

Instruction Manual **XENAX® PROFINET® and SIMATIC®**

Version 3.0.5

Edition 24. November 2022



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.

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 CPU315-2 PN/DP (6ES7 315-2EH14-0AB0) and 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

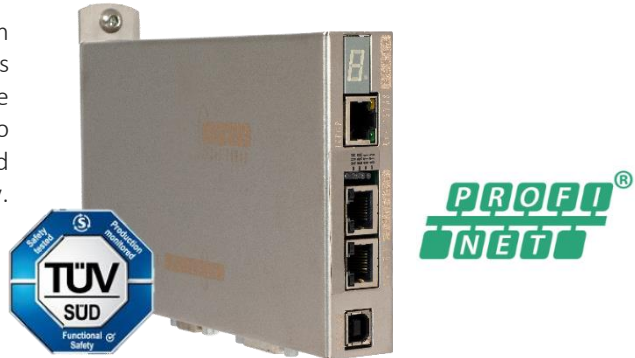
The PROFIdrive profile is the application profile for motion control based on PROFIBUS and PROFINET. As a supplier-independent drive profile the PROFIdrive profile covers all industrially relevant applications.



1.2 Jenny Science

1.2.1 XENAX® servo controller

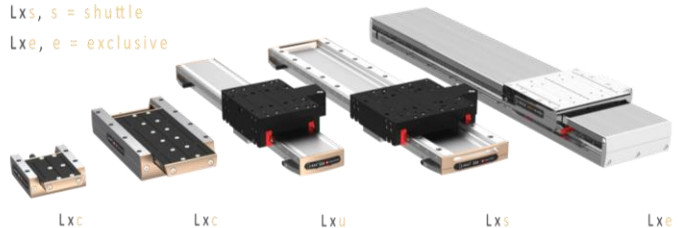
XENAX® servo controller for Jenny Science Axis with integrated Profinet bus module. The bus module is optional but it is required for this application. One XENAX® can control one axis. The XENAX® servo controller recognises all Jenny Science motors and configures the parameters correctly.



1.2.2 LINAX® Linear motors

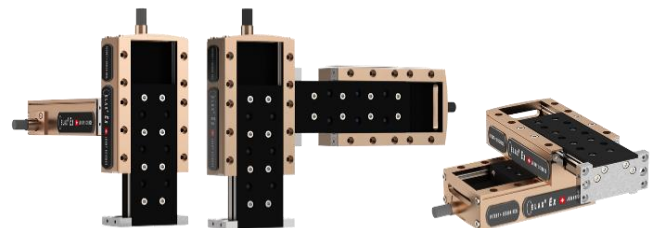
The LINAX® linear motor axes are highly modular and can be flexibly combined amongst each other. Four different series are available.

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.



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
Siemens_FB283_eng.pdf	Function block description for the Siemens function block FB283. It is used for creating the cyclic data exchange between a SIMATIC S7-300 PLC and a XENAX® servo controller.

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 9, PROFIdrive standard

The cyclic data between the SIMATIC PLC and the XENAX® servo controller is exchanged through the PROFIdrive standard telegram 9. The telegram is defined for the *“Program submode”* and *“MDI (Manual Data Input) submode”*. The XENAX® Xvi supports the *“MDI submode”*.

The telegram 9 is set up as follows:

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW0	0 - 1	STW1
%QW2	2 - 3	SATZANW
%QW4	4 - 5	STW2
%QW6 & %QW8	6 - 9	MDI_TARPOS
%QW10 & %QW12	10 - 13	MDI_VELOCITY
%QW14	14 - 15	MDI_ACC
%QW16	16 - 17	MDI_DEC
%QW18	18 - 19	MDI_MOD

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW0	0 - 1	ZSW1
%IW2	2 - 3	AKTSATZ
%IW4	4 - 5	ZSW2
%IW6 & %IW8	6 - 9	XIST_A

SATZANW / AKTSATZ not used with MDI Submode
XIST_A = Actual position linear motor axis

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	0 = Reject Traversing Task 1 = Do Not Reject Traversing Task
5	Intermediate Stop	0 = Intermediate Stop 1 = No Intermediate Stop (just by absolute positioning supported)
6	Enable setpoint	Activate Traversing Task, positive edge
7	Fault acknowledge	Fault Acknowledge, positive edge
8	Jog-1	Jog 1
9	Jog-2	Jog 2
10	Control via PLC	Control By PLC
11	Reference_start	Start Reference drive
12-15	Reserved	Device-specific

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 (No Fault)
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	No Following Error	1 = Following Error Within Tolerance Range (not supported)
9	Control requested	1 = Control requested
10	Setpoint reached	1 = Target position reached
11	Reference set	1 = Reference position set
12	Traversing task acknowledgement	1 = Traversing task acknowledgement on positive edge
13	Axis stands still	1 = Axis stopped
14-15	Reserved	Device-specific

2.1.3 SATZANW (Traversing Block Selection)

Bit	Symbolic name	Comment
0-7	Satz	Number of the motion record in the program storage intended to start (only relevant for program submode, not supported by XENAX®).
8-14	Reserved	Reserved
15	MDI_aktiv	0 = Program sub mode active (not supported by XENAX®) 1 = Activate MDI (Manual Data Input)

2.1.4 AKTSATZ (Actual Traversing Block)

Bit	Symbolic name	Comment
0-7	Satz	Number of the motion record currently active (not supported by XENAX®)
8-14	Reserved	Reserved
15	MDI_aktiv	MDI (Manual Data Input) active

