DA200A-F Series
AC Servo Drive PN Communication
Technical Guide

SHENZHEN INVT ELECTRIC CO., LTD.

Preface

Overview

Thanks for choosing DA200A-F series AC servo drive.

This manual mainly introduces the product hardware configuration, communication, PLC project configuration, and fault diagnosis. Read the manual carefully before installing and operating the drive.

Readers

Personnel with electrical professional knowledge (such as qualified electrical engineers or personnel with equivalent knowledge).

Change history

The manual is subject to change irregularly without prior notice due to product version upgrades or other reasons.

No.	Change description	Version	Release date
1	First release.	V1.0	April 2025

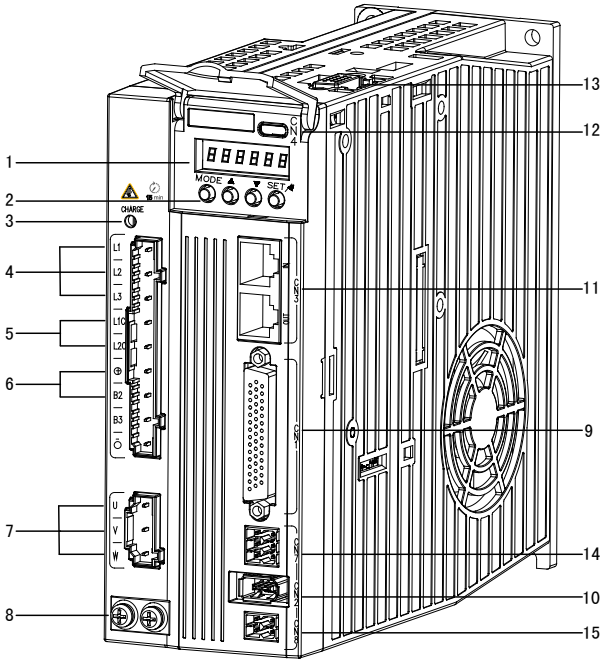
Contents

1 Hardware configuration

1.1 Terminal wiring

DA200A-F series servo drive that uses PN bus communication differs in overall appearance from the standard DA200 series servo drive, featuring the additional CN7 and CN8 terminals. The wiring definitions and functions of the CN1 terminal pins also differ slightly from those of the standard DA200 series. For details, see section 1.3 CN1 terminal definition. The CN3 terminal serves as the RJ45 port for PN communication, with cable entry from the top and exit from the bottom.

Figure 1-1 Outline drawing of the complete assembly



No.	Component	Description
1	LED display	Digital tube display
2	Operation panel	Menu key
3	CHARGE indicator	Main circuit power-on display
4	Main circuit power	Power input
5	Control circuit power	Control power input

No.	Component	Description
6	Regenerative resistor	External braking resistor
7	Motor	Motor power terminal
8	Grounding	PE safe grounding
9	CN1 interface	I/O control input/output signal
10	CN2 interface	1st encoder
11	CN3 interface	EtherCAT/PROFINET/CAN/RS485 communication port
12	CN4 interface	Upper computer USB communication port
13	CN5 interface	2nd encoder
14	CN7 interface	STO port
15	CN8 interface	Motor brake port

CN3 Ethernet RJ45 connector pinout:

The PROFIdrive and PROFINET communications use the standard RJ45 port. CN3 has two RJ45 interfaces, which are direction-independent (RT mode) and can be plugged in either way. The interface diagram is as follows. In PROFINET applications, the two interfaces are direction-independent and can be swapped.

Note: When using the IRT function, select CN3 interfaces based on the settings from the upper compuer. The upper port is Port 1, and the lower port is Port 2.

Figure 1-2 Two standard RJ45 interfaces

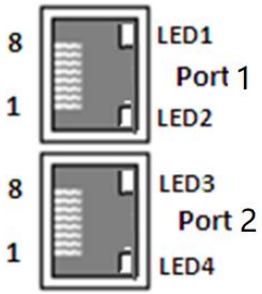


Table 1-1 Standard RJ45 interface functions

Pin	Name	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	Vcc	LED power supply
5	Vcc	LED power supply
6	RX-	Receive Data-

Pin	Name	Description
7	n/c	Not connected
8	FG	Ground of the housing

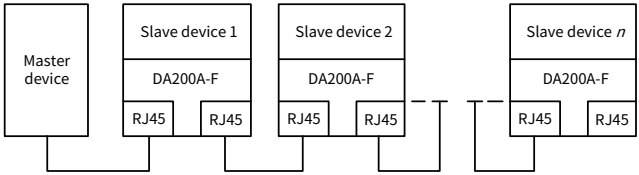
Table 1-2 CN3 interface LED indicators

LED	State	Description
LED1	Off	Port1 is not connected.
	On	Port1 has been connected.
LED2	Off	The network communication of Port1 is abnormal.
	Blinking	Port1 is in network communication.
	On	The network communication of Port1 is normal.
LED3	Off	Port2 is not connected.
	On	Port2 has been connected.
LED4	Off	The network communication of Port2 is abnormal.
	Blinking	Port2 is in network communication.
	On	The network communication of Port2 is normal.

1.2 Electrical connection

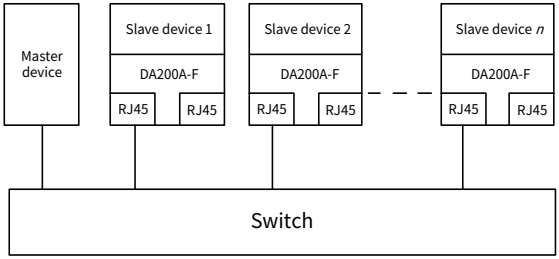
The PROFINET communication card adopts standard RJ45 interfaces, which can be used in a linear network topology and a star network topology. The electrical connection diagram is shown as follows.

Figure 1-3 Linear network topology electrical connection



Note: For the star network topology, you need to prepare PROFINET switches.

Figure 1-4 Star network topology electrical connection



1.3 CN1 terminal definition

DA200A-F series servo drive and DA200A-N series EtherCAT drive are the same in the IO terminals, which include seven DI terminals and four DO terminals, as described as follows.

Table 1-3 CN1 terminals

Pin	Signal	Name	Pin	Signal	Name
1	24V ground	24V power ground	23	-	Unused
2	COM+	Common terminal of digital input	24	-	Unused
3	DI7	Digital input 7	25	-	Unused
4	-	Unused	26	OCZ	Z-phase open collector output
5	DO1-	Digital output 1 -	27	OZ-	Z-phase differential output -
6	GND	Signal ground	28	OZ+	Z-phase differential output +
7	-	Unused	29	DO4+	Digital output 4 +
8	DO3-	DO3-	30	OCB	B-phase open collector output
9	-	Unused	31	-	Unused
10	DI3	Digital input 3	32	-	Unused
11	DO3+	Digital output 3 +	33	-	Unused
12	GND	Signal ground	34	DI5	Digital input 5
13	-	Unused	35	DO4-	Digital output 4 -
14	DO1+	Digital output 1 +	36	OCA	A-phase open collector output
15	DO2+	Digital output 2 +	37	DI2	Digital input 2
16	DI1	Digital input 1	38	-	Unused
17	DI6	Digital input 6	39	DI4	Digital input 4
18	-	Unused	40	24V	Internal 24V power supply
19	DO2-	Digital output 2 -	41	OB+	B-phase differential output +
20	-	Unused	42	OB-	B-phase differential output -
21	-	Unused	43	OA-	A-phase differential output -
22	-	Unused	44	OA+	A-phase differential output +

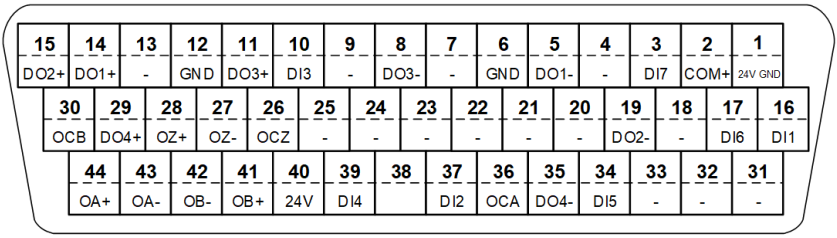
Table 1-4 Default configuration in PN communication mode (digital signal)

Signal	Pin	Name	PN communication mode		
			Default	Symbol	Function
DI1	16	Digital input 1	-	-	User configurable
DI2	37	Digital input 2	-	-	User configurable
DI3	10	Digital input 3	0x001	POT	Positive direction drive disabled
DI4	39	Digital input 4	0x002	NOT	Negative direction drive disabled

Signal	Pin	Name	PN communication mode		
			Default	Symbol	Function
DI5	34	Digital input 5	0x017	HOME	Zero position switch
DI6	17	Digital input 6	0x016	EMG	Emergency stop
DI7	3	Digital input 7	-	-	User configurable
DI8	4	Digital input 8	-	-	Not available
DI9	18	Digital input 9	-	-	Not available
DI10	22	Digital input 10	-	-	Not available
DO1+	14	Digital output 1 +	0x001	RDY	Servo ready for output
DO2+	15	Digital output 2 +	0x003	ALM	Fault output
DO3+	11	Digital output 3 +	0x005	BRK	Electromagnetic brake release signal
DO4+	29	Digital output 4 +	-	-	User configurable

Note: For the PN bus communication servo drive, DI1 and DI2 can be configured as probe 1 and probe 2. If you intend to reuse DI1 and DI2 for other functions, make sure the probe functions are disabled to prevent functional conflicts.

The CN1 terminal uses the DB44 connector, with the pin layout shown in the following figure.

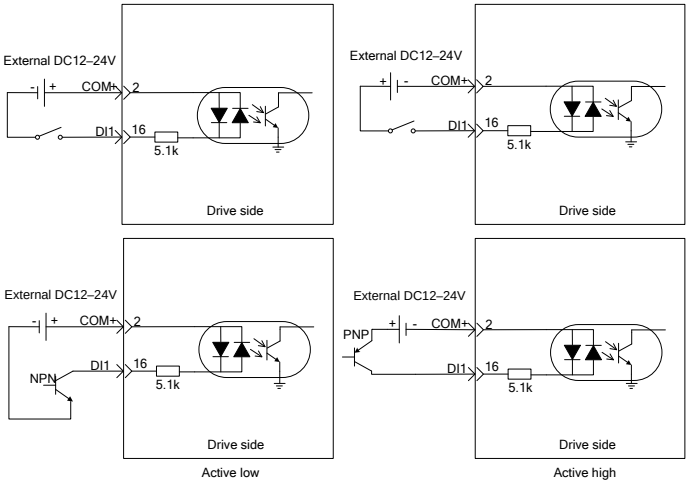


Bus interface definition

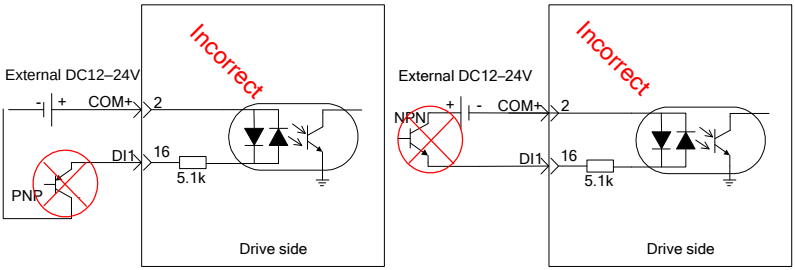
The PN bus communication servo drive does not support analog inputs or outputs, but it provides seven digital inputs and four groups of differential digital output. The PN bus communication servo drive and the standard servo drive are similar in the external wiring. For details, see section 5.4 Bus control mode in *DA200A Series AC Servo Drive User Manual*.

The digital input is illustrated using DI1 as an example, since the interface circuits for DI1 through DI7 are identical and follow the same wiring method.

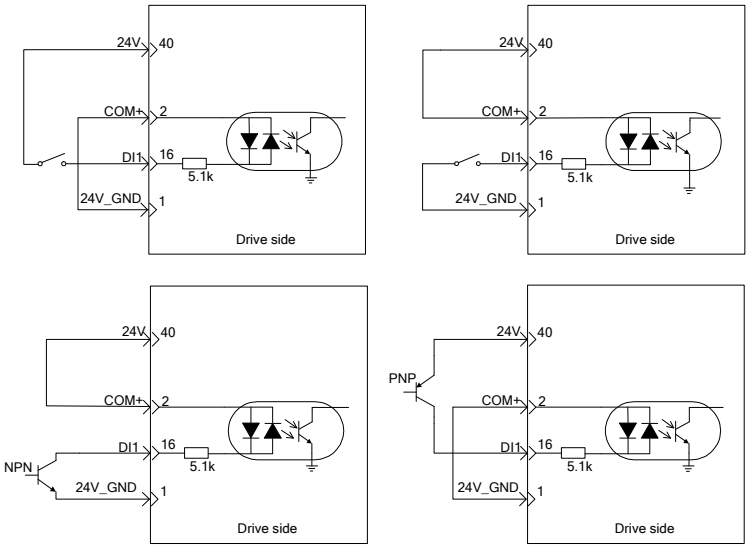
Wiring when using the user-provided power supply



Incorrect wiring method: mixed use of PNP and NPN transistors



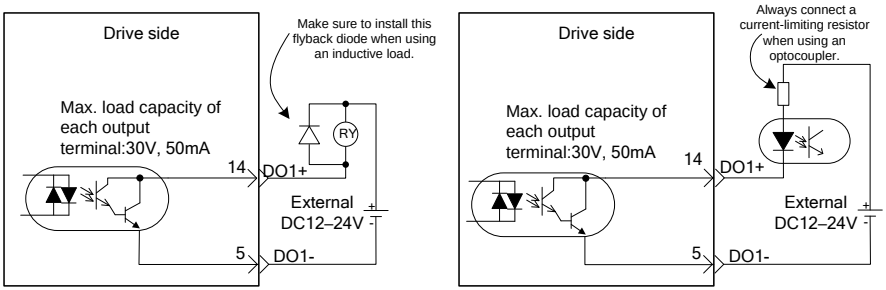
Wiring when using the locally provided power supply



- The digital input circuit has two connection methods: mechanical switch connection and open collector connection using transistor (NPN or PNP, but the two cannot be mixed).
- Either the 24V power supply with a maximum current of 100mA carried by the servo drive or the user-provided 12V–24V power supply can be used as the 24V power supply.

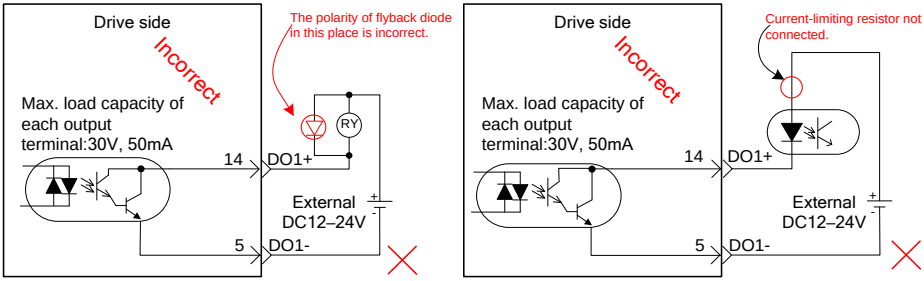
The external wiring of digital differential output is illustrated using DO1 as an example, since the interface circuits for DO1 through DO4 are identical and follow the same wiring method.

Wiring when using the user-provided power supply



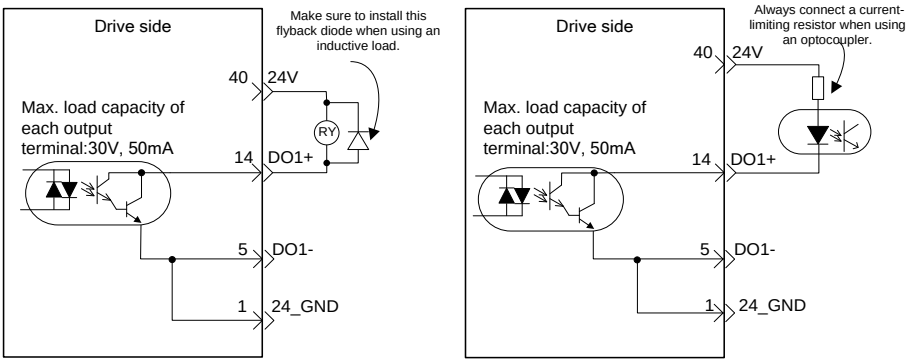
① Connection to relay coil ② Connection to optocoupler

Incorrect wiring



① Connection to relay coil ② Connection to optocoupler

Wiring when using the locally provided power supply



① Connection to relay coil ② Connection to optocoupler

- There are four digital output circuits, all of which are in the open-collector output structure. They can be used to drive relay coils or optocoupler loads with the load capacity shown in the figures.
- When connecting inductive loads such as relay coils, install a flyback diode in the way shown in the figures. When connecting to optocouplers, a current-limiting resistor must be connected; otherwise, damage to the drive may occur.
- The local 24V power supply can only provide a maximum current of 100mA. If the actual load current exceeds 100mA, please use your own power supply with the recommended capacity of 500mA.

2 PROFINET communication protocol

DA200A-F servo drive communicates with a controller using the PROFINET IO Ethernet real-time protocol and adopts PROFIdrive messages for drive control. PROFIdrive is a standard protocol for combined drive technology in PROFIBUS and PROFINET communication systems, which is widely used in production and process automation fields. It allows users to run automation applications with PROFIBUS DP and PROFINET IO easily and quickly without any changes. DA200A-F supports RT, IRT, and NRT channels. The RT real-time channel is used for transmitting IO data and alarms, the IRT channel is used for precise time-synchronized data transmission, and the NRT non-real-time channel is used for transmitting control commands, diagnostic information, drive configuration data, and other non-cyclic data.

2.1 Supported telegrams

DA200A-F series servo drive supports the following main telegrams: Standard telegrams 1, 2, 3, 5, 7, and 9; SIEMENS telegrams 102, 105, 110, and 111; and INVT defined telegrams DP-V0 and DP-V0-1. The supported supplementary telegrams include SIEMENS telegram 750 and INVT telegram 950.

The drive supports automatic telegram recognition, without the need of setting on the upper computer. When creating the TIA Portal project, select the PN main telegram and supplementary telegram, then compile and download the configuration to the PLC. The current telegrams can be viewed on the upper computer through status parameters R0.67 and R0.68.

Telegram	Max. PZD count		Description
	Receive word	Send word	
Standard telegram 1	2	2	R0.67=1
Standard telegram 2	4	4	R0.67=2
Standard telegram 3	5	9	R0.67=3
Standard telegram 5	9	9	R0.67=5
Standard telegram 7	2	2	R0.67=7
Standard telegram 9	10	5	R0.67=9
SIEMENS telegram 102	6	10	R0.67=102
SIEMENS telegram 105	10	10	R0.67=105
SIEMENS telegram 110	12	7	R0.67=110
SIEMENS telegram 111	12	12	R0.67=111
INVT defined telegram DP-V0	16	16	R0.68=200
INVT defined telegram DP-V0-1	16	16	R0.68=200
SIEMENS supplementary telegram 750	3	1	R0.67=750

Telegram	Max. PZD count		Description
	Receive word	Send word	
INVT supplementary telegram 950	5	5	R0.67=950

Note: One PZD equals one word. From the perspective of the servo drive, the process data received is referred to as the receive word, and the process data to be sent is referred to as the send word.

Only when DA200A-F is connected to SIMATIC S7-1500 and the TIA Portal version is V14 or higher, standard telegram 5 and SIEMENS telegram 105 are available.

The supplementary telegram must be used together with the main telegram and cannot be used independently.

- **Speed-based control mode**

Telegram	1		2		3		5		102		105	
Application level	1		4		1.4		4		1.4		4	
PZD1	STW1	ZSW1	STW1	ZSW1	ZSW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOLL_A	NIST_A	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B
PZD3	⬆	⬇										
PZD4			STW2	ZSW2	STW2	ZSW2	STW2	ZSW2	STW2	ZSW2	STW2	ZSW2
PZD5					G1_STW	G1_ZSW	G1_STW	G1_ZSW	MOMRED	MELDW	MOMRED	DELDW
PZD6	Receive telegram from PROFINET	Send telegram to PROFINET				G1_XIST1	XERR	G1_XIST1	G1_STW	G1_ZSW	G1_STW	G1_ZSW
PZD7										G1_XIST1	XERR	G1_XIST1
PZD8						G1_XIST2	FPC	G1_XIST2				
PZD9										G1_XIST2	KPC	G1_XIST2
PZD10												

When using telegram 1, 2, 3, 5, 102, or 105 in speed-based control mode, set the servo parameters as follows:

Set P0.03 [Control mode selection] = Speed mode.

Set P0.40 [Speed command selection] = Bus input.

Set P4.10 [Upper computer type] = Bus input.

Note: The servo parameters shall be set based on the position mode when standard telegram 5 or SIEMENS telegram 105 is selected, the configuration technology object is positioning axis or synchronous axis, and dynamic servo control (DSC) is enabled upon configuration.

- **Position-based control mode**

Telegram	7		9		110		111	
Application level	3		3		3		3	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	SATZANW	AKTSATZ	SATZANW	AKTSATZ	SATZANW	AKTSATZ	SATZANW	AKTSATZ
PZD3	⬆ Receive telegram from PROFINET	⬇ Send telegram to PROFINET	STW2	ZSW2	POS_STW	POS_ZSW	POS_STW2	POS_ZSW2
PZD4			MDI_TARPOS	XIST_A	STW2	ZSW2	STW2	ZSW2
PZD5					OVERRIDE	MELDW	OVERRIDE	MELDW
PZD6			MDI_VELOCITY		MDI_TARPOS	XIST_A	MDI_TARPOS	XIST_A
PZD7								
PZD8			MDI_ACC		MDI_VELOCITY		MDI_VELOCITY	NIST_B
PZD9			MDI_DEC					
PZD10			MDI_MOD		MDI_ACC		MDI_ACC	FAULT_CODE
PZD11					MDI_DEC		MDI_DEC	WARN_CODE
PZD12					MDI_MOD		user[D]	user[D]

When using telegram 7, 9, 110, 111 in position control mode, set the servo parameters as follows:

Set P0.03 [Control mode selection] = Position mode.

P0.20 [Position command selection] = PTP mode.

Set P4.10 [Upper computer type] = Bus input.

Note: "User" is used to set user-defined parameters.

- **Supplementary telegram**

SIEMENS supplementary telegram 750

Telegram	750	
Application level	-	
PZD1	M_ADD1	M_ACT
PZD2	M_LIMIT_POS	⬇ Send telegram to PROFINET
PZD3	M_LIMIT_NEG	
	⬆ Receive telegram from PROFINET	

When the TIA Portal project uses additional telegram 750, servo parameters are monitored as follows:

R0.68 [PROFIdrive supplementary telegram selection] = 750

INVT supplementary telegram 950

Telegram	950	
Application level	-	
PZD1	AUX950_CMD1	AUX950_FBK1
PZD2	AUX950_CMD2	AUX950_FBK2
PZD3	AUX950_CMD3	AUX950_FBK3
PZD4	AUX950_CMD4	AUX950_FBK4
PZD5	AUX950_CMD5	AUX950_FBK5
	⬆ Receive telegram from PROFINET	⬇ Send telegram to PROFINET

The functions of the user-defined control words AUX950_CMD1 to AUX950_CMD5 in PN additional telegram 950 are configured through parameters P6.10 to P6.14:

0: No function; 1: Brake output (dedicated brake D0); 2: Speed loop gain P2.00; 3: Speed loop integral time P2.01; 4: DO output

The functions of user-defined status words AUX950_FBK1 to AUX950_FBK5 in PN additional telegram 950 can be configured through parameters P6.15 to P6.19:

0: No function; 1: Output current (R0.10); 2: DC bus voltage (R0.07); 3: Fault code (R0.99); 4: Motor temperature (R0.60); 5: Drive temperature (R0.11); 6: DI signal status (R1.00); 7: DO signal status (R1.01); 8: Rotor position relative to Z pulse (R0.14); 9: Turns of multi-turn encoder (R0.25)

2.2 I/O data signal

Signal	Description	Receive/ Send word	Data type	Calibration
STW1	CW 1	Receive word	U16	-
STW2	CW 2	Receive word	U16	-
ZSW1	SW 1	Send word	U16	-
ZSW2	SW 2	Send word	U16	-
NSOLL_A	Rotation speed set value (16-bit)	Receive word	I16	4000hex==Rated rotation speed
NSOLL_B	Rotation speed set value B (32-bit)	Receive word	I32	40000000hex==Rated rotation speed
NIST_A	Actual speed value A (16-bit)	Send word	I16	4000hex==Rated rotation speed
NIST_B	Actual speed value B (32-bit)	Send word	I32	40000000hex==Rated rotation speed
G1_STW	Encoder 1 control	Receive word	U16	-

Signal	Description	Receive/ Send word	Data type	Calibration
	word			
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==P4.56
MELDW	Message word	Send word	U16	-
KPC	Position gain	Receive word	I32	-
XERR	Following error	Receive word	I32	-
SATZANW	Select position program segment	Receive word	U16	-
AKTSATZ	Selected position program segment	Send word	U16	-
MDI_TARPOS	MDI position	Receive word	I32	1hex==1LU
MDI_VELOCITY	MDI speed	Receive word	I32	1hex==1000LU/min
MDI_ACC	MDI acceleration multiplier	Receive word	I16	4000hex==100%
MDI_DEC	MDI deceleration multiplier	Receive word	I16	4000hex==100%
XIST_A	Actual position value A	Send word	I32	1hex==1LU
OVERRIDE	Position speed multiplier	Receive word	I16	4000hex==100%
MDI_MODE	Position MDI mode	Receive word	U16	-
FAULT_CODE	Fault code	Send word	U16	-
WARN_CODE	Alarm code	Send word	U16	-
POS_ZSW	Position status word	Send word	U16	-
M_ADD1	Additional torque	Receive word	I16	4000hex==P4.56
M_LIMIT_POS	Torque positive limit	Receive word	I16	4000hex==P4.56
M_LIMIT_NGE	Torque negative limit	Receive word	I16	4000hex==P4.56
M_ACT	Actual torque	Send word	I16	4000hex==P4.56

2.3 Control word definition

2.3.1 STW1 control word (telegram 1/2/3/5)

When telegram 5 is used, STW1.4, STW1.5, and STW1.6 are disabled.

Signal	Description
STW1.0	1 = ON (Pulse can be enabled) 0 = OFF1 (Brake through ramp function generator)
STW1.1	1 = No OFF2 (Allow enabling) 0 = OFF2(Immediately eliminate the pulse and disable the connection)
STW1.2	1 = No OFF3(Allow enabling) 0 = OFF3(Brake through ramp, eliminate the pulse, and disable the connection)
STW1.3	1 = Enable running (Pulse can be enabled) 0 = Disable running (Cancel the pulse)
STW1.4	1 = Run condition (Ramp function generator can be enabled) 0 = Disable ramp function generator (Ramp function generator output is set to zero)
STW1.5	1 = Keep ramp function generator 0 = Freeze ramp function generator (Freeze ramp function generator output)
STW1.6	1 = Enable set value 0 = Disable set value (Ramp function generator input is set to zero)
STW1.7	1 = ON (Response fault)
STW1.8	Reserved
STW1.9	Reserved
STW1.10	1 = Control through PLC
STW1.11	1 = Inverse set value
STW1.12	Reserved
STW1.13	Reserved
STW1.14	Reserved
STW1.15	Reserved

2.3.2 STW1 control word (telegram 102/5)

When telegram 105 is used, STW1.4, STW1.5, and STW1.6 are disabled.

