Content

Chapter 1 Telegram introduction

PROFINET, launched by PROFIBUS International, is a new generation automation bus standard based on industrial Ethernet technology. It can meet various communication requirements in industrial automation scenarios, and is an industrial network protocol that supports high performance, high reliability and high real-time performance.

PROFINET provides three types of channels: standard channel, real-time channel (RT), isochronous real-time channel (IRT), standard channel is a non-real-time protocol based on TCP/IP protocol, and RT and IRT channel is implemented based on Ethernet.

1.1 Supported telegram

Kinco PN servo drives (PN firmware version 00000005 or 10000005) support telegram 1, 3, 5, 9, 102, 105, and 111, covering AC (Application Class) 1, 3, and 4, as shown in Table 1-1. Additional telegram 750 is not currently supported.

Table 1-1 Available telegram

Application Class	telegram number
AC1	1
AC3	9,111
AC4	3,5,102,105

Note

- PN firmware 00000004 only supports telegram 1, 111, and 3(IRT is not supported). The PN firmware version can be found in [308001], see Table 2-1 for details.

The structure of each packet are as follows:

Table 1-2 telegram 1 (Application Class 1)

I/O data number	telegram 1	
	Set value	Actual value
1	STW1	ZSW1
2	NSOLL_A	NIST_A

Table 1-3 telegram 9, 111 (Application Class 3)

I/O data number	telegram 9		telegram 111	
	Set value	Actual value	Set value	Actual value
1	STW1	ZSW1	STW1	ZSW1
2	SATZANW	AKTSATZ	POS_STW1	POS_ZSW1
3	STW2	ZSW2	POS_STW2	POS_ZSW2
4	MDI_TARPOS	XIST_A	STW2	ZSW2
5			OVERRIDE	MELDW
6	MDI_VELOCITY		MDI_TARPOS	XIST_A
7				
8	MDI_ACC		MDI_VELOCITY	NIST_B
9	MDI_DEC			
10	MDI_MOD		MDI_ACC	FAULT_CODE
11			MDI_DEC	WARN_CODE
12			User	User

Table 1-4 telegram 3, 5, 102 ,105 (Application Class 4)

I/O data number	telegram 3		telegram 102		telegram 5		telegram 105	
	Set value	Actual value	Set value	Actual value	Set value	Actual value	Set value	Actual value
1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
2	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B
3								
4	STW2	ZSW2	STW2	ZSW2	STW2	ZSW2	STW2	ZSW2
5	G1_STW	G1_ZSW	MOMRED	MELDW	G1_STW	G1_ZSW	MOMRED	MELDW
6		G1_XIST1	G1_STW	G1_ZSW	XERR	G1_XIST1	G1_STW	G1_ZSW
7				G1_XIST1			XERR	G1_XIST1
8		G1_XIST2			KPC	G1_XIST2		
9				G1_XIST2			KPC	G1_XIST2
10								

1.2 I/O data signal

I/O data signal (set value and actual value) are used to compose the telegram, and the following table provides all signals for the I/O data.

Table 1-5 Signal table

Singal	Abbreviation	Data type	Description
Control word 1	STW1	U16	See Section 1.3.1
Status word 1	ZSW1	U16	
Control word 2	STW2	U16	See Section 1.3.2
Status word 2	ZSW2	U16	
Speed setpoint A	NSOLL_A	I16	4000h corresponds to the reference speed [a]
Speed actual value A	NIST_A	I16	
Speed setpoint B	NSOLL_B	I32	40000000h corresponds to the reference speed
Speed actual value B	NIST_B [b]	I32	
Sensor 1 control word	G1_STW	U16	See Section 1.3.5
Sensor 1 status word	G1_ZSW	U16	
telegram status word	MELDW	U16	

Singal	Abbreviation	Data type	Description
Sensor 1 position acutal value 1	G1_XIST1	I32	Equal to actual position [606300] plus position shift [60FB07]. Unit DEC
Sensor 1 position acutal value 2	G1_XIST2	I32	—
Position deviation value	XERR	I32	—
Position control factor	KPC	I32	—
Position acutal value A	XIST_A	I32	Equal to actual position [606300]. Unit DEC
Position table control word	SATZANW	U16	See Section 1.3.3
Position table status word	AKTSATZ	U16	
MDI mode control word	MDI_MOD	U16	
Position control word 1	POS_STW1	U16	See Section 1.3.4
Position status word 1	POS_ZSW1	U16	
Position control word 2	POS_STW2	U16	
Position status word 2	POS_ZSW2	U16	
MDI target position	MDI_TARPOS	I32	Equal to target position [607A00]. Unit DEC
MDI velocity	MDI_VELOCITY	U32	Unit DEC, DEC = (RPM * feedback_resolution [641003] * 512) / 1875
MDI acceleration percentage	MDI_ACC	U16	0~4000h corresponds to 0~100%, 2000h means the acceleration/deceleration is reduced to 1/2 of the drive setpoint
MDI deceleration percentage	MDI_DEC	U16	
MDI velocity percentage	OVERRIDE	U16	0~4000h corresponds to 0~100%, maximum 199%, 2000h means to reduce the speed to 1/2 of the drive setpoint
Torque limit value	MOMRED	I16	0~4000h corresponds to 100%~0, 4000h means the target current (torque) is limited to 0
Fault code	FAULT_CODE	U16	—
Warn code	WARN_CODE	U16	—
Telegram 111 custom receive word	User	I16	See Section 5.4.1, Article 7
Telegram 111 custom send word	User	I16	
a Reference speed = 1/2 of the maximum speed [607F00]. b When using telegram 111, the speed actual value NIST_B is equal to the actual speed [606C00] in DEC.			

1.3 Control word and status word

1.3.1 STW1 and ZSW1

- Control word 1 (STW1)

Table 1-6 STW1 each bit value meaning

Bit	Meaning	
	telegram 1,3,5,102,105 (Application Class 1, 4)	telegram 9,111 (Application Class 3)
0	On / Off (ramp stop [a])	
1	No coast stop / Coast stop	
2	No quick stop / Quick stop	
3	Operation enable / Operation disable	
4	Enable RFG [b] / Disable RFG (RFG output is 0)	Do not reject traversing task / Reject traversing task
5	Unfreeze RFG / Freeze RFG (RFG input is not updated)	No intermediate stop / Intermediate stop
6	Enable setpoint / Disable setpoint (RFG input is 0)	Activate traversing task (0→1)
7	Fault acknowledge (0→1)	
8	Reserved (Application Class 1, 4 do not support jog)	Start reverse jog / Stop reverse jog

9	Reserved	Start forward jog / Stop forward jog
10	Control by PLC / No control by PLC	
11	Setpoint is reversed / Setpoint is not reversed	Start homing procedure / Stop homing procedure
12~15	Reserved	
a When bit 4 of STW1 is 1, ramp stop corresponds to halt mode [605D00], and disable operation after stop. When bit 4 of STW1 is 0, ramp stop corresponds to shutdown stop mode [605B00]. b RFG = Ramp Function Generator (Trapezoidal curve velocity generator). When using Application Class 4, bit 5 does not work, and either bit 4 or bit 6 is 0, resulting in an RFG output of 0.		
Note：the significance for bit value = 1 is left of the slash ; bit value = 0 is right of the slash .		

- Status word 1 (ZSW1)

Table 1-7 ZSW1 each bit value meaning

Bit	Meaning	
	telegram 1,3,5,102,105 (Application Class 1, 4)	telegram 9,111 (Application Class 3)
0	Ready to switch on / Not ready to switch on	
1	Ready to operate / Not ready to Operate	
2	Operation enabled / Operation disabled	
3	Fault present / No fault	
4	Coast stop not activated / Coast stop activated	
5	Quick stop not activated / Quick stop activated	
6	Switching on inhibited / Switching on not inhibited	
7	Warn present / No warning	
8	Speed error within tolerance range / Speed error out of tolerance range	Following error within tolerance range / Following error out of tolerance range
9	Control requested / No control requested	
10	f or n reached or exceeded / f or n not reached	Target position reached / Not at target position
11	Reserved	Reference point set / Reference point not yet set
12	Reserved	Traversing task acknowledgement (0→1)
13	Reserved	Drive stopped / Drive moving
14	Moving forward / Moving reversely	Accelerating / Not accelerating
15	Reserved	Decelerating / Not decelerating
Note：the significance for bit value = 1 is left of the slash ; bit value = 0 is right of the slash .		

1.3.2 STW2 and ZSW2

- Control word 2 (STW2)

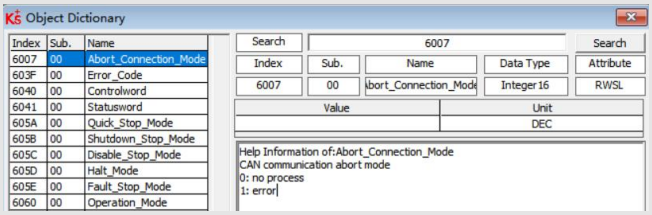
For telegram 3, 5, 102, and 105, valid only in IRT mode.

Table 1-8 STW2 each bit value meaning

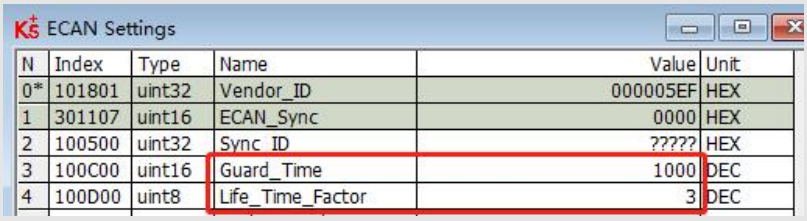
Bit	Meaning
0~11	Reserved
12~15	PLC heartbeat signal

Note

- If there is a PLC heartbeat signal error or other abnormal communication, the drive will generate a "CAN bus fault (alarm code 100.0)" alarm. The user can set Abort_Connection_Mode [600700] to 1: error processing; set to 0: do not process.



- The alarm time threshold is determined by Guard_Time [100C00](in ms) and Life_Time_Factor [100D00], and the default value is 1000ms * 3 = 3000 ms.



- Status word 2 (ZSW2)

For telegram 3, 5, 102, and 105, valid only in IRT mode.

Table 1-9 ZSW2 each bit value meaning

Bit	Meaning
0~11	Reserved
12~15	Drive heartbeat signal

1.3.3 SATZANW、AKTSATZ、MDI_MOD

- Position table control word (SATZANW)

Used for telegram 9.

Table 1-10 SATZANW each bit value meaning

Bit	Meaning
0~2	Index of the position task to be started in the position table (value range: 0~7) Bit 0~2 are valid only in the position table mode
3~14	Reserved
15	Operating mode selection = 1 MDI mode = 0 Position table mode

- Position table status word (AKTSATZ)

Used for telegram 9.

Table 1-11 AKTSATZ each bit value meaning

Bit	Meaning
0~4	The index of the actual effective positioning task (value range: 0~31) Bit 0~4 are valid only in the position table mode
5~14	Reserved
15	Operating mode = 1 MDI mode activated = 0 Position table mode activated

- MDI mode control word (MDI_MOD)

Used for telegram 9.

Table 1-12 MDI_MOD each bit value meaning

Bit	Meaning
0	Select absolute/relative positioning mode = 1 Absolute positioning mode = 0 Relative positioning mode
1~15	Reserved

1.3.4 POS_STW1、POS_STW2、POS_ZSW1、POS_ZSW2

- Position control word 1 (POS_STW1)

Used for telegram 111.

Table 1-13 POS_STW1 each bit value meaning

Bit	Meaning
0~2	Index of the position task to be started in the position table (value range: 0~7) Bit 0~2 are valid only in the position table mode
3~7	Reserved
8	Select absolute/relative positioning mode = 1 Absolute positioning mode = 0 Relative positioning mode
9~11	Reserved
12	Absolute positioning mode = 1 Execute the absolute positioning command immediately according to the target position chang = 0 The absolute positioning command will not be executed immediately according to the target position change.
13~14	Reserved
15	Operating mode selection = 1 MDI mode = 0 Position table mode

- Position control word 2 (POS_STW2)

Used for telegram 111.

Table 1-14 POS_STW2 each bit value meaning

Bit	Meaning
0	Reserved
1	= 1 Set the current position as the homing
2	= 1 Activate homing switch signal
3~13	Reserved
14	= 1 Activate software limit switch signal
15	= 1 Activate hardware limit switch signal

- Position status word 1 (POS_ZSW1)

Used for telegram 111.

Table 1-15 POS_ZSW1 each bit value meaning

Bit	Meaning
0~4	The index of the actual effective positioning task (value range: 0~31) Bit 0~4 are valid only in the position table mode
5~7	Reserved
8	= 1 Negative hardware limit switch signal active
9	= 1 Positive hardware limit switch signal active
10	= 1 Jog mode activated
11~12	Reserved
13	= 1 Position table mode activated
14	Reserved
15	= 1 MDI mode activated = 0 MDI mode not activated

- Position status word 2 (POS_ZSW2)

Used for telegram 111.

Table 1-16 POS_ZSW2 each bit value meaning

Bit	Meaning
0~3	Reserved
4	= 1 Moving forward = 0 Not moving forward
5	= 1 Moving reversely = 0 Not moving reversely
6	= 1 Negative software limit switch reached
7	= 1 Positive software limit switch reached
8~15	Reserved

1.3.5 G1_STW、G1_ZSW、MELDW

- Sensor 1 control word (G1_STW)

Used for telegram 3, 5, 102, 105.

Table 1-17 G1_STW each bit value meaning

Bit	Value	Meaning
0	1	Function 1 (Bit7=0)： Request to search sensor index signal position
1~3	—	Reserved
4~6	1~3	Command: 0: — 1: Activate function 1[a] 2: Read sensor index signal position and put it into G1_XIST2 3: Cancel function 1 4~7: —
7	0/1	Mode: Bit7=0: Sensor index signal position search Bit7=1: Reserved
8~12	—	Reserved
13	1	Request to transmit absolute actual position in G1_XIST2
14	1	Request to switch off the actual value measurements in the drive
15	1	Request to reset a sensor error
a Selection of function 1 (bit 0) and command (bit4~bit7) shall be set simultaneously.		

- Sensor 1 status word (G1_ZSW)

Used for telegram 3, 5, 102, 105.

Table 1-18 G1_ZSW each bit value meaning

Bit	Value	Meaning
0	1	Status: Function 1 activated
1~3	—	Reserved
4	1	Status: Sensor index signal position available
5~10	—	Reserved
11	1	Error acknowledgement in process
12	—	Reserved
13	1	Indication of the transmission of absolute actual position in G1_XIST2
14	1	Acknowledgement for indication of invalid G1_XIST1
15	1	Sensor fault present

- telegram status word (MELDW)

Used for telegram 102, 105.

Table 1-19 MELDW each bit value meaning

Bit	Meaning
0	Reserved
1	= 1 Torque does not reach the limit value = 0 Torque has reached the limit value
2~15	Reserved

Chapter 2 Application description

The PROFINET communication application in Chapters 3 to 6 is based on the following conditions:

1. TIA V17 PLC S7-1500(CPU 1511T-1 PN 6ES7 511-1TK01-0AB0 Firmware V2.8)

2. Kinco PN servo drive

Drive type	Drive firmware	PN firmware
FDxx5-PA-004	Software version year is 2024 or later	00000005、10000005
FDxx5P-PA-000		
MDx0-0xx-DMxK-PA-000		

3. GSD file

PN firmware version	Applicable GSD file
00000005、10000005	GSDML-V2.43-Kinco-PA5-20240328、GSDML-V2.33-Kinco-PA5-20240328
00000004	GSDML-V2.33-Kinco-MD60-20210507
Note: **a. The default is GSDML-V2.43-Kinco-PA5-20240328** **b. If PLC does not support V2.43 GSD, use GSDML-V2.33-Kinco-PA5-20240328**	

Chapter 7 introduces the method of using S7-200 SMART to control Kinco PN servo drive.

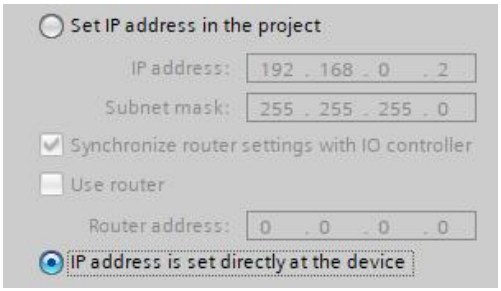
Table 2-1 PROFINET communication parameters

Parameter index	Parameter name	Description
308001	PN firmware version	Applicable PN firmware version for this manual is 00000005, 10000005
308003	PN device name	PROFINET device name (read-only)
308004~308007	PN device name 1~4	Used to modify PROFINET device name
308008	IP address	Drive IP address (hex, read-only)
308009	Subnet mask	Drive subnet mask (hex, read-only)
30800A	Default router	Drive default router (hex, read-only)
30800B	PN enable	= 1 PN telegram enabled, using telegram (e. g. telegram 105) control = 0 PN telegram disabled, using RS232 or acyclic communication control
30800C	Enable software limit	See Section 5.4.1, Article 5
30800D	PN user receive word	See Section 5.4.1, Article 8
30800E	PN user send word	
30800F~308010	MAC address 1~2	Drive MAC address (hex, read-only)
301101	ECAN synchronization cycle	Optional: 1ms, 2ms, 4ms, 8ms Need to be consistent with the update time of TIA portal configuration
301102	ECAN synchronization mode	= 1 Use isochronous synchronization (IRT) mode = 0 Do not use isochronous synchronization (IRT) mode
301103	ECAN synchronization shift	—
600700	Communication abort mode	See Section 1.3.2
100C00	Node guard time	
100D00	Node guard time factor	

Chapter 3 Acyclic communication

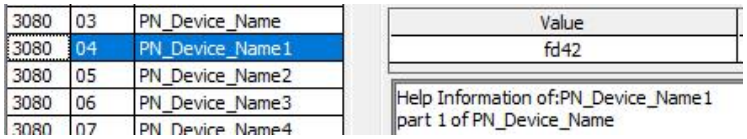
3.1 Drive IP and device name setting

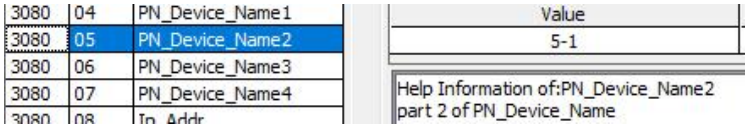
The PROFINET device name of the drive can be set using the KincoServo+ software, TIA portal and PRONETA software; the IP address of the drive can only be set using TIA portal and PRONETA software. Please note that if the IP address is to be set using the method described below, the "IP address is set directly at the device" option should be selected in TIA portal configuration:



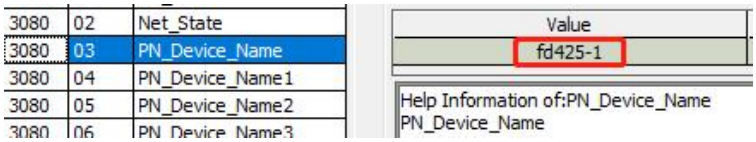
To set the device name in the KincoServo+ software, proceed as follows:

1. Disconnect the drive from the PLC and connect the drive to the KincoServo+ software via RS232.
2. Enter the device name in PN_Device_Name1~4 [308004~308007], the length of each PN_Device_Name is limited to 4 characters:





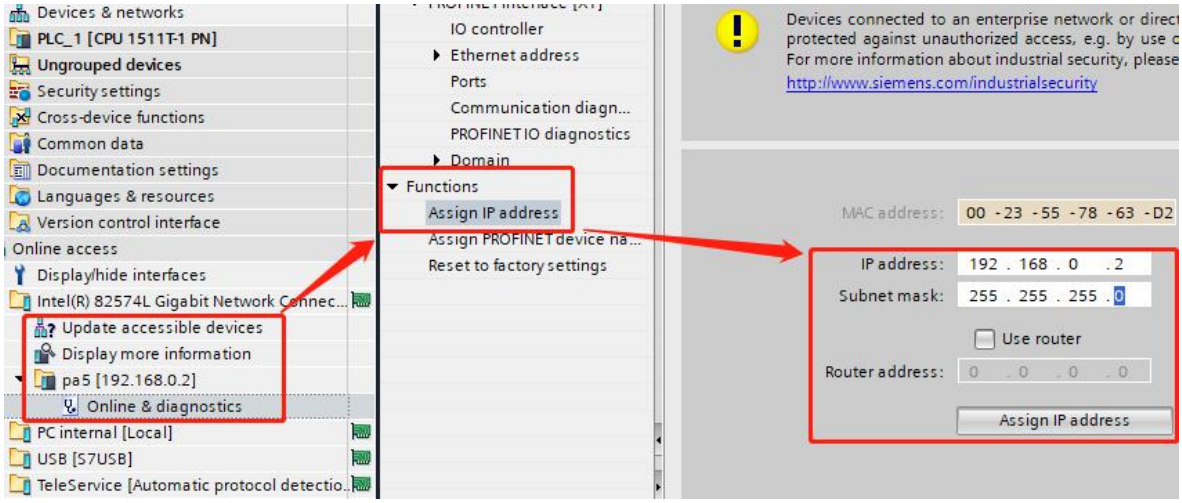
3. When the setting is completed, you can see that the PN_Device_Name [308003] has been modified:



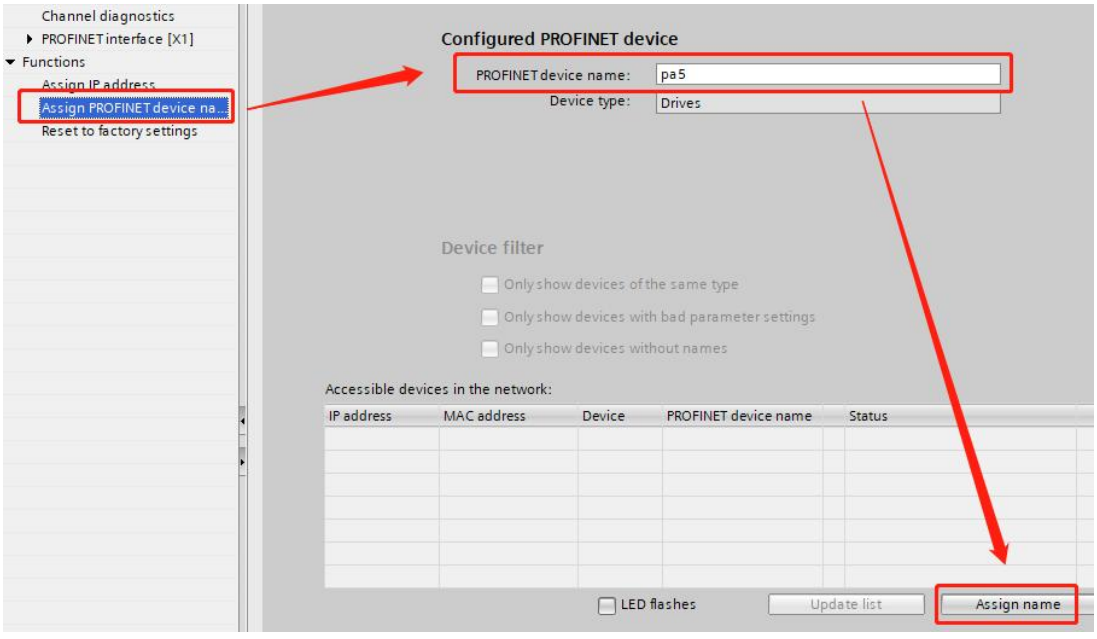
To set the drive IP and device name in TIA portal, proceed as follows:

1. Connect the drive to the computer with a network cable.
2. Open TIA portal, expand the "Online access" drop-down list, select the corresponding network card, and click "Update accessible devices". Once the software has scanned the drive, double click "Online & Diagnostics".

3. Double-click "Assign IP address" in the "Functions" drop-down list. Fill in the IP address and subnet mask, and then click the "Assign IP address" button. If you select "Set IP address in the project" in the configuration, this step can be omitted and you can go directly to step 4 to set the PROFINET device name.



4. Follow step 3, double click "Assign PROFINET device name" in the "Functions" drop-down list. Fill in the PROFINET device name and click "Assign name" button, the PROFINET device name must be the same as the name in the configuration, otherwise the drive can not communicate with the PLC.



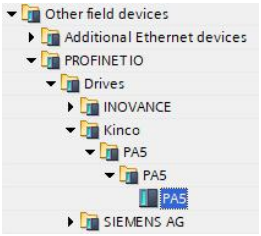
5. When the setting is complete, click "Update accessible devices" again to check whether the IP address and device name have been modified successfully.

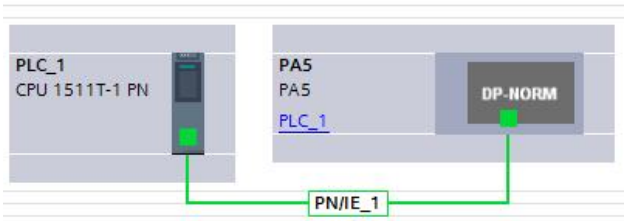
Alternatively, the drive IP address and device name can be set using the PRONETA software, which can be downloaded from the Siemens website: PRONETA - Siemens China.

3.2 Project configuration

1. Click menu "Options → Manage general station description files" to install GSD, please take the GSDML-V2.43-Kinco-PA5-20240328 as the standard. In addition, the GSD to which the PN firmware 00000004 applies is GSDML-V2.33-Kinco-MD60-20210507.

2. In the network view, click "Hardware catalog → Other field devices → PROFINET IO → Drives → Kinco → PA5" to add a drive and assign it to the PLC:

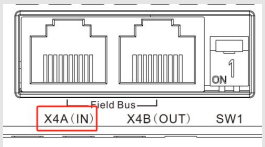


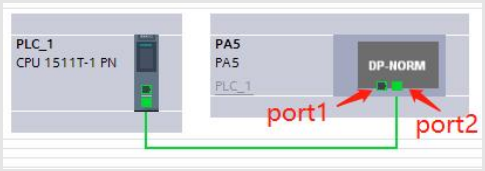


3. If PLC is required to automatically configure the device name of drive (the premise of automatic allocation is that the name of the drive is empty), the topology diagram must be connected. In the topology view, connect the ports according to the actual situation.

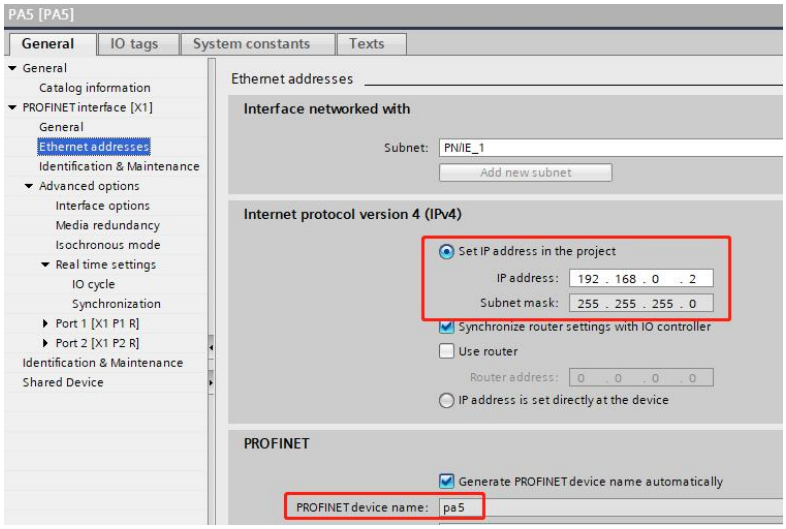
Note

- The ports on the topology diagram corresponding to the IN ports on different drives are different. The IN port of FD5P series drive and MD series drive corresponds to port 1 in the topology diagram;the IN port of FD5 series drive corresponds to port 2 in the topology diagram.

