ctrlX - Drive

- **Control in ProfiNet**

  - System configuration

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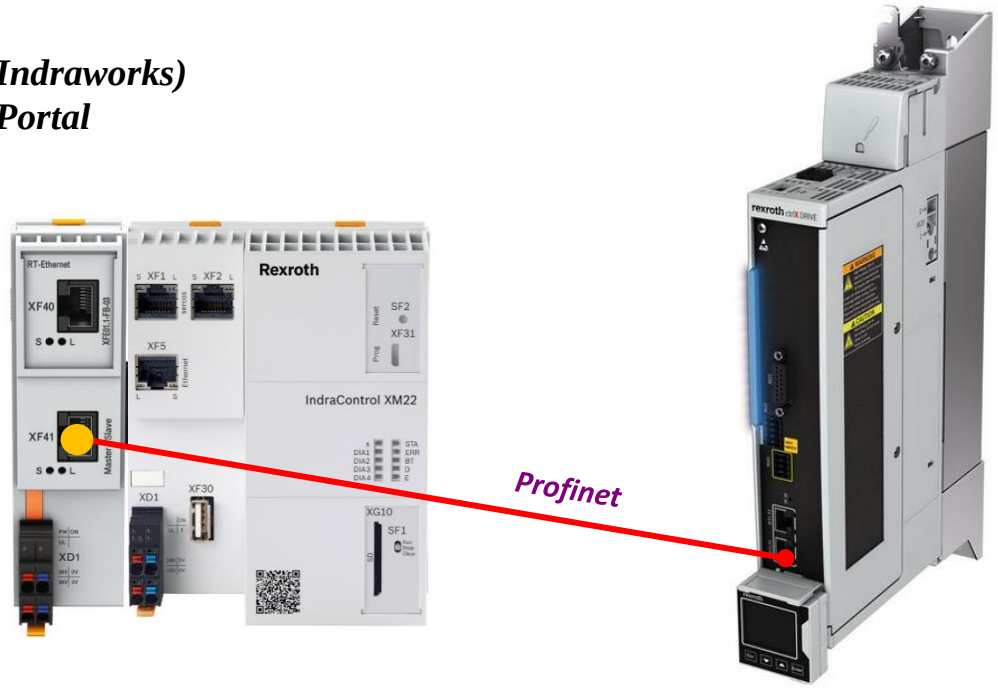
Goals:

- *ctrlX-Drive Configuration*
- *Description of a control FB (Indraworks)*
- *Control on Profinet with Tia Portal*



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Configuration in ctrlX-Drive

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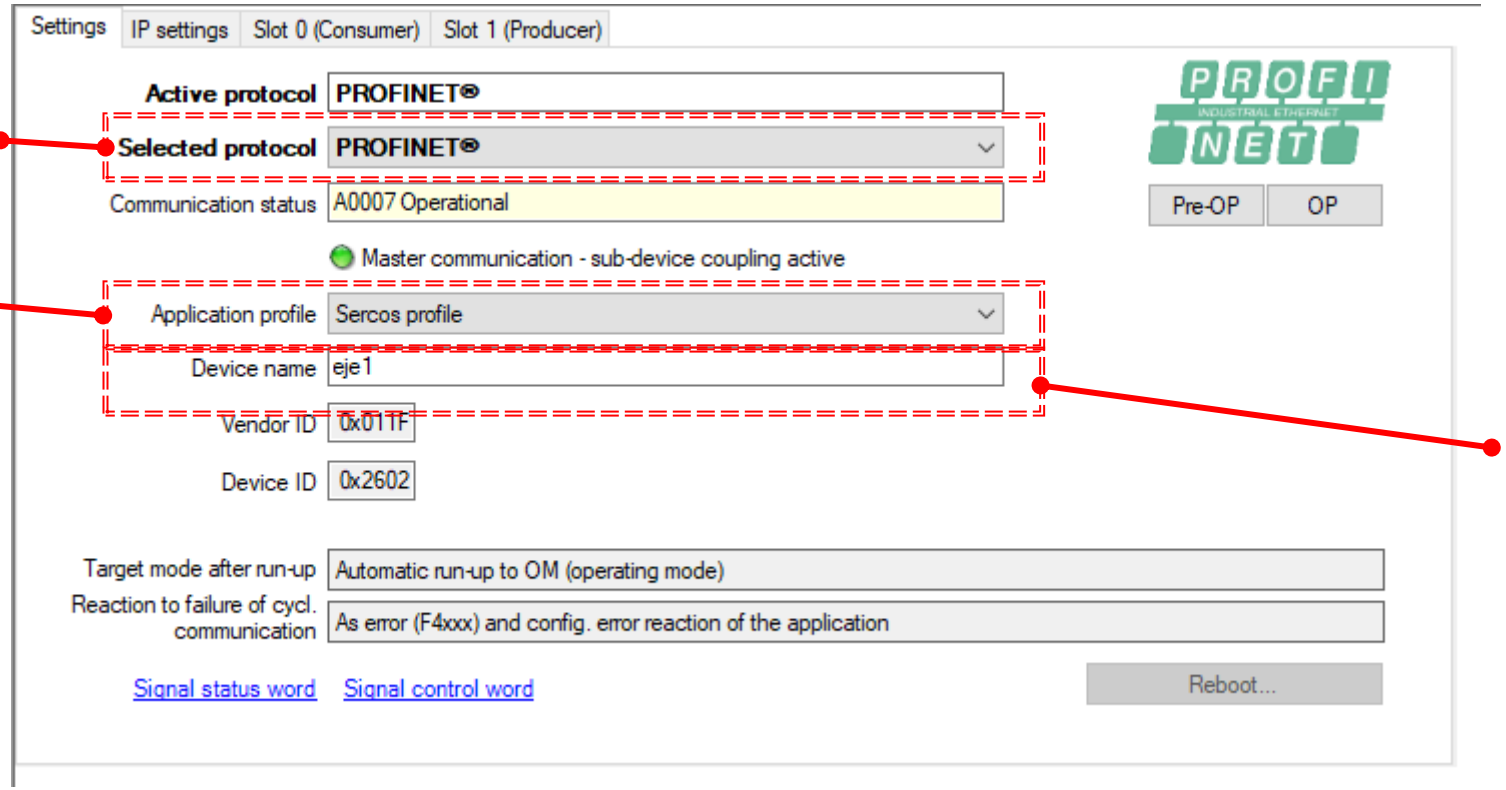
Communication selection:

Select Profinet Protocol

Select profile

You must choose "Sercos Profile" since the other modes do not allow the system to start



The name must match in the master to be able to establish communication correctly.

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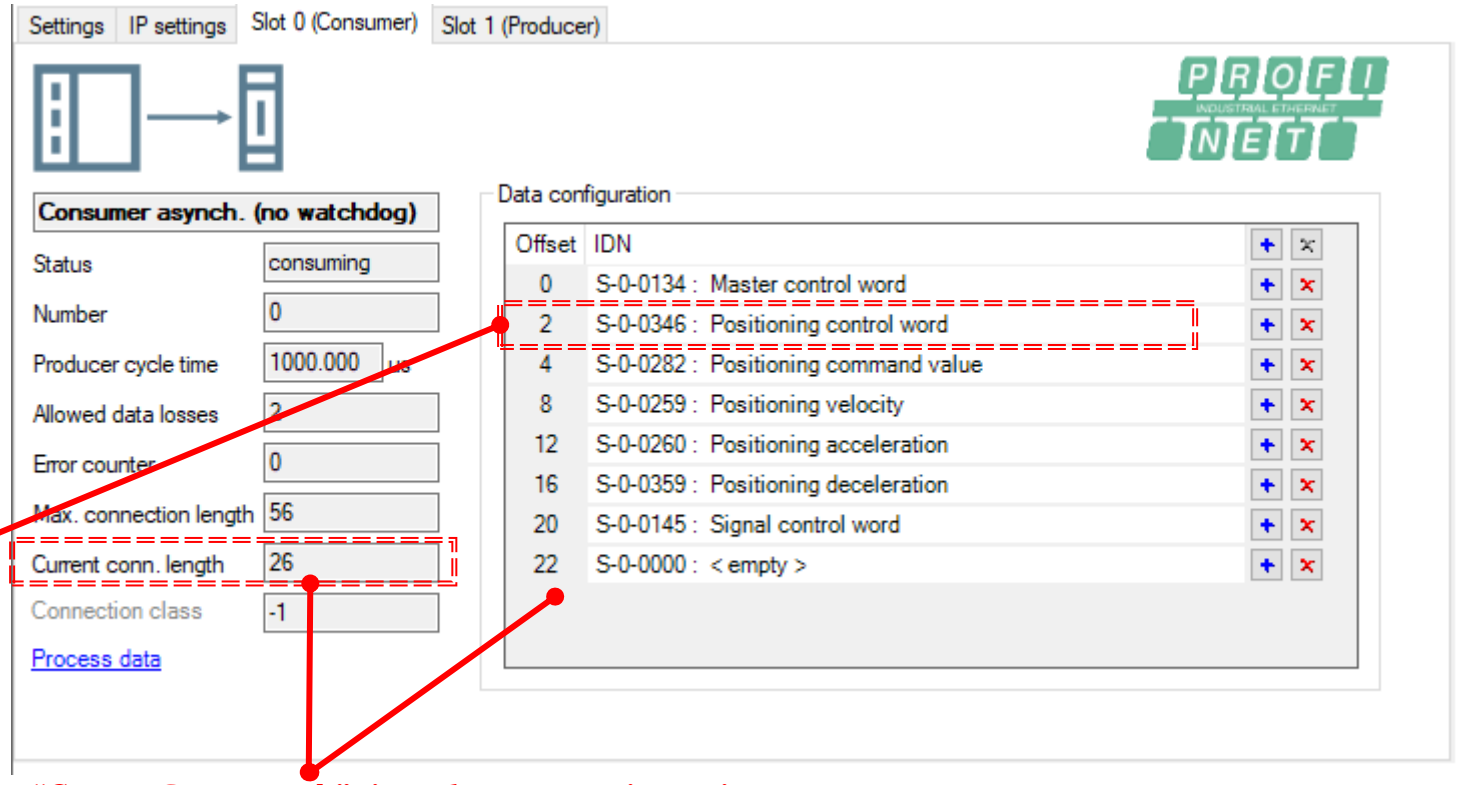
Configuration Slot 0 (Consumer)

For the equipment to work, in jogging and positioning mode, we must configure the ctrlXDrive with this structure for the control part, data sent from the Superior PLC

In the system, the standard fieldbus words used previously have been eliminated and work has been changed with parameter S-0-0134, which does not include some of the data previously used by P-0-4077.

Parameter S-0-0346 has been included manually for managing the positioning operation mode, since S-0-0134, among other things, only allows us to activate the axis (AH, AF) and change of operation mode if we have more than one.



Caution with the "Current Conn.Length" since, due to system issues, it incorporates a few more bytes in the communication and can bring us some surprise, if we do not take it into account. After the incorporation of the data we have 26 Bytes that do not agree with those assigned in the offset that would be about 24

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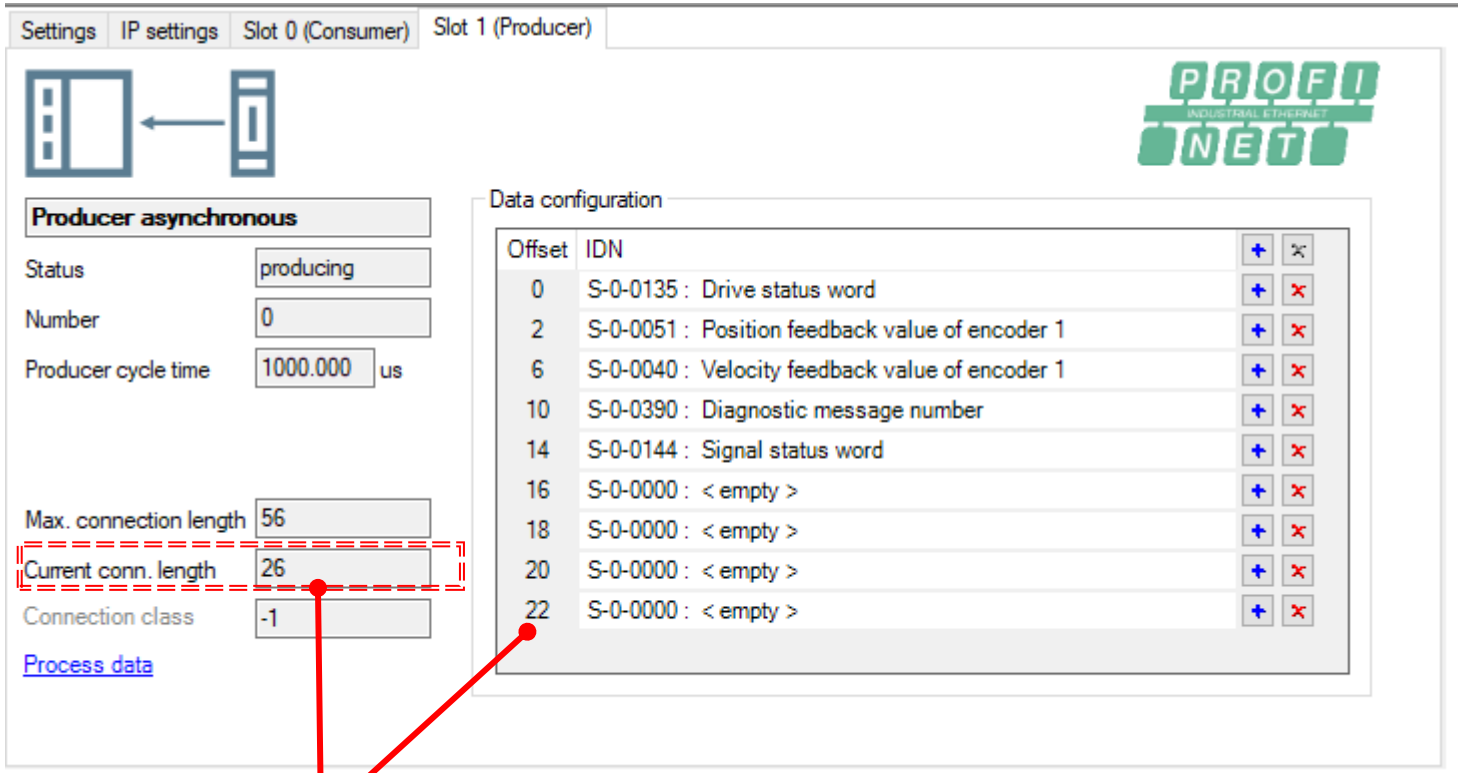
Slot 1 Configuration (Producer)

In the "Producer" part and to leave the size of communications the same as those used in the "Consumer", the 4 "empty" at the end are added.



As in the "Consumer" part, the bytes used maintain a certain discrepancy between those of the "Current Conn. Lengh" and those defined in the offset

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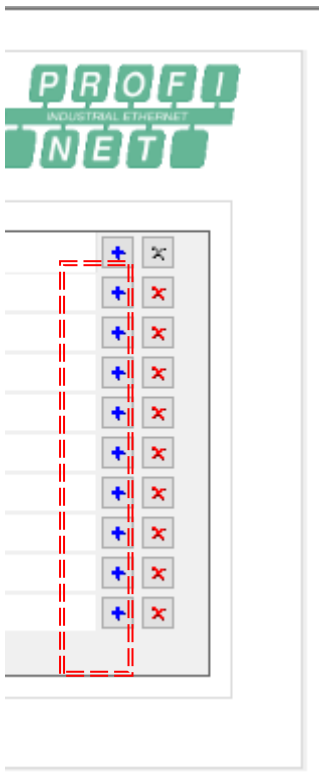
Communication parameter lists:

If there is any problem when adding parameters with the option [+] we can add them by accessing the parameter lists



Configuration Slot 0 (Consumer)

Parameter editor

IDN S-0-1050.0.6

Axis / power supply [1] defau

Name	Connection: Configuration list
Status	OK
Min / Max	-- / --
Elements	Act: 8 Max: 20
0	S-0-0134
1	S-0-0346
2	S-0-0282
3	S-0-0259
4	S-0-0260
5	S-0-0359
6	S-0-0145
7	S-0-0000

Slot 1 Configuration (Producer)

Parameter editor

IDN S-0-1050.1.6

Axis / power supply [1] defau

Name	Connection: Configuration list
Status	OK
Min / Max	-- / --
Elements	Act: 9 Max: 20
0	S-0-0135
1	S-0-0051
2	S-0-0040
3	S-0-0390
4	S-0-0144
5	S-0-0000
6	S-0-0000
7	S-0-0000
8	S-0-0000

Parameters can be added in the "Configuration List" from parameter S-0-1050.0.6 and S-0-1050.1.6

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Data mappings and communication structures (Consumer)

According to the offsets, defined from the positions within the frame, this would be this way

Offset	IDN
0	S-0-0134 : Master control word
2	S-0-0346 : Positioning control word
4	S-0-0282 : Positioning command value
8	S-0-0259 : Positioning velocity
12	S-0-0260 : Positioning acceleration
16	S-0-0359 : Positioning deceleration
20	S-0-0145 : Signal control word
22	S-0-0000 : < empty >