Signal	Description
STW1.0	↑ = ON(Pulse can be enabled) 0 = OFF1(Brake through ramp function generator)
STW1.1	1 = No OFF2 (Allow enabling)

Signal	Description
	0 = OFF2 (Immediately eliminate the pulse and disable the connection)
STW1.2	1 = No OFF3 (Allow enabling) 0 = OFF3 (Brake through ramp, eliminate the pulse, and disable the connection)
STW1.3	1 = Enable running (Pulse can be enabled) 0 = Disable running (Cancel the pulse)
STW1.4	1 = Run condition (Ramp function generator can be enabled) 0 = Disable ramp function generator (Ramp function generator output is set to zero)
STW1.5	1 = Keep ramp function generator 0 = Freeze ramp function generator (Freeze ramp function generator output)
STW1.6	1 = Enable set value 0 = Disable set value (Ramp function generator input is set to zero)
STW1.7	↑ = ON Response fault
STW1.8	Reserved
STW1.9	Reserved
STW1.10	1 = Control through PLC
STW1.11	Reserved
STW1.12	1 = Unconditionally release the brake
STW1.13	Reserved
STW1.14	1 = Closed-loop torque control takes effect 0 = Closed-loop speed control takes effect
STW1.15	Reserved

2.3.3 STW2 control word (telegram 2/3/5/102/105)

Signal	Description
STW2.0	Reserved
STW2.1	Reserved
STW2.2	Reserved
STW2.3	Reserved
STW2.4	Reserved
STW2.5	Reserved
STW2.6	Reserved
STW2.7	Reserved
STW2.8	1= Run to the fixed stop
STW2.9	Reserved

Signal	Description
STW2.10	Reserved
STW2.11	Reserved
STW2.12	Master life symbol, bit 0
STW2.13	Master life symbol, bit 1
STW2.14	Master life symbol, bit 2
STW2.15	Master life symbol, bit 3

2.3.4 STW1 control word (telegram 7/9/110/111)

Signal	Description
STW1.0	↑ = ON (Pulse can be enabled) 0 = OFF1 (Brake through ramp function generator, eliminate the pulse, and ready for connection)
STW1.1	1 = No OFF2 (Allow enabling) 0 = OFF2 (Immediately eliminate the pulse and disable the connection)
STW1.2	1 = No OFF3 (Allow enabling) 0 = OFF3 (Brake through ramp, eliminate the pulse, and disable the connection)
STW1.3	1 = Enable running (Pulse can be enabled) 0 = Disable running (Cancel the pulse)
STW1.4	1 = Do not refuse to execute the task 0 = Refuse to execute the task (decelerate to stop at maximum deceleration speed)
STW1.5	1 = Do not suspend the task 0 = Suspend the task
STW1.6	↑ = Activate running task
STW1.7	↑ = Response fault
STW1.8	1 = JOG1 signal source
STW1.9	1 = JOG2 signal source
STW1.10	1 = Control through PLC
STW1.11	1 = Start homing 0 = Stop homing
STW1.12	Reserved
STW1.13	Reserved
STW1.14	Reserved
STW1.15	Reserved

2.3.5 STW2 control word (telegram 9/110/111)

Signal	Description
STW2.0	Reserved
STW2.1	Reserved
STW2.2	Reserved
STW2.3	Reserved
STW2.4	Reserved
STW2.5	Reserved
STW2.6	Reserved
STW2.7	Reserved
STW2.8	1= Run to the fixed stop
STW2.9	Reserved
STW2.10	Reserved
STW2.11	Reserved
STW2.12	Master life symbol, bit 0
STW2.13	Master life symbol, bit 1
STW2.14	Master life symbol, bit 2
STW2.15	Master life symbol, bit 3

2.3.6 SATZANW control word

Signal	Description
SATZANW.0	1 = Run program segment selection, bit 0
SATZANW.1	1 = Run program segment selection, bit 1
SATZANW.2	1 = Run program segment selection, bit 2
SATZANW.3	1 = Run program segment selection, bit 3
SATZANW.4	1 = Run program segment selection, bit 4
SATZANW.5	1 = Run program segment selection, bit 5
SATZANW.6	Reserved
SATZANW.7	Reserved
SATZANW.8	Reserved
SATZANW.9	Reserved
SATZANW.10	Reserved
SATZANW.11	Reserved
SATZANW.12	Reserved
SATZANW.13	Reserved
SATZANW.14	Reserved
SATZANW.15	1 = Activate MDI 0 = Do not activate MDI

When SATZANW.15 = 0 (that is, MDI is not active), the system enters the run program segment selection mode. SATZANW.bit0 to bit5 represent the 6 bits used for selecting segments in this mode, supporting segment positions 0 to 63 within the PtP group. The execution mode, speed, and other parameters for each segment are configured through the corresponding control word.

When SATZANW.15 = 1 (that is, MDI is active), telegrams 7, 9, and 110 trigger the execution of PtP2.55 [Segment position 127]. Telegram 7 can be controlled through PtP2.54 [Control word for segment 127]. Telegrams 9 and 110 rely on the MDI_MODE control word to determine whether absolute or relative positioning is selected. Target speed, deceleration time, and other instructions are linked to parameters such as P5.36 [Target speed 15] and P5.95 [Deceleration time 15] through control words.

2.3.7 MDI_MOD control word

Signal	Description
MDI_MOD.0	1 = Absolute positioning selected 0 = Relative positioning selected
MDI_MOD.1	Reserved
MDI_MOD.2	Reserved
MDI_MOD.3	Reserved
MDI_MOD.4	Reserved
MDI_MOD.5	Reserved
MDI_MOD.6	Reserved
MDI_MOD.7	Reserved
MDI_MOD.8	Reserved
MDI_MOD.9	Reserved
MDI_MOD.10	Reserved
MDI_MOD.11	Reserved
MDI_MOD.12	Reserved
MDI_MOD.13	Reserved
MDI_MOD.14	Reserved
MDI_MOD.15	Reserved

2.3.8 POS_STW control word

Signal	Description
POS_STW.0	Reserved
POS_STW.1	1 = Set reference point 0 = Do not set reference point
POS_STW.2	1 = Reference point stop active

Signal	Description
POS_STW.3	Reserved
POS_STW.4	Reserved
POS_STW.5	1 = Jog increment activated 0 = Jog speed activated
POS_STW.6	Reserved
POS_STW.7	Reserved
POS_STW.8	Reserved
POS_STW.9	Reserved
POS_STW.10	Reserved
POS_STW.11	Reserved
POS_STW.12	Reserved
POS_STW.13	Reserved
POS_STW.14	Reserved
POS_STW.15	Reserved

2.3.9 POS_STW1 positioning control word

Signal	Description
POS_STW1.0	Run program segment selection, bit 0
POS_STW1.1	Run program segment selection, bit 1
POS_STW1.2	Run program segment selection, bit 2
POS_STW1.3	Run program segment selection, bit 3
POS_STW1.4	Run program segment selection, bit 4
POS_STW1.5	Run program segment selection, bit 5
POS_STW1.6	Reserved
POS_STW1.7	Reserved
POS_STW1.8	1 = Absolute positioning selected 0 = Relative positioning selected
POS_STW1.9	0 = Absolute positioning through shortest distance
POS_STW1.10	1 = Absolute positioning / MDI direction selection: forward 2 = Absolute positioning / MDI direction selection: reverse 3 = Absolute positioning through shortest distance
POS_STW1.11	Reserved
POS_STW1.12	1 = Continuous transmission 0 = MDI program segment switching triggered by a rising edge ↑ of the run task (STW1.6)
POS_STW1.13	Reserved
POS_STW1.14	1 = Signal adjustment selected

Signal	Description
	0 = Signal positioning selected
POS_STW1.15	1 = MDI selection

2.3.10 POS_STW2 positioning control word

Signal	Description
POS_STW2.0	Reserved
POS_STW2.1	1 = Set reference point
POS_STW2.2	1 = Reference point stop active
POS_STW2.3	Reserved
POS_STW2.4	Reserved
POS_STW2.5	1 = Jog incremental mode active 0 = Jog speed mode active
POS_STW2.6	Reserved
POS_STW2.7	Reserved
POS_STW2.8	Reserved
POS_STW2.9	1 = Start reference point search in negative direction 0 = Start reference point search in positive direction
POS_STW2.10	Reserved
POS_STW2.11	Reserved
POS_STW2.12	Reserved
POS_STW2.13	Reserved
POS_STW2.14	1= Activate soft limit switch
POS_STW2.15	1 = Stop active

2.4 Status word definition

2.4.1 ZSW1 status word (telegram 1/2/3/5)

Signal	Description
ZSW1.0	1 = Servo ready to start
ZSW1.1	1 = Ready to run
ZSW1.2	1= Enable running
ZSW1.3	1 = Fault exists
ZSW1.4	1 = Free stop disabled
ZSW1.5	1 = Quick stop disabled
ZSW1.6	1 = Switch-on inhibit active
ZSW1.7	Reserved
ZSW1.8	1 = Deviation of speed set value from actual value is within tolerance

ZSW1.9	1 = Control request
ZSW1.10	1 = Comparative value of *f* or *n* reached or exceeded
ZSW1.11	Reserved
ZSW1.12	1 = Open the brake
ZSW1.13	1 = No motor overtemperature alarm
ZSW1.14	1 = Motor forward rotating 0 = Motor reverse rotating
ZSW1.15	1 = No drive overloaded alarm

2.4.2 ZSW2 status word (telegram 2/3/5)

Signal	Description
ZSW2.0	Reserved
ZSW2.1	Reserved
ZSW2.2	Reserved
ZSW2.3	Reserved
ZSW2.4	Reserved
ZSW2.5	Reserved
ZSW2.6	Reserved
ZSW2.7	Reserved
ZSW2.8	1= Run to the fixed stop
ZSW2.9	Reserved
ZSW2.10	1 = Pulse enabling
ZSW2.11	Reserved
ZSW2.12	Slave life symbol, bit 0
ZSW2.13	Slave life symbol, bit 1
ZSW2.14	Slave life symbol, bit 2
ZSW2.15	Slave life symbol, bit 3

2.4.3 ZSW1 status word (telegram 102/105)

Signal	Description
ZSW1.0	1 = Servo ready to start
ZSW1.1	1 = Ready to run
ZSW1.2	1= Enable running
ZSW1.3	1 = Fault exists
ZSW1.4	1 = Coasting to stop invalid
ZSW1.5	1 = Quick stop invalid
ZSW1.6	1 = Switch-on inhibit active
ZSW1.7	Reserved

Signal	Description
ZSW1.8	1 = Deviation of speed set value from actual value is within tolerance
ZSW1.9	1 = Control request
ZSW1.10	1 = Comparative value of *f* or *n* reached or exceeded
ZSW1.11	Reserved
ZSW1.12	Reserved
ZSW1.13	Reserved
ZSW1.14	1 = Closed-loop torque control takes effect
ZSW1.15	Reserved

2.4.4 ZSW2 status word (telegram 102/105)

Signal	Description
ZSW2.0	Reserved
ZSW2.1	Reserved
ZSW2.2	Reserved
ZSW2.3	Reserved
ZSW2.4	Reserved
ZSW2.5	1 = Open the brake
ZSW2.6	Reserved
ZSW2.7	Reserved
ZSW2.8	1= Run to the fixed stop
ZSW2.9	Reserved
ZSW2.10	Reserved
ZSW2.11	Reserved
ZSW2.12	Slave life symbol, bit 0
ZSW2.13	Slave life symbol, bit 1
ZSW2.14	Slave life symbol, bit 2
ZSW2.15	Slave life symbol, bit 3

2.4.5 ZSW1 status word (telegram 7/9/110/111)

Signal	Description
ZSW1.0	1 = Ready to switch on
ZSW1.1	1 = Ready to run
ZSW1.2	1= Enable running
ZSW1.3	1 = Fault exists
ZSW1.4	1 = Coasting to stop invalid
ZSW1.5	1 = Quick stop invalid
ZSW1.6	1 = Switch-on inhibit active

Signal	Description
ZSW1.7	1 = Alarm exists
ZSW1.8	1 = Following error within tolerance
ZSW1.9	1 = Control request
ZSW1.10	1 = Target position reached
ZSW1.11	1 = Reference point already set
ZSW1.12	1 = Program block activated
ZSW1.13	1 = Fixed set value
ZSW1.14	Reserved
ZSW1.15	Reserved

2.4.6 ZSW2 status word (telegram 9/110/111)

Signal	Description
ZSW2.0	Reserved
ZSW2.1	Reserved
ZSW2.2	Reserved
ZSW2.3	Reserved
ZSW2.4	Reserved
ZSW2.5	Reserved
ZSW2.6	Reserved
ZSW2.7	Reserved
ZSW2.8	1= Run to the fixed stop
ZSW2.9	Reserved
ZSW2.10	1 = Pulse enabling
ZSW2.11	Reserved
ZSW2.12	Slave life symbol, bit 0
ZSW2.13	Slave life symbol, bit 1
ZSW2.14	Slave life symbol, bit 2
ZSW2.15	Slave life symbol, bit 3

2.4.7 MELDW status word

Signal	Description
MELDW.0	Reserved
MELDW.1	1 = Torque utilization < Torque threshold
MELDW.2	1 = |n_act| < Max. speed limit P4.31
MELDW.3	1 = |n_act| <= Max. speed limit P4.31
MELDW.4	Reserved
MELDW.5	Reserved
MELDW.6	1 = No motor overtemperature alarm

Signal	Description
MELDW.7	1 = No drive overloaded alarm
MELDW.8	1 = Deviation of speed set value from actual value is within tolerance
MELDW.9	Reserved
MELDW.10	Reserved
MELDW.11	1 = Controller enabling
MELDW.12	1 = Ready to drive
MELDW.13	1 = Pulse enabling
MELDW.14	Reserved
MELDW.15	Reserved

2.4.8 POS_ZSW1 position status word

Signal	Description
POS_ZSW1.0	Run program segment active, bit 0
POS_ZSW1.1	Run program segment active, bit 1
POS_ZSW1.2	Run program segment active, bit 2
POS_ZSW1.3	Run program segment active, bit 3
POS_ZSW1.4	Run program segment active, bit 4
POS_ZSW1.5	Run program segment active, bit 5
POS_ZSW1.6	Reserved
POS_ZSW1.7	Reserved
POS_ZSW1.8	1 = Negative stop active
POS_ZSW1.9	1 = Positive stop active
POS_ZSW1.10	1 = JOG active
POS_ZSW1.11	1 = Homing active
POS_ZSW1.12	Reserved
POS_ZSW1.13	1 = Run program segment active
POS_ZSW1.14	1 = Adjustment mode active
POS_ZSW1.15	1 = MDI active 0 = MDI not active

2.4.9 POS_ZSW2 position status word

Signal	Description
POS_ZSW2.0	1 = Tracking mode active
POS_ZSW2.1	1 = Speed limit active
POS_ZSW2.2	1 = Set value available
POS_ZSW2.3	1 = Brake status
POS_ZSW2.4	1 = Axis moving forward

Signal	Description
POS_ZSW2.5	1 = Axis moving backward
POS_ZSW2.6	1 = Negative software limit switch reached
POS_ZSW2.7	1 = Positive software limit switch reached
POS_ZSW2.8	Reserved
POS_ZSW2.9	Reserved
POS_ZSW2.10	Reserved
POS_ZSW2.11	Reserved
POS_ZSW2.12	1= Fixed stop point reached
POS_ZSW2.13	1 = Clamping torque of fixed stop point reached
POS_ZSW2.14	1 = Moving to fixed stop point active
POS_ZSW2.15	1 = Motion command active

2.5 PROFIdrive application parameter settings

Set the following parameters before using the DA200A-F servo drive for PROFIdrive application.

1. Use the LED panel or the Workshop software to set parameter P0.03 [Control mode selection] according to your requirement. The default setting is 0 (Position mode). If a switchover between Mode 3 and Mode1 or Mode2 is required when using SIEMENS telegram 111, set this parameter to 3 (Position/speed mode switching).
2. Use the LED panel or the Workshop software to set parameter P0.02 [Forward rotation of motor] to 0 (Anticlockwise).
3. Use the LED panel or the Workshop software to set parameter P0.20 [Position command selection] to 2 (PTP control).
4. Use the LED panel or the Workshop software to set parameter P4.10 [Upper computer type] to 1 (Bus input).
5. View the main telegram through R0.67.
6. View the additional telegram through R0.68.
7. View the DA200A-F drive PROFINET IP address through R0.64–R0.67.
8. View the DA200A-F drive PROFIdrive software version number through R0.37.
9. View the DA200A-F drive configuration table file version number through R0.59.
10. View the DA200A-F drive MAC address through R0.76, R0.77, and R0.78. For example, if the MAC address is 70:b3:d5:1d:01:d7, R0.76 is 0x70b3, R0.77 is 0xd51d, and R0.78 is 0x1d7.

Note:

- Changes to P0.03 and P4.10 take effect only after a power cycle or soft reset.
- Please configure the device name and IP address of the slave (servo drive) through the commissioning software PRONETA or motion controller.

Before communication between DA200A-F servo drive and PLC, it is recommended to set P4.10 to 0 (pulse + analog) and ensure that the actions such as jogging are normal. For details, see the product manual of standard DA200A-F servo drive.

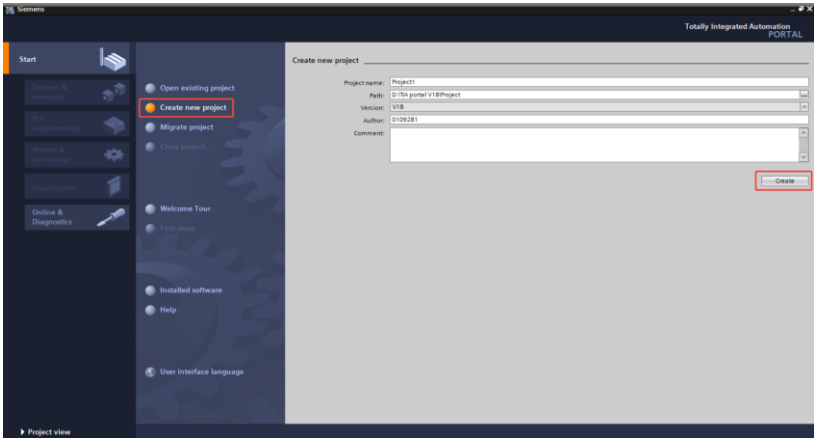
3 PLC project configuration

3.1 S7-1500 PLC project configuration

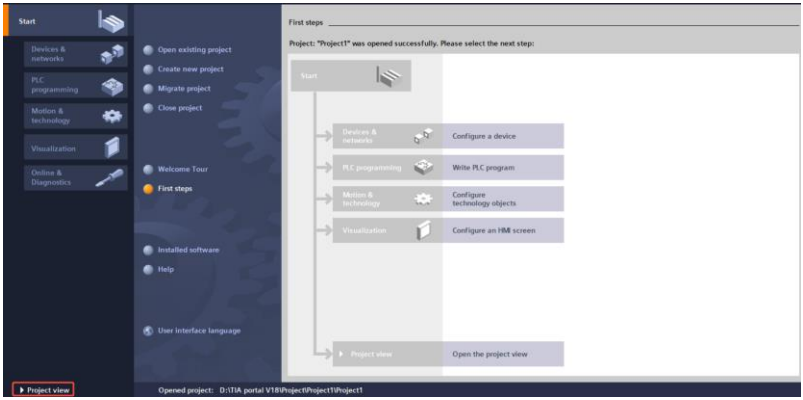
This section describes how to configure the S7-1500 PLC using the TIA Portal v18 project tool and establish communication with the DA200A-F servo drive through the PROFINET interface. In addition to the S7-1500 PLC, the project configuration and configuration process in this example are also applicable to other PLCs with PROFINET interfaces, such as the S7-1200 PLC.

3.1.1 Creating a project

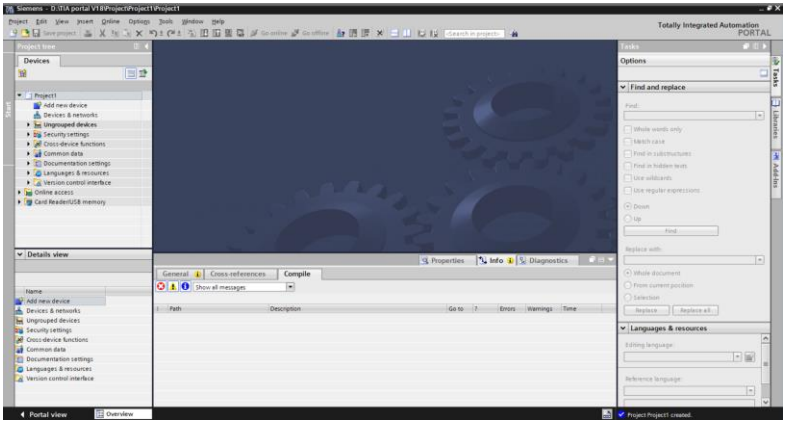
Step 1 Double-click the TIA Portal V18 icon to start the TIA Portal V18 project tool, click **Create new project**, and set the project name, path, and other related information on the right side of the project interface, as shown in the following figure.



Step 2 Click **Create** to create a new project.

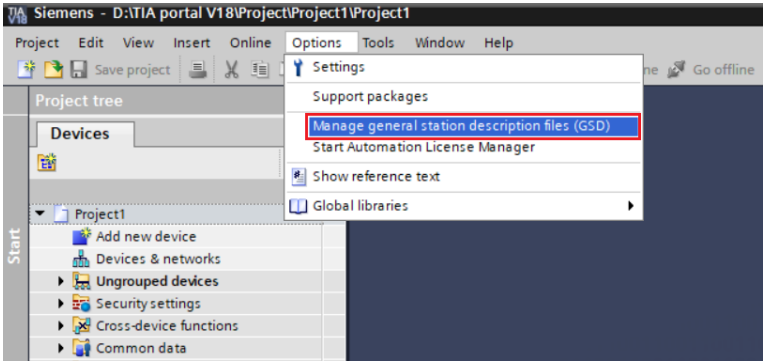


Step 3 Click **Project view** at the bottom left corner to access an overview of the entire project.

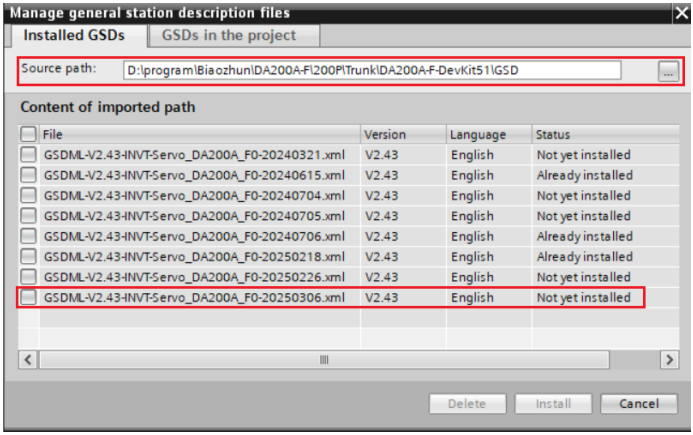


3.1.2 Uploading the GSD file

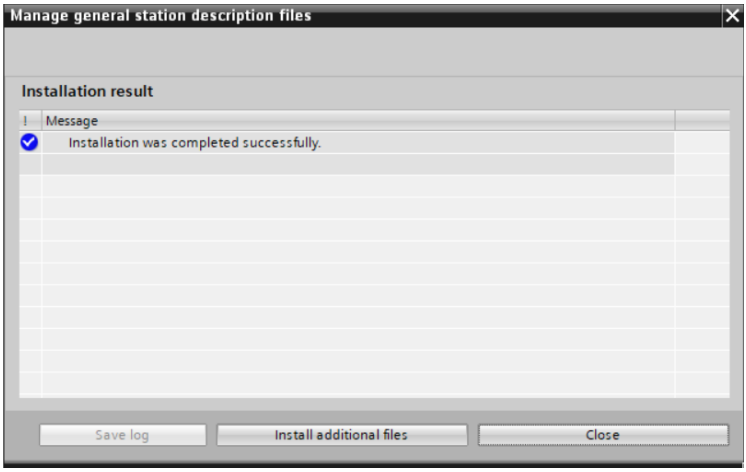
Step 1 In the project view, choose **Options** > **Manage general station description files (GSD)** from the top menu bar.



Step 2 In the dialog box that appears, browse the INVT_Servo_DA200A GSD file in the **Source path** field. Select the target file(s) and click **Install**.

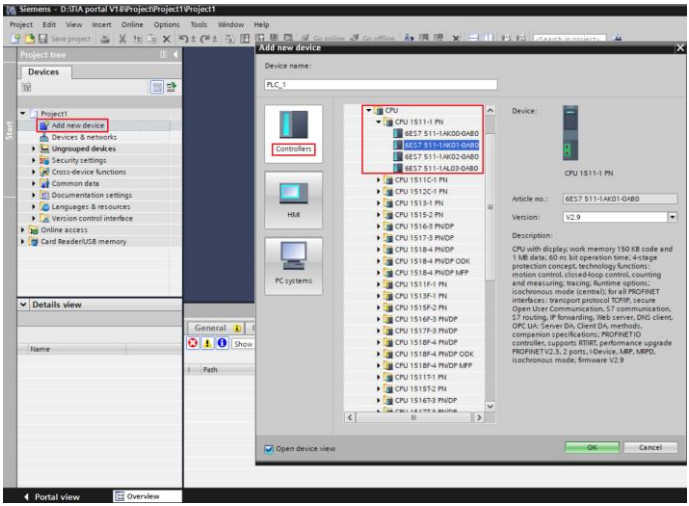


Step 3 If the installation is successful, the message **"Installation was completed successfully"** appears. It indicates that the GSDML file has been successfully installed.

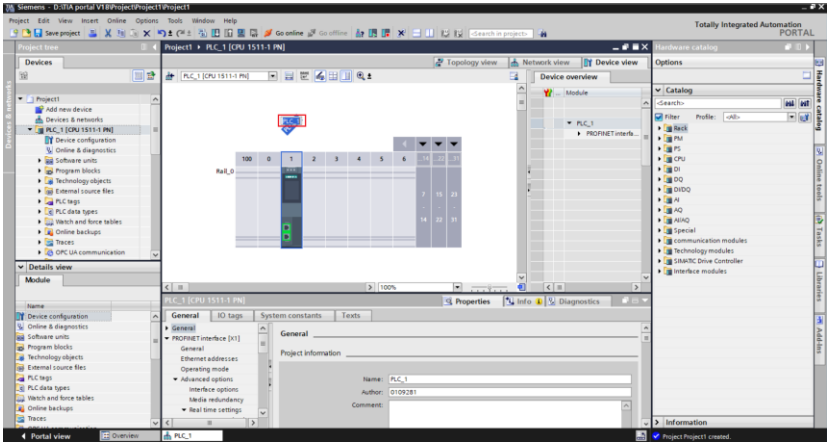


3.1.3 Adding a PLC device

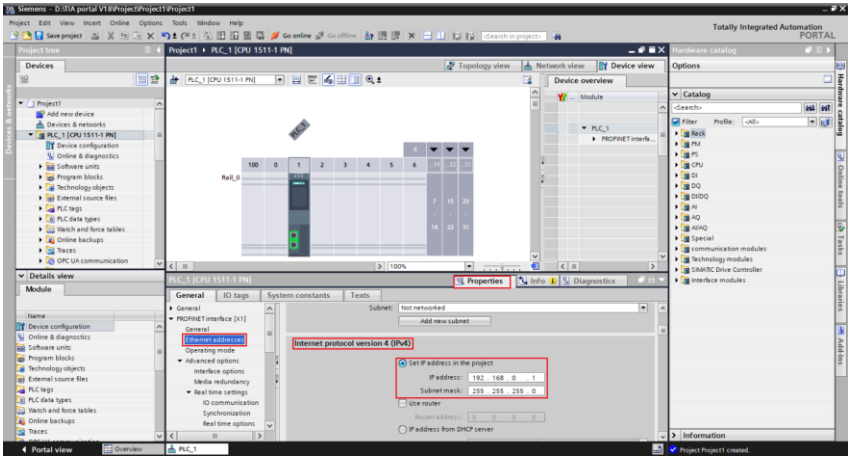
Step 1 Double-click **Add new device** in the project tree on the left. For example, for the PLC 6ES7 511-1AK01-0AB0, choose **Controllers** > **SIMATIC S7-1500** > **CPU** > **CPU 1511-1 PN** > **6ES7 511-1AK01-0AB0** in order.



Step 2 Click **OK** and open the device view. You can select the PLC device to modify its default device name.

