

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

Version 3.0.8

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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.

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## 1 Development Environment

### 1.1 Siemens

#### 1.1.1 TIA Portal V15

TIA Portal V15 can be used for programming the SIMATIC 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

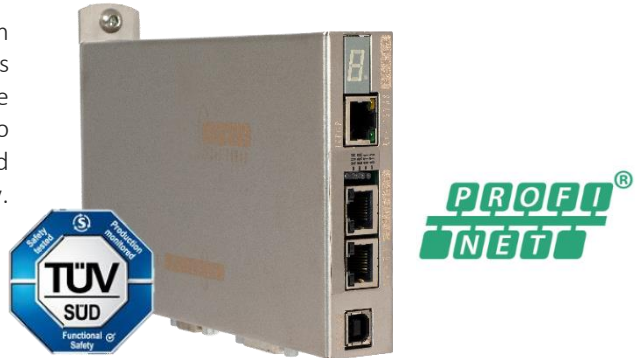
The PROFIdrive profile is the application profile for motion control based on PROFIBUS and PROFINET. As a supplier-independent drive profile the PROFIdrive profile covers all industrially relevant applications.



## 1.2 Jenny Science

### 1.2.1 XENAX® servo controller

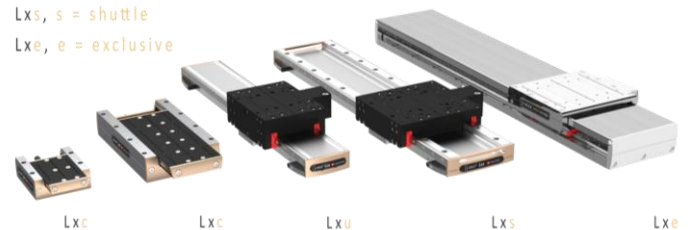
XENAX® servo controller for Jenny Science Axis with integrated Profinet bus module. The bus module is optional but it is required for this application. One XENAX® can control one axis. The XENAX® servo controller recognises all Jenny Science motors and configures the parameters correctly.



### 1.2.2 LINAX® Linear motors

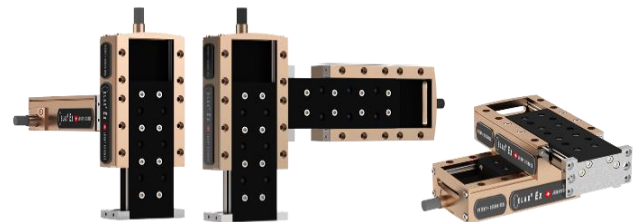
The LINAX® linear motor axes are highly modular and can be flexibly combined amongst each other. Four different series are available.

Lxc, c = compact  
Lcu, u = universal  
Lxs, s = shuttle  
Lxe, e = exclusive



### 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.

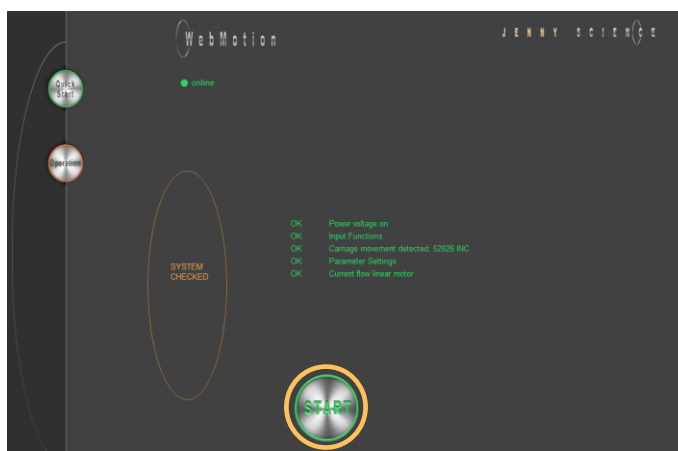
It is stored in the embedded Web server of the XENAX® servo controller.

WebMotion® is launched with a web browser by entering the corresponding TCP/IP address of XENAX®.

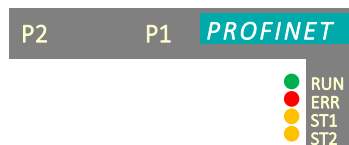
LINAX® linear motor axes, ELAX® linear motor slides or ROTAX® rotary motor axes are automatically recognized. The corresponding controller parameters are saved and loaded automatically. With the Quick Start button, the linear motors can operate immediately. No user manual is needed.

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](http://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 <a href="http://www.jennyscience.ch">www.jennyscience.ch</a> „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 <a href="http://Siemens">Siemens</a> .
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	Datatypes
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 from 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.

	Supplementary data 1	Supplementary data 2	Supplementary data 3	Supplementary data 4	Supplementary data 5	Supplementary data 6
<b>Parameters</b>						
<b>Output Data, PLC -&gt; Drive</b>						
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		
<b>Input Data, Drive -&gt; PLC</b>						
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
%QW20 & %QW22	20 - 23	S-Curve
%QW24 & %QW26	24 - 27	Following Pos Error Window
%QW28 & %QW30	28 - 31	Target Position Window

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

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

## 2.2.2 Signal Description

Signal	Description	Unit	Datatype
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



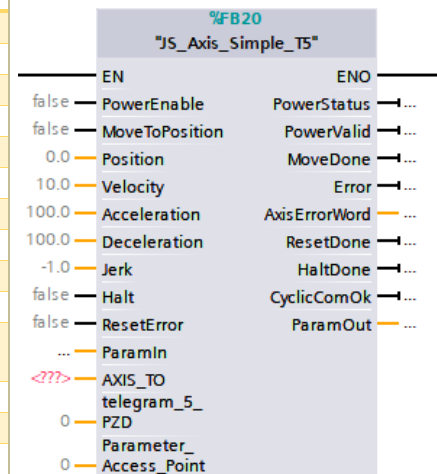
### 3 JennyScience MotionControl Library

#### 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 <sup>2</sup> ]
Deceleration	Max. deceleration [mm/s <sup>2</sup> ]
Jerk	Max. change of acceleration [mm/s <sup>3</sup> ]
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



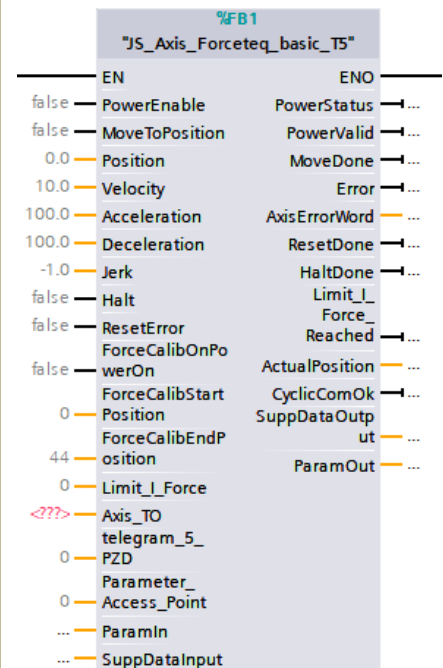
Internally used Functions

- 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 <sup>2</sup> ]
Deceleration	Max. deceleration [mm/s <sup>2</sup> ]
Jerk	Max. change of acceleration [mm/s <sup>3</sup> ]
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



