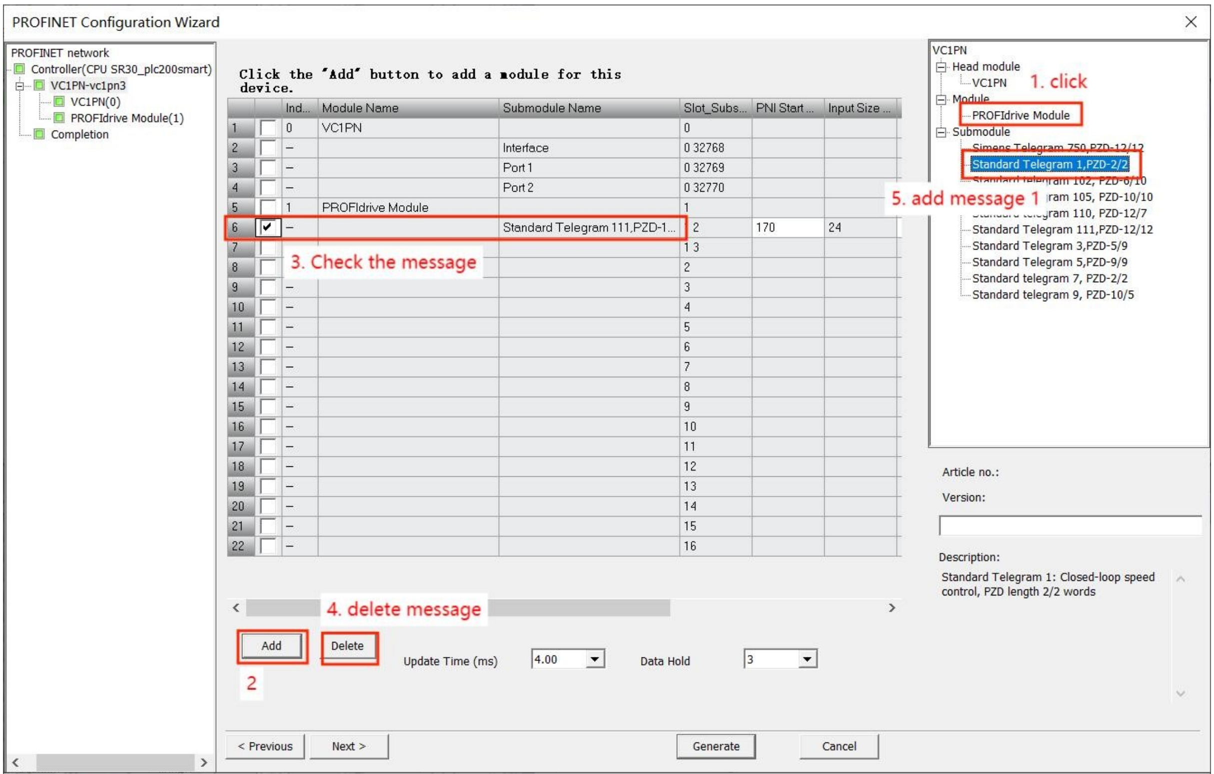


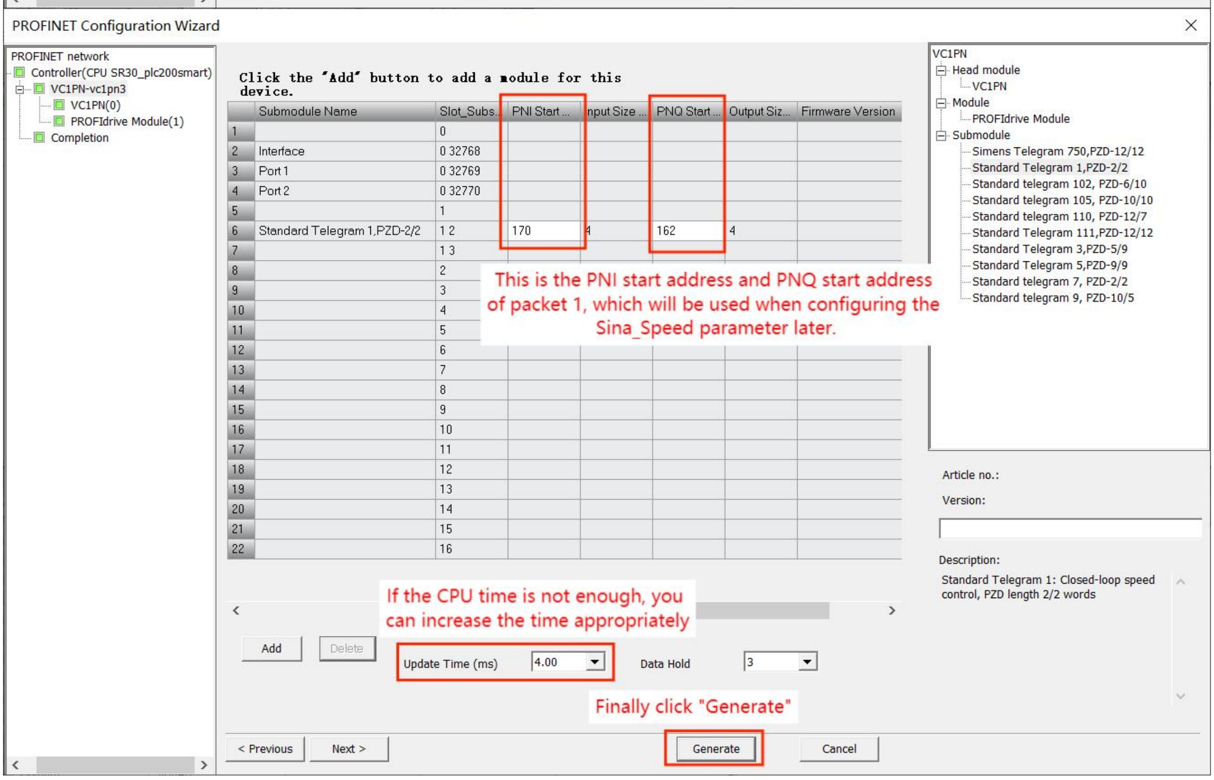


12.11.4 Add drives, configure IP addresses

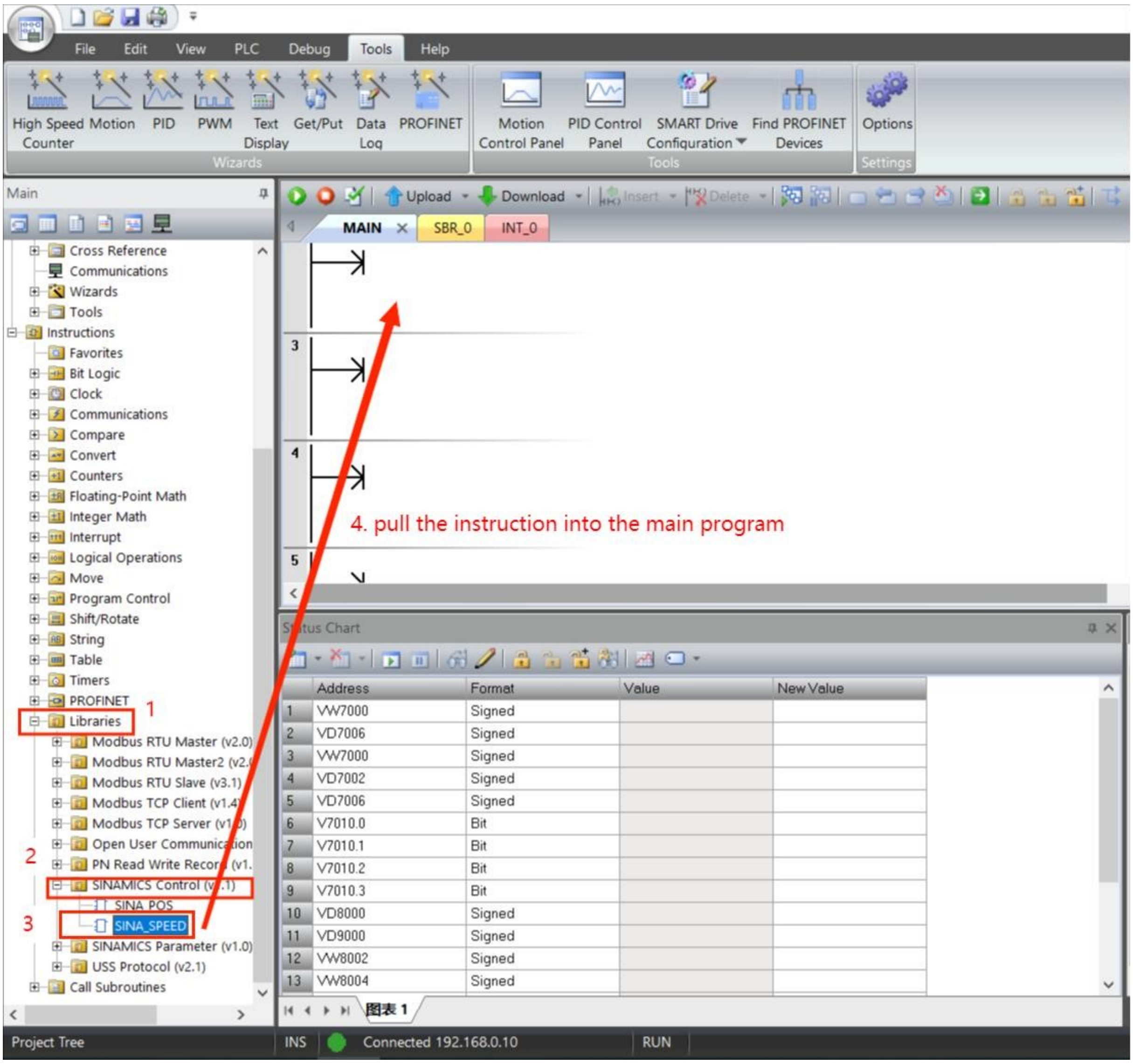


12.11.5 Configuration message 1



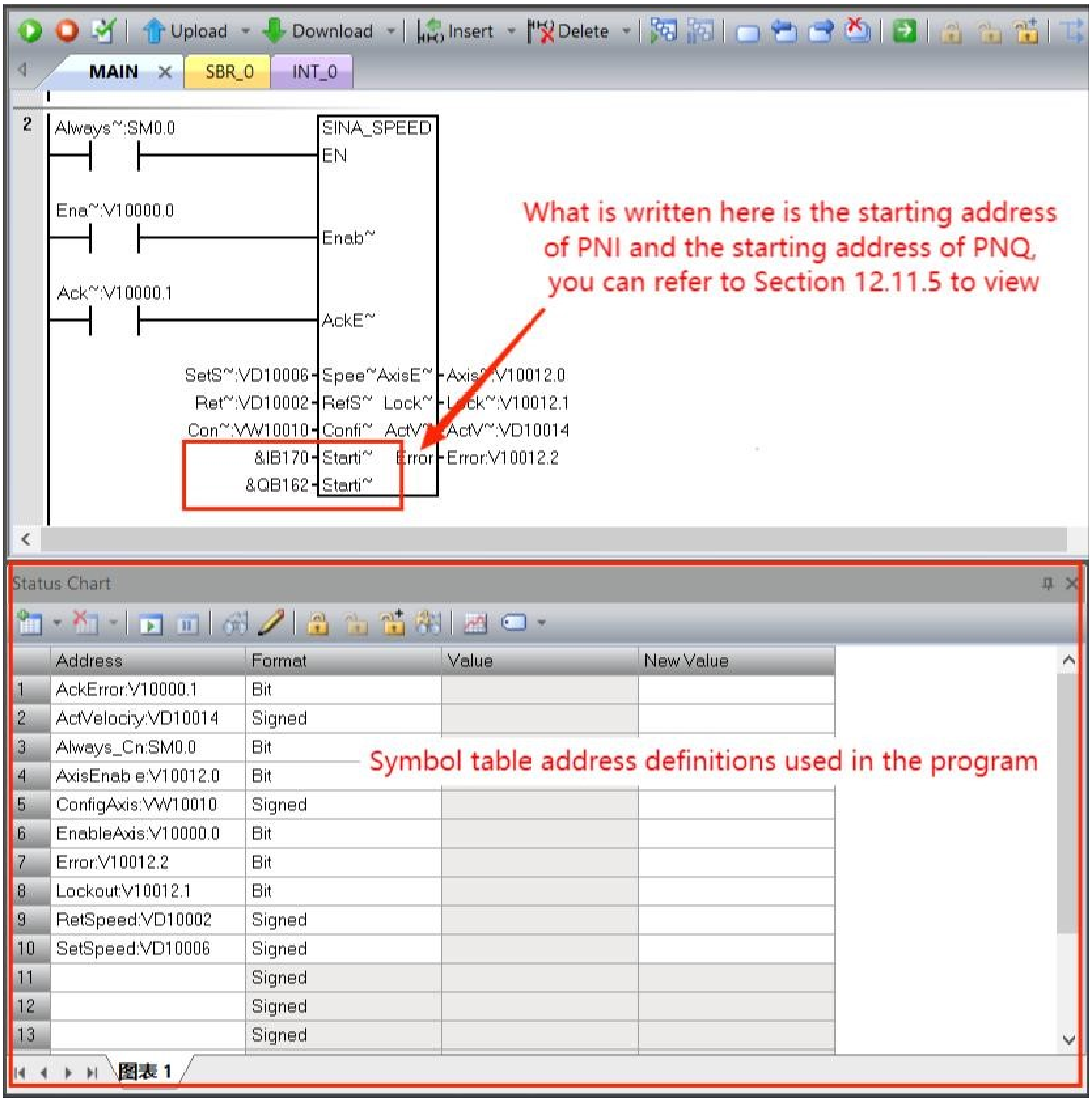