0	1		
2	3		
4	5	6	7
8	9	10	11
12	13	14	15
16	17	18	19
20	21		
22	23		

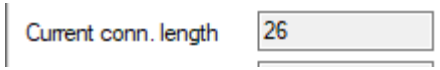
10	11		
12	13		
14	15		
16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31
32	33		
34	35		

Total: 26 Bytes

The structures use the 4-byte system and in this way, the system itself always places the beginning of 4-byte structures (Dword) on multiples of four

0
4
8
12
16
20
24
28
32
36
40

However, when in the PLC part we put that the first of the areas start with the value 10, a "shift" of the areas is produced and in this case 2 more Bytes are "added" to the frame generated by the 26 of the "Current Conn. Length"



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Data Mappings and Communication Structures (Producer)

Offset	IDN
0	S-0-0135 : Drive status word
2	S-0-0051 : Position feedback value of encoder 1
6	S-0-0040 : Velocity feedback value of encoder 1
10	S-0-0390 : Diagnostic message number
14	S-0-0144 : Signal status word
16	S-0-0000 : < empty >
18	S-0-0000 : < empty >
20	S-0-0000 : < empty >
22	S-0-0000 : < empty >

0	1		
2	3	4	5
6	7	8	9
10	11	12	13
14	15		
16	17		
18	19		
20	21		
22	23		

10	11		
12	13	14	15
16	17	18	1
20	21	22	23
24	25		
26	27		
28	29		
30	31		
32	33		
34	35		

Total: 26 Bytes

The structures use the 4-byte system and in this way, the system itself always places the beginning of 4-byte structures (Dword) on multiples of four

0
4
8
12
16
20
24
28
32
36
40

In this case, as in the "Consumer" section, if we start with area 10 we will see that the elements fit perfectly, although two more bytes are used that generate the 26 of the "Current Conn. Length"

Current conn. length	26

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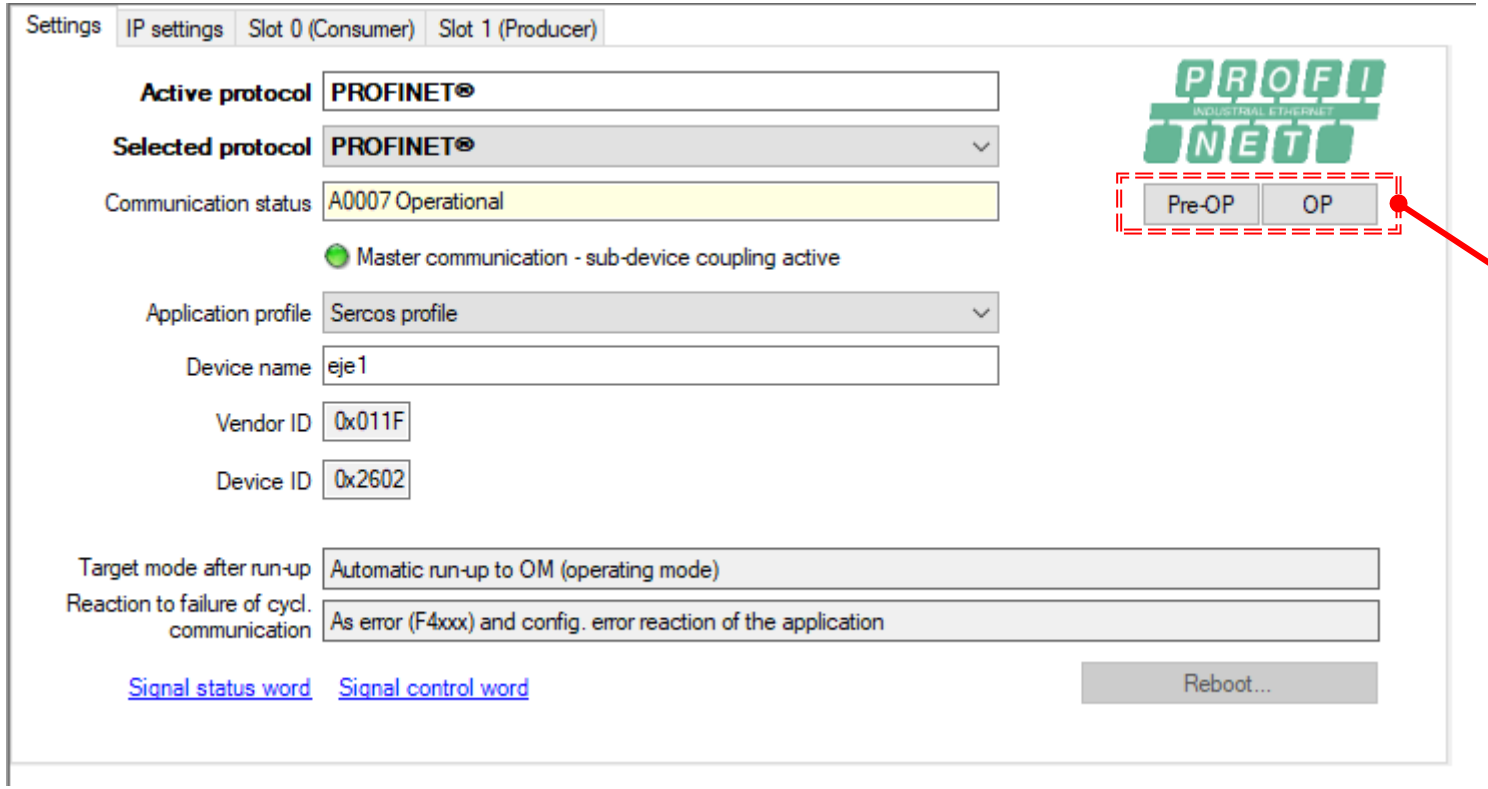
The modifications in the communication must be "validated" by activating "Pre-OP" and then activating "OP". This allows the frame to be updated, both for the subsequent scanning of the equipment from the Master PLC and if we have changed any data manually. .



Validate the configuration with
1st Pre-OP
2nd OP

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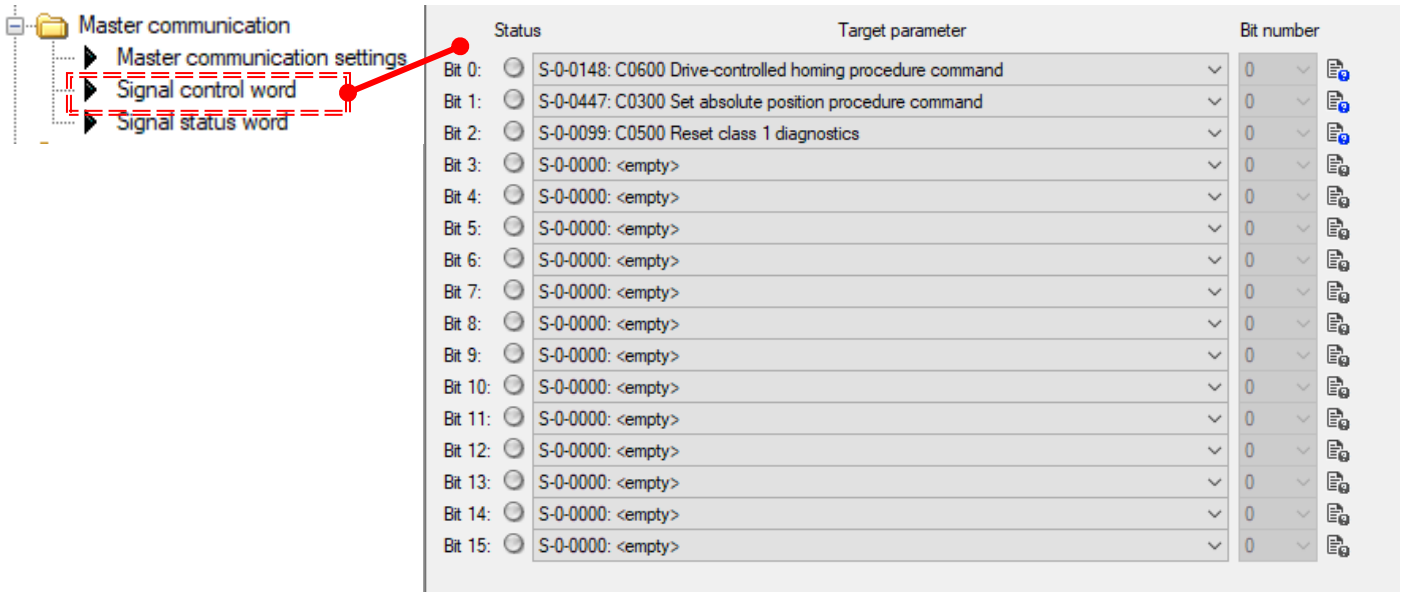
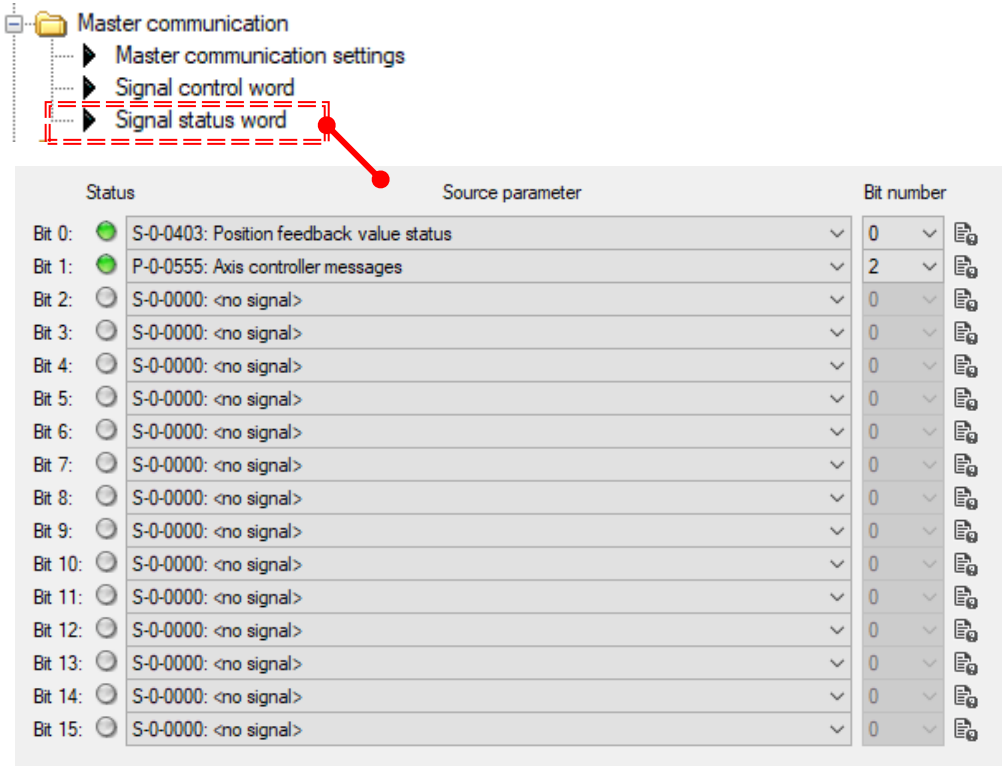
Provisional definition of the "Signal Control Word" and "Signal Status Word" configurations





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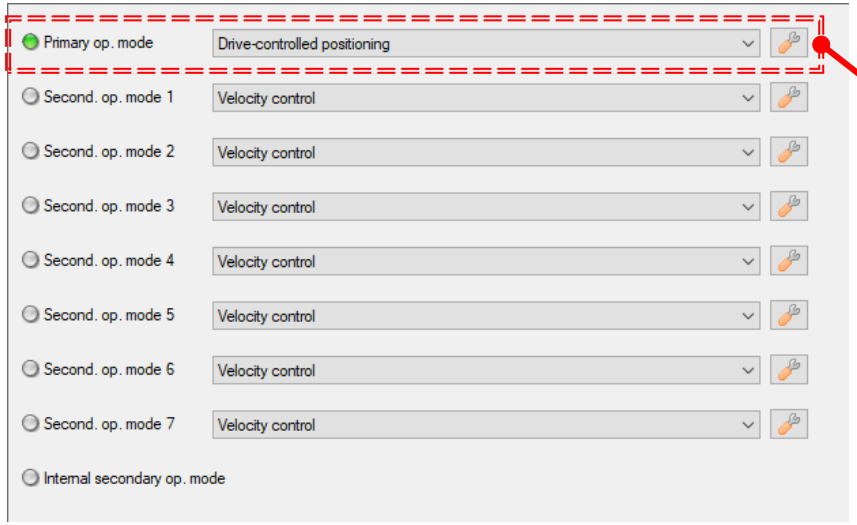
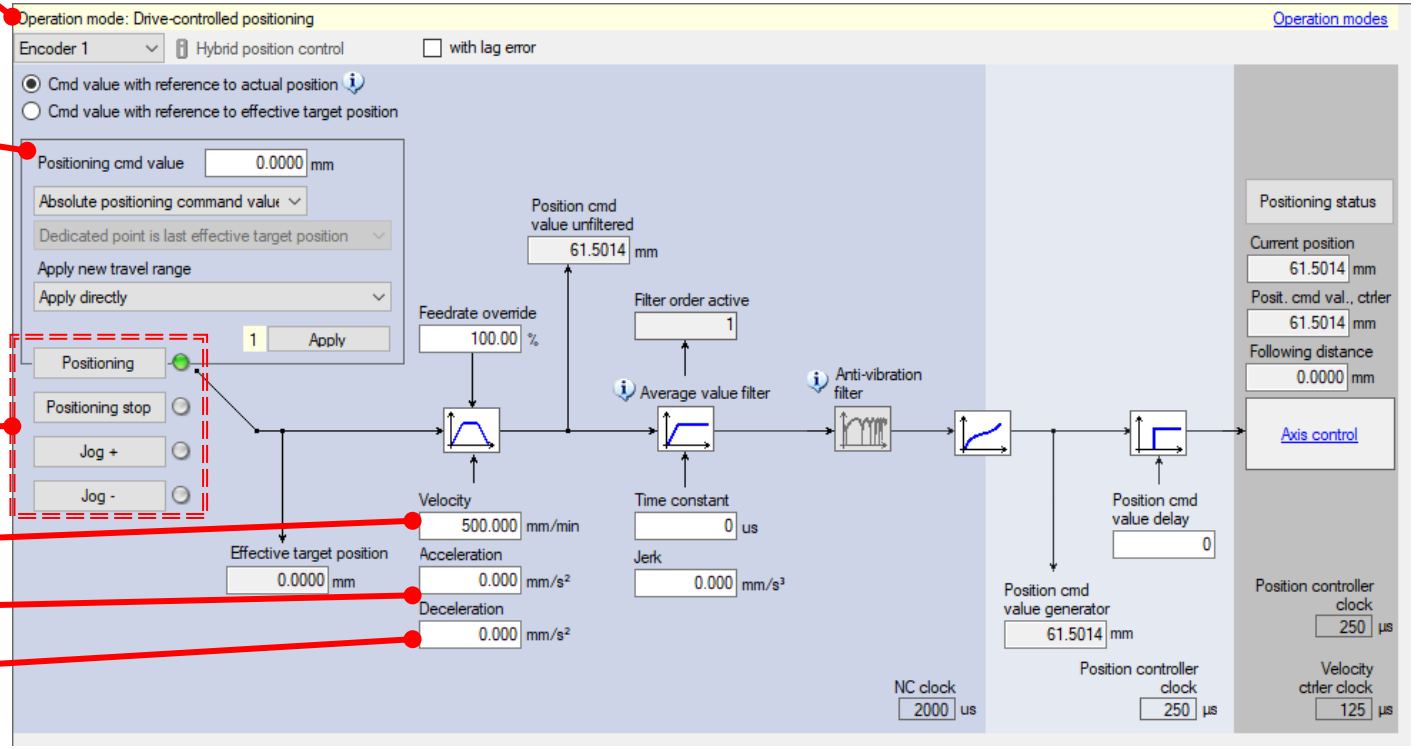
Configuration of operating modes:



Initially we are only going to use the "Drive-Controller Positioning" mode of operation



S-0-0282

Parameter bits P-0-0346

S-0-0259

S-0-0260

S-0-0359

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Parameters

S-0-0134 Drive Control Word

Bit	Designation/function
10-8	**Command operation mode** **000:** Primary operation mode **001:** Secondary operation mode 1, etc. **111:** Secondary operation mode 7
13	**Drive Halt, 1-0 change:** Deceleration of drive while maintaining maximum acceleration (S-0-0138) (only possible if bits 14 and 15 = 1)
14	**Drive enable** **1-0 change:** Torque disable without delay (independent of bit 15 or 13)
15	**Drive ON** **1-0 change:** Best possible deceleration (only possible if bit 14 = 1)

S-0-0135 Drive Status Word

Bit	Designation/function
3	**Status of command value processing** **0:** Drive ignores command value input **1:** Drive follows command value input
4	**Status Drive Halt** **0:** Not active, bit 13 in "S-0-0134" is 1 **1:** Active, bit 13 in "S-0-0134" was set to 0, actual velocity within "S-0-0124, Standstill window"
5	**Position feedback value status** (S-0-0403)
7	**Hardware enable (emergency stop)** **0:** Not active (bits 15 and 14 of "S-0-0134" are ignored, emergency stop is active) **1:** Active
10-8	**Actual operation mode** **000:** Primary operation mode active **001:** Secondary operation mode 1 active **010:** Secondary operation mode 2, etc.
12	**Class 2 diagnostics warning (cf. S 0-0012)** The bit is set if a class 2 diagnostics warning is present.
13	**Class 1 diagnostics drive error (cf. S-0-0011)** The bit is set if a class 1 diagnostics error is present (drive lock-out).
15/14	**Ready for operation (P-0-0116, bit 15/14)** **00:** Not ready for power on (e.g., P2) **01:** Ready for power on (bb) **10:** Control section and power section ready for op. (Ab) **11:** In operation, with torque (e.g. AF)

