Instruction Manual
XENAX® PROFINET® and SIMATIC® with Motion control functionality

Version 3.0.5

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XENAX® Ethernet servo controller with PROFINET® Busmodul

Functional Safety, TÜV certified
Force processes with „Force Limitation“, „Force Monitoring“ and „Force Control“

General

This manual describes the connection of a XENAX® Xvi75V8/S and XENAX® Xvi48V8 Servo controller to a Siemens SIMATIC PLC TIA Portal V15 with motion control functionality.

This document contains an example of the configuration, program integration and test run.

Contents

1 Development Environment

1.1 Siemens

1.1.1 TIA Portal V15

TIA Portal V15 can be used for programming the SIMACTIC S7 PLC Family from Siemens.

This instruction manual and the example application have been created with TIA Portal V15. The creation of a project and the configuration of the hardware will be explained step by step at the end of this document with the help of an example application.

1.1.2 SIMATIC PLC

The XENAX® servo controller Xvi with PROFINET bus module can be connected to any SIMATIC PLC of the S7 family with a PROFINET I/O interface which supports the extended PROFINET diagnosis.

This instruction manual and the example projects were created for a SIMATIC CPU1511-1 PN (6ES7 511-1AK01-0AB0).

In case you are using another SIMATIC PLC, the hardware configuration has to be adjusted to suit its requirements.

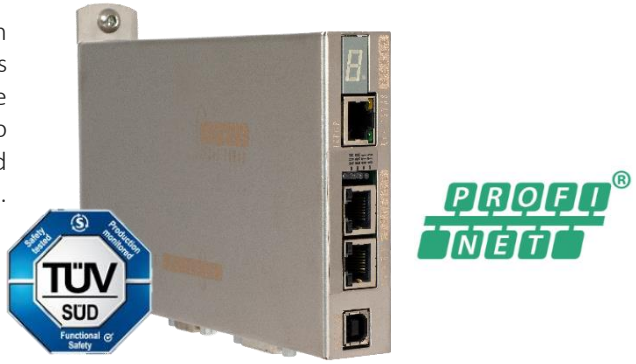
1.1.3 PROFIdrive

The PROFIdrive profile is the application profile for motion control based on PROFIBUS and PROFINET. As a supplier-independent drive profile the PROFIdrive profile covers all industrially relevant applications.

1.2 Jenny Science

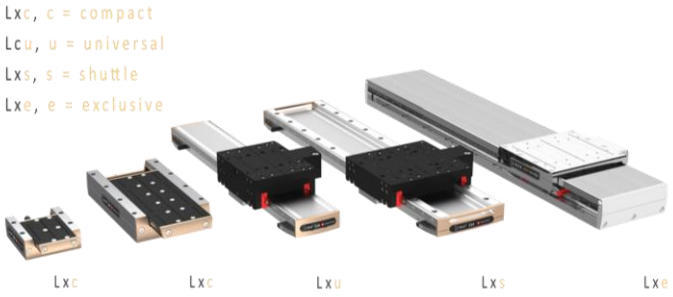
1.2.1 XENAX® servo controller

XENAX® servo controller for Jenny Science Axis with integrated Profinet bus module. The bus module is optional but it is required for this application. One XENAX® can control one axis. The XENAX® servo controller recognises all Jenny Science motors and configures the parameters correctly.



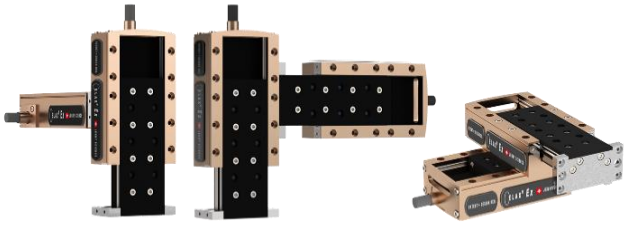
1.2.2 LINAX® Linear motors

The LINAX® linear motor axes are highly modular and can be flexibly combined amongst each other. Four different series are available.



1.2.3 ELAX® Linear motor slides

Specifically designed for handling and Pick and Place tasks with strokes from 30mm up to 150mm. The configuration is extremely modular and there is only one cable to the XENAX® servo controller.



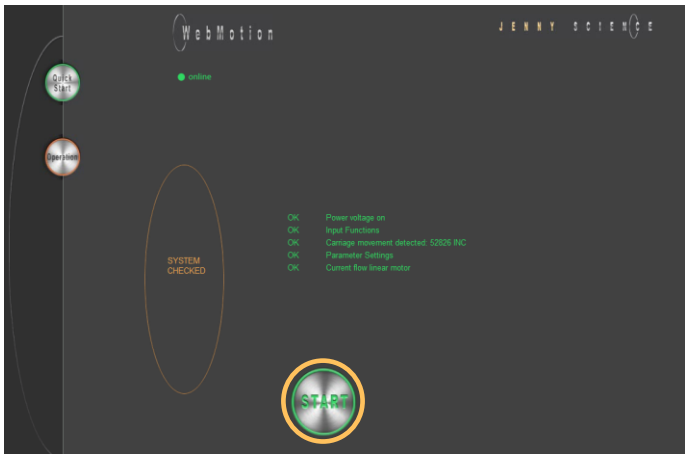
1.2.4 ROTAX® Rotary motor axes

Specifically designed for fast and precise assembly and handling tasks. It can be equipped with standard gripping tools which enables a 360° rotation and has a hollow shaft feedthrough for vacuum or compressed air.

Rxvp = vacuum pressure
Rxhq = high torque

1.2.5 WebMotion®

This is the graphical user interface from Jenny Science. It is stored in the embedded Web server of the XENAX® servo controller.
WebMotion® is launched with a web browser by entering the corresponding TCP/IP address of XENAX®.
LINAX® linear motor axes, ELAX® linear motor slides or ROTAX® rotary motor axes are automatically recognized. The corresponding controller parameters are saved and loaded automatically. With the Quick Start button, the linear motors can operate immediately. No user manual is needed.



Before the XENAX® controller can be used with the SIMATIC PLC via PROFINET, a set-up must be made via WebMotion®. This includes the set-up of a payload, soft limits, etc.
For further information on the set-up of a linear motor axis please refer to the instruction manual or the tutorial video that can be found on www.jennyscience.ch.

1.3 Status LED's of PROFINET bus module

LED Status	RUN	ERR (BF)	ST1 (State 1)	ST2 (State 2)
<OFF>	Initialisation state or no power	-	-	-
<ON>	Bus module correctly started	No connection to a PLC	Firmware CRC check during a bus module update	Bootloader active
<BLINK>	-	-	-	Node flash test active/ Firmware update active

1.4 Additional Material

The following data is needed for a successful operation of the XENAX® servo controller with a PROFINET bus module:

Filename	Description
JSC_GSD_PROFINET	Jenny Science GSD-file for the HW-configuration in TIA Portal. The GSD-file can be downloaded on your website www.jennyscience.ch „XENAX® Servocontroller" and „Firmware Bus Module"
Drive_Lib.zip	For the S7-1500 CPU series there are two Siemens FBs (SINA_PARA_S and SINA_PARA) which can be used for acyclic parameter reading/writing from the XENAX®. The newest Version can be downloaded from Siemens.
SINAMICS_Blocks_TIAP_V14.pdf	Description of the DriveLib function blocks (SINA_PARA_S / SINA_PARA)
JSC_PROFIdrive_Parameter.pdf	Description of all available PROFIdrive parameters for the XENAX® servo controller with PROFINET bus module

2 PROFIdrive

The drive profile PROFIdrive describes the drive interface from the perspective of the control application as well as its mapping to the communication system. PROFIdrive is available for PROFIBUS and PROFINET. PROFIdrive covers the scenarios from straightforward frequency converters to highly dynamic servo-controls in six application classes. The XENAX® Xvi with PROFINET bus module supports the application class AC3 basic positioner with the PROFIdrive standard telegram 9 and the application class AC4 (with DSC) central interpolation with PROFIdrive standard telegram 5.

2.1 Telegram 5, PROFIdrive standard

The cyclic data between the PLC and the XENAX® servo controller is exchanged through the PROFIdrive standard telegram 5. The telegram 5 is designed for drives with “Dynamic Servo Control” DSC support. The telegram is set up as follows:

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW0	0 - 1	STW1
%QW2 & %QW4	2 - 5	NSOLL_B
%QW6	6 - 7	STW2
%QW8	8 - 9	G1_STW
%QW10 & %QW12	10 - 13	XERR
%QW14 & %QW16	14 - 17	KPC

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW0	0 - 1	ZSW1
%IW2 & %IW4	2 - 5	NIST_B
%IW6	6 - 7	ZSW2
%IW8	8 - 9	G1_ZSW
%IW10 & %IW12	10 - 13	G1_XIST1
%IW14 & %IW16	14 - 17	G1_XIST2

2.1.1 STW1 (Control Word 1)

Bit	Symbolic name	Comment
0	OFF1	0 = OFF 1 = ON
1	OFF2	0 = Coast Stop 1 = No Coast Stop
2	OFF3	0 = Quick Stop 1 = No Quick Stop
3	Enable operation	0 = Inhibit operation 1 = Enable operation
4	Enable ramp generator	Not relevant for the XENAX®
5	Unfreeze ramp generator	Not relevant for the XENAX®
6	Enable setpoint	Not relevant for the XENAX®
7	Fault acknowledge	Fault Acknowledge, positive edge
8	Jog-1	Jog 1
9	Jog-2	Jog 2
10	Control via PLC	1 = Control via PLC
11	Device-specific	Not relevant for the XENAX®
12-15	Reserved	Reserved

2.1.2 ZSW1 (Status Word 1)

Bit	Symbolic name	Comment
0	Ready to Switch On	1 = Ready for servo on
1	Ready to Operate	1 = Ready for operation
2	Operation Status	1 = Operation Enabled
3	Fault present	1 = Fault present
4	No coast down active	1 = No coast down active (OFF2 inactive)
5	No quick stop active	1 = No quick stop active (OFF3 inactive)
6	Switching on inhibited	1 = Switching on inhibited active
7	Warning	1 = Warning present
8	Speed setpoint - Error within tolerance	1 = Speed setpoint – actual value deviation within tolerance range (not supported)
9	Control requested	1 = Control requested
10	Setpoint reached or exceeded	1 = Target Position Reached
11-15	Device-specific	Not relevant for the XENAX®

2.1.3 STW2 (Control Word 2)

Bit	Symbolic name	Comment
0-11	Device-specific	Not relevant for the XENAX®
12-15	Controller Sign-Of-Life	Controller Sign-Of-Life Bit0-3

2.1.4 ZSW2 (Status Word 2)

Bit	Symbolic name	Comment
0-9	Device-specific	Not relevant for the XENAX®
10	Pulses enabled	Power stage enabled
12-15	DO Sign-Of-Life	XENAX® Sign-of-Life Bit0-3

2.1.5 G1_STW

Bit	Symbolic name	Comment
0-7	Device-specific	Not relevant for the XENAX®
8-12	Reserved	Reserved
13	Request absolute value cyclically	Request of additional cyclic transmission of the absolute actual position in Gx_XIST2.
14	Activate parking sensor	Request to switch off monitoring of the measuring system and the actual value measurements in the drive.
15	Acknowledging a sensor error	Request to reset a sensor error (Gx_ZSW, bit 15)

2.1.6 G1_ZSW

Bit	Symbolic name	Comment
0-12	Device-specific	Not relevant for the XENAX®
13	Transmit absolute value cyclically	Indication of cyclic transmission of the absolute position in Gx_XIST2.
14	Parking sensor active	Acknowledgement for “activate parking sensor” (Gx_STW, bit 14)
15	Sensor error	Signalises a sensor error or an error in the actual value measurement.