12.11.6 Write PLC program

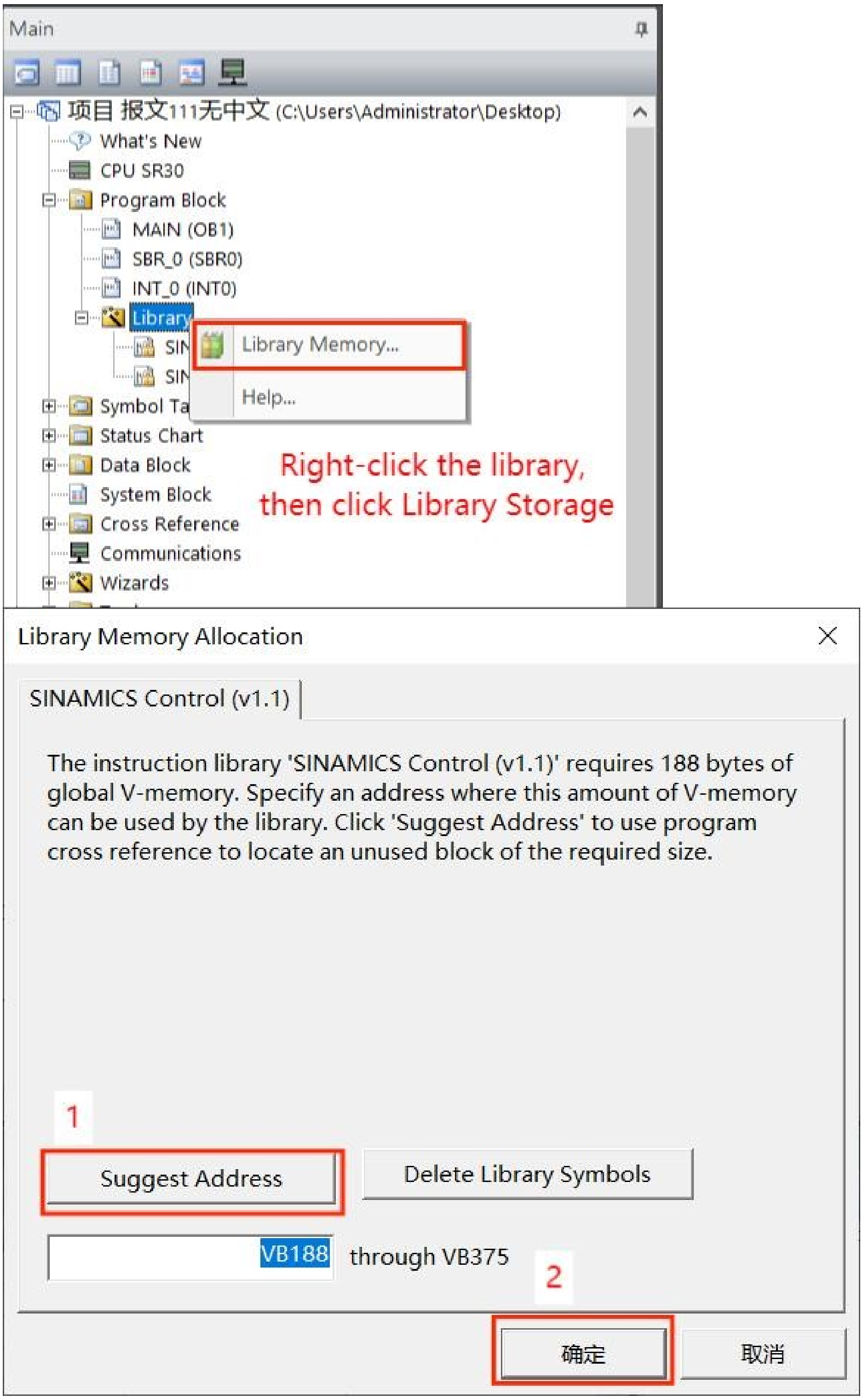


In the main program, write the following program, note that the addresses of Starting_I_add and Starting_Q_add must correspond to the IO address of message 1:

For inputs "Starting_I_add" and "Starting_Q_add", the addressing instruction operand mode is indirect addressing. You must enter an & sign at the beginning of the input operand and ensure that the offset corresponds to the offset in the PROFINET wizard.