S-0-0346 Positioning control word

Bit	Designation/function
0	**Application of positioning command value** Applied by toggling
2/1	**Activation of positioning** **00:** Positioning active, started by toggling of bit 0 **Positioning aborted by:** **01:** Infinite travel in positive direction (jog+) **10:** Infinite travel in negative direction (jog-) **11:** Stopping the axis (positioning stop)
3	**Type of positioning command value** **0:** Absolute **1:** Relative (depending on bit 4)
4	**Dedicated point for positioning command values** **0:** Last effective target position (S-0-0430) **1:** Active position feedback value (S-0-0386)
5	**Immediate block change** **0:** Drive moves to current target position, before positioning at new target position **1:** Immediate block change, i.e., drive immediately moves to new target position
7/6	**Behavior for sequential block (bit 5 = 0)** **00:** Halt at target position of start block **01:** Overrunning target position of start block (mode 1) **10:** Overrunning target position of start block (mode 2)

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Configuration in Indraworks

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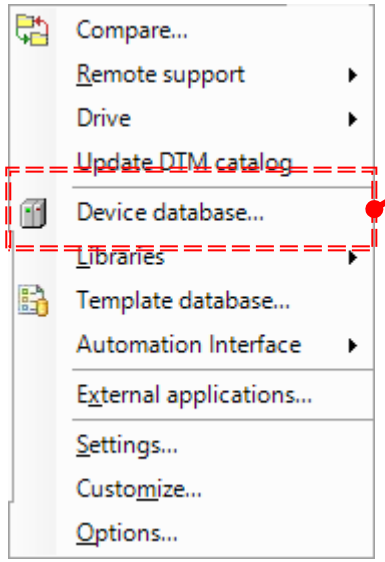
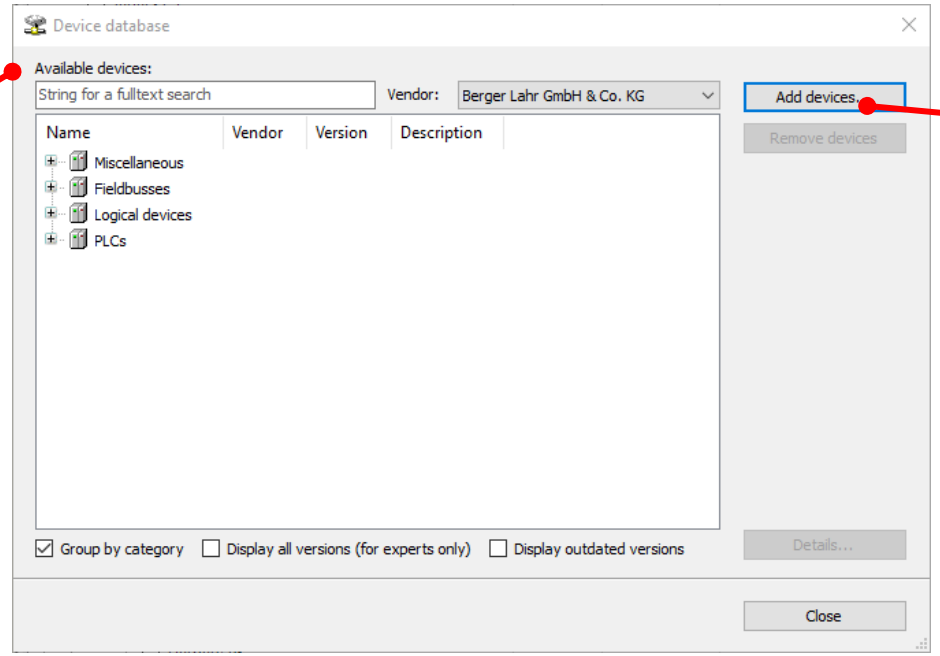
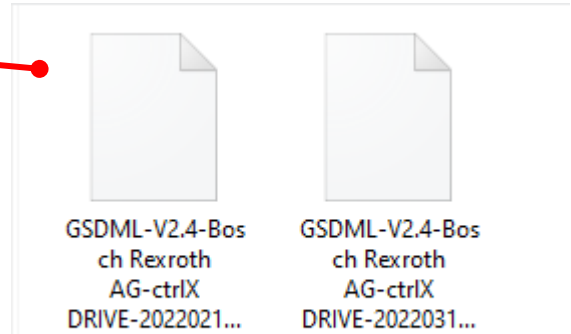
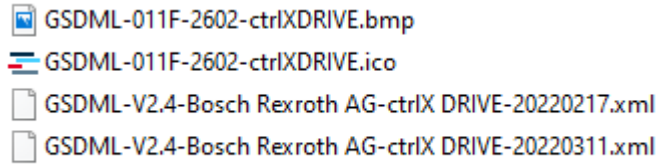
Insert XML file:





Find files in the path where they are saved





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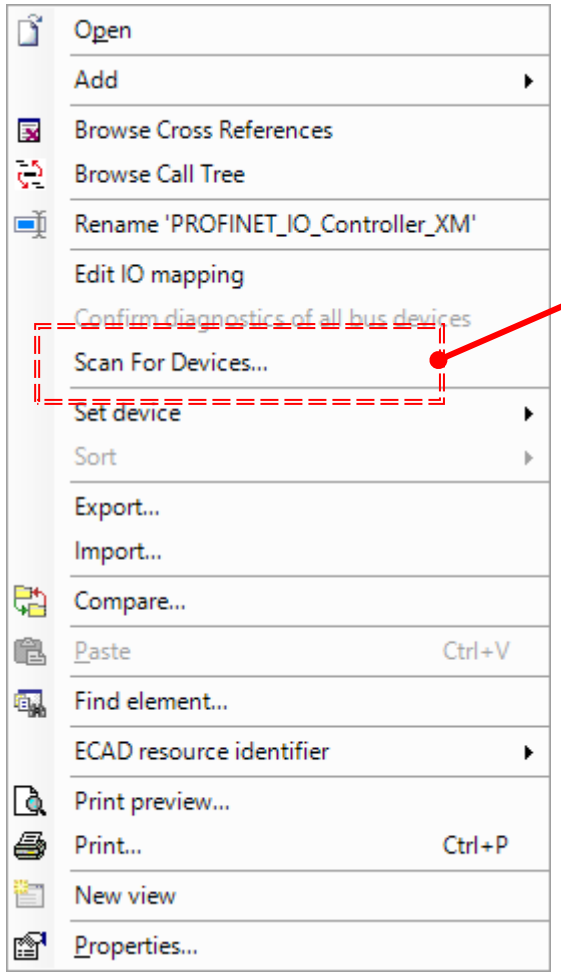
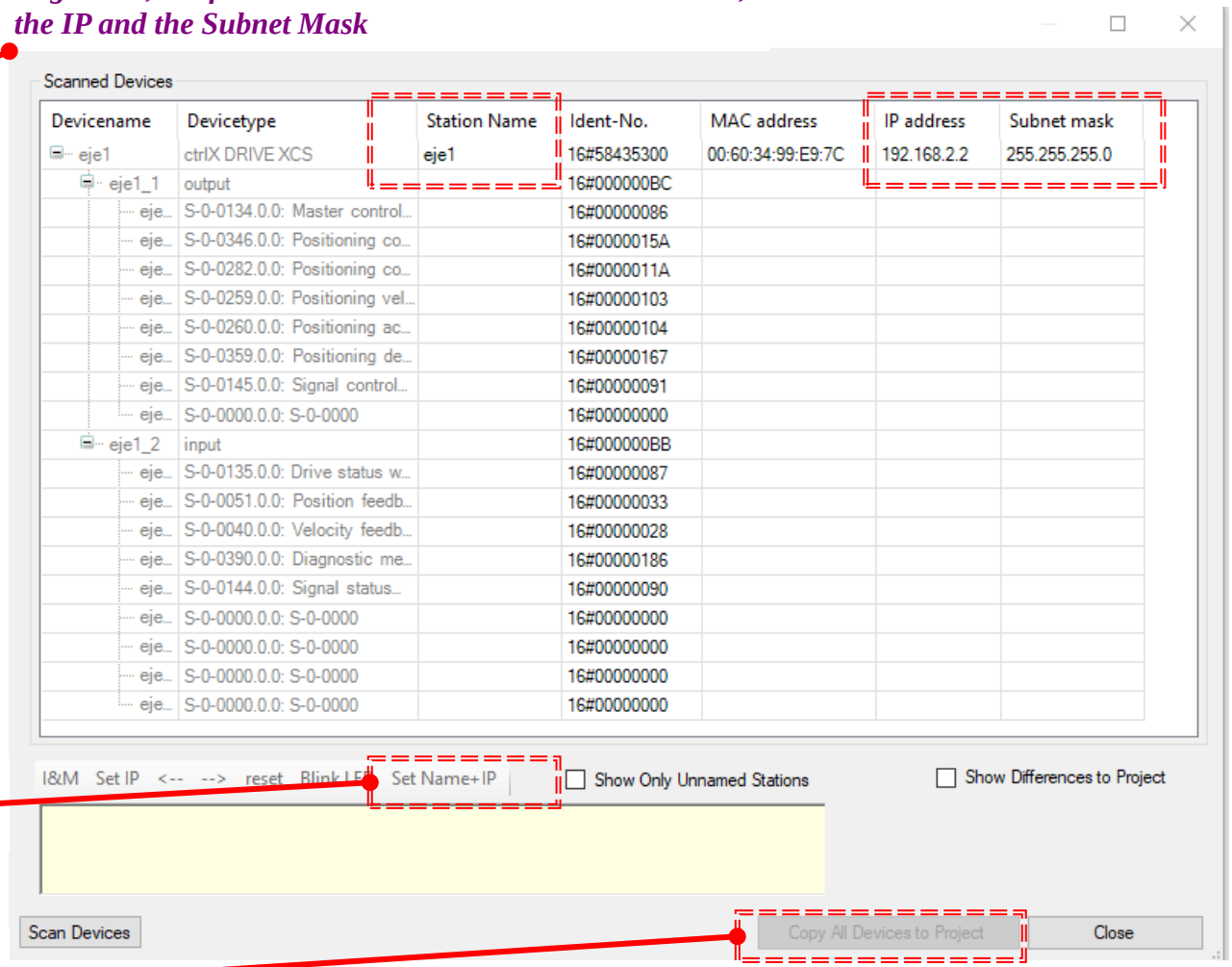
Scan for Devices



In general, the first scanner will ask us to enter the name, the IP and the Subnet Mask



Activate "SetNameÌP" to validate the entered data

Activate to add the axes found in the project

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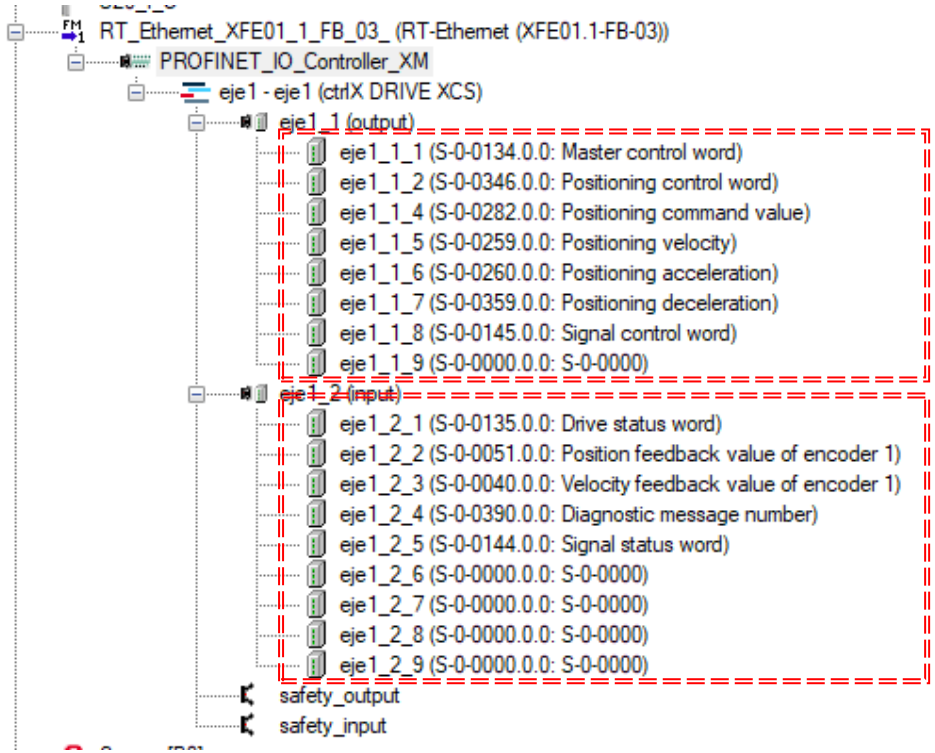
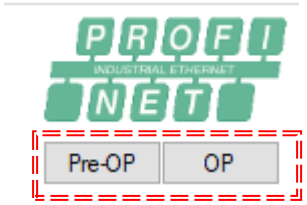
Once the device has been scanned, the read configuration should appear



Data sent to the ctrlX-Drive

Data received from the ctrlX-Drive

Remember that if the configuration read differs from the one we have programmed, it may be because we have not validated it with:
1st Pre-OP
2nd OP



In the case of the ctrlX-Drive the I/O configuration appears separated by parameters

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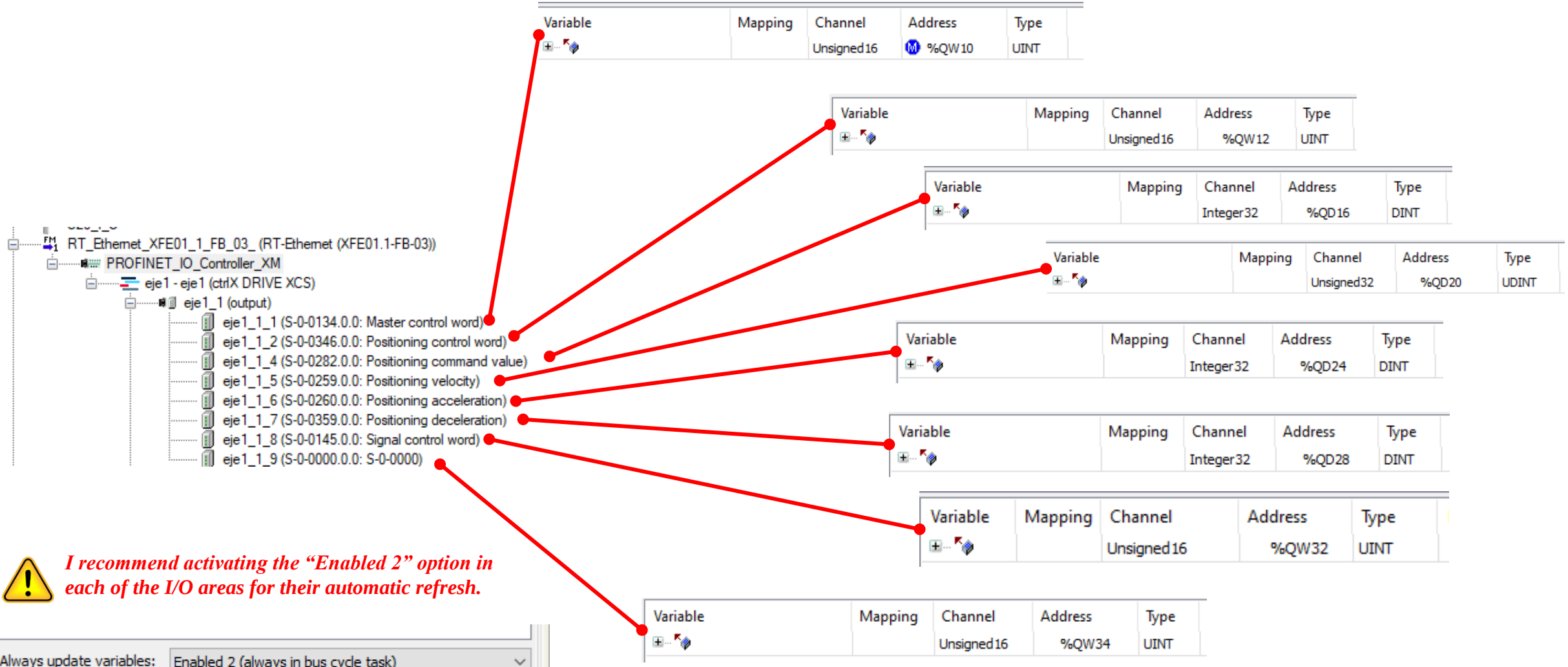
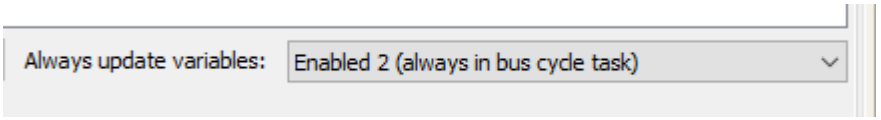
Data sent to the ctrlX-Drive



I recommend activating the "Enabled 2" option in each of the I/O areas for their automatic refresh.