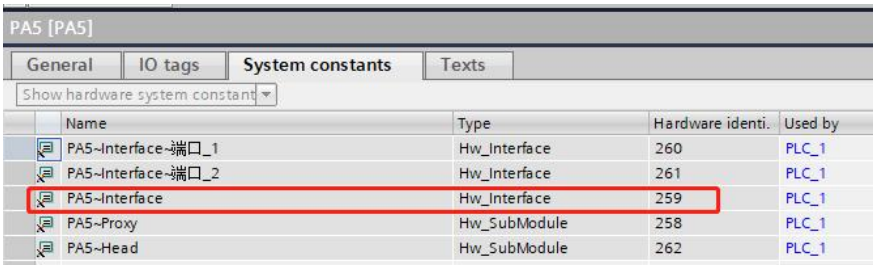




4. Double-click the PA5 module, click "Ethernet addresses" in "General", and set the configured IP address and PROFINET device name. The device names need to be consistent with the actual device names of the drives. When there are multiple drives, the device names cannot be the same:



5. Click on the "System constants" column and note down the HW_Interface, which will be used later in the read-write parameters module:



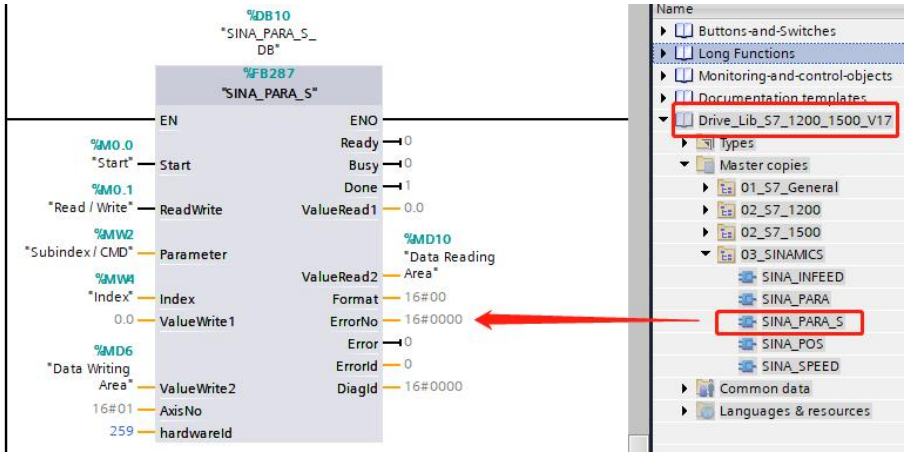
3.3 SINA_PARA_S (FB287) introduction

FB287 can realize acyclic commumication between PLC and drive, and realize servo parameters read-write function. If you cannot find the corresponding function block (FB), you can download the library file Drive_Lib_S7_1200_1500_V17 from Siemens official website:

https://support.industry.siemens.com/cs/document/109475044/sinamics-communication-blocks-drivelib-for-reading-and-writing-drive-data-within-tia-portal-context?dti=0&lc=en-WW

After the download is completed, click menu "Options → Global libraries → Open library", and install the corresponding library file according to the prompt.

Add FB287 to Main[OB1] and assign variables to its pins as shown below.



FB287 pin definition are as follow：

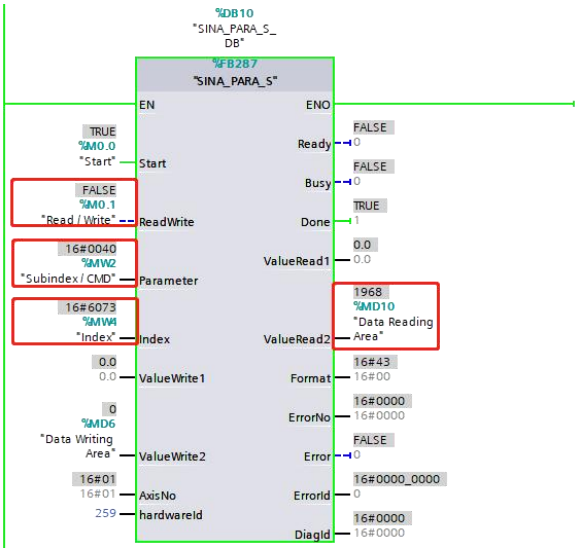
Table 3-1 FB287 pin definitions

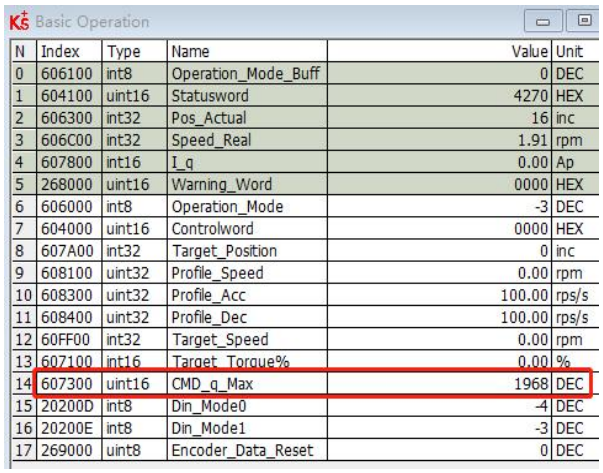
Pin name	Data type	Description
Start	Bool	The rising edge triggers data transmission
ReadWrite	Bool	= 0 Read = 1 Write
Parameter	Int	Bit8~15: Parameter subindex Bit0~7: Command word
Index	Int	Parameter index
ValueWrite1	Real	Reserved
ValueWrite2	DInt	Data writing area, can write 1 to 4 bytes
AxisNo	Byte	Fixed to 1
hardwareId	HW_IO	See Section 2.3, Article 4, by which the parameter is used to distinguish between different axes
ValueRead1	Real	Reserved
ValueRead2	DInt	Data reading area
Error	Bool	Indicates read-write parameters error, when the responsing command word in Kinco communication protocol is 0x80, this bit is set to 1
Note: Command word: read all 40H; Write 1 byte 2FH, write 2 bytes 2BH, and write 4 bytes 23H.		

3.4 Read-write parameters using FB287

Take the read-write CMD_q_Max [607300] as an example: the parameter index is 0x6073, the subindex is 0x00, and the data type is uint16, so the command word of writing parameter is 0x2B, and that of reading parameter is uniformly 0x40.

1. Read CMD_q_Max: When the "Start" pin changes from 0 to 1, the pin "Data Reading Area" automatically becomes 1968 and “ERROR”pin is 0, the data reading is successful:



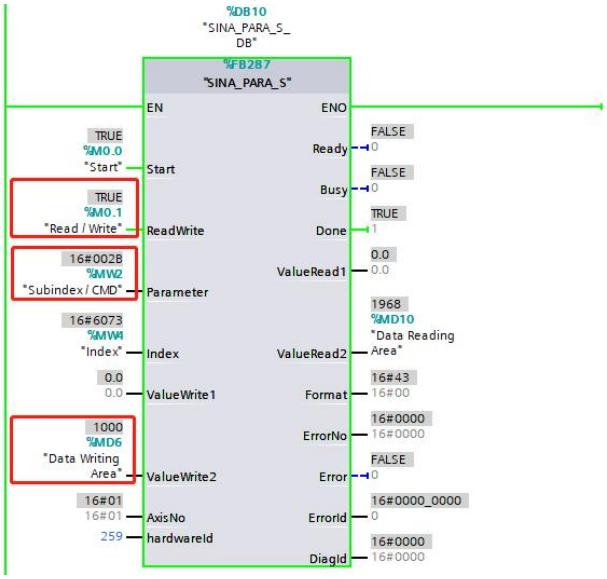


Basic Operation

N	Index	Type	Name	Value	Unit
0	606100	int8	Operation_Mode_Buff	0	DEC
1	604100	uint16	Statusword	4270	HEX
2	606300	int32	Pos_Actual	16	inc
3	606C00	int32	Speed_Real	1.91	rpm
4	607800	int16	I_q	0.00	Ap
5	268000	uint16	Warning_Word	0000	HEX
6	606000	int8	Operation_Mode	-3	DEC
7	604000	uint16	Controlword	0000	HEX
8	607A00	int32	Target_Position	0	inc
9	608100	uint32	Profile_Speed	0.00	rpm
10	608300	uint32	Profile_Acc	100.00	rps/s
11	608400	uint32	Profile_Dec	100.00	rps/s
12	60FF00	int32	Target_Speed	0.00	rpm
13	607100	int16	Target_Torque%	0.00	%
14	607300	uint16	CMD_q_Max	1968	DEC
15	20200D	int8	Din_Mode0	-4	DEC
16	20200E	int8	Din_Mode1	-3	DEC
17	269000	uint8	Encoder_Data_Reset	0	DEC

2. Write CMD_q_Max: Verify that PN_Enable [30800B] is 0. "ReadWrite" pin is switched to 1, "Parameter" pin is 0x002B. "Data Writing Area" is written to 1000. Then trigger the "Start" pin to write

the data. Observing the KincoServo+ software, CMD_q_Max is changed to 1000 DEC.



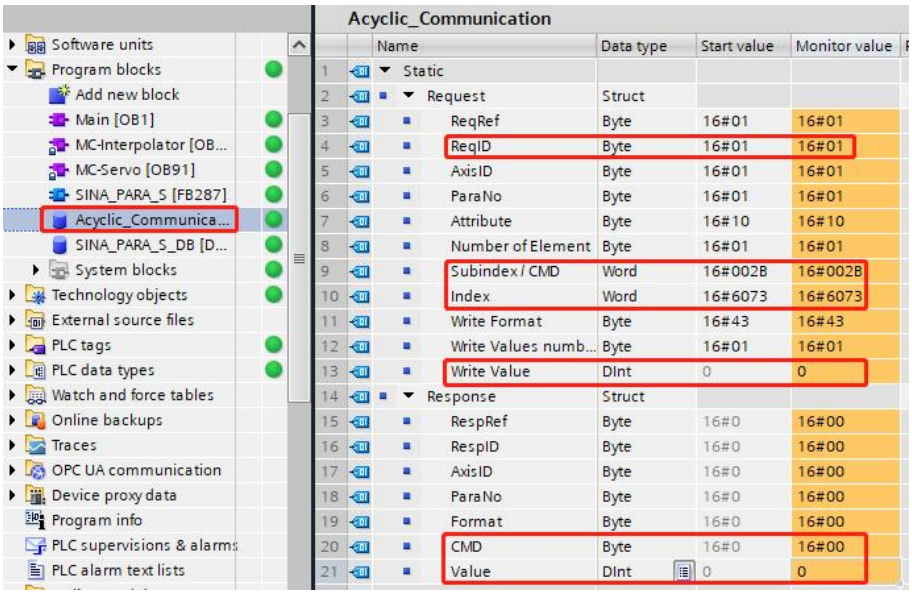
Basic Operation

N	Index	Type	Name	Value	Unit
0	606100	int8	Operation_Mode_Buff	0	DEC
1	604100	uint16	Statusword	4270	HEX
2	606300	int32	Pos_Actual	16	inc
3	606C00	int32	Speed_Real	1.77	rpm
4	607800	int16	I_q	0.00	Ap
5	268000	uint16	Warning_Word	0000	HEX
6	606000	int8	Operation_Mode	-3	DEC
7	604000	uint16	Controlword	0000	HEX
8	607A00	int32	Target_Position	0	inc
9	608100	uint32	Profile_Speed	0.00	rpm
10	608300	uint32	Profile_Acc	100.00	rps/s
11	608400	uint32	Profile_Dec	100.00	rps/s
12	60FF00	int32	Target_Speed	0.00	rpm
13	607100	int16	Target_Torque%	0.00	%
14	607300	uint16	CMD_q_Max	1000	DEC
15	20200D	int8	Din_Mode0	-4	DEC
16	20200E	int8	Din_Mode1	-3	DEC
17	269000	uint8	Encoder_Data_Reset	0	DEC

3.5 Read-write parameters using WRREC and RDREC

The following describes how to read/write parameters using the WRREC / RDREC blocks, which can be found in "Instructions → Extended instructions → Distributed I/O".

1. First, create a new data block (DB) called Acyclic_Communication. The data in this block is defined as follows:

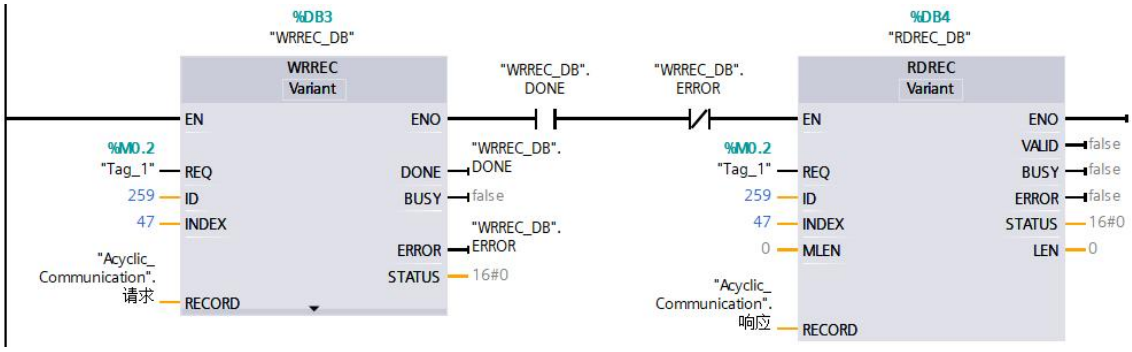


The data block Acyclic_Communication is described as follows:

Request	Response
ReqID: 0x01: read-only 0x02: readable and writable Other: Reserved	CMD: Responsing command word
Subindex / CMD:	

Bit 8~15: parameter subindex Bit 0~7: sending command word	Value: Data reading area
Index: Parameter index	
Write Value: Data writing area	
Other data are in principle consistent with the above figure.	

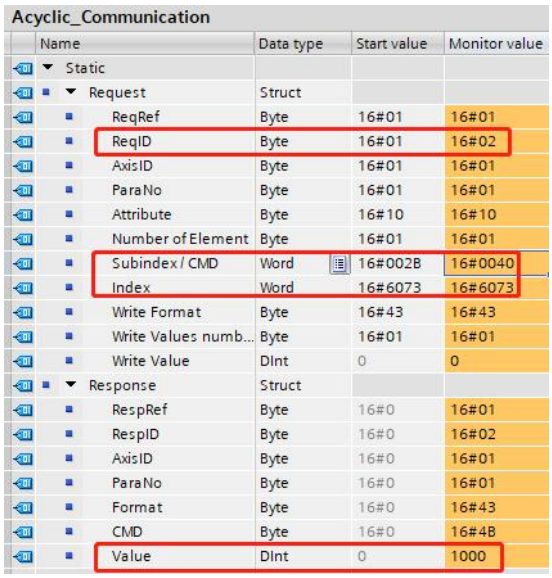
2. Establish the connection of WRREC / RDREC block according to the following figure. The transmission starts when the "REQ" pin is set to 1. "ID" is the HW_Interface and can be used to distinguish between different axes. "INDEX" is fixed to 47 and "MLEN" is 0.



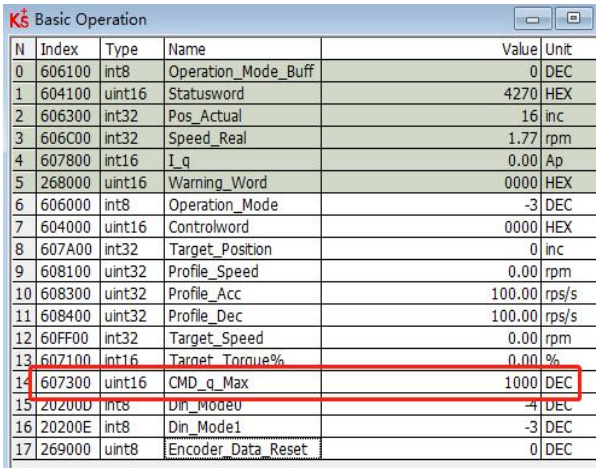
3. The following utilizes the WRREC / RDREC block to read/write CMD_q_Max [607300]. The parameter index is 0x6073, subindex is 0x00, and data type is uint16, so the sending command word for writing parameter is 0x2B, and for reading parameter is uniformly 0x40.

a. Read CMD_q_Max:

Use KincoServo+ software to check CMD_q_Max is 1000 DEC. The "ReqID" of the Acyclic_Communication data block is assigned 0x02, "Subindex / CMD" is assigned 0x0040, and "Index" is assigned 0x6073. Trigger "REQ" pin to complete the data reading, and the reading data is displayed in the "Value" of "Response":


Acyclic_Communication

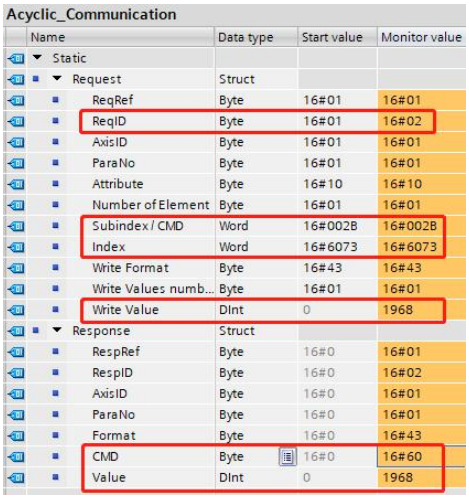
Name	Data type	Start value	Monitor value
Static			
Request	Struct		
ReqRef	Byte	16#01	16#01
ReqID	Byte	16#01	16#02
AxisID	Byte	16#01	16#01
ParaNo	Byte	16#01	16#01
Attribute	Byte	16#10	16#10
Number of Element	Byte	16#01	16#01
Subindex / CMD	Word	16#002B	16#0040
Index	Word	16#6073	16#6073
Write Format	Byte	16#43	16#43
Write Values numb...	Byte	16#01	16#01
Write Value	DInt	0	0
Response	Struct		
RespRef	Byte	16#0	16#01
RespID	Byte	16#0	16#02
AxisID	Byte	16#0	16#01
ParaNo	Byte	16#0	16#01
Format	Byte	16#0	16#43
CMD	Byte	16#0	16#4B
Value	DInt	0	1000

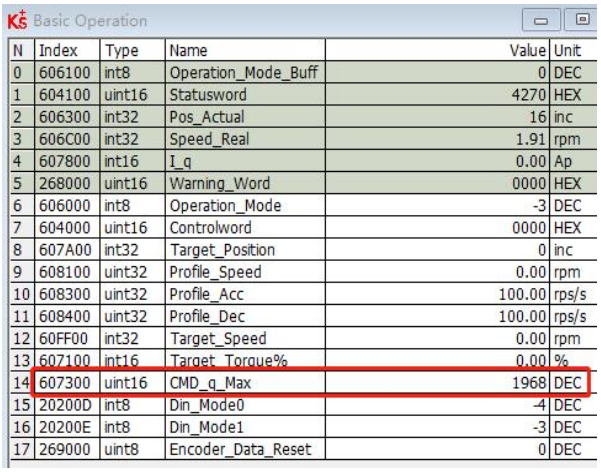

Basic Operation

N	Index	Type	Name	Value	Unit
0	606100	int8	Operation_Mode_Buff	0	DEC
1	604100	uint16	Statusword	4270	HEX
2	606300	int32	Pos_Actual	16	inc
3	606C00	int32	Speed_Real	1.77	rpm
4	607800	int16	I_q	0.00	Ap
5	268000	uint16	Warning_Word	0000	HEX
6	606000	int8	Operation_Mode	-3	DEC
7	604000	uint16	Controlword	0000	HEX
8	607A00	int32	Target_Position	0	inc
9	608100	uint32	Profile_Speed	0.00	rpm
10	608300	uint32	Profile_Acc	100.00	rps/s
11	608400	uint32	Profile_Dec	100.00	rps/s
12	60FF00	int32	Target_Speed	0.00	rpm
13	607100	int16	Target_Torque%	0.00	%
14	607300	uint16	CMD_q_Max	1000	DEC
15	20200D	int8	Din_Mode0	-4	DEC
16	20200E	int8	Din_Mode1	-3	DEC
17	269000	uint8	Encoder_Data_Reset	0	DEC

b. Write CMD_q_Max:

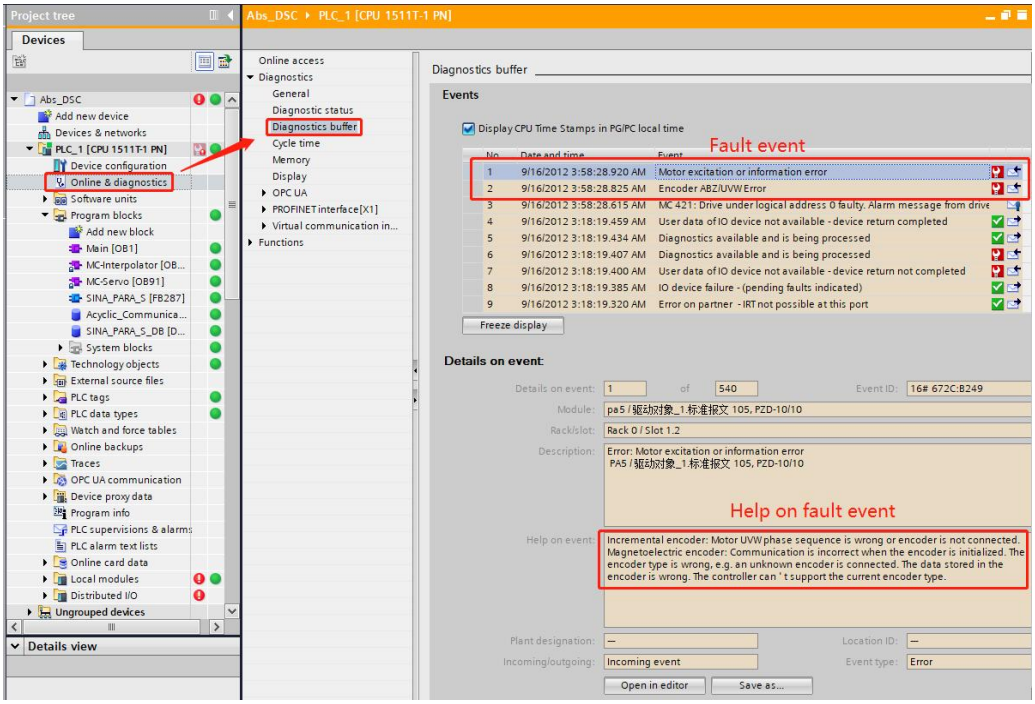
Verify that PN_Enable [30800B] is 0. "ReqID" is assigned 0x02, "Subindex / CMD" is assigned 0x002B, "Index" is assigned 0x6073, "Write Value" is assigned 1968. Triggers "REQ" pin to complete the data writing. See the figure below, "CMD" of "Response" is 0x60, indicating that the writing is successful. Use KincoServo+ software to view CMD_q_Max becomes 1968 DEC.

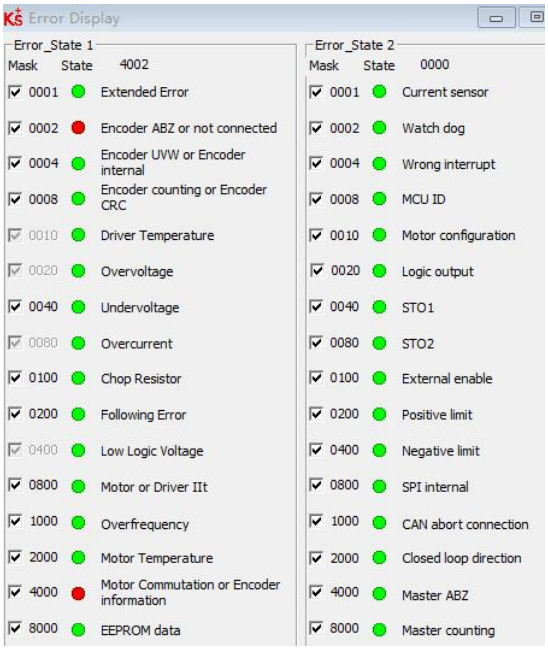




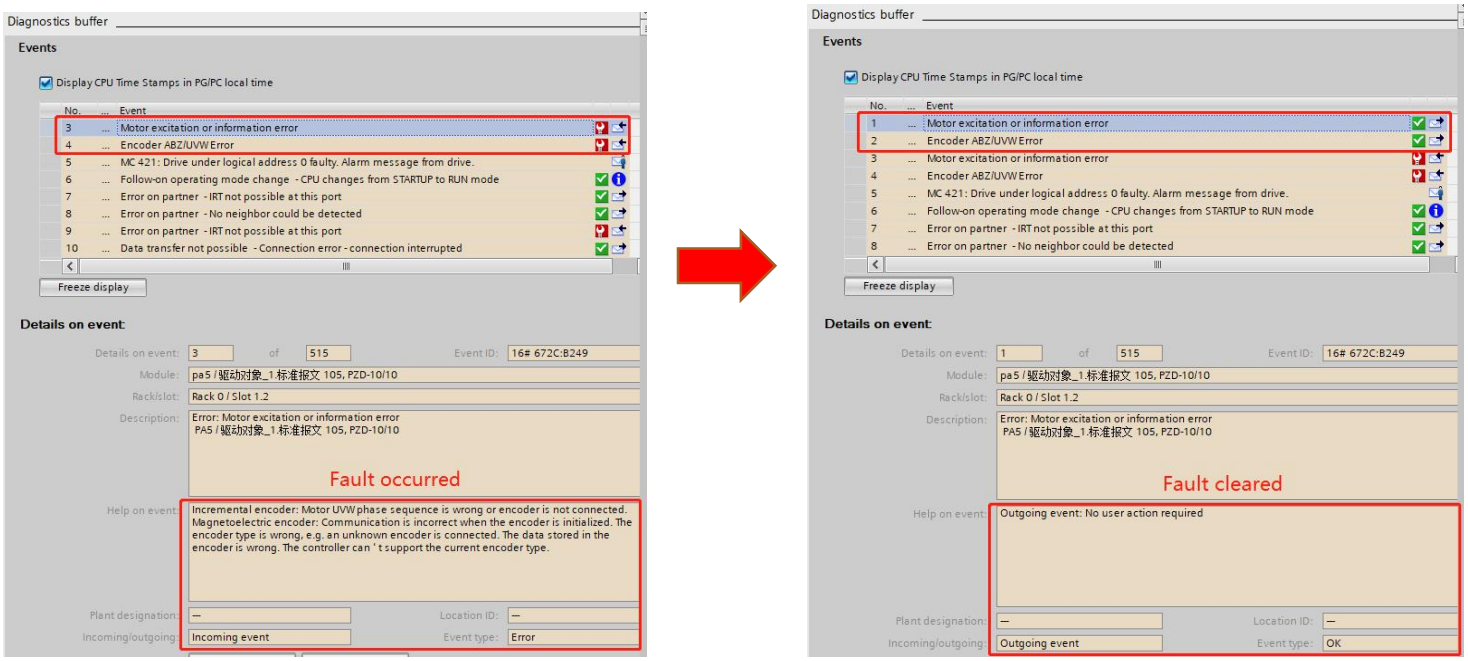
3.6 Fault diagnosis function

Through the online diagnosis interface of TIA portal, the fault information of the drive can be viewed. Double-click "Online & diagnosis" under PLC_1, click "Diagnosis buffer" in the "Diagnosis" drop-down list, and the drive fault event can be seen, which is consistent with the error display of KincoServo+ software. The "Details on event" section below provides the cause of the alarm and what to do about it:





When the drive fault has been eliminated and confirmed, the diagnostics buffer will show that the drive fault event has been cleared:



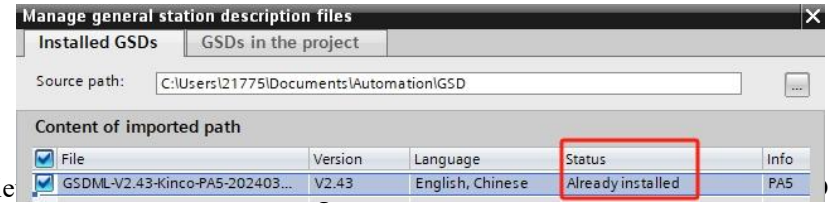
Chapter 4 Application class 1

4.1 Overview

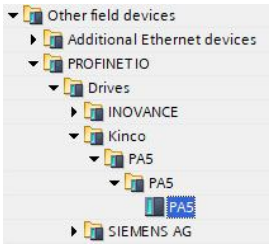
Kinco PN servo drive can use telegram 1 in Application Class 1. PLC can control the drive through FB285 to achieve speed control. Isochronous synchronization (IRT) operation is not supported.

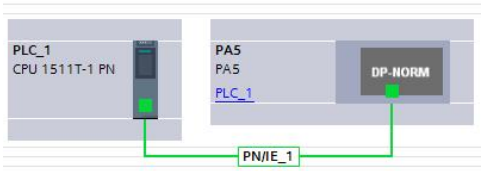
4.2 Project configuration

1. See Section 3.1 for the modification of the drive IP address and device name.
2. Click menu "Options → Manage general station description files" to install GSD, please take the GSDML-V2.43-Kinco-PA5-20240328 as the standard. In addition, the GSD to which the PN firmware 00000004 applies is GSDML-V2.33-Kinco-MD60-20210507.