2.1.5 STW2 (Control Word 2)

Bit	Symbolic name	Comment
0-15	Reserved	Reserved, no function

2.1.6 ZSW2 (Status Word 2)

Bit	Symbolic name	Comment
0-9	Reserved	Reserved
10	Pulses_enabled	Pulses Enabled
11-15	Reserved	Reserved

2.1.7 MDI_MOD (MDI Mode)

Bit	Symbolic name	Comment
0	MDIMode	0 = relative positioning 1 = absolute positioning
1-15	Reserved	Reserved

2.1.8 Set Point/Actual Values

Signal	Description	Unit	Datatypes
MDI_TARPOS	Target position absolute or relative depends on the signal MDI_MOD	inc	Integer 32
XIST_A	Actual position	inc	Integer 32
MDI_VELOCITY	Set point speed	inc/s	Integer 32
MDI_ACC	Acceleration as percentage relating to nominal value (PROFIdrive parameter 2007)	%	Unsigned 16
MDI_DEC	Deceleration is the same as acceleration (signal not supported)		Unsigned 16

2.1.9 Standardisation

The nominal value for the acceleration MDI_ACC can be set using the PROFIdrive parameter 2007. The following values are set as default:

Motor	Nominal value
LINAX® / ELAX® 1µm scale	10'000'000 inc/s ²
LINAX® 100nm scale	100'000'000 inc/s ²
Rotary motor	500 turn/s ²

For a rotary motor with gearbox, the nominal value, which set by the XENAX®, is the nominal value at motor side. For example:

$$\text{ROTAX® Rxvp nominal value} = 500 \cdot 64000 \cdot \frac{1}{5}$$

Motor	Gear ratio
ROTAX® Rxvp	1:5
ROTAX® Rxhq	No gearbox

The range of MDI_ACC is from 0% - 200% with 0x4000 corresponding to 100%. The desired acceleration can be calculated as follows:

$$\frac{\text{Nominal value}}{0x4000} * MDI_{ACC} = \text{setpoint acceleration} \left[\frac{\text{inc}}{\text{s}^2} \right]$$

For example: If an acceleration of 800'000 inc/s² is requested and the nominal value is 10'000'000 inc/s², signal MDI_ACC has to be set to the value of 0x51F, which corresponds to a value of 8%.

$$\frac{10'000'000}{0x4000} * 0x51F = 800'000 \left[\frac{\text{inc}}{\text{s}^2} \right]$$

2.2 Telegram 9, 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 >= v3.00).

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
Parameters						
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
%QW20	20 - 21	Limit I_Force
%QW22 & %QW24	22 - 25	Following Pos Error Window
%QW26 & %QW28	26 - 29	Target Position Window
%QW30 & %QW32	30 - 33	Digital Output

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW10	10 - 11	Motor Current Actual Value
%IW12 & %IW14	12 - 15	I_Force Actual
%IW16 & %IW18	16 - 19	Process Status Register
%IW20 & %IW22	20 - 23	Actual Position Following Error
%IW24 & %IW26	24 - 27	Digital Input
%IW28 & %IW30	28 - 31	Digital Output

2.2.2 Supplementary data 2

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW20 & %QW22	20 - 23	Digital Output

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW10 & %IW12	10 - 13	Process Status Register
%IW14 & %IW16	14 - 17	Digital Input
%IW18 & %IW20	18 - 21	Digital Output

2.2.3 Supplementary data 3

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW20	20 - 21	Limit I_Force

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW10 & %IW12	10 - 13	I_Force Actual
%IW14 & %IW16	14 - 17	Process Status Register

2.2.4 Supplementary data 4

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW20	20 - 21	Limit I_Force
%QW22 & %QW24	22 - 25	Limit Force
%QW26 & %QW28	26 - 29	S-Curve
%QW30 & %QW32	30 - 33	Following Pos Error Window
%QW34 & %QW36	34 - 37	Target Position Window
%QW38 & %QW40	38 - 41	Digital Output

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW10	10 - 11	Motor Current Actual Value
%IW12 & %IW14	12 - 15	I_Force Actual
%IW16 & %IW18	16 - 19	Force Actual
%IW20 & %IW22	20 - 23	Process Status Register
%IW24 & %IW26	24 - 27	Actual Position Following Error
%IW28 & %IW30	28 - 31	Digital Input
%IW32 & %IW34	32 - 35	Digital Output

2.2.5 Supplementary data 5

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW20	20 - 21	Limit I_Force
%QW22 & %QW24	22 - 25	Limit Force

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW10 & %IW12	10 - 13	I_Force Actual
%IW14 & %IW16	14 - 17	Force Actual
%IW18 & %IW20	18 - 21	Process Status Register

2.2.1 Supplementary data 6

Address relative (16Bit)	Byte-Nr	Output Data PLC -> Drive
%QW20	20 - 21	Limit I_Force
%QW30 & %QW32	22 - 25	Following Pos Error Window
%QW34 & %QW36	26 - 40	Target Position Window

Address relative (16Bit)	Byte-Nr	Input Data Drive -> PLC
%IW10	10 - 11	Motor Current Actual Value
%IW20 & %IW22	12 - 15	Process Status Register
%IW24 & %IW26	16 - 19	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

2.3 Telegram 910 & 911

Telegrams 910 and 911 are based on Telegram 9 with additional data. However, we recommend using the PROFIdrive standard Telegram 9 with supplementary data (refer to 2.2 Telegram 9, Supplementary Data).

2.3.1 Telegram 910, I_Force

Basis for the Jenny Science Telegram 910 is the Standard Telegram 9 which is extended with additional signals.