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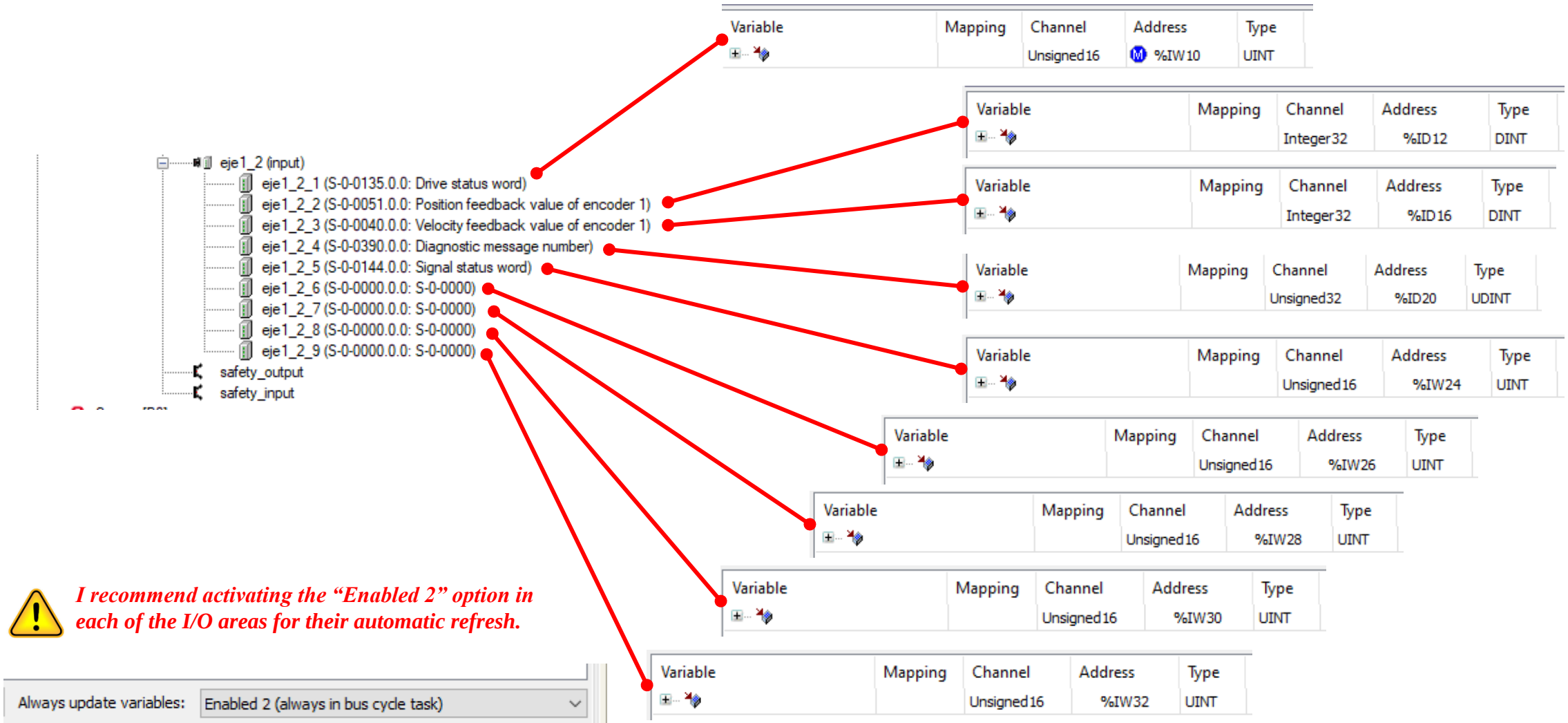
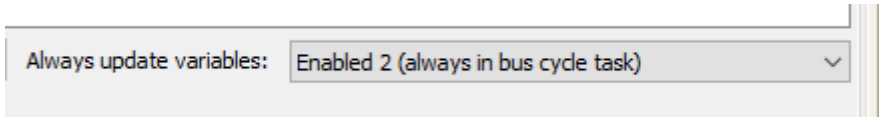
Data received from the ctrlX-Drive



I recommend activating the "Enabled 2" option in each of the I/O areas for their automatic refresh.



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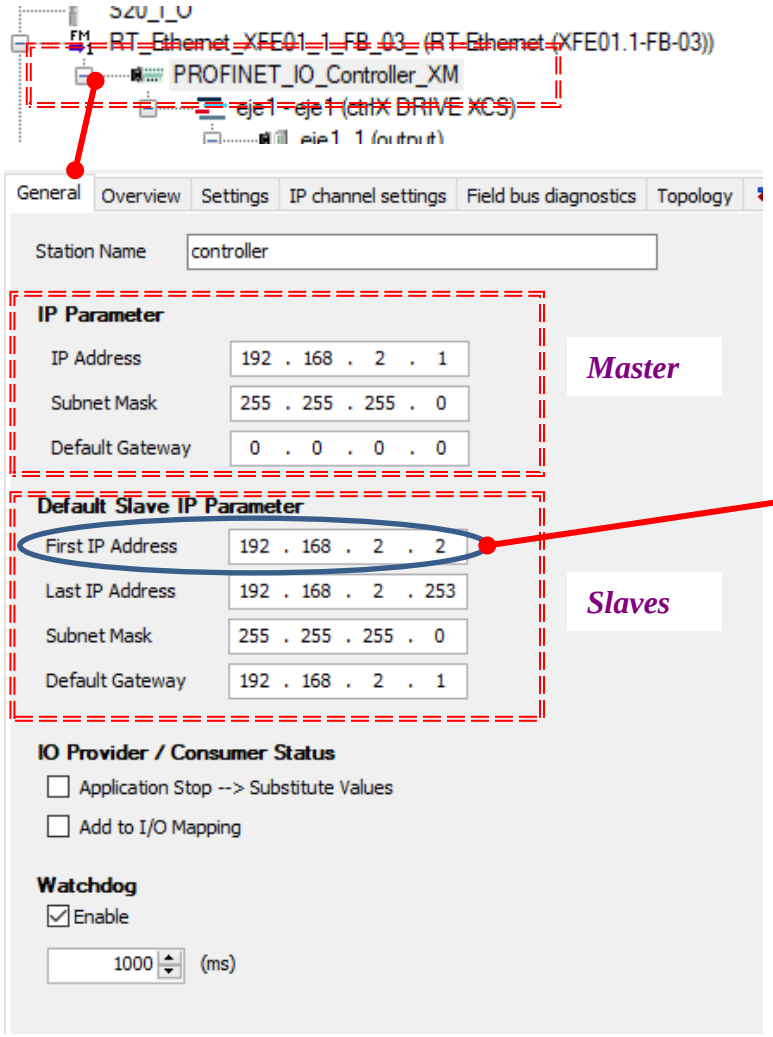
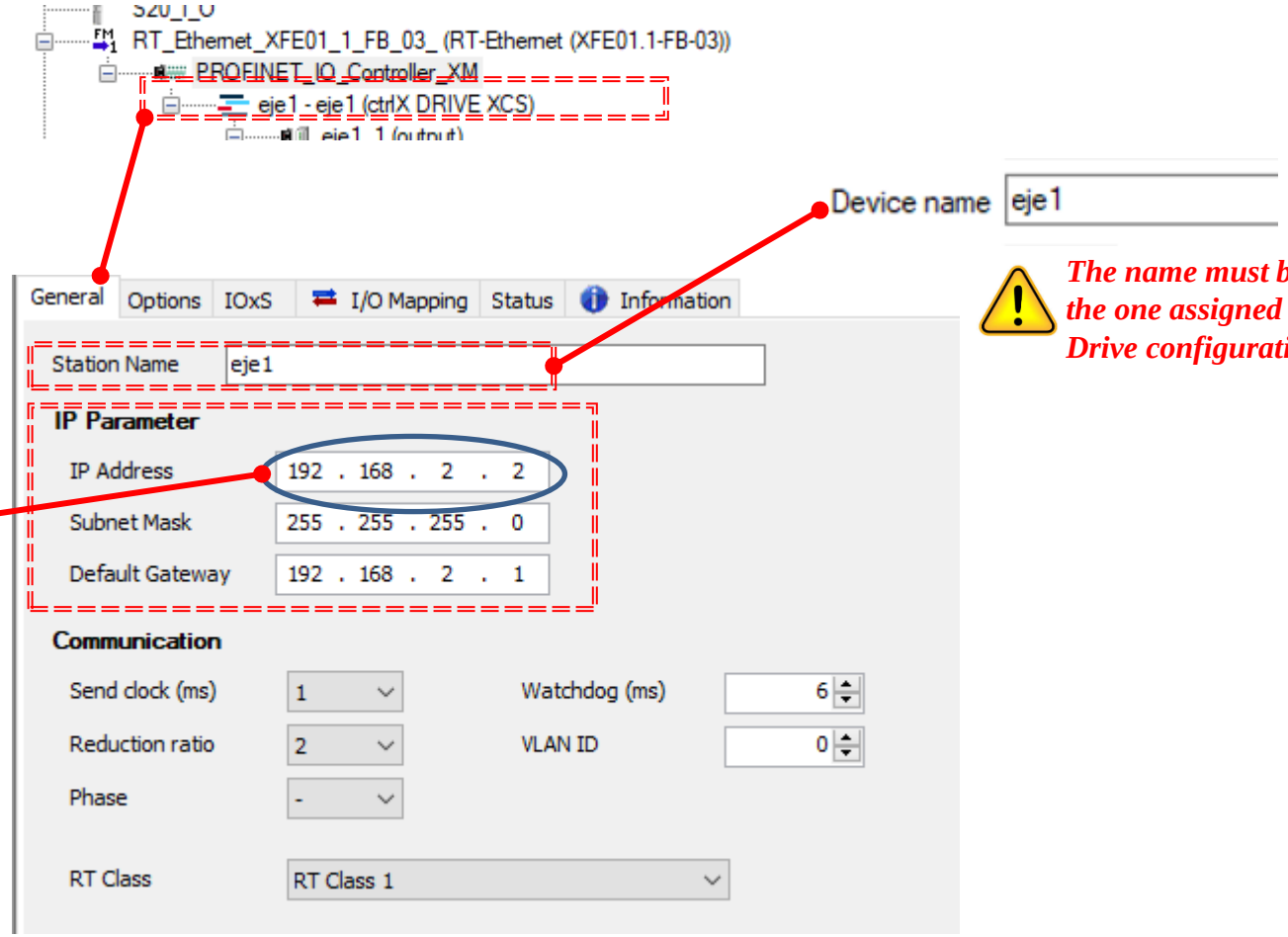
Communication settings:



Master

Slaves



The name must be the same as the one assigned in the ctrlX-Drive configuration

The IP must be assigned from the area for slaves defined in the Master part

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Control FB Configuration

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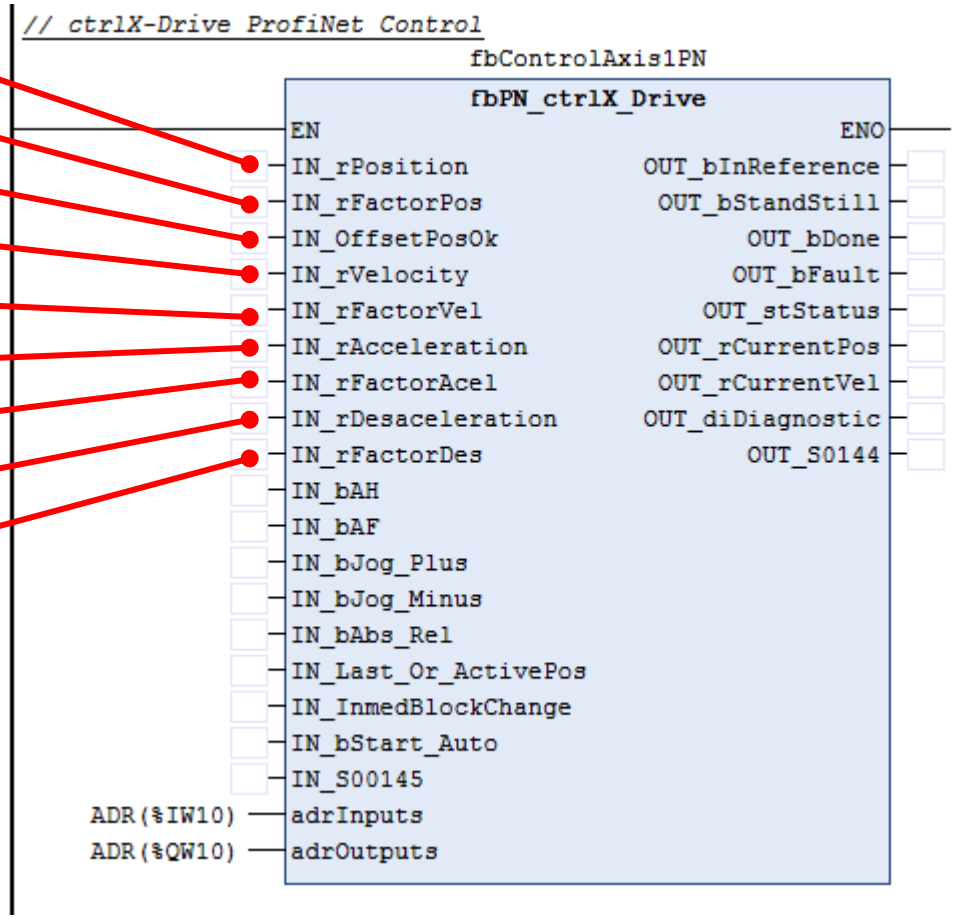
Description of the control Fb used in the example (CMD Setpoint Values)

Setpoint values sent to the drive

- CMD for axis position
- Factor for Position (10000)
- Offset for Ok position
- CMD for Axis Speed
- Factor for Speed (1000)
- CMD for Axis Acceleration
- Factor for Acceleration (1000)
- CMD for Axis Deceleration
- Factor for Deceleration (1000)



The factors are applied to the standard values and allow direct adjustment of the real value sent to the corresponding decimals in the ctrlX-Drive

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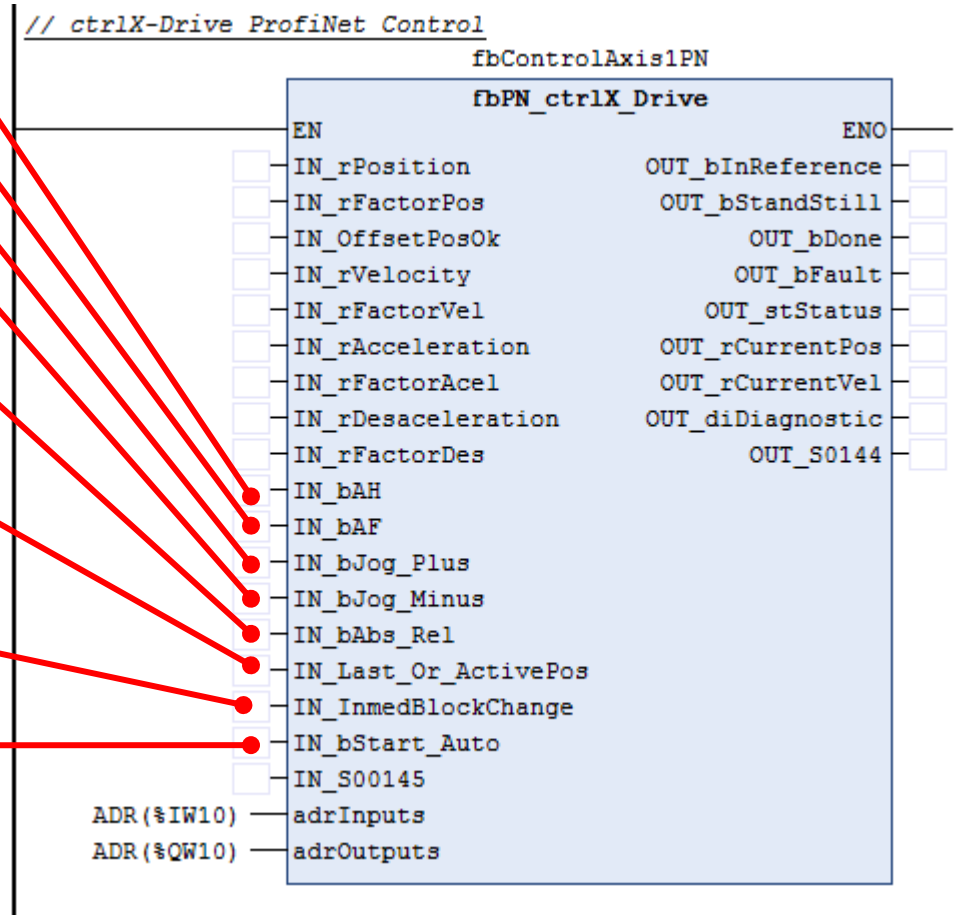
Description of the control Fb used in the example (Activation Bits)

Activation values and option control

- Activate Axis in AH Mode
- Activate Axis in AF Mode
- Movement in Jogging Plus
- Movement in Jogging Minus
- Selection of the type of movement
  Absolute Motion = False
  Relative Motion = True
- Starting point selection
  Last position = False
  Current Position = True
- Selection to update values
  Move to new Pos. After reaching position = False
  Move to new Pos. Directly = True
- Toggle Bit, activation to the new position