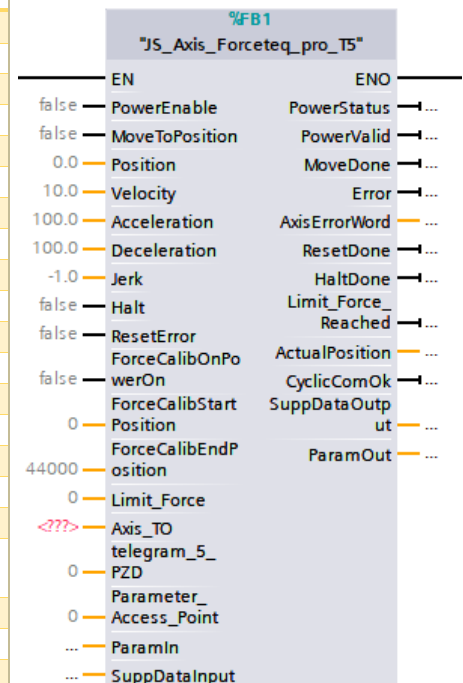
Internally used Functions

- 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/s <sup>2</sup> ]
Deceleration	Max. deceleration [mm/s <sup>2</sup> ]
Jerk	Max. change of acceleration [mm/s <sup>3</sup> ]
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

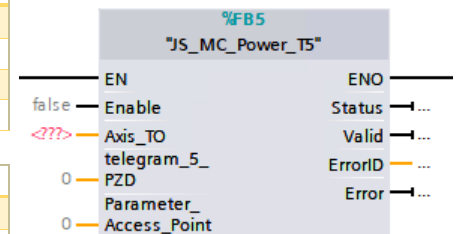


## 3.2 JennyScience MCFunctionBlocks

### 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

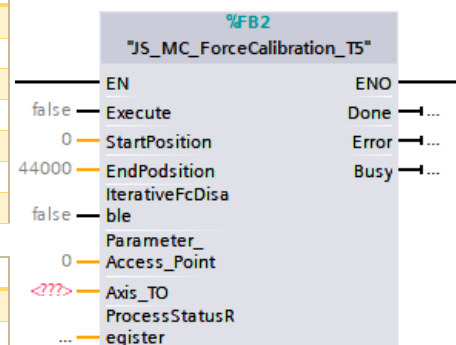
Outputs	
Status	State of the power stage
Valid	1 = Power stage stable or 0 = changing
ErrorID	ErrorWord of technology object
Error	Axis has error



### 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

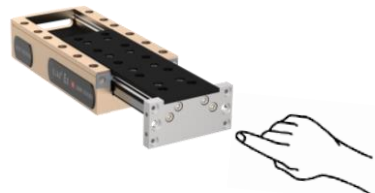
#### 4.1.1 JSC\_SimpleTest\_Telegram\_5

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.



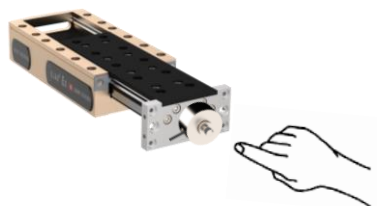
#### 4.1.3 JSC\_Forceteq\_basic\_ForceMonitoring\_Telegram\_5

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).

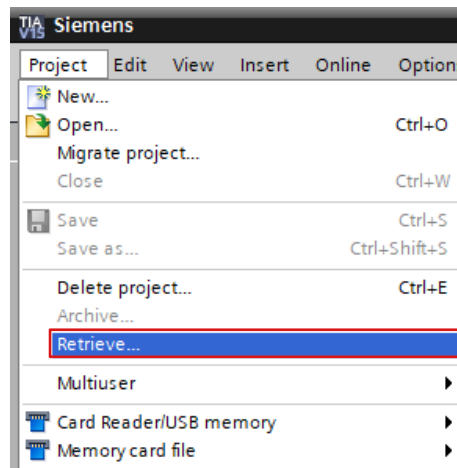


## 4.2 Import Demo

### 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 “4.6 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.



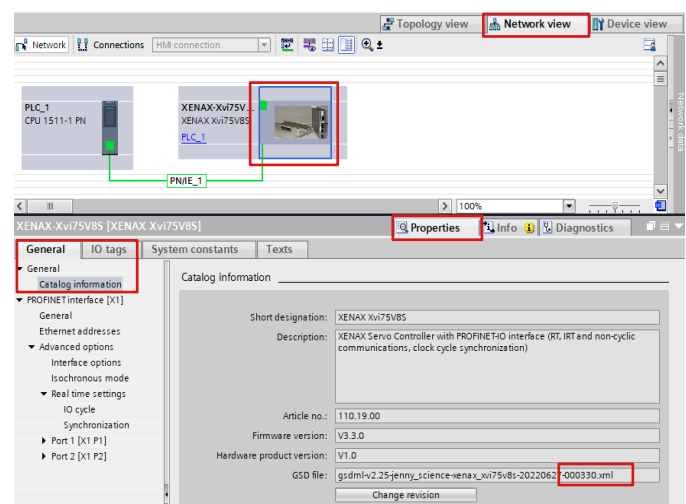
Import an application example with telegram 5 and save it on the computer.

Name	Änderungsdatum	Größe
1_JSC_SimpleTest_Telegram_5.zap15	07.07.2022 16:30	1'746 KB
2_JSC_Forceteq_basic_ForceLimit_Telegram_5.zap15	07.07.2022 16:32	2'205 KB
3_JSC_Forceteq_basic_ForceMonitoring_Telegram_5.zap15	07.07.2022 16:33	2'233 KB
4_JSC_Forceteq_pro_ForceLimit_Telegram_5.zap15	07.07.2022 16:34	2'264 KB
5_JSC_Forceteq_pro_ForceMonitoring_Telegram_5.zap15	07.07.2022 16:39	2'068 KB
6_JSC_2_Axes_Telegram_5.zap15	07.07.2022 16:41	2'152 KB

## 4.3 Check GSD file

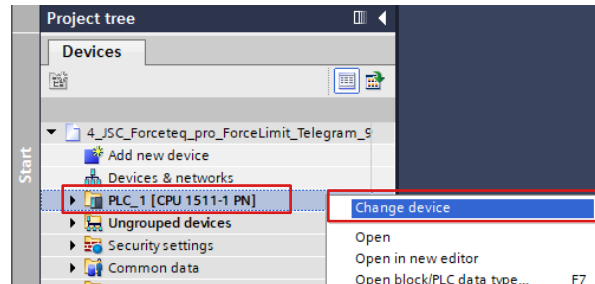
Check the GSD-File from the Demo-Application matches to the Busmodul-Firmware. You can see the GSD-Version by clicking on the XENAX® in the Network view and the register “Properties”, “General”, “Catalog information”. At the end of the filename you can see the version (here “000330.xml” = 3.30) of the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

Press on the button “Change revision” if necessary.