I/O Data number (16Bit)	Output Data PLC -> Drive
1	STW1
2	SATZANW
3	STW2
4 & 5	MDI_TARPOS
6 & 7	MDI_VELOCITY
8	MDI_ACC
9	MDI_DEC
10	MDI_MOD
11	Limit I_Force

I/O Data number (16Bit)	Input Data Drive -> PLC
1	ZSW1
2	AKTSATZ
3	ZSW2
4 & 5	XIST_A
6 & 7	I_Force Actual
8 & 9	Process Status Register

2.3.2 Telegram 911, I_Force and I/O

Basis for the Jenny Science Telegram 911 is the Standard Telegram 9 which is extended with additional signals.

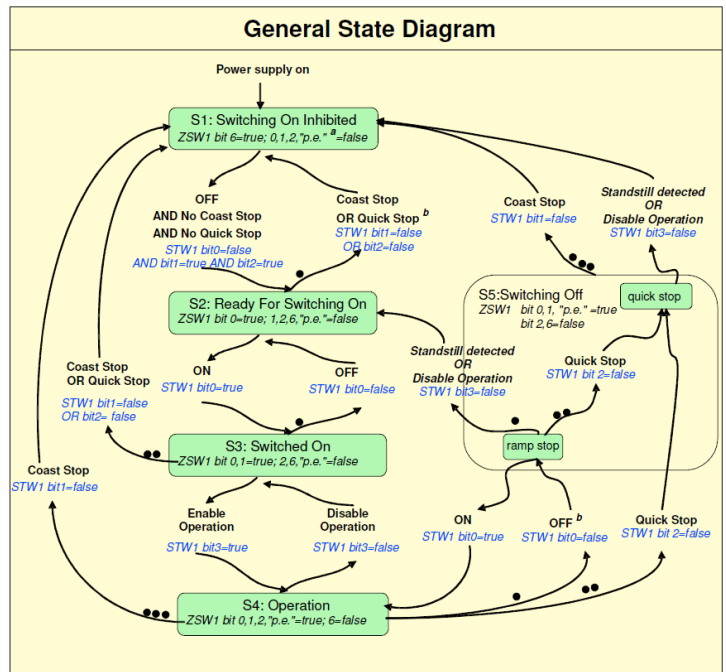
I/O Data number (16Bit)	Output Data PLC -> Drive
1	STW1
2	SATZANW
3	STW2
4 & 5	MDI_TARPOS
6 & 7	MDI_VELOCITY
8	MDI_ACC
9	MDI_DEC
10	MDI_MOD
11	Limit I_Force
12 & 13	S-Curve
14 & 15	Following Position Error Window
16 & 17	Target Position Window
18 & 19	Digital Output

I/O Data number (16Bit)	Input Data Drive -> PLC
1	ZSW1
2	AKTSATZ
3	ZSW2
4 & 5	XIST_A
6	Motor Current Actual Value
7 & 8	I_Force Actual
9 & 10	Process Status Register
11 & 12	Actual Position Following Error
13 & 14	Digital Input
15 & 16	Digital Output

2.4 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”.



2.5 State machine MDI submode

Via “MDI (Manual Data Input) submode” state machine the axis can be moved, if the basic state machine is set to State S4. STW1 is also used to switch to the individual states. The current state is visible in ZSW1.

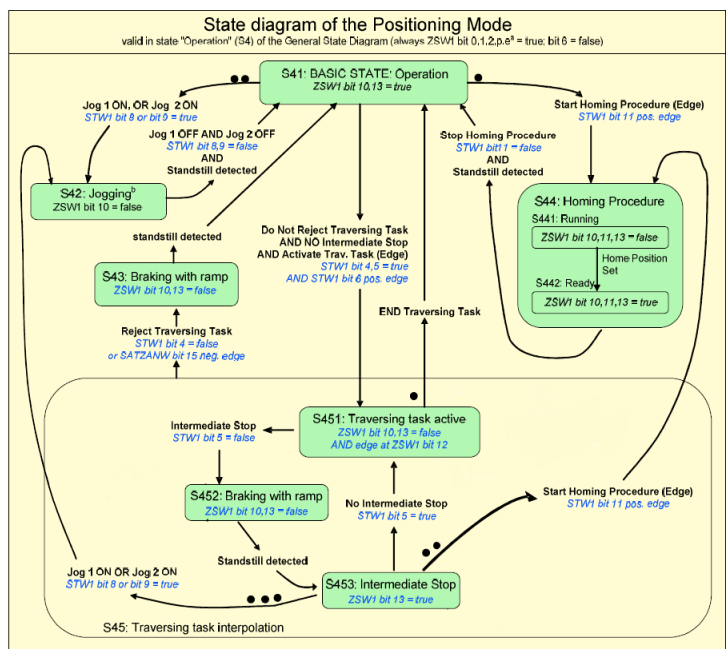
Notes:

Currently the transition from state S453 to S451 (No Intermediate Stop) is only supported in absolute position. With relative positioning state S453 changes to state S41.

For parameterising the Jog mode the parameters 2572, 2585, 2586, 2587, 2588 and 2591 are important.

The “Homing Procedure” (Reference) is started with a positive edge on STW1 bit11. If the “Homing Procedure” is not finish yet (state 442 reached) a falling edge on STW1 bit11 aborts the “Homing Procedure” (PROFINET Firmware >= v1.81).

Thereby the XENAX® can recognise the falling edge on STW1 bit11 for the transition of state S442 to S41 at least one PROFINET update cycle is required.