2.1.7 Set Point/Actual Values

Signal	Description	Unit	Datatyp
NSOLL_B	Speed setpoint B (disabled by default XENAX®)	inc	Integer 32
NIST_B	Speed actual value B (calculated)	inc/s	Integer 32
XERR	System deviation	inc	Integer 32
KPC	Position controller, gain factor (Not supported by the XENAX® but must be >= 1)		Integer 32
G1_XIST1	Sensor 1 position actual value 1	inc	Integer 32
G2_XIST2	Sensor 1 position actual value 2 or error code	inc	Integer 32

The new target position for the XENAX® is calculated internally with actual position + XERR.

2.1.8 Offset Adjustment

The absolute value G1_XIST2 of the telegram 5 has an offset of 100000 Inc. This offset has to be set for each axis once after referencing. In the demo project the function block “JS_MC_Reference” sets the offset correctly.

2.2 Supplementary Data

To get more data form the XENAX® Xvi for an optimal use of the “Force process” and the “Functional Safety SMU” functionality you can configure supplementary Data in Slot 1, Subslot 3 (Possible with PROFINET Firmware >= v1.81).

The example projects show how to use the supplementary data.

The following supplementary Data packets are available.

Parameters	Supplementary data 1	Supplementary data 2	Supplementary data 3	Supplementary data 4	Supplementary data 5	Supplementary data 6
Output Data, PLC -> Drive						
Limit I_Force	x		x	x	x	x
Limit Force				x	x	
Following Position Error Window	x			x		x
Target Position Window	x			x		x
S-Curve				x		x
Digital Output	x	x		x		
Input Data, Drive -> PLC						
Motor Current Actual Value	x			x		x
I_Force Actual	x		x	x	x	x
Force Actual				x	x	
Process Status Register	x	x	x	x	x	x
Actual Position Following Error	x			x		x
Digital Input	x	x		x		
Digital Output	x	x		x		

2.2.1 Supplementary data 1

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW18	18 - 19	Limit I_Force
%QW20 & %QW22	20 - 23	Following Pos Error Window
%QW24 & %QW26	24 - 27	Target Position Window
%QW28 & %QW30	28 - 31	Digital Output

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW18	18 - 19	Motor Current Actual Value
%IW20 & %IW22	20 - 23	I_Force Actual
%IW24 & %IW26	24 - 27	Process Status Register
%IW28 & %IW30	28 - 31	Actual Position Following Error
%IW32 & %IW34	32 - 35	Digital Input
%IW36 & %IW38	36 - 39	Digital Output

2.2.2 Supplementary data 2

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW18 & %QW20	18 - 21	Digital Output

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW18 & %IW20	18 - 21	Process Status Register
%IW22 & %IW24	22 - 25	Digital Input
%IW26 & %IW28	26 - 29	Digital Output

2.2.3 Supplementary data 3

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW18	18 - 19	Limit I_Force

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW18 & %IW20	18 - 21	I_Force Actual
%IW22 & %IW24	22 - 25	Process Status Register

2.2.4 Supplementary data 4

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW18	18 - 19	Limit I_Force
%QW20 & %QW22	20 - 23	Limit Force
%QW24 & %QW26	24 - 27	S-Curve
%QW28 & %QW30	28 - 31	Following Pos Error Window
%QW32 & %QW34	32 - 37	Target Position Window
%QW36 & %QW38	36 - 41	Digital Output

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW18	18 - 19	Motor Current Actual Value
%IW20 & %IW22	20 - 23	I_Force Actual
%IW24 & %IW26	24 - 27	Force Actual
%IW28 & %IW30	28 - 31	Process Status Register
%IW32 & %IW34	32 - 35	Actual Position Following Error
%IW36 & %IW38	36 - 39	Digital Input
%IW40 & %IW42	40 - 43	Digital Output

2.2.5 Supplementary data 5

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW18	18 - 19	Limit I_Force
%QW20 & %QW22	20 - 23	Limit Force

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW18 & %IW20	18 - 21	I_Force Actual
%IW22 & %IW24	22 - 25	Force Actual
%IW26 & %IW28	26 - 29	Process Status Register

2.2.1 Supplementary data 6

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW18	18 - 19	Limit I_Force
%QW28 & %QW30	20 – 23	Following Pos Error Window
%QW32 & %QW34	24 - 27	Target Position Window

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW18	18 - 19	Motor Current Actual Value
%IW28 & %IW30	20 – 23	Process Status Register
%IW32 & %IW34	24 - 27	Actual Position Following Error

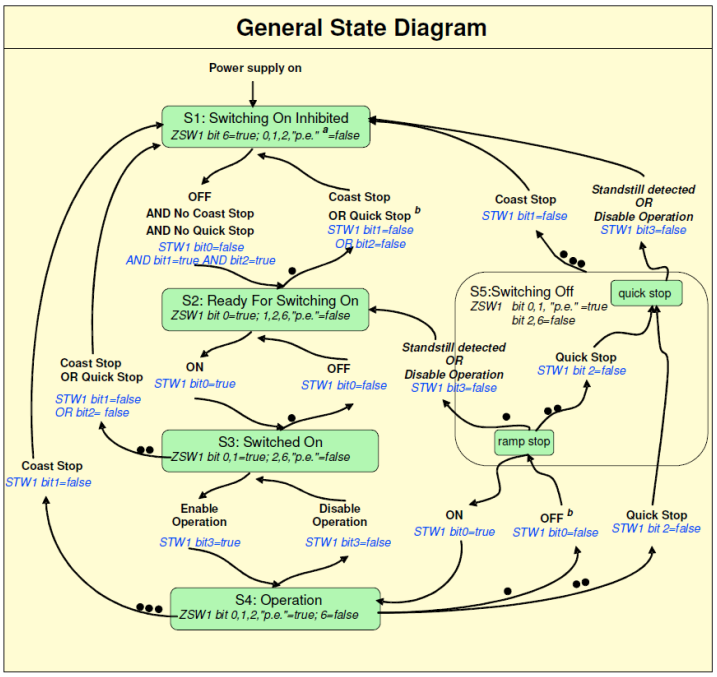
Use the available data types from the library according to the selected Supplementary data.

2.2.2 Signal Description

Signal	Description	Unit	Datatyp
Limit I_Force	Force limited by limiting the axis current	10 mA	Unsigned 16
Limit Force	Force limited by measuring Force with an external force sensor	mN	Unsigned 32
Following Position Error Window	Maximum position deviation in encoder increments („DP“ ASCII Command)	inc	Unsigned 32
Target Position Window	Permissible deviation in target point („DTP“ ASCII Command)	inc	Unsigned 32
Digital Output	Digital Outputs set, read Bit 0-15 = not used Bit 16-23 = Digital outputs XENAX® 1-8 Bit 24-31 = not used	-	DWORD (Unsigned 32)
Motor Current Actual Value	Actual not filtered motor current	mA	Integer 16
I_Force Actual	Force proportional axis current value filtered	mA	Integer 32
Force Actual	Force measured by external force sensor	mN	Integer 32
Process Status Register	Process Status Register XENAX („TPSR“ ASCII Command)	-	DWORD (Unsigned 32)
Actual Position Following Error	Actual position deviation	inc	Integer 32
Digital Input	Digital Inputs read Bit 0 = Limit switch negative (LS-, Input Function) Bit 1 = Limit switch positive (LS+, Input Function) Bit 2 = not used Bit 3 = Emergency Exit (EE/EE_1, Input Function) Bit 16-28 = Digital inputs XENAX® 1-12 Bit 29-31 = not used	-	DWORD (Unsigned 32)
S-Curve	S-Curve specifies the smoothness of an S-Curve 1-100% during the acceleration and deceleration part. Higher values result in a smoother curve and thus a lower Jerk. The default is 20%.	%	Integer 32

2.3 General State Machine

The basic state machine has to be set to “State S4 Operation” in order to turn on the power stage of the XENAX® Xvi and to be able to move the LINAX® linear motor axis.
Via “STW1” the basic state machine can be switched to each individual state. The current state is visible in “ZSW1”. Normally the PLC will control the “STW1” and you have no permission to manipulate the “STW1”.



2.4 Parameter

PROFIdrive offers the possibility to parameterize the XENAX® servo controller or to read certain values via acyclic data exchange.
These provided parameters correspond to the ASCII command set of the XENAX Furthermore, specific PROFIdrive parameters are available. All supported parameters can be found in the document *“PROFIdrive Parameter Jenny Science”* which is attached to this manual.

The S7-1500 family employs two different function blocks for cyclic communication as well as another block for acyclic communication.