3. In the network vie → Drives → Kinco → PA5" to add a drive and assign it to the PLC:

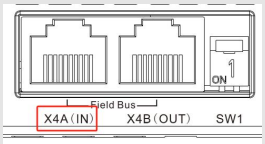


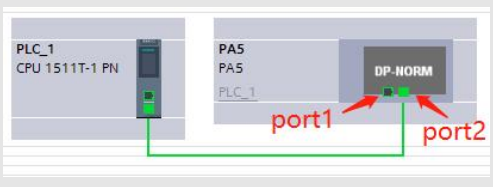


4. If PLC is required to automatically configure the device name of drive (the premise of automatic allocation is that the name of the drive is empty), the topology diagram must be connected. In the topology view, connect the ports according to the actual situation.

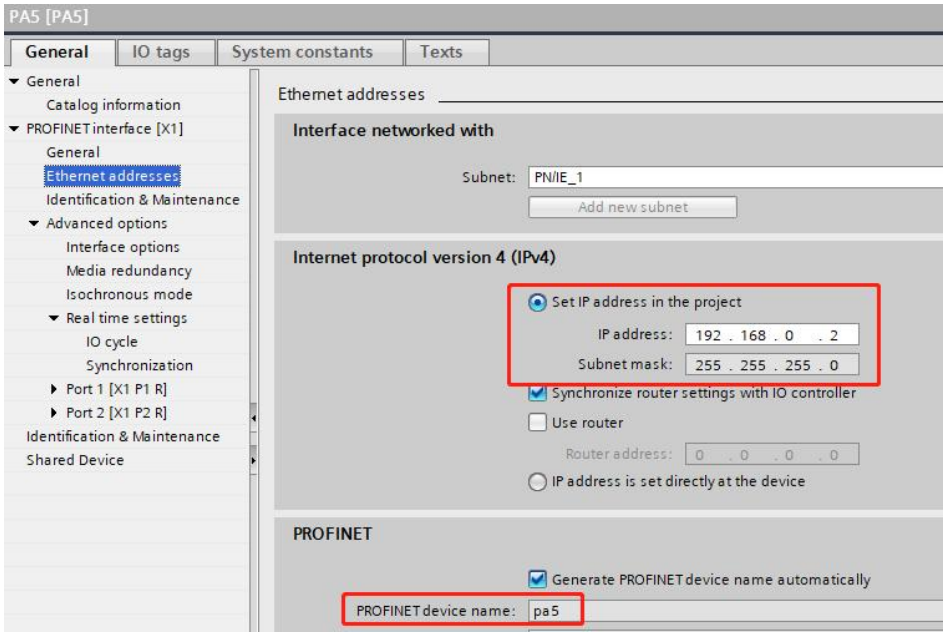
Note

- The ports on the topology diagram corresponding to the IN ports on different drives are different. The IN port of FD5P series drive and MD series drive corresponds to port 1 in the topology diagram;the IN port of FD5 series drive corresponds to port 2 in the topology diagram.

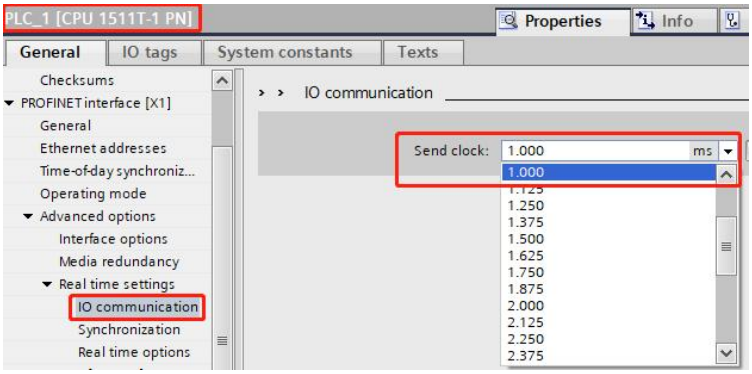




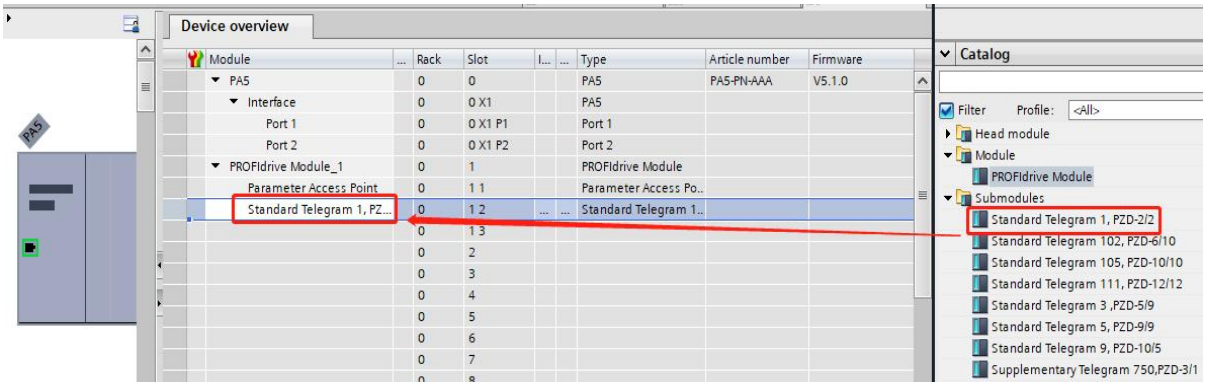
5. Double-click the PA5 module, click "Ethernet addresses" in "General", and set the configured IP address and PROFINET device name. The device names need to be consistent with the actual device names of the drives. When there are multiple drives, the device names cannot be the same:



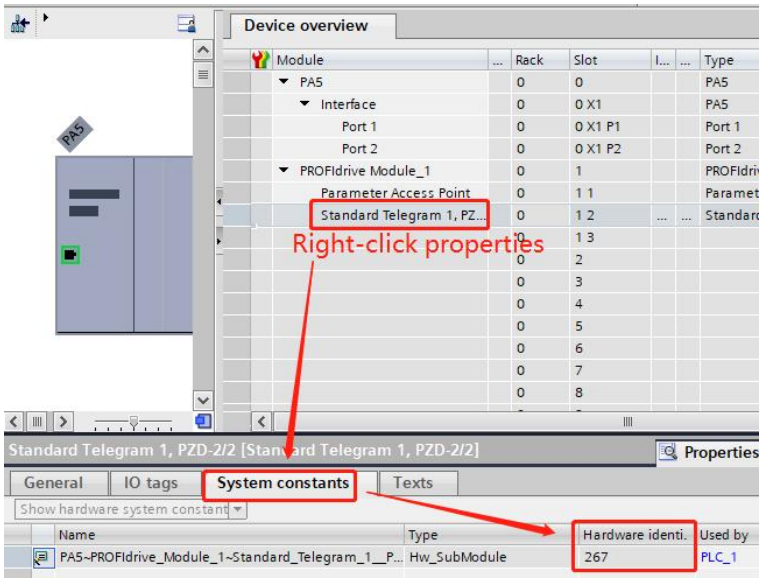
6. In the device view, select PLC_1, click "general → PROFINET interface → Advanced options → Real time settings → IO communication" to set the PLC's Send clock:



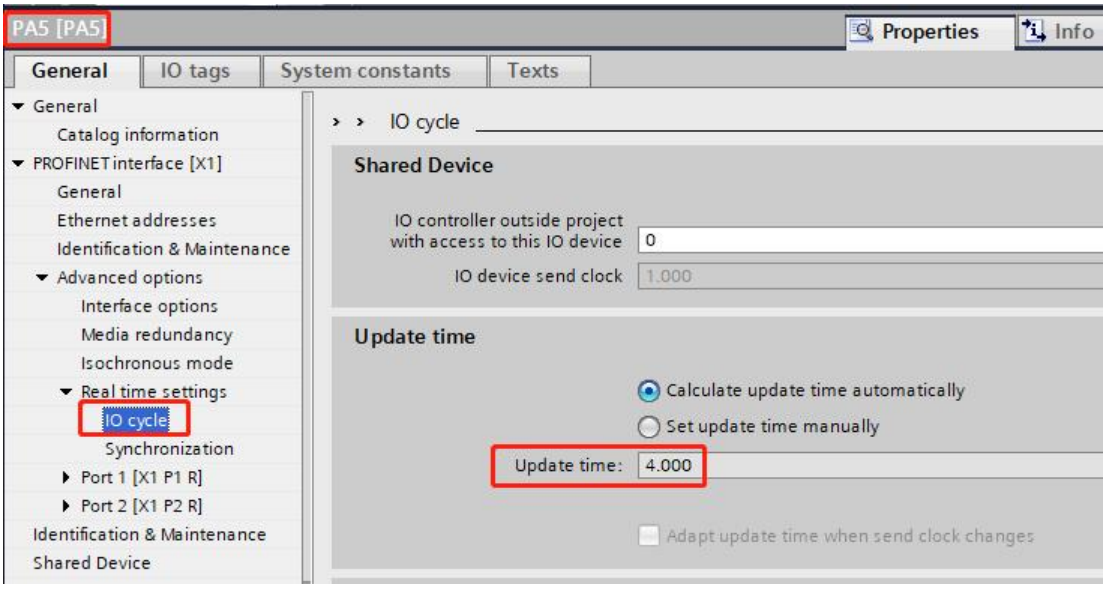
7. In the device view, select PA5, click "Hardware catalog → Module → PROFIdrive Module → Submodules", delete telegram 3 under "Device overview" first, and then add telegram 1 to the corresponding position:



8. Remember the hardware identifier: select telegram 1 → right-click Properties→ System constants → Hardware identifier:



9. In the device view, select PA5, click "General→ PROFINET interface → Advanced options → Real time settings → IO cycle" to set the configured drive update time:

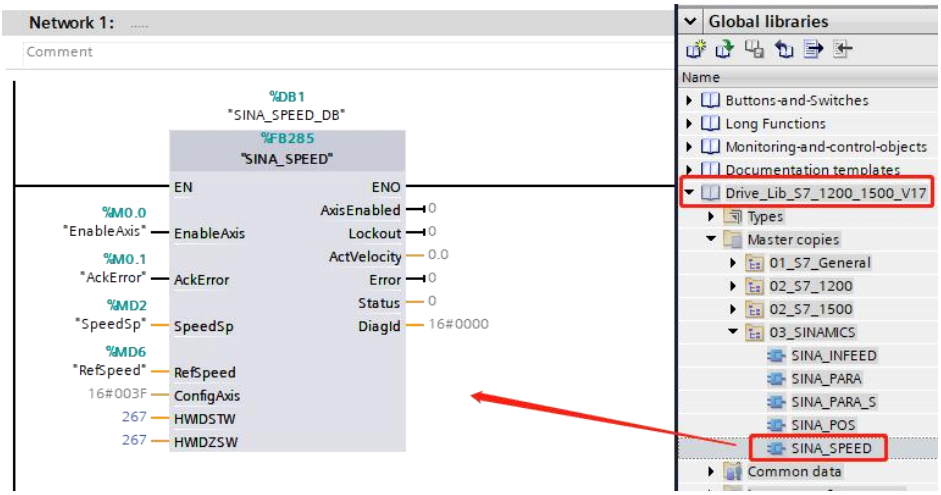


10. Add FB285 to Main[OB1] and assign variables to its pins.

If you cannot find the corresponding function block (FB), you can download the library file Drive_Lib_S7_1200_1500_V17 from Siemens official website:

https://support.industry.siemens.com/cs/document/109475044/sinamics-communication-blocks-drivelib-for-reading-and-writing-drive-data-within-tia-portal-context?dti=0&lc=en-WW

After the download is completed, click menu "Options → Global libraries → Open library", and install the corresponding library file according to the prompt.



4.3 SINA_SPEED (FB285) introduction

Table 4-1 describes the FB285 pin definition

Table 4-1 FB285 pin definition

<table>
<tr><th>Pin name</th><th>Data type</th><th>Description</th></tr>
<tr><td>EnableAxis</td><td>Bool</td><td>Enable axis:
=0 Disable, control word is 0xE
=1 Enable，control word is 0xF</td></tr>
<tr><td>AckError</td><td>Bool</td><td>Reset fault, rising edge valid</td></tr>
<tr><td>SpeedSp</td><td>Real</td><td>Speed setpoint in RPM</td></tr>
<tr><td>RefSpeed</td><td>Real</td><td>Reference speed, must be 1/2 of the maximum speed [607F00] in RPM</td></tr>
<tr><td>ConfigAxis</td><td>Word</td><td>The default is 16#3F, and the corresponding relationship with STW1 is as follows:
<table><tr><th>Bit in ConfigAxis</th><th>Bit in STW1</th></tr><tr><td>Bit 0</td><td>Bit 1</td></tr><tr><td>Bit 1</td><td>Bit 2</td></tr><tr><td>Bit 2</td><td>Bit 3</td></tr><tr><td>Bit 3</td><td>Bit 4</td></tr><tr><td>Bit 4</td><td>Bit 5</td></tr><tr><td>Bit 5</td><td>Bit 6</td></tr><tr><td>Bit 6</td><td>Bit 11</td></tr><tr><td>Bit 7~15: Reserved</td><td></td></tr></table>See Table 1-6 for the meaning of each bit in STW1</td></tr>
<tr><td>HWIDSTW</td><td>HW_IO</td><td rowspan="2">See Section 4.2, Article 7, by which the parameter is used to distinguish between different axes</td></tr>
<tr><td>HWIDZSW</td><td>HW_IO</td></tr>
<tr><td>AxisEnabled</td><td>Bool</td><td>=1 Axis is enabled</td></tr>
<tr><td>Lockout</td><td>Bool</td><td>=1 Switching on inhibited</td></tr>
<tr><td>ActVelocity</td><td>Real</td><td>Speed actual value in RPM</td></tr>
<tr><td>Error</td><td>Bool</td><td>=1 Fault present</td></tr>
<tr><td>Status</td><td>Int</td><td>Status indication:
16#7002: No error
16#8401: Drive fault
16#8402: Switching on inhibited
16#8600: DPRD_DAT error
16#8601: DPWR_DAT error</td></tr>
<tr><td>DiagId</td><td>Word</td><td>Extended communication error</td></tr>
</table>

Chapter 5 Application class 3

5.1 Overview

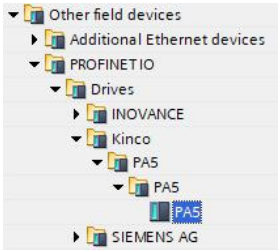
Kinco PN servo drive can select telegram 9 and 111 in Application Class 3. When using telegram 111, PLC can control the drive through FB284 to realize the basic positioning (EPOS) function. The operation modes are Jog, Homing, MDI, position table, etc. Isochronous synchronization (IRT) operation is not supported.

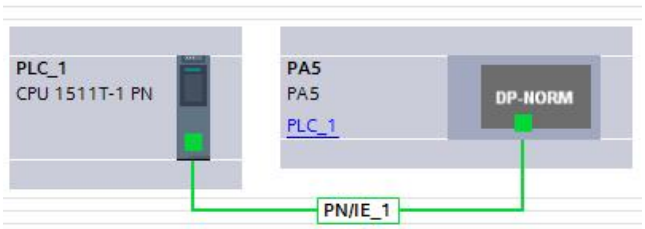
5.2 Project configuration

1. See Section 3.1 for the modification of the drive IP address and device name.

2. Click menu "Options → Manage general station description files" to install GSD, please take the GSDML-V2.43-Kinco-PA5-20240328 as the standard. In addition, the GSD to which the PN firmware 00000004 applies is GSDML-V2.33-Kinco-MD60-20210507.

3. In the network view, click "Hardware catalog → Other field devices → PROFINET IO → Drives → Kinco → PA5" to add a drive and assign it to the PLC：

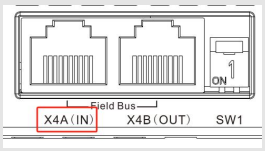




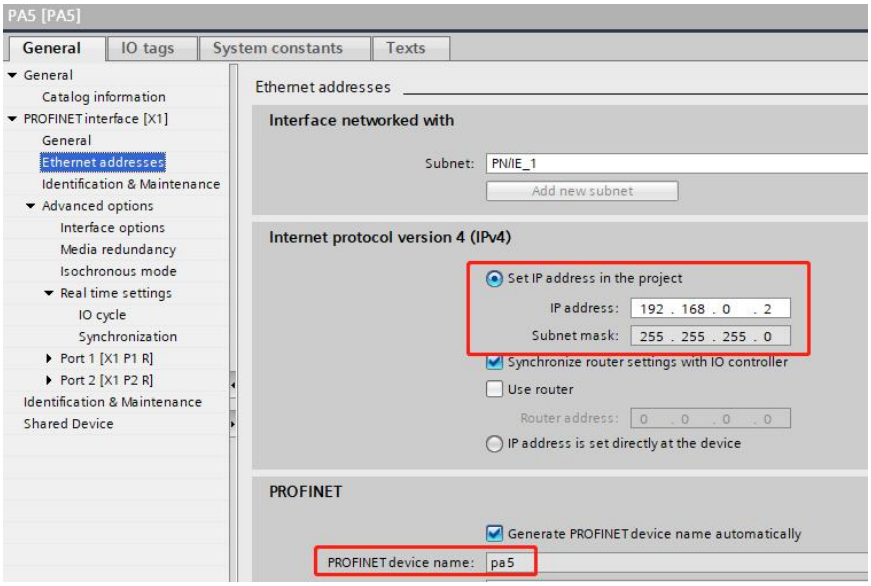
4. If PLC is required to automatically configure the device name of drive (the premise of automatic allocation is that the name of the drive is empty), the topology diagram must be connected. In the topology view, connect the ports according to the actual situation.

Note

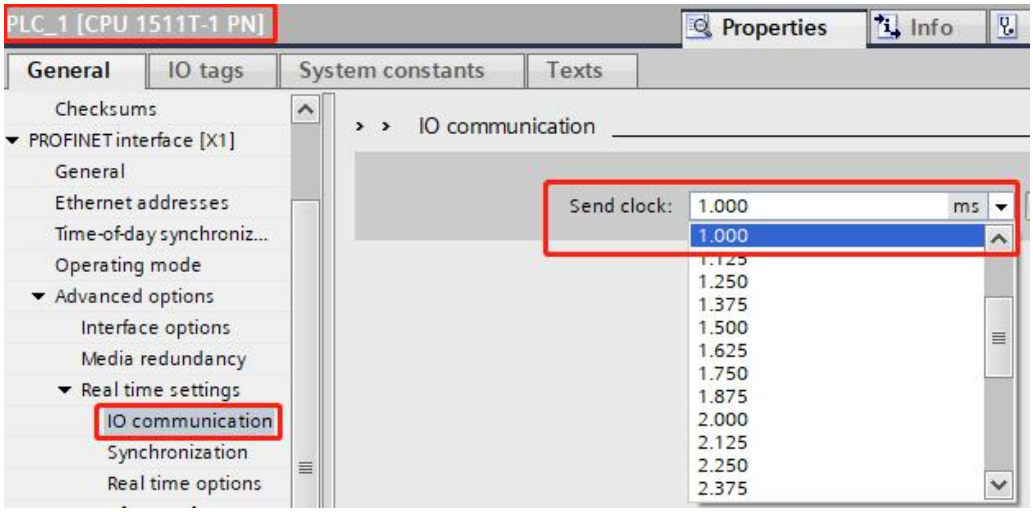
- The ports on the topology diagram corresponding to the IN ports on different drives are different. The IN port of FD5P series drive and MD series drive corresponds to port 1 in the topology diagram;the IN port of FD5 series drive corresponds to port 2 in the topology diagram.



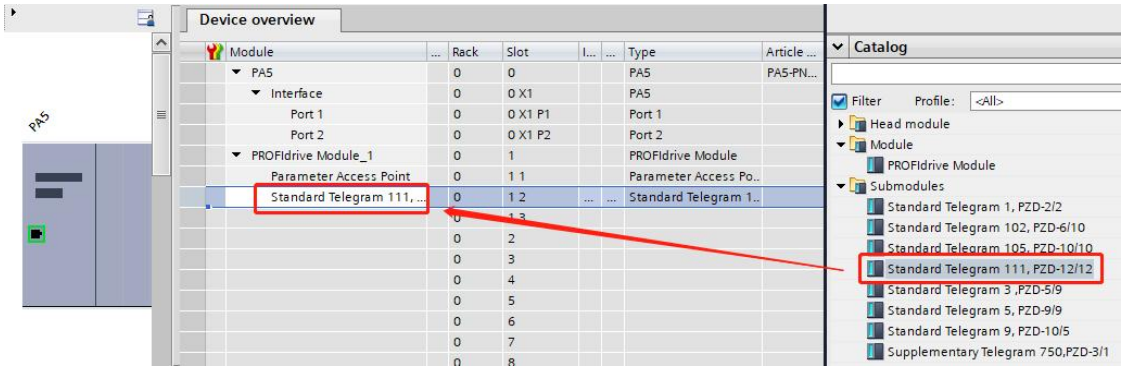
5. Double-click the PA5 module, click "Ethernet addresses" in "General", and set the configured IP address and PROFINET device name. The device names need to be consistent with the actual device names of the drives. When there are multiple drives, the device names cannot be the same:



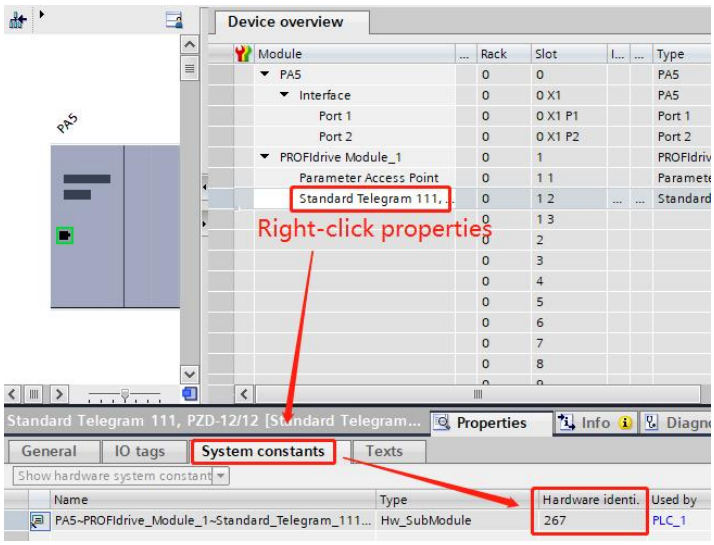
6. In the device view, select PLC_1, click "general → PROFINET interface → Advanced options → Real time settings → IO communication" to set the PLC's Send clock:



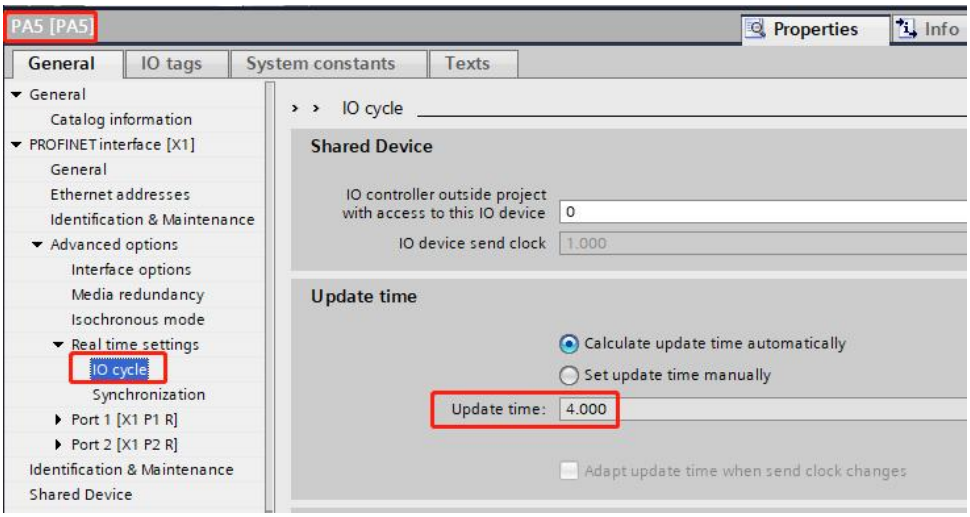
7. In the device view, select PA5, click "Hardware catalog → Module → PROFIdrive Module → Submodules", delete telegram 3 under "Device overview" first, and then add telegram 111 to the corresponding position:



8. Remember the hardware identifier: select telegram 111 → right-click Properties→ System constants → Hardware identifier:



9. In the device view, select PA5, click "General→ PROFINET interface → Advanced options → Real time settings → IO cycle" to set the configured drive update time:

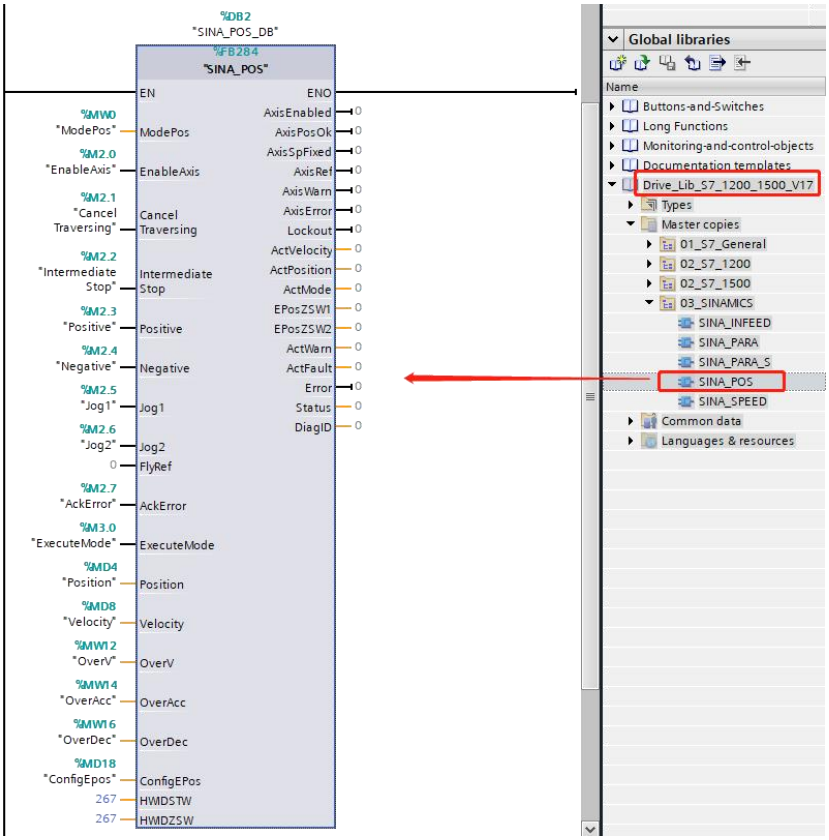


10. Add FB284 to Main[OB1] and assign variables to its pins.

If you cannot find the corresponding function block (FB), you can download the library file Drive_Lib_S7_1200_1500_V17 from Siemens official website:

https://support.industry.siemens.com/cs/document/109475044/sinamics-communication-blocks-drivelib-for-reading-and-writing-drive-data-within-tia-portal-context?dti=0&lc=en-WW

After the download is completed, click menu "Options → Global libraries → Open library", and install the corresponding library file according to the prompt.