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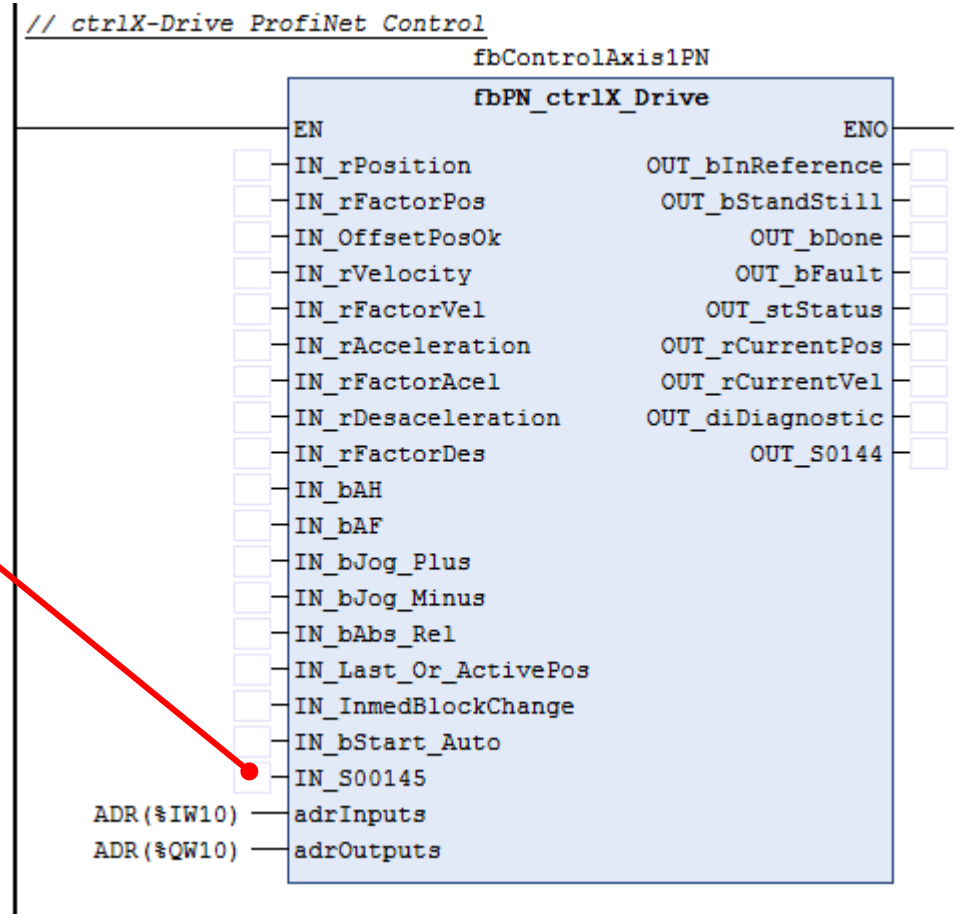
ctrlX-Drive - *Control in ProfiNet (Control FB description)*

Description of the control Fb used in the example (Signal Control Word)

We will use the "Signal Control Word" for the time being to activate the referencing, incremental or absolute modes and the error reset

Signal Control Word

	Status	Target parameter	Bit number
Bit 0:		S-0-0148: C0600 Drive-controlled homing procedure command	0
Bit 1:		S-0-0447: C0300 Set absolute position procedure command	0
Bit 2:		S-0-0099: C0500 Reset class 1 diagnostics	0
Bit 3:		S-0-0000: <empty>	0
Bit 4:		S-0-0000: <empty>	0
Bit 5:		S-0-0000: <empty>	0
Bit 6:		S-0-0000: <empty>	0
Bit 7:		S-0-0000: <empty>	0
Bit 8:		S-0-0000: <empty>	0
Bit 9:		S-0-0000: <empty>	0
Bit 10:		S-0-0000: <empty>	0
Bit 11:		S-0-0000: <empty>	0
Bit 12:		S-0-0000: <empty>	0
Bit 13:		S-0-0000: <empty>	0
Bit 14:		S-0-0000: <empty>	0
Bit 15:		S-0-0000: <empty>	0



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Description of the control Fb used in the example (Assignment Inputs / Outputs Areas)

I/O definition

We will use ADR() to define the I/O bytes assigned to the axis. In this way and automatically the internal structures of the FB collect the information of the areas and assign them to the different internal parameters of the FB

The starting address is determined by the first communications word used in the I/Os.

eje1_2_1 (S-0-0135.0.0: Drive status word)

Variable	Mapping	Channel	Address	Type
		Unsigned16	%IW10	UINT

eje1_1_1 (S-0-0134.0.0: Master control word)

Variable	Mapping	Channel	Address	Type
		Unsigned16	%QW10	UINT

```
// ctrlX-Drive ProfiNet Control
                    fbControlAxis1PN
                    fbPN_ctrlX_Drive
EN                                          ENO
IN_rPosition                  OUT_bInReference
IN_rFactorPos                 OUT_bStandStill
IN_OffsetPosOk                      OUT_bDone
IN_rVelocity                        OUT_bFault
IN_rFactorVel                     OUT_stStatus
IN_rAcceleration              OUT_rCurrentPos
IN_rFactorAcel                OUT_rCurrentVel
IN_rDesaceleration          OUT_diDiagnostic
IN_rFactorDes                       OUT_S0144
IN_bAH
IN_bAF
IN_bJog_Plus
IN_bJog_Minus
IN_bAbs_Rel
IN_Last_Or_ActivePos
IN_InmedBlockChange
IN_bStart_Auto
IN_S00145
ADR(%IW10) ---- adrInputs
ADR(%QW10) ---- adrOutputs
```


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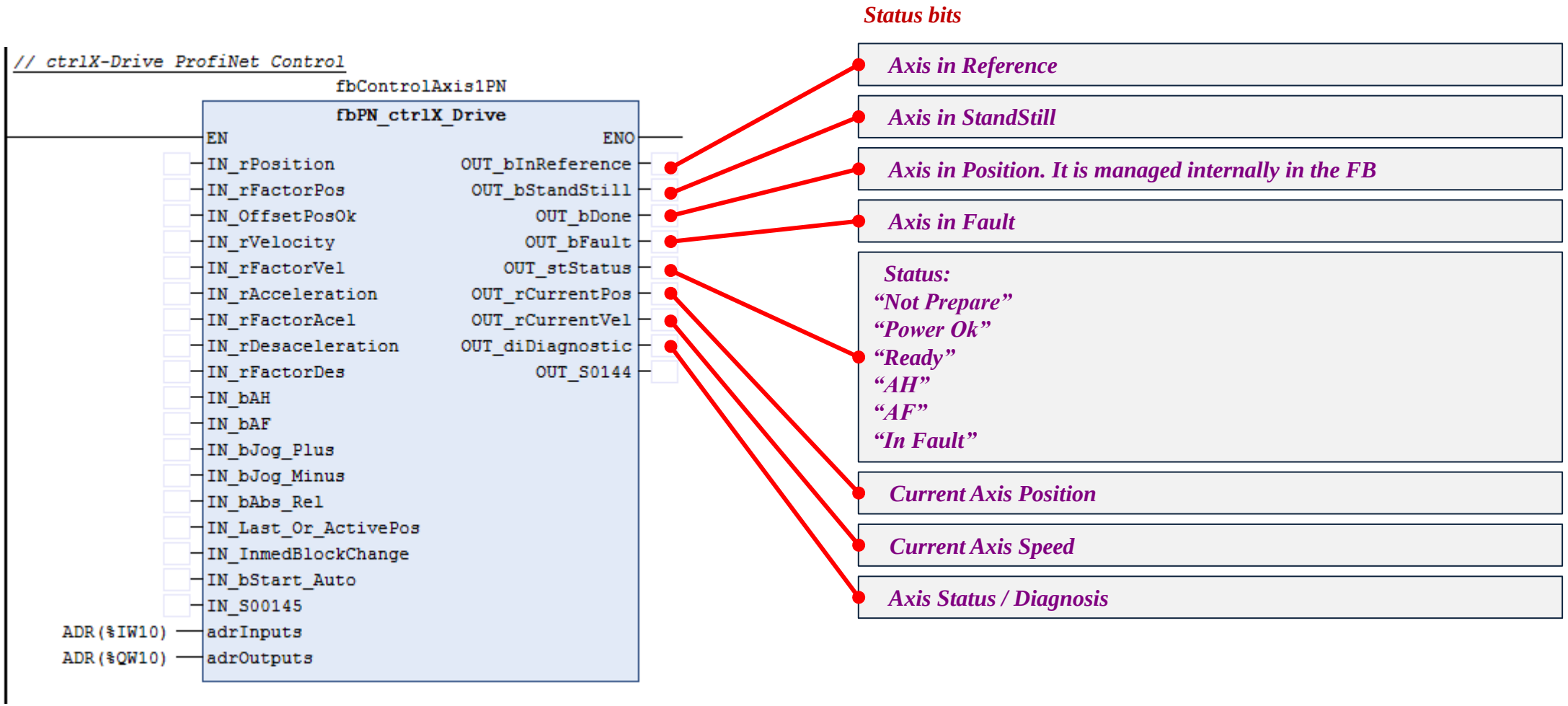
Description of the control Fb used in the example (Assignment Inputs / Outputs Areas)



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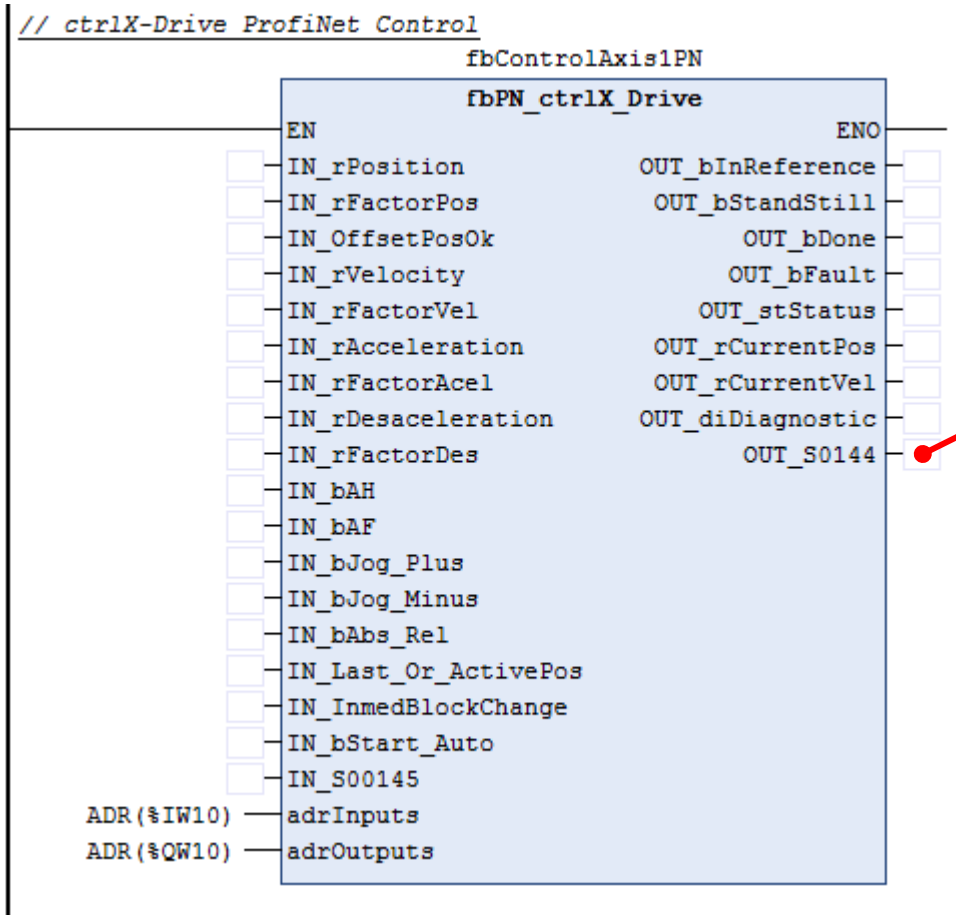
Description of the control Fb used in the example (Assignment Inputs / Outputs Areas)



The "Signal Status Word" will be used for the time being to control the referenced axis and the standstill

Signal Status Word

	Status	Source parameter	Bit number
Bit 0:		S-0-0403: Position feedback value status	0
Bit 1:		P-0-0555: Axis controller messages	2
Bit 2:		S-0-0000: <no signal>	0
Bit 3:		S-0-0000: <no signal>	0
Bit 4:		S-0-0000: <no signal>	0
Bit 5:		S-0-0000: <no signal>	0
Bit 6:		S-0-0000: <no signal>	0
Bit 7:		S-0-0000: <no signal>	0
Bit 8:		S-0-0000: <no signal>	0
Bit 9:		S-0-0000: <no signal>	0
Bit 10:		S-0-0000: <no signal>	0
Bit 11:		S-0-0000: <no signal>	0
Bit 12:		S-0-0000: <no signal>	0
Bit 13:		S-0-0000: <no signal>	0
Bit 14:		S-0-0000: <no signal>	0
Bit 15:		S-0-0000: <no signal>	0

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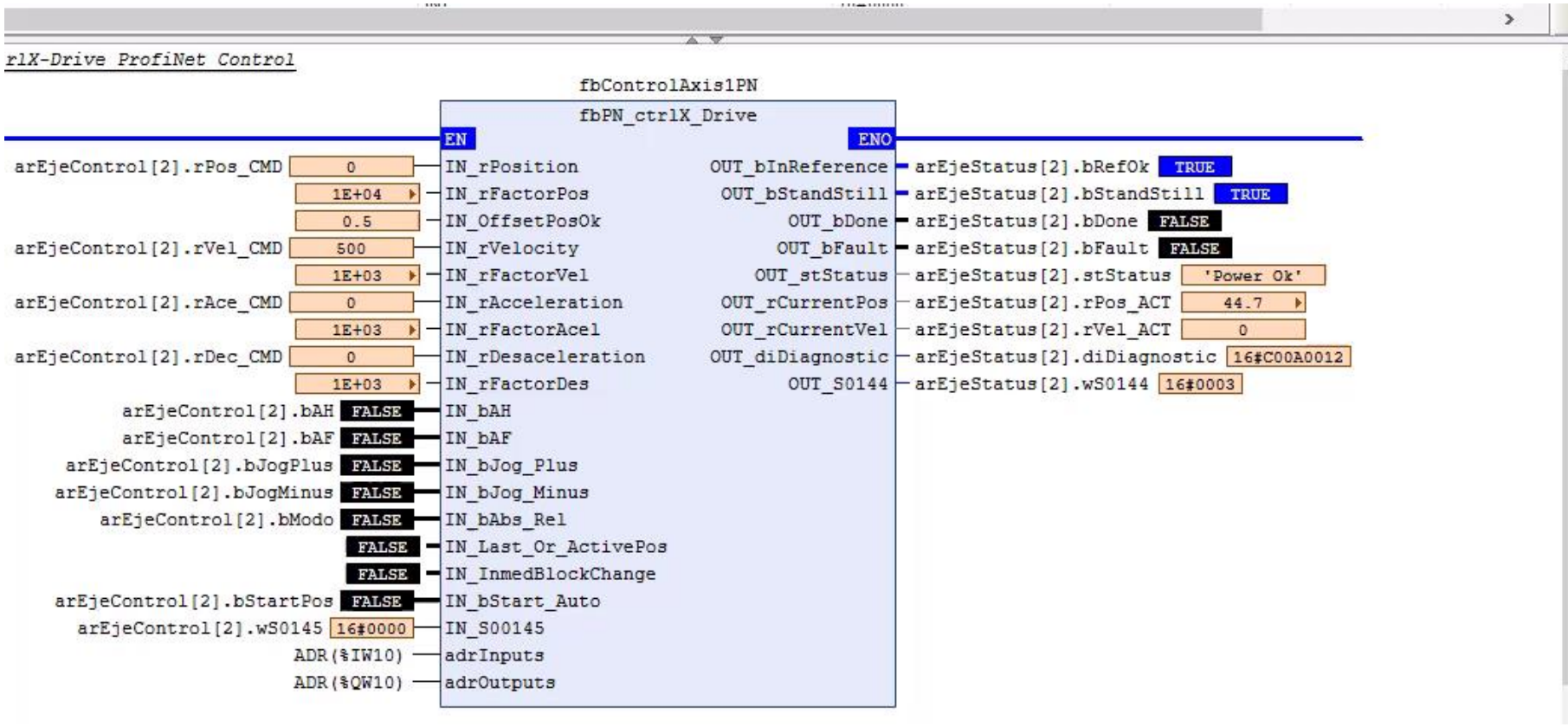
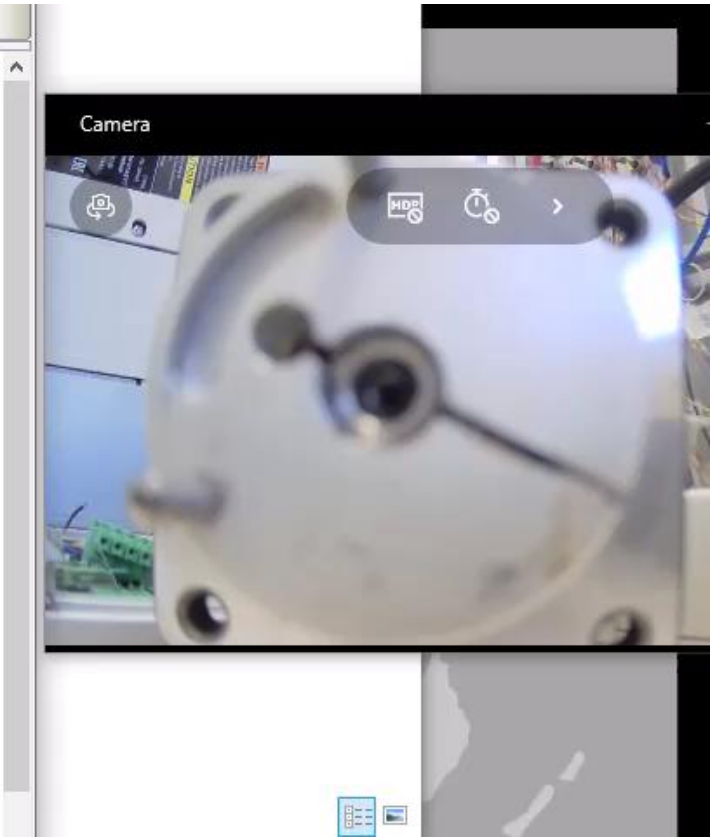
ctrlX-Drive - *Control in ProfiNet (Video Example)*