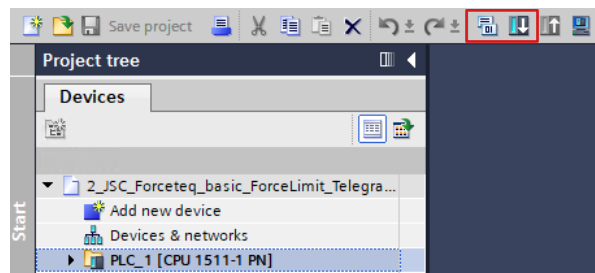


#### 4.4 Run Demo

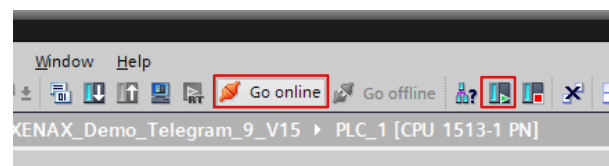
The demo projects were created for the S7-1511-1 PN CPU. If a different PLC is used, the PLC device must be changed in the project tree.



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

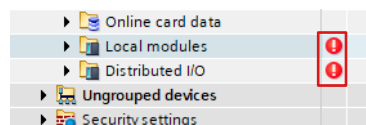


Go online and make sure the PLC is running.



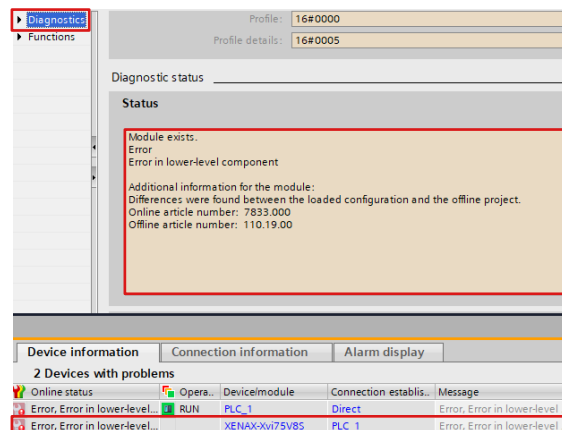
#### 4.5 Common Errors

If the axis does not move, there is a high chance that the PLC could not connect to the axis. First, a power cycle may be required for the PLC and the servo controller to adjust to the correct telegram number. Second, check if your error is one of the following.



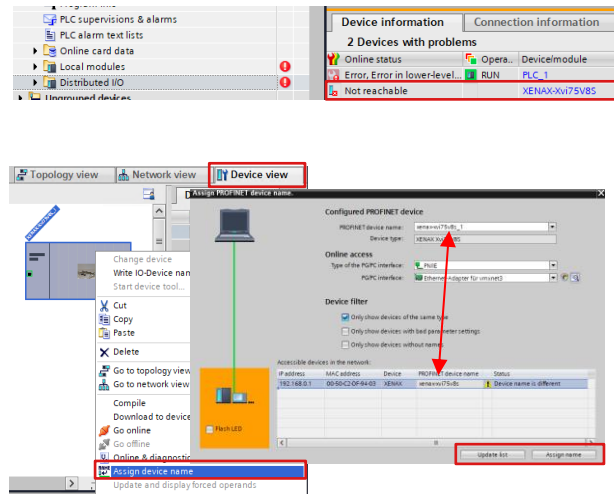
##### 4.5.1 Error in lower-level component, article number

The GSD version in the project may be wrong. See chapter 4.3 Check GSD file.



#### 4.5.2 Device not reachable

If you get an error message “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 “4.6 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”.



## 4.6 Change Device Type

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”.

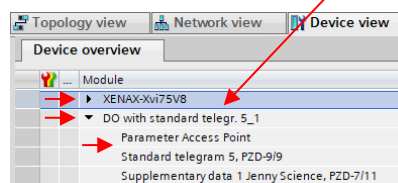
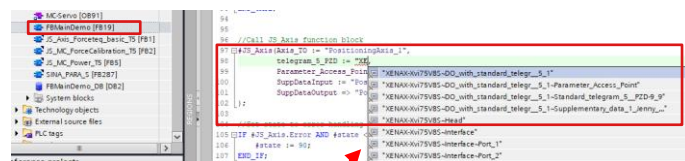
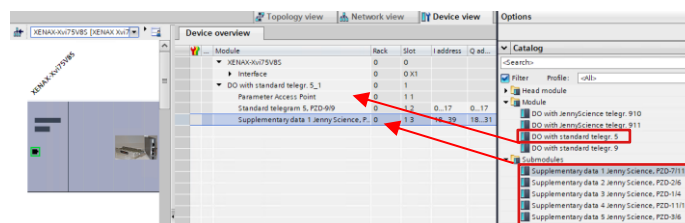
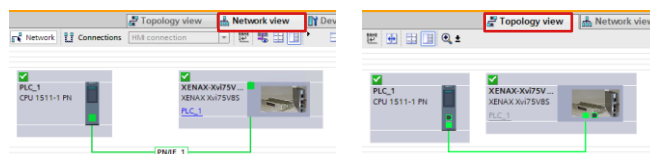
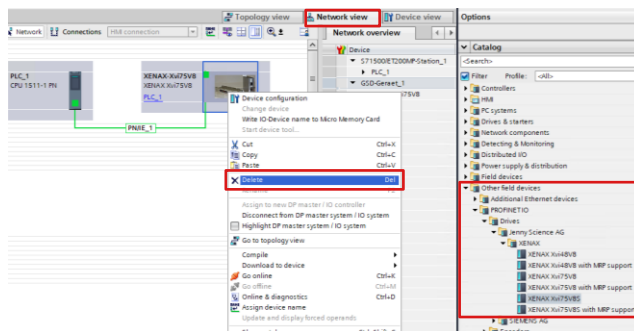
Add the “DO with standard telegr. 5” and the needed Submodules to the device under “Device view”.

SimpleTest uses no Submodule Forceteq® basic and 2 Axis uses Suppl. data 1 and Forceteq pro uses SupData 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.