5.3 SINA_POS (FB284) introduction

Table 5-1 describes the FB284 pin definition

Table 5-1 FB284 pin definition

Pin name	Data type	Description
ModePos	Int	Operating mode: =0 — =1 Relative positioning =2 Absolute positioning =3 — =4 Active homing =5 Direct homing =6 Position table (not supported) =7 Jog at the specified speed =8 —

<table>
<tr><th>Pin name</th><th>Data type</th><th>Description</th></tr>
<tr><td>EnableAxis</td><td>Bool</td><td>=0 Disable, control word is 0xE
=1 Enable，control word is 0xF</td></tr>
<tr><td>CancelTraversing</td><td>Bool</td><td>=1 Do not reject traversing task
=0 Reject traversing task</td></tr>
<tr><td>IntermediateStop</td><td>Bool</td><td>=1 No intermediate stop
=0 Intermediate stop</td></tr>
<tr><td>Positive</td><td>Bool</td><td>Positive direction</td></tr>
<tr><td>Negative</td><td>Bool</td><td>Negative direction</td></tr>
<tr><td>Jog1</td><td>Bool</td><td>Jog reversely</td></tr>
<tr><td>Jog2</td><td>Bool</td><td>Jog forward</td></tr>
<tr><td>FlyRef</td><td>Bool</td><td>Invalid, need to be 0</td></tr>
<tr><td>AckError</td><td>Bool</td><td>Reset fault, rising edge valid</td></tr>
<tr><td>ExecuteMode</td><td>Bool</td><td>Activate operating mode, rising edge valid</td></tr>
<tr><td>Position</td><td>DInt</td><td>Position set point for operating mode 1, 2
Position table start/New task index for operating mode 6. The value ranges from 0 to 7</td></tr>
<tr><td>Velocity</td><td>DInt</td><td>Speed set point for operating mode 1, 2, 7</td></tr>
<tr><td>ConfigEPos</td><td>DWord</td><td>The default is 16#00000003. The corresponding relationship with relevant control word is as follows:
<table>
<tr><th>Bit in ConfigEPos</th><th>Bit in control word</th></tr>
<tr><td>Bit 0</td><td>STW1 Bit 1</td></tr>
<tr><td>Bit 1</td><td>STW1 Bit 2</td></tr>
<tr><td>Bit 2</td><td>POS_STW2 Bit 14</td></tr>
<tr><td>Bit 3</td><td>POS_STW2 Bit 15</td></tr>
<tr><td>Bit 6</td><td>POS_STW2 Bit 2</td></tr>
<tr><td>Bit 8</td><td>POS_STW1 Bit 12</td></tr>
<tr><td>Other Bits: Reserved</td><td></td></tr>
</table>
See Table 1-6 for the meaning of each bit in STW1
See Table 1-13 for the meaning of each bit in the POS_STW1
See Table 1-14 for the meaning of each bit in the POS_STW2</td></tr>
<tr><td>OverV</td><td>Int</td><td>The percentage of the speed set point when the operating mode is 1, 2, and 7, unit : %, Range 0 to 199%</td></tr>
<tr><td>OverAcc</td><td>Int</td><td>The percentage of the acceleration when the operating mode is 1, 2, and 7, unit : %, Range 0 to 100%</td></tr>
<tr><td>OverDec</td><td>Int</td><td>The percentage of the deceleration when the operating mode is 1, 2, and 7, unit : %, Range 0 to 100%</td></tr>
<tr><td>HWIDSTW</td><td>HW_IO</td><td rowspan="2">See Section 5.2, Step 7, for this parameter to distinguish between different axes</td></tr>
<tr><td>HWIDZSW</td><td>HW_IO</td></tr>
<tr><td>AxisEnabled</td><td>Bool</td><td>=1 Axis is enabled</td></tr>
<tr><td>AxisPosOk</td><td>Bool</td><td>=1 Target position reached</td></tr>
<tr><td>AxisSpFixed</td><td>Bool</td><td>=1 Setpoint position reached</td></tr>
<tr><td>AxisRef</td><td>Bool</td><td>=1 Reference point set</td></tr>
<tr><td>AxisWarn</td><td>Bool</td><td>=1 Warn present</td></tr>
<tr><td>AxisError</td><td>Bool</td><td>=1 Fault present</td></tr>
<tr><td>Lockout</td><td>Bool</td><td>=1 Switching on inhibited</td></tr>
<tr><td>ActVelocity</td><td>DInt</td><td>Speed actual value</td></tr>
<tr><td>ActPosition</td><td>DInt</td><td>Position actual value</td></tr>
<tr><td>ActMode</td><td>Int</td><td>Current operating mode</td></tr>
</table>

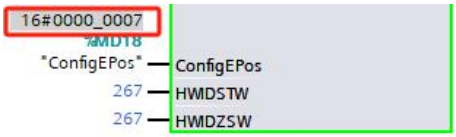
Pin name	Data type	Description
EPosZSW1	Word	POS_ZSW1 current value, see Table 1-15
EPosZSW2	Word	POS_ZSW2 current value, see Table 1-16
ActWarn	Word	Speed actual value
ActFault	Word	Drive error code [603F00]
Error	Bool	=1 Fault present
Status	Word	Status indication: 16#7002: No error 16#8401: Drive fault 16#8402: Switching on inhibited 16#8403: Homing procedure forbidden during positioning 16#8600: DPRD DAT error 16#8601: DPWR DAT error 16#8202: Operating mode is selected incorrectly 16#8203: Setpoint is incorrect 16#8204: Position table task index error
DiagID	Word	Extended communication error

5.4 FB284 function description

5.4.1 Operating condition and setting

1. The initial value of the input pin "ConfigEPos" should be 3.
2. The input pins "CancelTraversing" and "IntermediateStop" are valid for all modes except jog mode, and should be set to 1 during operation, as follows:
   a. When "CancelTraversing" = 0, it means that the current task is canceled, and the deceleration corresponds to the halt mode [605D00]. The operating mode can be switched after the axis stops.
   b. When "IntermediateStop" = 0, it means to pause the current task, and the deceleration corresponds to the halt mode [605D00]. The axis will continue to run after resetting "IntermediateStop" = 1. The operating mode can be switched after the axis stops.
3. The input pin "ModePos" is used to select the operating mode; the rising edge of "ExecuteMode" triggers the positioning movement.
4. Activate software limit switch

   After setting the reference point, if you need to use a software limit switch, you need to set bit 2 of the input pin "ConfigEPos" to 1 ("ConfigEPos" = 16#00000007) or set the En_SoftWare_Limit [30800C] to 1.



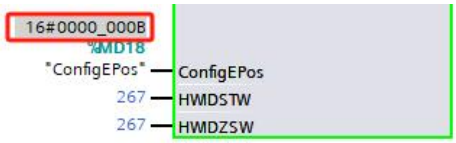
Activate the software limit function, set the soft positive limit [607D01] and the soft negative limit [607D02] for the drive.

30800C	uint8	En_SoftWare_Limit	1	DEC
607D01	int32	Soft_Positive_Limit	10000000	DEC
607D02	int32	Soft_Negative_Limit	-10000000	DEC

After you set soft positive limit more than soft negative limit and set the reference point, the software limit function is enabled.

5. Activate hardware limit switch

If you need to use a hardware limit switch, you need to set bit 3 of the input pin "ConfigEPos" to 1 ("ConfigEPos" = 16#0000000B):

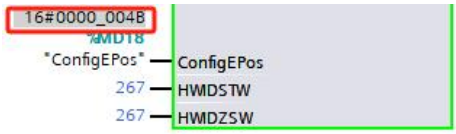


Use KincoServo+ software to define the positive limit and negative limit for the DIN of the drive. The drive can only be operated when the hardware limit switch signal is high.

Please note that only positive and negative limits are configured in the KincoServo+ software, but bit 3 of "ConfigEPos" is not set to 1, then the hardware limit function will not take effect.

6. Activate homing switch

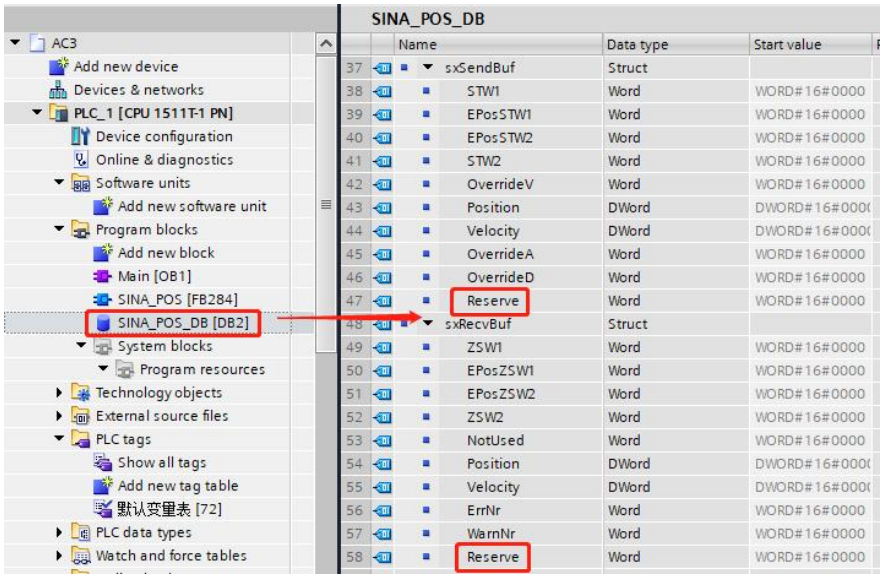
The homing switch signal can be activated by setting bit 6 of the input pin "ConfigEPos" to 1 ("ConfigEPos" = 16#0000004B):



The same purpose can be achieved by configuring the home signal for the drive's DIN on the KincoServo+ software:

7. Setting and reading servo parameters using telegram 111

The PLC allocates 24-byte receiving and sending areas for telegram 111, which can be viewed in the FB284 DB block. The "Reserve" variables under the structures "sxSendBuf" and "sxRecvBuf" can be used to customize the settings and read servo parameters:



The relevant servo parameters are the PN_User_Receive [30800D] and the PN_User_Send [30800E]:

30800D	uint8	PN_User_Receive	0	DEC
30800E	uint8	PN_User_Send	0	DEC

The explanation is as follows:

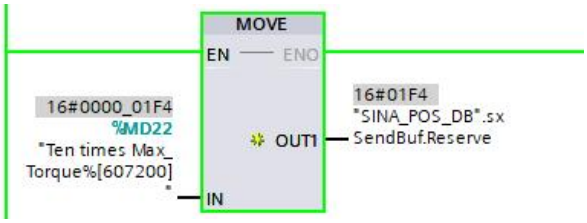
PN_User_Receive	=0 non-functional =1 Enable torque limiting and transmit the torque limit value in "Reserve" under "sxSendBuf"
PN_User_Send	=0 non-functional =2 Transfer the actual current in "Reserve" under "sxRecvBuf"

a. Torque limiting function

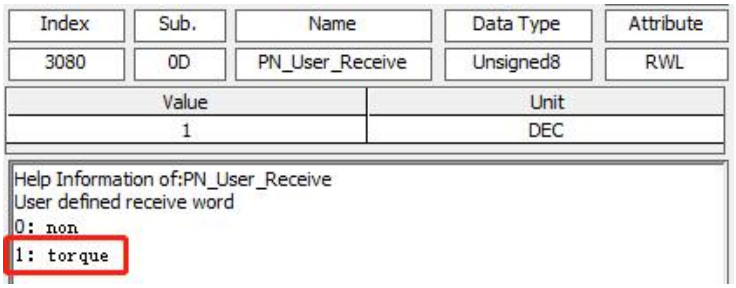
When using the torque limiting function, please set the appropriate torque limit value; if the limit value is too small, it may cause the drive's following error to be too large.

The "Reserve" variable of "sxSendBuf" in the FB284 DB block corresponds to ten times the Max_Torque%[607200].

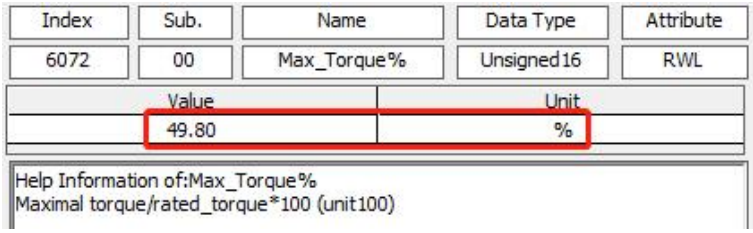
First set "Reserve" to 16#1F4 = 500, then the Max_Torque% should be 50%:



Then set the PN_User_Receive [30800D] to 1: torque as follows:



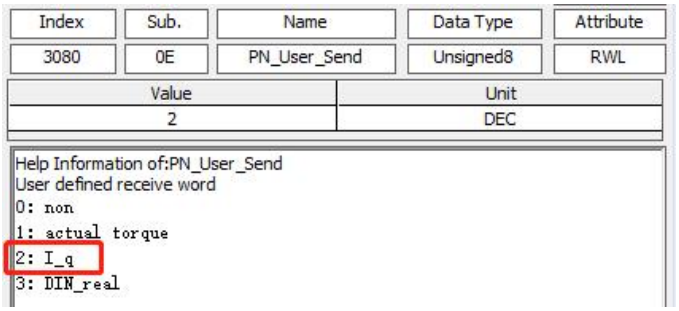
Max_Torque% has become 50%:



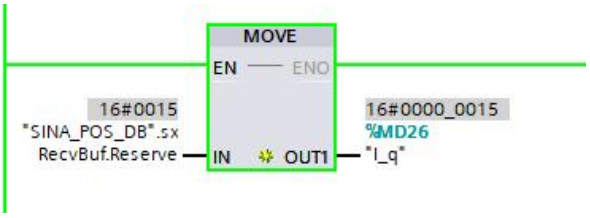
Please note that once [30800D] is set to 1, the torque limit becomes effective, and after setting [30800D] to 0 again, the torque limit value does not revert to the initial value, but it is possible to set the torque limit [607200] directly on the KincoServo+ software.

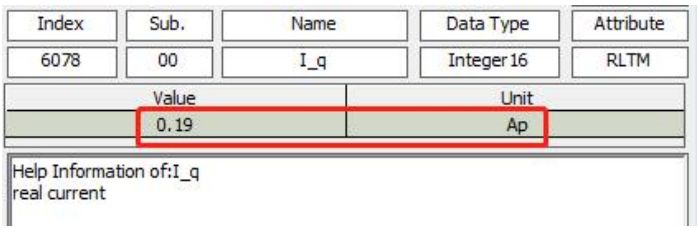
b. Read actual current

First set the PN_User_Send [30800E] to 2: I_q as follows:



In FB284 DB block, "sxRecvBuf" → "Reserve" variable reads drive actual current, unit DEC, which needs to be converted, such as the reading value converted to Ap: 16 # 15 = 21, 21 / 2048 * 18Ap (I_Max [651003]) = 0.19Ap:





5.4.2 Operating mode 1 (Relative positioning)

Requirements:

1. Operating mode "ModePos" = 1
2. "ConfigEPos" = 16#00000003
3. "EnableAxis" = 1
4. "CancelTraversing" and "IntermediateStop" must be 1, and "Jog1" and "Jog2" must be 0.

Steps:

1. Specify the target position and target speed through the input pin "Position" and "Velocity". The unit of position and velocity is DEC. Refer to the drive manual for conversion, and the unit of velocity is transformed into: DEC = RPM * 512 * feedback_resolution [641003] / 1875.
2. Use "OverV", "OverAcc" and "OverDec" to scale the percentage of the target speed and profile acceleration and deceleration.
3. The direction of movement is determined by the positive or negative value set in "Position".
4. The movement is triggered by the rising edge of "ExecuteMode", and "AxisPosOk" is set to 1 after reaching the target position. If there is an error locating, "Error" is set to 1.
5. The currently running command can be replaced with a new command via the "ExecuteMode" rising edge. At any time, it can switch between operating mode 1 and 2. If you need to switch to another operating mode, the axis must be stationary.

5.4.3 Operating mode 2 (Absolute positioning)

Requirements:

1. Operating mode "ModePos" = 2
2. "ConfigEPos" = 16#00000003
3. "EnableAxis" = 1
4. "CancelTraversing" and "IntermediateStop" must be 1, and "Jog1" and "Jog2" must be 0.

Steps:

1. Specify the target position and target speed through the input pin "Position" and "Velocity". The unit of position and velocity is DEC. Refer to the drive manual for conversion, and the unit of velocity is transformed into: DEC = RPM * 512 * feedback resolution [641003] / 1875.
2. Use "OverV", "OverAcc" and "OverDec" to scale the percentage of the target speed and profile acceleration and deceleration.
3. When running, the drive will follow the shortest path to the target position, and "Positive" and "Negative" must be 0.
4. The movement is triggered by the rising edge of "ExecuteMode", and "AxisPosOk" is set to 1 after

reaching the target position. If there is an error locating, "Error" is set to 1.

5. The currently running command can be replaced with a new command via the "ExecuteMode" rising edge. At any time, it can switch between operating mode 1 and 2. If you need to switch to another operating mode, the axis must be stationary.
6. By setting bit 8 of "ConfigEPos" ("ConfigEPos" = 16#00000103), after updating "Position" on the PLC, there is no need to trigger "ExecuteMode", the new setting value will take effect immediately, and the servo will immediately execute the absolute positioning instruction according to the target position change.

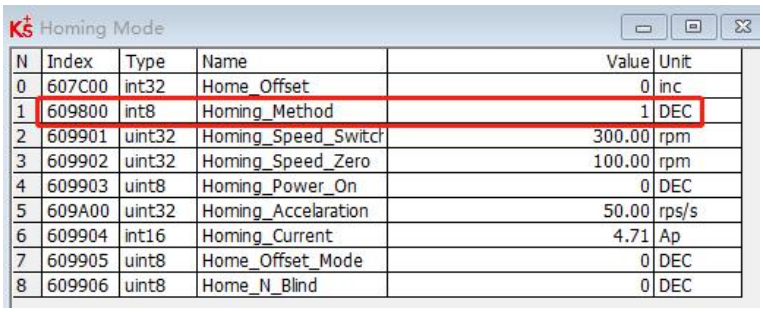
5.4.4 Operating mode 4 (Active homing)

Requirements:

1. Operating mode "ModePos" = 4
2. "ConfigEPos" = 16#00000003. If hardware limits are used, "ConfigEPos" = 16#0000000B.
3. "EnableAxis" = 1
4. "CancelTraversing" and "IntermediateStop" must be 1, and "Jog1" and "Jog2" must be 0.

Steps:

1. The way and the speed of returning to the reference point should be configured by the KincoServo+ software (PLC only sends the command, and the planning of returning to the homing is set by the servo parameters). Please refer to the drive manual for the specific way of returning to the homing:



N	Index	Type	Name	Value	Unit
0	607C00	int32	Home_Offset	0	inc
1	609800	int8	Homing_Method	1	DEC
2	609901	uint32	Homing_Speed_Switch	300.00	rpm
3	609902	uint32	Homing_Speed_Zero	100.00	rpm
4	609903	uint8	Homing_Power_On	0	DEC
5	609A00	uint32	Homing_Accelaration	50.00	rps/s
6	609904	int16	Homing_Current	4.71	Ap
7	609905	uint8	Home_Offset_Mode	0	DEC
8	609906	uint8	Home_N_Blind	0	DEC

2. A return to the homing motion is triggered by the rising edge of "ExecuteMode". After the motion, "AxisRef" is set to 1, if there is an error during the operation, "Error" is set to 1.

5.4.5 Operating mode 5 (Direct homing)

Requirements:

1. Operating mode "ModePos" = 5
2. "ConfigEPos" = 16#00000003
3. "EnableAxis" = 1
4. The axis must be stationary.

Steps:

The homing of the axis is set by the rising edge of the "ExecuteMode". When the homing operation has been done, the output pin "AxisRef" turns to be 1.

5.4.6 Operating mode 7 (Jog at the specified speed)

Requirements:

1. Operating mode "ModePos" = 7
2. "ConfigEPos" = 16#00000003
3. "EnableAxis" = 1
4. The axis must be stationary.

Steps:

1. Specify the jog speed through the input pin "Velocity", which must be a positive value in unit DEC.
2. Use "OverV", "OverAcc" and "OverDec" to scale the percentage of the jog speed and profile acceleration and deceleration.
3. "CancelTraversing" and "IntermediateStop" have nothing to do with the jog mode. The running direction is independent of "Positive" and "Negative".
4. There is no need to trigger "ExecuteMode". Reverse jogging when "Jog1" = 1, forward jogging when "Jog2" = 1. "Jog1" and "Jog2" can only be triggered separately. When "Jog1" and "Jog2" are 0 or 1 at the same time, the axis stops.

Chapter 6 Application class 4

6.1 Overview

Kinco PN servo drive can select telegram 3, 5, 102, 105 in Application Class 4. The technology object is configured in PLC and controlled using PLC_open function blocks such as MC_Power and MC_MoveAbsolute, where the position loop calculation of the servo three-loop control is completed in PLC, and the drive is in speed mode. The functional differences between the different telegrams are shown in Table 6-1.

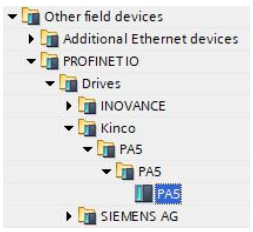
Table 6-1 Application Class 4 telegram function difference

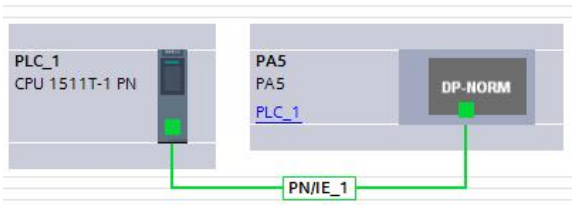
Telegram	IRT supported	Torque limiting supported	DSC supported
105	Yes	Yes	Yes
102	Yes	Yes	No
5	Yes	No	Yes
3	Yes	No	No

6.2 Project configuration

1. See Section 3.1 for the modification of the drive IP address and device name.
2. Click menu "Options → Manage general station description files" to install GSD, please take the GSDML-V2.43-Kinco-PA5-20240328 as the standard. In addition, the GSD to which the PN firmware 00000004 applies is GSDML-V2.33-Kinco-MD60-20210507.

3. In the network view, click "Hardware catalog → Other field devices → PROFINET IO → Drives → Kinco → PA5" to add a drive and assign it to the PLC:

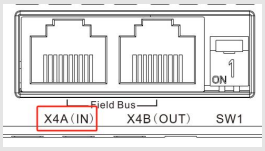




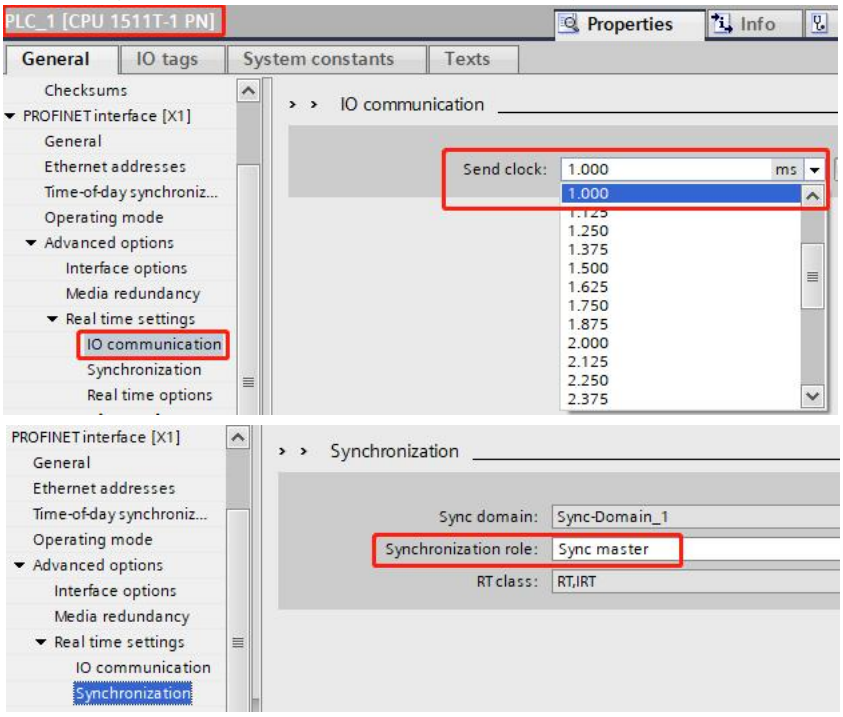
4. The topology diagram must be connected to use the isochronous synchronization mode. In the topology view, connect the ports according to the actual situation.

Note

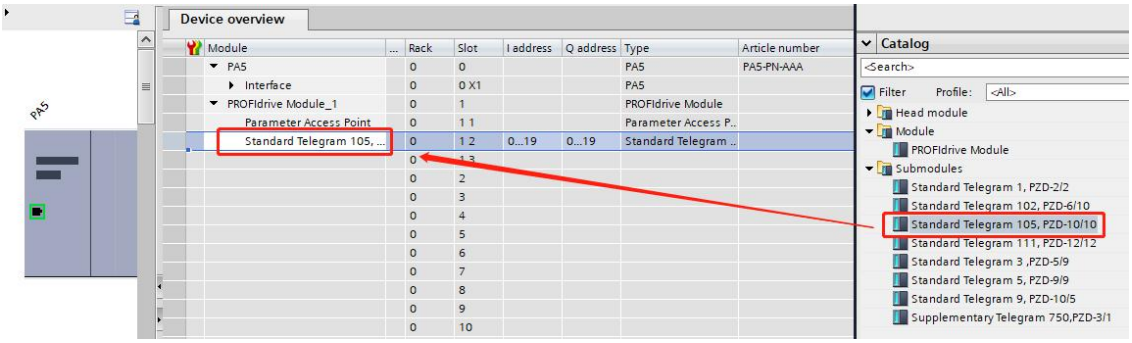
- The ports on the topology diagram corresponding to the IN ports on different drives are different. The IN port of FD5P series drive and MD series drive corresponds to port 1 in the topology diagram;the IN port of FD5 series drive corresponds to port 2 in the topology diagram.