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Control on Profinet with TIA Portal

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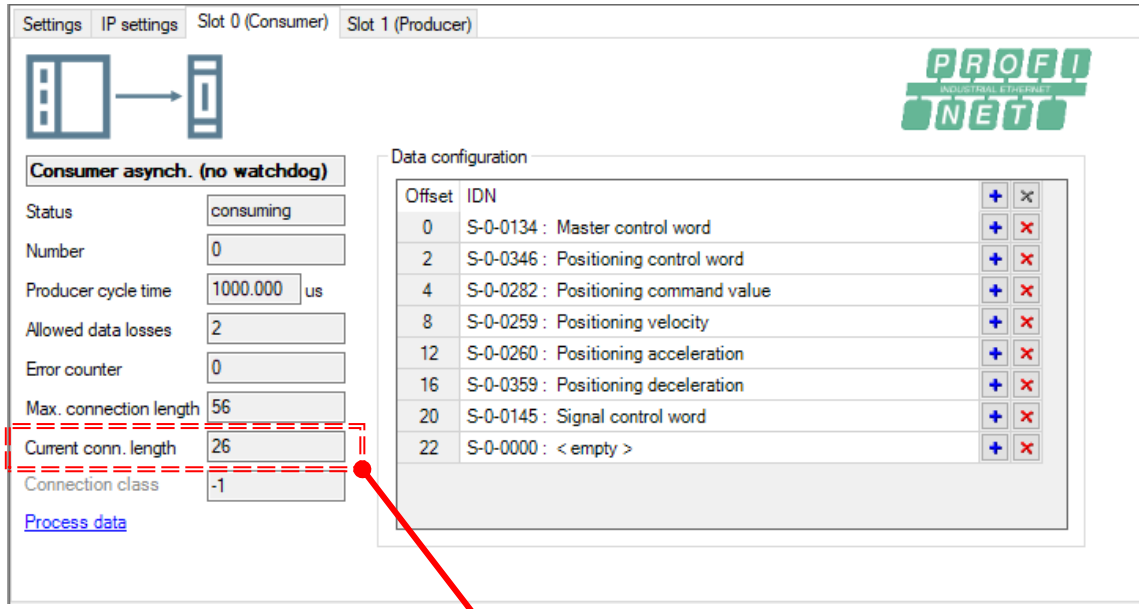
For the control of the axis through Tia Portal, we will use the same configuration in ctrlXdrive used previously for use with the XM

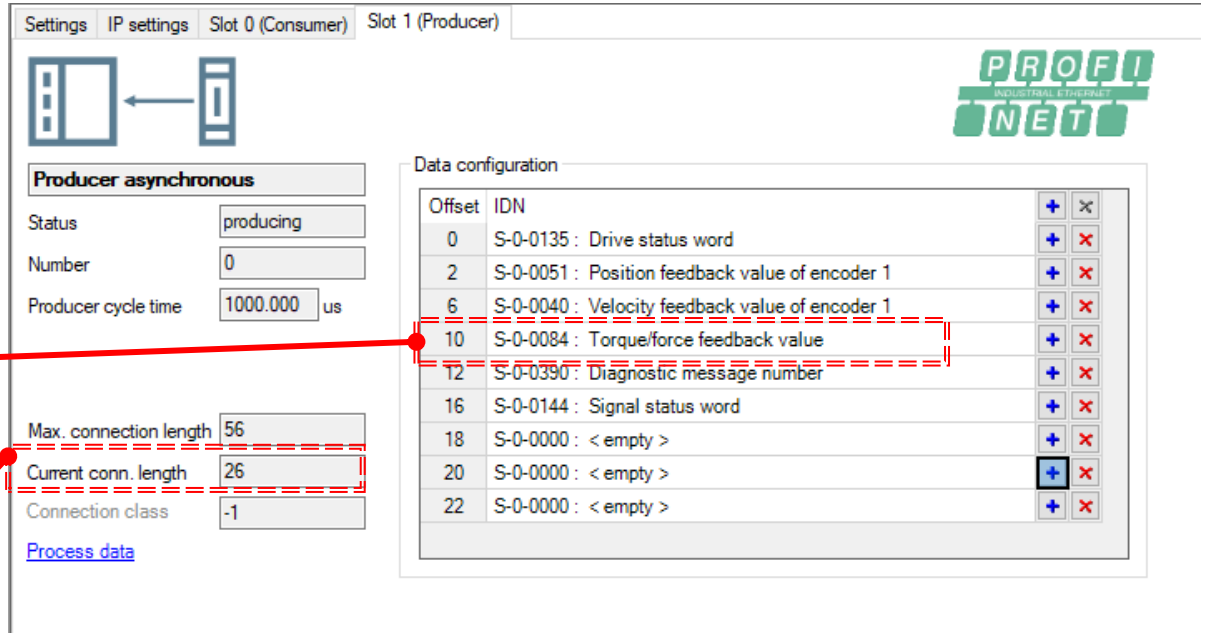
Configuration Slot 0 (Consumer)



In the example communication used in Tia Portal, the value of "Torque Feedback value" has been added

The size of the "Current Connection Length" is still maintained at 26 Bytes as can be seen in the image

Slot 1 Configuration (Producer)



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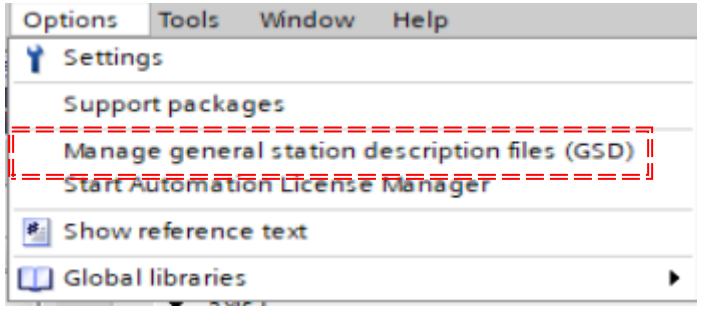
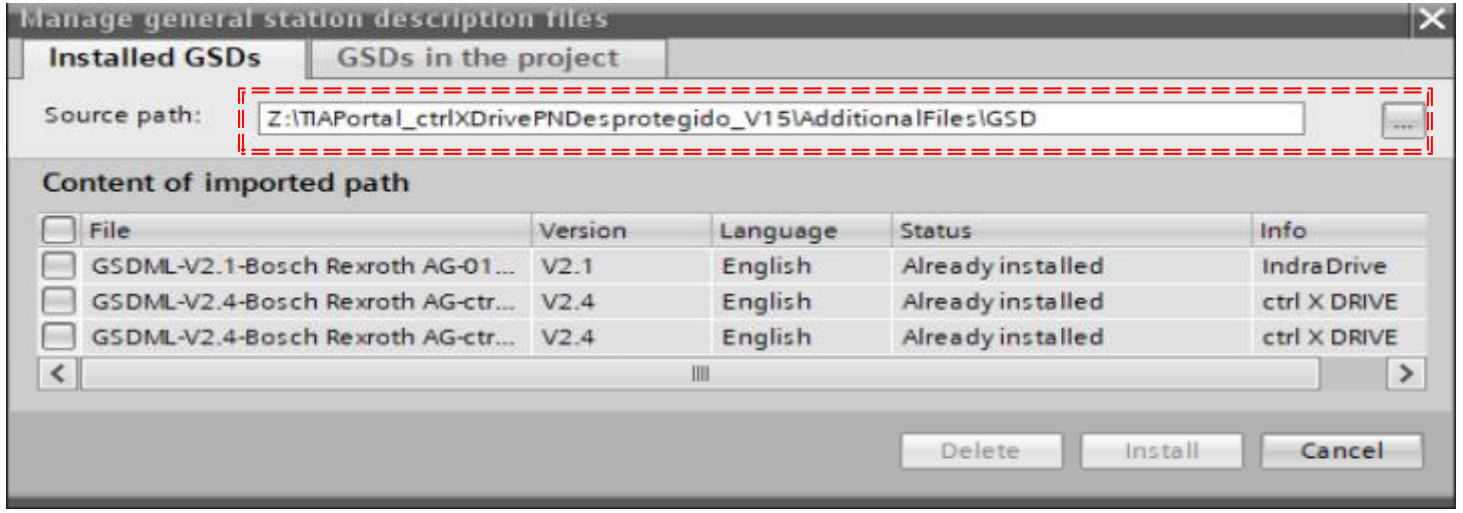
Logically, the first thing we must do is add the XML files to the system.

In the "Options" section select "Manage General Station Description Files"

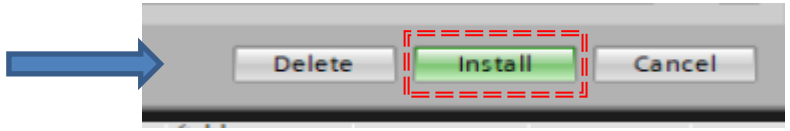


Then choose the path where we have saved the XML files



Select the files that we want to install, (in the example the two ctrlXDrive files were already installed

Press "Install"



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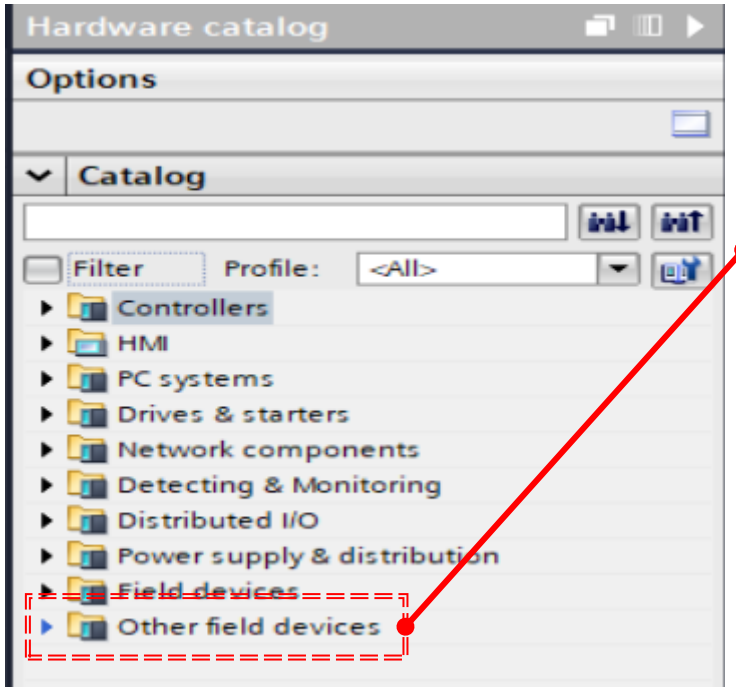
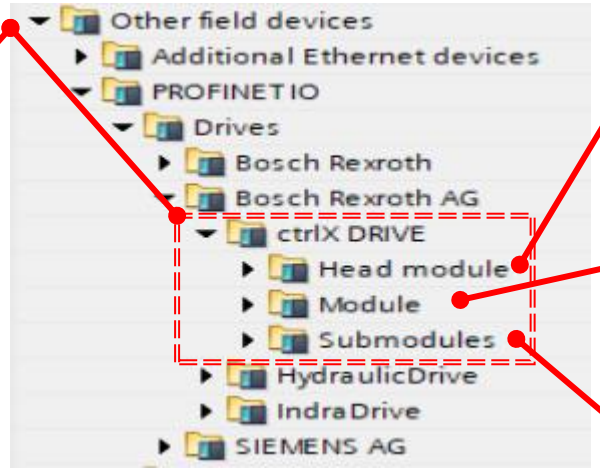
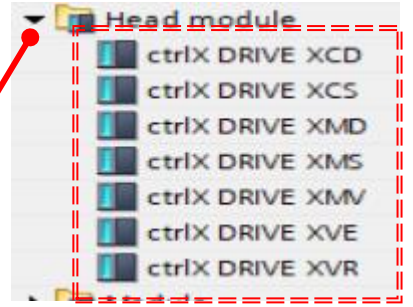
The inserted XML files should appear in the Hardware catalog

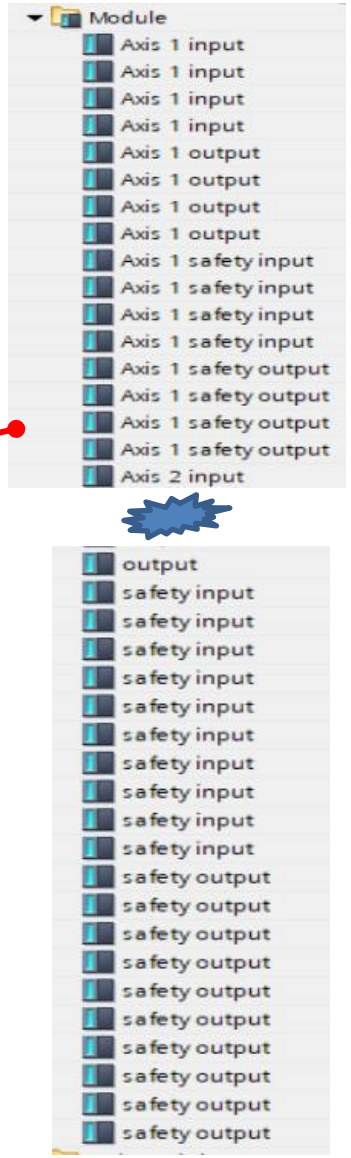




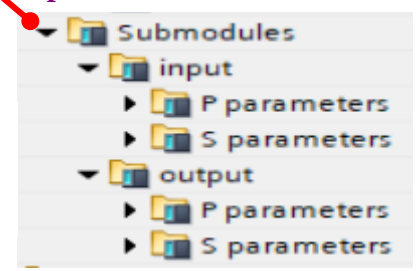
Available equipment



General modules



Submódulos para parametrización usuario



The submodules at the IO level allow the selection of the different parameters that we must use for communication

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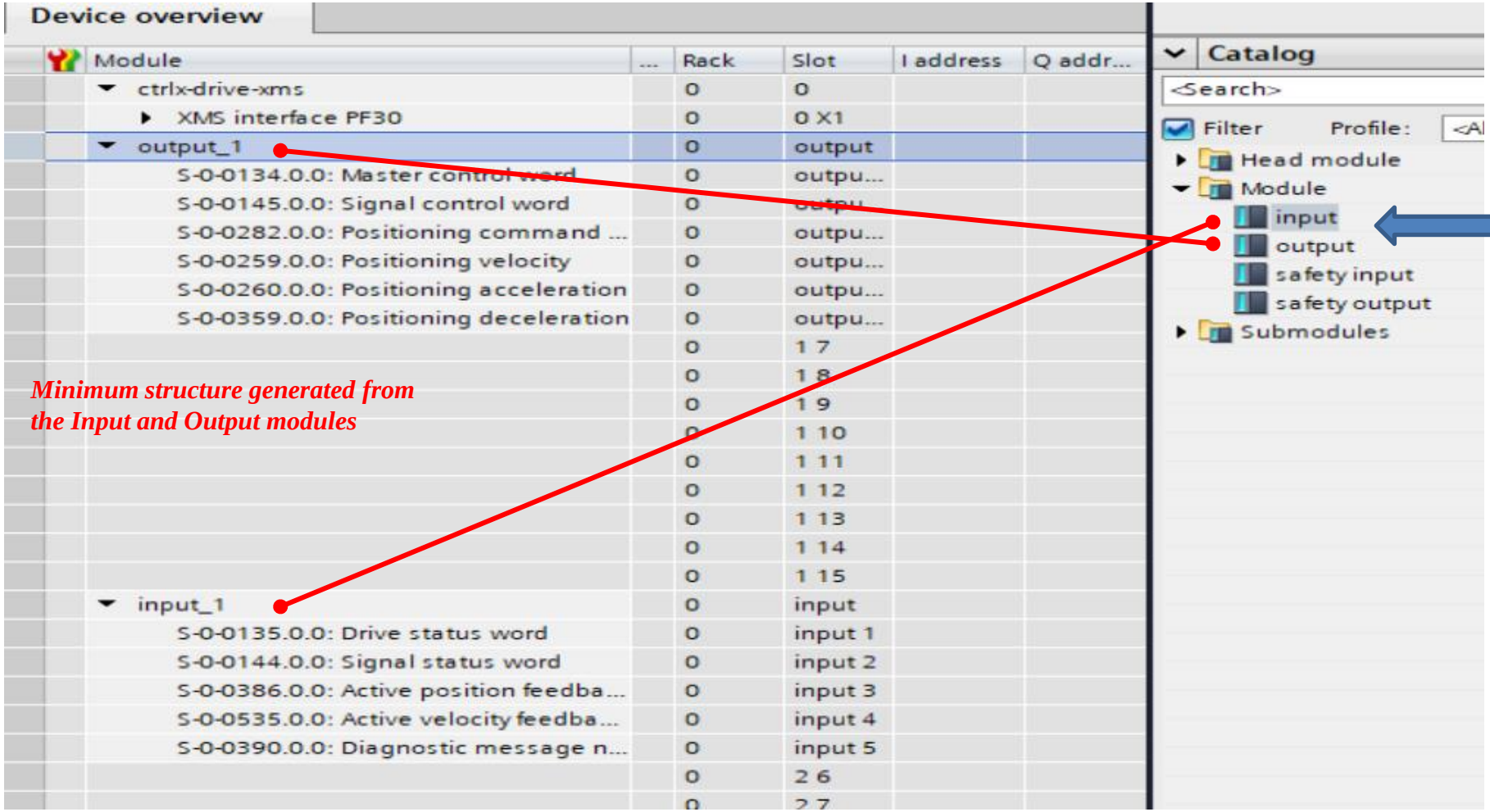
Once the ctrlXDrive of the desired type has been inserted, the module allows us to configure it according to what we want. In any case, there should always be an Outputs area and an Inputs area.