The screenshot shows the SIMATIC Manager interface. At the top, a table lists PLC tags with columns for Name, Data type, and Address. Red boxes highlight the 'SuppDataInput\_1' and 'SuppDataOutput\_1' tags, with red arrows pointing to their respective addresses in the hardware configuration table below. The hardware configuration table shows modules in a rack, including an interface module and a DO module with standard telegram 5. The addresses for the input and output data are set to 18.39 and 18.31 respectively.

Name	Data type	Address
PositioningAxis_1_Supp_Input	*SuppDataInput_1*	%I18.0
PositioningAxis_1_Supp_Output	*SuppDataOutput_1*	%Q18.0

Module	Rack	Slot	I address	Q address	Type
XENAX-Xvi75V85	0	0			XENAX Xvi75V85
Interface	0	0 X1			XENAX-Xvi75V85
DO with standard telegr. 5_1	0	1			DO with standard t...
Parameter Access Point	0	1 1			Parameter Access P...
Standard telegram 5, PZD-9/9	0	1 2	0...1	0...	Standard telegram ...
Supplementary data 1 Jenny Science, P...	0	1 3	18...39	18...31	Supplementary dat...

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

The screenshot shows the 'IO addresses' dialog box in the 'Properties' window. The 'General' tab is selected, and the 'IO addresses' section is expanded. The 'Input addresses' and 'Output addresses' fields are set to start at 0 and end at 17. The 'Organization block' is set to 'MC-Servo' and the 'Process image' is set to 'PPF OB Servo'.

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

The screenshot shows the 'Function view' in the 'Parameter view' window. The 'Drive' configuration is displayed, showing the connection between the PLC, the drive, and the motor. The 'Drive type' is set to 'PROFdrive' and the 'Drive' is set to 'XENAX-Xvi75V85'. The 'Standard telegram 5' is selected in the 'Configuration' menu.

## 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.

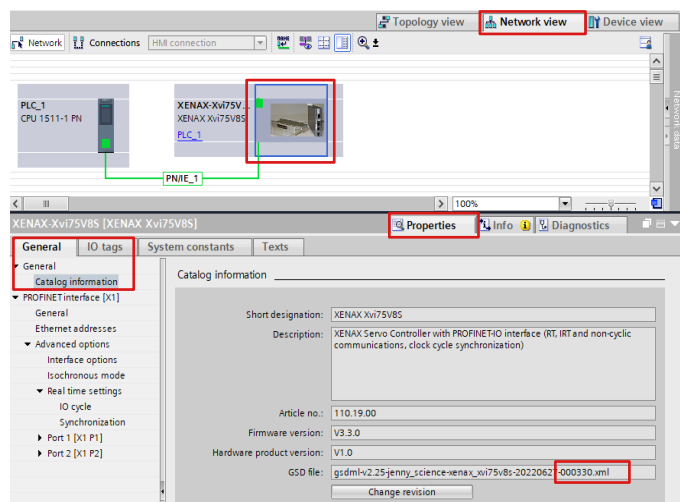
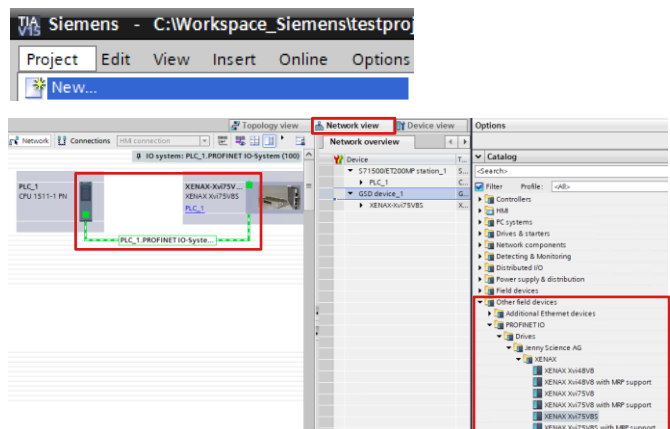
To install the GSD files, go to Options -> Manage general station description files (GSD).

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.

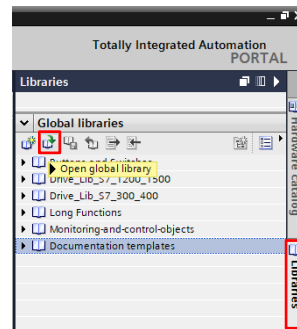
After adding the XENAX® to the Network view, connect the XENAX® to the PLC in this view.



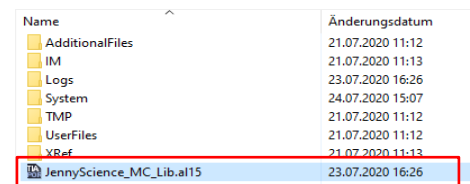


## 5.2 Open JennyScience\_MC\_Lib

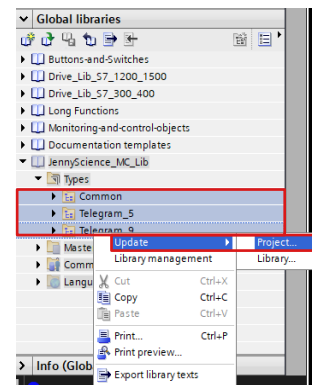
Under “Libraries”, “Global libraries” select “Open global library”.



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

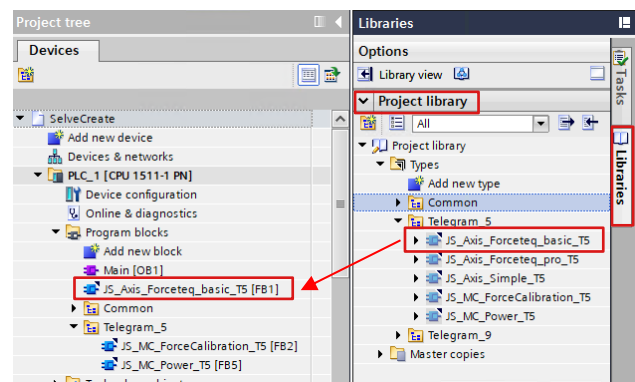
Sina\_Para and Sina\_Para\_S function block are used for acyclic data communications. Sina\_Para\_S provides a single parameter access while Sina\_Para alters multiple Parameters at once. Sina\_Para\_S V511 is provided in the JennyScience\_MC\_Lib. If you need a different version, it can be downloaded from [Siemens](https://www.siemens.com/press/en/pressrelease/2019/09/20190910_01.htm). 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.

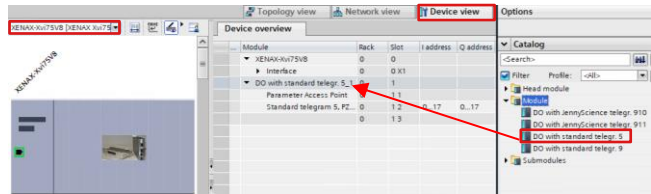
**Note:**

Do not copy JS\_MC function blocks if you have already copied an axis block.