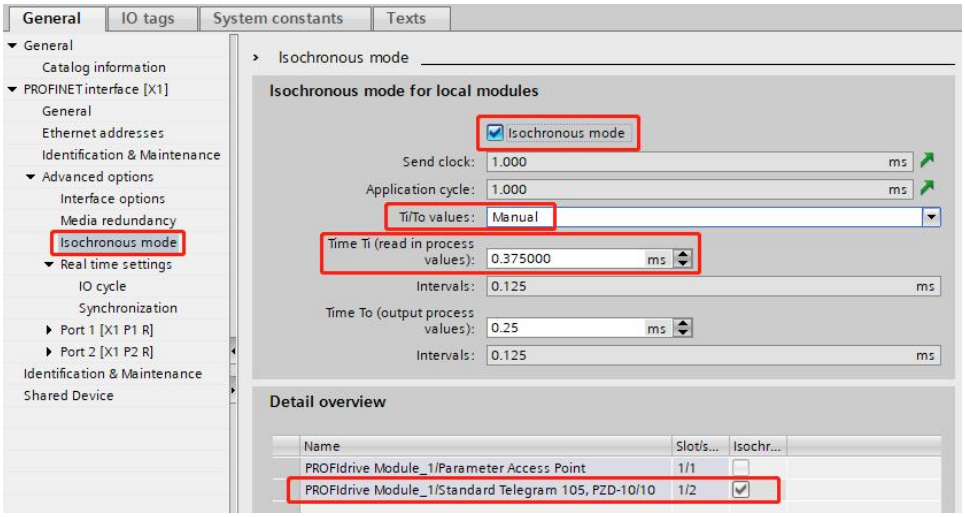
5. In the device view, select PLC_1, click "General → PROFINET interface → Advanced options → Real time settings" to set the send clock and enable the synchronization mode:



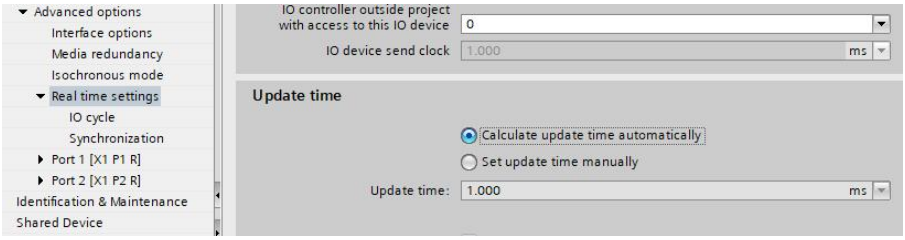
6. In the device view, select PA5, click "Hardware catalog → Module → PROFIdrive Module → Submodules", delete telegram 3 under "Device overview" first, and then add telegram 105 to the corresponding position:



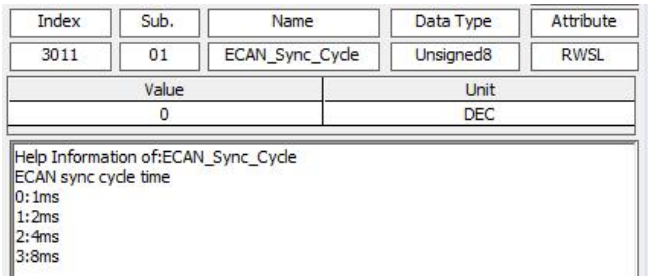
7. Click "General → PROFINET interface → Advanced options → Isochronous mode", then check telegram 105 below to enable the synchronization mode, and set Ti to 0.375ms:



8. In IRT mode, device update time = PLC send clock:



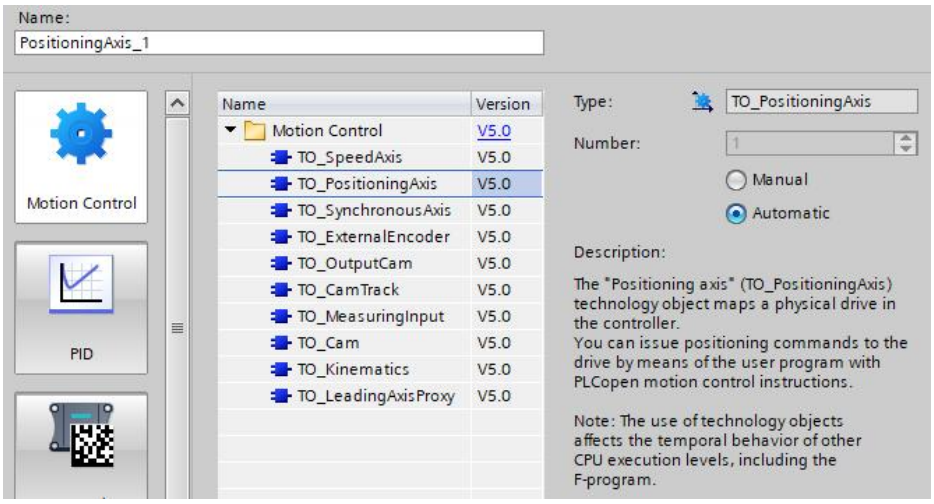
The update time of the configuration needs to be consistent with the ECAN_Sync_Cycle [301101], set to 0 for 1ms:



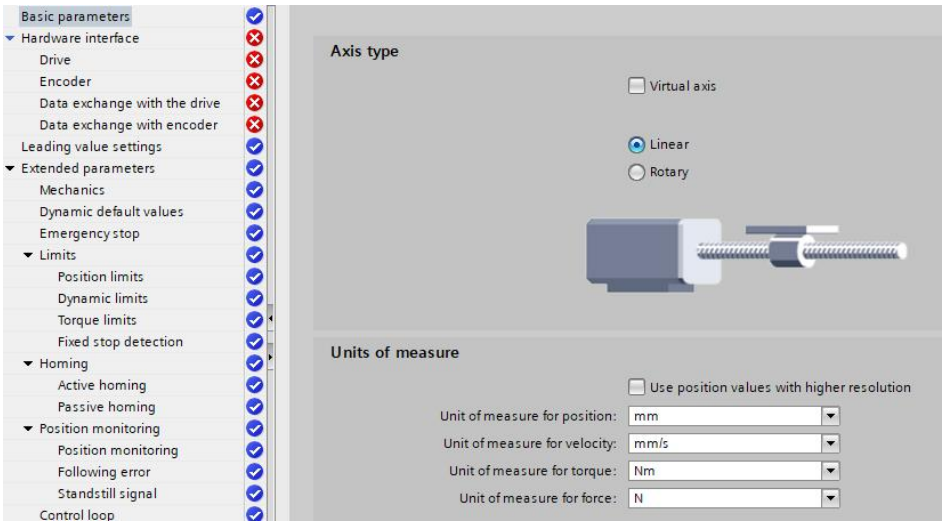
9. Enable isochronous synchronization mode on the drive side by setting ECAN_Sync_Clock [301102] to 1 and also setting ECAN_Sync_Shift [301103] to 4:

301101	uint8	ECAN_Sync_Cycle	0	DEC
301102	uint8	ECAN_Sync_Clock	1	DEC
301103	uint8	ECAN_Sync_Shift	4	DEC

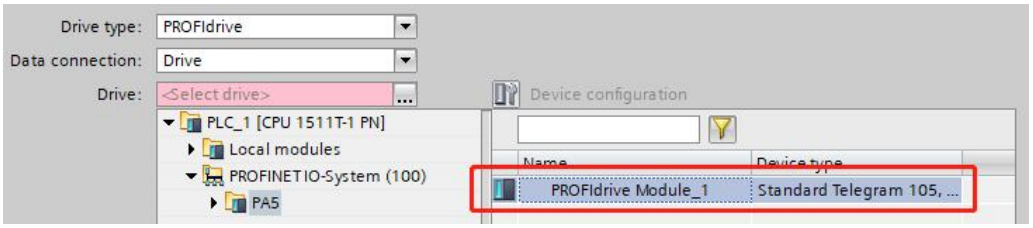
10. After the device is configured, click "Technology objects" in the drop-down list of PLC_1 on the left side to add a new technology object and select the positioning axis:



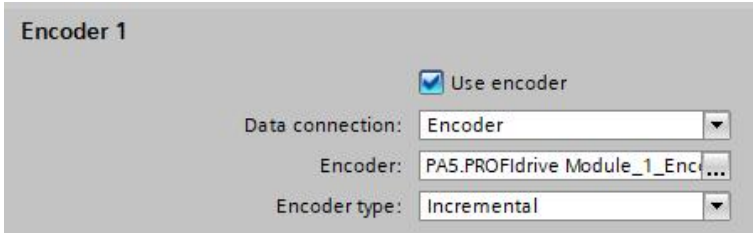
11. Click "Technology objects → PositioningAxis_1 → Configuration → Basic parameters", select Axis type:



12. Click "Hardware interface → Drive", select telegram 105：

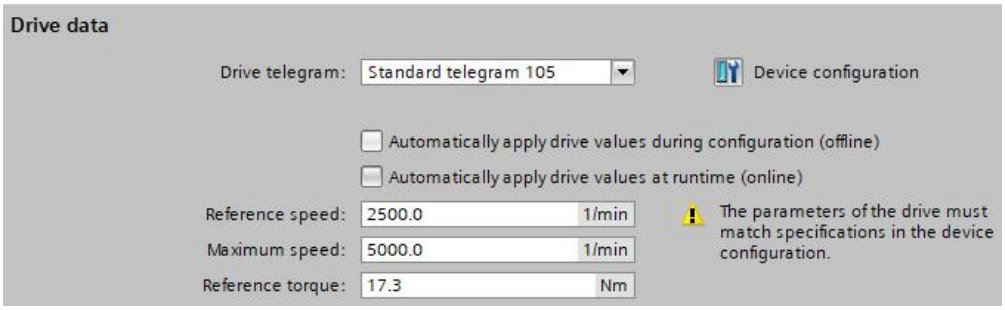


13. Kinco PN servo drives support incremental and absolute encoders. Click "Hardware interface → Encoder", select "Incremental" if a Kinco single-turn encoder motor is used:

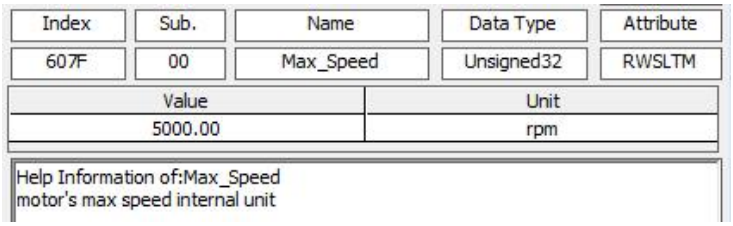


Select "Cyclic absolute" if a Kinco multi-turn absolute encoder motor is used:

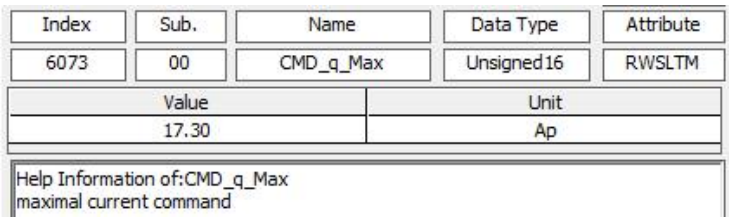
14. Click on "Data exchange with the drive" to set the Reference speed, Maximum speed and Reference torque:



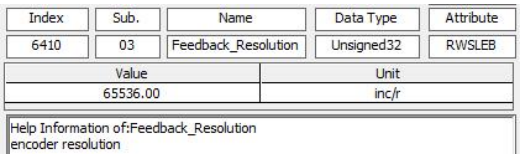
The Reference speed is 1/2 of the Max_Speed [607F00]:

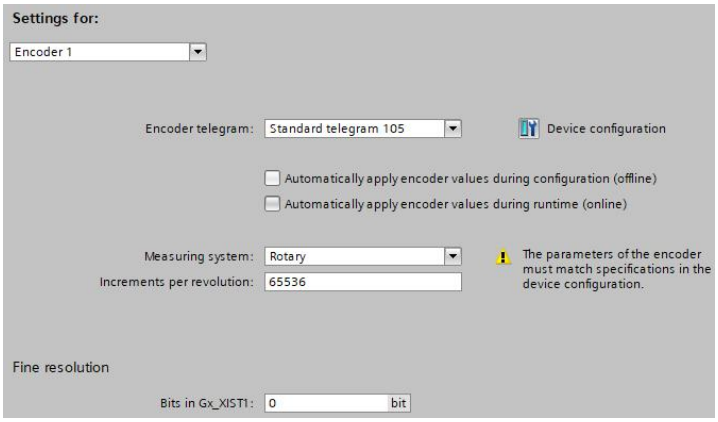


CMD_q_Max [607300] and Max_Torque% [607200] of the drive are related, and the Reference torque can be taken as the initial default value of CMD_q_Max [607300], with the unit of Ap, which is generally the lesser of the two values of the drive peak current and the motor peak current:

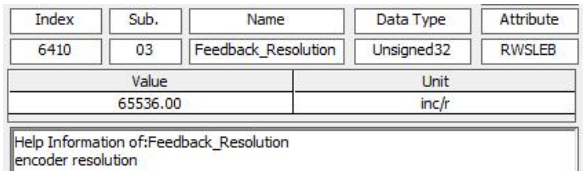


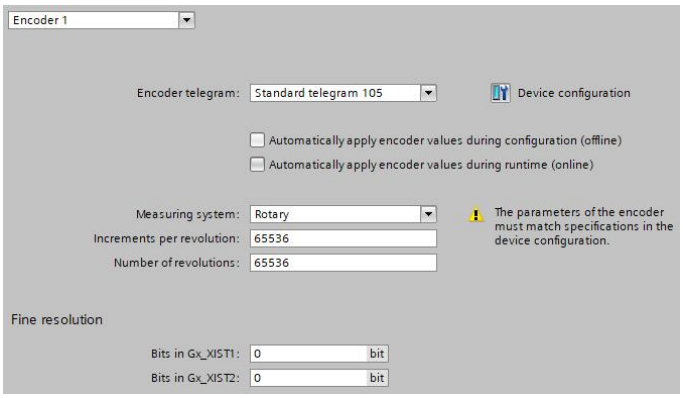
15. Click on "Data exchange with encoder". If a Kinco single-turn encoder motor is used, the Increments per revolution is Feedback _Resolution [641003]. For Fine resolution, select Gx_XIST1 bit 0:



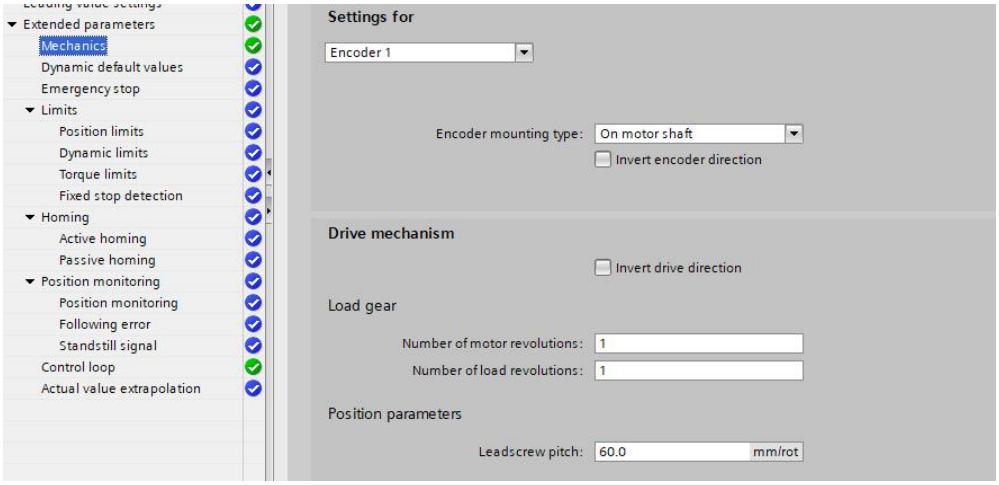


If a Kinco multi-turn absolute encoder motor is used, the Increments per revolution is Feedback _Resolution [641003], e.g. 65536, and the Number of revolutions is also set to 65536, with Fine resolution selections G1_XIST1 bit 0 and G1_XIST2 bit 0:



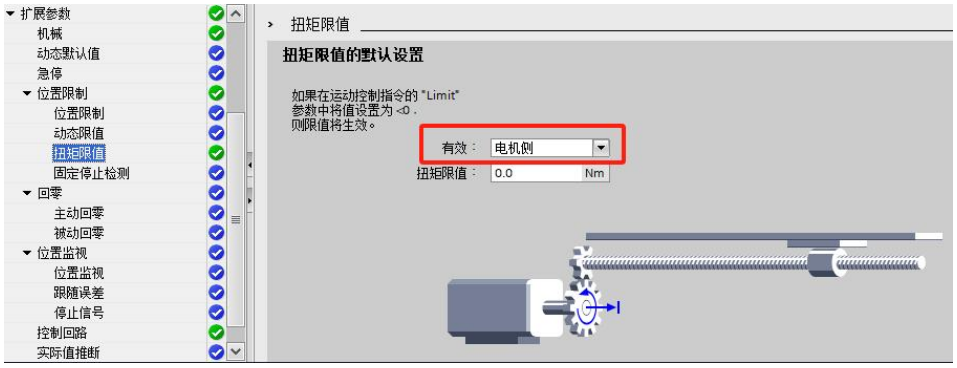


16. Click "Extended parameters → Mechanics" to set the position parameters：

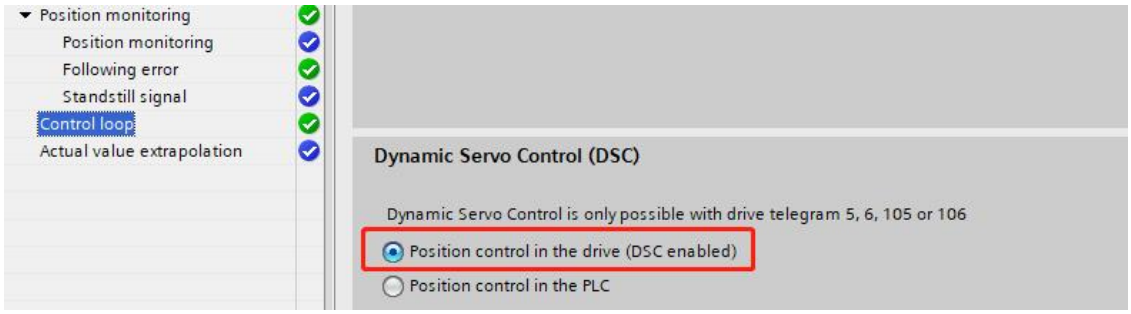


17. Click "Extended parameters → Position monitoring → Following error" to disable the following error monitoring. When monitoring is enabled and the following error setting is small, the PLC will report error easily after enabling operation:

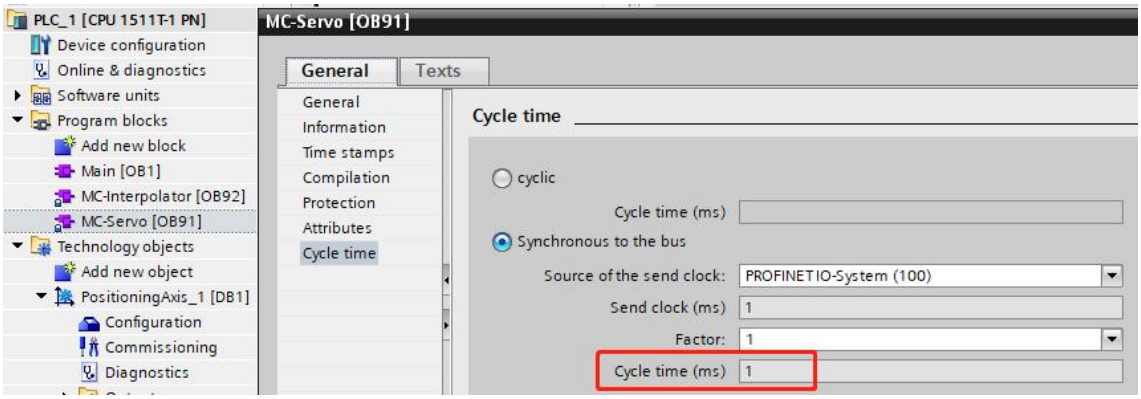
18. Click "Extended parameters → Limits → Torque limits" and select "On motor side":



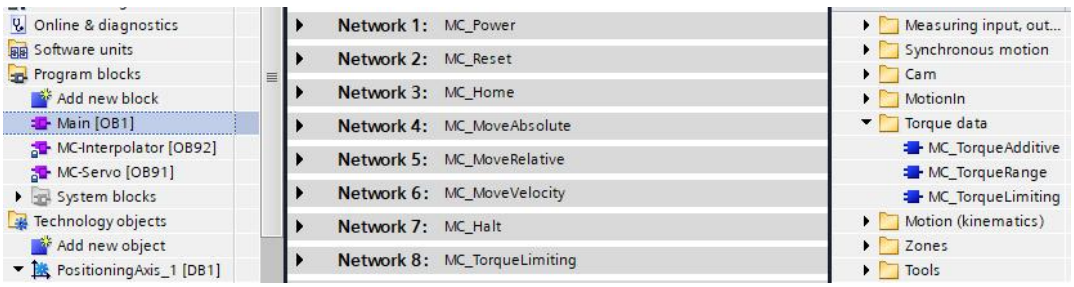
19. DSC can be enabled by clicking "Extended parameters → Control loop", see section 6.5 for details on how to use it.



20. After the technology object has been configured, click "Program blocks → MC-Servo [OB91]" in the drop-down list of PLC_1 on the left side, and then right-click to open the properties to set the PLC application cycle. Please note that when using the DSC function, the PLC application cycle, device update cycle (see Artile 8) and ECAN_Sync_Cycle [301101] must be the same.

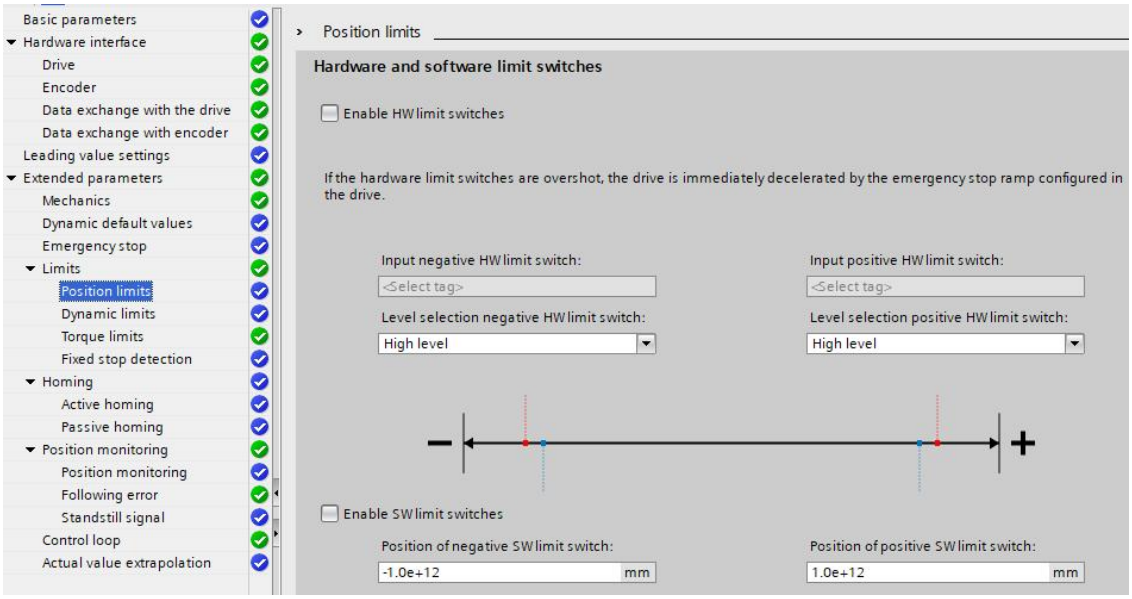


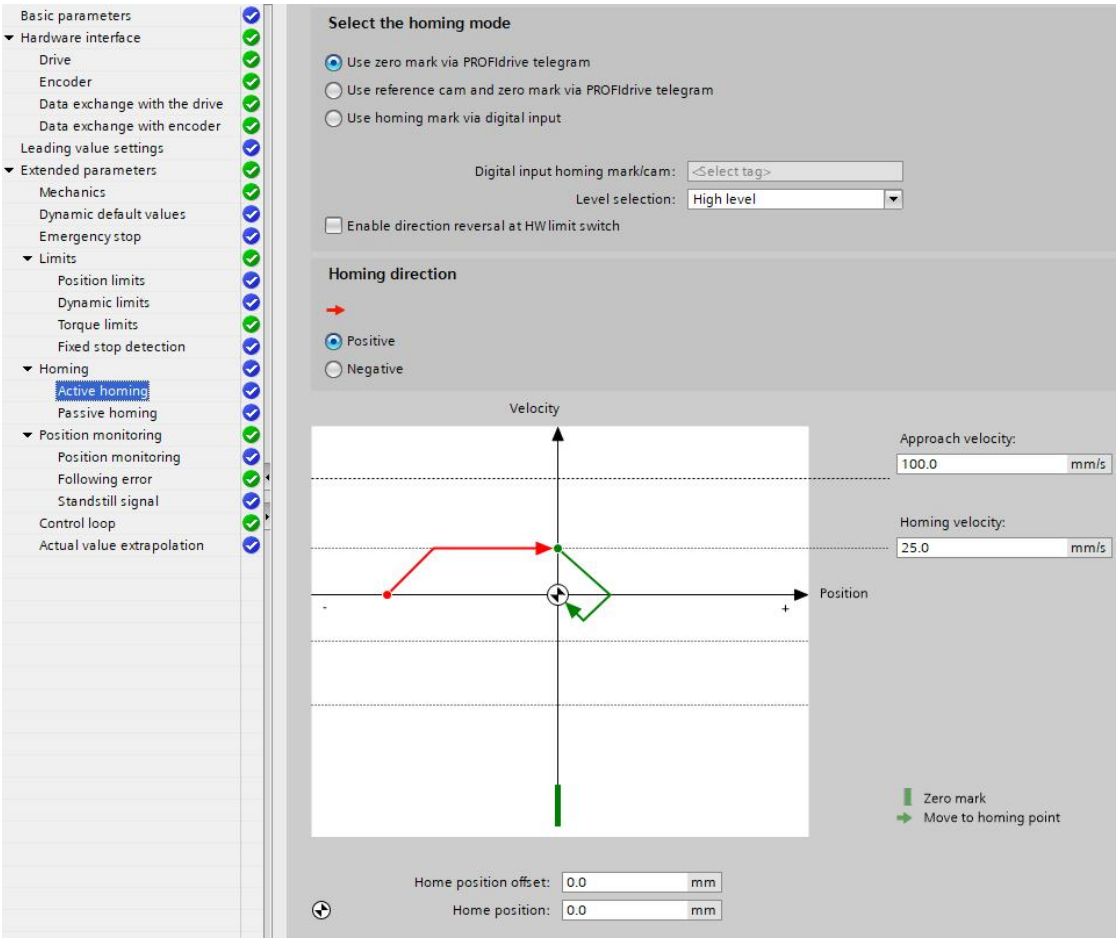
21. Configuration completed, program written, compiled and downloaded to PLC:



6.3 MC_Home introduction

The drive must complete homing motion before absolute positioning. The homing trajectory is generated by the PLC, and the homing switch and limit switches are usually connected to the PLC:





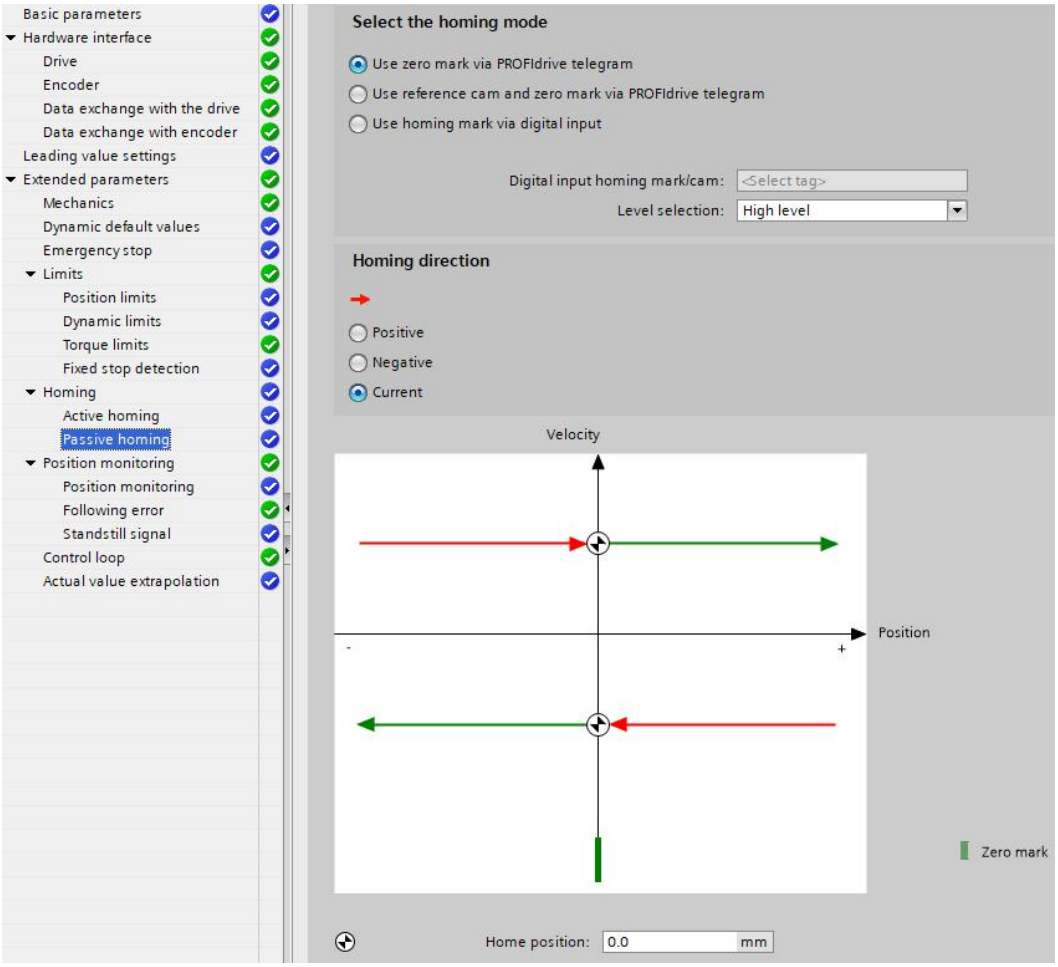


Table 6-2 describes the MC_Home pin definition

Table 6-2 MC_Home pin definition

Pin name	Data type	Description
Axis	TO_PositioningAxis TO_SynchronousAxis TO_ExternalEncoder	Technology objects
Execute	Bool	Start job with a rising edge
Position	LReal	The specified value is used according to the selected "Mode"
Mode	Int	Homing modes: = 0 Direct homing (absolute), the current position of the technology object is set to the value of parameter "Position". = 1 Direct homing (relative), the current position of the technology object is shifted by the value of parameter "Position = 2 Passive homing, the current position of the technology object is set to the value of parameter "Position". = 3 Active homing, the current position of the technology object is set to the value of parameter "Position". = 6 Absolute encoder adjustment (relative), the current position is shifted by the value of parameter "Position". = 7 Absolute encoder adjustment (absolute), the current position is set to the value of parameter "Position".