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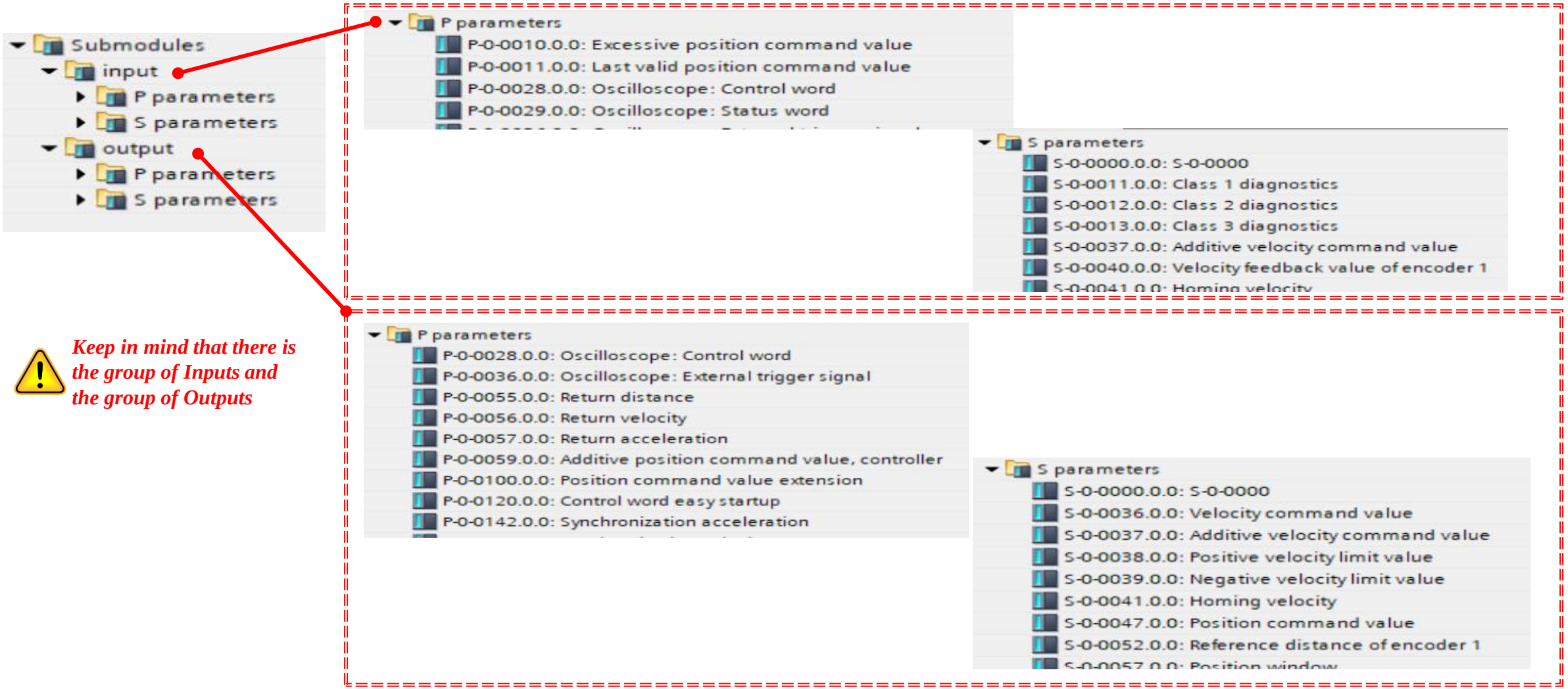
The addition of parameters by the user must be done from the "Submodule" option



Keep in mind that there is the group of Inputs and the group of Outputs

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In Device Owerview we assign the communication structures.

Device overview

Module	...	Rack	Slot	I address	Q address
axis1		0	0		
XMS interface PF30		0	0 X1		
output_1		0	output		
S-0-0134.0.0: Master control word		0	output 1		50...51
S-0-0346.0.0: Positioning control word		0	output 2		52...53
S-0-0282.0.0: Positioning command value		0	output 3		54...57
S-0-0259.0.0: Positioning velocity		0	output 4		58...61
S-0-0260.0.0: Positioning acceleration		0	output 5		62...65
S-0-0359.0.0: Positioning deceleration		0	output 6		66...69
S-0-0145.0.0: Signal control word		0	output 7		70...71
S-0-0000.0.0: S-0-0000		0	output 8		72...73
		0	1 9		
		0	1 10		
		0	1 11		
		0	1 12		
		0	1 13		
		0	1 14		
		0	1 15		
input_1		0	input		
S-0-0135.0.0: Drive status word		0	input 1	50...51	
S-0-0051.0.0: Position feedback value of encoder 1		0	input 2	52...55	
S-0-0040.0.0: Velocity feedback value of encoder 1		0	input 3	56...59	
S-0-0084.0.0: Torque/force feedback value		0	input 4	60...61	
S-0-0390.0.0: Diagnostic message number		0	input 5	62...65	
S-0-0144.0.0: Signal status word		0	input 6	66...67	
S-0-0000.0.0: S-0-0000		0	input 7	68...69	
S-0-0000.0.0: S-0-0000_1		0	input 8	70...71	
S-0-0000.0.0: S-0-0000_2		0	input 9	72...73	
		0	2 10		
		0	2 11		
		0	2 12		
		0	2 13		
		0	2 14		
		0	2 15		
		0	safety output		
		0	safety input		

Unlike in the case of XM, shown above, the I/O structures do not generate any type of offset, as can be seen in the I and Q assignments of the communication

These structures must correspond to those assigned in the ctrlXDrive configuration

Data configuration

Offset	IDN
0	S-0-0134 : Master control word
2	S-0-0346 : Positioning control word
4	S-0-0282 : Positioning command value
8	S-0-0259 : Positioning velocity
12	S-0-0260 : Positioning acceleration
16	S-0-0359 : Positioning deceleration
20	S-0-0145 : Signal control word
22	S-0-0000 : < empty >

Data configuration

Offset	IDN
0	S-0-0135 : Drive status word
2	S-0-0051 : Position feedback value of encoder 1
6	S-0-0040 : Velocity feedback value of encoder 1
10	S-0-0084 : Torque/force feedback value
12	S-0-0390 : Diagnostic message number
16	S-0-0144 : Signal status word
18	S-0-0000 : < empty >
20	S-0-0000 : < empty >
22	S-0-0000 : < empty >

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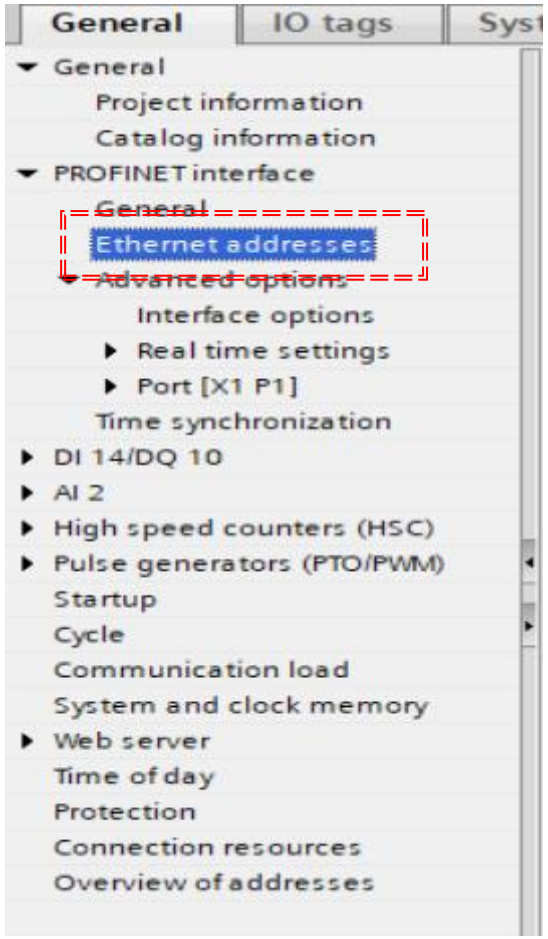
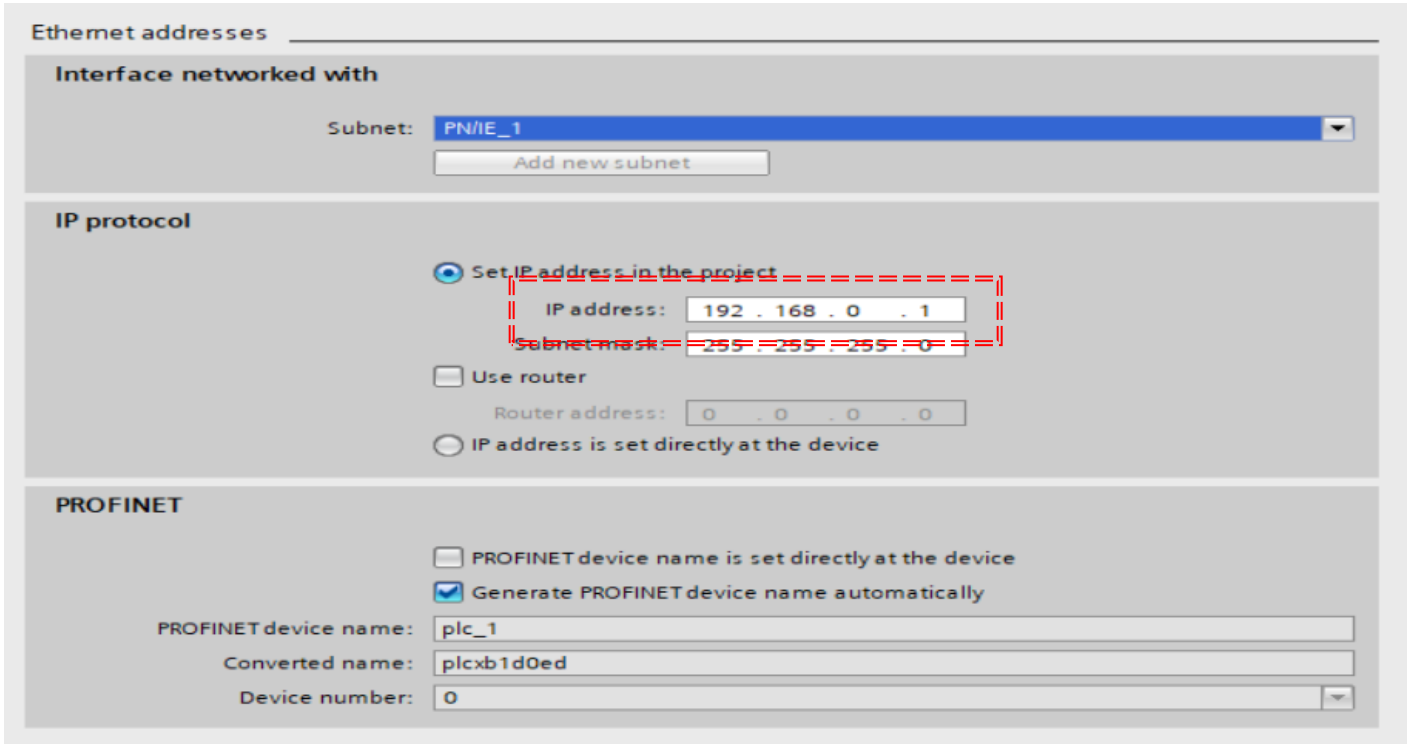
IP assignment of the Siemens CPU (in the example)





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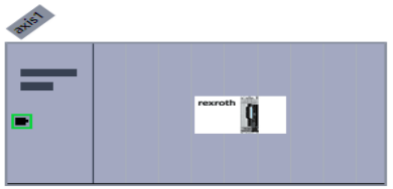
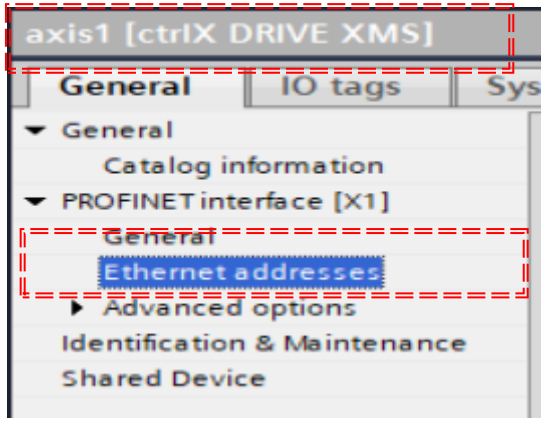
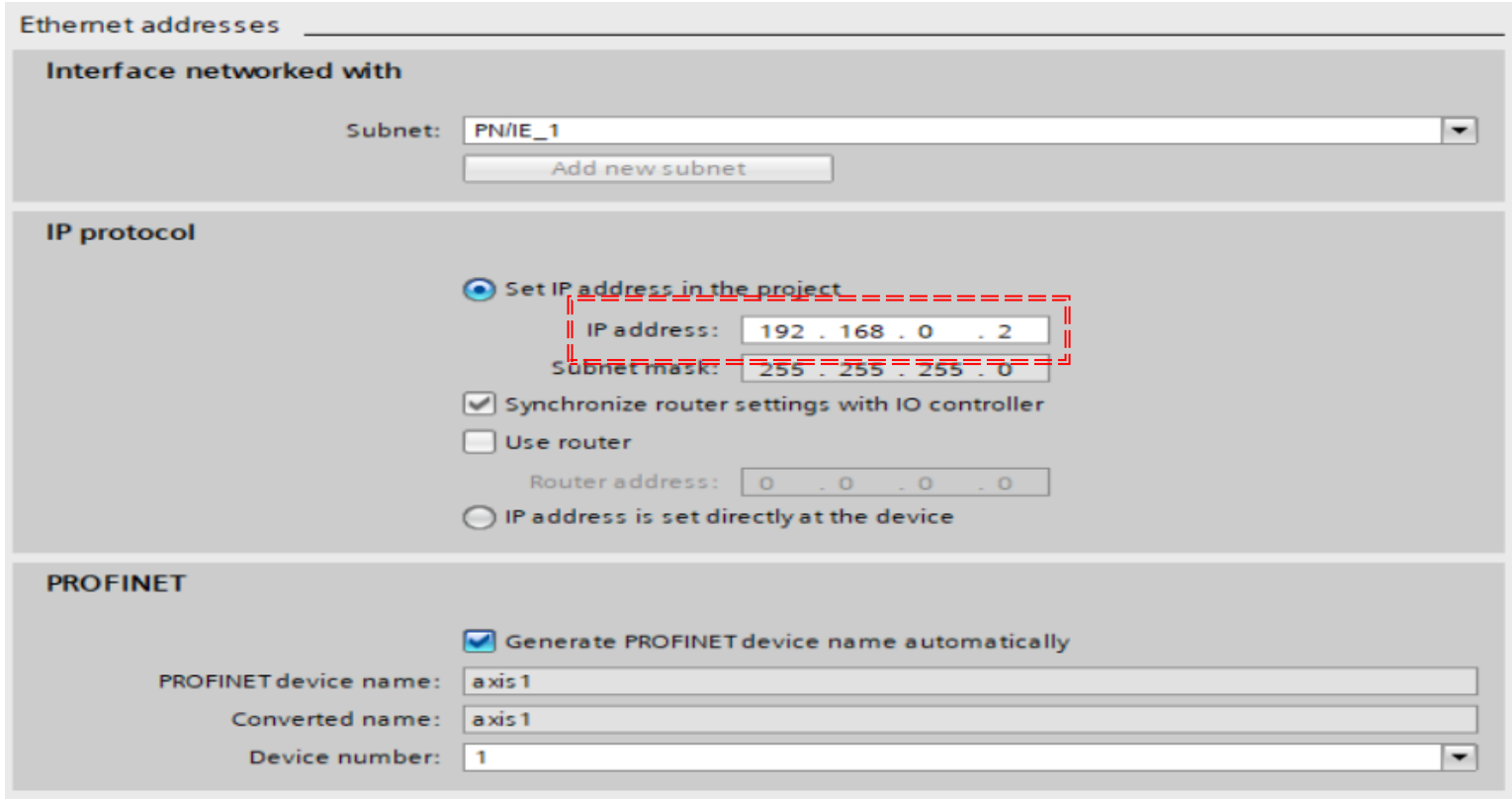
IP assignment for the axis of type ctrlDrive XMS