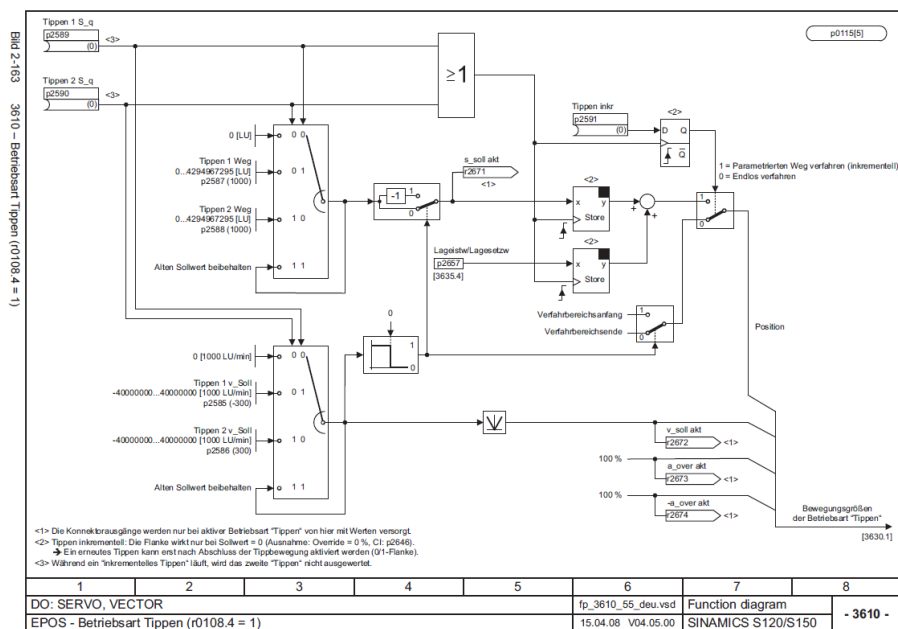
2.5.1 Description jog mode

The jog mode using Profinet is put into practice like SINAMICS List Manual from Siemens. In the jog mode you have to use the parameters from JSC_PROFIdrive_Parameter.pdf:

Parameter Nr.	Name	Beschreibung	Name Length	Default Value	Low Limit	High Limit	Data Length (Byte)	Data Type
2572	a_max	Max. Acceleration (für Tipp-Betr.)	5	0x989680	0x7D0	0x3B9ACA00	4	Unsigned32
2585	Tippen 1 v. Soll	Jog 1 Demand Velocity	15	0x00	0xFA0A1F00	0x05F5E100	4	Integer 32
2586	Tippen 2 v. Soll	Jog 2 Demand Velocity	15	0x00	0xFA0A1F00	0x05F5E100	4	Integer 32
2587	Tippen 1 Weg	Jog 1 Way	12	0x00	0x00	0x7FFFFFFF	4	Unsigned32
2588	Tippen 2 Weg	Jog 2 Way	12	0x00	0x00	0x7FFFFFFF	4	Unsigned32
2591	Tippen ink	Jog incremental	10	0x00	0x00	0x01	4	Unsigned32

Simplified jogging functionality implemented. If all jogging parameters 2585-2588 are set to 0 (default by power up), MDI velocity is used for jogging speed and Jog 1 starts a positive jogging drive and Jog 2 starts a negative jogging drive.

With connected telegram 5 (cyclic synchronous mode), exclusive access over PROFIdrive state machine is released in state S1 "Switch On Inhibited" (power stage off). So in state S1, commands from outside PROFIdrive state machine over parameter access or serial commands are allowed, e.g. for starting a force calibration drive.

**p2572**

SERVO (EPOS),
VECTOR (EPOS)

EPOS maximum acceleration / a_max

Can be changed: T

Data type: Unsigned32

P-Group: Basic positioner

Not for motor type: -

Min

1 [1000 LU/s²]

Calculated: -

Dynamic index: -

Units group: -

Scaling: -

Max

2000000 [1000 LU/s²]

Access level: 1

Func. diagram: 3630

Unit selection: -

Expert list: 1

Factory setting

100 [1000 LU/s²]

Description:

Sets the maximum acceleration for the function module "basic positioner" (r0108.4).

Dependency:

Refer to: p2619, p2644

Note:

The maximum acceleration appears to exhibit jumps (without jerk).

"Traversing blocks" operating mode:

The programmed acceleration override (p2619) acts on the maximum acceleration.

"Direct setpoint input/MDI" mode:

The acceleration override is effective (p2644. 4000 hex = 100 %).

"Jog" and "search for reference" modes

No acceleration override is active. The axis starts with the maximum acceleration.

2.6 Parameter

PROFIdrive offers the possibility to parameterize the XENAX® servo controller or to read certain values via acyclic data exchange.

The 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. The older PLC S7-300 family uses the FB283 for cyclic and acyclic communication. The S7-300 controllers were replaced with the S7-1500 controllers.