Pin name	Data type	Description
ReferenceMarkPosition	LReal	Display of the position at which the technology object was homed (valid when "Done" = TRUE)
Done	Bool	= 1 Job is completed
Busy	Bool	= 1 The job is being processed
CommandAborted	Bool	=1 The job was aborted by another job during execution
Error	Bool	=1 Error, see "ErrorID"
ErrorID	Word	Please consult the information system of TIA portal for help

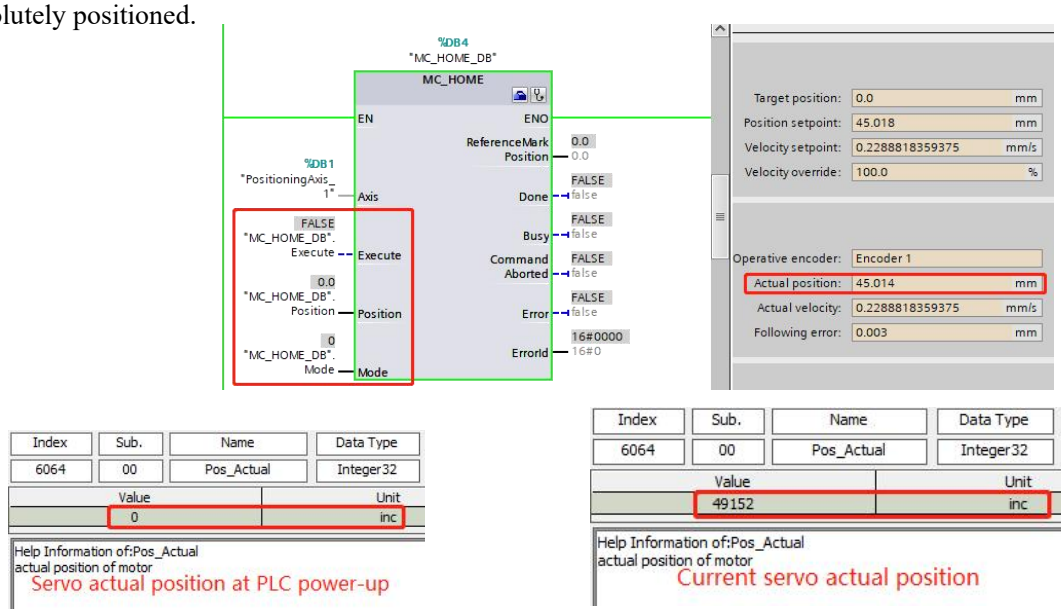
The homing modes supported by different encoders are shown in Table 6-3.

Table 6-3 Supported homing mode

Homing mode	Incremental encoder (Kinco single-turn encoder)	Absolute encoder (Kinco multi-turn absolute encoder)
Active homing ("Mode"= 3)	√	—
Passive homing ("Mode"= 2)	√	—
Set actual position ("Mode"= 0)	√	√
Relative offset to the actual position ("Mode"= 1)	√	√
Absolute encoder adjustment ("Mode"= 6、7)	—	√

6.3.1 Homing mode 0 (Absolute direct homing)

The axis does not move after the MC_Home is executed. The result of executing the instruction is that the actual position of the axis is directly changed to "Position specified in MC_Home". In the following example, "Position" = 0 mm, then the actual position of the axis becomes 0 mm after homing.The coordinate value belongs to the "absolute" coordinate value, that is, the axis has established an absolute coordinate system and can be absolutely positioned.



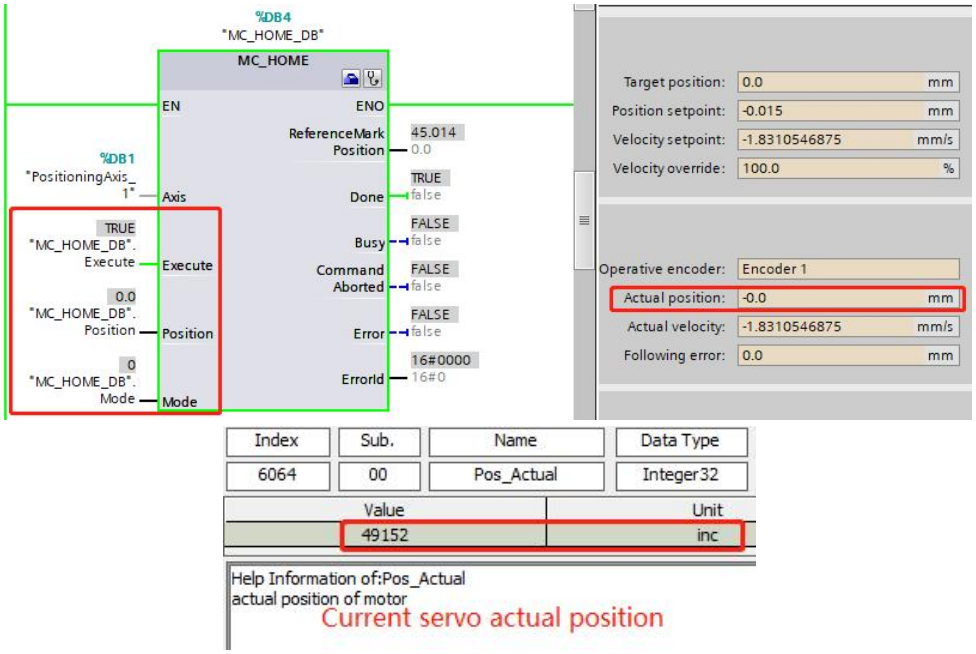
The above figure shows the state before homing, the current position of the axis is 45 mm and the drive actual position [606300] is 49152 DEC. In Section 6.2, Article 16, the leadscrew pitch is 60 mm/rot, the conversion relation is as follows:

Actual position of PLC technology object axis (mm) = (Current servo actual position [606300] - Servo actual position [606300] at PLC power-up) / Feedback _Resolution [641003] * Leadscrew pitch

Or

Actual position change of PLC technology object axis (mm) = Servo actual position [606300] change / Feedback _Resolution [641003] * Leadscrew pitch

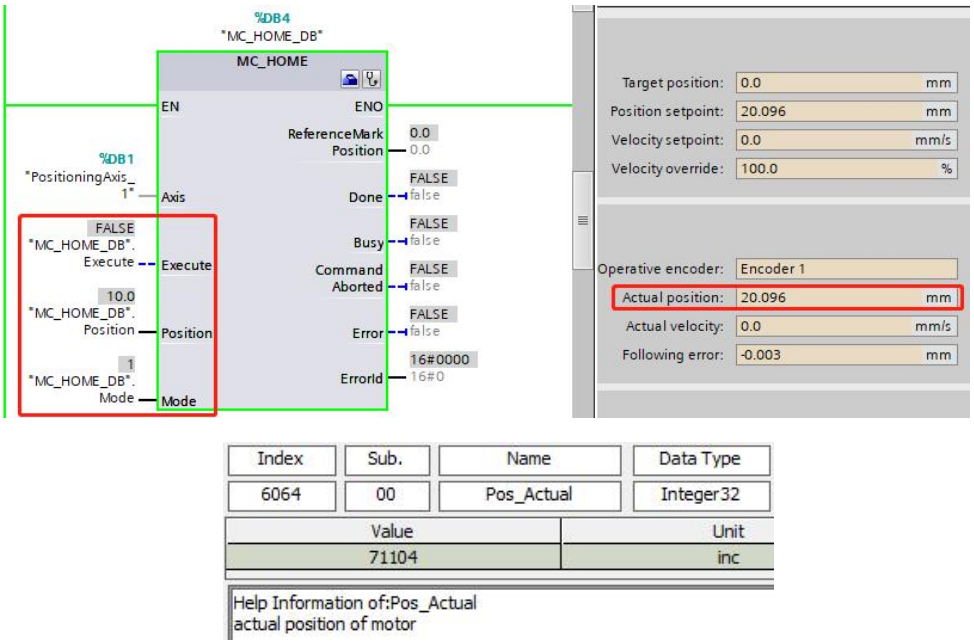
The following figure shows the state after homing, the actual position of the axis = "Position specified in MC_Home" = 0 mm, and the drive actual position [606300] does not change and remains at 49152 DEC.



After the homing motion is completed, no matter what position the axis moves to, as long as the PLC is powered off, the actual position data of the axis will be lost and become 0, instead of being converted over with the current encoder value of the drive.

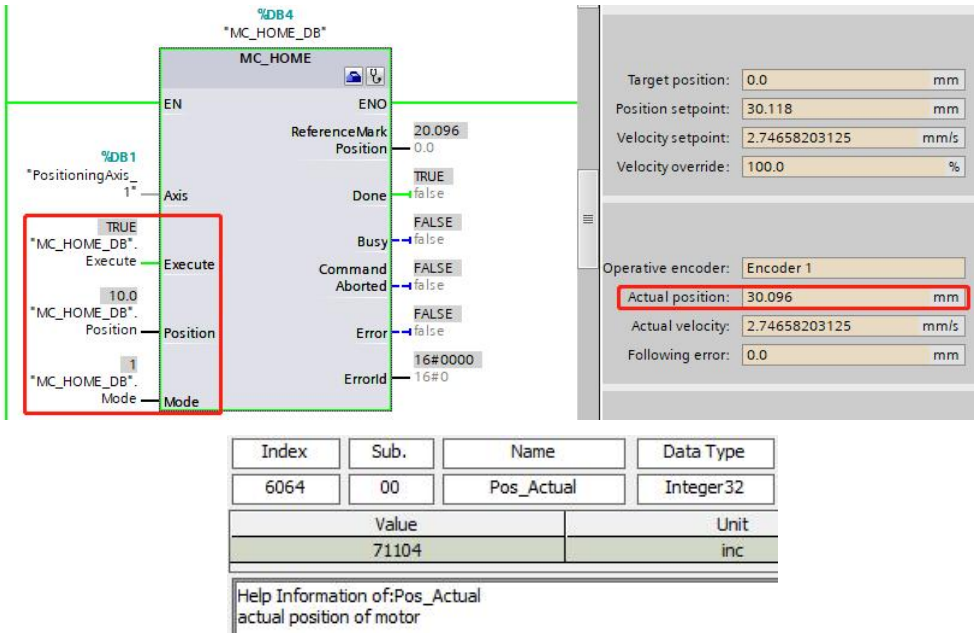
6.3.2 Homing mode 1 (Relative direct homing)

The axis does not move after the MC_Home is executed. The result of executing the instruction is that the actual position of the axis is directly changed to "current position + Position specified in MC_Home". In the following example, "Position" = 10 mm, the current position of the axis was 20 mm before MC_Home was executed, and the actual position of the axis after MC_Home was executed became 30 mm.



The above figure shows the state before homing, the current position of the axis is 20 mm and the drive actual position [606300] is 71104 DEC.

The following figure shows the state after homing, the actual position of the axis = "current position + Position specified in MC_Home" = 30 mm, and the drive actual position [606300] does not change and remains at 71104 DEC.

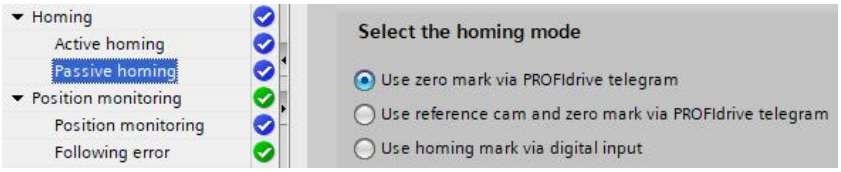


After the homing motion is completed, no matter what position the axis moves to, as long as the PLC is powered off, the actual position data of the axis will be lost and become 0, instead of being converted over with the current encoder value of the drive.

6.3.3 Homing mode 2 (Passive homing)

When only MC_Home is triggered, the axis will not move, and other motion control instructions (e.g. MC_MoveRelative) are needed to make the axis run, and when the axis reaches the homing switch, the current position will be changed to "Position specified in MC_Home".

Passive homing requires the MC_Home command to be used in combination with the MC_MoveAbsolute or MC_MoveRelative or MC_MoveVelocity command, and the axis is completed to the homing in the process of executing other motion commands. After PLC power off and restart, the actual position data of the axis will be lost.



1. Use zero mark via PROFIdrive telegram (i.e. detecting zero mark)

   Motion sequence:

   a. Start passive homing via the "MC_Home" instruction.
   b. Move via other motion control instruction (e.g. MC_MoveRelative). The detection of the homing mark is enabled when the actual position value of the axis moves in the assigned homing direction.
   c. When zero mark is detected, the actual position is changed to "Position specified in MC_Home".

   Or

   a. Move in the assigned homing direction via other motion control instruction (e.g. MC_MoveRelative).
   b. Start passive homing via the "MC_Home" instruction.
   c. When zero mark is detected, the actual position is changed to "Position specified in MC_Home".

2. Use reference cam and zero mark via PROFIdrive telegram (i.e. detecting zero mark after digital input is detected.)

   Motion sequence:

   a. Start passive homing via the "MC_Home" instruction.
   b. Move via other motion control instruction (e.g. MC_MoveRelative) and wait for the digital input.
   c. Detection of zero mark will begin as soon as the digital input is detected and disengaged.
   d. When zero mark is detected, the actual position is changed to "Position specified in MC_Home".

   Or

   a. Move via other motion control instruction (e.g. MC_MoveRelative).
   b. Start passive homing via the "MC_Home" instruction and wait for the digital input.
   c. Detection of zero mark will begin as soon as the digital input is detected and disengaged.
   d. When zero mark is detected, the actual position is changed to "Position specified in MC_Home".

3. Use homing mark via digital input (i.e. detecting digital input)

   Motion sequence:

   a. Start passive homing via the "MC_Home" instruction.

   b. Move via other motion control instruction (e.g. MC_MoveRelative) and wait for the digital input.

   c. When the digital input is detected, the actual position is changed to the "Position specified in MC_Home".

   Or

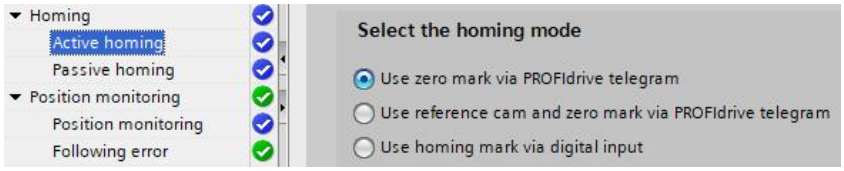
   a. Move via other motion control instruction (e.g. MC_MoveRelative).

   b. Start passive homing via the "MC_Home" instruction and wait for the digital input.

   c. When the digital input is detected, the actual position is changed to the "Position specified in MC_Home".

6.3.4 Homing mode 3 (Active homing)

The technology object performs a homing movement according to the configuration:



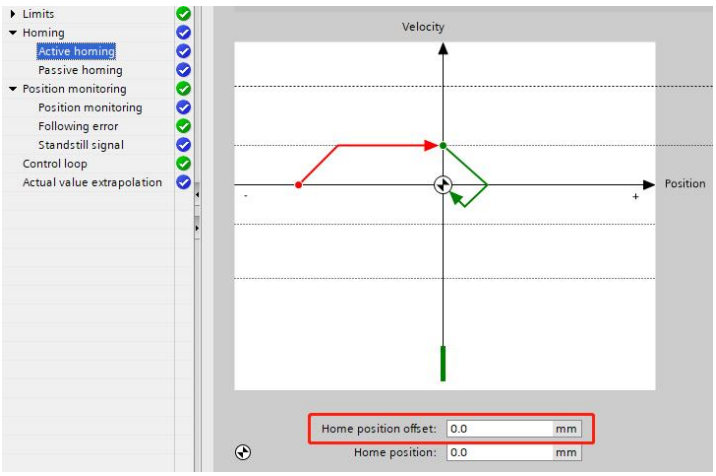
1. Use zero mark via PROFIdrive telegram (i.e. detecting zero mark)

   Motion sequence:

   a. Start active homing via the "MC_Home" instruction.

   b. Look for the zero mark during motion.

   c. When zero mark is detected, the actual position is changed to "Position specified in MC_Home" - "Home position offset":



   d. The axis will then move a distance of the "Home position offset" and the actual position will be equal to "Position specified in MC_Home" after completion.

2. Use reference cam and zero mark via PROFIdrive telegram (i.e. detecting zero mark after digital input is detected.)

   Motion sequence:

   a. Start active homing via the "MC_Home" instruction.
   b. The axis detects digital input during motion.
   c. Decelerates when digital input is detected, and detect zero mark when the falling edge of digital input is detected.
   d. When zero mark is detected, the actual position is changed to "Position specified in MC_Home" - "Home position offset".
   e. The axis will then move a distance of the "Home position offset" and the actual position will be equal to "Position specified in MC_Home" after completion.

3. Use homing mark via digital input (i.e. detecting digital input)

   Motion sequence:

   a. Start active homing via the "MC_Home" instruction.
   b. Detection of the rising edge at the digital input, while moving with homing velocity.
   c. Decelerates when the rising edge of digital input is detected; when the falling edge of digital input is detected, the actual position is changed to "Position specified in MC_Home" - "Home position offset".
   d. The axis will then move a distance of the "Home position offset" and the actual position will be equal to "Position specified in MC_Home" after completion.

6.3.5 Homing mode 6 (Absolute encoder adjustment (relative))

This mode is only for the connected encoder type is absolute value encoder, in this mode, after the MC_Home instruction is triggered, the axis will not run, and will not search for the home switch, it will set the current position value to "current position + Position specified in MC_Home". The absolute value is stored retentively in the CPU, and will not be lost after the CPU power off.

6.3.6 Homing mode 7 (Absolute encoder adjustment (absolute))

This mode is only for the connected encoder type is absolute value encoder, in this mode, after the MC_Home instruction is triggered, the axis will not run, and will not search for the home switch, it will set the current position value to "Position specified in MC_Home". The absolute value is stored retentively in the CPU, and will not be lost after the CPU power off.

6.4 MC_TorqueLimiting introduction

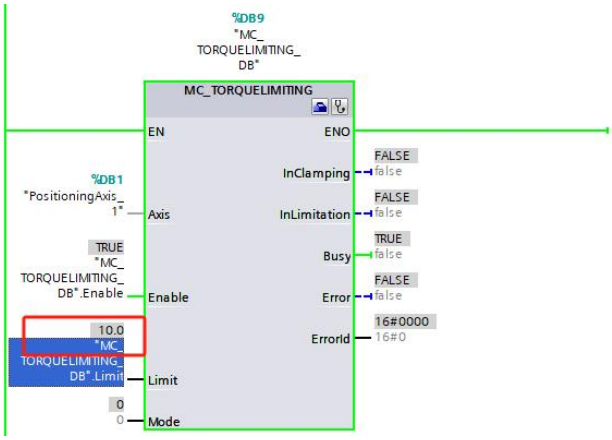
The CMD_q_Max [607300] and the Max_Torque% [607200] of the drive are associated. The maximum current (torque) can be limited using the MC_TorqueLimiting instruction.

1. The MC_TorqueLimiting pin is defined in Table 6-4.

Table 6-4 MC_TorqueLimiting pin definition

Pin name	Data type	Description
Axis	TO_SpeedAxis TO_PositioningAxis TO_SynchronousAxis	Technology objects
Enable	Bool	= 1 Activate torque limiting function
Limit	LReal	Equal to CMD_q_Max [607300] value in Ap Range: 0 to drive / motor peak current
Mode	DInt	= 0 Torque limit mode = 1 —
InClamping	Bool	—
InLimitation	Bool	= 1 I_q [607800] reaches CMD_q_Max [607300]
Busy	Bool	= 1 Tasks in progress
Error	Bool	= 1 Error, see "ErrorID"
ErrorID	Word	Please consult the information system of TIA portal for help

2. Enable the torque limit function, "Enable" pin set to 1, in the "Limit" pin input target maximum current value 10 (unit Ap), then drive CMD_q_Max [607300] becomes 10 Ap:



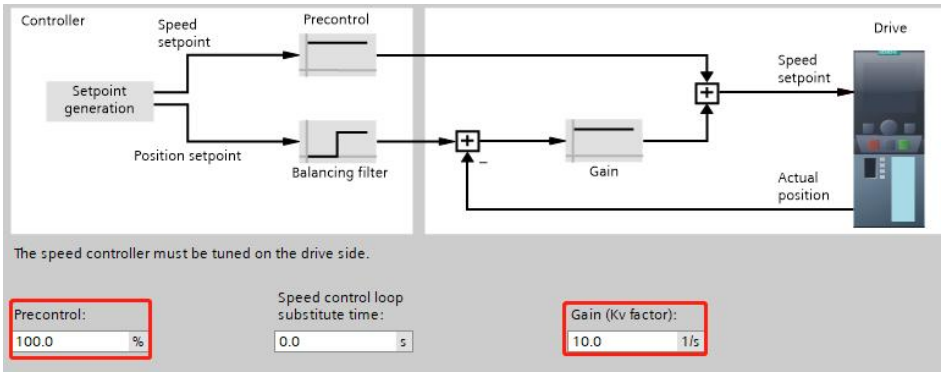
3. When I_q [607800] reaches CMD_q_Max [607300], the output pin "InLimitation" is set to 1, and the drive message status word MELDW's bit 1 is set to 0 (see Table 1-19).

6.5 DSC (Dynamic Servo Control) introduction

When using telegram 3 and 102, the drive works in speed mode, the position loop calculation is completed by the PLC, and the calculation update cycle of the position loop is the same as the communication cycle of

PROFINET. Telegram 5 and 105 support Dynamic Servo Control (DSC). When DSC is enabled, the drive works in interpolation mode, and the calculation and update cycle of the position loop is the local control cycle of the drive. The DSC function puts the PLC position loop calculation into the drive to complete, and the PLC only needs to perform the central interpolation calculation of the position, and then adjust the position loop calculation of the drive periodically through the PROFINET interface.

In the technology objects configuration interface, click "Extended parameters → Control loop" to set the parameters related to the DSC function, as shown in the following figure:



In the above figure, "Gain (Kv factor)" can not be 0, its specific value will not affect the servo's position loop proportional gain, keep it as the default value; "Pre-control" is the percentage of speed feedforward, and the role of K_Velocity_FF [60FB02] is the same:

Position Loop

N	Index	Type	Name	Value	Unit
0	60FB01	int16	Kpp[0]	10.00	Hz
1	60FB02	int16	K_Velocity_FF	100.00	%
2	60FB03	int16	K_Acc_FF	32767	DEC

Please note that when using the DSC function, if the type of encoder connected is a single-turn encoder (incremental encoder), it is necessary to set the Store_Position [60FB06] to 1, then write 0 to the Position_Shift [60FB07] and store the control parameters:

Basic Operation

N	Index	Type	Name	Value	Unit
0	606100	int8	Operation_Mode_B	0	DEC
1	604100	uint16	Statusword	4270	HEX
2	606300	int32	Pos_Actual	0	inc
3	606C00	int32	Speed_Real	0.72	rpm
4	607800	int16	I_q	0.00	Ap
5	268000	uint16	Warning_Word	0000	HEX
6	606000	int8	Operation_Mode	-3	DEC
7	604000	uint16	Controlword	0000	HEX
8	607A00	int32	Target_Position	0	inc
9	608100	uint32	Profile_Speed	0.00	rpm
10	608300	uint32	Profile_Acc	100.00	rps/s
11	608400	uint32	Profile_Dec	100.00	rps/s
12	60FF00	int32	Target_Speed	0.00	rpm
13	607100	int16	Target_Torque%	0.00	%
14	607300	uint16	CMD_q_Max	17.30	Ap
15	202000	int8	Din_Mode0	-4	DEC
16	20200E	int8	Din_Mode1	-3	DEC
17	269000	uint8	Encoder_Data_Res	0	DEC
18	60FB06	uint8	Store_Position	0	DEC
19	60FB07	int32	Pos_Shift	-21570	DEC

Basic Operation

N	Index	Type	Name	Value	Unit
0	606100	int8	Operation_Mode_B	0	DEC
1	604100	uint16	Statusword	C270	HEX
2	606300	int32	Pos_Actual	-21570	inc
3	606C00	int32	Speed_Real	1.49	rpm
4	607800	int16	I_q	0.00	Ap
5	268000	uint16	Warning_Word	0000	HEX
6	606000	int8	Operation_Mode	-3	DEC
7	604000	uint16	Controlword	0000	HEX
8	607A00	int32	Target_Position	0	inc
9	608100	uint32	Profile_Speed	0.00	rpm
10	608300	uint32	Profile_Acc	100.00	rps/s
11	608400	uint32	Profile_Dec	100.00	rps/s
12	60FF00	int32	Target_Speed	0.00	rpm
13	607100	int16	Target_Torque%	0.00	%
14	607300	uint16	CMD_q_Max	17.30	Ap
15	202000	int8	Din_Mode0	-4	DEC
16	20200E	int8	Din_Mode1	-3	DEC
17	269000	uint8	Encoder_Data_Res	0	DEC
18	60FB06	uint8	Store_Position	1	DEC
19	60FB07	int32	Pos_Shift	0	DEC

Chapter 7 S7-200 SMART Application

7.1 Application description

The PROFINET communication application in this chapter is based on the following conditions:

1． STEP 7-Micro/Win SMART V02.08.02.00_00.01

PLC S7-200 SMART(CPU ST20 DC/DC/DC V02.04.01_00.00.03.00 固件 V2.6)

2． Kinco PN servo drive

Drive type	Drive firmware	PN firmware
FDxx5-PA-004	Software version vintage 2024 and beyond	00000005, 10000005
FDxx5P-PA-000		
MDx0-0xx-DMxK-PA-000		

3． GSD file

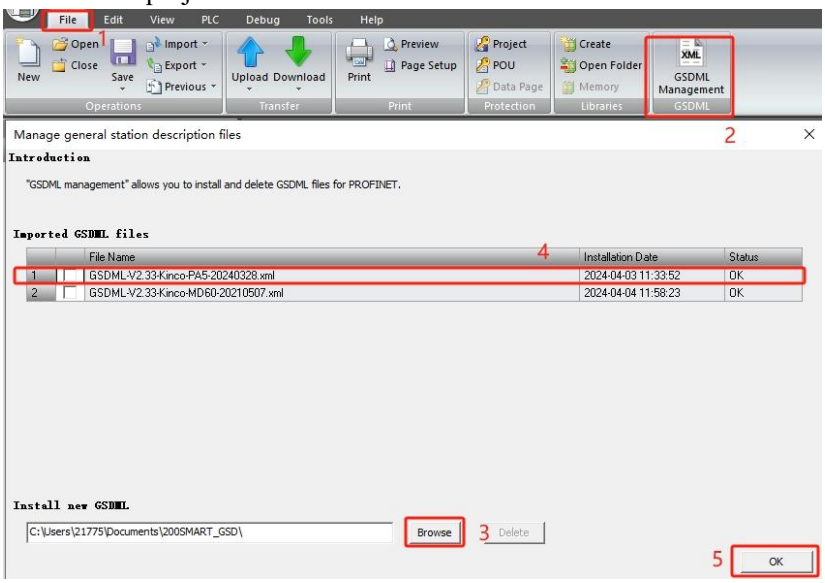
PN firmware version	Applicable GSD file
00000005、10000005	GSDML-V2.33-Kinco-PA5-20240328
00000004	GSDML-V2.33-Kinco-MD60-20210507

Table 2-1 describes the parameters related to the servo PROFINET communication.