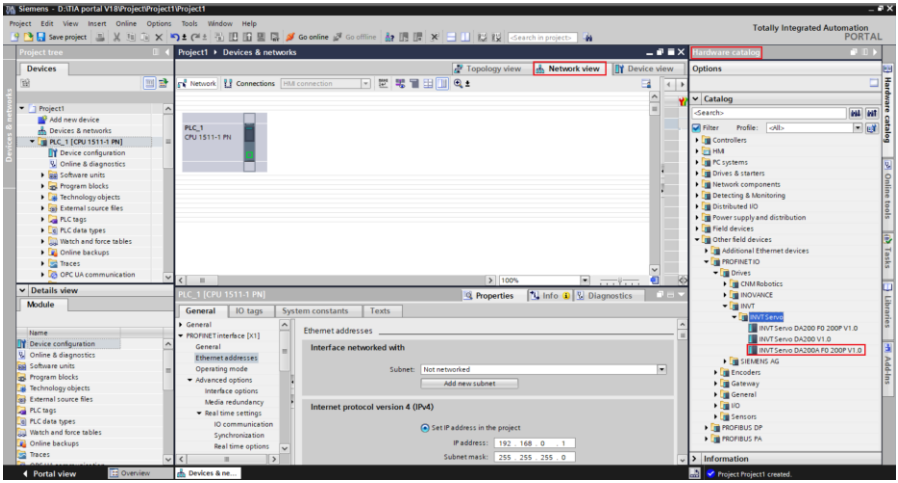


Step 3 Choose the PLC device. In the **Properties** panel, click the **General** tab, and choose **Ethernet addresses**. In this tab, you can modify the default assigned IP address of the PLC.

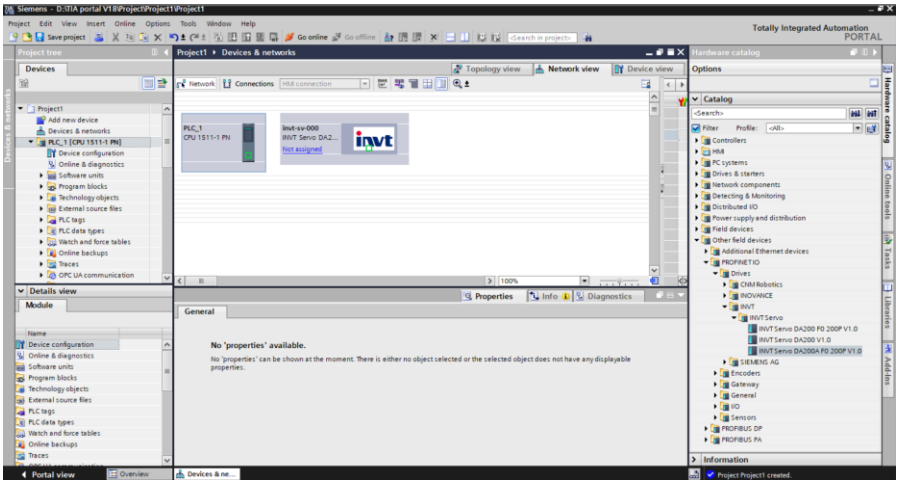


3.1.4 Adding the DA200A-F servo drive

Step 1 Switch the interface form **Device view** to **Network view**. In the **Hardware catalog** panel on the right, choose **Other field devices** > **PROFINET IO** > **Drives** > **INVT** > **INVT Servo** > **INVT Servo DA200A F0 200P V1.0**.

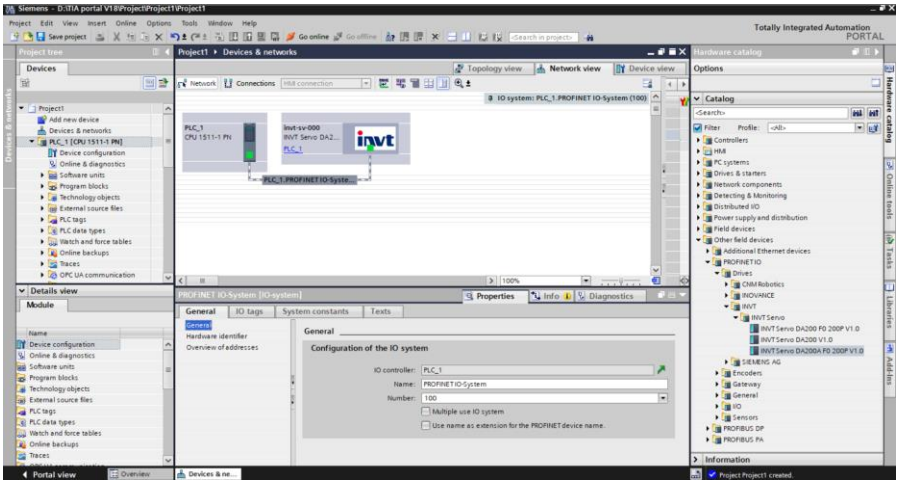


Step 2 Double-click or drag the **INVT Servo DA200A V1.0** icon to add the DA200A-F servo drive to the project.

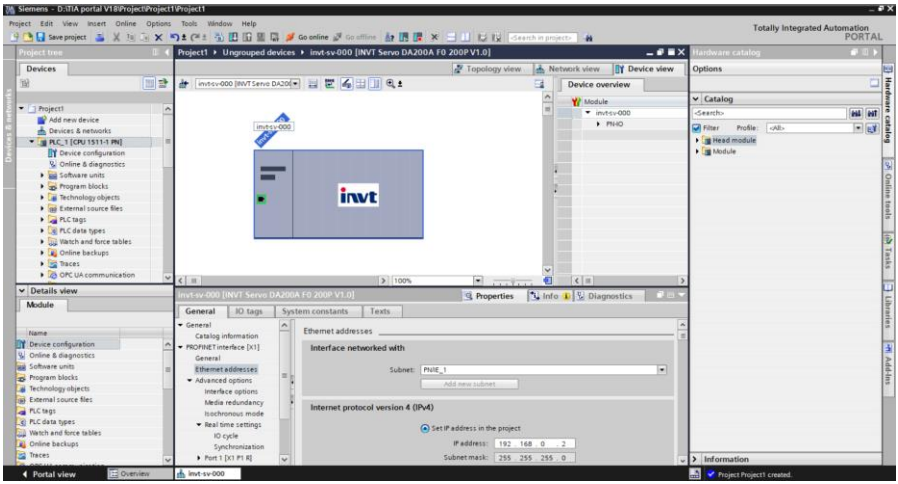


Step 3 Click the **Not assigned** option of DA200A-F servo drive, and select the IO controller **PLC_1.PROFINET interface_1** to connect the PLC and DA200A-F servo

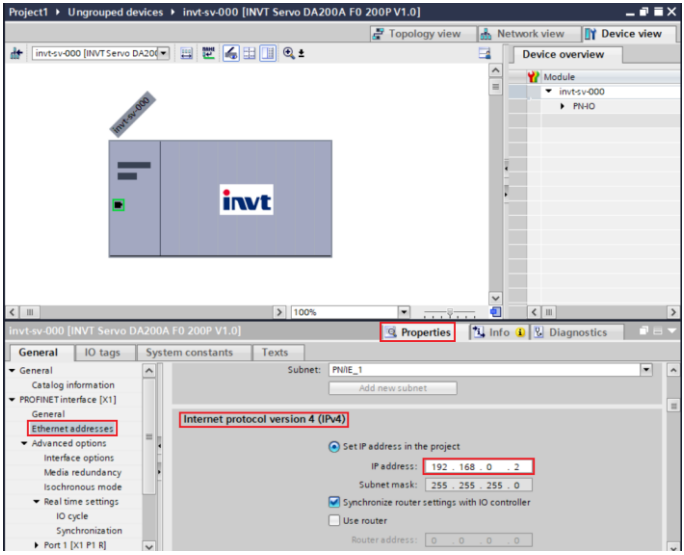
drive to the same PROFINET sub network.



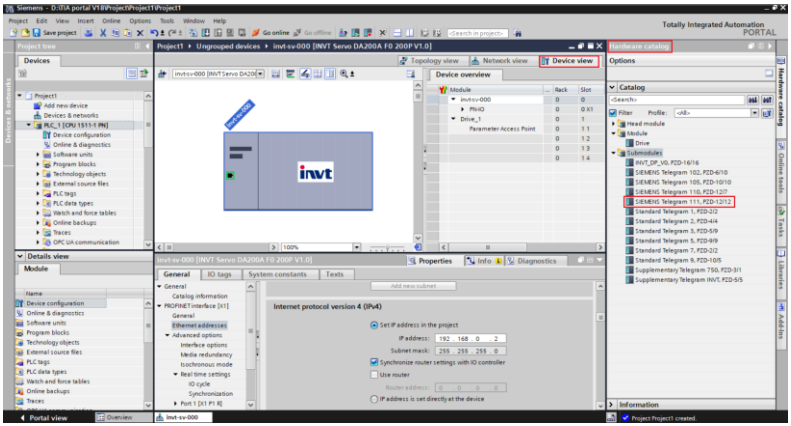
Step 4 Double-click the **INVT Servo DA200A** icon to enter the device view. Click the INVT Servo DA200A F0 device to change its default device name.



Step 5 Choose the INVT Servo DA200A F0 device. In the **Properties** panel, click the **General** tab, and choose **PROFINET interface [X1]** > **Ethernet addresses**. In this tab, you can modify the default assigned IP address of the INVT Servo DA200A device.

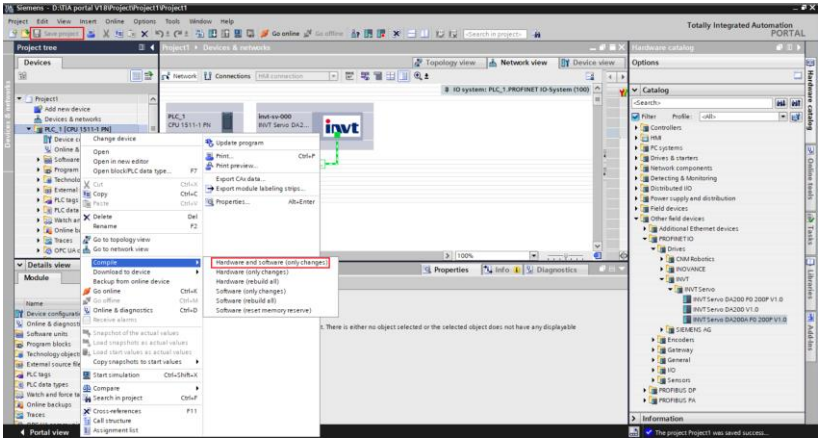


Step 6 In the device view of the INVT Servo DA200A device, choose **Hardware catalog** > **Module**, double-click **Drive**, and double-click the required telegram from **Submodules** to add it to the project.



3.1.5 Saving, compiling, and downloading

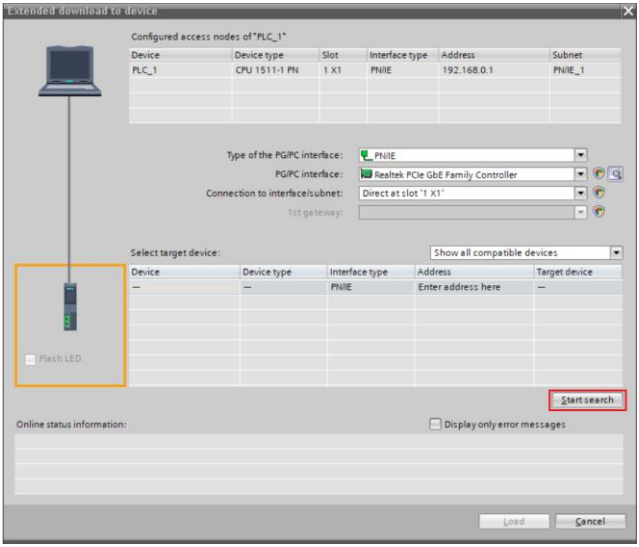
Step 1 After completing the project configuration, click **Save project** to save the project. In the project tree on the left, right-click **PLC_1[CPU 1511-1 PN]** and choose **Compile** > **Hardware and software (only changes)**.



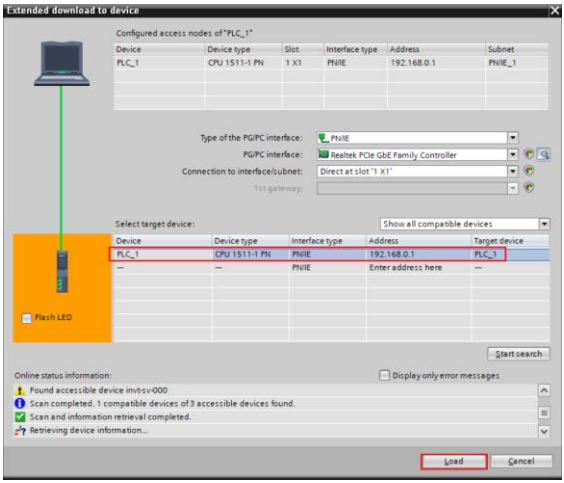
Note:

- Before downloading the configuration to the PLC, ensure that the PLC and INVT Servo DA200A are properly connected to the PC via the network cable.
- The actual device name and IP address should be consistent with the configuration in the project, which can be set using the free debugging tool Pronata.

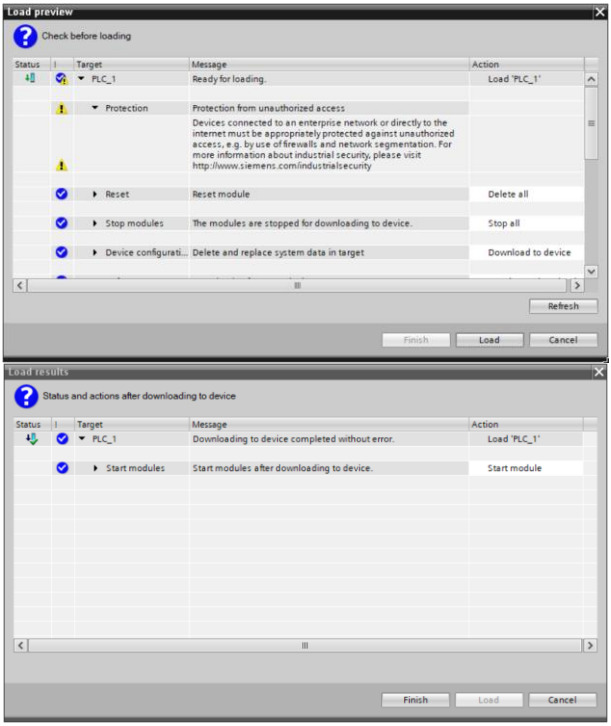
Step 2 Click the **Download to device** button and click **Start search** in the pop-up interface to start scanning for PLC devices in the detection network.



Step 3 Select the PLC to download, and click **Download**.



Step 4 Click the corresponding buttons and then click **Load** > **Finish**.



4 Speed control mode

4.1 Axis technology object configuration

By configuring the axis technology object in TIA Portal, the DA200A-F servo can be set up to communicate with the upper computer using telegrams 1, 2, 3, 5, 102, and 105, and controlled through PLC Open function blocks such as MC_Power. The following example shows the configuration steps using standard telegram 3.

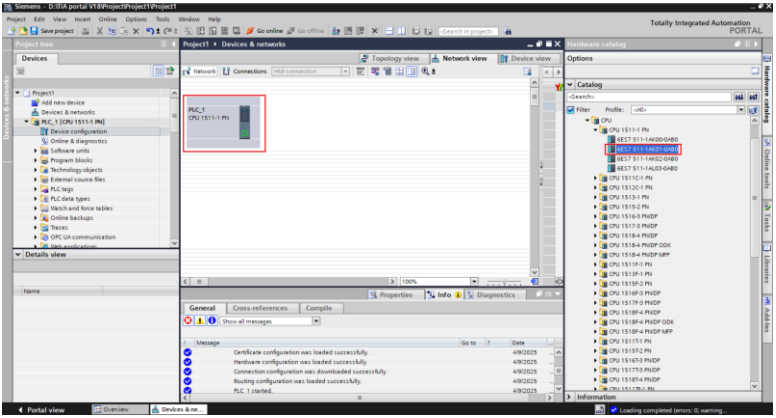
Set parameters through INVT Workshop, the upper computer commissioning software.

- Set P0.03 [Control mode selection] to "Speed mode".
- Set P0.40 [Speed command selection] to "Bus input".
- Set P4.10 [Upper computer type] to "Bus input".
- Save the parameters and restart the servo drive after power-off.

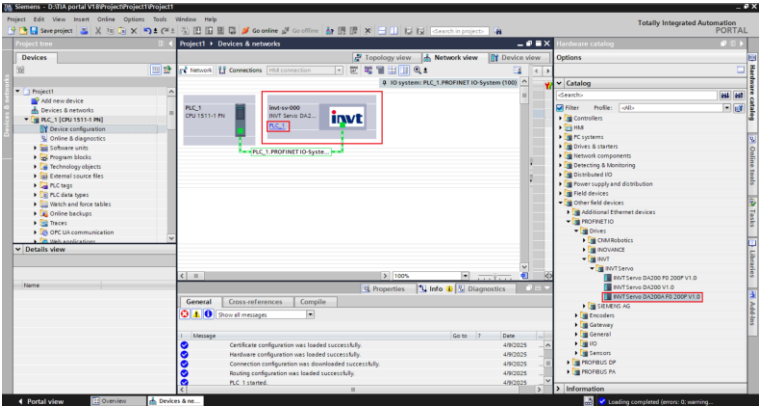
Note: When the technology object is used, P0.54–P0.57 should be set to 0.

On the TIA Portal, configure the DA200A PROFIdrive drive and add telegrams.

Step 1 Add a PLC in the network view.



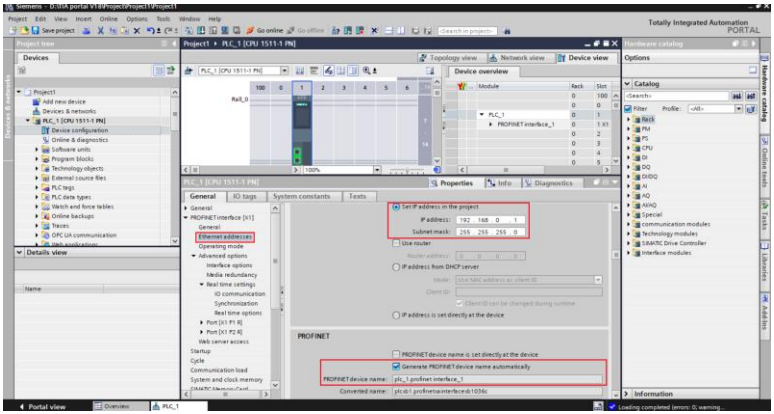
Step 2 Add the DA200A-F device to the view and create a network connection to the PLC.



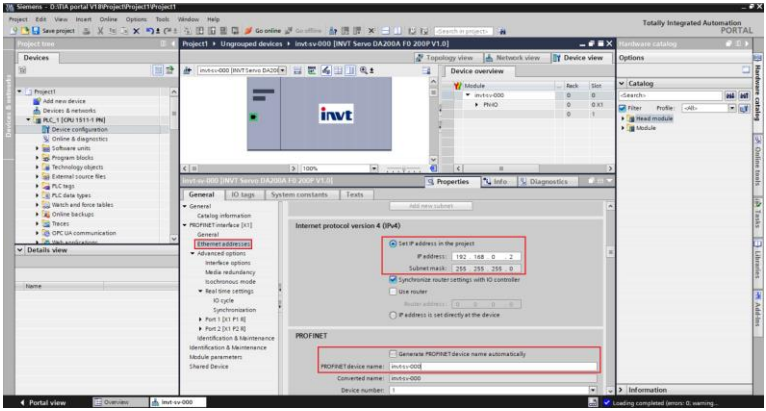
The GSD file for the DA200A-F can be installed by choosing **Options** > **Manage general station description files (GSD)** from the top menu bar.

Step 3 Set the IP addresses and device names for the PLC and DA200A-F.

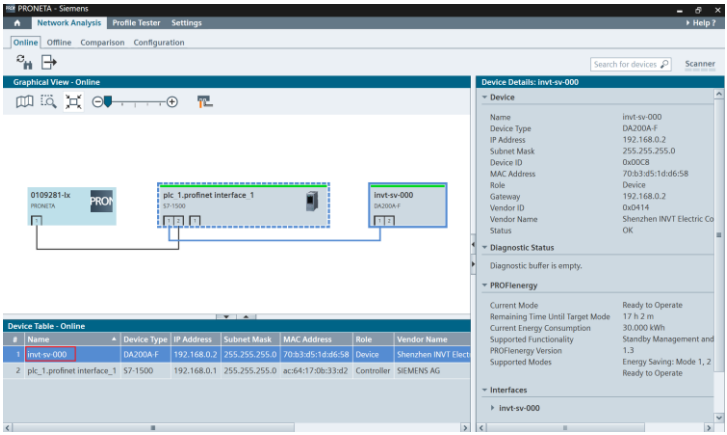
(1) Set the IP address for the PLC.

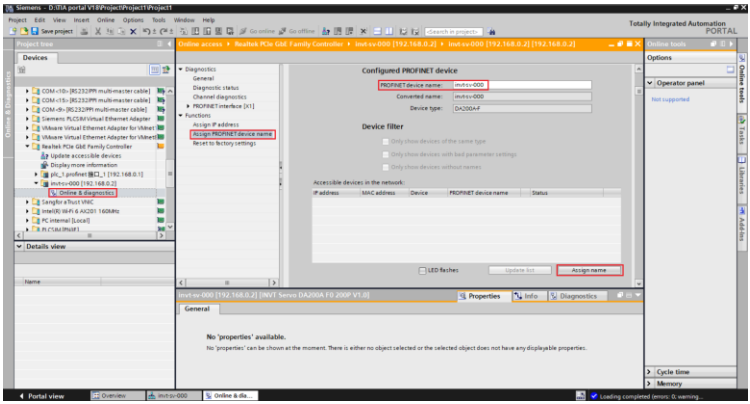


(2) Set the IP address and device name for DA200A-F.

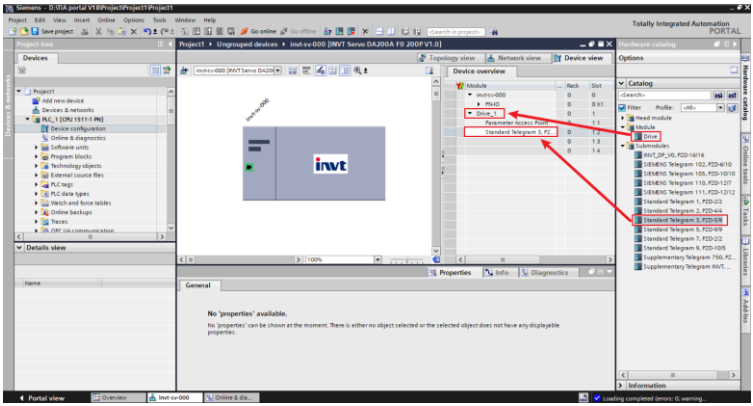


(3) The device name of the DA200A-F servo can be changed through the SIEMENS PRONETA software or the TIA Portal. The device name must be consistent with that in the TIA Portal project.



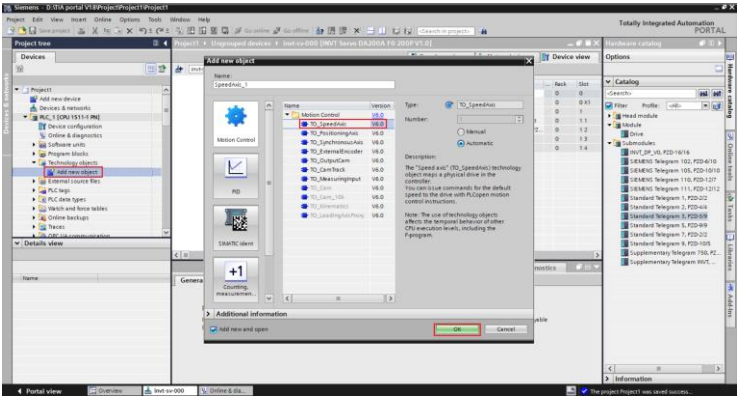


Step 4 Insert the module **Drive** in the **Device** view, and then insert the submodule standard telegram 3.

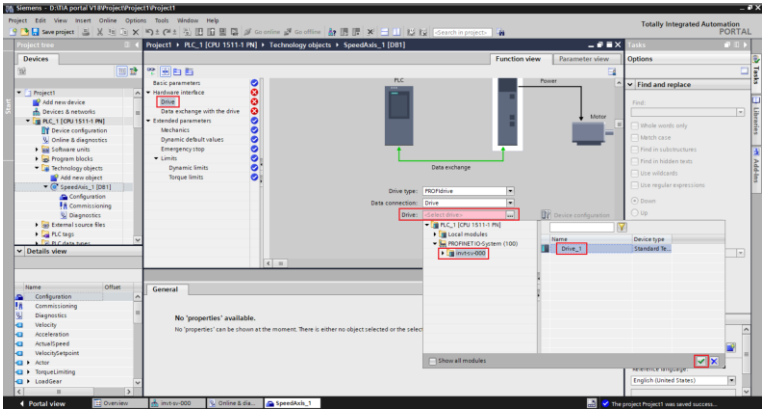


4.1.1 Speed axis TO_SpeedAxis

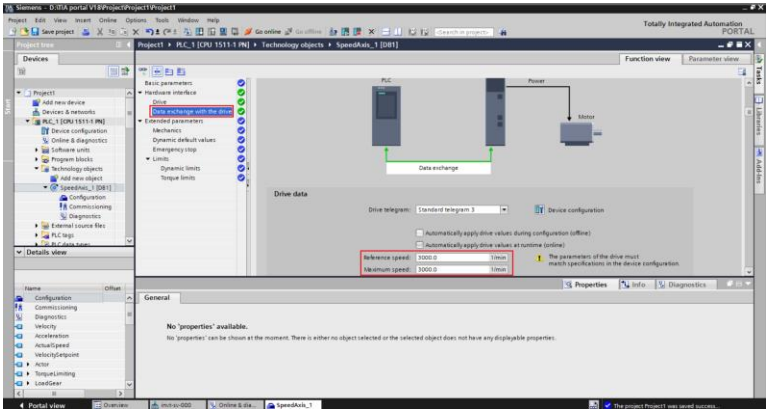
Step 1 Choose **Technology objects** > **Add new object** > **TO_SpeedAxis**, and click **OK**.



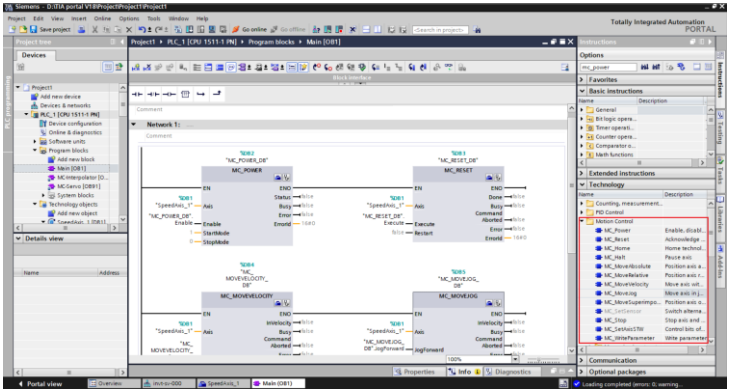
Step 2 Select the DA200A PN device Drive_1 as the drive.