CPU	Telegram	Cyclic communication	Acyclic communication
S7_3xx	9	FB283	FB283
S7_15xx	9	DPRD_DAT & DPWR_DAT	SINA_PARA_S or SINA_PARA

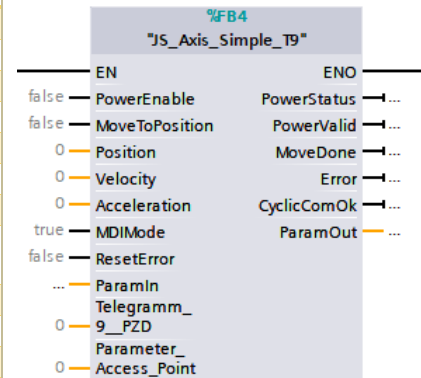
3 JennyScience MotionControl Library

3.1 JennyScience AxisFunctionBlocks

3.1.1 JS_Axis_Simple_T9

Inputs	
PowerEnable	Enables or disabled power stage
MoveToPosition	Move to position on positive edge
Position	Target position [inc]
Velocity	Max. velocity [inc/s]
Acceleration	Max. acceleration [% of parameter 2007 0x4000=100%]
MDIMode	Position mode: 0 = relative, 1 = absolute
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
ResetError	Acknowledge error
Telegramm_9__PZD	Telegram 9 reference
Parameter_Access_Point	Telegram 9 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
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



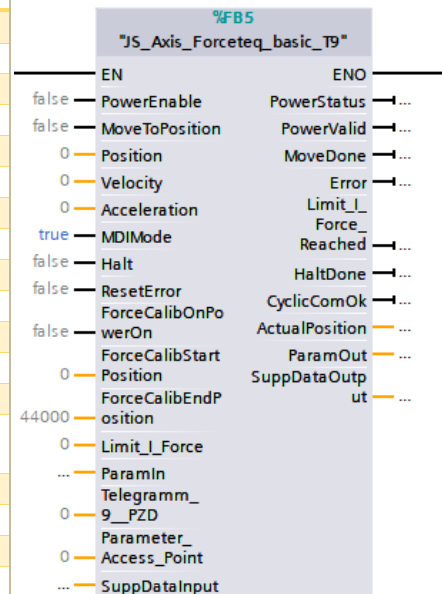
Internally used Functions

- JS_MC_MoveAbsolute_T9
- JS_MC_Power_T9
- JS_MC_Reference_T9
- SINA_PARA_S (Siemens)

3.1.2 JS_Axis_Forceteq_basic_T9

Inputs	
PowerEnable	Enables or disabled power stage
MoveToPosition	Move to position on positive edge
Position	Target position [inc]
Velocity	Max. velocity [inc/s]
Acceleration	Max. acceleration [% of parameter 2007 0x4000=100%]
MDIMode	Position mode: 0 = relative, 1 = absolute
Halt	Calls JS_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]
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
Telegramm_9_PZD	Telegram 9 reference
Parameter_Access_Point	Telegram 9 access point
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
Limit_I_Force_Reached	I_Force limit is reached
HaltDone	JS_MC_HALT is done
CyclicComOK	1 = OK, 0 = Axis disconnected from PLC
ActualPosition	Actual position of the axis [inc]
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
SuppDataOutput	Supplementary Data Output

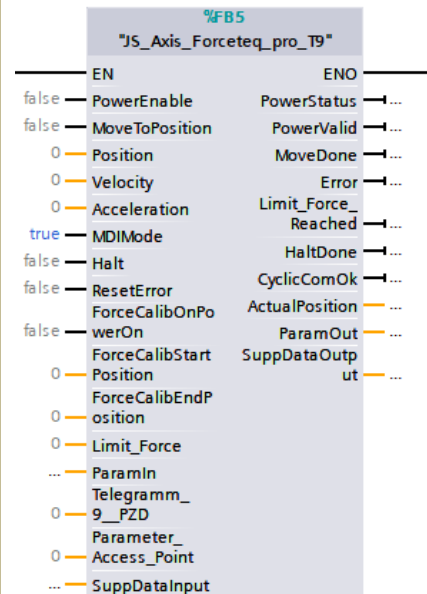


- Internally used Functions
- JS_MC_ForceCalibration_T9
 - JS_MC_MoveAbsolute_T9
 - JS_MC_Power_T9
 - JS_MC_Reference_T9
 - JS_MC_Halt_T9
 - SINA_PARA_S (Siemens)

3.1.3 JS_Axis_Forceteq_pro_T9

Inputs	
PowerEnable	Enables or disables power stage
MoveToPosition	Move to position on positive edge
Position	Target position [inc]
Velocity	Max. velocity [inc/s]
Acceleration	Max. acceleration [% of parameter 2007 0x4000=100%]
MDIMode	Position mode: 0 = relative, 1 = absolute
Halt	Calls JS_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	Limit Force [mN]
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
Telegramm_9__PZD	Telegram 9 reference
Parameter_Access_Point	Telegram 9 access point
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
Limit_Force_Reached	Force limit is reached
HaltDone	JS_MC_HALT is done
CyclicComOK	1 = OK, 0 = Axis disconnected from PLC
ActualPosition	Actual position of the axis [inc]
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
SuppDataOutput	Supplementary Data Output



Internally used Functions

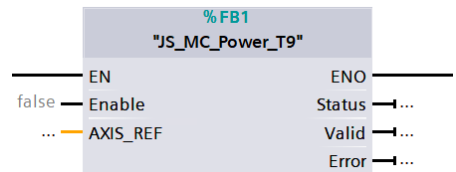
- JS_MC_ForceCalibration_T9
- JS_MC_MoveAbsolute_T9
- JS_MC_Power_T9
- JS_MC_Reference_T9
- JS_MC_Halt_T9
- SINA_PARA_S (Siemens)

3.2 JennyScience MCFunctionBlocks

3.2.1 JS_MC_Power_T9

Inputs	
Enable	Enables or disabled power stage
AXIS_REF	Reference to Telegram data from DPRD_DAT

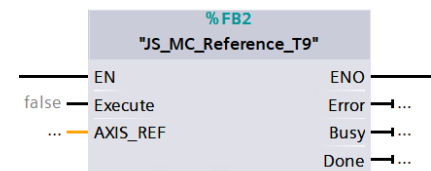
Outputs	
Status	State of the power stage
Valid	1 = Power stage stable or 0 = changing
Error	Error occurred within function block