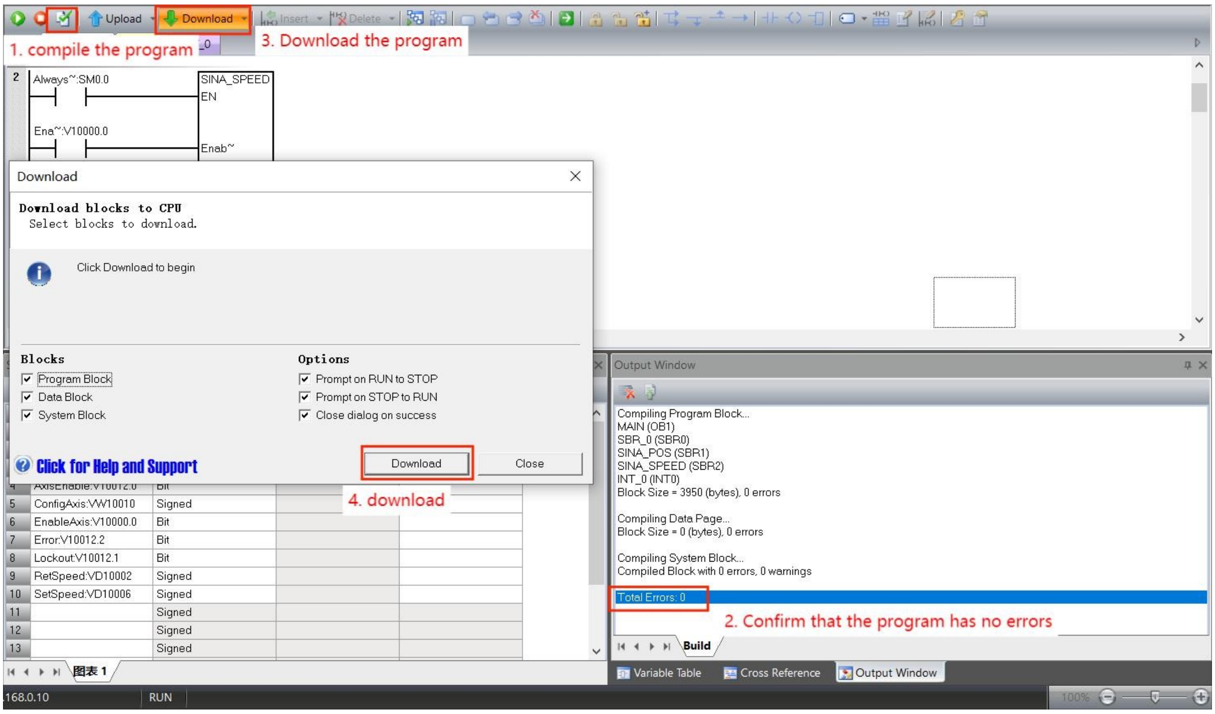


Allocate the V address area used by the program library:



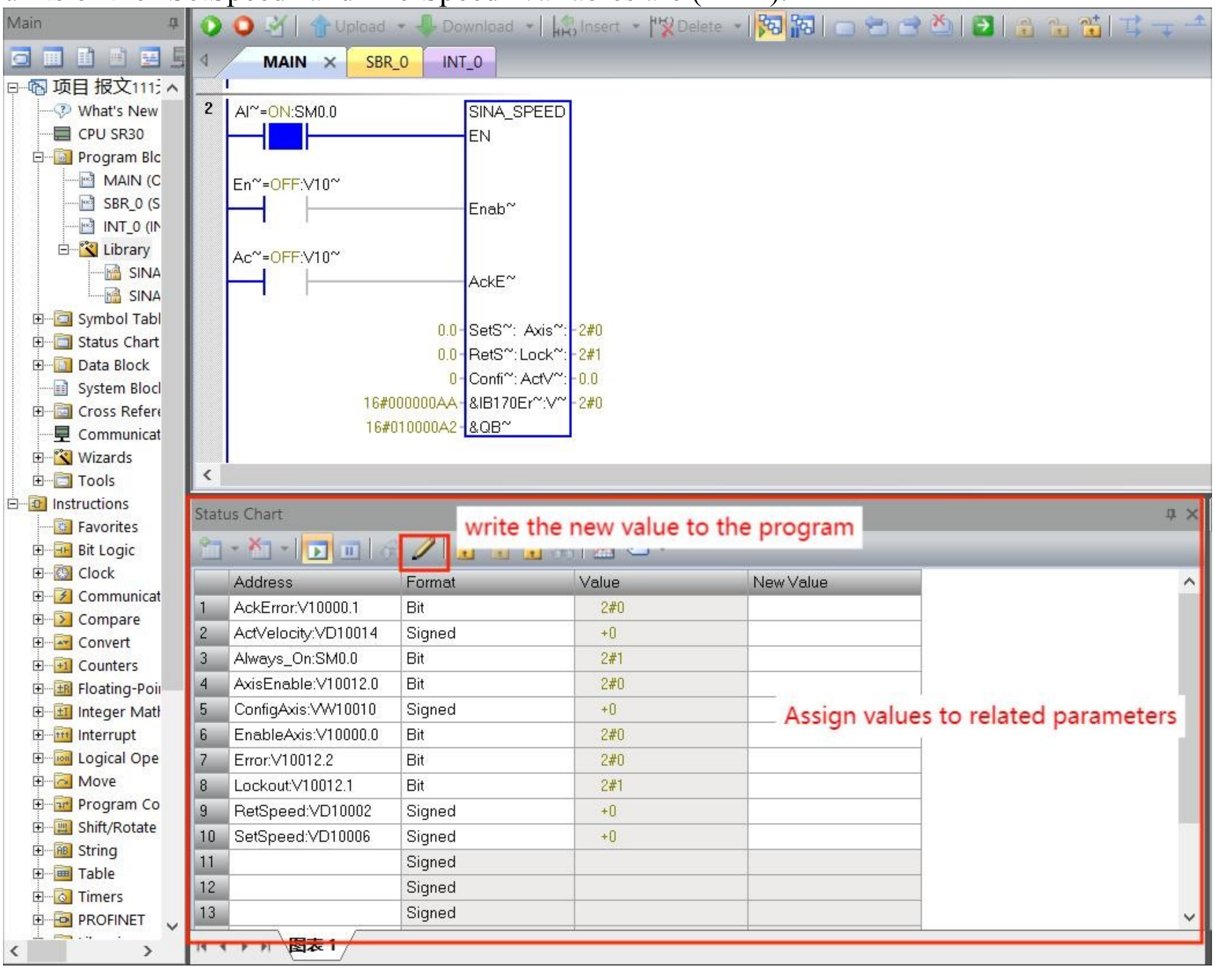
12.11.7 Compile and download the program for testing

Note that if the message of the servo is changed, the servo needs to be powered on again after downloading the program.



Relevant functional tests through state diagrams:

Note that to enable the drive, the "ConfigAxis" variable must be set to 63 (decimal). The units of the "SetSpeed" and "RefSpeed" variables are (RPM).