## 5.4 Add Telegram 5

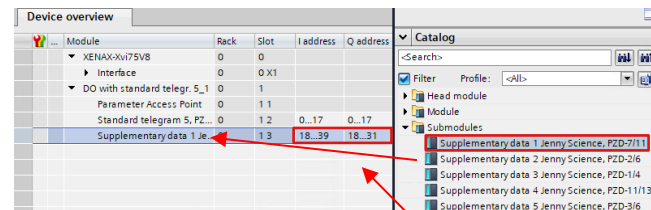
In the “device configuration” change to the tap “Device view” select the XENAX® and add “DO with standard telegr. 5” form the Module folder in the “Hardware catalog”.



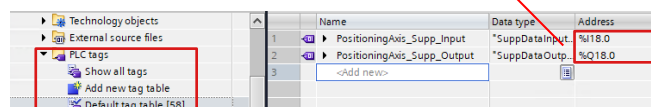
## 5.5 Add Supplementary Data

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.

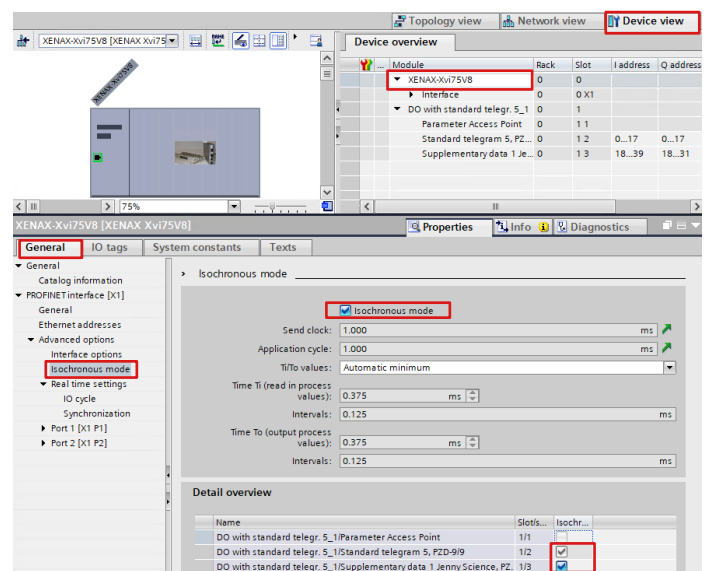


If another Supplementary data is to be used, the HW configuration and the tags must be adapted accordingly.

## 5.6 XENAX Configuration

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

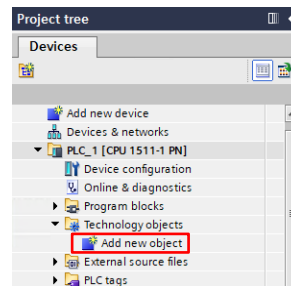
In the “Device configuration”, “Device view” of the XENAX® “Properties” under “PROFINET interface [X1]” “Advanced options” the “Isochronous mode” must be enabled for all possible data.



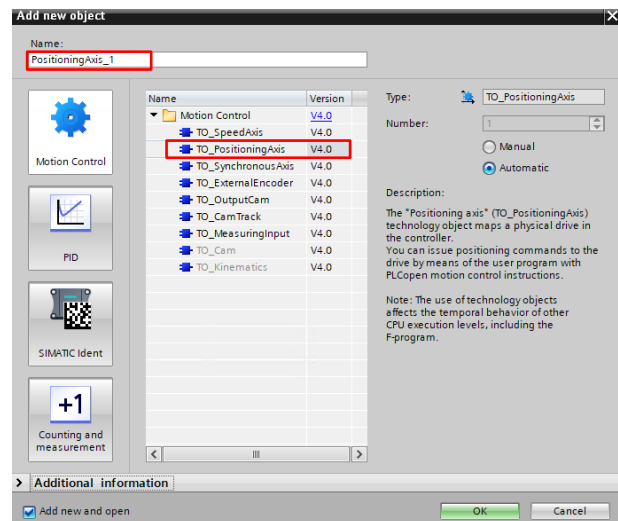
## 5.7 Technology Object

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.

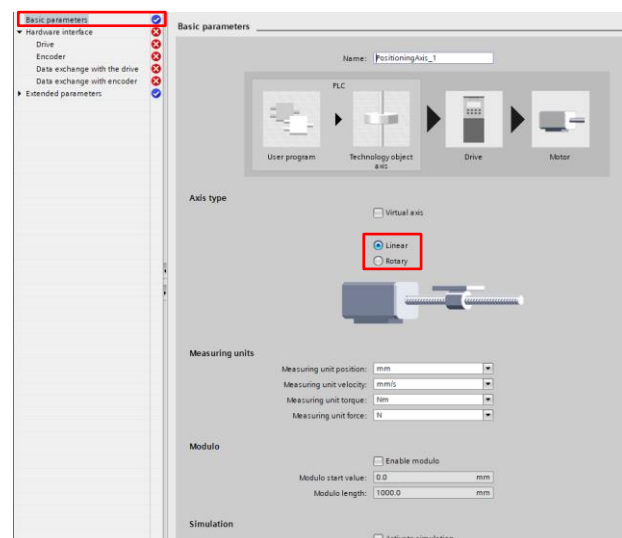


Select the TO\_PositioningAxis, choose a name for this axis, -> Confirm with OK



### 5.7.1 Basic Settings

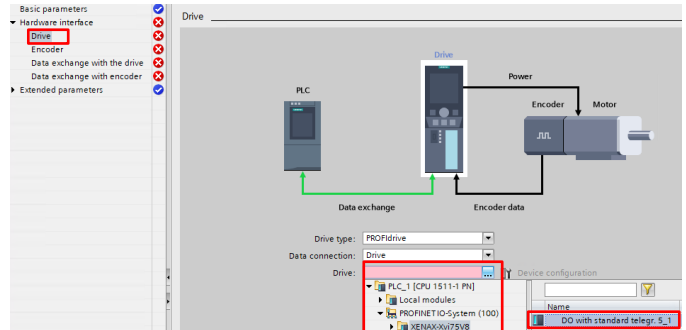
The axis configuration wizard will be opened. Basic parameters, keep the default settings for linear axis. For ROTAX® axis change the Axis type to “Rotary”.