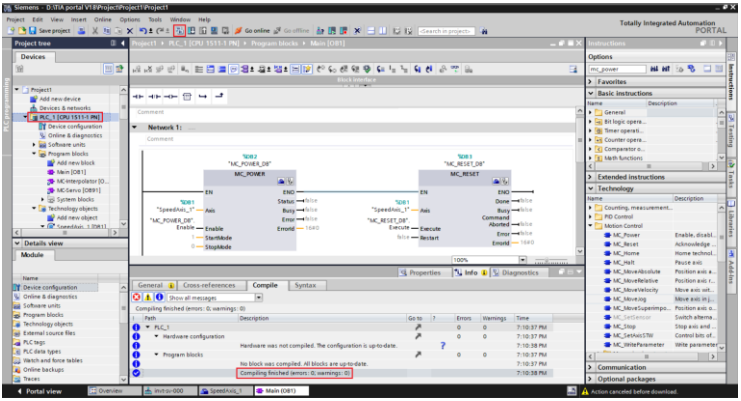
Step 3 For data exchange with the drive, do not choose **Automatically apply drive values at runtime**. Set the motor rated speed in the **Reference speed** field and the motor maximum speed in the **Maximum speed** field.

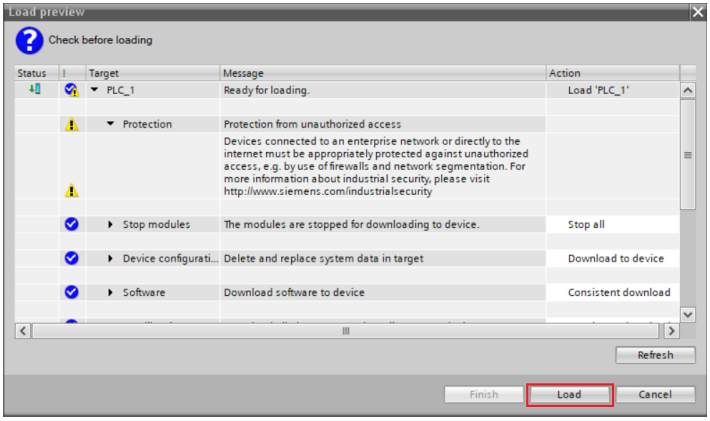


Motion control can be programmed using the commands from **Motion Control** under **Technology**.

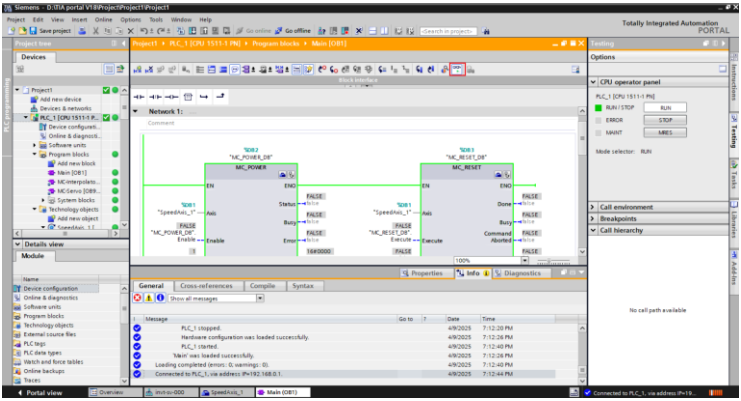


Step 4 Compile the project and download it to the PLC.

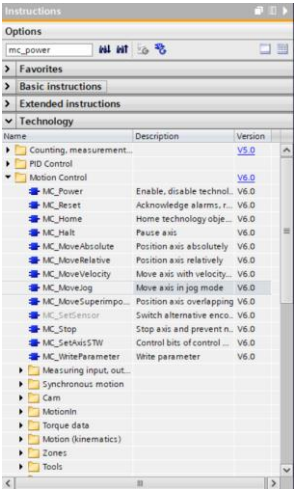




Step 5 Transfer the project to online. Speed axis control is available through the MC motion control function block.

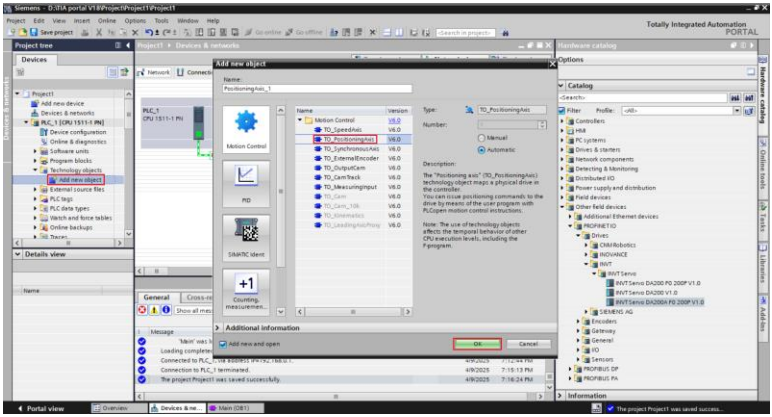


If the technology object is a speed axis, the following MC function blocks are available: MC_Power, MC_Reset, MC_Halt, MC_Velocity, and MC_Jog

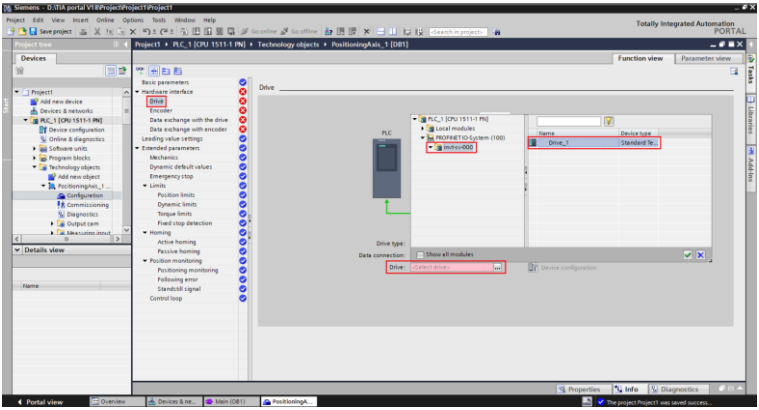


4.1.2 Positioning axis TO_PositioningAxis

Step 1 Choose **Technology objects** > **Add new object** > **TO_PositioningAxis**.

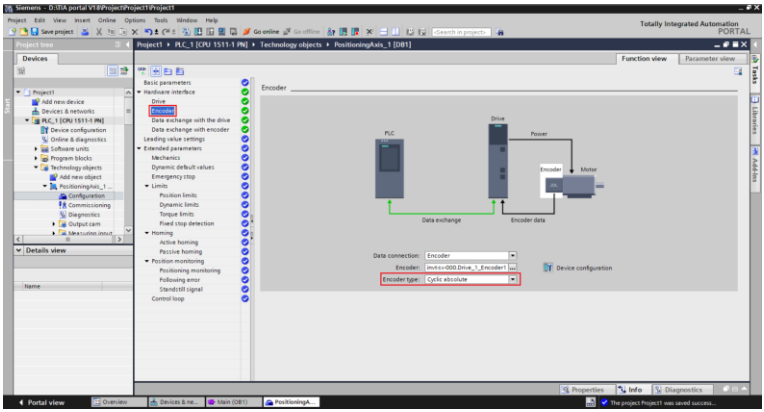


Step 2 Select the DA200A PN device Drive_1 as the drive.



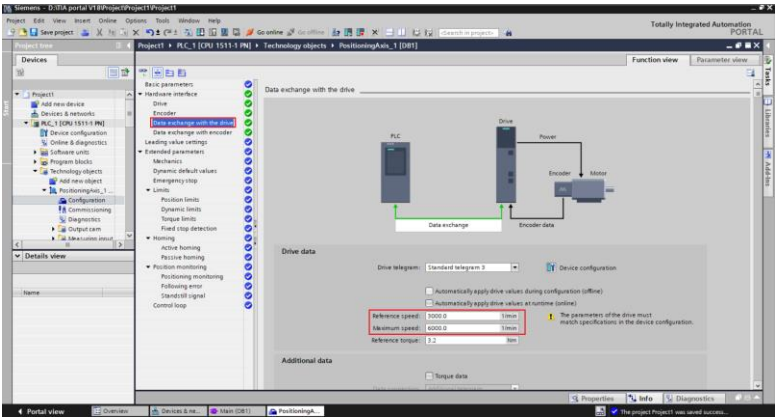
Step 3 Select the encoder type according to the actual application. The following options are available: Incremental, Absolute, and Cyclic absolute.

Absolute motors can also be applied as incremental encoders.



For data exchange with the drive, do not choose **Automatically apply drive values at runtime**.

Step 4 Set the motor rated speed in the **Reference speed** field and the motor maximum speed in the **Maximum speed** field.



For data exchange with the encoder, do not choose **Automatic data exchange for encoder values**.

For incremental pulses per revolution, check parameter P0.01 [Encoder type]:

- for a 2500PPR incremental encoder: 4*2500=10000;
- for a 17-bit absolute encoder: 2^17=131072;
- for a 23-bit absolute encoder: 2^23=8388608, and so on.

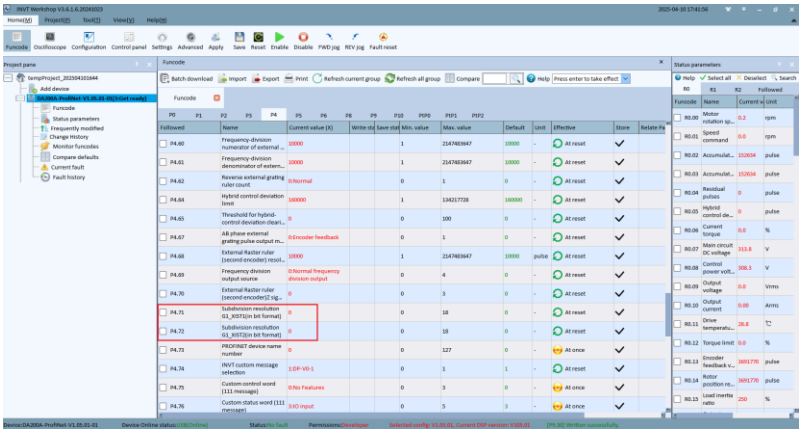
For the number of turns, it is available only when the encoder type set in the TIA Portal

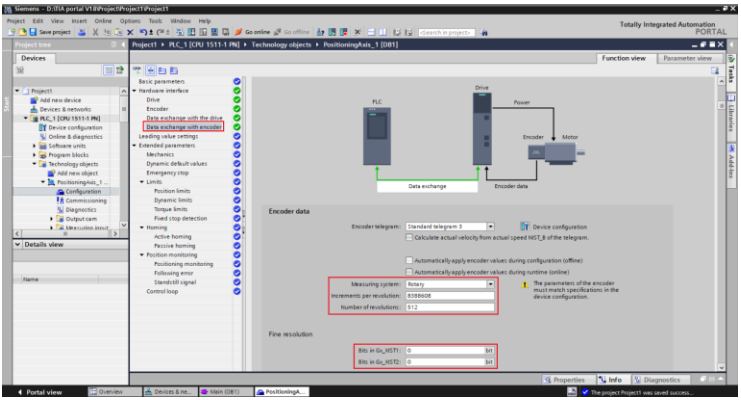
configuration is absolute or cyclic absolute.

Step 5 Check parameter P0.70 [Absolute encoder mode setting]: If P0.70 is set to Single-turn absolute, the number of turns is set to 1; if the encoder type is Multi-turn absolute and P0.70 is set to Multi-turn absolute, the number of turns can be set for multi-turn monitoring.

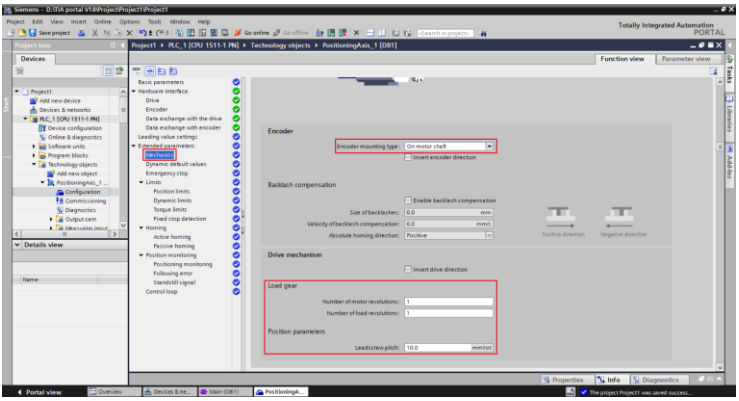
$$\text{Max. number of turns} = \frac{232}{\text{Increment per turn} * 2^{G1\_XIST1}}$$

Bits in Gx_XIST1/Gx_XIST2: View the values of DA200A-F servo parameters P4.71 and P4.72 and fill the values into Gx_XIST1 and Gx_XIST2 on the TIA Portal. The settings must be consistent with the DA200A-F servo parameters P4.71 and P4.72.

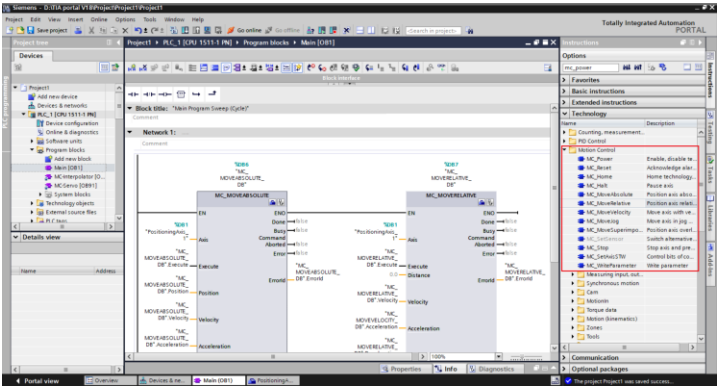




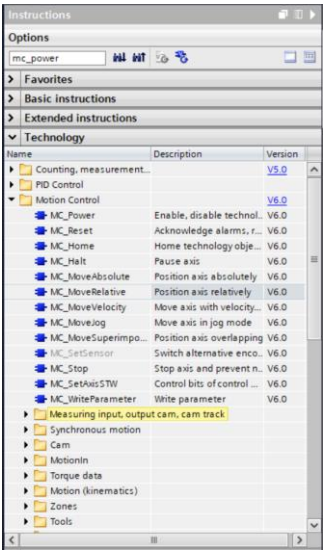
For extended parameters - Mechanics: Set **Encoder mounting type** to **On motor shaft** and set other parameters according to the actual situation.



Motion control can be programmed using the commands from **Motion Control** under **Technology**.



If the technology object is a positioning axis, the following MC function blocks are available: MC_Power, MC_Reset, MC_Halt, MC_MoveAbsolute, MC_MoveRelative, MC_Velocity, MC_Jog, and MC_MoveSuperimposed



4.1.3 Supplementary telegram 750

The torque limiting and additional torque reference of the axis can be achieved by using supplementary telegram 750. When the axis is configured by using SIEMENS telegram 102 or 105, the torque mode is switched through the control word STW1.14. Torque control is performed via MC_TorqueLimiting, MC_TorqueRange, MC_TorqueAdditive function block commands.

The following example shows the configuration steps using SIEMENS telegram 105 and supplementary telegram 750.

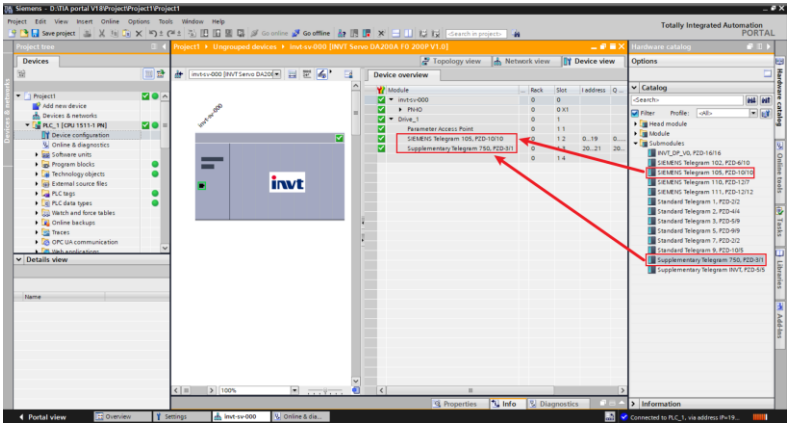
Step 1 Set P0.03 [Control mode selection] = Position mode or Torque mode.

Step 2 Set P4.10 [Upper computer type] = Bus input.

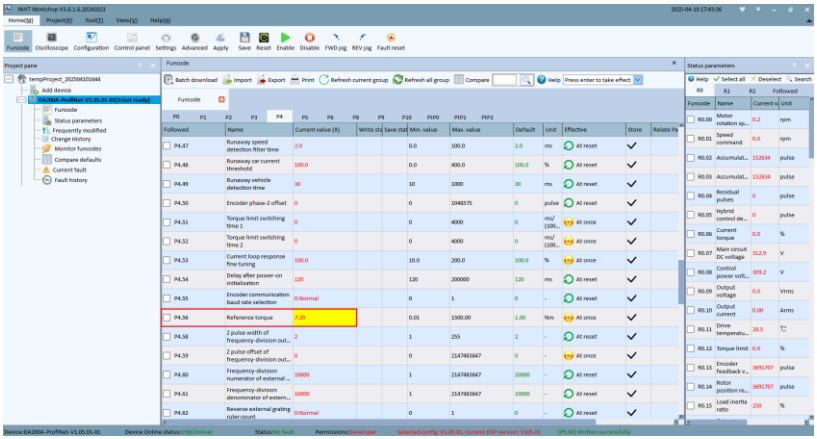
Step 3 Set P0.09 [Torque limit mode setting] = Max torque limit 1 + Max torque limit 2.

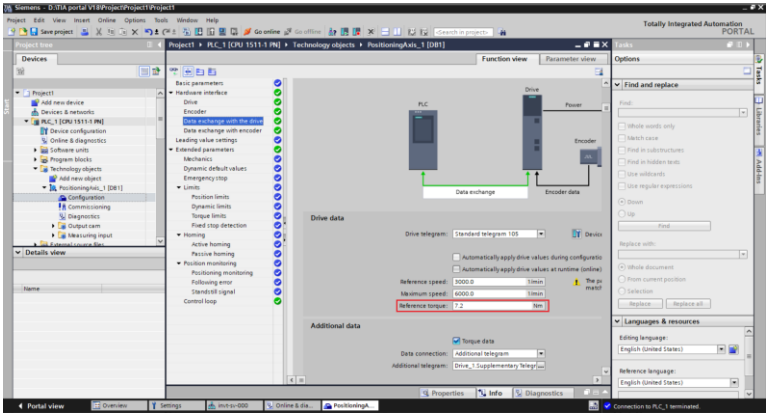
Step 4 After completing parameter setting, click **Save** and restart the servo.

Step 5 Configure supplementary telegrams in the device view. Choose **Supplementary Telegram 750** from **Supplementary Telegrams**.

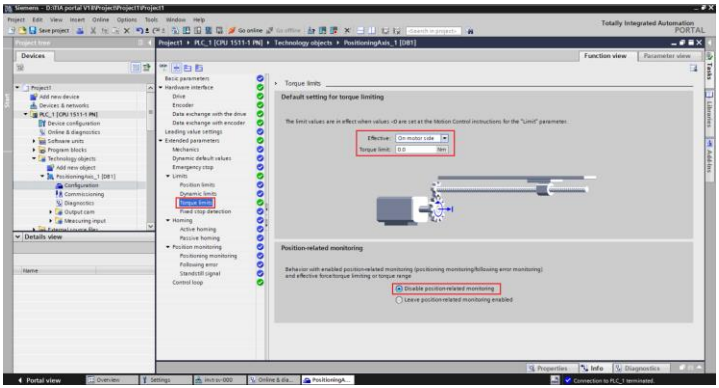


For data exchange with the drive: To set the reference torque, view P4.56 [Torque reference] and set the value of P4.56 as the reference torque.

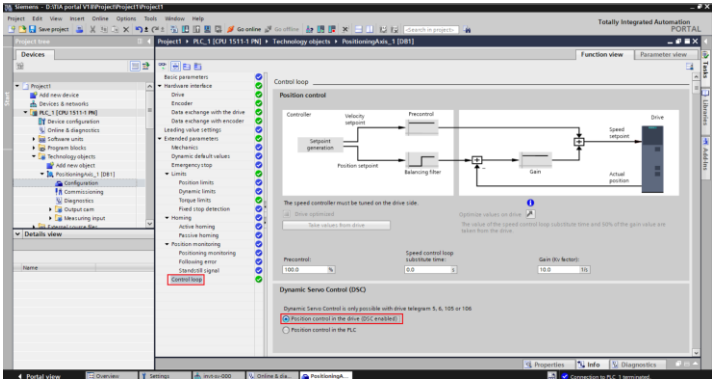




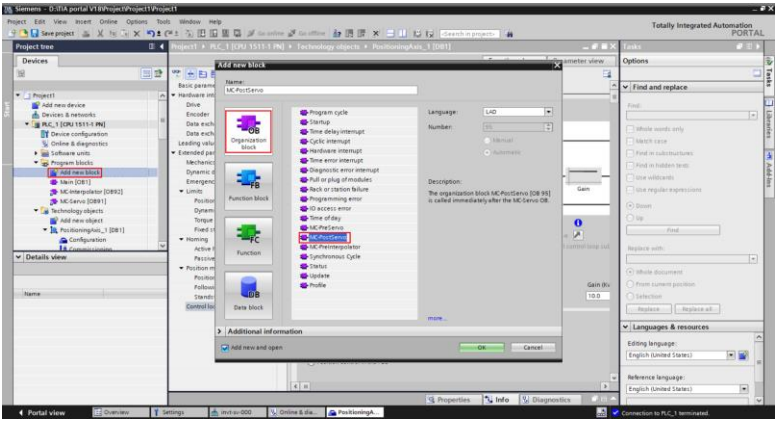
In the **Torque limits** panel, set **Effective** to **On motor side**.



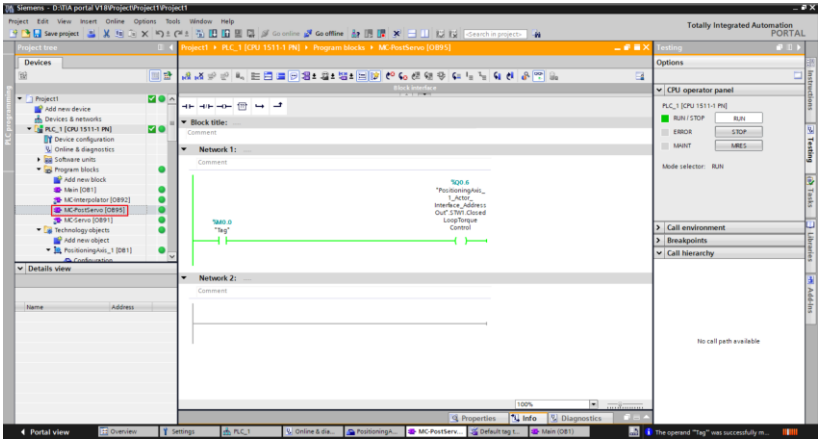
In the **Control loop** panel, enable the DSC function (supported by telegram 5 and telegram 105).



Use the MC_PostServo function block (added by choosing **Program blocks** > **Add new block**) to enable closed-loop torque control switchover through control word STW1.14 in SIEMENS telegrams 102 and 105.

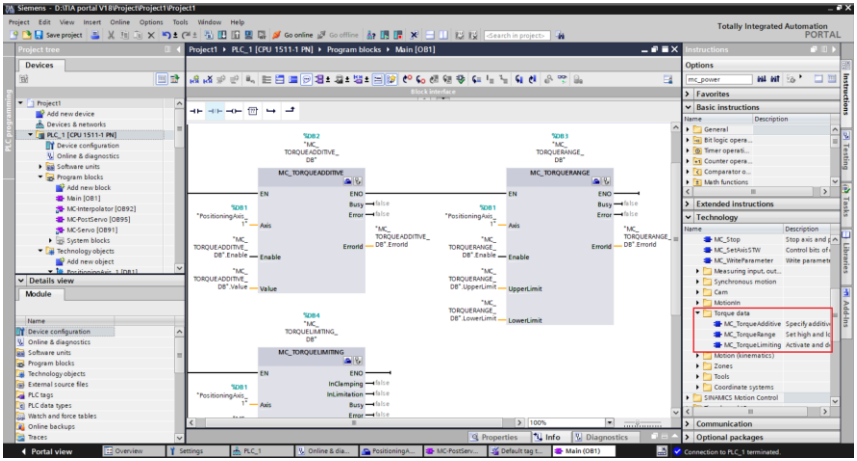


Program the MC_PostServo function block to perform the closed-loop torque control switchover for SIEMENS telegram 102 and 105.

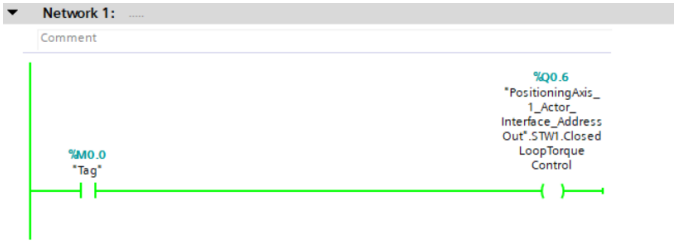


Note: When the torque switchover is performed through the control word STW1.14, the servo must be disabled through MC_Power before switching from torque mode to position mode; otherwise, the servo will run at the maximum speed to the position before the switchover.

Choose **Technology** > **Torque data**, and add function blocks to write additional torque commands.



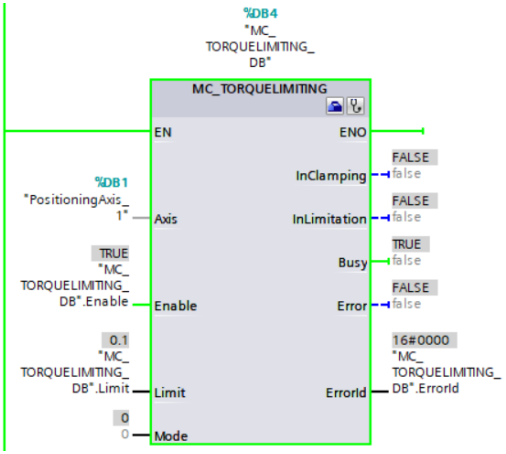
Set the control word STW1.14 to 1 through SIEMENS telegram 102/105 to switch the servo to torque control.



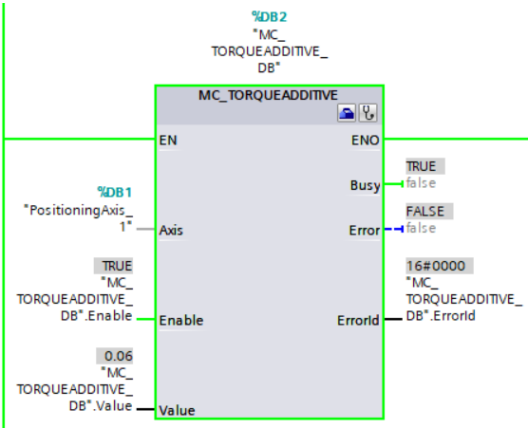
Note: When the torque switchover is performed through the control word STW1.14, the servo must be disabled through MC_Power before switching from torque mode to position mode; otherwise, the servo will run at the maximum speed to the position before the switchover.

The value of R0.32 [Current mode] is Torque mode.

Use function blocks MC_TorqueLimiting and MC_TorqueRange for torque limiting.



Use the function block MC_TorqueAdditive to set the additional torque reference.