CPU	Telegram	Cyclic communication	Acyclic communication
S7_15xx	5	DPRD_DAT & DPWR_DAT	SINA_PARA_S or SINA_PARA

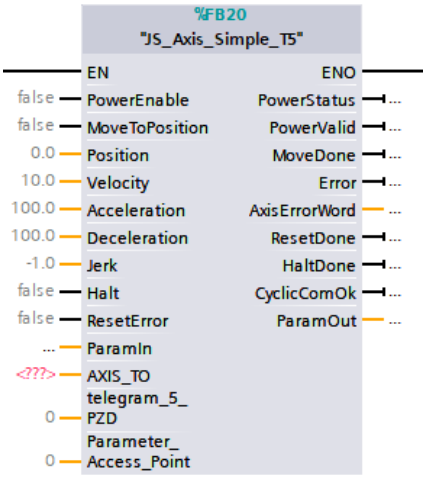
3 JennyScience MotionControl Library

3.1 JennyScience AxisFunctionBlocks

3.1.1 JS_Axis_Simple_T5

Inputs	
PowerEnable	Enables or disables power stage
MoveToPosition	Move to position on positive edge
Position	Target position [mm]
Velocity	Max. velocity [mm/s]
Acceleration	Max. acceleration [mm/s^2]
Deceleration	Max. deceleration [mm/s^2]
Jerk	Max. change of acceleration [mm/s^3]
Halt	Calls MC_Halt
ResetError	Acknowledge error
ParamIn.Nr	Parameter Number of Param. access Interface [dec]
ParamIn.Index	0 for non string parameters Character index of string parameter
ParamIn.ValueWrite	Value to write of Param. access Interface [dec]
ParamIn.Write	1 = Write, 0 = Read of Param. access Interface
ParamIn.Start	Execute on positive edge of Param. access Interface
AXIS_TO	Reference to TO_PositioningAxis
Telegramm_5_PZD	Telegram 5 reference
Parameter_Access_Point	Telegram 5 access point

Outputs	
PowerStatus	State of the power stage
PowerValid	1 = Power stage stable or 0 = changing
MoveDone	Target position reached
Error	Axis has error
AxisErrorWord	ErrorWord of technology object
ResetDone	Acknowledge error done
HaltDone	MC_Halt is done
CyclicComOk	1 = OK, 0 = Axis disconnected from PLC
ParamOut.Done	Param. access job done
ParamOut.Busy	Param. access job in process
ParamOut.ReadValue	Result of the read mode by Param. access [dec]
ParamOut.Error	Error during Param. access

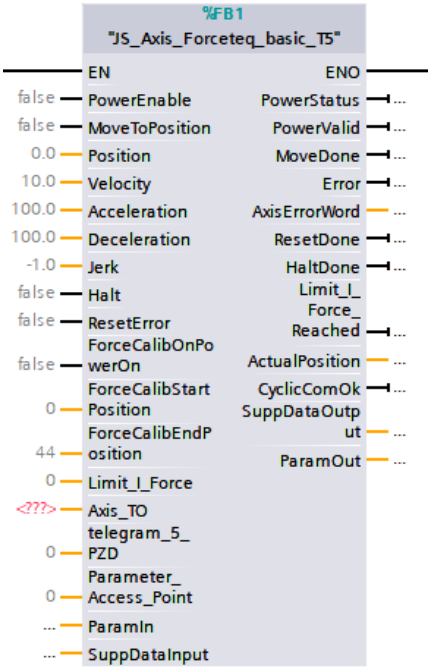


Internally used Functions
- JS_MC_Power_T5
- MC_MOVEABSOLUTE
- MC_HALT
- MC_HOME
- MC_POWER
- MC_RESET

3.1.2 JS_Axis_Forceteq_basic_T5

Inputs	
PowerEnable	Enables or disables power stage
MoveToPosition	Move to position on positive edge
Position	Target position [mm]
Velocity	Max. velocity [mm/s]
Acceleration	Max. acceleration [mm/s^2]
Deceleration	Max. deceleration [mm/s^2]
Jerk	Max. change of acceleration [mm/s^3]
Halt	Calls MC_Halt
ResetError	Acknowledge error
ForceCalibOnPowerOn	Performs a Force Calibration on powerup
ForceCalibStartPosition	Start position of Force Calibration [inc]
ForceCalibEndPosition	End position of Force Calibration [inc]
Limit_I_Force	Limits I_Force [x10mA]
AXIS_TO	Reference to TO_PositioningAxis
Telegramm_5_PZD	Telegram 5 reference
Parameter_Access_Point	Telegram 5 access point
ParamIn.Nr	Parameter Number of Param. access Interface [dec]
ParamIn.Index	0 for non string parameters Character index of string parameter
ParamIn.ValueWrite	Value to write of Param. access Interface [dec]
ParamIn.Write	1 = Write, 0 = Read of Param. access Interface
ParamIn.Start	Execute on positive edge of Param. access Interface
SuppDataInput	Supplementary Data Input

Outputs	
PowerStatus	State of the power stage
PowerValid	1 = Power stage stable or 0 = changing
MoveDone	Target position reached
Error	Axis has error
AxisErrorWord	ErrorWord of technology object
ResetDone	Acknowledge error done
HaltDone	MC_Halt is done
Limit_I_Force_Reached	I_Force limit is reached
ActualPosition	Actual position of the axis [mm]
SuppDataOutput	Supplementary Data Output
CyclicComOk	1 = OK, 0 = Axis disconnected from PLC
ParamOut.Done	Param. access job done
ParamOut.Busy	Param. access job in process
ParamOut.ReadValue	Result of the read mode by Param. access [dec]
ParamOut.Error	Error during Param. access

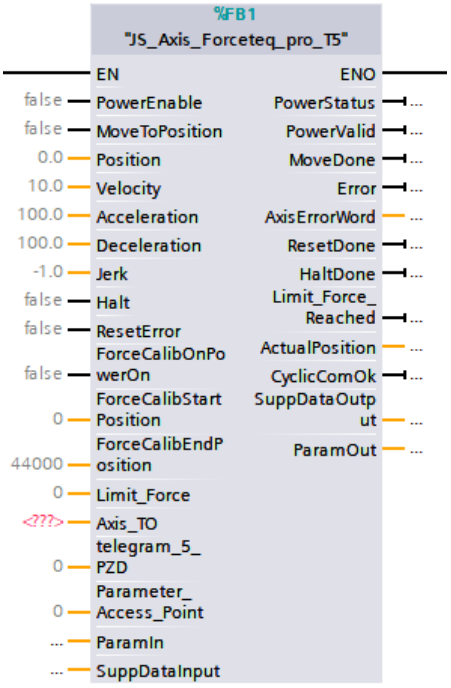


Internally used Functions
- JS_MC_Power_T5
- JS_MC_ForceCalibration_T5
- MC_MOVEABSOLUTE
- MC_HALT
- MC_HOME
- MC_POWER
- MC_RESET
- SINA_PARA_S

3.1.3 JS_Axis_Forceteq_pro_T5

Inputs	
PowerEnable	Enables or disabled power stage
MoveToPosition	Move to position on positive edge
Position	Target position [mm]
Velocity	Max. velocity [mm/s]
Acceleration	Max. acceleration [mm/s²]
Deceleration	Max. deceleration [mm/s²]
Jerk	Max. change of acceleration [mm/s³]
Halt	Calls MC_Halt
ResetError	Acknowledge error
ForceCalibOnPowerOn	Performs a Force Calibration on powerup
ForceCalibStartPosition	Start position of Force Calibration [inc]
ForceCalibEndPosition	End position of Force Calibration [inc]
Limit_Force	Limits Force [mN]
AXIS_TO	Reference to TO_PositioningAxis
Telegramm_5_PZD	Telegram 5 reference
Parameter_Access_Point	Telegram 5 access point
ParamIn.Nr	Parameter Number of Param. access Interface [dec]
ParamIn.Index	0 for non string parameters Character index of string parameter
ParamIn.ValueWrite	Value to write of Param. access Interface [dec]
ParamIn.Write	1 = Write, 0 = Read of Param. access Interface
ParamIn.Start	Execute on positive edge of Param. access Interface
SuppDataInput	Supplementary Data Input

Outputs	
PowerStatus	State of the power stage
PowerValid	1 = Power stage stable or 0 = changing
MoveDone	Target position reached
Error	Axis has error
AxisErrorWord	ErrorWord of technology object
ResetDone	Acknowledge error done
HaltDone	MC_Halt is done
Limit_Force_Reached	Force limit is reached
ActualPosition	Actual position of the axis [mm]
SuppDataOutput	Supplementary Data Output
CyclicComOk	1 = OK, 0 = Axis disconnected from PLC
ParamOut.Done	Param. access job done
ParamOut.Busy	Param. access job in process
ParamOut.ReadValue	Result of the read mode by Param. access [dec]
ParamOut.Error	Error during Param. access



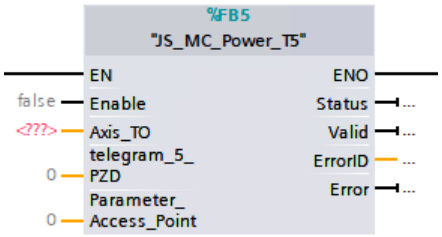
Internally used Functions
- JS_MC_Power_T5
- JS_MC_ForceCalibration_T5
- MC_MOVEABSOLUTE
- MC_HALT
- MC_HOME
- MC_POWER
- MC_RESET
- SINA_PARA_S

3.2 JennyScience MCFunctionBlocks

3.2.1 JS_MC_Power_T5

Inputs	
Enable	Enables or disabled power stage
Axis_TO	Reference to TO_PositioningAxis
Telegramm_5_PZD	Telegram 5 reference
Parameter_Access_Point	Telegram 5 access point

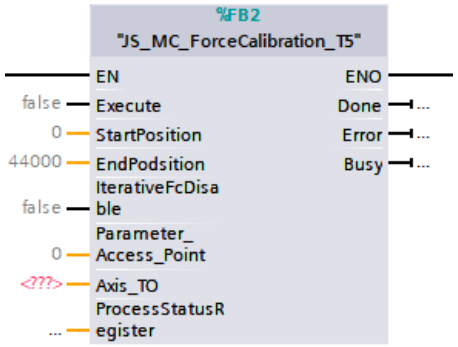
Outputs	
Status	State of the power stage
Valid	1 = Power stage stable or 0 = changing
ErrorID	ErrorWord of technology object
Error	Axis has error



3.2.2 JS_MC_ForceCalibration_T5

Inputs	
Execute	Starts the Force Calibration drive on positive edge
StartPosition	Start position of Force Calibration [inc]
EndPosition	End position of Force Calibration [inc]
IterativeFcDisable	Clears the old calibration data before new cal.-drive
Parameter_Access_Point	Telegram 5 access point
Axis_TO	Reference to Technology object
ProcessStatusRegister	Process Status Register XENAX („TPSR“ Command)

Outputs	
Done	Force Calibration done
Error	Error occurred within function block
Busy	Force Calibration in process



4 Example Project in TIA Portal

The example projects are available for TIA Portal V15 and can be upgraded to a newer version. There are several demo projects from simple moving to Forceteq basic, Forceteq pro and two axes as described further on this page.