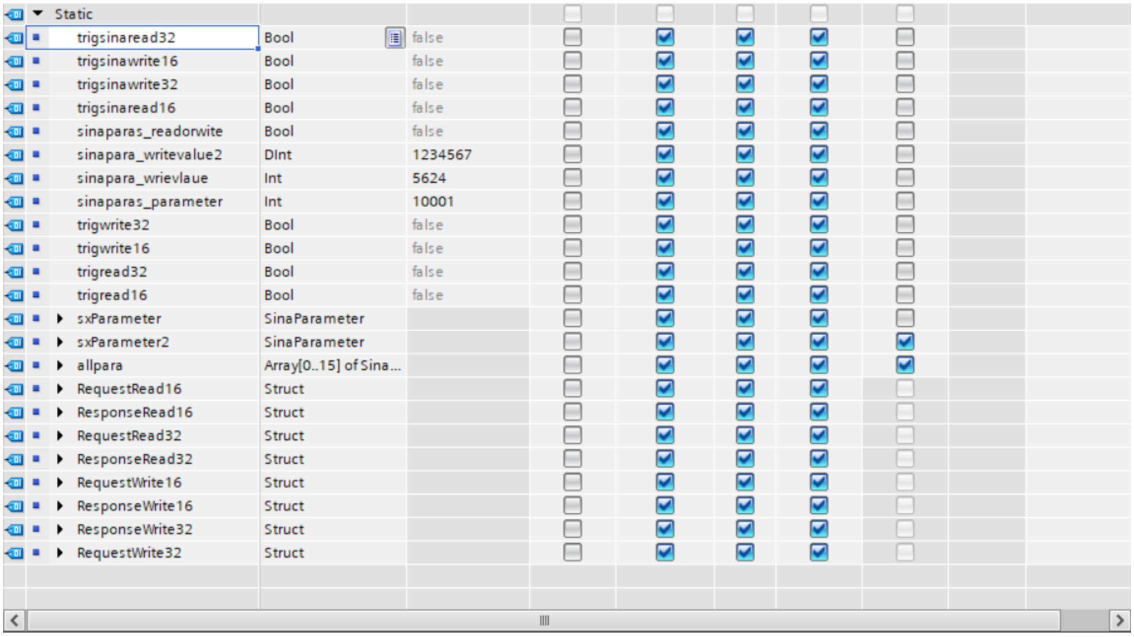


12.12 Use SINA_PARA_S to read and write servo parameters

All parameters inside the servo can be read or written through SINA_PARA_S, and continuous reading and writing of multiple parameters is temporarily not supported, that is, the SINA_PARA command is not supported. The usage steps are as follows.

12.12.1 Configure according to Section 12.3 first.

12.12.2 Add data blocks (some parameters are not used in the figure, the display is only helpful to read the following program)



Static			☐	☐	☐	☐	☐
trigsinaread32	Bool	false	☐	☑	☑	☑	☐
trigsinawrite16	Bool	false	☐	☑	☑	☑	☐
trigsinawrite32	Bool	false	☐	☑	☑	☑	☐
trigsinaread16	Bool	false	☐	☑	☑	☑	☐
sinaparas_readorwite	Bool	false	☐	☑	☑	☑	☐
sinapara_writevalue2	DInt	1234567	☐	☑	☑	☑	☐
sinapara_wrievlaue	Int	5624	☐	☑	☑	☑	☐
sinaparas_parameter	Int	10001	☐	☑	☑	☑	☐
trigwrite32	Bool	false	☐	☑	☑	☑	☐
trigwrite16	Bool	false	☐	☑	☑	☑	☐
trigread32	Bool	false	☐	☑	☑	☑	☐
trigread16	Bool	false	☐	☑	☑	☑	☐
sxParameter	SinaParameter		☐	☑	☑	☑	☐
sxParameter2	SinaParameter		☐	☑	☑	☑	☑
allpara	Array[0..15] of Sina...		☐	☑	☑	☑	☑
RequestRead16	Struct		☐	☑	☑	☑	☐
ResponseRead16	Struct		☐	☑	☑	☑	☐
RequestRead32	Struct		☐	☑	☑	☑	☐
ResponseRead32	Struct		☐	☑	☑	☑	☐
RequestWrite16	Struct		☐	☑	☑	☑	☐
ResponseWrite16	Struct		☐	☑	☑	☑	☐
ResponseWrite32	Struct		☐	☑	☑	☑	☐
RequestWrite32	Struct		☐	☑	☑	☑	☐

12.12.3 write programs

（1）The procedure for reading 16-bit parameter data is as follows.

SINA_PARA_S The input parameters are introduced as follows.

Start： Startup parameter read and write

ReadWrite： false is read. True is write.

Parameter： Set to servo parameter number + 10000, for example

parameter=10001 corresponds to P00.01;
parameter=10002 corresponds to P00.02;
parameter=10201 corresponds to P02.01;
parameter=11001 corresponds to P10.01;

ValueWrite1： The value of the 16-bit parameter that needs to be written.

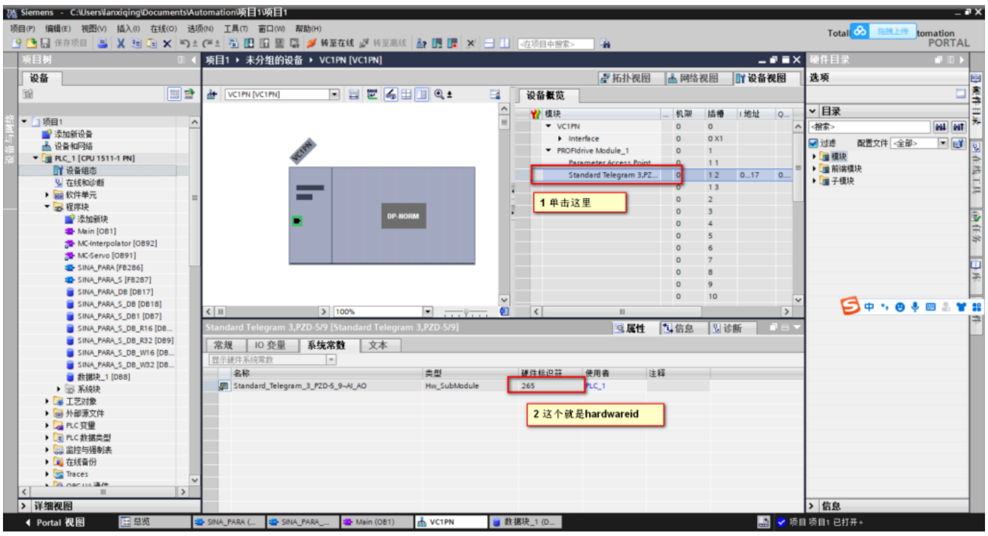
ValueWrite2： The value of the 32-bit parameter that needs to be written.

ValueRead1： The value of the 16-bit parameter read.