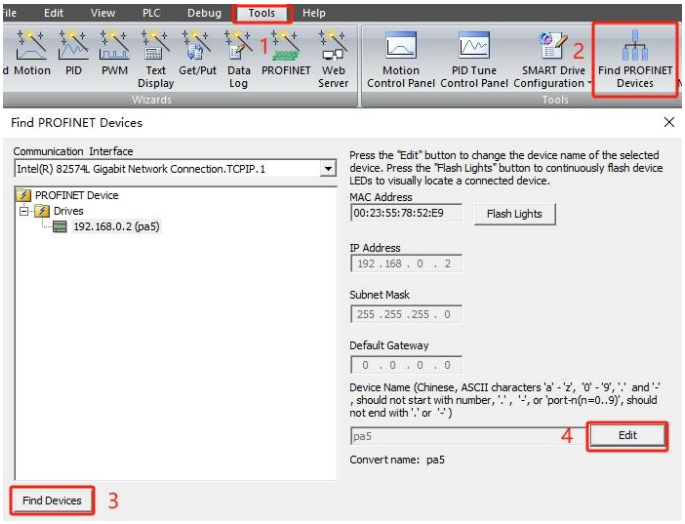
7.2 Acyclic communication

7.2.1 Project configuration

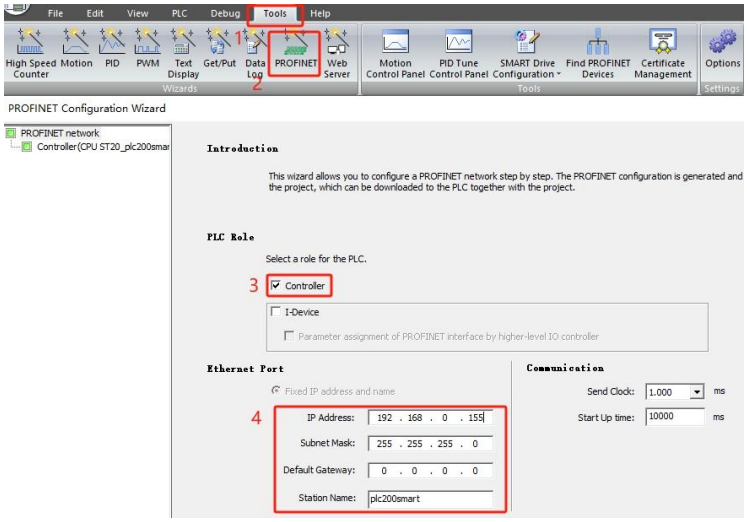
1. Click the menu "File → GSDML Management" to install the GSD file (GSDML-V2.33-Kinco-PA5-20240328). After successful installation, there is no need to repeat the installation for a new project:



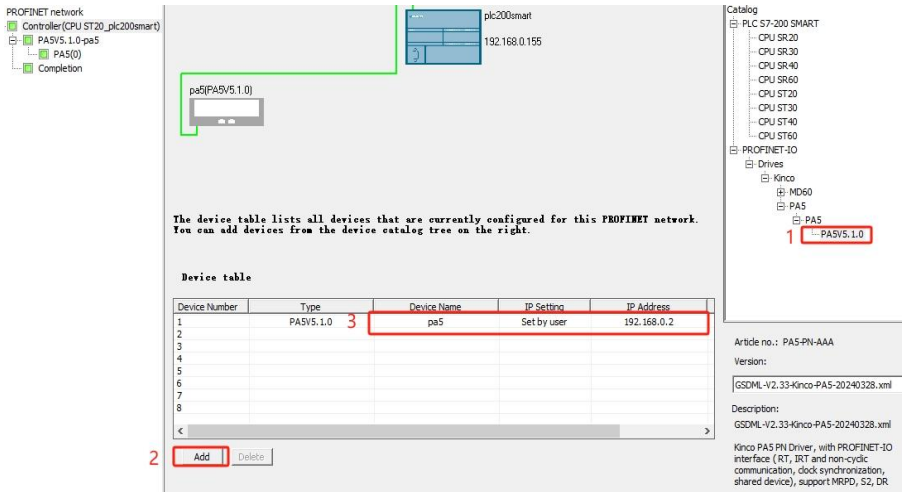
2. Click "Tools → Find PROFINET Devices" to ensure that the servo is connected. See Section 3.1 to modify the servo IP address and device name, or click "Edit" here to modify the device name:



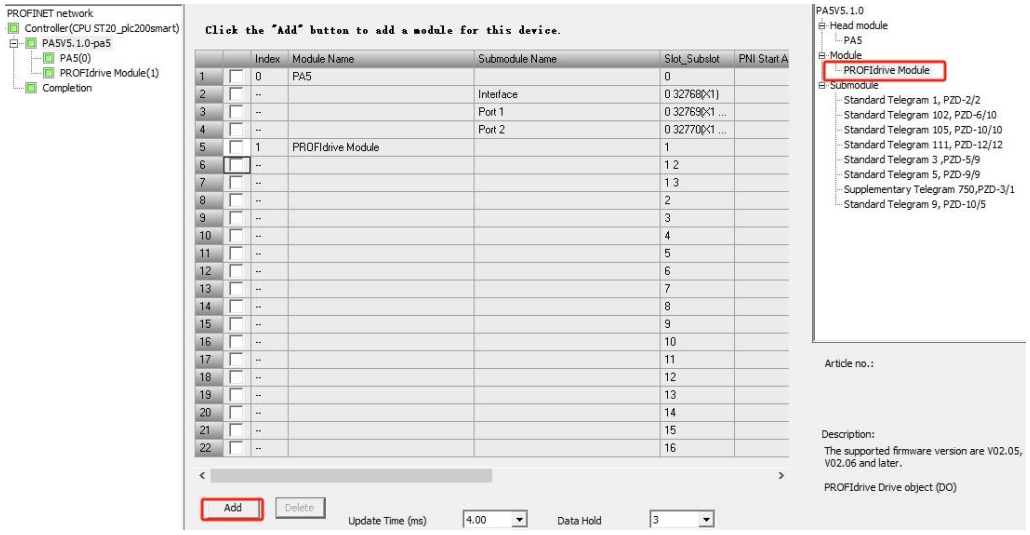
3. Click "Tools → PROFINET", select "Controller", set the PLC IP address and station name, and click "Next" :



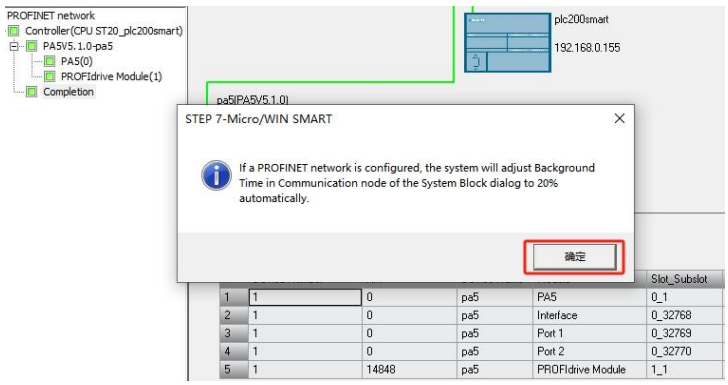
4. Add the servo to the device table, set the IP address and device name (need to be the same as the actual connected device), and then click "Next" :



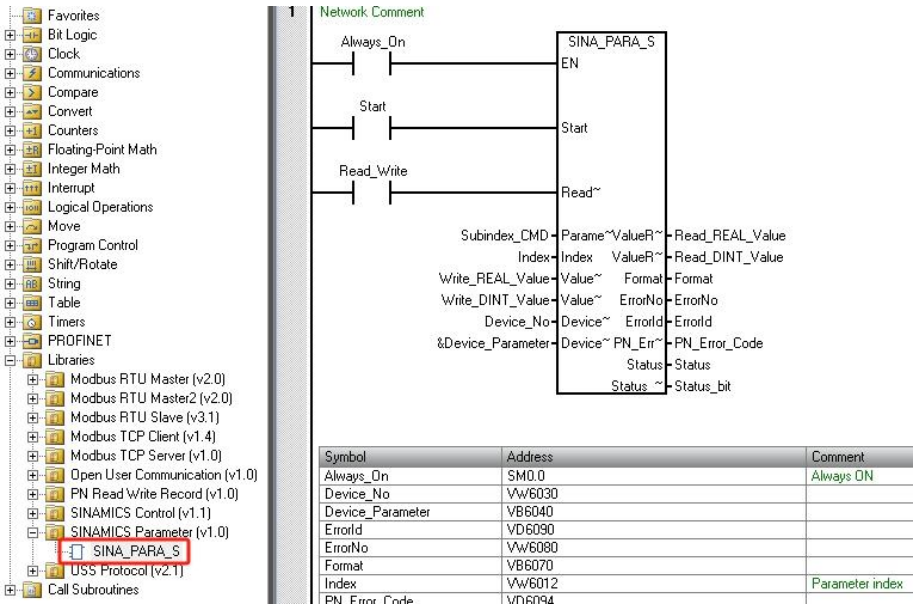
5. Add the PROFIdrive module for the servo, and the submodule of Standard Telegram 3 will be added by default. If only acyclic communication is carried out, the submodule of the telegram can be deleted:



6. Then keep clicking "Next" until it is successfully generated:



7. In the main program, call SINA_PARA_S and write the following program:

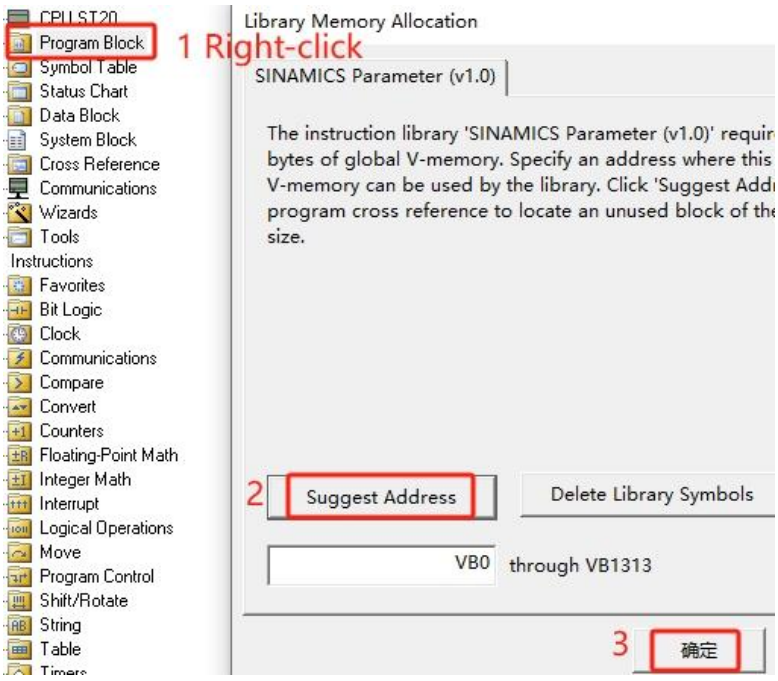


8. The symbol table address used in the program is defined as shown in the following figure:

Symbol Table

	Symbol	Address	Comment
1	Start	V6000.0	Rising edge triggers read and write
2	Read_Write	V6000.1	0: read 1: write
3	Device_Parameter	VB6040	
4	Format	VB6070	
5	Status	VB6100	
6	Status_bit	VB6102	
7	Write_REAL_Value	VD6020	
8	Write_DINT_Value	VD6024	Dara written to the servo
9	APINumber	VD6042	
10	Read_REAL_Value	VD6060	
11	Read_DINT_Value	VD6064	Data read from the servo
12	ErrorId	VD6090	
13	PN_Error_Code	VD6094	
14	Subindex_CMD	VW6010	Parameter subindex + Command word
15	Index	VW6012	Parameter index
16	Device_No	VW6030	
17	SlotNumber	VW6046	
18	SubSlotNumber	VW6048	
19	ErrorNo	VW6080	

9. Before downloading the program, assign the V-address area used by the library:



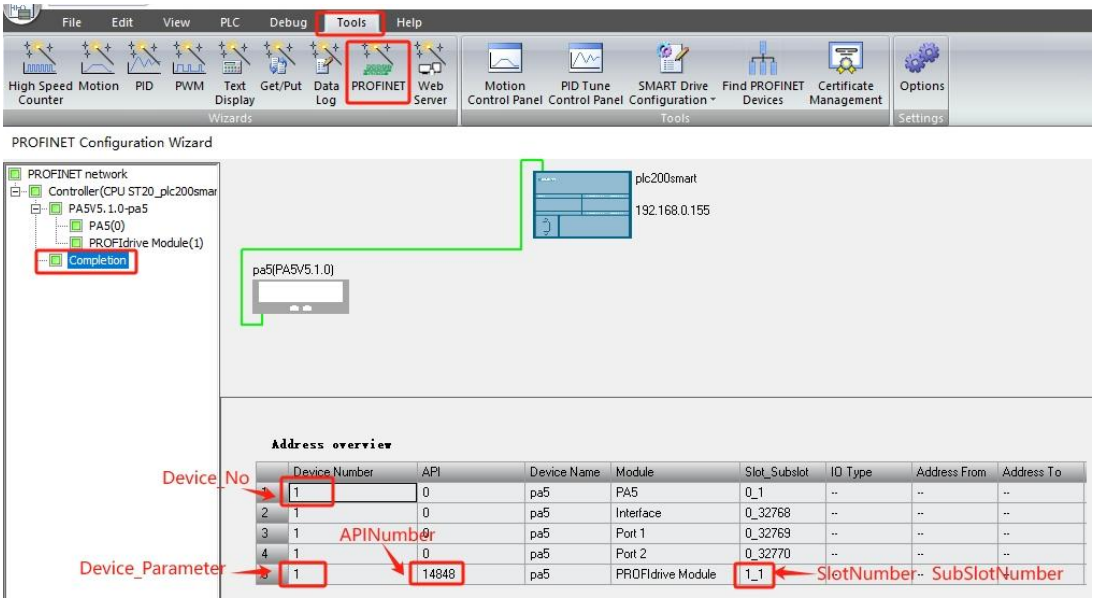
7.2.2 SINA_PARA_S introduction

Table 7-1 describes the SINA_PARA_S pin definition.

Table 7-1 SINA_PARA_S pin definitions

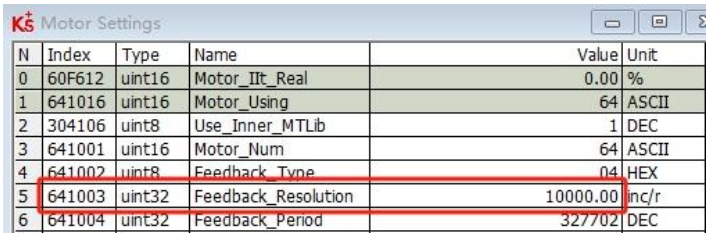
Pin name	Data type	Description
Start	Bool	The rising edge triggers data transmission
ReadWrite	Bool	0=Read; 1=Write
Parameter	Int	Bit8~15: Parameter subindex; Bit0~7: Command word
Index	Int	Parameter index
ValueWrite1	Real	Reserved
ValueWrite2	DInt	Data writing area, can write 1 to 4 bytes
DeviceNo	Word	Device number
Device_Parameter	DWord	PROFINET device parameters, byte offset as follows: 0: Axis number 1: Reserved 2~5: API number(Fixed to 14848) 6~7: Slot number 8~9: Subslot number
ValueRead1	Real	Reserved
ValueRead2	DInt	Data reading area
Format	Byte	Parameter format: 02H: Int8 03H: Int16 04H: Int32 05H: Unsigned8 06H: Unsigned16 07H: Unsigned 32 08H: Float 10H: Octal string (16bit) 13H: Time diff (32bit) 41H: Byte 42H: Word 43H: Double word 44H: Error
ErrorNo	Word	Error number according to the PROFIdrive specification
ErrorID	DWord	First word: Binary encoding indicating a faulty parameter access Second word: Type of fault
PN_Error_Code	DInt	Error code according to the PROFINET protocol
Status	Byte	Bit0~4: System definition error codes for instructions RDREC and WRREC; Bit5: Error; Bit6: Request in progress
Status_bit	Byte	Indicates the status of the reading/writing parameter, which is 4 when the reading/writing is successful
Note: Command word—Read: 40H; Write 1 byte: 2FH; Write 2 bytes: 2BH; Write 4 bytes: 23H.		

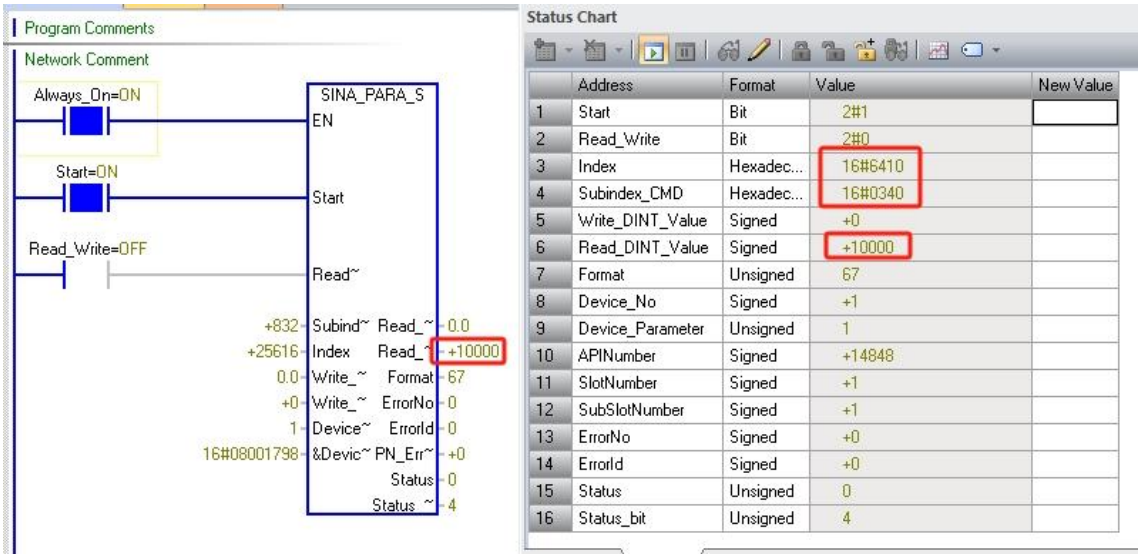
The Device_Parameter in Table 7-1 can be confirmed in the following figure:



7.2.3 Read-write parameters using SINA_PARA_S

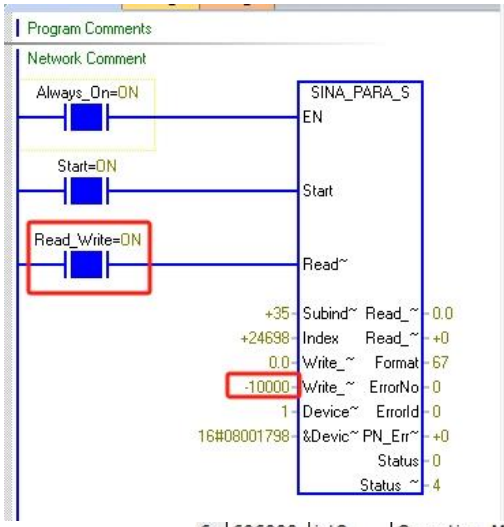
1. Read feedback_resolution: the parameter index is 0x6410, the parameter subindex is 0x03, and the read parameter command word is unified as 0x40. When the "Start" pin changes from 0 to 1, the "ValueRead2" pin in the data reading area automatically becomes 10000, and the "Status_bit" pin is 4, the data reading is successful.





2. Write target_position: the parameter index is 0x607A, the parameter subindex is 0x00, and the data type is Int32, so the write parameter command word is 0x23, the "ReadWrite" pin is switched to 1. The data

writing area is written to -10000. When the "Start" pin is changed from 0 to 1, the data is written. The "Status_bit" pin is 4, and the data is written successfully. Observing the KincoServo+ software, the target position is changed to -10000.



Status Chart

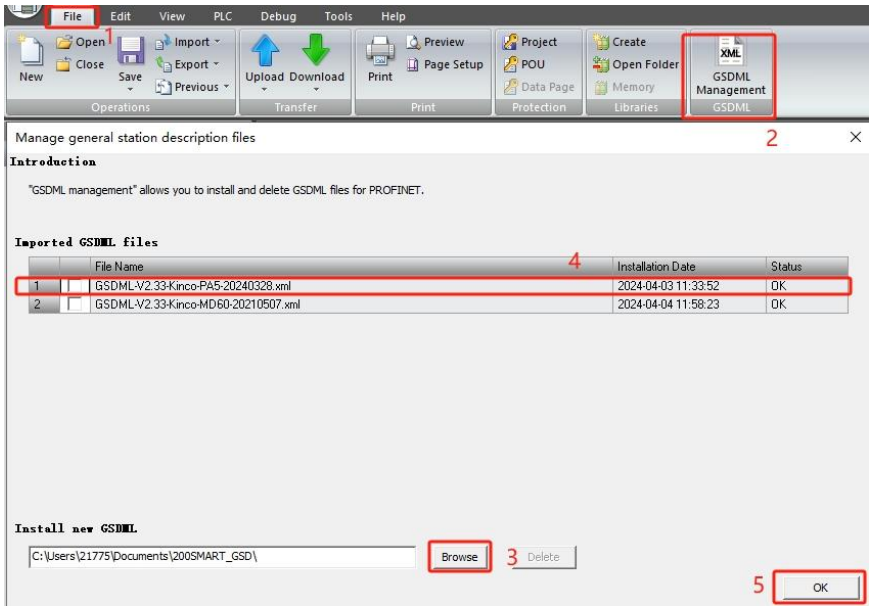
	Address	Format	Value	New Value
1	Start	Bit	2#1	
2	Read_Write	Bit	2#1	
3	Index	Hexadec...	16#607A	
4	Subindex_CMD	Hexadec...	16#0023	
5	Write_DINT_Value	Signed	-10000	
6	Read_DINT_Value	Signed	+0	
7	Format	Unsigned	67	
8	Device_No	Signed	+1	
9	Device_Parameter	Unsigned	1	
10	APINumber	Signed	+14848	
11	SlotNumber	Signed	+1	
12	SubSlotNumber	Signed	+1	
13	ErrorNo	Signed	+0	
14	ErrorId	Signed	+0	
15	Status	Unsigned	0	
16	Status_bit	Unsigned	4	

6	606000	int8	Operation_Mode	1	DEC
7	604000	uint16	Controlword	0006	HEX
8	607A00	int32	Target_Position	-10000	inc
9	608100	uint32	Profile_Speed	0.00	rpm
10	608300	uint32	Profile_Acc	100.00	rps/s
11	608400	uint32	Profile_Dec	100.00	rps/s

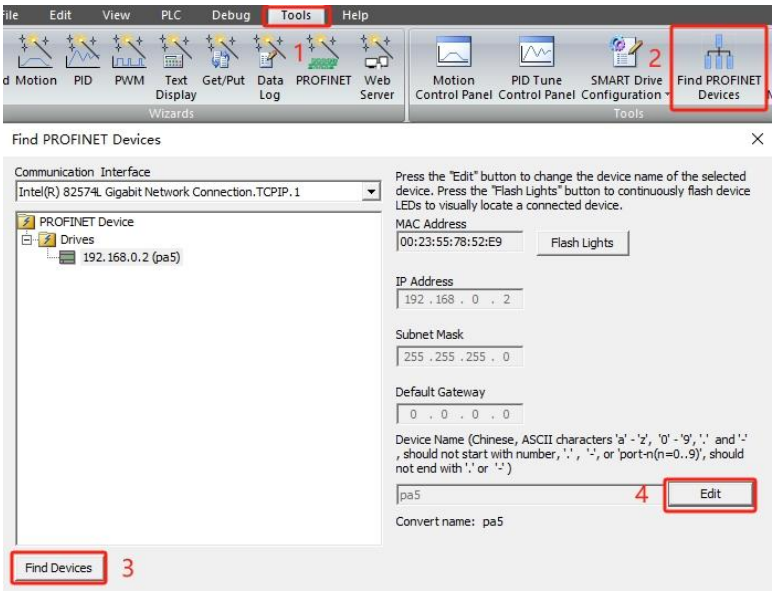
7.3 Telegram 1 application

7.3.1 Project configuration

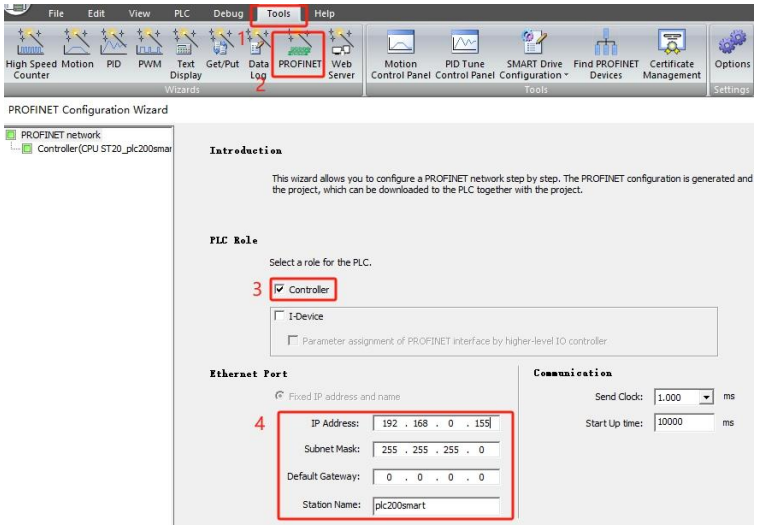
1. Click the menu "File → GSDML Management" to install the GSD file (GSDML-V2.33-Kinco-PA5-20240328). After successful installation, there is no need to repeat the installation for a new project:



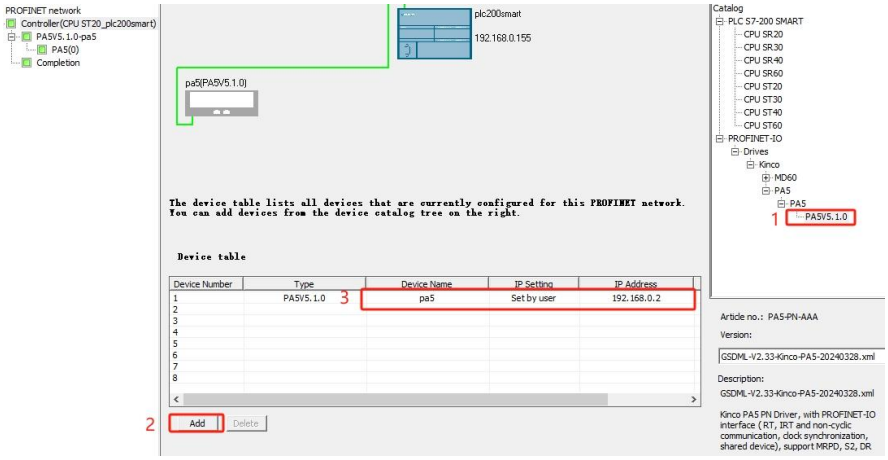
2. Click "Tools → Find PROFINET Devices" to ensure that the servo is connected. See Section 3.1 to modify the servo IP address and device name, or click "Edit" here to modify the device name:



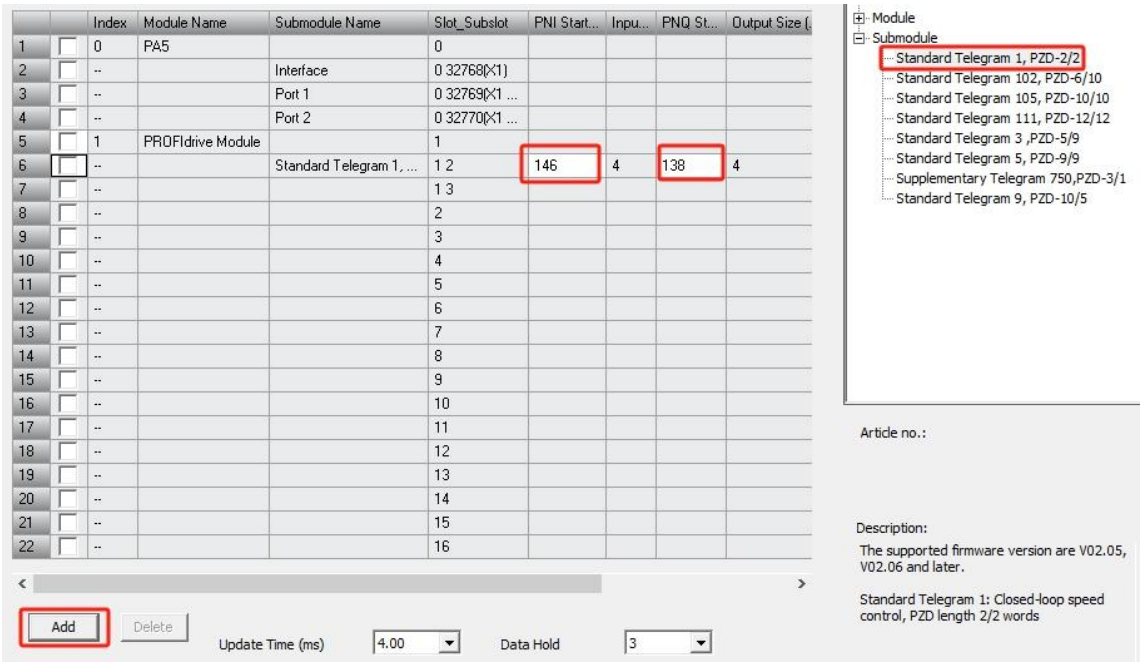
3. Click "Tools → PROFINET", select "Controller", set the PLC IP address and station name, and click "Next" :



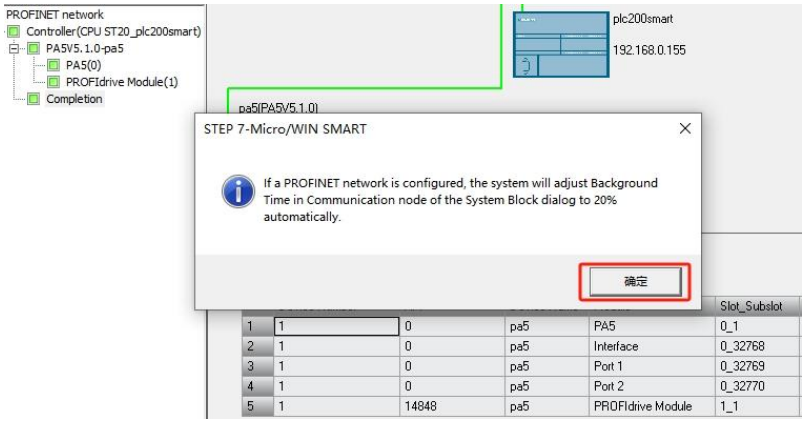
4. Add the servo to the device table, set the IP address and device name (need to be the same as the actual connected device), and then click "Next" :



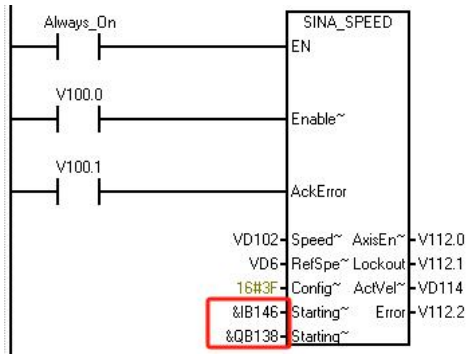
5. Add the PROFIdrive module to the servo, then select and delete the submodule of standard telegram 3 added by default, add the submodule of standard telegram 1, and note down the start address of the I/O data which is needed when calling SINA_SPEED:



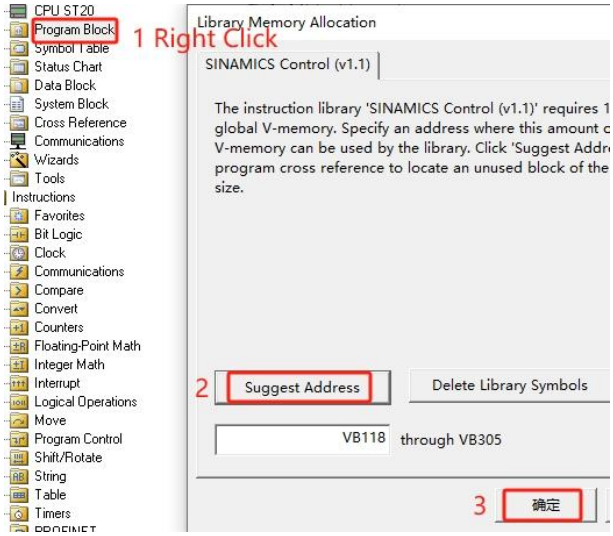
6. Then keep clicking "Next" until it is successfully generated:



7. In the main program, call SINA_SPEED and write the following program, where the inputs "Starting_I_add" and "Starting_Q_add" must correspond to the start address of the I/O data of telegram 1 (see step 5) :



8. Before downloading the program, assign the V-address area used by the library:



7.3.2 SINA_SPEED introduction

Table 7-2 describes the SINA_SPEED pin definition.