## 5.7.2 Hardware Interface

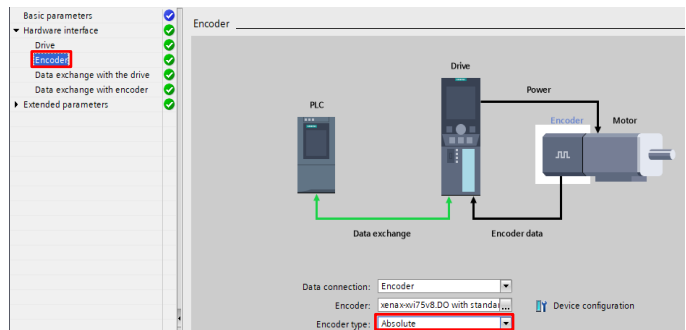
### Drive

Select the previously added telegram.



### Encoder

Set the encoder type to absolute.

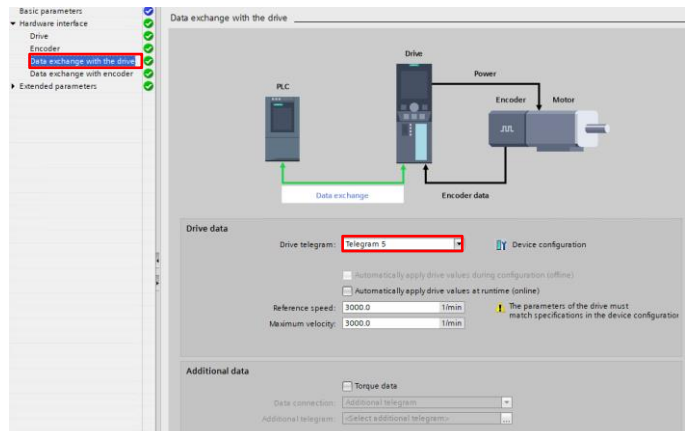


### Data exchange with the drive

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

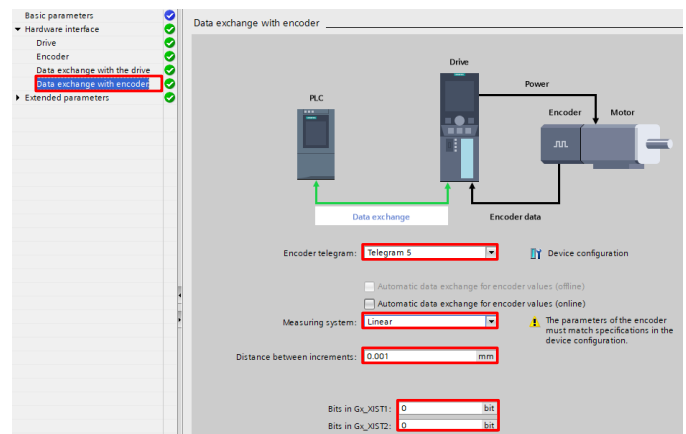
Select "DP\_TEL5\_STANDARD" as "Encoder telegram"

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.



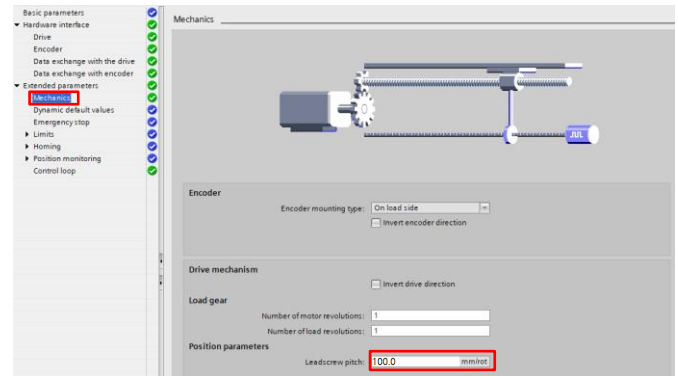
## 5.7.3 Extended parameters

### Mechanics

Keep "Load gear" settings to 1

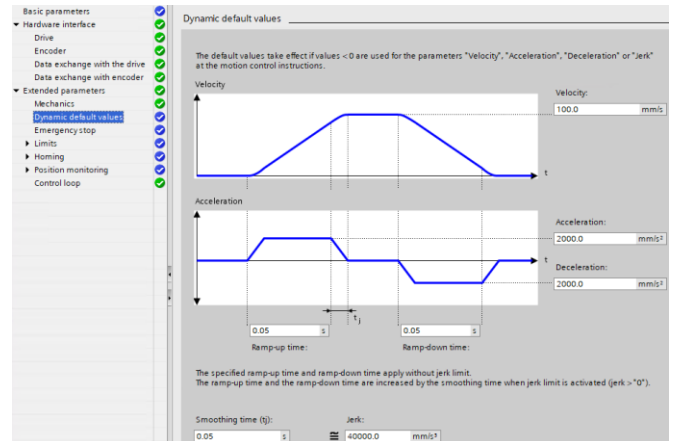
For Linear axis, set the "Leadscrew pitch" to 100.0 mm/rot

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



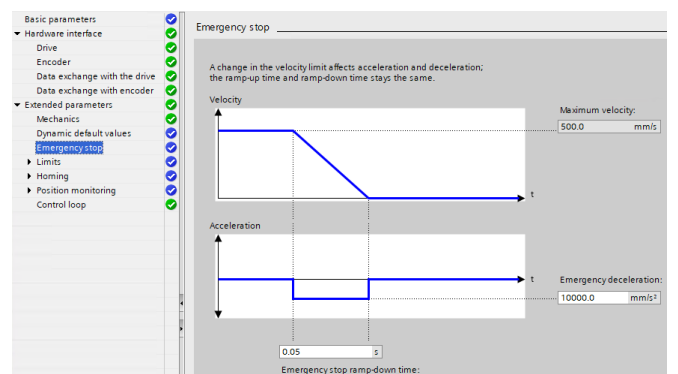
### Dynamic default values

These parameters are dependent on your application needs.



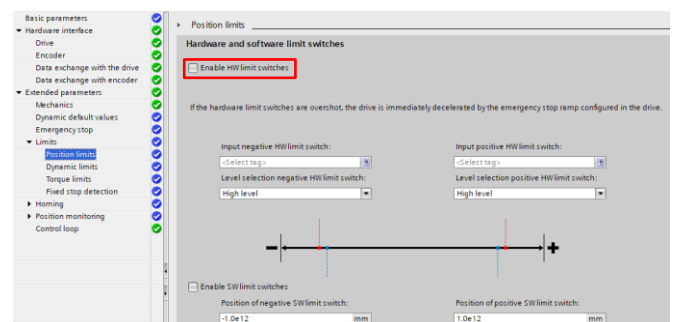
### Emergency stop

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.