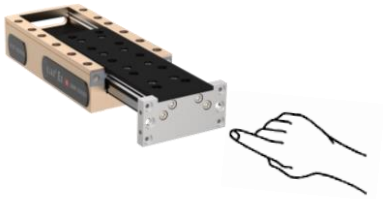
4.1 List of Demo Applications

4.1.1 JSC_SimpleTest_Telegram_5

Simple demo application of an axis driving from start position to end position and back in an infinite loop.

4.1.2 JSC_Forceteq_basic_ForceLimit_Telegram_5

This demo shows the force limitation part of Forceteq® basic.
The axis drives forward with a limited force. If an obstacle is in the forward path, the force limit will be reached and the axis moves back quickly to the starting position.

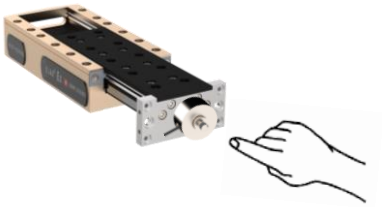


4.1.3 JSC_Forceteq_basic_ForceMonitoring_Telegram_5

This is an extended version of the ForceLimit demo project. This example includes a demo of force monitoring where 3 sectors are defined. When the axis detects an obstacle in the forward path, it will evaluate the sectors and show in which sector the obstacle was.

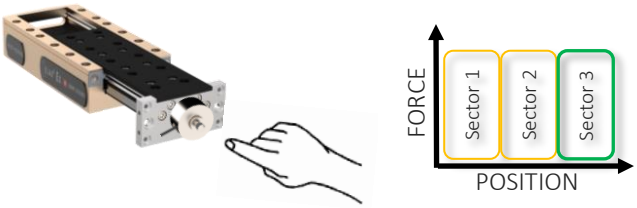
4.1.4 JSC_Forceteq_pro_ForceLimit_Telegram_5

This demo application is similar to the ForceLimit demo with Forceteq® basic. The difference is the way force is measured. Forceteq® pro demo employs an external force sensor, while the Forceteq® basic demo measured the motor current. Only possible with XENAX® Xvi 75V8S and Signateq®.



4.1.5 JSC_Forceteq_pro_ForceMonitoring_Telegram_5

This is an extended version of the Forceteq® pro ForceLimit demo project. This example includes a demo of force monitoring where 3 sectors are defined. When the axis detects an obstacle in the forward path, it will evaluate the sectors and show in which sector the obstacle was.
Only possible with XENAX® Xvi 75V8S and Signateq®.



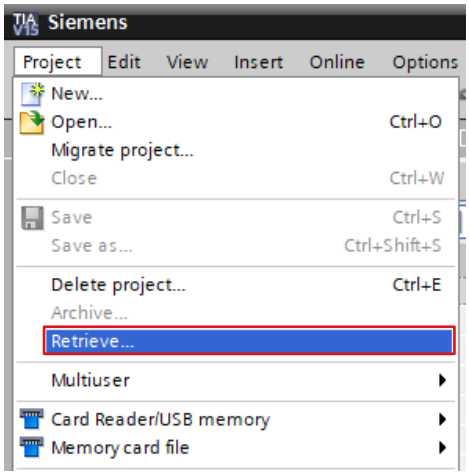
4.1.6 JSC_2_Axes_Telegram_5

This example application shows how to add a second axis. Both axes will move between two alternating positions with limited Force
(same as JSC_Forceteq_basic_ForceLimit).

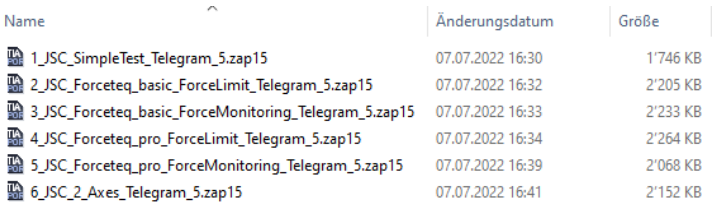
4.2 Import Demo

Note:
The demo projects were created for the XENAX® Xvi 75V8S. If you are using a different controller than the Xvi75V8S, please refer to chapter “4.5 Change Device Typ” after the import for the steps to follow.

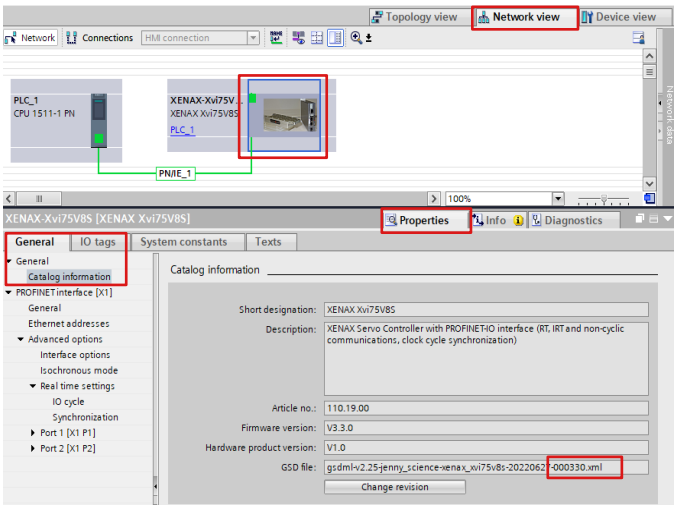
Go to the project view of TIA Portal and press retrieve in the project category.



Import an application example with telegram 5 and save it on the computer.

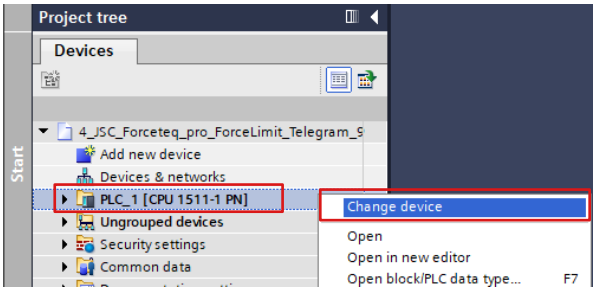


Check the GSD-File from the Demo-Application matches to the Busmodul-Firmware.
You can see the GSD-Version by clicking on the XENAX® in the Network view and the register “Properties”, “General”, “Catalog information”.
At the end of the filename you can see the version (here “000330.xml” = 3.30) of the GSD-File. The Version of the Busmodul-Firmware can be checked or updated by the JSC_Ethernet_Installer.

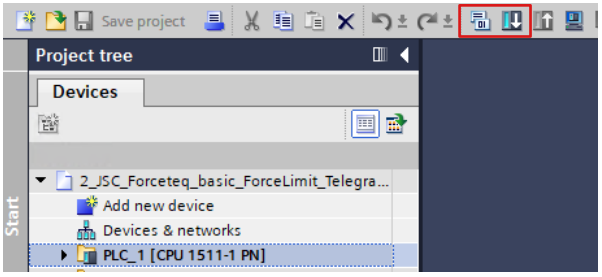


4.3 Run Demo

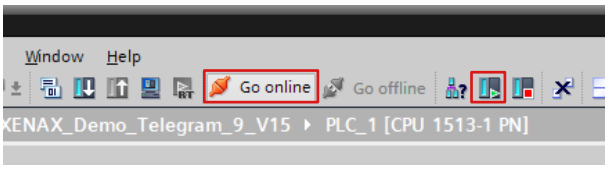
The demo projects were created for the S7-1511-1 PN CPU. If a different PLC is used, the PLC device must be changed in the project tree.



Remember to adjust the IP address of the PLC. Finally, the project can be compiled and downloaded.

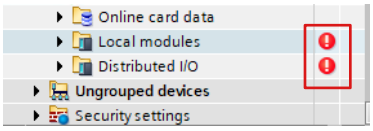


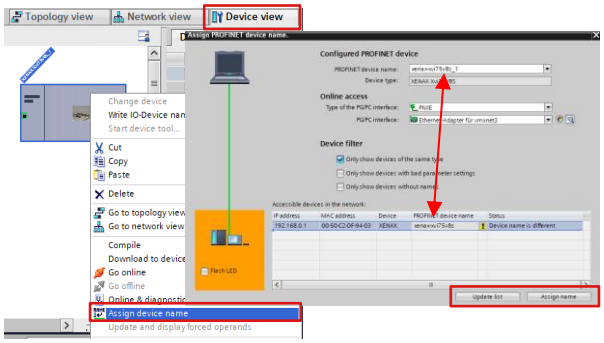
Go online and make sure the PLC is running.



4.4 Device name mismatch

If you get an error massage “Device not reachable” you may have the wrong Device (XENAX® Typ) or not the same name of the device like in the Project. Please follow the steps in chapter “4.5 Change Device Typ” or if the Typ is correct, match the name by right click to the XENAX® under “Device view”, “Assign device name”, “Update list” and finally “Assign name”.

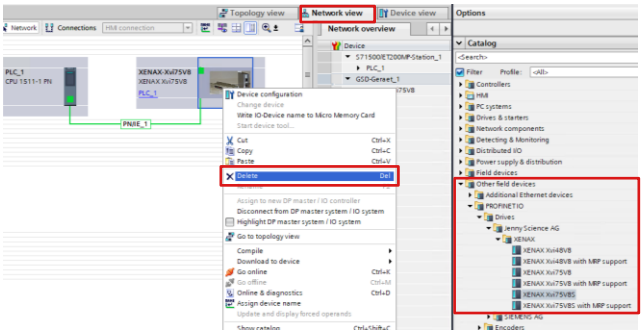




4.5 Change Device Typ

The demo projects were created for the XENAX® Xvi 75V8S. If you are using a different controller than the Xvi75V8S, please follow the steps below.

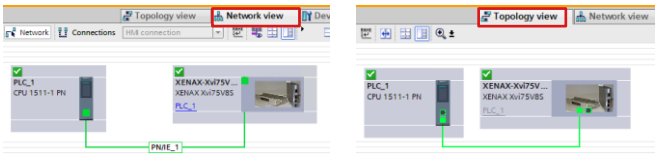
Delete the existing Device under “Devices & networks”, “Network view” by right click to the XENAX® and “Delete”.



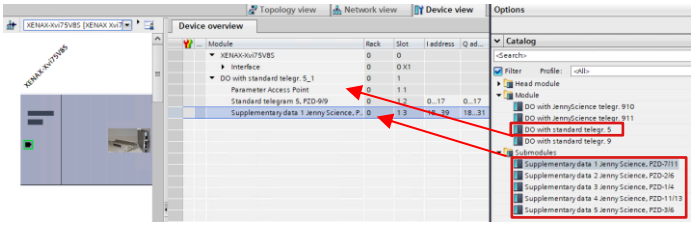
After, you can choose the used XENAX® model from the Hardware catalog “Other field devices”, “PROFINET IO”, “Drives”, “Jenny Science AG”, “XENAX”.