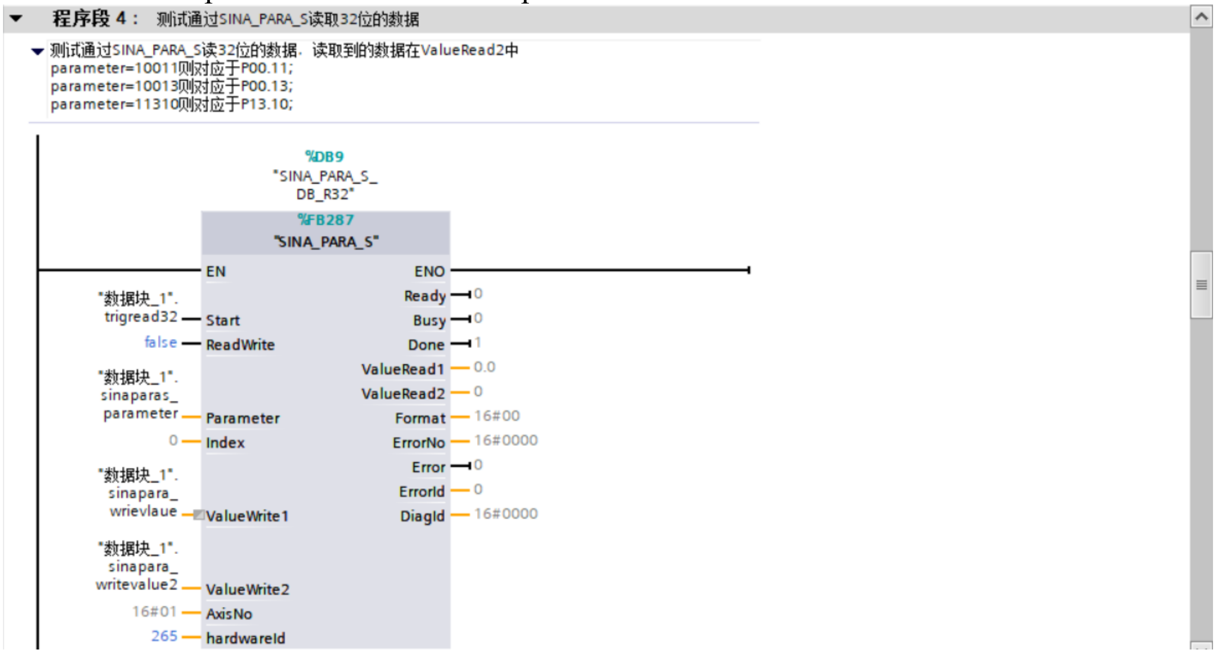
ValueRead2： The value of the 32-bit parameter read.

AxisNo:The fixed value is 1. No matter how many axes, it is set to 1. The specific axis to read and write is distinguished by the hardwareid.

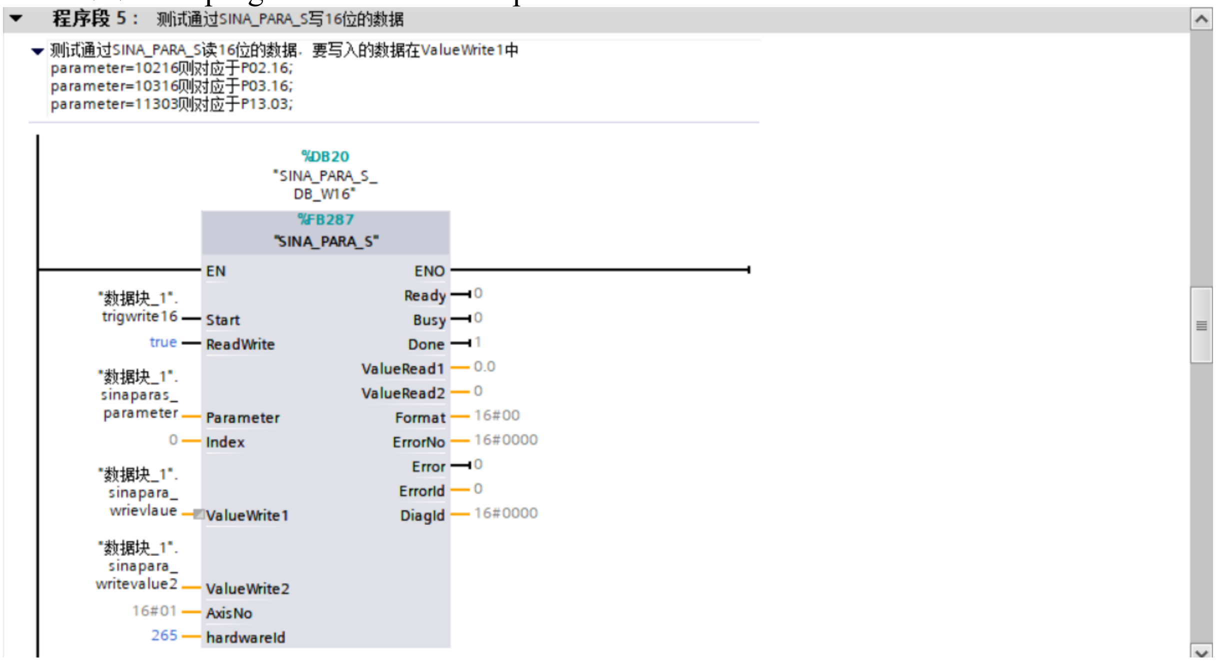
Hardwareid： Hardware identifier set to 3 of the message. As shown in the following figure.



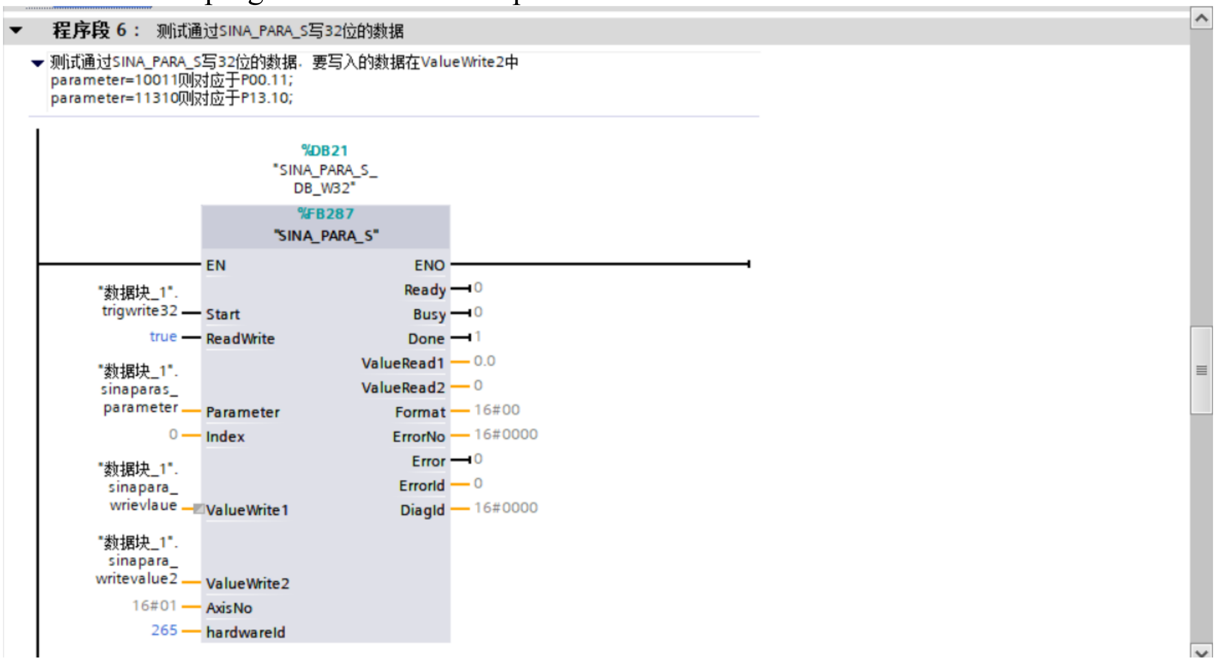
（2）The procedure to read 32-bit parameter data is as follows.