The speed limit in the Torque mode is set through P0.46 [Internal speed 1/Speed limit 1]

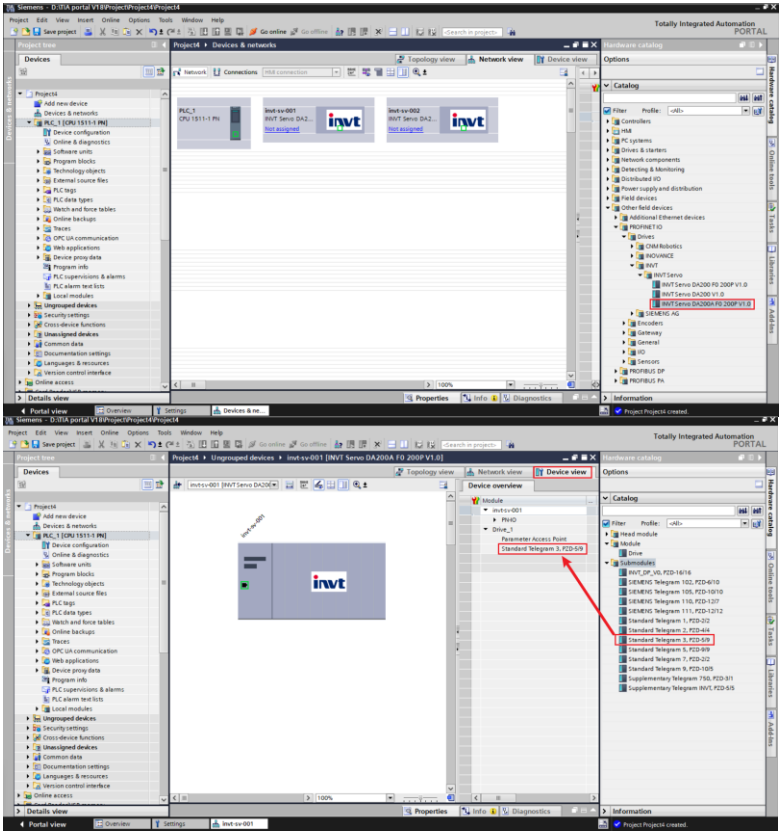
4.2 IRT function configuration

This section describes how to configure the S7-1500 PLC and DA200A-F servo drive using the SIEMENS TIA PORTAL V18 to implement the PROFINET IRT communication between the devices.

The following example uses telegram 3 to configure the S7-1500 PLC. The same steps apply to other PROFINET interface PLCs that support IRT functionality.

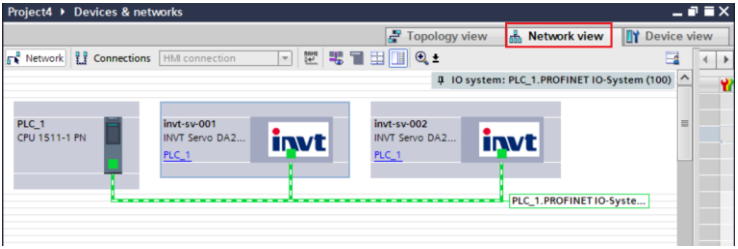
4.2.1 Creating a project

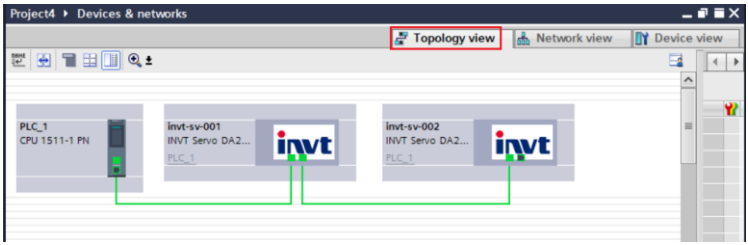
Start the TIA Portal V18 and create a new project. In the project, add one S7-1500 PLC and two DA200A-F servo drives. Add INVT I/O submodules to each drive, set the IP addresses and device names for the S7-1500 PLC and DA200A-F servo drives, and assign telegram 3. The completed project configuration is shown in the following figure.



4.2.2 Connection settings

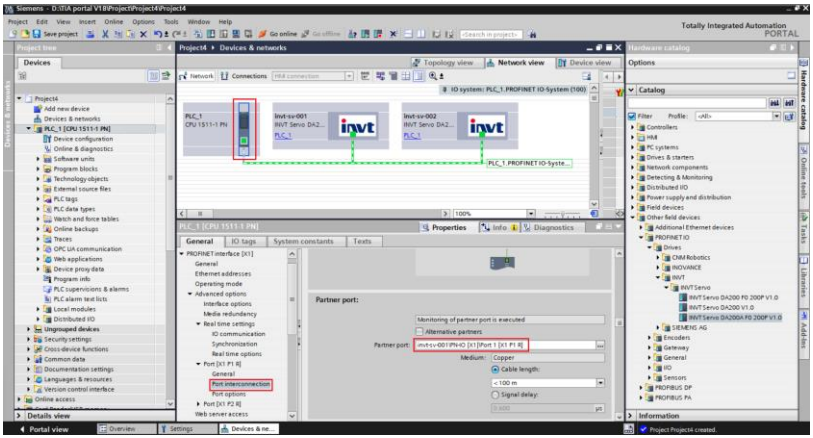
In the **Network view** and **Topology view**, connect the PLC to invt-sv-001 and invt-sv-002. Ensure that the physical topology matches the configuration.



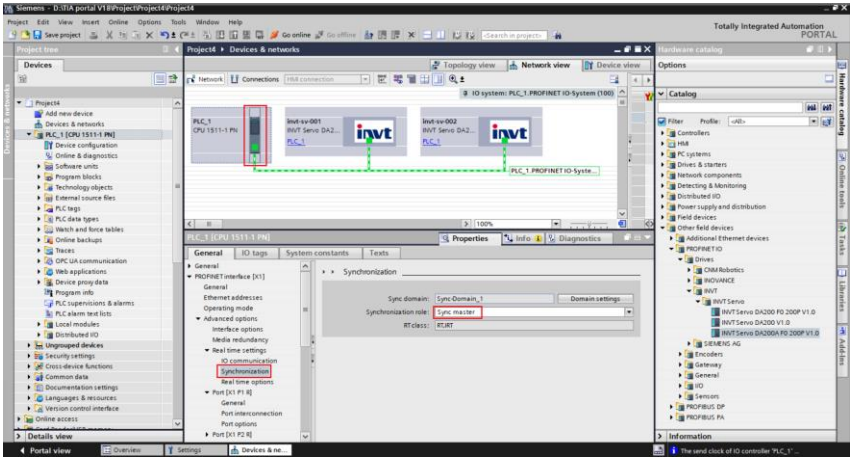


4.2.3 PLC settings

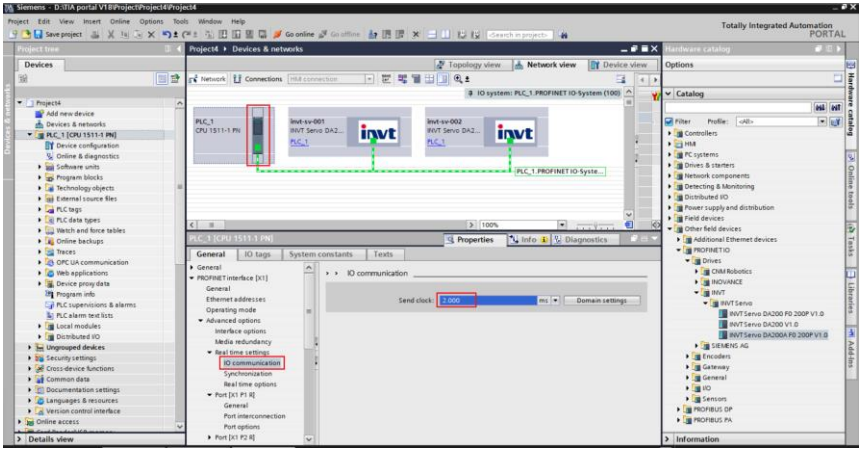
Step 1 Click **PLC_1**, then choose **PROFINET interface [X1]** > **Port [X1 P1 R]** > **Port interconnection**, and set the partner port. In this example, Port1 of the PLC is connected to Port1 of the invt-sv-001 drive. See the following figure.



Step 2 Choose **Synchronization**, and set **Synchronization role** to **Sync master**.

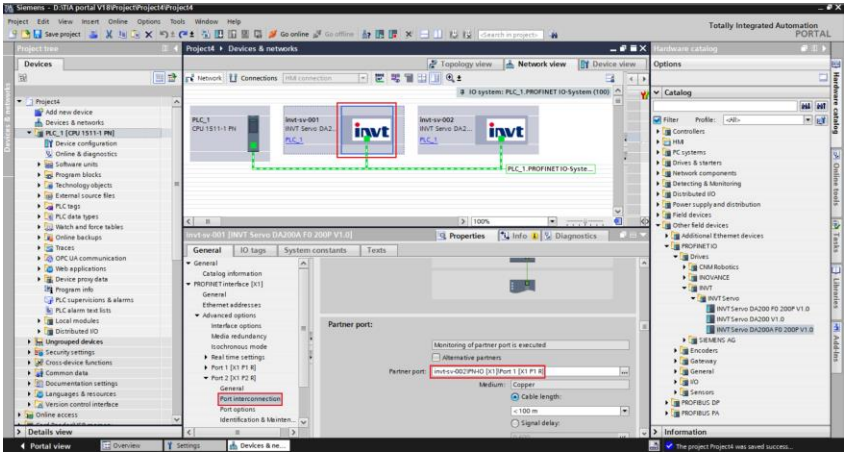


Step 3 Choose **IO Communication**, and set **Send clock**.

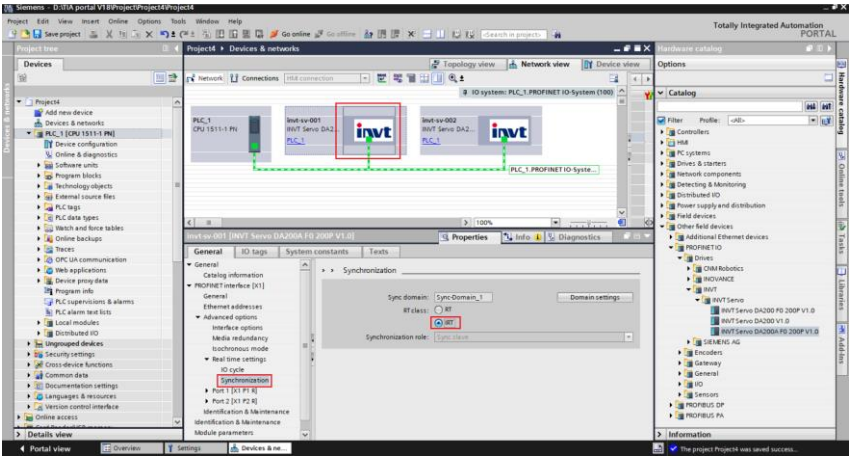


4.2.4 Configuring the DA200A-F drive

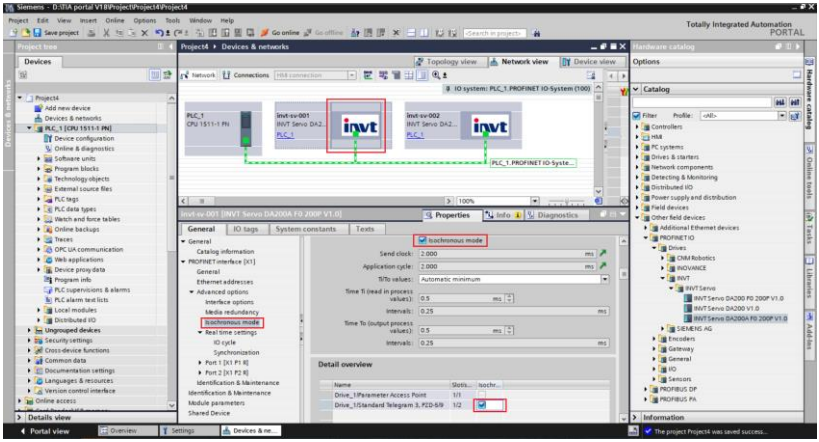
Step 1 Click **invt-sv-001**, then choose **PROFINET interface [X1]** > **Port1 -RJ45[X2 P1 R]** > **Port interconnection**, and set the partner port. In this example, Port2 of invt-sv-001 is connected to Port2 of invt-sv-002.



Step 2 Choose **Synchronization role**, and set **RT class** to **IRT**.

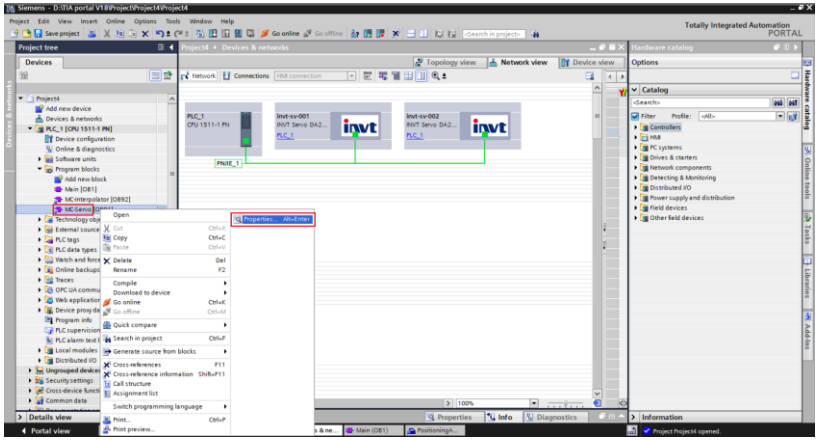


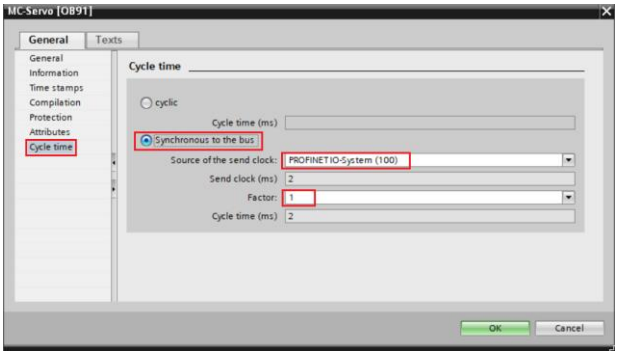
Step 3 In the **General** tab, choose **Isochronous mode** on the left, and choose **Isochronous mode** at the top of the right.



Step 4 Click **invt-sv-002** and set the preceding parameters in the same way.

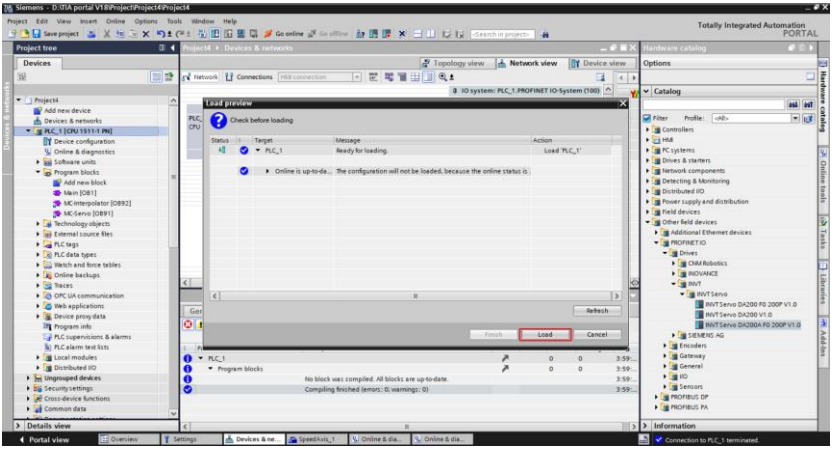
Step 5 Right-click **MC_Servo(OB91)** and choose **Synchronize with bus**. If CPU performance is low, adjust the **Factor** parameter to reduce the load on the CPU.





4.2.5 Saving, compiling, and downloading

Step 1 After completing the compiling, download the project configuration to the PLC controller. See the following figure.



Step 2 View R0.27 to check whether the DA200A-F drive PN communication mode is IRT.

R0.25	Turns of multiturn encoder	0
R0.26	Encoder type	0:2500 line incremental...
R0.27	PN communication mode	1:IRT mode
R0.28	PROFIdrive Universal state machine	2:Switching On Inhibited
R0.29	PROFIdrive encoder state machine	1:OPERATION
R0.30	System status	3:Get ready

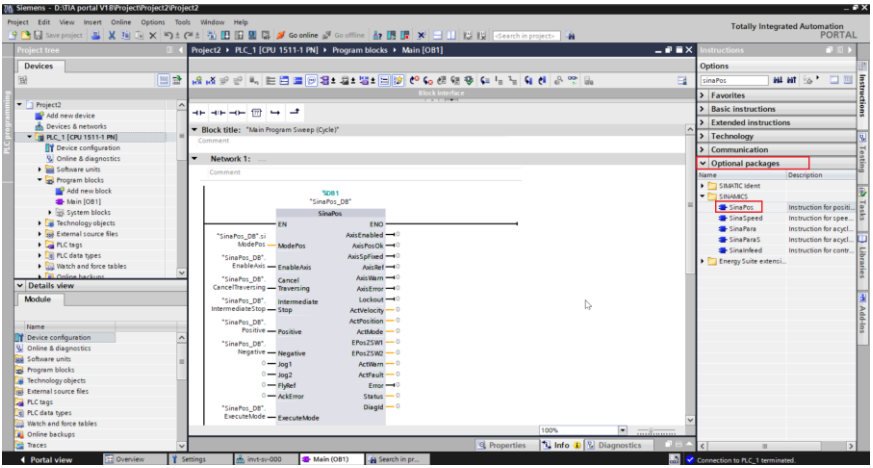
5 Basic positioning control mode

5.1 Instructions for using SIEMENS telegram 111

DA200A-F servo drive supports SIEMENS telegram 111 and enables basic positioning control of the servo system through the SinaPos function block provided in the SIEMENS function library. The basic positioning control is used for the absolute and relative positioning of linear or rotary axes. The main operation modes include Jog, Homing, MDI, program segment, etc.

5.1.1 Introduction to the SinaPos function block

The SinaPos function block is located in the command library as follows.



Enter ModePos in the function block to select the operation mode.

Input	Type	Default	Description
ModePos	INT	0	Operation mode: 1: Relative positioning 2: Absolute positioning 3: Continuous operation at specified speed 4: Active homing 5: Set homing position directly 6: Run program segment 0–63 7: Speed jog 8: Incremental jog

Command unit:

- Position reference unit: LU(User command unit)
- Speed reference unit: 1000LU/min
- Position feedback unit: LU
- Speed feedback unit: P8.02/2^{30}rpm, P8.02 (Motor rated speed)

Note: For details on the relationship between command units and feed amount, see the section on electronic gear ratios in the *DA200A Series Servo Drive User Manual*.

5.1.2 Speed jog mode

ConfigEPos: 3

ModePos: 7

EnableAxis: TRUE (enable)

OverV: Speed reference magnification, 0–199 (%)

Jog1: Jog reversely

Jog2: Jog forward

Note: P6.00 specifies the forward jogging speed, while P6.01 specifies the reverse jogging speed. The ACC/DEC time is not affected by the ACC/DEC time multiplier.

5.1.3 Incremental jog mode

ModePos: 8

EnableAxis: TRUE (enable)

Jog1: Jog reversely

Jog2: Jog forward

Note: P5.01 specifies the incremental jog movement amount, P05.02 specifies the incremental jog speed, and P5.03 specifies the incremental jog ACC/DEC time. The ACC/DEC time is not affected by the ACC/DEC time multiplier.

5.1.4 Speed mode

ModePos: 3

EnableAxis: TRUE (enable)

ExecuteMode: started at the rising edge

IntermediateStop: TRUE (Normal), FALSE (Pause)

CancelTraversing: TRUE (Normal), FALSE (Stop) (After the stop takes effect, you need to re-start the running.)

Positive, Negative: direction (effective after triggering)

Velocity: speed reference (positive, effective after triggering)

OverV: Speed reference magnification, 0–199 (%) (effective after triggering)

OverAcc, OverDec: ACC/DEC time magnification (parameters P0.54, P0.55), 0–100 (%) (effective after triggering)

5.1.5 Positioning mode

ModePos: 1 (Relative positioning), 2 (Absolute positioning)

EnableAxis: TRUE (enable)

ExecuteMode: PTP triggering (started at the rising edge)

IntermediateStop: TRUE (Normal), FALSE (PTP pause)

CancelTraversing: TRUE (Normal), FALSE (PTP stop)

Position: Position reference (effective after triggering)

Velocity: speed reference (must be positive, effective after triggering)

OverV: Speed reference magnification, 0–199 (%)

OverAcc, OverDec: ACC/DEC time magnification P5.52, P5.95), 0–100 (%)

5.1.6 Multi-step positioning mode

ModePos: 6

EnableAxis: TRUE (enable)

ExecuteMode: PTP triggering (started at the rising edge)

IntermediateStop: TRUE (Normal), FALSE (PTP pause)

CancelTraversing: TRUE (Normal), FALSE (PTP stop)

Position: Step number reference (0–63, effective after triggering)

OverV: Speed reference magnification, 0–199 (%)

OverAcc, OverDec: ACC/DEC time magnification (P5.37–P5.52, P5.80–P5.95), 0–100 (%)

Note: Segment attributes are set by the PtP segment control word, and the segment position reference is set by the PtP segment position.

5.1.7 Homing mode

ModePos: 4 (Homing mode is set by P5.10); 5 (when the current position is defined as the home, P5.10 is set to 8 automatically)

EnableAxis: TRUE (enable)

ExecuteMode: Homing triggering, 4 (started at the rising edge and stopped at the falling

edge), 5 (started at the rising edge)

AxisRef: TRUE (homing completed)

Note:

- When the homing mode is 4, the home switch signal can be input through ConfigEPos.%X6 (16#40) (the switch signal can also be connected to the servo, which is in a logical OR relationship with the digital HOME switch input). The positive and negative limit switches must be connected to the servo I/O.
- Speed 1 and speed 2 of homing step are set through P5.12 and P5.13.

5.1.8 User-defined PZD12

Related parameters: P4.28 (IO output control enabling), P4.75 (User-defined control word), P4.76 (User-defined status word)

■ **P4.75 (User-defined control word)**

0: No function

1: Torque feedforward. 0x4000 equals to 100% (P8.03 [Rated torque]), associated parameter P2.44 [Torque command offset].

2: Speed feedforward. 0x4000 equals to 100% (P8.02 [Rated speed]). Set the speed feedforward percentage through P2.10 [Speed feed-forward gain] and view the actual speed feedforward through R2.11 [Feed-forward speed command].

3: IO output. P4.28 [IO output control enabling, reset is effective] is set to 1. The lower 4 bit can be used to control four IO outputs.

■ **P4.76 (User-defined status word)**

0: No function

1: Actual torque (based on the rated torque). 0x4000 equals to 100% (P8.03 [Rated torque]). It can be view through R0.06.

2: Output current (absolute value). 0x4000 equals to 100% (P8.01 [Rated current]). The actual current can be view through R0.10.

3: IO input. IO input status. It can be viewed through R1.00.

4: IO output. IO output status. It can be viewed through R1.01.

5: Actual torque (based on the reference torque). 0x4000 equals to 100% (P4.56 [Reference torque]). It can be view through R0.06.

5.1.9 Other parameter description

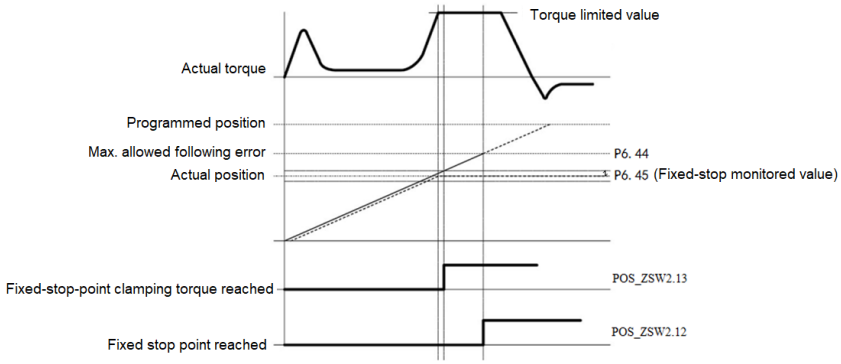
Input	Type	Default	Description
EnableAxis	BOOL	0	STW1.0 (OFF1), deceleration time (P0.55)
AckError	BOOL	0	Rising edge (Fault reset enabling); Falling edge (Fault reset disabling)
Output	**Type**	**Default**	**Description**
AxisEnabled	BOOL	0	TRUE (Enable); FALSE (Disable)
AxisRef	BOOL	0	TRUE (Homing completed; the multi-turn absolute encoder remains the homing state upon power failure) FALSE (Not back to origin)
AxisPosOk	BOOL	0	TRUE (Position reached); FALSE (Running)
Error	BOOL	0	TRUE (Fault); FALSE (Normal)
ActFault	WORD	0	Fault code, corresponding to the servo fault code
ActPosition	DINT	0	Position feedback
ActVelocity	DINT	0	Speed feedback
EPosZSW2.%X3	BOOL	0	Servo control brake status
EPosZSW2.%X12	BOOL	0	Fixed stop point reached
EPosZSW2.%X13	BOOL	0	Clamping torque of fixed stop point reached
EPosZSW2.%X14	BOOL	0	Moving to fixed stop point active

Related functions of ConfigEPOS in modules:

Module interface	Telegram parameter	Description
ConfigEPos.%X0	STW1.1	1 = No OFF2
ConfigEPos.%X1	STW1.2	1 = No OFF3
ConfigEPos.%X2	POS_STW2.14	1= Activate soft limit
ConfigEPos.%X3	POS_STW2.15	1= Activate hard limit
ConfigEPos.%X6	POS_STW2.2	1 = Activate reference point stop
ConfigEPos.%X8	POS_STW1.12	1 = Continuous transmission
ConfigEpos.%30	STW2.8	1= Run to the fixed stop

5.2 Running to the fixed stop point

The Run to fixed stop point function can be used to run the motor to a fixed stop point at a specific torque without triggering a fault message. This specific torque remains constant after the motor reaches the fixed stop point. To use this function, a clamping torque must be set. When the motor encounters a physical stop during movement and the torque reaches the configured clamping torque, it will maintain the clamping state.



Parameter settings:

1. In the TIA Portal, select SIEMENS telegram 111, compile and download it to the PLC. You can use the Workshop software to verify the setting by checking parameter R0.67 [PN main telegram] = 111 (SIEMENS telegram).
2. Set P4.10 [Upper computer type] = 1 (Bus input).
3. Set P0.40 [Speed command selection] = 2 (Bus input).
4. Set P0.20 [Position command selection] = 2 (PTP control).
5. Set P6.43 [Clamping torque at fixed stop] = 0.1Nm.
6. Set P6.44 [Max. following error at fixed stop] = 1000pulse.
7. Set P6.45 [Fixed stop monitoring window] = 2500pulse.

Followed	Name	Current value (X)
R0.67	PN main message	111:Siemens Message 111
P4.10	Upper computer type	1:Bus input
P0.40	Speed command source	2:Bus input
P0.20	Position command source	2:PTP control
P6.43	Clamping torque of fixed block	0.10
P6.44	Max. follow-up error of the fixed block	1000
P6.45	Monitoring window of the fixed block	2500

Example:

If the rated torque of the test motor is 2.4 Nm, the torque limit is calculated as (0.1 / 2.4) * 100% ≈ 4.2%.

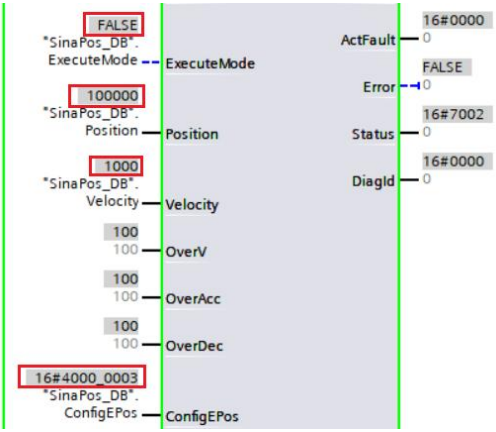
The procedure is as follows:

Step 1 Set control word MDI_POS [Target position] = 100000.

Step 2 Set control word MDI_VEL [Target speed] = 1000LU/Min.

Step 3 Set ConfigEPos = 16#40000003 to activate the function of running to the fixed stop.