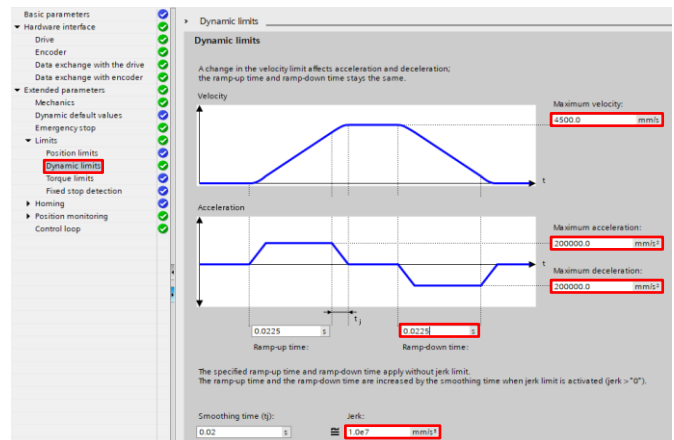
## Dynamic limits

For linear axis 1µm encoder system:

Parameter	Value
Maximum velocity	4'500mm/s
Maximum acceleration	200'000mm/s <sup>2</sup>
Maximum deceleration	200'000mm/s <sup>2</sup>
Jerk	10'000'000mm/s <sup>3</sup>

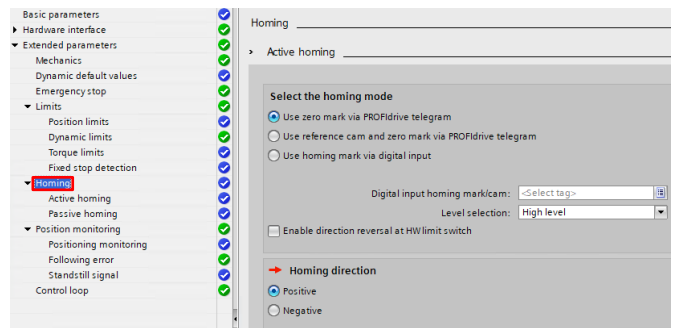
For linear axis 100nm encoder system:

Parameter	Value
Maximum velocity	900mm/s
Maximum acceleration	200'000mm/s <sup>2</sup>
Maximum deceleration	200'000mm/s <sup>2</sup>
Jerk	10'000'000mm/s <sup>3</sup>



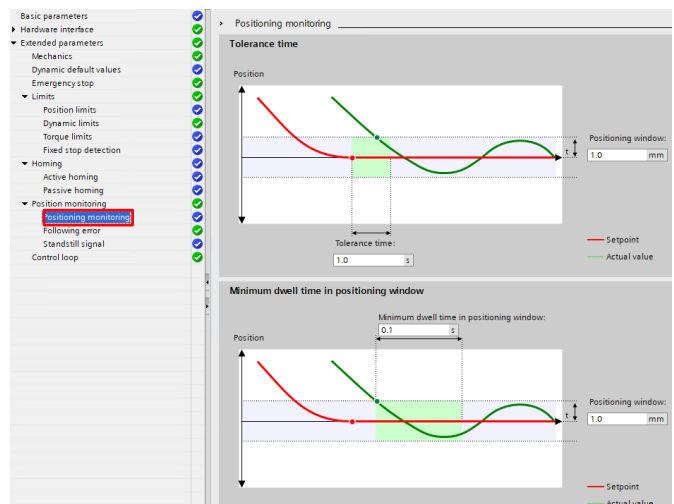
## Homing

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



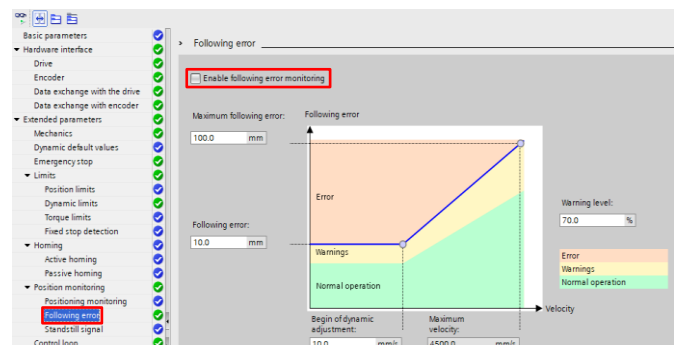
## Position monitoring

These parameters are dependent on your application needs.



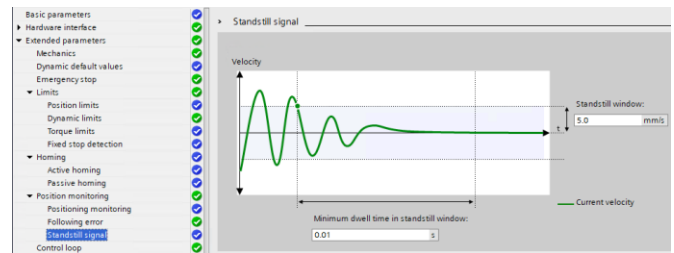
## Following error

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



## Standstill signal

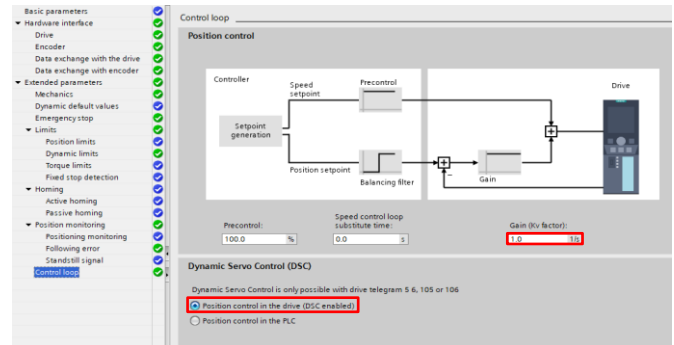
These parameters are dependent on your application needs.



## Control loop

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

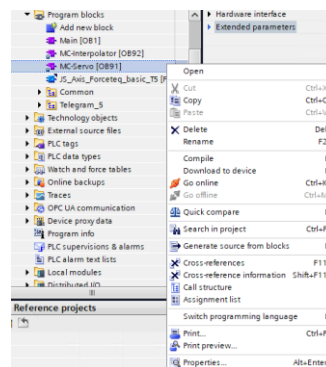
Enable the "Dynamic Servo Control (DSC enabled)".