3.2.2 JS_MC_Reference_T9

Inputs	
Execute	Starts the reference on positive edge
AXIS_REF	Reference to Telegram data from DPRD_DAT

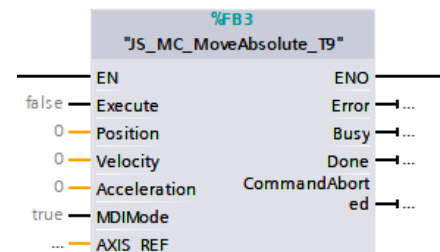
Outputs	
Error	Error occurred within function block
Busy	Reference in process
Done	Reference done



3.2.3 JS_MC_MoveAbsolute_T9

Inputs	
Execute	Move to position on positive edge
Position	Target position [inc]
Velocity	Max. velocity [inc/s]
Acceleration	Max. acceleration [% of parameter 2007 0x4000=100%]
MDIMode	Position mode: 0 = relative, 1 = absolute
AXIS_REF	Reference to Telegram data from DPRD_DAT

Outputs	
Error	Error occurred within function block
Busy	MoveAbsolute in process
Done	MoveAbsolute done
CommandAborted	Function block is aborted by another command



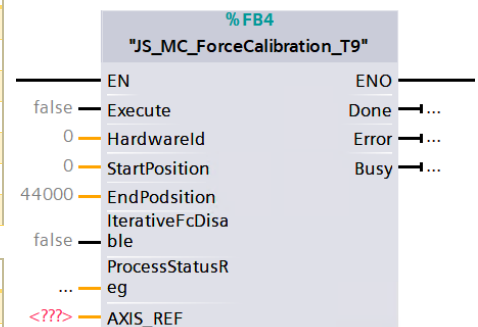
3.2.4 JS_MC_ForceCalibration_T9

Note:

Before executing a ForceCalibration the Power.Enable must be set to False. This will cause the axis to be powerless for a short time.

Inputs	
Execute	Starts the Force Calibration drive on positive edge
HardwareId	HW Identifier of module access point
StartPosition	Start position of Force Calibration [inc]
EndPosition	End position of Force Calibration [inc]
IterativeFcDisable	Clears the old calibration data before new cal.-drive
ProcessStatusReg	Process Status Register XENAX („TPSR“ Command)
AXIS_REF	Reference to Telegram data from DPRD_DAT

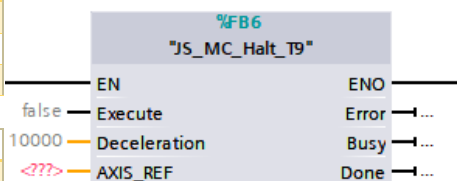
Outputs	
Done	Force Calibration done
Error	Error occurred within function block
Busy	Force Calibration in process



3.2.5 JS_MC_Halt_T9

Inputs	
Execute	Decelerating the axis on a positive edge
Deceleration	Max. deceleration [inc/s²]
AXIS_REF	Reference to Telegram data from DPRD_DAT

Outputs	
Error	Error occurred within function block
Busy	MC_Stop in process
Done	MC_Stop done



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. Two of them are for the older S7-300 Family. Please note that the demo projects for S7-300 controllers are no longer being developed.

4.1 List of Demo Applications

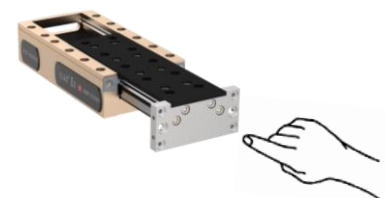
4.1.1 JSC_SimpleTest_Telegram_9

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_9

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.



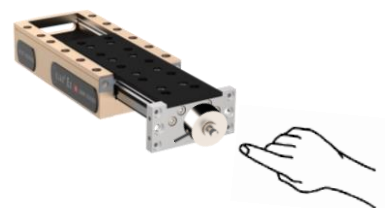
4.1.3 JSC_Forceteq_basic_ForceMonitoring_Telegram_9

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_9

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_9

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_9

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).

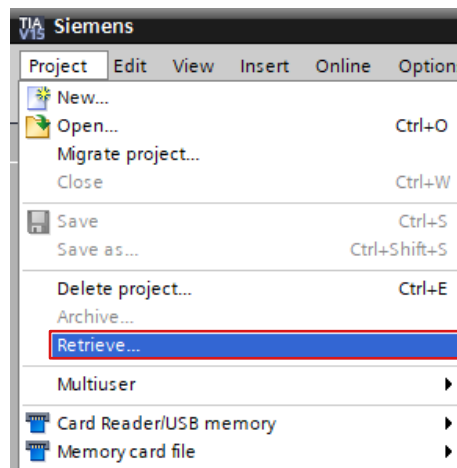


4.2 Import Demo

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.

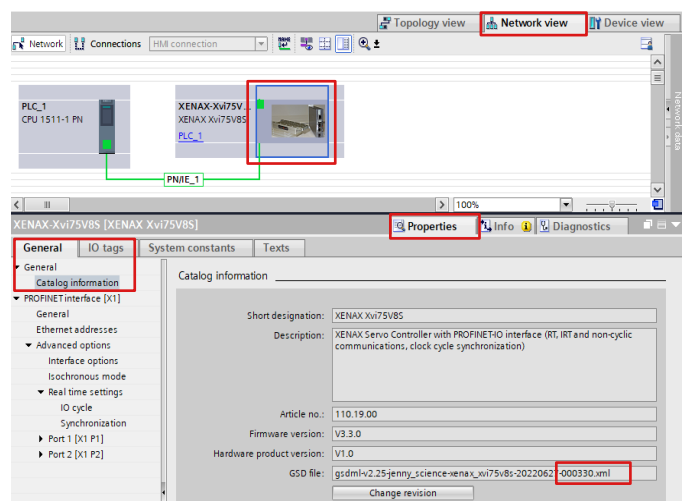
Go to the project view of TIA Portal and press retrieve in the project category.