It is possible to select between a XENAX® with MRP (Media Redundancy Protocol -> Ring topology) support or without MRP support. If MRP is not required, the XENAX® should be projected without MRP support.

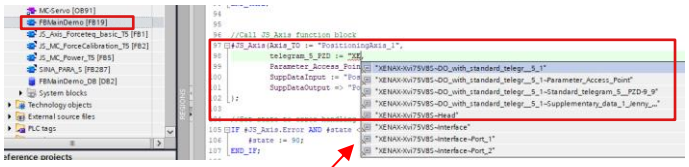
After adding the XENAX® to the Network view connect the XENAX® to the PLC in the “Network view” and the “Topology view”.



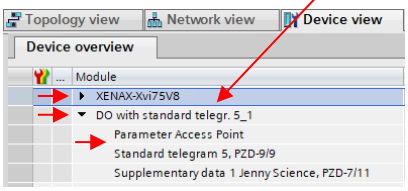
Add the “DO with standard telegr. 5” and the needed Submodules to the device under “Device view”.
SimpleTest uses no Submodul
Forceteq® basic and 2 Axis uses Suppl. data 1 and Forceteq pro uses SuppData 4.



Change the Inputs “Telegramm_5_PZD” and Parameter_Access_Point” for the JS_Axis. For that, open the “FB_MainDemo” under “Program blocks” and modify the name at the Call of the JS_Axis function block.

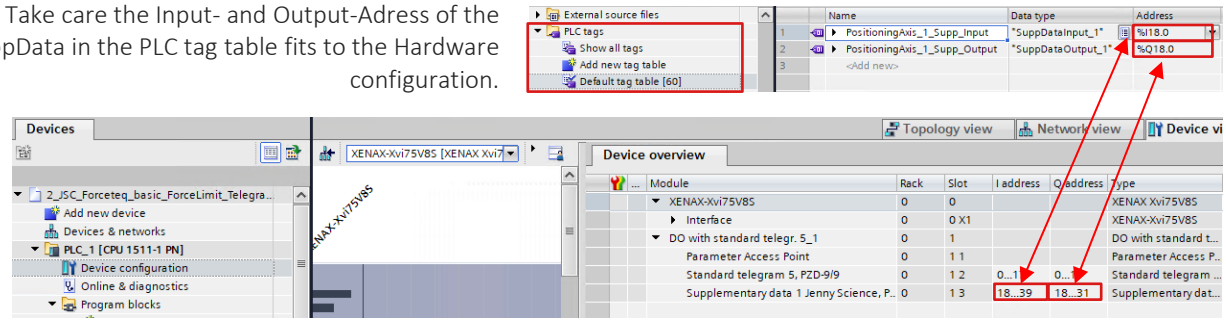


The addresses consist of the device name, the telegram and the corresponding data. These can be found in the "Device configuration" in the "Device view".

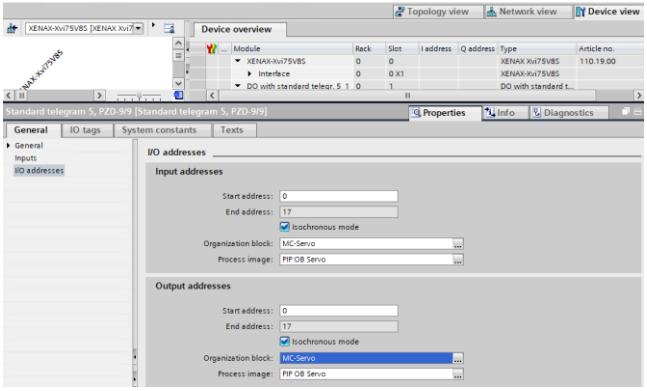


“Telegramm_5_PZD” :=	“Device name~Telegram~Standard_Telegramm_5_PZD-9_9”
Parameter_Access_Point :=	“Device name~Telegram~Parameter_Access_Point”
SuppDataInput :=	“PLC tag Name for input data” (see next step)
SuppDataOutput :=	“PLC tag Name for output data” (see next step)

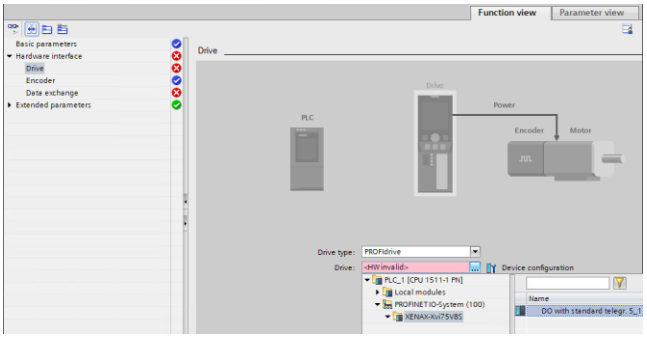
Take care the Input- and Output-Adress of the SuppData in the PLC tag table fits to the Hardware configuration.



Reset the MC-Servo for Organization block as Input and Output addresses under “Device view”, “Properties”, “General” in menu “I/O addresses”.



Set the standard telegr. 5 in the “Technology object”, “PositioningAxis” under “Configuration” in menu “Hardware interface” and “Drive”.

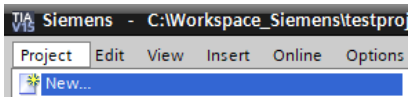


5 New Project in TIA Portal

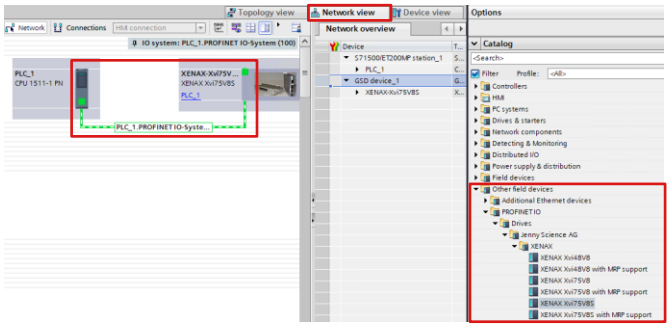
In order to operate the XENAX® Xvi including the bus module PROFINET with a SIMATIC PLC it is preconditioned that TIA Portal V15 or later is installed correctly and the PG/PC interface is configured for the communication with the SIMATIC. Also, the XENAX® has to be set up with WebMotion®.

5.1 Create Project

Open the TIA Portal, create a new project.

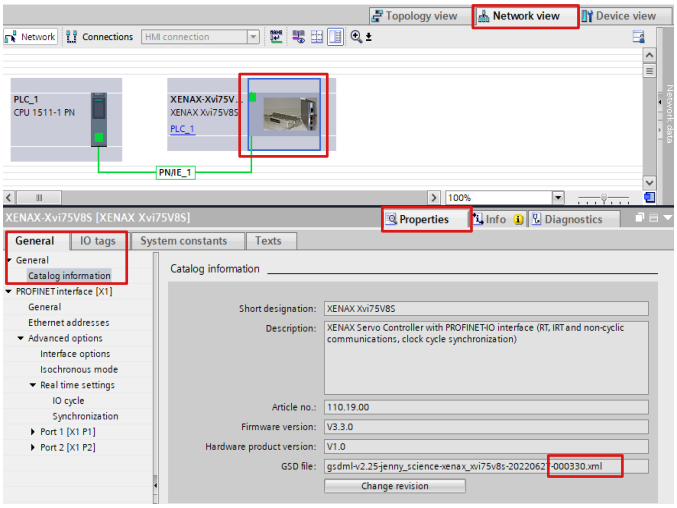


Open the Device & networks configuration, select tap “Network view” and add your PLC and choose the used XENAX® model from the Hardware catalog “Other field devices”, “PROFINET IO”, “Drives”, “Jenny Science AG”, “XENAX”.



If the XENAX® Xvi is not present in the Hardware catalog you need to install the GSD file.
To install the GSD files, go to
Options -> Manage general station description files (GSD).

The GSD-file can be downloaded from Jenny Science under XENAX® Servocontroller →Firmware Bus Module. Take care that the GSD-File matches to the Busmodul-Firmware. At the end of the filename you can see the version (here “000330.xml” = 3.30) of the GSD-File. The Version of the Busmodul-Firmware can be checked or updated by the JSC_Ethernet_Installer.
Note: You have to install a separate GSD file for the XENAX® Xvi75V8, Xvi75V8S and Xvi48V8.

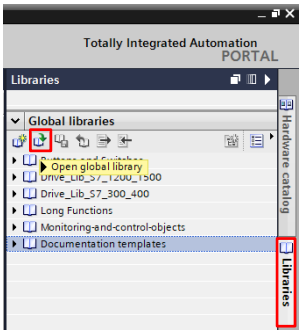


It is possible to select between a XENAX® with MRP (Media Redundancy Protocol -> Ring topology) support or without MRP support. If MRP is not required, the XENAX® should be projected without MRP support.

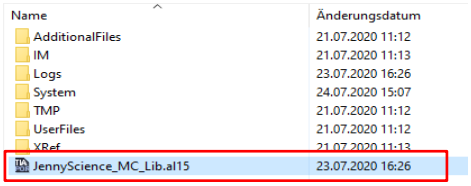
After adding the XENAX® to the Network view, connect the XENAX® to the PLC in this view.

5.2 Open JennyScience_MC_Lib

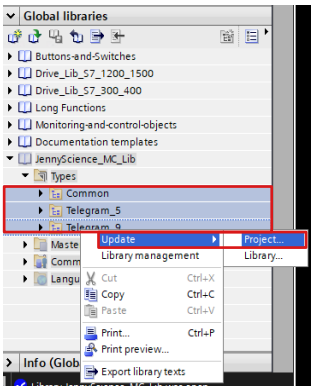
Under “Libraries”, “Global libraries” select “Open global library”.



Open the JennyScience_MC_lib you have downloaded.

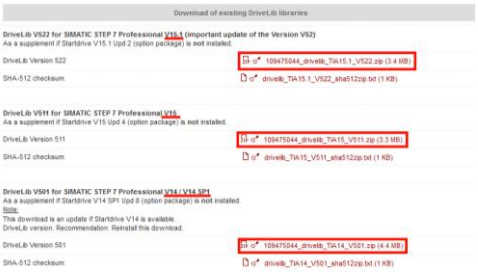


Select all subfolders under Types and update the project with a right-click. This will copy the whole library into the project.