The assignment of the IP number in the ctrlXDrive is done automatically from the Tia Portal itself

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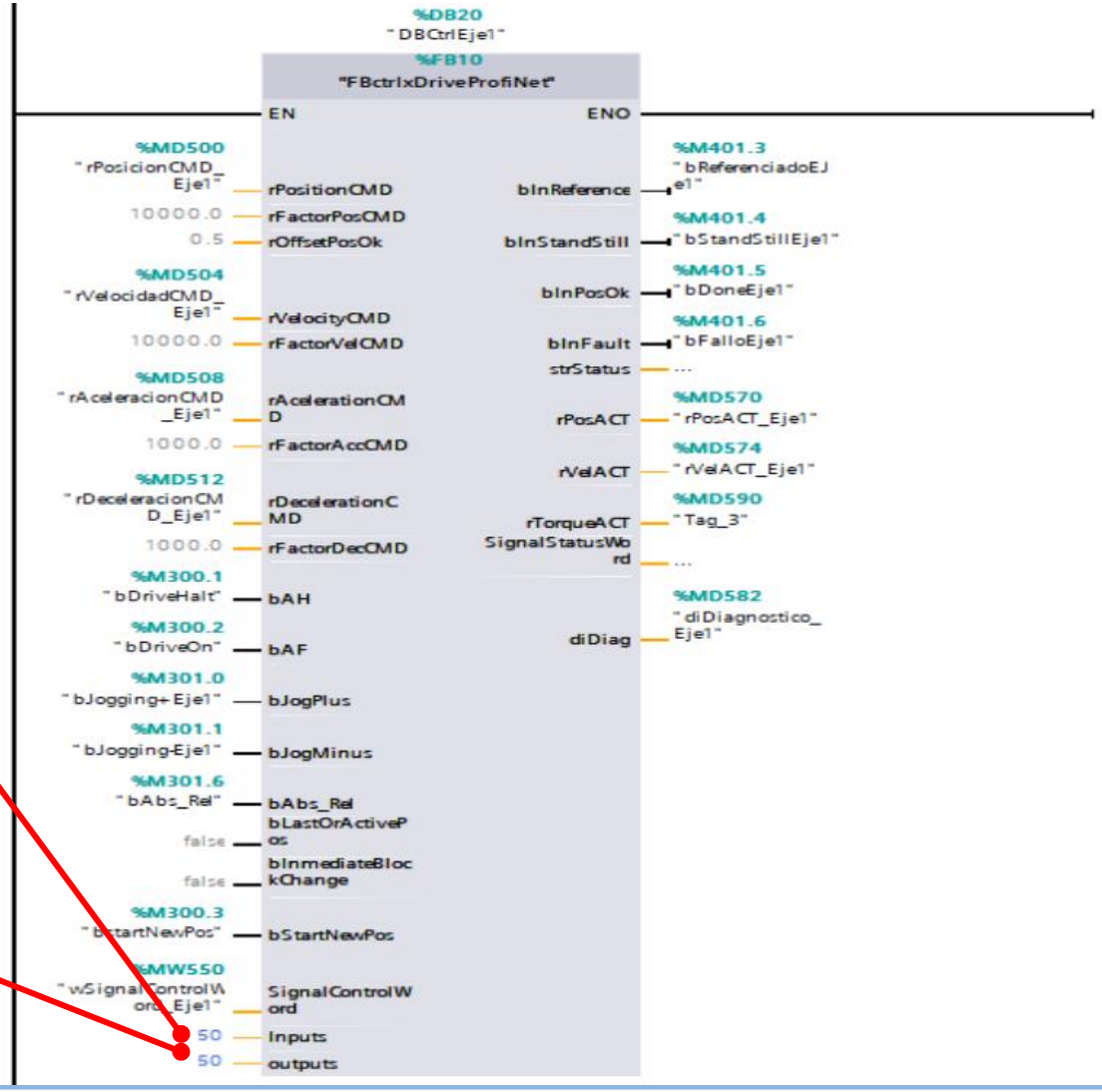
FB module for the control and status of ctrlXDrive in "Drive-Controller Positioning" mode

Similary to what happened in the control module used with Indracontrol XM, in this part we also use the initial area of the IO structures to extract the various parameters that are part of the communication. This simplifies the programming of the module.

input_1	
S-0-0135.0.0: Drive status word	50...51
S-0-0051.0.0: Position feedback value of encoder 1	52...55
S-0-0040.0.0: Velocity feedback value of encoder 1	56...59
S-0-0084.0.0: Torque/force feedback value	60...61
S-0-0390.0.0: Diagnostic message number	62...65
S-0-0144.0.0: Signal status word	66...67
S-0-0000.0.0: S-0-0000	68...69
S-0-0000.0.0: S-0-0000_1	70...71
S-0-0000.0.0: S-0-0000_2	72...73

output_1	
S-0-0134.0.0: Master control word	50...51
S-0-0346.0.0: Positioning control word	52...53
S-0-0282.0.0: Positioning command value	54...57
S-0-0259.0.0: Positioning velocity	58...61
S-0-0260.0.0: Positioning acceleration	62...65
S-0-0359.0.0: Positioning deceleration	66...69
S-0-0145.0.0: Signal control word	70...71
S-0-0000.0.0: S-0-0000	72...73



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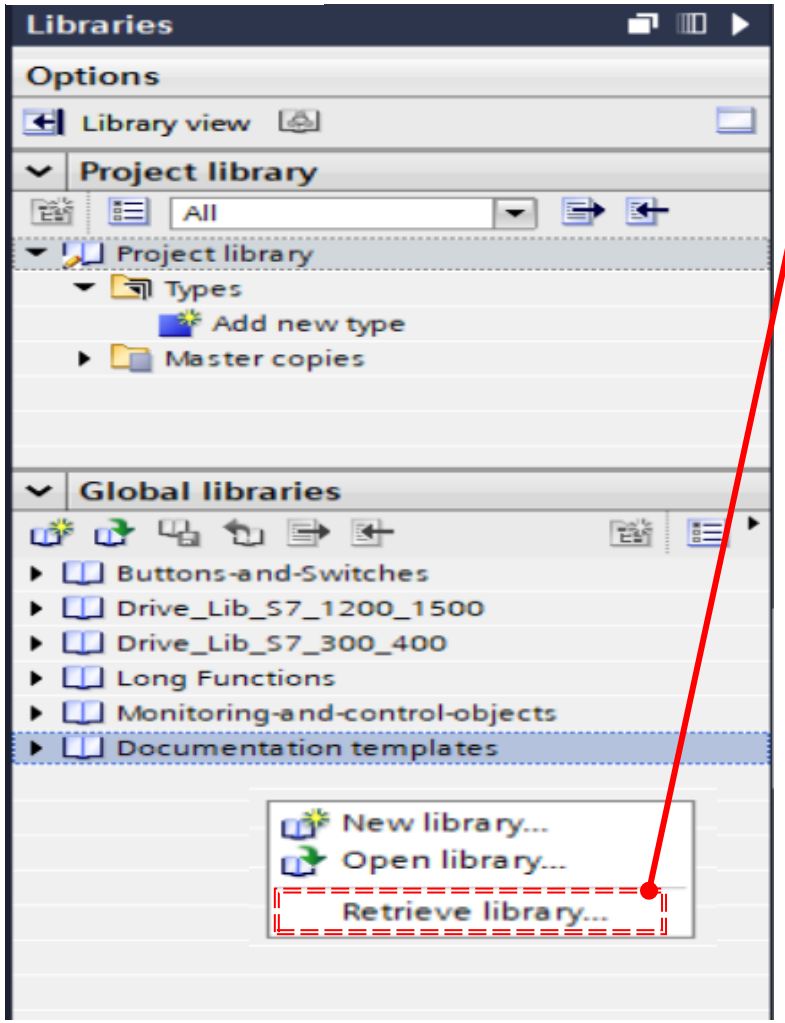
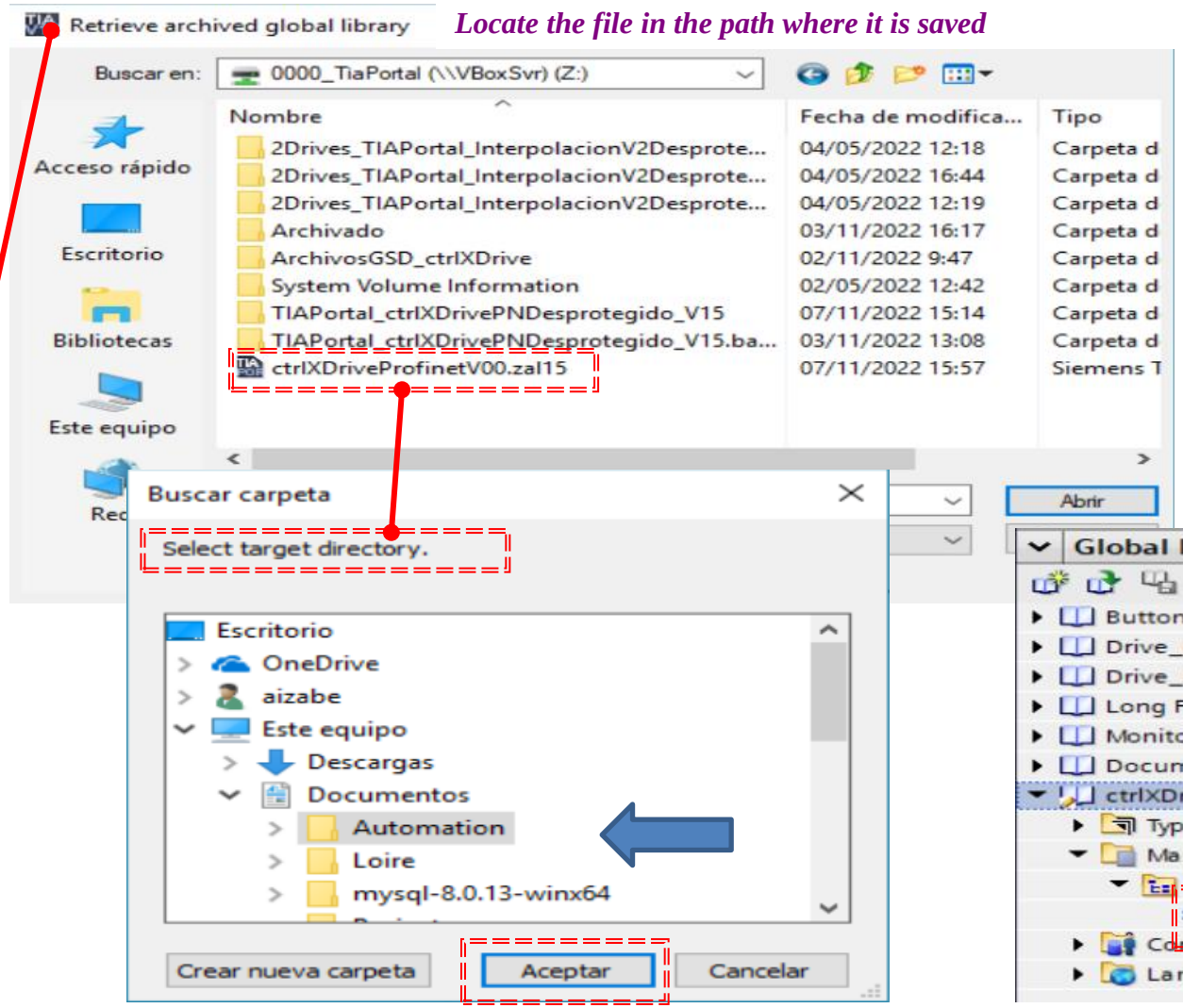
The first version of the control FB is in the generated library

ctrlXDriveProfinetV00.zal15

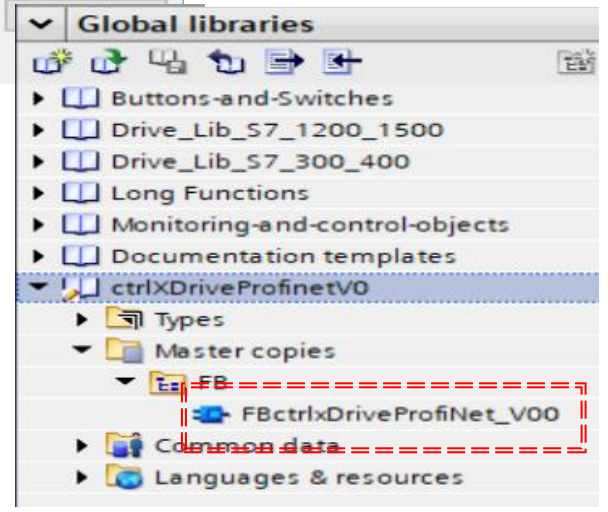
Install Library



Locate the file in the path where it is saved



Inserted library



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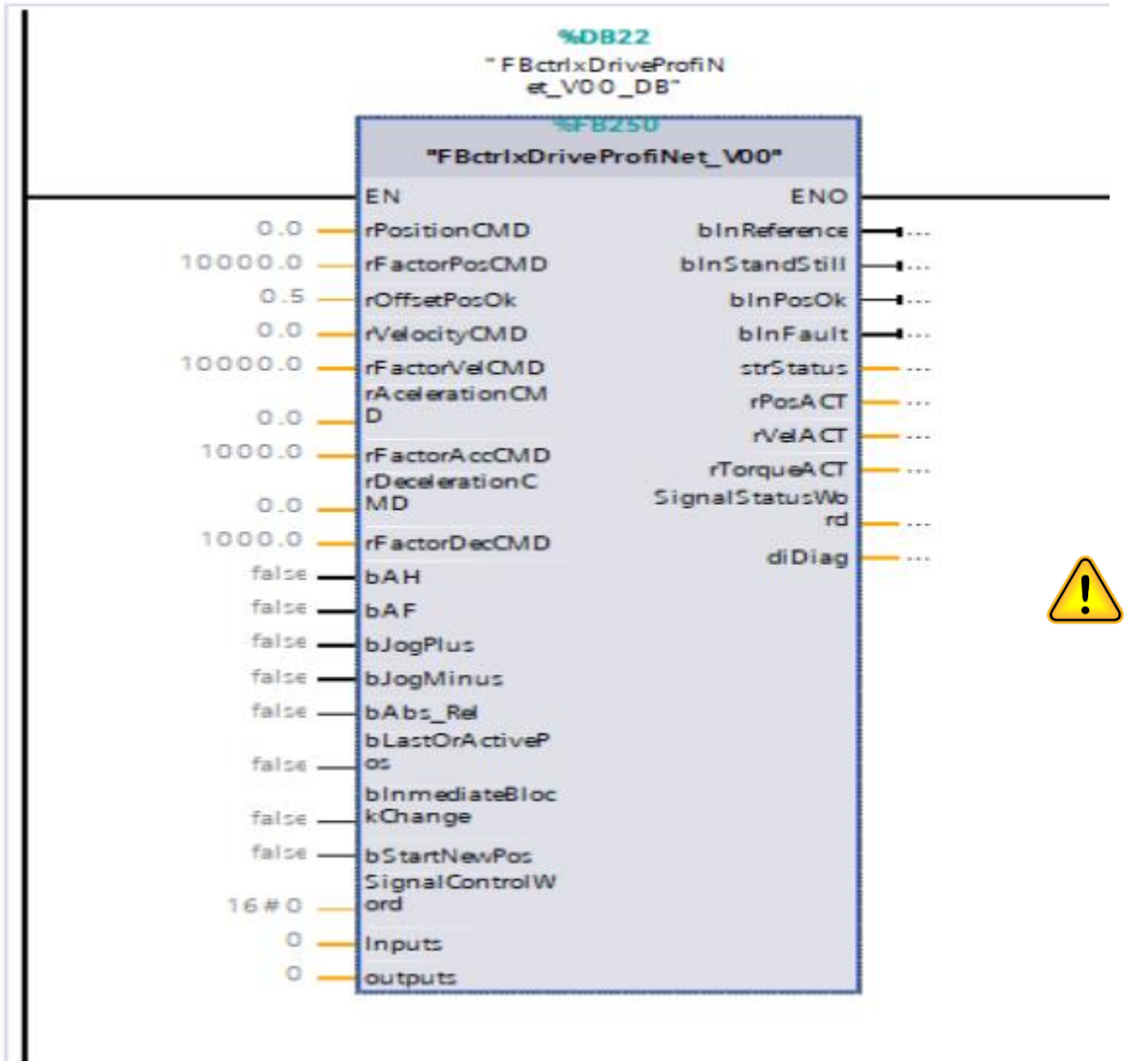
Library inserted in the project



The library containing this fb is generated with version 15 of TIA Portal

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Thanks for your attention

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