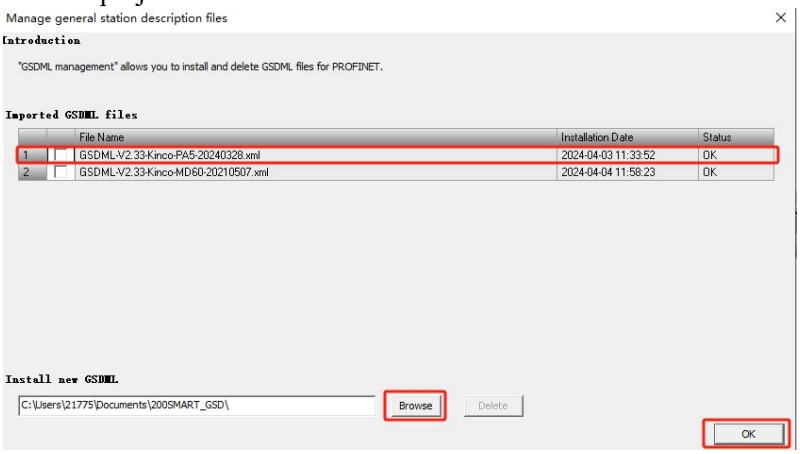
Table 7-2 SINA_SPEED pin definition

Pin name	Data type	Description
EnableAxis	Bool	=1 Enable
AckError	Bool	Reset fault, rising edge valid
SpeedSp	Real	Speed setpoint in RPM
RefSpeed	Real	Reference speed, must be 1/2 of the maximum speed [607F00] in RPM
ConfigAxis	Word	The default is 16#3F, and the corresponding relationship with STW1 is as follows: Bit in ConfigAxis / Bit in STW1 Bit 0 / Bit 1 Bit 1 / Bit 2 Bit 2 / Bit 3 Bit 3 / Bit 4 Bit 4 / Bit 5 Bit 5 / Bit 6 Bit 6 / Bit 11 See Table 1-6 for the meaning of each bit in STW1
Starting_I_add	DWord	Start address of the PN I area of telegram 1
Starting_Q_add	DWord	Start address of the PN Q area of telegram 1
AxisEnabled	Bool	=1 Axis is enabled
Lockout	Bool	=1 Switching on inhibited
ActVelocity	Real	Speed actual value in RPM
Error	Bool	=1 Fault present

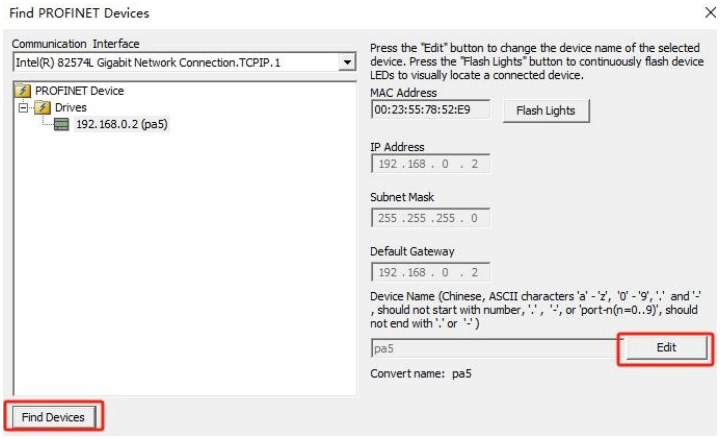
7.4 Telegram 111 application

7.4.1 Project configuration

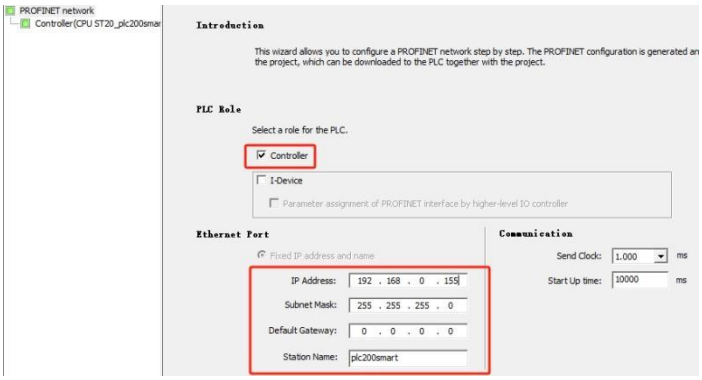
1. Click the menu "File → GSDML Management" to install the GSD file (GSDML-V2.33-Kinco-PA5-20240328). After successful installation, there is no need to repeat the installation for a new project:



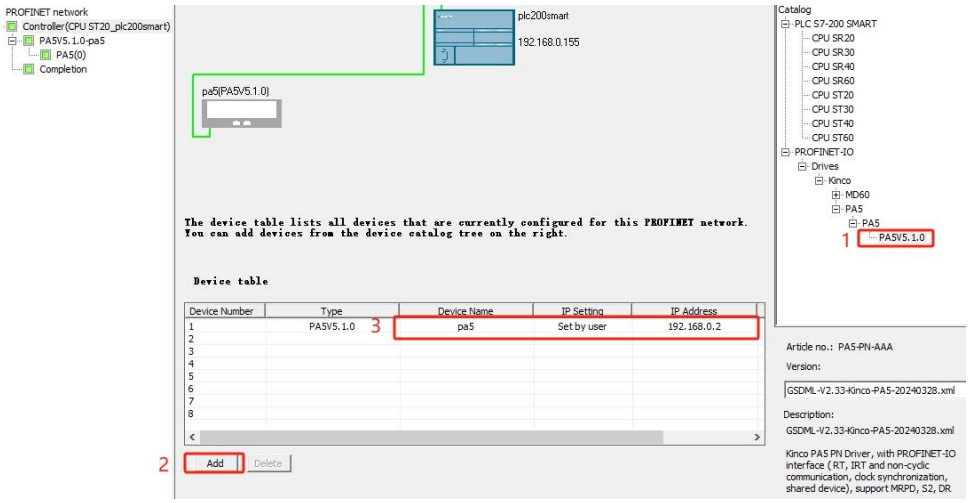
2. Click "Tools → Find PROFINET Devices" to ensure that the servo is connected. See Section 3.1 to modify the servo IP address and device name, or click "Edit" here to modify the device name:



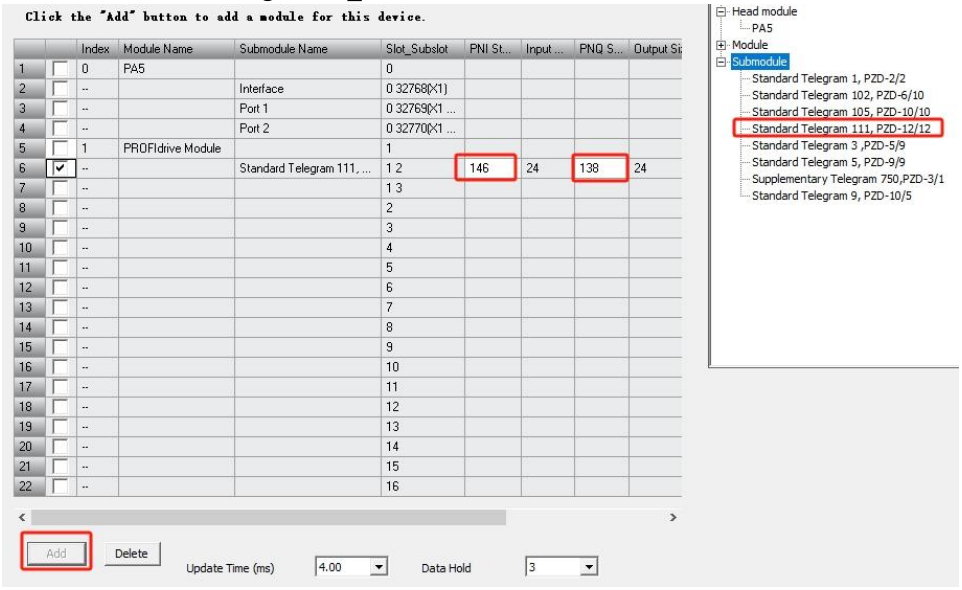
3. Click "Tools → PROFINET", select "Controller", set the PLC IP address and station name, and click "Next" :



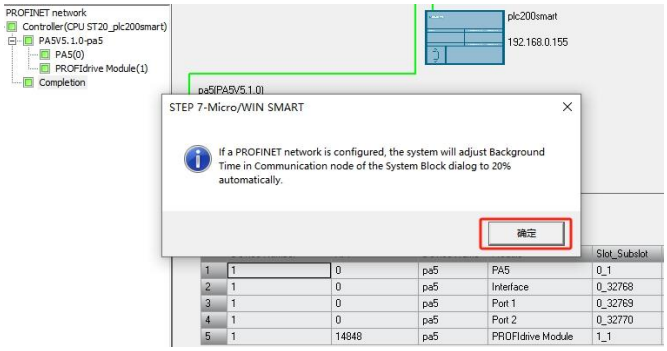
4. Add the servo to the device table, set the IP address and device name (need to be the same as the actual connected device), and then click "Next" :



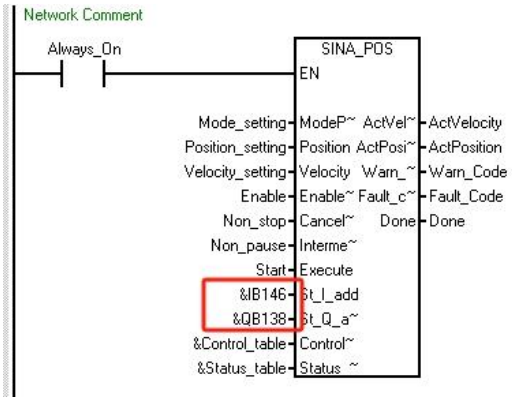
5. Add the PROFIdrive module to the servo, then select and delete the submodule of standard telegram 3 added by default, add the submodule of standard telegram 111, and note down the start address of the I/O data which is needed when calling SINA_POS:



6. Then keep clicking "Next" until it is successfully generated:



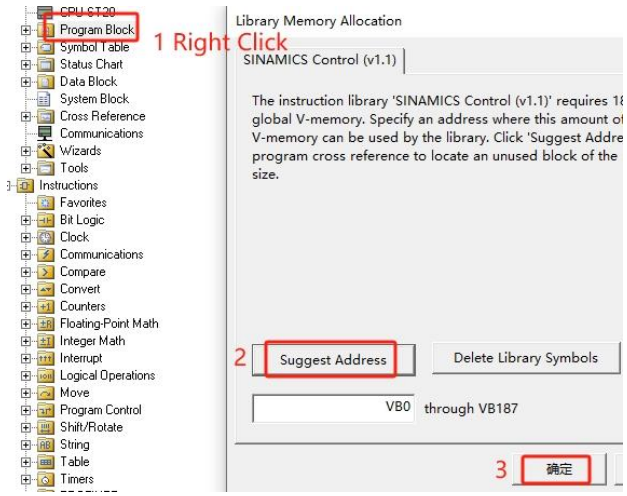
7. In the main program, call SINA_ POS and write the following program, where the inputs " St_I_add " and "St_Q_add" must correspond to the start address of the I/O data of telegram 111 (see step 5) :



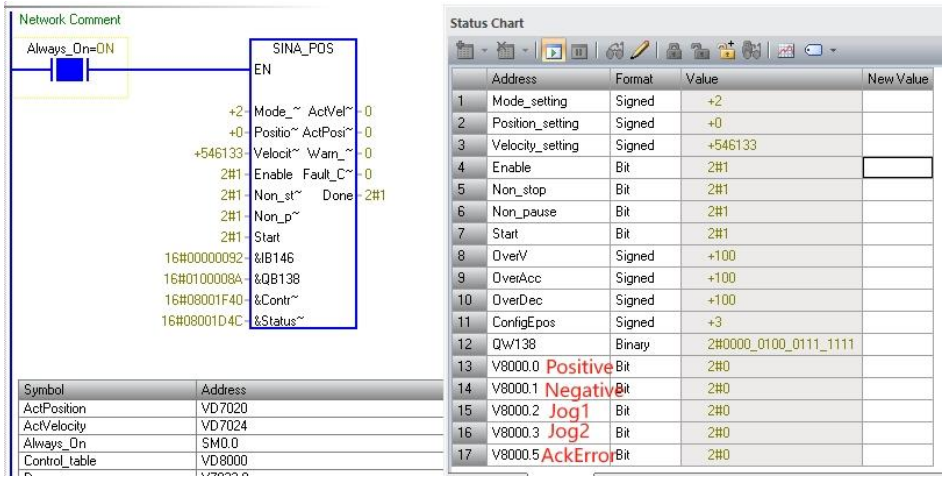
8. The symbol table address used in the program is defined as shown in the following table:

Mode_setting	VW7000
Position_setting	VD7002
Velocity_setting	VD7006
Enable	V7010.0
Non_stop	V7010.1
Non_pause	V7010.2
Start	V7010.3
Control_table	VD8000
Status_table	VD7500
ActPosition	VD7020
ActVelocity	VD7024
Warn_Code	VW7028
Fault_Code	VW7030
Done	V7032.0
OverV	VW8002
OverAcc	VW8004
OverDec	VW8006
ConfigEpos	VD8008

9. Before downloading the program, assign the V-address area used by the library:



10. After downloading the program, you can test it with a status chart:



7.4.2 SINA_POS introduction

Table 7-3 describes the SINA_POS pin definition

Table 7-3 SINA_POS pin definition

Pin name	Data type	Description
ModePos	Int	Operating mode: =0 — =1 Relative positioning =2 Absolute positioning =3 — =4 Active homing =5 Direct homing =6 Position table (not supported) =7 Jog at the specified speed =8 —
Position	DInt	Position setpoint for operating mode 1, 2
Velocity	DInt	Speed setpoint for operating mode 1, 2, 7
EnableAxis	Bool	=0 Disable, servo control word is 0xE =1 Enable, servo control word is 0xF
CancelTraversing	Bool	=1 Do not reject traversing task =0 Reject traversing task
IntermediateStop	Bool	=1 No intermediate stop =0 Intermediate stop
Execute	Bool	Activate operating mode, rising edge valid
St_I_add	DWord	Start address of the PN I area of telegram 111
St_Q_add	DWord	Start address of the PN Q area of telegram 111

<table>
<tr><th>Pin name</th><th>Data type</th><th>Description</th></tr>
<tr><td>Control_table</td><td>DWord</td><td>A pointer to the start address of Control_table, for example &VD8000
<table>
<tr><th>Byte</th><th>Bit7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit0</th></tr>
<tr><td>0</td><td>Reserved</td><td>Reserved</td><td>Ack-Error</td><td>Reserved</td><td>Jog 2</td><td>Jog 1</td><td>Negative</td><td>Positive</td></tr>
<tr><td>1</td><td colspan="8">Reserved</td></tr>
<tr><td>2
3</td><td colspan="8">OverV: Percentage of Speed Setpoint at Operating Modes 1, 2, 7, unit %, range 0 to 199%</td></tr>
<tr><td>4
5</td><td colspan="8">OverAcc: Acceleration percentage when operating mode is 1, 2 and 7, unit %, range 0~100%</td></tr>
<tr><td>6
7</td><td colspan="8">OverDec: Deceleration percentage when operating mode is 1, 2 and 7, unit %, range 0~100%</td></tr>
<tr><td>8
9
10
11</td><td colspan="8">ConfigEpos ——
Bit0: Coast stop Bit1: Quick stop
Bit2: Activate software limit Bit3: Activate hardware limit
Bit6: Reference point switch
Bit8: The absolute positioning set point is changed immediately
Note that the initial value of the ConfigEpos is 3.</td></tr>
</table></td></tr>
<tr><td>Status_table</td><td>DWord</td><td>A pointer to the start address of Status_table, for example &VD7500
<table>
<tr><th>Byte</th><th>Bit7</th><th>Bit6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th></tr>
<tr><td>0</td><td>Reserved</td><td>Over-range</td><td>Axis-Error</td><td>Axis-Warn</td><td>Lock-out</td><td>Axis-Ref</td><td>Axis-PosOk</td><td>Axis-Enabled</td></tr>
<tr><td>1</td><td colspan="8">Error ID——
0: No error
1: Drive fault
2: Drive disabled
3: Unsupported mode
4: OverV, OverAcc and OverDec is overranged</td></tr>
<tr><td>2
3</td><td colspan="8">ActMode: Current operating mode</td></tr>
<tr><td>4
5</td><td colspan="8">POS_ZSW1 current value, see Table 1-15</td></tr>
<tr><td>6
7</td><td colspan="8">POS_ZSW2 current value, see Table 1-16</td></tr>
</table></td></tr>
<tr><td>ActVelocity</td><td>DWord</td><td>Speed actual value</td></tr>
<tr><td>ActPosition</td><td>DWord</td><td>Position actual value</td></tr>
<tr><td>Warn_code</td><td>Word</td><td>Servo warn code</td></tr>
<tr><td>Fault_code</td><td>Word</td><td>Servo error code [603F00] absolute positioning.</td></tr>
<tr><td>Done</td><td>Bool</td><td>The target position is reached when operation mode is relative or absolute positioning.</td></tr>
</table>

7.4.3 Operating condition and setting

1. Enabled by entering pin "EnableAxis" = 1, "AxisEnabled" in "Status_table" is 1 if the servo is ready and fault-free ("AxisError " = 0).

2. The input pin "CancelTraversing" and "IntermediateStop" are valid for all modes except jog mode, and should be set to 1 during operation, as follows:

a. When "CancelTraversing" = 0, it means that the current task is canceled, and the deceleration corresponds to the halt_mode [605D00]. The operating mode can be switched after the axis stops.

b. When "IntermediateStop" = 0, it means to pause the current task, and the deceleration corresponds to the halt_mode [605D00]. The axis will continue to run after resetting "IntermediateStop" = 1. The operating mode can be switched after the axis stops.

3. The input pin "ModePos" is used to select the operating mode; the rising edge of "Execute" triggers the positioning movement.

4. Activate software limit switch

After setting the reference point, if you need to use a software limit switch, you need to set bit 2 of the input pin "ConfigEPos" to 1 ("ConfigEPos" = 16#00000007) or set the En_SoftWare_Limit [30800C] to 1.

Activate the software limit function, set the soft positive limit [607D01] and the soft negative limit [607D02] for the servo.

30800C	uint8	En_SoftWare_Limit	1	DEC
607D01	int32	Soft_Positive_Limit	10000000	DEC
607D02	int32	Soft_Negative_Limit	-10000000	DEC

After you set soft positive limit more than soft negative limit and set the reference point, the software limit function is enabled.

5. Activate hardware limit switch

If you need to use a hardware limit switch, you need to set bit 3 of the input pin "ConfigEPos" to 1 ("ConfigEPos" = 16#0000000B):

Use KincoServo+ software to define the positive limit and negative limit for the DIN of the servo. The servo can only be operated when the hardware limit switch signal is high.

Please note that only positive and negative limits are configured in the KincoServo+ software, but bit 3 of "ConfigEPos" is not set to 1, then the hardware limit function will not take effect.

7.4.4 Operating mode 1 (Relative positioning)

Requirements:

1. Operating mode "ModePos" = 1
2. "ConfigEPos" = 16#00000003
3. "EnableAxis" = 1
4. "CancelTraversing" and "IntermediateStop" must be 1, and "Jog1" and "Jog2" must be 0.

Steps:

1. Specify the target position and target speed through the input pin "Position" and "Velocity". The unit of position and velocity is DEC. Refer to the servo drive manual for conversion, and the unit of velocity is transformed into: DEC = RPM * 512 * feedback_resolution [641003] / 1875.
2. Use "OverV", "OverAcc" and "OverDec" to scale the percentage of the target speed and profile acceleration and deceleration.
3. The direction of movement is determined by the positive or negative value set in "Position".
4. The movement is triggered by the rising edge of "Execute", and "AxisPosOk" is set to 1 after reaching the target position. If there is an error locating, "AxisError" is set to 1.
5. The currently running command can be replaced with a new command via the "Execute" rising edge. At any time, it can switch between operating mode 1 and 2. If you need to switch to another operating mode, the axis must be stationary.
6. Please note that "Execute" needs to be reset to 0 after the relative positioning motion is triggered by the rising edge of "Execute".

7.4.5 Operating mode 2 (Absolute positioning)

Requirements:

1. Operating mode "ModePos" = 2
2. "ConfigEPos" = 16#00000003
3. "EnableAxis" = 1
4. "CancelTraversing" and "IntermediateStop" must be 1, and "Jog1" and "Jog2" must be 0.

Steps:

1. Specify the target position and target speed through the input pin "Position" and "Velocity". The unit of position and velocity is DEC. Refer to the servo drive manual for conversion, and the unit of velocity is transformed into: DEC = RPM * 512 * feedback_resolution [641003] / 1875.
2. Use "OverV", "OverAcc" and "OverDec" to scale the percentage of the target speed and profile acceleration and deceleration.
3. The servo will follow the shortest path to the target position when running. "Positive" and "Negative" must be 0.
4. The movement is triggered by the rising edge of "Execute", and "AxisPosOk" is set to 1 after reaching the target position. If there is an error locating, "AxisError" is set to 1.
5. The currently running command can be replaced with a new command via the "Execute" rising edge. At any time, it can switch between operating mode 1 and 2. If you need to switch to another operating mode, the servo must be stationary.

6. By setting bit 8 of "ConfigEPos" ("ConfigEPos" = 16#00000103), after updating "Position" on the PLC, there is no need to trigger "Execute", the new setting value will take effect immediately, and the servo will immediately execute the absolute positioning instruction according to the target position change.
7. Please note that "Execute" needs to be reset to 0 after the absolute positioning motion is triggered by the rising edge of "Execute".

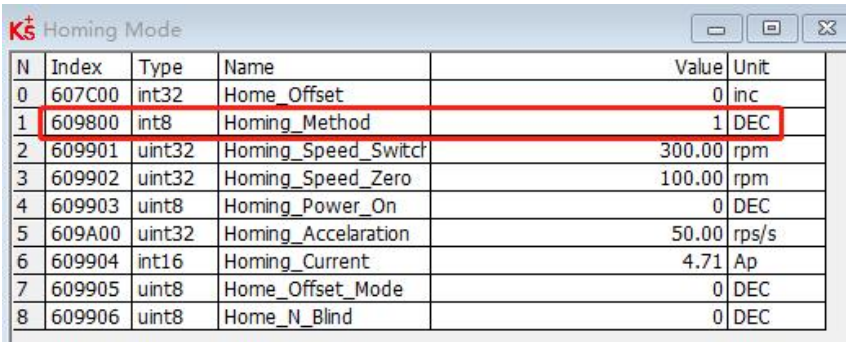
7.4.6 Operating mode 4 (Active homing)

Requirements:

1. Operating mode "ModePos" = 4
2. "ConfigEPos" = 16#00000003. If hardware limits are used, "ConfigEPos" = 16#0000000B.
3. "EnableAxis" = 1
4. "CancelTraversing" and "IntermediateStop" must be 1, and "Jog1" and "Jog2" must be 0.
5. One of "Negative" and "Positive" must be set to 1.

Steps:

1. The way and the speed of returning to the reference point should be configured by KincoServo+ software (PLC only sends the command, and the planning of returning to the reference point is set by the servo parameters). Please refer to the servo drive manual for the specific way of returning to the reference point:



N	Index	Type	Name	Value	Unit
0	607C00	int32	Home_Offset	0	inc
1	609800	int8	Homing_Method	1	DEC
2	609901	uint32	Homing_Speed_Switch	300.00	rpm
3	609902	uint32	Homing_Speed_Zero	100.00	rpm
4	609903	uint8	Homing_Power_On	0	DEC
5	609A00	uint32	Homing_Accelaration	50.00	rps/s
6	609904	int16	Homing_Current	4.71	Ap
7	609905	uint8	Home_Offset_Mode	0	DEC
8	609906	uint8	Home_N_Blind	0	DEC

2. A return to the reference point motion is triggered by the rising edge of "Execute", which should remain 1 during the motion. After the motion, "AxisRef" is set to 1, and if there is an error during the operation, "AxisError" is set to 1.

7.4.7 Operating mode 5 (Direct homing)

Requirements:

1. Operating mode "ModePos" = 5
2. "ConfigEPos" = 16#00000003
3. "EnableAxis" = 1
4. The axis must be stationary.

Steps:

The reference point of the axis is set by the rising edge of the "Execute". When the homing operation has been done, the output pin "AxisRef" turns to be 1.

7.4.8 Operating mode 7 (Jog at the specified speed)

Requirements:

1. Operating mode "ModePos" = 7
2. "ConfigEPos" = 16#00000003
3. "EnableAxis" = 1
4. The axis must be stationary.

Steps:

1. Specify the jog speed through the input pin "Velocity", which must be a positive value in unit DEC.
2. Use "OverV", "OverAcc" and "OverDec" to scale the percentage of the jog speed and profile acceleration and deceleration.
3. "CancelTraversing" and "IntermediateStop" are not related to the jog mode. The running direction is independent of "Positive" and "Negative".
4. There is no need to trigger "Execute". Reverse jogging when "Jog1" = 1, forward jogging when "Jog2" = 1. "Jog1" and "Jog2" can only be triggered separately. When "Jog1" and "Jog2" are 0 or 1 at the same time, the axis stops.