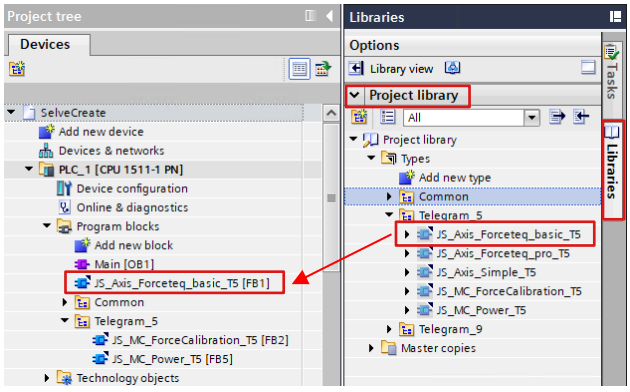
5.3 Sina_Para_S

Sina_Para and Sina_Para_S function block are used for acyclic data communications. Sina_Para_S provides a single parameter access while Sina_Para alters multiple Parameters at once. Sina_Para_S V511 is provided in the JennyScience_MC_Lib. If you need a different version, it can be downloaded from Siemens. Choose the latest DriveLib for your Tia Portal version.



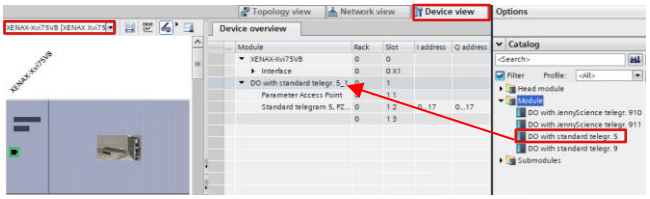
Copy the needed JS_Axis-Functionblock from the “Project library” to your project. All components required for this axis block (such as JS_MC-FB or data types) are automatically copied from the project library into the project.

Note:
Do not copy JS_MC function blocks if you have already copied an axis block.



5.4 Add Telegram 5

In the “device configuration” change to the tap “Device view” select the XENAX® and add “DO with standard telegr. 5” form the Module folder in the “Hardware catalog”.



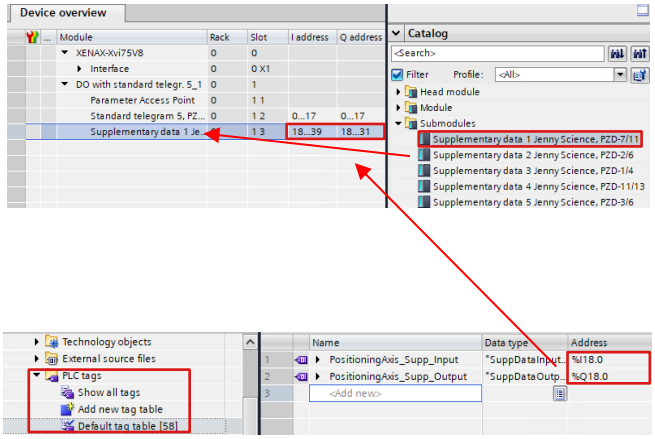
5.5 Add Supplementary Data

If additional data to the standard Telegram 5 is needed, these can be added via Supplementary Data. More information about this can be found in the chapter “2.2 Supplementary Data”.

Choose the needed Supplementary data from the Submodules folder and note the start address of "I address" (here 18) and "Q address" (here 18) for the definition of the new tags.

Define the new “PLC tags” for the Supplementary Data and enter the “I address” and “Q address” from the HW configuration in the step before.

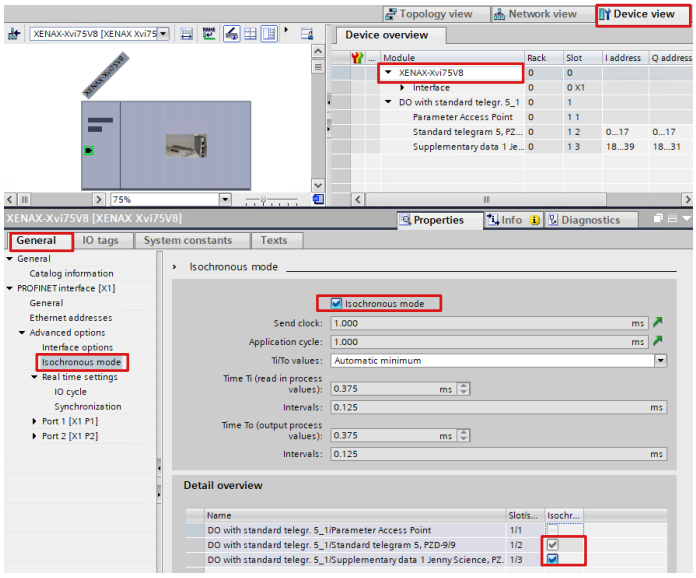
If another Supplementary data is to be used, the HW configuration and the tags must be adapted accordingly.



5.6 XENAX Configuration

To use the motion control functionality isochronous operation for PROFINET is needed.

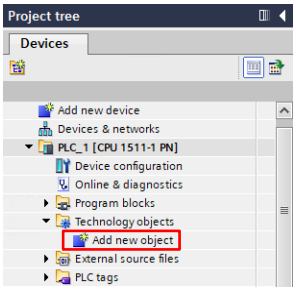
In the “Device configuration”, “Device view” of the XENAX® “Properties” under “PROFINET interface [X1]” “Advanced options” the “Isochronous mode” must be enabled for all possible data.



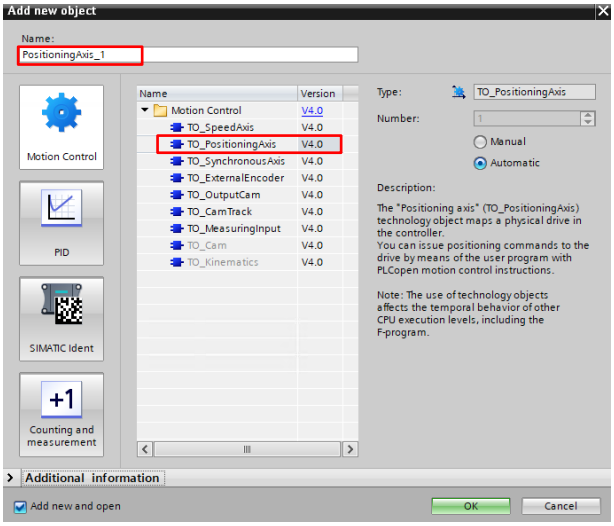
5.7 Technology Object

To use the motion control functionality of the S7-1500 CPU we need to add a “Technology object” for each XENAX® Xvi.

Select “Add new object” from the Project tree.

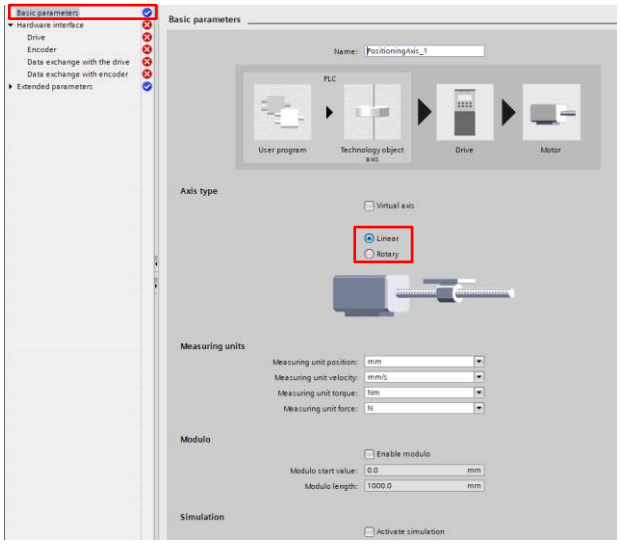


Select the TO_PositioningAxis, choose a name for this axis, -> Confirm with OK



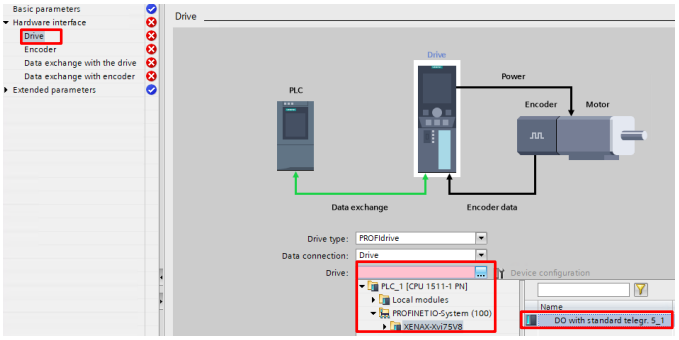
5.7.1 Basic Settings

The axis configuration wizard will be opened. Basic parameters, keep the default settings for linear axis. For ROTAX® axis change the Axis type to “Rotary”.

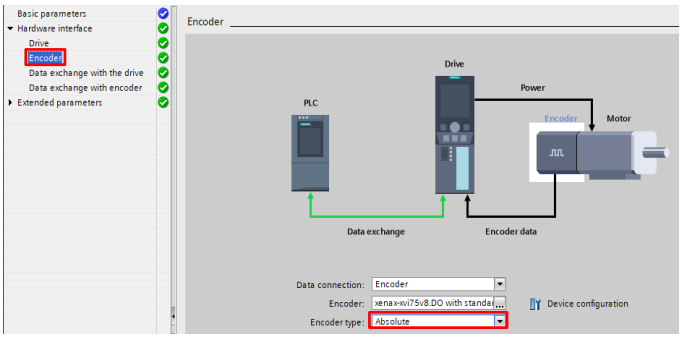


5.7.2 Hardware Interface

Drive
Select the previously added telegram.

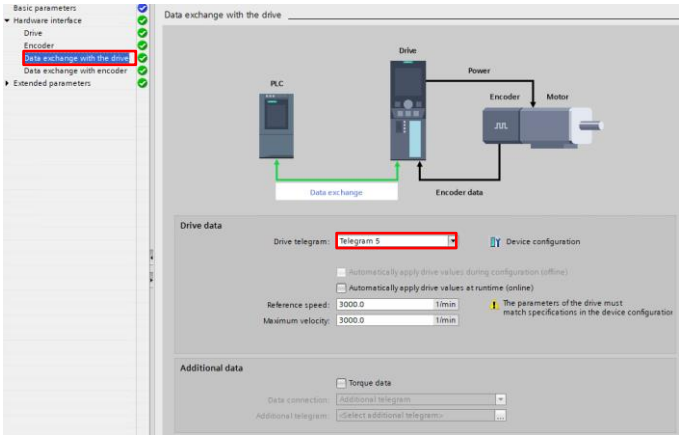


Encoder
Set the encoder type to absolute.