（3）The program to write 16-bit parameter data is as follows.



（4）The program to write 32-bit parameter data is as follows.

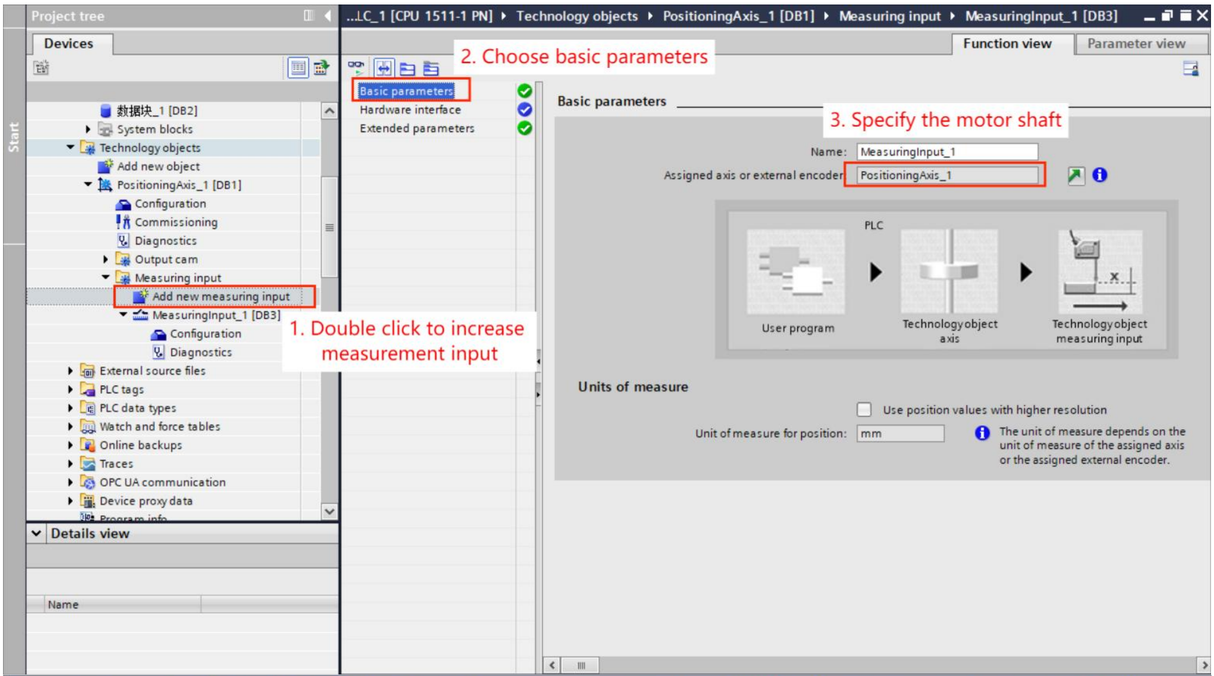


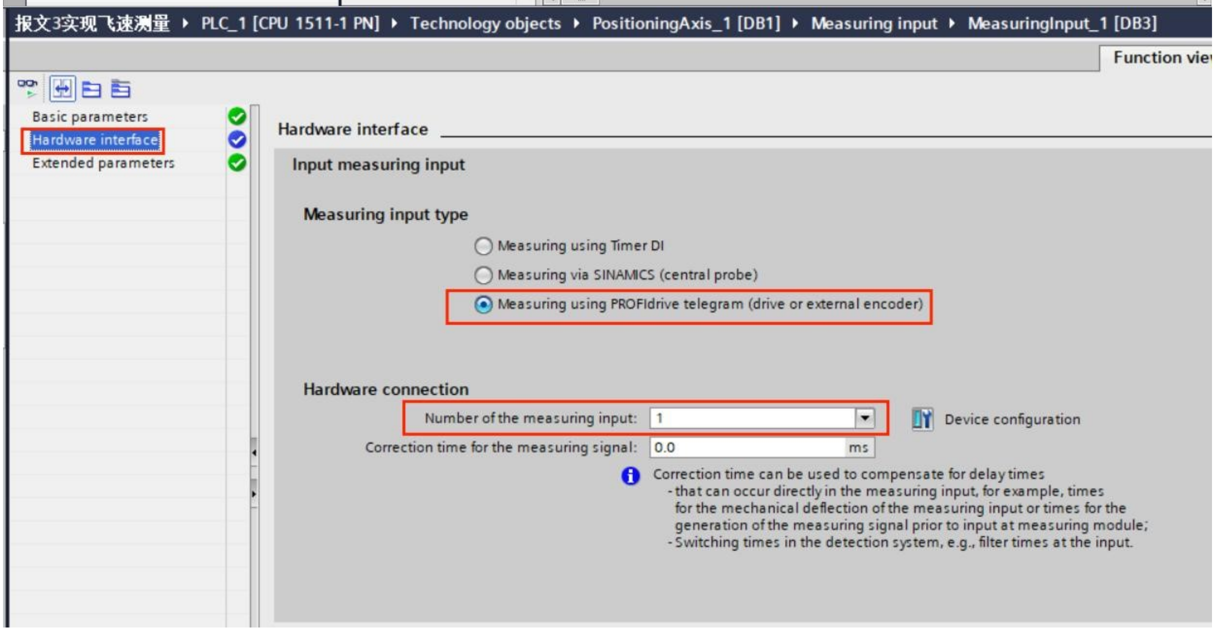
12.13 On-the-fly measurement using message 3 based on S7-1500

The servo supports the rapid measurement of the motor encoder, and the measurement pulse is fixedly input from DI1. After enabling on-the-fly measurement, the rising or falling edge of DI1 can trigger the latching of the motor encoder position.