Import an application example with telegram 9 and save it on the computer.

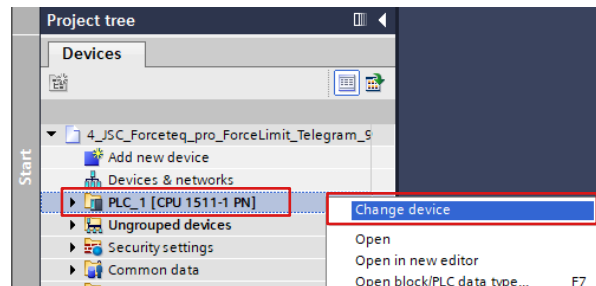
Name	Änderungsdatum	Größe
1_JSC_SimpleTest_Telegram_9.zap15	07.07.2022 16:21	1'637 KB
2_JSC_Forceteq_basic_ForceLimit_Telegram_9.zap15	07.07.2022 16:25	1'962 KB
3_JSC_Forceteq_basic_ForceMonitoring_Telegram_9.zap15	07.07.2022 16:26	2'084 KB
4_JSC_Forceteq_pro_ForceLimit_Telegram_9.zap15	07.07.2022 16:26	2'071 KB
5_JSC_Forceteq_pro_ForceMonitoring_Telegram_9.zap15	07.07.2022 16:27	2'166 KB
6_JSC_2_Axes_Telegram_9.zap15	07.07.2022 16:28	2'217 KB

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](#).

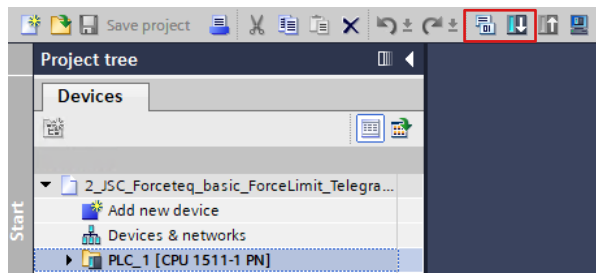


4.3 Run Demo

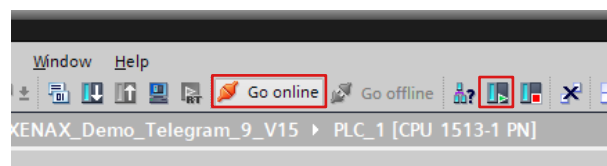
The demo projects were created for the S7-1511-1 PN CPU. If a different PLC is used, the PLC device must be changed in the project tree.



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

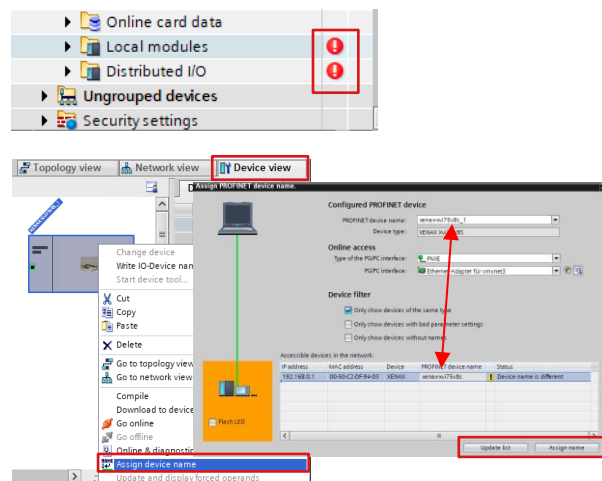


Go online and make sure the PLC is running.



4.4 Device name mismatch

If you get an error 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 "4.5 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".



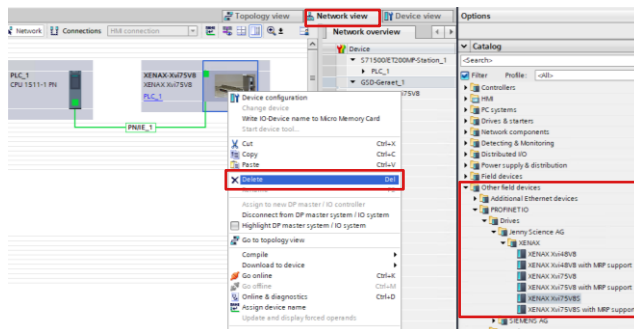
4.5 Change Device Type

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.

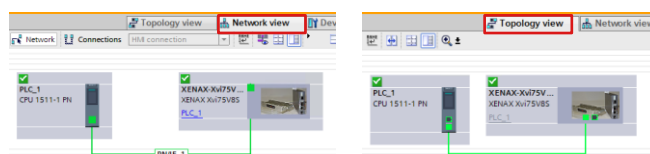
Delete the existing Device under “Devices & networks”, “Network view” by right click to the XENAX® and “Delete”.

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.