Data exchange with the drive
Select “DP_TEL5_STANDARD” at “Drive telegram”

(Optional) Feed Forward Drive Settings
Reference speed and Maximum speed are only relevant if velocity feed forward is activated.
Set for example 4500 1/min for 1µm encoder systems
or
900 1/min for 100nm encoder systems.
(For Velocity Feed Forward activation see Chapter “5.15 Velocity Feed Forward Activation (optional)”)

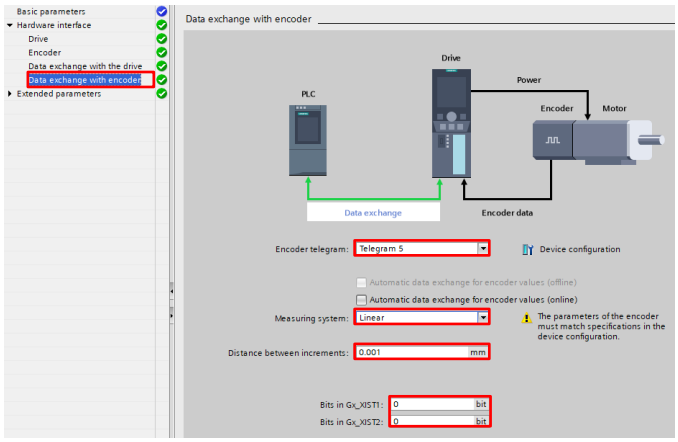


Data exchange with encoder
Select “DP_TEL5_STANDARD” as “Encoder telegram”

Settings for Linear axis
Measuring system: Linear
Distance between increments:
for 1µm set 0.001 mm
for 100nm set 0.0001 mm

Settings for ROTAX® axis
Measuring system: Rotary
Increments per revolution: 120000

Fine resolution:
We do not use fine resolution, so set both to 0 bits.



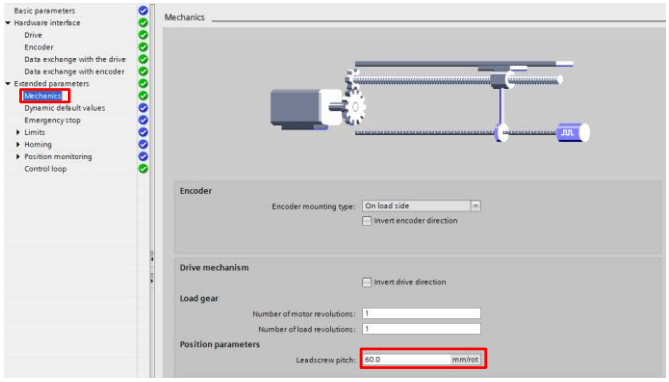
5.7.3 Extended parameters

Mechanics

Keep “Load gear” settings to 1

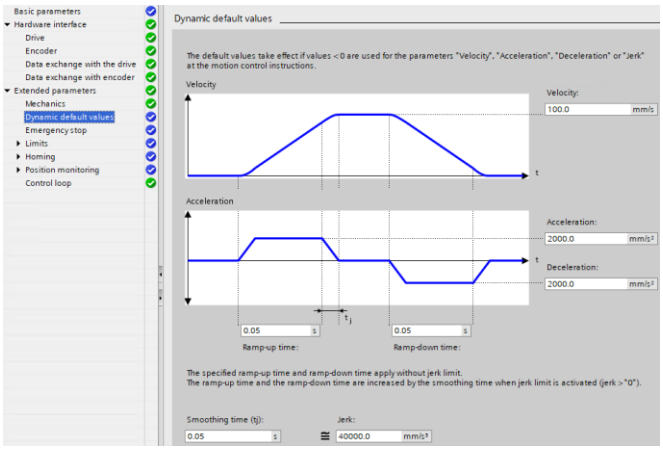
For Linear axis, set the “Leadscrew pitch” to 60.0 mm/rot

Note: This value is not needed for a direct linear axis but the configuration wizard needs the value to calculate dynamic limits.



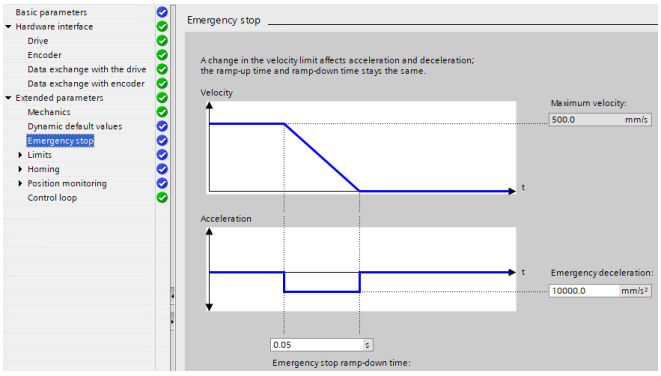
Dynamic default values

These parameters are dependent on your application needs.



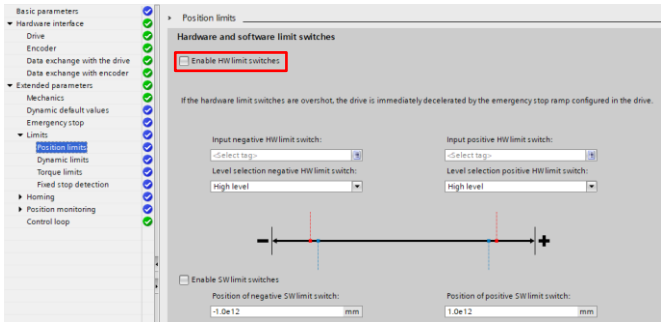
Emergency stop

These parameters are dependent on your application needs.



Position limits

Leave the hardware and software limit switches disabled. The Limits are handled by the XENAX® servo controller and can be configured in WebMotion.



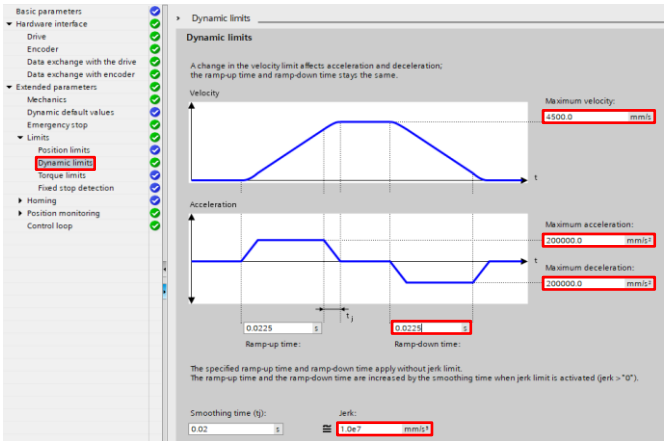
Dynamic limits

For linear axis 1µm encoder system:

Parameter	Value
Maximum velocity	4’500mm/s
Maximum acceleration	200‘000mm/s^2
Maximum deceleration	200‘000mm/s^2
Jerk	10’000’000mm/s^2

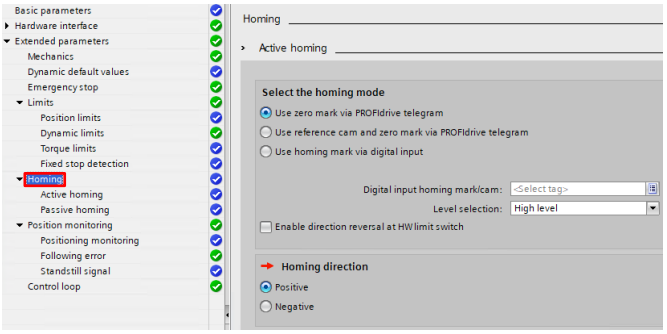
For linear axis 100nm encoder system:

Parameter	Value
Maximum velocity	900mm/s
Maximum acceleration	200‘000mm/s^2
Maximum deceleration	200‘000mm/s^2
Jerk	10’000’000mm/s^2



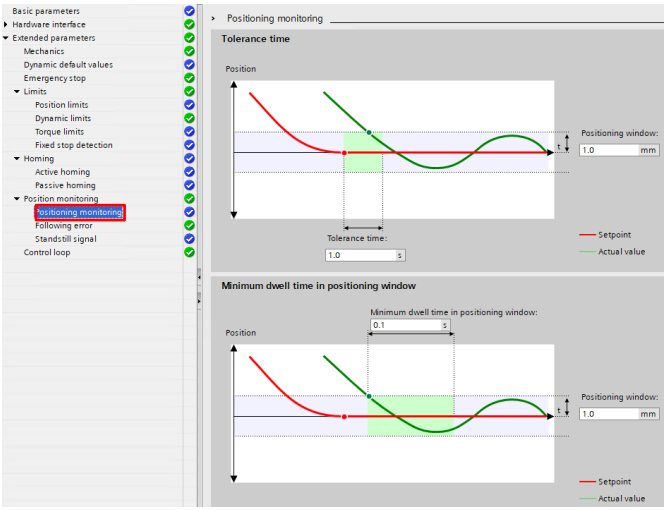
Homing

Since we use a XENAX® internal homing procedure we do not need to configure active or passive homing.



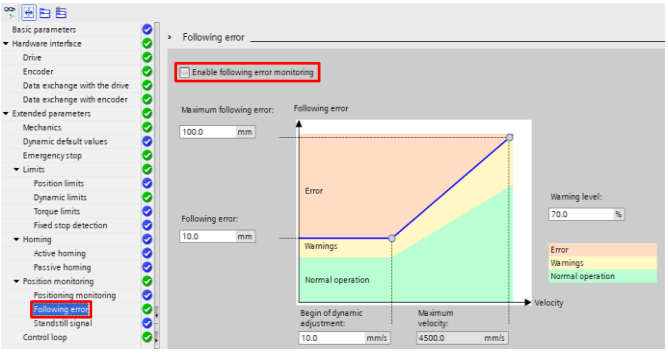
Position monitoring

These parameters are dependent on your application needs.



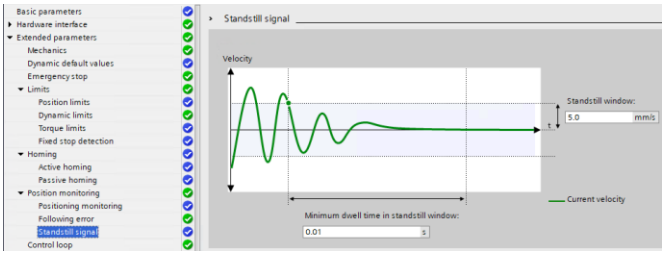
Following error

There is a XENAX® internal following error monitoring. On that account the following error monitoring in the PLC has to be disabled.