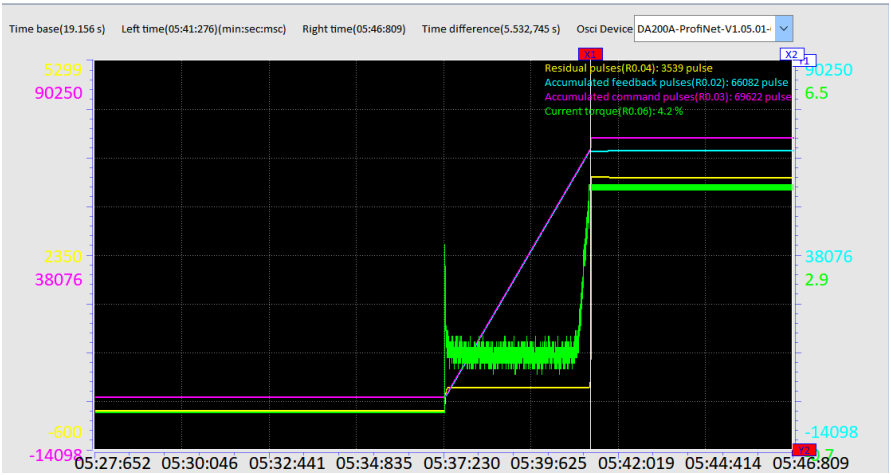
Step 4 The rising edge triggers ExecuteMode, and the motor starts to rotate.



The axis starts from the initial position and approaches the target position at a set speed. The fixed stop point must be between the initial position and the target position. The set torque limit takes effect from the beginning and the Err22-0 position overrun fault is invalid when the Run to fixed stop point function is activated.

5.2.1 Fixed stop point reached

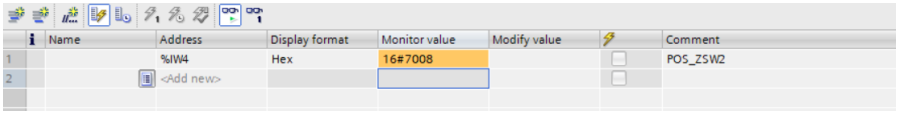
When the axis reaches the mechanical fixed point, the torque value will continue to increase until it reaches the clamping torque. Once the actual following error exceeds the parameter P6.44 [Max. following error at fixed stop], it indicates that the fixed stop has been reached, and the axis will remain at the fixed stop point. The axis will stay at the fixed stop point until an external continue signal is given, as shown in the following figure.



When the fixed stop point is reached, the status word is displayed:

- Status word POS_ZSW2.12 [Fixed stop point reached] = 1
- Status word POS_ZSW2.13 [Clamping torque at fixed stop point reached] = 1.
- Status word POS_ZSW2.14 [Running to fixed stop point active] = 1

See the following figure.



	Name	Address	Display format	Monitor value	Modify value	Comment
1		%IW4	Hex	16#7008		POS_ZSW2
2		<Add new>				

5.2.2 Not reaching the fixed stop point

If the axis does not detect the fixed stop before the positioning operation ends, fault Err22-6: Fixed stop point not reached will be triggered.

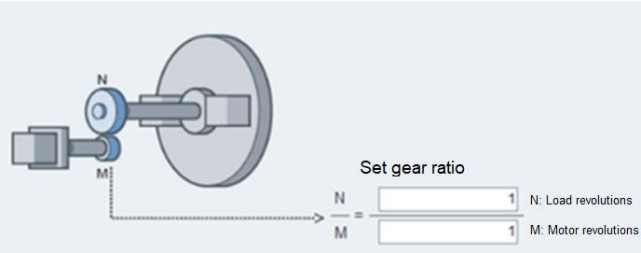
INDEX	Main cod	Sub code	Name	Time	Cause	Workaround	History	Clearable	Stop at once
R9.22	22	6	Fixed stop block - not reaching the fixed stop...	2025-04-10 19:28:47	No fixed block was found within the operating rang...	1. Confirm whether the stopper is within the ran...	✓	✓	✓

After reaching the fixed stop point, if the axis moves away from this position and exceeds the range defined by parameter P6.45 [Fixed stop monitoring window], fault Err22-5: Fixed stop out of monitoring window will be triggered.

INDEX	Main cod	Sub code	Name	Time	Cause	Workaround	History	Clearable	Stop at once
R9.22	22	5	Fixed stopper - fixed stop point outside the monitoring window	2025-04-10 19:41:27	After finding the fixed stopping point, the positi...	1. Check if the P6.45 setting value is reasonable.2. Re...	✓	✓	✓

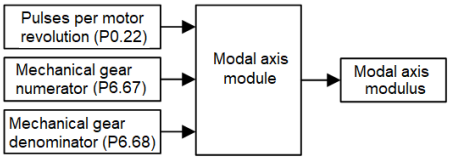
5.3 Modal axis

5.3.1 Modal axis principle



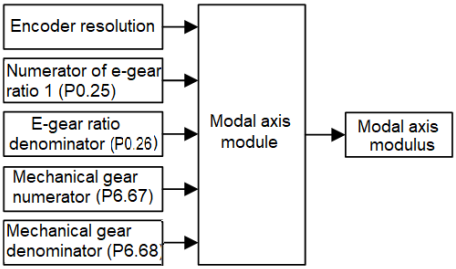
The modal axis function resets the position signal to zero after traveling a defined distance. When applied to a rotary axis, the angular position will reset to zero after a certain angle of rotation. When applied to a linear axis, the position signal will reset to zero after moving a certain distance.

If the number of pulses required for one motor revolution (P0.22) is not zero:



$$\text{Modal axis modulus} = \text{Number of pulses per motor revolution (P0.22)} * \frac{\text{Mechanical gear numerator (P6.67)}}{\text{Mechanical gear denominator (P6.68)}}$$

If the number of pulses required for one motor revolution (P0.22) is zero:



$$\text{Modal axis modulus} = \text{Encoder resolution} / \frac{\text{Numerator of e-gear ratio 1 (P0.25)}}{\text{E-gear ratio denominator (P0.26)}} * \frac{\text{Mechanical gear numerator (P6.67)}}{\text{Mechanical gear denominator (P6.68)}}$$

5.3.2 New parameters

Function code	Name	Description	Setting range	Default	Modify
P6.71	Absolute value system selection	0: Absolute position linear mode 1: Absolute position rotary mode 2: Absolute position rotary mode with single-turn absolute command for modal axis	[0,2]	0	RST
P6.72	Mechanical gear-ratio numerator for absolute position rotary mode	Mechanical gear-ratio numerator for absolute position rotary mode	[1,32767]	1	RST
P6.73	Mechanical gear-ratio denominator for absolute position rotary mode	Mechanical gear-ratio denominator for absolute position rotary mode	[1,32767]	1	RST
R0.81	Modulus of modal axis	Number of pulses corresponding to one full turn of the modal axis in user units	-	-	-

Absolute value system selection (P6.71):

0: Absolute position linear mode, used for linear axes, and supported already.

1: Absolute position rotary mode, used for modal axes, and multi-turn running supported.

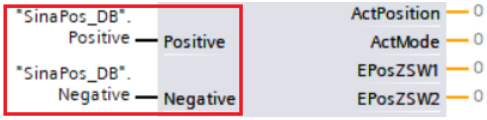
Execution logic: The rotation distance is calculated as the difference between the target position (Position) and the actual position (ActPosition). A positive value indicates forward rotation, and a negative value indicates reverse rotation.

Example: Assume the modulus of the modal axis is 36000. If the actual position (ActPosition) is 18000 and the target position (Position) is 54000, the system performs one full forward rotation.

If the actual position (ActPosition) is 18000 and the target position (Position) is -54000, the system performs two full reverse rotations.

2: Absolute position rotary mode with single-turn absolute command for modal axis

- When using the SinaPos function block: Set the positive input to 1 to move forward.
- When using the SinaPos function block: Set the negative input to 1 to move reversely.
- If both positive and negative inputs are 1 or both are 0, the axis moves in the direction requiring the shortest travel distance.



Execution logic: First, perform a modulo operation on the Position value:

X % (Modal range) = Y

Assume the current position is Z.

For forward running:

- If Y > Z, rotate forward by (Y - Z).
- If Y < Z, rotate forward by (Y + Modal range - Z).
- If Y = Z, do not move.

For reverse running:

- If Y > Z, rotate in reverse by (Z + Modal range - Y).
- If Y< Z , rotate in reverse by (Z - Y).
- If Y = Z, do not move.

For shortest distance:

- If Y > Z, choose the smaller (less than or equal to) distance between forward rotation (Y - Z) or reverse rotation (Z + Modal range - Y).
- If Y < Z, choose the smaller (less than or equal to) distance between reverse rotation (Z - Y) or forward rotation (Y + Modal range - Z).
- If Y = Z, do not move.

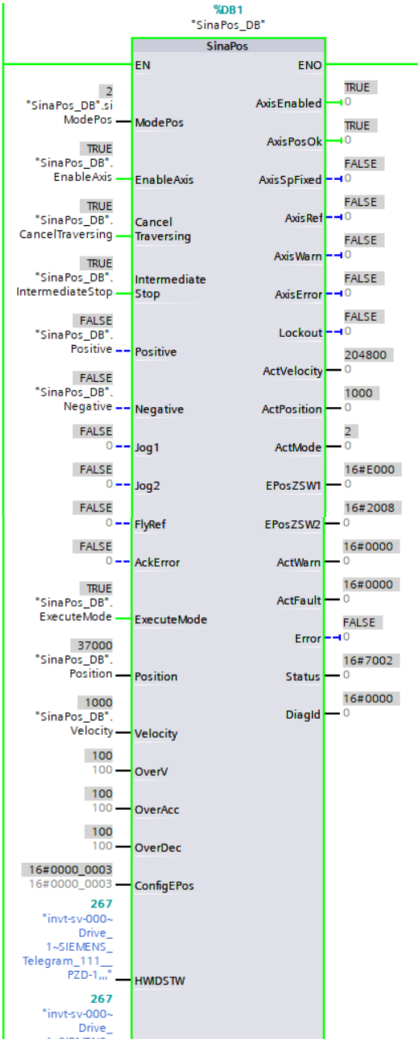
Example: Assume the modulus of the modal axis is 36000. The actual position (ActPosition) is 12000, and the target position (Position) is 24000. If forward rotation is specified, the motor rotates forward by 1/3 of a turn.

If reverse rotation is specified, the motor rotates backward by 2/3 of a turn.

If minimum distance is specified, the motor rotates forward by 1/3 of a turn.

5.3.3 Application example

Use telegram 111 in TIA to control the axis. With SinaPos for online debugging, select operation mode 2 (MDI absolute positioning), and set the value of Position. When ExecuteMode changes from FALSE to TRUE, the motion is executed.



Note: The modulus of the modal axis cannot be modified directly. It must be calculated by modifying the relevant parameters.

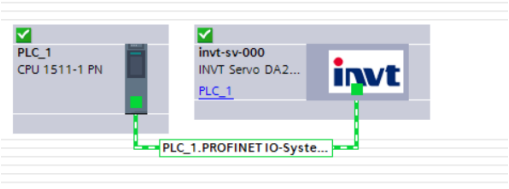
6 Servo parameter reading and writing

During the communication between the PLC and the servo drive, it is necessary to read and write the operation data on the drive. The PLC can read and write the drive parameters through the non-cyclic communication function block SinaParaS, which supports only single-parameter access. At present, the function block can read and write the servo parameters required by the upper computer in the DA200A-F servo drive. For the list of supported parameters, please contact the technical staff.

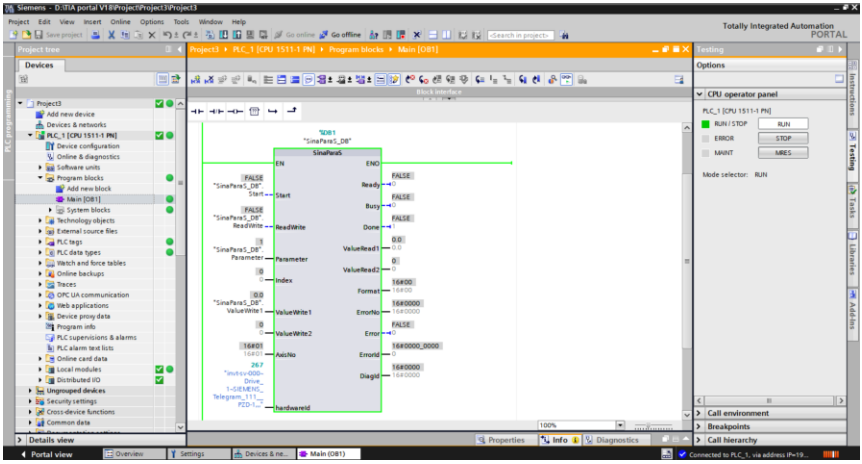
6.1 S7-1500 PLC reading/writing servo parameters

This section uses the S7-1500 PLC as an example to demonstrate how to configure the DA200A-F servo drive in TIA Portal V18 and use the SinaParaS function block to read or modify parameter P2.00 [First speed gain] through non-cyclic communication.

Configure the DA200A-F servo drive by referring to section 3.1. In this example, SIEMENS telegram 111 is selected to compile and download the project to the PLC.

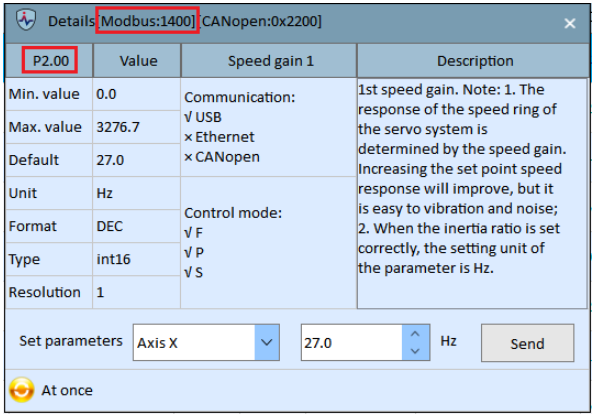


After correct configuration, add the library function SinaParaS to the program block, set and define the variables of the function block, download the project to the PLC, run the PLC, and set the project to online.



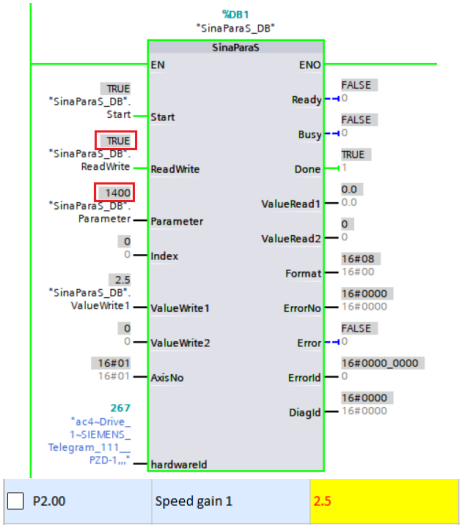
Note: For the DA200A-F servo drive, the default value of AxisNo in SinaParaS is set to 1.

Set the parameter value in SinaParaS according to the servo parameter Modbus address number. The value of P2.00 in SinaParaS is 1400.



6.1.1 Writing the parameter: First speed gain

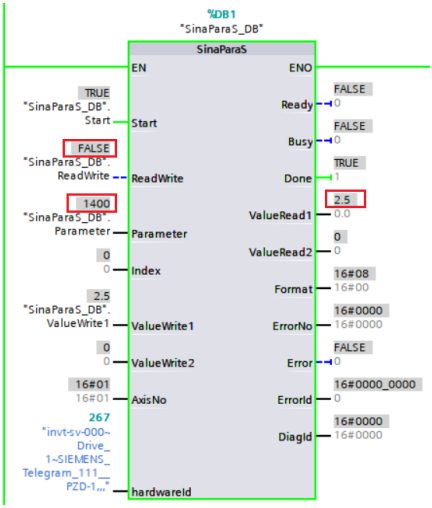
Enter the parameter value to be written according to the parameter type. If the data type is real, the parameter value is written to **ValueWrite1** in SinaParaS. If the data type is integer, the parameter value is written to **ValueWrite2** in SinaParaS. In this example, the data type of parameter P2.00 is a real number and the parameter value should be written to ValueWrite1. Assign **2.5** to **ValueWrite1**, set **ReadWrite** to **1** to switch to write mode, trigger Start to start the task, and observe the parameter value corresponding to parameter P2.00 on the upper computer Workshop.



6.1.2 Reading the parameter: First speed gain

Set **ReadWrite** to **0** to enter the read parameter mode, trigger Start to start the task, and observe the **ValueRead1** or **ValueRead2** value in SinaParaS. If the data type of the parameter is real, the parameter value is displayed in **ValueRead1**. If the data type of the parameter is integer, the parameter value is displayed in **ValueRead2**.

Note: The double-word PZD is currently displayed as 32-bit on the upper computer and shown in the R1 group. It does not support separate 16-bit display.



7 User-defined telegram

7.1 DP-V0 communication protocol

DP-V0 is a basic communication protocol version that only supports cyclic data exchange (MS0 communication). It provides basic configuration, parameter definitions, and simple diagnostic mechanisms.

The cyclic transmission telegram uses a fixed 32-byte frame length for transmission, and the data format is as follows.

0–7 (Byte)	8–31 (Byte)
PKW	PZD

PKW (Parameter channel) is used for transmitting non-cyclic data, used to configure the drive parameters and perform read/write operations on the drive parameters. PZD (Process data channel) is used for transmitting cyclic data, such as control words, speed commands, position commands, torque commands, or status words, speed feedback, position feedback, torque feedback. PZD data can also transmit configuration parameter data.

■ **PKW telegram format**

PKW								
PKW number (Byte)	1	2	3	4	5	6	7	8
-	PKE*¹		IND*²		PWE*³			

Note:

- *¹: PKE indicates the telegram format.
- *²: Parameter communication IND, which is described as follows:
  - The communication address is the same as the Modbus address, and all addresses are in decimal format.
  - Unless otherwise specified, the address is a 32-bit data address. For more details, refer to the manual. For example, parameter P4.13 represents the bus speed reference. The data itself is int16, but the Modbus address is 1826, 1827.
- *³: PWE indicates the parameter value.
- Only one PKW request is processed at a time, but the servo drive continues to respond until the controller updates the command.

■ **PKE telegram format**

PKE																
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

PKE		
	AK (Task or response ID)	Reserved (to 0)

- **AK task ID**

Master -> Slave		Slave -> Master	
Task ID	**Function**	**Positive response ID**	**Negative response ID**
0	No task	0	0
1	Read parameter	1, 2	7
2	Write parameter (single word)	1	7
3	Write parameter (double word)	2	7
13	Write parameter (single word) and save to EEPROM	1	7
14	Write parameter (double word) and save to EEPROM	2	7

Example:

- **Read parameter**

Read parameter P0.05 (Jog speed). The value is 200, Modbus address is 1010, and data type is int16.

Slave -> Master								
PKW number (Byte)	1	2	3	4	5	6	7	8
	PKE		IND		PWE			
	16#1000		16#03F2		16#0000_0000			
Slave -> Master								
PKW number (Byte)	1	2	3	4	5	6	7	8
	PKE		IND		PWE			
	16#1000		16#03F2		16#0000_00C8			

- **Write parameter**

Write parameter P0.05 (Jog speed). The written value is 500, Modbus address is 1010, and data type is int16.

Slave -> Master								
PKW number (Byte)	1	2	3	4	5	6	7	8
	PKE		IND		PWE			
	16#2000		16#03F2		16#0000_01F4			
Slave -> Master								
PKW number (Byte)	1	2	3	4	5	6	7	8

Slave -> Master			
	PKE	IND	PWE
	16#2000	16#03F2	16#0000_01F4

When the written value (1200) exceeds the max. value (1000) of parameter P0.05 (Jog speed), the negative response ID is 7 and the PWE is 2, indicating that the value exceeds the allowable parameter range.

Slave -> Master								
PKW number (Byte)	1	2	3	4	5	6	7	8
	PKE		IND		PWE			
	16#2000		16#03F2		16#0000_04B0			
Slave -> Master								
PKW number (Byte)	1	2	3	4	5	6	7	8
	PKE		IND		PWE			
	16#7000		16#03F2		16#0000_0002			

■ **PZD telegram format**

PZD												
WORD*1	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Downward run	CW	Speed command	Position command *2		Torque command	Reserved	Configured setting parameter 1*3		Configured setting parameter 2		Configured setting parameter 3	
Upward run	SW	Speed feedback	Position feedback		Torque feedback	Reserved	Configured feedback parameter 1		Configured feedback parameter 2		Configured feedback parameter 3	

***1**: The length of a word is 16 bits.

***2**: The fixed content of PZD data corresponds to the following parameters:

- Position command corresponds to P4.12 [Bus position command].
- Speed command corresponds to P4.13 [Bus speed command].
- Torque command corresponds to P4.14 [Bus torque command].
- Speed feedback corresponds to R0.21 [Instantaneous speed].
- Position feedback corresponds to R0.02 [Accumulated feedback pulses].
- Torque feedback corresponds to R0.06 [Actual torque].

*3: Configured setting parameters 1–3 correspond to P4.80–P4.82 [PZD setting parameter *n* configuration].

Configured feedback parameters 1–3 correspond to P4.85–P4.87 [PZD feedback parameter *n* configuration].

The control word (CW) bits are listed in the bitwise sequence:

Bit	Function
0	MODE_SWITCH
1	GAIN_SWITCH
2	JRATIO_SWITCH
3	TRQLIMIT_SWITCH
4	ZCLAMP
5	POSERR_CLEAR
6	VIB_SUB
7	QUICK_STOP
8	SERVO_DI_INH
9	SERVO_ON
10	FAULT_CLEAR
11	EMEGENCY
12	POT(POSITIVE_LIMIT)
13	NOT(NAGETIVE_LIMIT)
14	HOME_SINGAL
15	HOME_TRIGGER

When bit 8 is set to 0, the drive uses the digital input as the source for the corresponding function (but CW control remains effective, and it operates in an OR relation with the digital input); when set to 1, the digital input is masked, and only the corresponding control bit in the CW is used as the source for the function, and this control function is limited to forward/reverse drive inhibition (P3.40 needs to be set to enable limit switch), HOME switch signal, and HOME trigger.

The status word (SW) bits are listed in the bitwise sequence:

Bit	Function
0	SPD_COIN
1	SPD_AT
2	SPD_LIMITING
3	SPD_CMD_VALID
4	SPD_ZERO
5	TRQ_LIMITING
6	HOME_END
7	PZD_CONTROLING
8	READY
9	RUN
10	FAULT

Bit	Function
11	ALARM
12	BREAK_OFF
13	POS_CMD_VALID
14	POS_COIN
15	MODE_CHANGE_STATUS

All words and double words used are transmitted in Big-Endian format, that is, the high byte or high word is transmitted first, followed by the low byte or low word (the preceding CW and SW are already in Big-Endian format).

The GSD file is a text file, which is required for each PROFINET slave on the PROFINET bus. The GSD file is used to describe the characteristics of a PROFINET device. The GSD file contains all device defined parameters, including the supported information length, and input/output data quantity.

7.2 DP-V0-1 protocol optimization

Set parameter P4.74 [INVT defined telegram selection] to 1: DP-V0-1. The transmission still uses a fixed 32-byte frame length, but only the PZD parameters are optimized. The optimized PZD telegram format is as follows.

■ **PZD telegram format**

PZD												
WORD*1	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Downward run	CW	Speed command*2	Configured setting parameter 1*3		Configured setting parameter 2		Configured setting parameter 3		Configured setting parameter 4		Configured setting parameter 5	
Upward run	SW	Speed feedback	Configured feedback parameter 1		Configured feedback parameter 2		Configured feedback parameter 3		Configured feedback parameter 4		Configured feedback parameter 5	

*1: The length of a word is 16 bits.

*2: The fixed content of PZD data corresponds to the following parameters:

Speed command corresponds to P4.13 [Bus speed command].

Speed feedback corresponds to R0.21 [Instantaneous speed].

*3: Configured setting parameters 1–5 correspond to P4.80–P4.84 [PZD setting parameter *n* configuration].
Configured feedback parameters 1–5 correspond to P4.85–P4.89 [PZD feedback parameter *n* configuration].

Note: P0.03 does not support switching the torque limit in torque control mode.

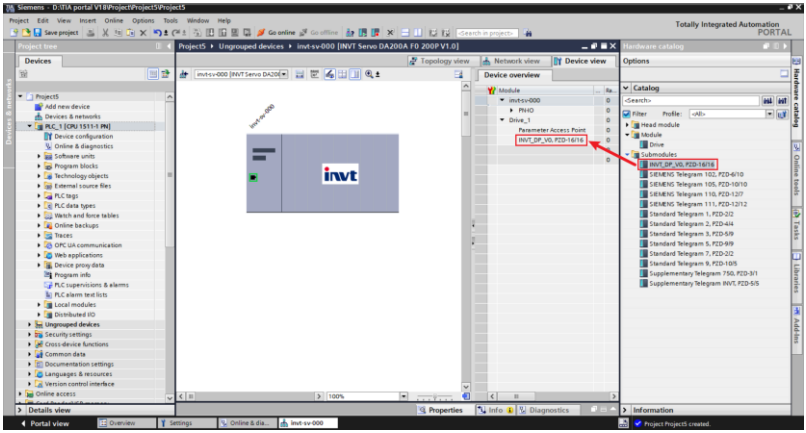
7.3 Communication configuration

This section describes how to configure the S7-1500 PLC and DA200A-F servo drive using the SIEMENS TIA Portal V18 to implement the PROFINET communication through the DP-V0 and DP-V0-1 protocols.

7.3.1 Adding telegrams

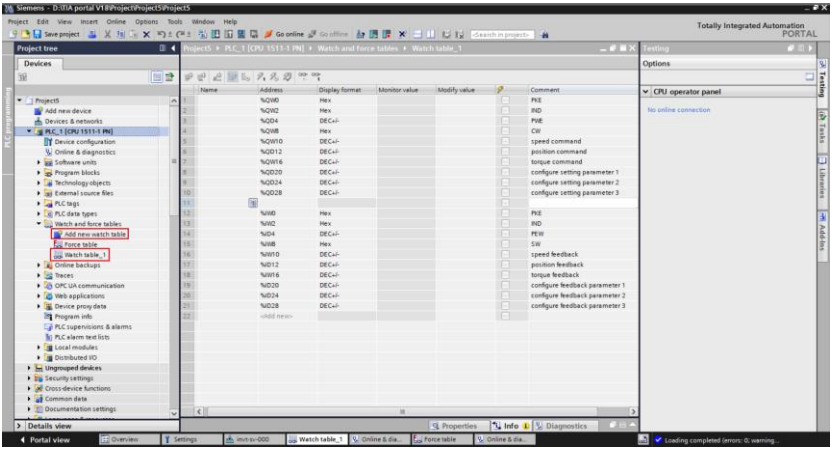
Add an INVT I/O submodule to the project.

Double-click the **INVT Servo DA200A F0 200P V1.0** icon in the network view to access the device view. Under **Hardware catalog** on the right, choose **Module**, double-click **Drive**, click **Submodules**, and double-click **INVT_DP_V0, PZD-16/16**. Add the INVT defined telegram to the project.