## 5.8 MC-Servo

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

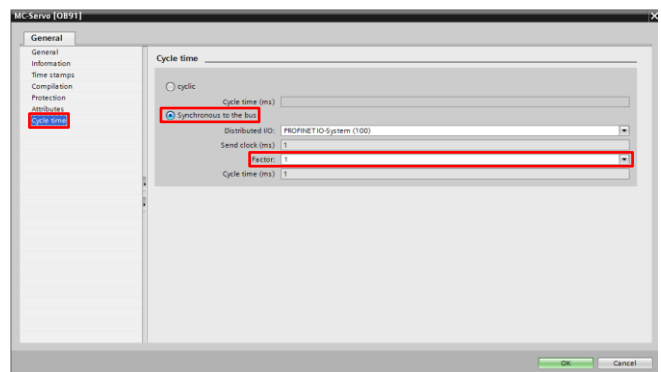
In the project tree right click on "MC-Servo" and "Properties"



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

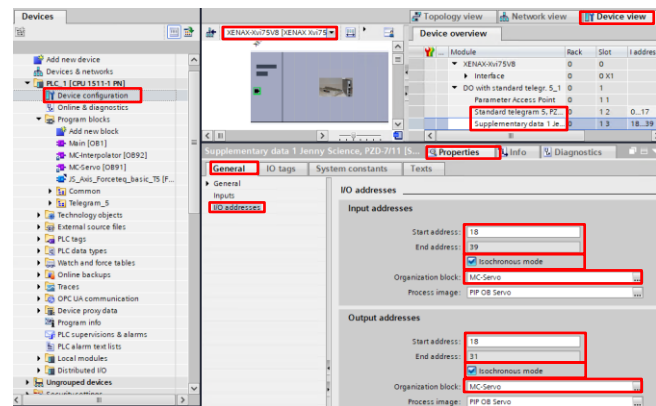
Set the option "Synchronous to the bus"

Set the "Factor" to 1



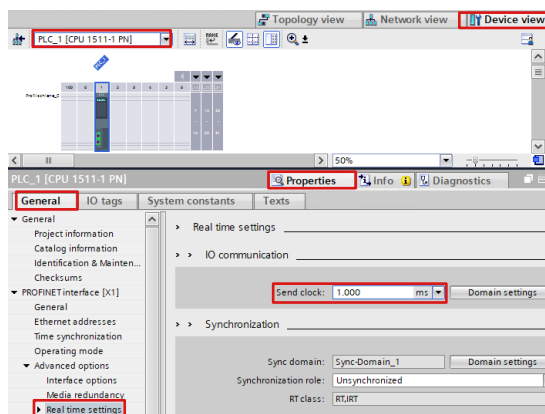
## 5.9 I/O addresses

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

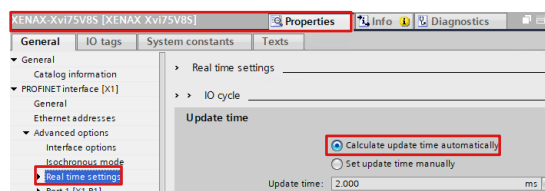


## 5.10 Set Cyclictime

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.

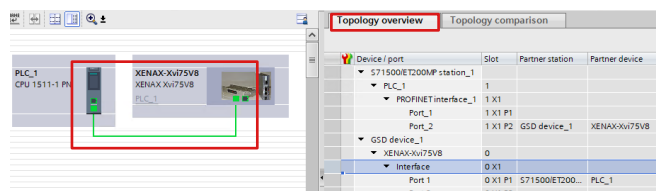


In the same menu item for the XENAX®, the "Update time" can be set to "Calculate update time automatically".



## 5.11 Topology connection and compile

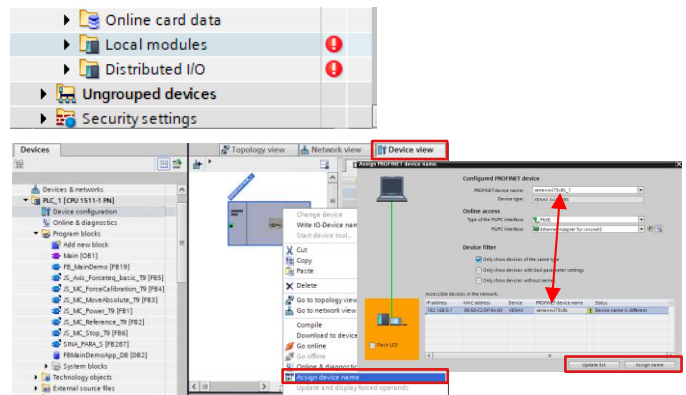
Finally, you can connect the XENAX® to the PLC in the "Topology view" and compile and load the Hardware and Software.





## 5.12 Device name mismatch

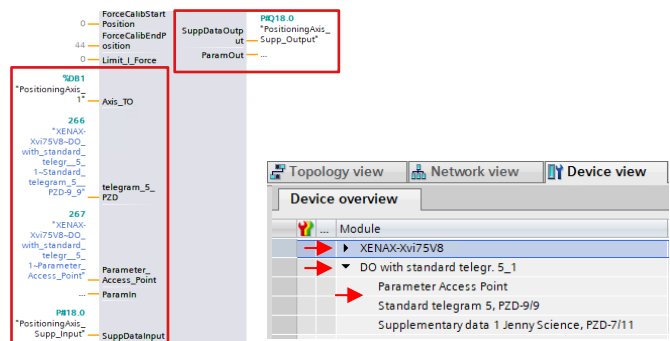
If you get an error message “Device not reachable” you may have not the same name of the device like in the Project. Please match the name by right click to the XENAX® under “Device view”, “Assign device name”, “Update list” and finally “Assign name”.



## 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".



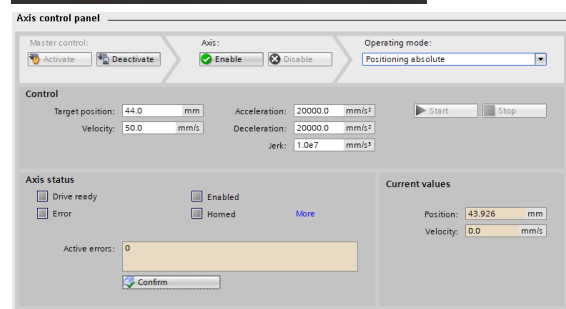
“Telegramm\_5\_PZD” := “Device name~Telegram~Standard\_Telegramm\_5\_PZD-9\_9”  
 Parameter\_Access\_Point := “Device name~Telegram~Parameter\_Access\_Point”  
 SuppDataInput := “PLC tag Name for input data” (see chapter “5.5 Add Supplementary Data”)  
 SuppDataOutput := “PLC tag Name for output data” (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 equal to the reference speed set in Chapter “5.7.2 Hardware Interface” (Data exchange with the drive) 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)
1µm	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 from 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 “4.6 Change Device Typ”.

## 7 Version history

Version	Date	Changelog
3.0.7	04.06.2024	<ul style="list-style-type: none"><li>- All axis function blocks have an input to reset following error</li><li>- Support for driving with LAxisCtrl function block. Two demo applications for Tia Portal V18 are available.</li><li>- All function blocks support Software Units</li><li>- Support for Technology Object to drive in ° instead of mm for rotary axes.</li></ul>

## Notes

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