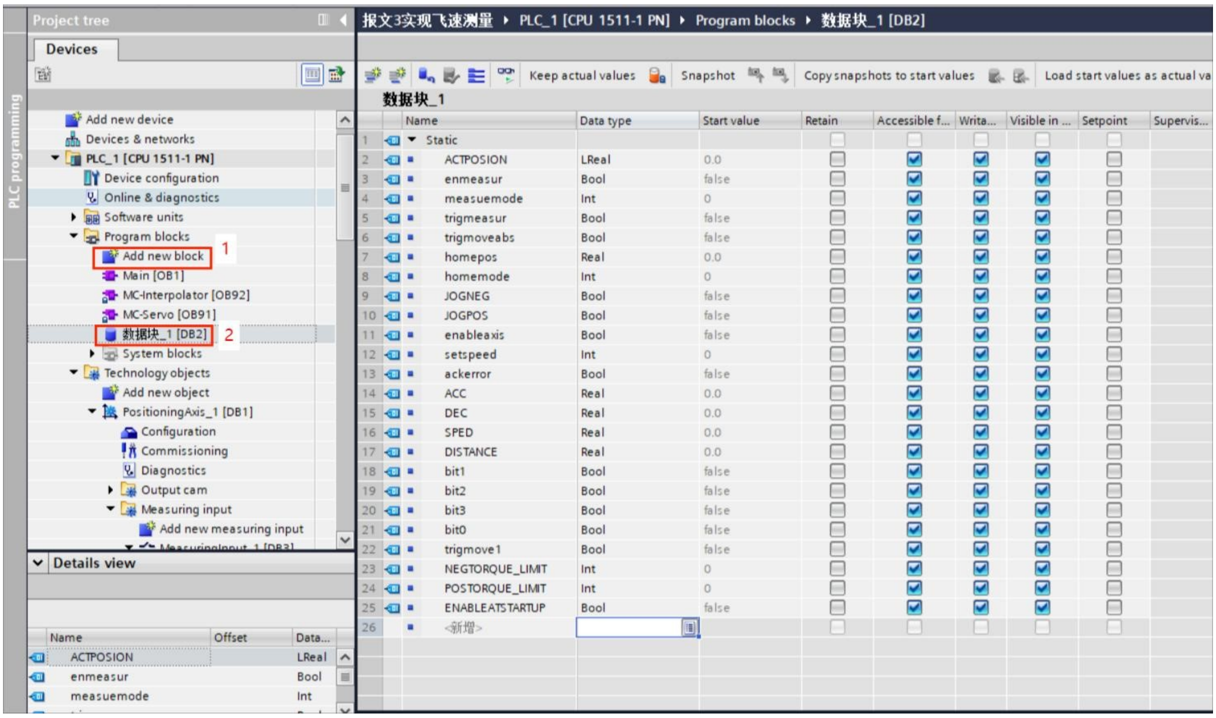
12.13.1 Configure according to Section 12.3 first.

12.13.2 Add measurement input configuration

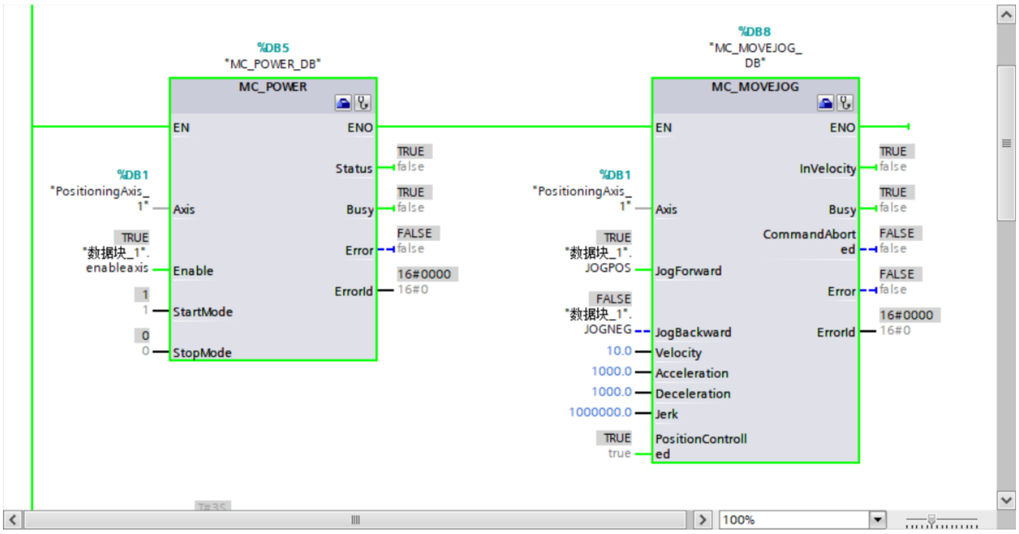


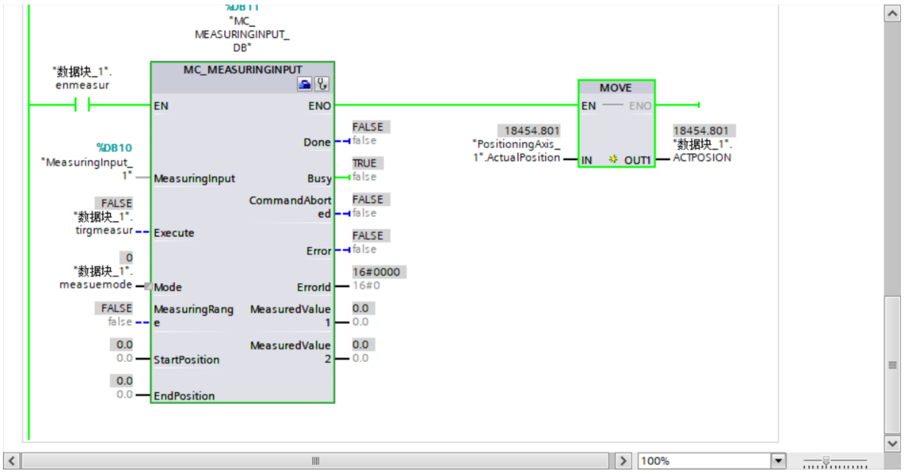


12.13.3 Add a data block (some variables in the figure are not used)



12.13.4 write programs





An introduction to measurement input modules.

MeasringInput： Configuration name of the measurement input.

Execute： Start measuring input.

Mode：

When Mode=0, measure the value of the encoder on the rising edge of DI1.

When Mode=1, measure the value of the encoder at the falling edge of DI1.

When Mode=2,measure the value of the encoder on the rising and falling edges of DI1.

Mode=3 Currently not supported

Mode=4 Not supported at the moment

MeasuringRange： The measurement range is activated. After activation, the measurement input will only be activated if the position value is between StartPosition and EndPosition.

12.14 Internal zero return mode for telegram 111

Please refer to chapter 5.2.9 for the homing mode.

Version Update Record

release date	Description of changes	version
2022-03-10	The naming of the servo series is updated to VCXXX, the version number is added, and the calibration manual	1.01
2022-03-16	Calibration Manual	1.02
2022-04-21	Split the manual to generate the VC330 resolver feedback servo manual	1.03
2022-12-13	Modify the description of CN3-9/10 pin, and modify the pin number of torque and speed block diagram	1.04
2022-12-21	Add STO function description and dynamic braking function description.	1.05
2023-09-01	Add -E structure dimension drawing	1.06