Standstill signal

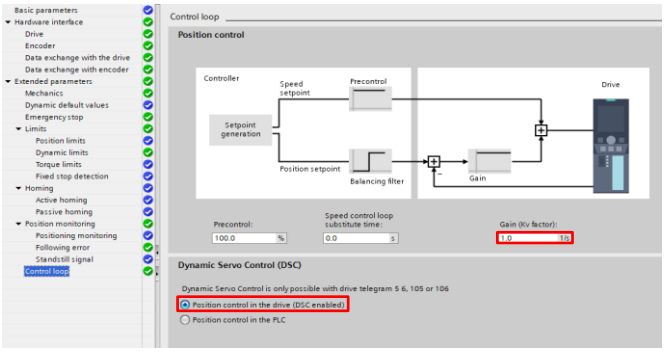
These parameters are dependent on your application needs.



Control loop

Set the Velocity gain kv to $1.0\ \frac{1}{s}$

Enable the “Dynamic Servo Control (DSC enabled)”.

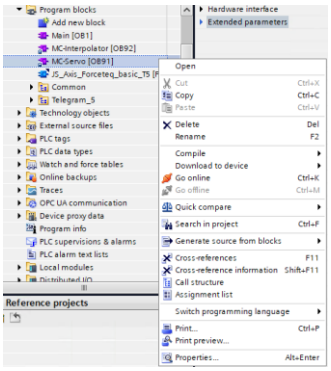


5.8 MC-Servo

For a correct operation of the MC-Servo, additional configuration steps are required.

In the project tree

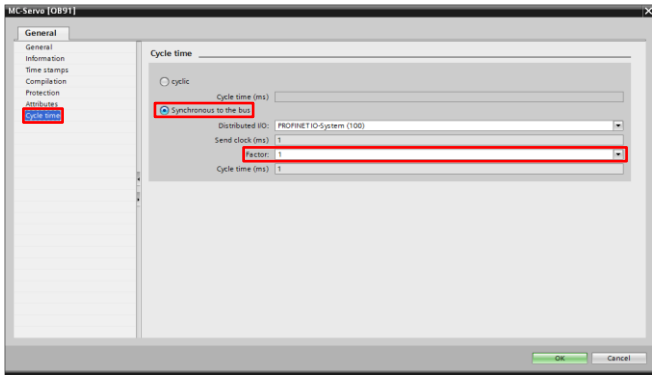
right click on “MC-Servo” and “Properties”



In the MC-Servo property window change to “Cycle time”.

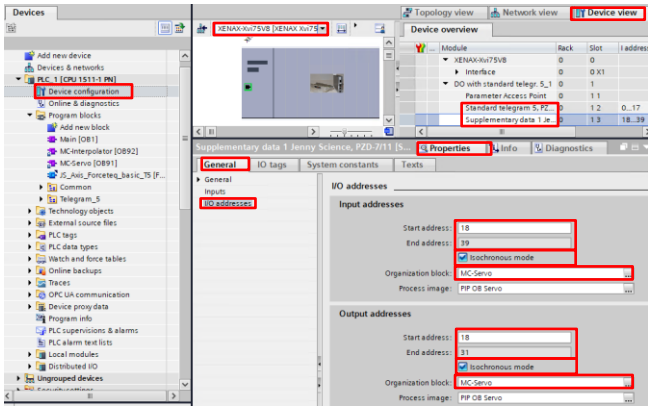
Set the option “Synchronous to the bus”

Set the “Factor” to 1



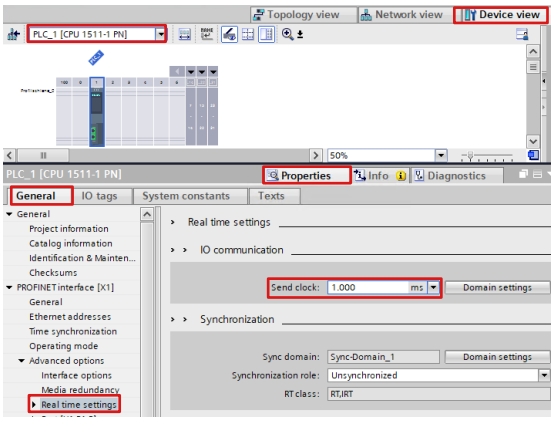
5.9 I/O addresses

Set the “Organization block” for Input- und Output adresses for the Standard telegram and the optional Supplementary data in the “Properties” of the XENAX® “Device view” and “I/O adresses”. Take care that the “Isochronous mode” is enabled.

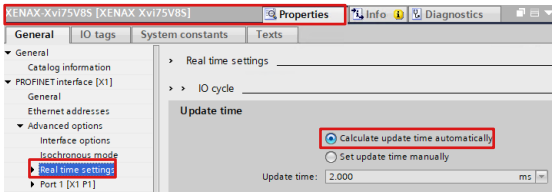


5.10 Set Cycletime

Set the send clock for the IO communication in the “Device view” by choosing the PLC and go to the register “Properties” and “General”. The standard value for the Send clock in the menu “Real time settings” is 1ms.

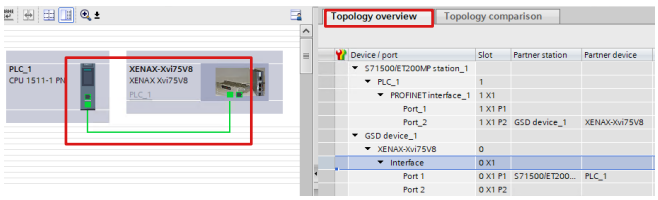


In the same menu item for the XENAX®, the "Update time" can be set to "Calculate update time automatically".



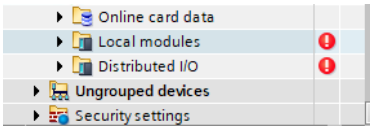
5.11 Topology connection and compile

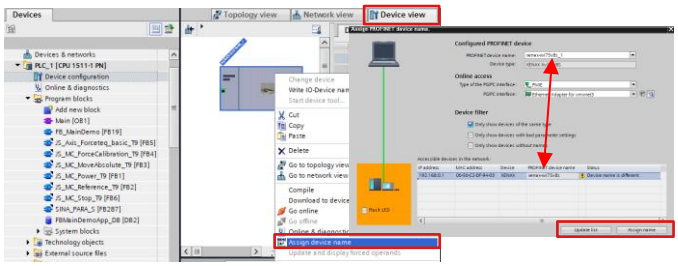
Finally, you can connect the XENAX® to the PLC in the “Topology view” and compile and load the Hardware and Software.



5.12 Device name mismatch

If you get an error massage “Device not reachable” you may have not the same name of the device like in the Project. Please match the name by right click to the XENAX® under “Device view”, “Assign device name”, “Update list” and finally “Assign name”.

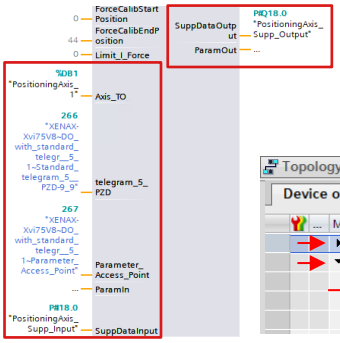


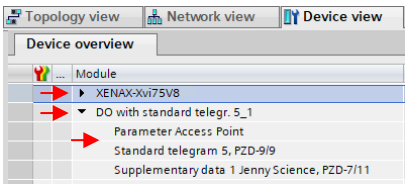


5.13 Run project

Finally, you have entered the address for the Inputs “Telegramm_9__PZD”, “Parameter_Access_Point” and “SuppDataInput” as well as for the “SuppDataOutput”, you can “Go online” and control the axis over the inputs of this JS_Axis-FB.

The addresses consist of the device name, the telegram and the corresponding data. These can be found in the "Device configuration" in the "Device view".



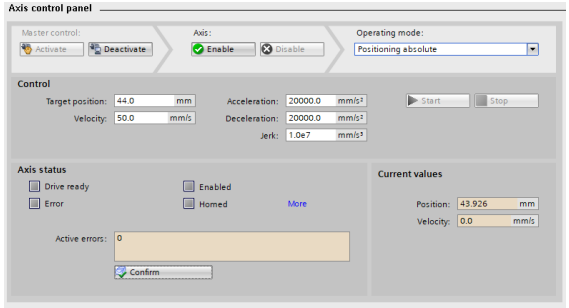


“Telegramm_5_PZD” := “Device name~Telegram~Standard_Telegramm_5_PZD-9_9”
Parameter_Access_Point := “Device name~Telegram~Parameter_Access_Point”
SuppDataInput := “PLC tag Name for input data” (see chapter “5.5 Add Supplementary Data”)
SuppDataOutput := “PLC tag Name for output data” (see chapter “5.5 Add Supplementary Data”)

5.14 Axis Control Panel

It is possible to drive with the Axis Control Panel **once the axis is referenced beforehand**. The Axis Control Panel is a manual driving interface which is integrated into Tia Portal. The axis can be referenced with WebMotion. Press reference and then power quit.

The Axis control panel can now be used with the referenced axis.



5.15 Velocity Feed Forward Activation (optional)

To activate velocity feed forward for enhanced trajectory interpolation in XENAX®, set the value of PROFIdrive parameter 2000 according to the reference speed set in Chapter "5.7.2 Hardware Interface" in inc/s. By default, this parameter is set to 0 and velocity feed forward is not active.

Axis Resolution	Reference Speed (Technology object parameter)	Reference Velocity (PROFIdrive Parameter 2000)
1um	4'500 1/min	4'500'000 inc/s
100nm	900 1/min	9'000'000 inc/s

Note: the parameter 2000 will be reset to 0 at every PLC power cycle.
It is recommended to automatically set the parameter in a PLC task.

5.16 Full Application Implementation

The TIA Portal projects from this document are not an out-of-the-box solution. This document provides an idea of how the XENAX® servo controller can be used together with a SIMATIC PLC S7-1500.

Some additional important steps are required for a real application (list may not be complete):

- Implement application specified exception handling
- Evaluate errors from the SIMATIC PLC
- Evaluate errors form the XENAX®
- Implement an application specified initialisation of the XENAX® function blocks and your main application.
- Evaluate the correct function of the function blocks for your application

6 Replacing XENAX® Xvi 75V8 by Xvi 75V8S

To replace a XENAX® Xvi 75V8 with an Xvi 75V8S in an existing project, you can follow the steps in chapter "4.5 Change Device Typ".

Notes

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