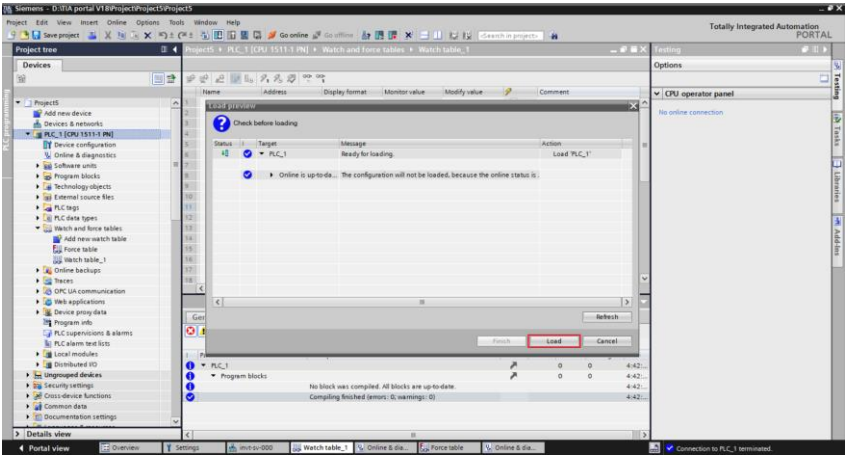


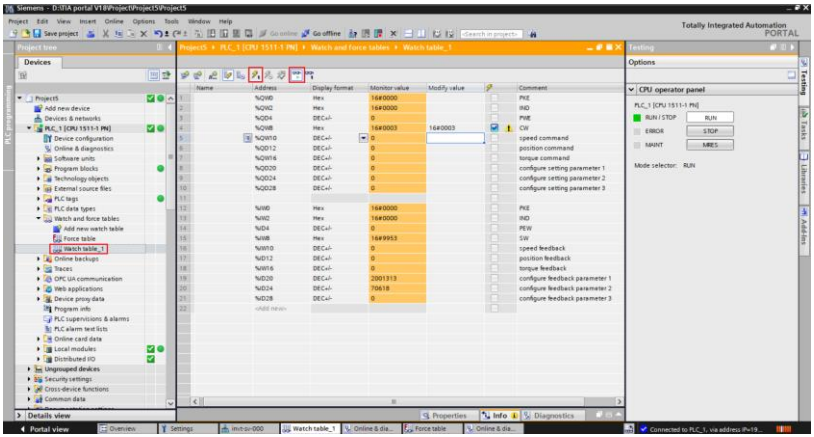
7.3.2 Monitoring varaible tables

Step 1 Choose **Watch and force tables** > **Add new watch table** in the project tree on the left. Taking the DP-V0 telegram as an example (P4.74 [INVT defined telegram selection] = 0: DP-V0), add read/write parameters in the monitoring table as shown in the following. Among them: QW0–QW31 correspond to the PLC output addresses, which are consistent with the configured Q addresses; IW0–IW31 correspond to the PLC input addresses, which are consistent with the configured I addresses.



Step 2 Download the configuration and compile it to the PLC, and then enter online simulation mode. Click on the red box icon to monitor and modify parameters





7.4 Operation mode

7.4.1 Position mode—Bus position

7.4.1.1 Basic description

The servo drive (slave) receives position commands from the master (upper computer), which, after conversion through the electronic gear ratio, is used as the target position for internal position control.

When P0.22 is set to a non-zero value: Position command encoder unit = Position command user unit * Encoder resolution / P0.22 [Pulses per motor revolution]

When P0.22 is set to zero: Position command encoder unit = Position command user unit * P0.25 [Numerator of electronic gear ratio 1] / P0.26 [Denominator of electronic gear ratio]

Note: This mode requires planning parameters such as speed and acceleration on the PLC side.

7.4.1.2 Procedure

Step 1 Set P0.03 [Control mode] (IND = 1006) to 0 (Position mode).

Step 2 Set P4.12 [Bus position command] to the target position (IND = 1824; Unit: user unit).

Step 3 Set P0.33 [Position command smooth filtering] (IND = 1066). This parameter takes effect immediately and can be configured as PZD setting (in version V2.61 or later).

Step 4 Set P0.34 [Position command FIR filtering] (IND = 1068) (FIR filter time = PZD control cycle), which takes effect after stop.

Step 5 Set P0.22 (IND = 1044) to adjust the electronic gear ratio denominator.

Step 6 Set CW.bit0 (SERVO_DI_INH) to 1, and then set CW.bit1 (SERVO_ON) to enable the servo drive and start the motor operation.

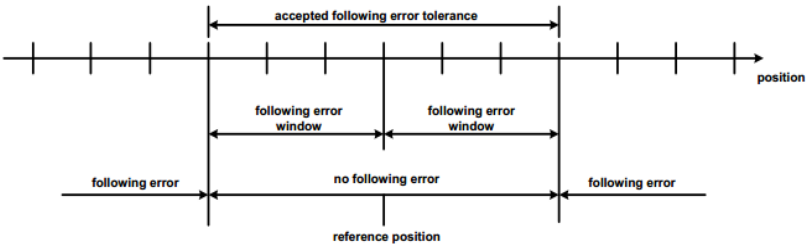
Step 7 Query R0.02 (IND = 4004) to get the actual motor position feedback (Position feedback is 64-bit data).

Step 8 Query the corresponding bits in SW to obtain the servo drive status feedback (READY, RUN, POS_CMD_VALID, and POSITION_COIN).

7.4.1.3 Other objects

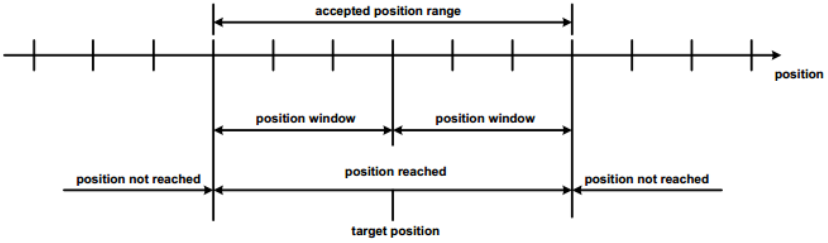
Step 1 Set P4.33 (IND = 1866) to adjust the position deviation tolerance (unit: user unit).

Step 2 Query R0.04 (IND = 4012) to get the actual motor position deviation (unit: user unit).



Reference position

Step 3 Set P3.50 (IND = 1700) to adjust the positioning completion range (unit: user unit).



Position reached

7.4.2 Position mode—Internal PTP

7.4.2.1 Basic description

The servo drive (slave) receives position commands from the master (upper computer), which, after conversion through the electronic gear ratio, is used as the target position for internal position control.

When P0.22 is set to a non-zero value: Position command encoder unit = Position command user unit * Encoder resolution / P0.22 [Pulses per motor revolution]

When P0.22 is set to zero: Position command encoder unit = Position command user unit * P0.25 [Numerator of electronic gear ratio 1] / P0.26 [Denominator of electronic gear ratio]

7.4.2.2 Procedure

Step 1 Set P0.03 [Control mode] (IND = 1006) to 0 (Position mode).

Step 2 Set P0.20 [Position command selection] to 2 (PTP control).

Step 3 Set P4.80 [PZD setting parameter 1 configuration] to (IND=2042). Check P5.21 for the reference value (unit: r/min).

Step 4 Set P4.81 [PZD setting parameter 2 configuration] to (IND=3202). Check PTP0.01 for the reference value (unit: user unit).

The PTP trigger signal is sent through PKW data.

Step 5 Set P0.33 [Position command smooth filtering] (IND = 1066). This parameter takes effect immediately and can be configured as PZD setting (in version V2.61 or later).

Step 6 Set P0.34 [Position command FIR filtering] (IND = 1068) (FIR filter time = PZD control cycle), which takes effect after stop.

Step 7 Set P0.22 (IND = 1044) to adjust the electronic gear ratio denominator.

Step 8 Set CW.bit0 (SERVO_DI_INH) to 1, and then set CW.bit1 (SERVO_ON) to enable the servo drive and start the motor operation.

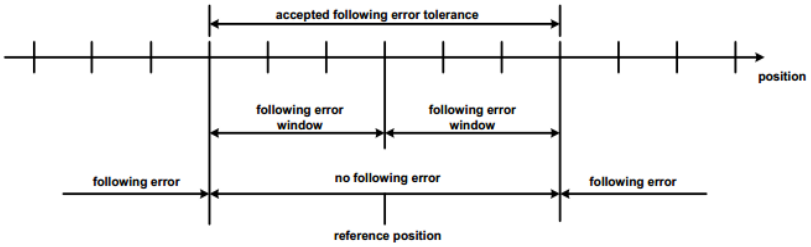
Step 9 Query R0.02 (IND = 4004) to get the actual motor position feedback (Position feedback is 64-bit data).

Step 10 Query the corresponding bits in SW to obtain the servo drive status feedback (READY, RUN, POS_CMD_VALID, and POSITION_COIN).

7.4.2.3 Other objects

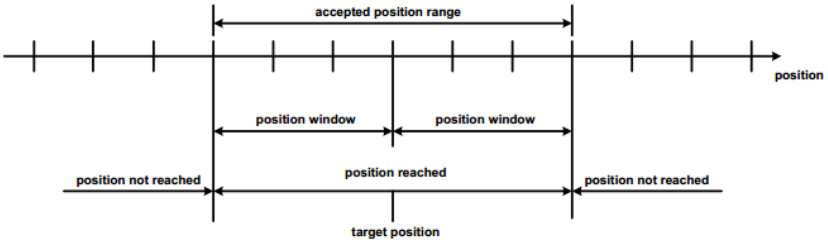
Step 1 Set P4.33 (IND = 1866) to adjust the position deviation tolerance (unit: user unit).

Step 2 Query R0.04 (IND = 4012) to obtain the actual motor position deviation (unit: user unit).



Reference position

Step 3 Set P3.50 (IND = 1700) to adjust the positioning completion range (unit: user unit).



Position reached

7.4.3 Speed mode

7.4.3.1 Basic description

In speed mode, the servo drive (slave) receives a speed command from the upper computer (master) and performs speed planning internally based on the configured acceleration parameters.

7.4.3.2 Procedure

Step 1 Set P0.03 [Control mode] (IND = 1006) to 1 (Speed mode).

Step 2 Set P4.13 [Bus speed command] to the target speed (IND = 1826 or WORD1 in the PZD) (unit: rpm).

Step 3 Set P0.54 [Acceleration Time] (IND = 1108) to adjust the acceleration curve (unit: ms from 0 to rated speed).

Step 4 Set P0.55 [Deceleration Time] (IND = 1110) to adjust the deceleration curve (unit: ms from rated speed to 0).

Step 5 Set CW.bit0 (SERVO_DI_INH) to 1, and then set CW.bit1 (SERVO_ON) to enable the servo drive and start the motor operation.

Step 6 Query the corresponding bits in SW to obtain the servo drive status feedback

(READY, RUN, SPD_CMD_VALID, SPEED_COIN, and SPEED_AT).

Step 7 Query R0.21 [Instantaneous speed] (IND = 4046) to obtain the actual speed feedback (unit: rpm).

7.4.3.3 Other objects

Set P3.53 [Speed consistency threshold] (IND=1706) to change the speed consistency range (unit: rpm).

Set P3.54 [Speed reaching range] (IND=1708) to change the speed reaching range (unit: rpm).

Set P3.55 [Zero speed range] (IND=1710) to change the zero speed range (unit: rpm).

Set P4.31 [Max. speed limit] (IND=1862) to change the max. speed limit (unit: rpm).

Set P4.39 [Speed deviation setting] (IND=1878) to change the speed deviation setting (unit: rpm).

7.4.4 Torque mode

7.4.4.1 Basic description

In torque mode, the servo drive (slave) receives a torque command from the upper computer (master) and performs torque planning internally based on the configured torque parameters.

7.4.4.2 Procedure

Step 1 Set P0.03 [Control mode] (IND = 1006) to 2 (Torque mode).

Step 2 Set P0.68 [RAMP time of torque command] (IND = 1136) to adjust the torque planning (unit: ms from 0 to 100% rated torque).

Step 3 Set P4.14 [Bus torque command] to the torque speed (IND = 1828 or WORD4 in the PZD) (unit: 0.1% rated torque).

Step 4 Set P0.46 [Speed limit 1] (IND=1092) to change the speed limit (unit: rpm).

Step 5 Set CW.bit0 (SERVO_DI_INH) to 1, and then set CW.bit1 (SERVO_ON) to enable the servo drive and start the motor operation.

Step 6 Query the corresponding bits in SW to obtain the servo drive status feedback (READY, RUN, SPEED_LIMITING, and TORQUE_LIMITING).

Step 7 Set R0.06 [Current torque] (IND = 4016) to obtain the actual torque output (unit: 0.1% rated torque).

Step 8 Query R0.21 [Instantaneous speed] (IND = 4046) to obtain the actual speed feedback (unit: rpm).

7.4.4.3 Other objects

Step 1 Set P0.10 [Max. torque limit] (IND = 1020) to change the max. torque limit (unit: 0.1% rated torque).

Step 2 Set P8.03 [Rated torque] (IND = 2606) to obtain the motor rated torque (unit: 0.01Nm).

Step 3 Query R0.10 [Output current] (IND = 4024) to obtain the actual output current (unit: 0.01A).

7.4.5 Analog output

The servo carries two analog outputs, corresponding to parameters P3.37 and P3.38.

The analog output is servo controlled by default. If it is controlled by the master through PROFINET communication, set P3.30 [Analog output selection 1] to 0 (disabled), P3.32 [Analog output selection 2] to 0 (enabled), or write P3.37 and P3.38 through PKW or PZD.

P3.30	Function of AO 1	0:Invalid
P3.31	Voltage gain of AO 1	1
P3.32	Function of AO 2	0:Invalid
P3.33	Voltage gain of AO 2	1
P3.37	Communication-b ased control analog output 1	0
P3.38	Analog output 2	0

The units of P3.37 and P3.38 are related to P3.31 and P3.33.

The actual output voltage is calculated by dividing the value of P3.37 or P3.38 by the corresponding voltage gain. For example, P3.37 is set to 1, voltage gain is set to 10, and the voltage of output analog 1 is 0.1V.

7.4.6 Digital output

The servo provides four differential outputs. For specific definitions, see Table 1-3 CN1 terminals.

The digital output is servo controlled by default. If it is controlled by the master through PROFINET communication, set bit 12 of P4.43 [PROFINET related control] to 1 (enabled), or write P3.39 through PKW or PZD.

P3.39 is a 16-bit unsigned data parameter composed of three 16-bit values. For example, in 0xABC:

- Bh: Controls the enabling status of the four digital outputs (1 = enabled).

- Ch: Sets the output logic state of the four digital outputs (0 = logic state 0, 1 = logic state 1).
- Ah: Defines the output state after communication disconnection (24-D alarm). When set to 1, the digital output logic will switch to 0 upon disconnection.

8 Fault and diagnosis

8.1 PROFIdrive communication faults and solutions

Fault code	Name	Cause	Countermeasure
Er24-5	PROFIdrive fault–Communication disconnection	●After the drive is enabled, the network cable is not inserted properly or the master node does not run properly.	●Check whether network cable is connected properly. ●Check whether the switch (if used) is working properly. ●Check that the master is working properly.
Er24-6	PROFIdrive fault–Internal communication initialization fault	●Drive internal communication initialization failed.	●Restart the servo drive. ●Replace the servo drive.

8.2 PROFINET communication faults and solutions

Fault code	Name	Cause	Countermeasure
Er24-0	PROFINET fault-PWK parameter ID error	●The PWK parameter ID is incorrect.	●View the manual and ensure that the PWK parameter ID is the same as the corresponding parameter ID.
Er24-1	PROFINET fault-PWK parameter out-of-range	●The PWK parameter value is out of the allowed range.	●View the manual and ensure that the setting value of PWK parameter is within the allowed range of the corresponding parameter.
Er24-2	PROFINET fault-Read-only PWK parameter	●An attempt was made to write to read-only parameters in PWK.	●View the manual and ensure that the operation parameter is readable and writable.
Er24-3	PROFINET fault-PZD setting parameter does not exist	●The parameter ID selected for PZD configuration is incorrect.	●View the manual and ensure that the PZD configuration parameter ID is the same as the corresponding parameter ID.
Er24-4	PROFINET fault-PZD setting	●A parameter that does not take effect immediately has	●View the manual and ensure that the PZD configuration

Fault code	Name	Cause	Countermeasure
	parameter property does not match	been selected for PZD configuration.	parameter takes effect immediately.
Er24-5	PROFINET fault–Communication disconnection	●After the drive is enabled, the network cable is not inserted properly or the master node does not run properly.	●Check whether network cable is connected properly. ●Check whether the switch (if used) is working properly. ●Check whether the PROFINET master works properly.
Er24-6	PROFINET alarm–Communication setting error	●When P4.10 is not configured as bus input, communication reference is enabled or I/O is enabled.	●Set P4.10 [Upper computer type] to "Bus input".
Er24-7	PROFINET fault—PZD parameter value out-of-range	●The PZD set parameter value is out of range.	●Check the PZD parameter values sent from the master.

8.3 DA200A faults and solutions

Fault code	Name	Cause	Countermeasure
Er01-0	Software overcurrent	●The drive actual output current exceeds the specified value. ●A drive fault has occurred (drive circuit, current sampling circuit, or IGBT exception, or poor connection between drive and control board). ●Motor cables U, V, and W are short connected, or motor cables are grounded or contacted improperly. ●The motor internal windings are short-circuited. ●The motor cables U, V, and W	●Remove the motor cables and then enable the drive. If the fault persists, replace the drive. ●Ensure the motor cables and wiring are in good conditions. ●Replace the motor cable with the unshielded one. ●Reduce the settings of P0.10 and P0.11 to reduce the maximum output torque. ●Increase the ACC/DEC time. ●Replace the drive with a new one with greater power. ●Replace the motor.

Fault code	Name	Cause	Countermeasure
		are connected in reverse phases. ●The UVW motor cable is too long, especially when using a shielded motor cable, causing a false alarm on the drive. ●Improper parameter settings cause system exception. ●The ACC/DEC time in the start or stop process is too short. ●Instantaneous load is too heavy. ●The encoder is either interfered or damaged.	
Er01-1	Braking transistor fault (7.5kW and above models)	●A fault has occurred in the braking circuit (drive circuit, IGBT, or feedback detection circuit). ●The braking resistor has been incorrectly connected to PB and the bus negative terminal.	●Check the wiring ●Replace the drive.
Er01-2	U-phase IGBT fault	●U-phase IGBT is shorted. ●U-phase drive circuit is abnormal. ●U-phase short circuit detected.	●Check the wiring ●Replace the drive.
Er01-3	V-phase IGBT fault	●V-phase IGBT is shorted. ●V-phase drive circuit is abnormal. ●V-phase short circuit detected.	●Check the wiring ●Replace the drive.
Er01-4	W-phase IGBT fault	●W-phase IGBT is shorted. ●W-phase drive circuit is abnormal. ●W-phase short circuit detected.	●Check the wiring ●Replace the drive.
Er01-5	Bus hardware overcurrent	●The drive actual output current exceeds the specified	●Remove the motor cables and then enable the drive. If

Fault code	Name	Cause	Countermeasure
		value. ●Drive fault (such as drive circuit, bus overcurrent detection circuit, or IGBT fault). ●Motor cables U, V, and W are short connected, or motor cables are grounded or contacted improperly. ●The motor internal windings are short-circuited. ●The motor cables U, V, and W are connected in reverse phases. ●The UVW motor cable is too long, especially when using a shielded motor cable, causing a false alarm on the drive. ●Improper parameter settings cause systematic divergence. ●The ACC/DEC time in the start or stop process is too short. ●Instantaneous load is too heavy.	the fault persists, replace the drive. ●Ensure the motor cables and wiring are in good conditions. ●Replace the motor cable with the unshielded one. ●Reduce the settings of P0.10 and P0.11 to reduce the maximum output torque. ●Increase the ACC/DEC time. ●Replace the drive with a new one with greater power. ●Replace the motor.
Er02-0	Encoder fault—(Incremental or resolver) encoder disconnection	●The encoder is not connected, or the connector is loose. ●Incorrect parameter settings. ●Encoder wiring exception (insulation damage, short circuit, incorrect connection, or disconnection) ●Drive or encoder malfunction	●Connect the encoder according to the correct wiring method. Ensure the encoder plug contact is proper. Replace the encoder cable if the cable is broken. ●Ensure the incremental encoder power and voltage are proper. ●Perform cross check by replacing the motor or drive. If the fault is eliminated, replace the faulty motor or drive.

Fault code	Name	Cause	Countermeasure
Er02-1	Encoder fault–Encoder feedback deviation too large	●Serious system interference. ●Incorrect A and B pulse counts and Z signal correspondence in the incremental encoder. ●Incorrect encoder related parameter settings. ●The Z signal type set in P8.20 does not match the encoder's actual signal.	●Check whether the encoder shielding PE is properly grounded at both ends, and the PE wire at the terminal of the aviation connector has good contact and continuity. At the same time, check whether the motor power cable PE is properly grounded at both ends. ●Check whether there is a grounding wire on site and whether the drive is properly grounded. ●If the encoder cable shield layer and power cable PE grounding are in good condition, you can appropriately increase the number of encoder error thresholds. ●Measure whether the Z signal type matches the setting value of P8.20.
Er02-2	Reserved	●Reserved	●Reserved
Er02-3	Encoder fault–CRC check error	●Interference causes communication data exceptions.	●Check whether the encoder shielding PE is properly grounded at both ends, and the PE wire at the terminal of the aviation connector has good contact and continuity. At the same time, check whether the motor power cable PE is properly grounded at both ends. ●Check whether there is a grounding wire on site and whether the drive is properly

Fault code	Name	Cause	Countermeasure
			grounded. ●If the encoder cable shield layer and power cable PE grounding are in good condition, you can appropriately increase the encoder disconnection detection time (P9.84) but not greater than 20.
Er02-4	Reserved	-	-
Er02-5	Reserved	-	-
Er02-6	Encoder fault–Encoder communication timeout	●The communication encoder is not connected, or the connector is loose. ●Incorrect parameter settings. ●Encoder wiring exception (insulation damage, short circuit, incorrect connection, or disconnection) ●Drive or encoder malfunction ●Interference causes communication interruptions or data exceptions. ●The encoder type or drive model is not supported. ●The encoder supply voltage is too low (the drive's 5V voltage is too low, or the encoder cable is too long, causing excessive voltage drop).	●Ensure that the encoder is reliably connected and the parameters are correctly set. ●Connect the encoder according to the correct wiring method. Ensure the encoder plug contact is proper. Replace the encoder cable if the cable is broken. ●For the handling of interference caused exception, see the handling solution for Er02-3. ●Ensure the encoder power voltage is proper. ●Perform cross check by replacing the motor or drive. If the fault is eliminated, replace the faulty motor or drive.
Er02-7	Encoder fault–Encoder multi-turn error	●When the drive is not powered on and only the encoder battery is supplying power, the motor shaft may move rapidly under external force. ●The encoder code disk is abnormal (damaged,	●If the drive is not powered on and the motor without a brake has been moved or transported over a long distance, and this fault occurs after power-up, it is recommended to clear the

Fault code	Name	Cause	Countermeasure
		contaminated with oil, or dusty). ●Strong external interference causes a false alarm by affecting the encoder itself, while actual multi-turn data remains normal.	multi-turn data using P0.71 and rehome the motor; then it can function normally. ●Check the motor appearance and whether the encoder harness at the rear cover is contaminated, and whether the motor shaft has signs of abrasion; if such issues exist, it is recommended to contact the manufacturer for motor replacement. ●If this fault occurs on site, but comparison between single-turn and multi-turn data and mechanical positions shows no loss of turn data, check whether the encoder cable shield PE and motor power cable PE are properly grounded.
Er02-8	Encoder fault–Encoder battery low-voltage alarm	●When a multi-turn absolute encoder is used, the external battery voltage of the encoder is between 3.0V–3.2V. ●The encoder battery cable has poor contact or is connected in reverse. ●The on-site environment is humid, resulting in rapid battery discharge. ●Encoder is abnormal.	●Ensure the encoder battery cable is connected properly. ●Use the multimeter to check whether the external battery voltage is lower than 3.2V. If yes, replace the battery. ●Replace the battery with the drive powered on; otherwise, the encoder's absolute data will be lost and it will need to be rehomed. ●Replace the motor or encoder.
Er02-9	Encoder fault–Encoder battery undervoltage fault	●When a multi-turn absolute encoder is used, the external battery voltage of the encoder is between 2.5V–3.0V.	●Ensure the encoder battery cable is connected properly. ●Use the multimeter to check whether the external battery

Fault code	Name	Cause	Countermeasure
		●The encoder battery cable has poor contact or is connected in reverse. ●The on-site environment is humid, resulting in rapid battery discharge. ●Encoder is abnormal.	voltage is lower than 3.0V. If yes, replace the battery. ●Replace the battery with the drive powered on; otherwise, the encoder's absolute data will be lost and it will need to be rehomed. ●Replace the motor or encoder.
Er02-a	Encoder fault–Encoder overheating	●The encoder feedback temperature is higher than the temperature threshold for protection against overheating.	●Ensure the temperature threshold for protection against overheating is correct. ●Check whether the motor temperature is too high and optimize the cooling conditions.
Er02-b	Encoder fault–Encoder EEPROM writing error	●If the motor is used with a communication encoder, a communication transmission or data check error occurs when the drive updates data to the encoder EEPROM.	●Ensure encoder cables are connected properly and eliminate the conditions that disturb encoder communication. ●Make multiple writing attempts. If the fault is reported repeatedly, replace the motor.
Er02-c	Encoder fault–No data in encoder EEPROM	●When working with a communication encoder, the motor fails to read data from the encoder EEPROM during power-on or reset. ●The encoder is subject to interference.	●Check whether the encoder ground wire is properly connected; contact the manufacturer or replace the motor. ●Select the motor model based on the setting of P0.00 and execute the operation of writing data to the encoder EEPROM through P4.97. ●Mask this fault by setting P4.98. The motor parameters

Fault code	Name	Cause	Countermeasure
			in the drive EEPROM are used for initialization.
Er02-d	Encoder fault–Encoder EEPROM data check error	●When working with a communication encoder, the motor experiences a data checksum error while reading from the encoder EEPROM during power-on or reset. ●The encoder is subject to interference.	●Ensure encoder cables are connected properly and eliminate the conditions that disturb encoder communication. ●Select the motor model based on the setting of P0.00 and execute the operation of writing data to the encoder EEPROM through P4.97 so that data in the encoder EEPROM is updated. ●Mask this fault by setting P4.98. The motor parameters in the drive EEPROM are used for initialization.
Er02-e	Encoder fault–Encoder identification error	●FPGA initialization has not been completed.	●Perform repower-on, if the fault is reported repeatedly, contact the manufacturer or replace the drive.
Er02-f	Encoder fault–Failed to write the encoder offset angle	●The drive failed to write the encoder offset angle to the FPGA.	●Contact the manufacturer or replace the drive.
Er03-0	Current sensor fault–Phase-U current sensor fault	●Both V-phase and W-phase current sampling circuits are abnormal. ●Power-on is made when the motor shaft is in non-static state. ●The module cannot be properly enabled (only for bootstrap-type drives).	●Contact the manufacturer or replace the drive.
Er03-1	Current sensor fault–Phase-V current sensor	●The V-phase current sampling circuit is abnormal. ●Power-on is made when the	●Contact the manufacturer or replace the drive.

Fault code	Name	Cause	Countermeasure
	fault	motor shaft is in non-static state. ●The module cannot be properly enabled (only for bootstrap-type drives).	
Er03-2	Current sensor fault–Phase-W current sensor fault	●The W-phase current sampling circuit is abnormal. ●Power-on is made when the motor shaft is in non-static state. ●The module cannot be properly enabled (only for bootstrap-type drives).	●Contact the manufacturer or replace the drive.
Er04-0	System initialization fault	●The motor is moving during initialization and the filtered motor speed (R0.21) is greater than 250RPM.	●During servo power-up and soft reset, keep the motor stationary or ensure the filtered motor speed (R0.21) is less than 250RPM.
Er04-1	Motor identification initialization check failure	●The motor model saved in the drive does not match the actual motor model set by P0.00.	●Perform a soft reset. ●Set the correct motor model.
Er05-0	Setting fault–Motor model not exist	●P9.50 is set incorrectly.	●Ensure the drive model is correctly set in P9.50 and the parameter value is within the allowed range.
Er05-1	Setting fault–Motor model not exist	●A third-party motor is used. ●Incorrect motor model setting in P0.00.	●Check whether the motor model setting in P0.00 is correct.
Er05-2	Setting fault–Motor and drive model not match	●Incorrect motor model setting in P0.00.	●Check whether the motor model in P0.00 matches the power rating of the drive.
Er05-3	Setting fault–Incorrect software limits	●Software limits are set incorrectly. The setting of P0.35 is equal to or less than that of P0.36.	●Reconfigure P0.35 and P0.36, and ensure that the value of P0.35 is less than P0.38.
Er05-4	Setting fault–Incorrect homing	●Unreasonable setting of P5.10 homing mode: T mode value	●Incorrect setting of P5.10 homing mode: T mode value

Fault code	Name	Cause	Countermeasure
	mode	exceeds 1, Z mode exceeds 2, or M mode exceeds 8.	≤1, Z mode ≤2, and M mode ≤8.
Er05-5	Setting fault–PTP-control travel overflow	●Ensure that the single travel increment does not exceed ±(2³–1) in the absolute position mode.	●Ensure that the single travel increment does not exceed ±(2³–1) in the absolute position mode.
Er05-6	Setting fault–Power module setting error	●Imported configuration parameters are incorrect.	●Ensure the drive model is correctly set in P9.37 and the parameter value is within the allowed range.
Er07-0	Regenerative discharge overload fault	●Incorrect settings of braking resistor parameters (internal/external, resistance, power, braking switch voltage). ●The selected braking resistor power is too small (common in a motor with frequent deceleration, high inertia, or other regenerative conditions). ●The bus voltage is too high and exceeds the braking transistor threshold.	●Check whether the parameters related to the braking resistor are set correctly. ●Check whether the motor power lines (U, V, W), including those of other axes in the system, are shorted to the motor housing. ●Change the built-in braking resistor to an external one, and select an external resistor with higher power. ●Properly increase the deceleration time. ●In some cases, consider using a common DC bus or an external capacitor module with buffering.
Er08-0	AI overvoltage fault–AI 1	●The actual analog input voltage exceeds the threshold. ●Abnormal terminal wiring. ●Incorrect setting of voltage threshold parameter P3.22, P3.25, or P3.75. ●Incorrect setting of analog	●Set P3.22, P3.25 and P3.75 correctly. ●Ensure the terminal wiring is proper. ●Set P3.22, P3.25 and P3.75 to 0 to disable protection. ●Set P3.20, P3.23 and P3.71 correctly.
Er08-1	AI overvoltage fault–AI 2		
Er08-2	AI overvoltage fault–AI 3		

Fault code	Name	Cause	Countermeasure
		input offset parameter P3.20, P3.23, or P3.71.	
Er09-0	EEPROM fault–Read/write error	●Data is damaged in the data storage area when the drive reads data from the EEPROM. ●Writing data to the EEPROM is disturbed.	●Try again after re-power on. ●If the fault occurs repeatedly, replace the drive.
Er09-1	EEPROM fault–Data check error	●Writing data to the EEPROM is disturbed. ●The drive software version is updated.	●Set all parameters again (through P9.97). ●If the fault occurs repeatedly, replace the drive.
Er10-0	Hardware fault–FPGA fault	●The FPGA on the control board reports a fault.	●Perform repower-on. ●If the fault occurs repeatedly, replace the drive.
Er10-1	Hardware fault–Communication card fault	●External communication card fault reported.	●Perform repower-on. ●If the fault occurs repeatedly, replace the communication card.
Er10-2	Hardware fault–To-ground short circuit fault	●One of the motor cables V and W is short connected to the ground, which is found in to-ground short circuit detection during drive power-on.	●Ensure motor cables are connected properly. ●Replace motor cables or check for aging of insulation.
Er10-3	Hardware fault–External input fault	●This fault occurs when the digital terminal configured with the external fault input function acts.	●Clear the external fault input and enable fault clearing. ●Re-power on the drive.
Er10-4	Hardware fault–Emergency stop fault	●This fault occurs when the emergency stop button (digital terminal configured with the emergency stop function) acts.	●Cancel the emergency stop input and enable fault clearing. ●Re-power on the drive.
Er10-5	Hardware fault–485 communication fault	●Strong EMI on RS485 communication circuit causes a drive serial communication alarm.	●Use shielded twisted pairs for RS485 communication. ●Route communication cables and motor cables separately.
Er10-6	Hardware fault–AC	●Phase loss has occurred to R,	●Check the power wiring.

Fault code	Name	Cause	Countermeasure
	power phase loss	S, or T.	●Set the power input parameter P0.12 correctly.
Er10-7	Hardware fault–Fan fault	●Fan or drive-related circuit exception.	●Check whether there is any foreign object blocking the fan causing the exception. ●Replace the fan. ●If the fault persists, replace the drive.
Er10-8	Hardware fault–Regenerative transistor fault	●The braking resistor is not connected. ●Braking circuit exception.	●Check whether the braking resistor value and its wiring are correct. ●If the fault persists, replace the drive.
Er10-9	Hardware fault–STO phase loss	●Both safety terminal inputs 1 and 2 are abnormal.	●Check the safety terminal input power and wiring. ●Perform cross check by replacing the drive. If the fault persists, replace the drive.
Er10-a	Hardware fault–STO DPIN1 fault	●Safety terminal input 1 is abnormal.	●Check the safety terminal input power and wiring. ●Perform cross check by replacing the drive. If the fault persists, replace the drive.
Er10-b	Hardware fault–STO DPIN2 fault	●Safety terminal input 2 is abnormal.	●Check the safety terminal input power and wiring. ●Perform cross check by replacing the drive. If the fault persists, replace the drive.
Er10-e	STO terminal fault	●The STO function enabling parameter (P9.69) is set to disable, and the STO terminal is not plugged in.	●Check whether the STO terminal is correctly inserted. ●Check whether the STO terminal wiring is correct.
Er11-0	Software fault–Motor control task re-entry	●The DSP CPU utilization is too high.	●Contact customer service personnel to update the drive software.

Fault code	Name	Cause	Countermeasure
Er11-1	Software fault–Periodic task re-entry		
Er11-2	Software fault–Illegal operation		
Er12-0	I/O fault–Duplicate DI assignment	●Two or more digital inputs are configured with the same function.	●Reset P3.00–P3.09 and ensure each setting is unique.
Er12-1	I/O fault–Duplicate AI assignment	●When the drive is a standard model, analog inputs 1 to 3 are configured as duplicate command inputs.	●Check whether analog inputs 1 to 3 are assigned as duplicates and configured to the correct values.
Er12-2	I/O fault–Pulse input frequency too high	●The pulse input frequency detected by the drive is higher than the specified frequency. ●External input pulse signal frequency is too high. ●The internal pulse frequency detection circuit of the drive is damaged.	●Reduce the external input pulse signal frequency. ●If the fault persists though the external input signal is normal, replace the drive.
Er13-0	Main circuit overvoltage fault	●The detected main circuit DC voltage of the drive exceeds the protection threshold. ●Grid voltage too high. ●Under the braking condition, no braking resistor is connected or the resistance is too high, causing the braking circuit abnormal or braking resistor damaged. ●Incorrect drive parameter (overvoltage protection) setting. ●Internal voltage detection circuit of the drive is abnormal.	●Ensure the grid input voltage is within the allowed range. ●Check the wiring of braking resistor is normal. ●Reduce the braking resistor resistance value appropriately. ●Check whether the bus voltage waveform monitored by the upper computer discharges normally after reaching the braking transistor activation threshold. ●Check R0.07 when the drive is disabled. If it is abnormal and does not match the grid input voltage, replace the drive.

Fault code	Name	Cause	Countermeasure
Er13-1	Main circuit undervoltage fault	●The detected main circuit DC voltage of the drive is lower than the protection threshold. ●The grid voltage is too low. ●The buffer relay is not closed. ●Incorrect drive parameter (undervoltage protection) setting. ●Internal voltage detection circuit of the drive is abnormal. ●The drive output power is too high.	●Ensure the grid input voltage is within the allowed range. ●Re-power on the drive. Ensure the buffer relay is closed. If the buffer relay is closed, there is a sound indicating actuation. ●Check R0.07 when the drive is disabled. If it is abnormal and does not match the grid input voltage, replace the drive.
Er14-0	Control power undervoltage fault	●The detected control power voltage of the drive is lower than the protection threshold. ●The grid voltage is too low. ●Incorrect drive parameter (control power undervoltage protection) setting. ●Control power voltage detection circuit of the drive is abnormal.	●Ensure the grid input voltage is within the allowed range. ●Check R0.08 when the drive is disabled. If it is abnormal and does not match the grid input voltage, replace the drive.
Er17-0	Drive overload fault (for 7.5kW and higher models)	●The drive outputs excessive short-term current. ●Incorrect motor phase sequence, incorrect encoder initial angle, or incorrect motor parameter. ●The drive frequently runs in a low-frequency, high-torque state, causing stalling or excessive load, with the motor brake not released. ●Drive or motor damage.	●Check whether the load is abnormal. ●Check whether the motor's UVW wiring is correct, any phase loss has occurred, the encoder initial angle is accurate, and the motor brake is functioning. ●Check whether the drive matches the motor and actual load; consider selecting a higher-level drive. ●Replace the drive or motor.
Er17-1	Drive overload fault 2	●The estimated junction temperature of the drive IGBT	●Check whether the load is abnormal.

Fault code	Name	Cause	Countermeasure
		exceeds the protection threshold. ●Incorrect motor phase sequence, incorrect encoder initial angle, or incorrect motor parameter. ●The drive frequently runs in a low-frequency, high-torque state, causing stalling or excessive load, with the motor brake not released. ●Abnormal drive temperature caused by high ambient temperature, fan malfunction, or other factors. ●Drive or motor damage.	●Check whether the motor's UVW wiring is correct, any phase loss has occurred, the encoder initial angle is accurate, and the motor brake is functioning. ●Check whether the drive matches the motor and actual load; consider selecting a higher-level drive. ●Replace the drive or motor.
Er18-0	Motor overload fault	●The motor load ratio exceeds the value of P4.38. ●Incorrect motor phase sequence, incorrect encoder initial angle, or incorrect motor parameter. ●The drive frequently runs in a low-frequency, high-torque state, causing stalling or excessive load, with the motor brake not released. ●Drive or motor damage.	●Check whether the load is abnormal. ●Check whether the motor's UVW wiring is correct, any phase loss has occurred, the encoder initial angle is accurate, and the motor brake is functioning. ●Check whether the drive matches the motor and actual load; consider selecting a higher-level drive. ●Replace the drive or motor.
Er18-1	Motor overtemperature fault	●The motor temperature sensor is damaged or has a loose connection. ●Incorrect parameter settings related to motor temperature sampling. ●Internal motor temperature sampling circuit of the drive is abnormal.	●Check the motor temperature sensor and its wiring. ●Replace the drive or motor.

Fault code	Name	Cause	Countermeasure
		●Abnormal motor temperature caused by high ambient temperature, motor fan malfunction, excessive load, or other factors.	
Er18-2	Motor three-phase loss fault	●Any two phases or three phases of the motor power cable are not reliably connected to the drive, or the inside of the motor has been damaged.	●Check whether the motor power cable is broken or disconnected. ●Check whether the power cable terminal and the drive are plugged tightly. ●Check whether the power cable terminal and the power cable are connected reliably. ●Check whether the motor is damaged. ●Check whether the drive U, V, and W outputs are normal.
Er18-4	Motor U-phase loss fault	●U phase of the motor power cable are not reliably connected to the drive, or the inside of the motor has been damaged. ●The detection time for motor phase loss is set too short.	●Check whether the motor power cable is broken or disconnected. ●Check whether the power cable terminal and the drive are plugged tightly. ●Check whether the power cable terminal and the power cable are connected reliably. ●Check whether the motor is damaged. ●Ensure that the wiring and equipment are normal. Then disable the function by setting P4.77 (Motor phase loss detection time) to 0.
Er18-5	Motor V-phase loss fault	●V phase of the motor power cable are not reliably connected to the drive, or the inside of the motor has been damaged.	●Check whether the motor power cable is broken or disconnected. ●Check whether the power cable terminal and the drive

Fault code	Name	Cause	Countermeasure
		●The detection time for motor phase loss is set too short.	are plugged tightly. ●Check whether the power cable terminal and the power cable are connected reliably. ●Check whether the motor is damaged. ●Ensure that the wiring and equipment are normal. Then disable the function by setting P4.77 (Motor phase loss detection time) to 0.
Er18-6	Motor W-phase loss fault	●W phase of the motor power cable are not reliably connected to the drive, or the inside of the motor has been damaged. ●The detection time for motor phase loss is set too short.	●Check whether the motor power cable is broken or disconnected. ●Check whether the power cable terminal and the drive are plugged tightly. ●Check whether the power cable terminal and the power cable are connected reliably. ●Check whether the motor is damaged. ●Ensure that the wiring and equipment are normal. Then disable the function by setting P4.77 (Motor phase loss detection time) to 0.
Er18-7	Motor temperature detection disconnection fault	●The motor temperature sensor is damaged or has a loose connection. ●The wiring for the motor temperature detection is disconnected. ●Internal motor temperature sampling circuit of the drive is abnormal.	●Check the motor temperature sensor and its wiring. ●Replace the drive or motor.
Er19-0	Speed fault–Overspeed fault	●The motor UVW wiring phase sequence is incorrect. ●P4.32 (Overspeed threshold) is	●Check whether the motor UVW wiring phase sequence is correct.

Fault code	Name	Cause	Countermeasure
		set improperly. ●The electronic gear ratio parameters are set improperly. ●The motor speed overshoot is too large. ●The encoder feedback signal is interfered.	●Set the overspeed threshold reasonably based on actual needs. It is recommended to set P4.32 (Overspeed threshold) to 1.2 times P4.31 (Max. speed limit). ●Check the electronic gear ratio parameter settings. ●Check the motor speed loop control parameter settings. ●Check whether the motor encoder is wired properly.
Er19-1	Speed fault–FWD overspeed fault	●P4.40 (Forward speed limit parameter) is set improperly. ●See the cause of Er19-0.	●Check the setting of P4.40 (Forward speed limit parameter). ●See the handling solution of Er19-0.
Er19-2	Speed fault–REV overspeed fault	●The speed feedback exceeds P4.41 (Reverse speed limit) for more than 20 ms. ●See the cause of Er19-0.	●Check the setting of P4.41 (Reverse speed limit). ●See the handling solution of Er19-0.
Er19-3	Speed fault–Incorrect overspeed parameter□setting	●The forward speed limit parameter P4.40 is equal to or less than 0. ●The reverse speed limit parameter P4.41 is equal to or greater than 0.	●Ensure that the forward speed limit parameter P4.40 is greater than 0. ●Ensure that the reverse speed limit parameter P4.41 is less than 0.
Er19-4	Overspeed fault–Out-of-control fault	●The motor UVW wiring phase sequence is incorrect. ●Encoder feedback data is subject to interference. ●The machine rigidity parameter P1.03 is set too high. ●The encoder offset angle parameter P8.19 is set incorrectly.	●Check whether the motor UVW wiring phase sequence is correct. ●Check whether the motor encoder is wired properly. ●Reduce the setting of the machine rigidity parameter P1.03. ●Set P4.96 to perform the encoder initial angle test again. ●Set parameters P3.47, P3.48,

Fault code	Name	Cause	Countermeasure
			and P3.49 again.
Er20-0	Speed out-of-tolerance fault	●The motor UVW wiring phase sequence is incorrect. ●The motor load is too heavy, which causes motor stalling. ●The drive force is insufficient, which causes motor stalling. ●The setting of the speed deviation setting parameter P4.39 is too low. ●Incorrect motor model selection. ●P1.03 (Machine rigidity) is set improperly. ●The acceleration of the speed reference is too high.	●Check whether the motor UVW wiring phase sequence is correct. ●Check whether the conveyor belt or chain is too tight or the workbench reaches the boundary or encounters obstacles. ●Ensure that the drive is intact and undamaged, and the servo system model is correct. ●Increase the setting of the speed deviation setting parameter P4.39. ●Select a motor with higher rated rotation speed. ●Check whether the machine rigidity setting parameter P1.03 is set properly. ●Increase ACC/DEC time.
Er21-0	Position overtravel – FWD overtravel	●Abnormal forward overtravel signal. ●For motor travel, the value of R0.02 (Accumulated feedback pulses) exceeds the value of P0.35 (Software limit in forward position control).	●Check whether the forward overtravel signal is correct. ●Check whether the value of P0.35 (Software limit in forward position control) is proper.
Er21-1	Position overtravel – REV overtravel	●Abnormal reverse overtravel signal. ●For motor travel, the value of R0.02 (Accumulated feedback pulses) exceeds the value of P0.36 (Software limit in reverse position control).	●Check whether the reverse overtravel signal is correct. ●Check whether the value of P0.36 (Software limit in reverse position control) is proper.
Er22-0	Position out-of-tolerance fault	●Servo control parameters are set improperly. ●The motor load is too heavy,	●Perform parameter autotuning or manually adjust position loop gain,

Fault code	Name	Cause	Countermeasure
		which causes motor stalling. ●Pulse input frequency is too high, exceeding the max. motor speed. ●P4.33 (Pulse threshold of position deviation) is too small. ●Encoder feedback data is subject to interference. ●The step variable in the position command input exceeds the setting of P4.33 (Pulse threshold of position deviation).	speed loop gain, and inertia ratio. ●Check whether the conveyor belt or chain is too tight or the workbench reaches the boundary or encounters obstacles. ●Adjust electronic gear ratio parameters. ●Increase the value of P4.33 (Pulse threshold of position deviation). ●Check whether the motor encoder is wired properly. ●Decrease the variation of position command input.
Er22-1	Hybrid control deviation too large	●The motor UVW wiring phase sequence is incorrect. ●Interference in grating encoder feedback data. ●Improper settings of P4.60 (Frequency-division numerator of external linear encoder), P4.61 (Frequency-division denominator of external linear encoder), and P4.62 (Direction reversal of external linear encoder). ●The machine rigidity parameter P1.03 is set too small. ●Encoder feedback data is subject to interference. ●Transmission mechanism is slipping or jammed. ●The setting of P4.64 (Hybrid control deviation limit) is too small.	●Check whether the motor UVW wiring phase sequence is correct. ●Ensure the grating ruler and drive are connected properly. ●Check the settings of P4.60 (Frequency-division numerator of external linear encoder), P4.61 (Frequency-division denominator of external linear encoder), and P4.62 (Direction reversal of external linear encoder). ●Increase the setting of P1.03 (Machine rigidity). ●Check whether the motor encoder is wired properly. ●Check whether the conveyor belt or chain is too tight or the workbench reaches the boundary or encounters obstacles.

Fault code	Name	Cause	Countermeasure
			●Increase the setting of P4.64 (Hybrid control deviation limit).
Er22-2	Position increment overflow fault	●The step change in the position command input is too large. ●The electronic gear ratio is set improperly.	●Reduce the step change in the position command input. ●Modify the electronic gear ratio to a proper setting.
Er23-0	Drive overtemperature fault	●The ambient temperature of the drive exceeds the specified temperature. ●Abnormal drive temperature caused by high ambient temperature, fan malfunction, or other factors. ●The drive is overloaded. ●The drive module model is set incorrectly.	●Reduce the ambient temperature and improve the ventilation condition. ●Replace the servo system with a new one with greater power. ●Increase the ACC/DEC time and reduce the load. ●Check whether the drive model and module model parameters are correct.
Er24-0	Communication fault–PWK parameter ID error	●The PWK parameter ID is incorrect.	●View the manual and ensure that the PWK parameter ID is the same as the corresponding parameter ID.
Er24-1	Communication fault–PWK parameter out-of-range	●The PWK parameter value is out of the allowed range.	●View the manual and ensure that the setting value of PWK parameter is within the allowed range of the corresponding parameter.
Er24-2	Communication fault–Read-only PWK parameter	●An attempt was made to write to read-only parameters in PWK.	●View the manual and ensure that the operation parameter is readable and writable.
Er24-3	Communication fault–PZD setting parameter does not exist	●The parameter ID selected for PZD configuration is incorrect.	●View the manual and ensure that the PZD configuration parameter ID is the same as the corresponding parameter ID.
Er24-4	Communication fault–PZD setting	●A parameter that does not take effect immediately has	●View the manual and ensure that the PZD configuration

Fault code	Name	Cause	Countermeasure
	parameter property does not match	been selected for PZD configuration.	parameter takes effect immediately.
Er24-8	Communication fault–EtherCAT communication card initialization fault	●The initialization of EtherCAT communication card failed.	●Contact the manufacturer or replace the drive.
Er24-9	Communication fault–EtherCAT communication card EEPROM loading fault	●The EtherCAT chip is in poor contact.	●Use TwinCAT tool to download xml file to EtherCAT EEPROM.
Er24-a	Communication fault–EtherCAT communication DC Sync0 interruption exception fault	●DC Sync0 interruption signal is not detected during a period of time under DC sync working mode.	●Check whether interruption causes data loss. ●Check whether EtherCAT master can work normally.
Er24-b	Communication fault–EtherCAT communication Port0 disconnection fault	●After the drive is enabled, the network cable is not inserted properly, or the EtherCAT master does not run properly.	●Check whether network cable is connected properly, the connection mode of network cable is top-in and bottom-out. ●Check the interference problems. ●Check whether EtherCAT master can work properly.
Er24-c	Communication fault–No PDO data in EtherCAT communication DC mode	●No PDO data in EtherCAT communication DC mode	●No PDO data is received after the drive has been enabled for a period of time.
Er24-d	Communication fault—PROFINET disconnection alarm	●After the first communication is normal, the network cable is not inserted properly or the PROFINET master does not run properly.	●Check whether network cable is connected properly. ●Check the interference problems. ●Check whether the PROFINET master works properly.

Fault code	Name	Cause	Countermeasure
Er25-3	Application fault—Phase sequence detection timeout / Phase sequence detection failure	●The motor is stalled or has excessive inertia. ●Phase loss in power lines, affecting correct phase sequence detection.	●Check whether the motor shaft can rotate freely or the load is heavy, and carry out the detection after repower-on. ●Check the power line wiring for phase loss. If phase loss is found, repair the power lines promptly.
Er25-4	Application fault–Encoder offset angle test timeout	●An exception occurred in the encoder offset angle test. ●There is great fluctuation in current feedback in the encoder offset angle test.	●Ensure the motor shaft can rotate freely and then carry out the test after repower-on. ●Reduce the setting of P4.53 and then carry out the test after repower-on.
Er25-5	Application fault–Encoder offset angle test failed	●The motor Z signal or Hall signal is not found. ●The motor Z signal or Hall signal is abnormal. ●Motor load is too heavy. ●Motor phase loss.	●Check whether R0.14 (Motor Z signal) and R2.50 (Hall signal) are normal. ●Ensure the motor shaft can rotate freely and then carry out the test after repower-on. ●Check the motor UVW wiring.
Er25-6	Application fault–Homing offside	●The system encountered the limit switch or software limit during the homing process.	●Modify P5.10 (Homing mode) to avoid exceeding the limit switch or software limit during homing. Re-power on the system and try again. ●The home switch or motor Z signal position exceeds the limit. Adjust the position of the home switch or motor Z signal. Re-power on the system and try again.
Er25-7	Application fault–Inertia identifying failed	●During inertia identifying, the motor stops rotating with vibration of longer than 4.375s. ●The actual ACC time for inertia	●Improve the mechanical rigidity properly. ●Increase the setting of P1.07. ●Increase the setting of P1.06.

Fault code	Name	Cause	Countermeasure
		identifying is too short. ●The inertia identifying speed is lower than 150r/min.	
Er25-8	Application fault — Magnetic pole detection failure	●The actual phase sequence of the power lines does not match the configured phase sequence. ●The incremental encoder is subject to interference. ●P6.53 (Magnetic pole detection inertia ratio) is set improperly. ●Pole detection parameters are set improperly. ●External force or overload occurs in the magnetic pole detection.	●Check whether the power line phase sequence is correct. ●Check whether the encoder cable is properly grounded and whether a ferrite core is installed on the power cable. ●Check whether P6.53 (Magnetic pole detection inertia ratio) is set properly. ●Check whether the pole detection data settings are correct or within parameter setting limits. ●Check whether external force occurs in the motor running.
Er25-9	Application fault– Overtravel/overspeed in☒confirmation of magnetic pole detection	●The actual phase sequence of the power lines does not match the configured phase sequence. ●The incremental encoder is subject to interference.	●Check whether the power line phase sequence is correct. ●Check whether the encoder cable is properly grounded and whether a ferrite core is installed on the power cable.
Er25-a	Application fault– Out-of-range in magnetic pole detection	●The setting of P6.54 or P6.55 (about pole detection speed command) is too high. ●The setting of P6.60 or P6.61 (about magnetic pole detection movable range) is too small.	●Adjust the setting of P6.54 or P6.55 (about pole detection speed command). ●Adjust the setting of P6.60 or P6.61 (about magnetic pole detection movable range).
Er25-b	Application fault– Short-circuit detection fault 1	●P9.50 (Drive type) is set incorrectly. ●At least one lower arm IGBT in the U, V, or W phase is short-circuited due to	●Check whether P9.50 (Drive type) is set correctly. ●Check whether the U, V, W outputs of the drive are short-circuited to the bus

Fault code	Name	Cause	Countermeasure
		breakdown. ●When only control power is applied, the braking IGBT may experience breakdown-induced short circuit. ●Exception in the current sensor channel.	positive or negative terminal. ●Contact the manufacturer or replace the drive.
Er25-c	Application fault–Short-circuit detection fault 2	●V-phase lower arm cannot be turned on; the V-phase lower-arm IGBT is open or the associated drive circuit is abnormal. ●Exception in the V-phase current sensor channel. ●One or more of the U, V, W phase upper-arm IGBTs have been short-circuited due to breakdown, or the associated drive circuits are faulty, causing the upper-arm IGBT to remain continuously on. ●One or more of the U, V, W phases are short-circuited to PE (earth).	●Check whether the U, V, W outputs (including the drive itself, power cables, and internal motor windings) are shorted to ground. ●Check whether the U, V, W outputs of the drive are short-circuited to the bus positive or negative terminal. ●Contact the manufacturer or replace the drive.
Er25-d	Application fault–Short-circuit detection fault 3	●One or more of the U, V, W phase lower-arm IGBTs have been short-circuited due to breakdown, or the associated drive circuits are faulty, causing the lower-arm IGBT to remain continuously on.	●Contact the manufacturer or replace the drive.
Er25-e	Application fault–Short-circuit detection fault 4	●W-phase lower arm cannot be turned on; the W-phase lower-arm IGBT is open or the associated drive circuit is abnormal. ●Exception in the W-phase	●Check whether the U, V, W outputs (including the drive itself, power cables, and internal motor windings) are short-circuited to the ground. ●Check whether one or more

Fault code	Name	Cause	Countermeasure
		current sensor channel. ●One or more of the U, V, W phase upper-arm IGBTs have been short-circuited due to breakdown, or the associated drive circuits are faulty, causing the upper-arm IGBT to remain continuously on. ●One or more of the U, V, W phases are short-circuited to PE (ground).	of the U, V, W phases of the drive have been short-circuited to the bus positive or negative terminal due to breakdown. Check whether the U, V, W outputs are short-circuited to PE (ground). ●Contact the manufacturer or replace the drive.
Er25-f	Application fault–Short-circuit detection fault 5	●One or more of the U, V, W phase lower-arm IGBTs have been short-circuited due to breakdown, or the associated drive circuits are faulty, causing the lower-arm IGBT to remain continuously on.	●Contact the manufacturer or replace the drive.

8.4 Alarm clearing

For clearable alarms:

Method 1: After alarm codes are confirmed and the causes are located, for those faults that can be cleared online, if the fault conditions are removed, the faults can be cleared by short connecting the digital input terminal (P3.00–P3.09) with COM+. If the drive still has enabling command input, the drive will not be able to clear the fault automatically.

Note: Before clearing the fault through short-connecting configuration, set P3.00–P3.09 to 0x004 or 0x104.

Method 2: For CAN and EtherCAT bus models, the fault can be cleared by writing to the fault bit of the control word 0x6040, or by setting parameter P4.90 to 1. For PN bus models, the fault can be reset through the associated function block or process axis.

Method 3: You can clear the fault by setting P4.90 on the LED panel.

For non-clearable alarms:

Non-clearable alarms require the drive to be powered off. After eliminating the cause of the fault, the drive must be powered on again to clear the fault. If the alarm persists after re-powering on, contact our technical support.

Your Trusted Industry Automation Solution Provider

Shenzhen INVT Electric Co., Ltd.
Address: INVT Guangming Technology Building, Songbai Road, Matian, Guangming District, Shenzhen, China

INVT Power Electronics (Suzhou) Co., Ltd.
Address: No. 1 Kunlun Mountain Road, Science & Technology Town, Gaoxin District, Suzhou, Jiangsu, China

Website: www.invt.com

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