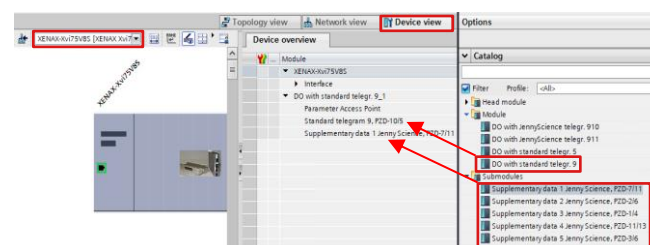


After adding the XENAX® to the Network view connect the XENAX® to the PLC in the “Network view” and the “Topology view”.

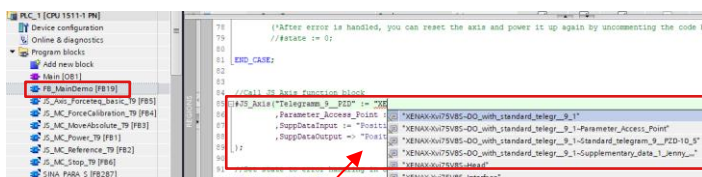


Add the “DO with standard teleg. 9” and the needed Submodules to the device under “Device view”.

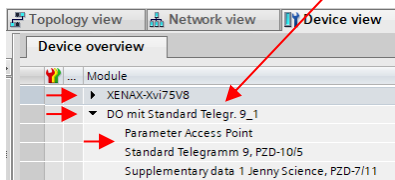
SimpleTest uses no Submodule Forceteq® basic and 2 Axis uses Suppl. data 1 and Forceteq pro uses SupData 4.



Change the Inputs “Telegramm_9__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_9_PZD” := “Device name~Telegram~Standard_Telegramm_9_PZD-1,,,,”
 Parameter_Access_Point := “Device name~Telegram~Parameter_Access_Point”
 SupDataInput := “PLC tag Name for input data” (see next step)
 SupDataOutput := “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 displays the Siemens SIMATIC Manager interface. The top window shows the 'PLC 1 [CPU 1511-1 PN]' tag table with the following data:

Name	Data type	Address
PositioningAxis_1_Supp_Input	"SuppDataInput_1"	%I10.0
PositioningAxis_1_Supp_Output	"SuppDataOutput_1"	%Q20.0
-Add new-		

The bottom window shows the 'Device overview' for 'XENAX-Xvi75V85'. The hardware configuration table is as follows:

Module	Rack	Slot	I address	Q address	Type	Article
XENAX-Xvi75V85	0	0			XENAX-Xvi75V85	110.1
Interface	0	0 X1			XENAX-Xvi75V85	
DO with standard telegr. 9_1	0	1			DO with standard t...	
Parameter Access Point	0	1.1			Parameter Access P...	
Standard telegram 9, PZD-10/5	0	1.2	0...9	0...9	Standard telegram ...	
Supplementary data 1 Jenny Science, PZD-7/11	0	1.3	10...31	20...33	Supplementary dat...	

Red arrows indicate the mapping of addresses: from '%I10.0' in the tag table to '0...9' in the hardware configuration, and from '%Q20.0' to '20...33'.

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”.

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.

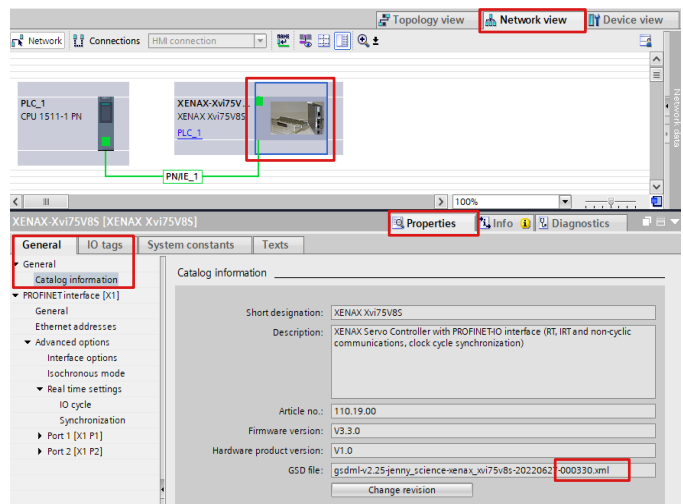
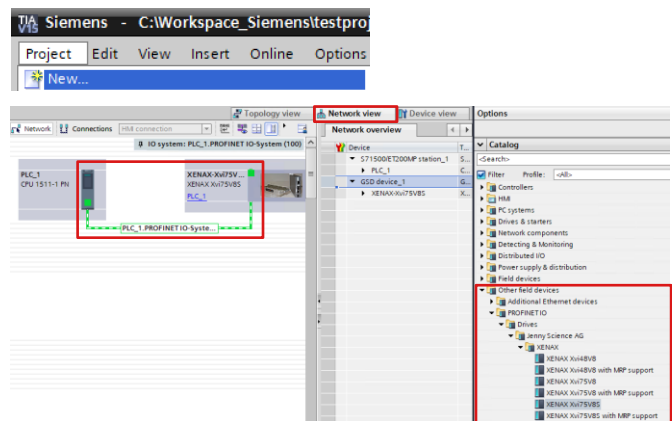
If the XENAX® Xvi is not present in the Hardware catalog you need to install the GSD file.

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](#).

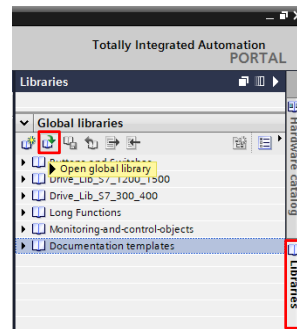
Note: You have to install a separate GSD file for the XENAX® Xvi75V8, Xvi75V8S and Xvi48V8.

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



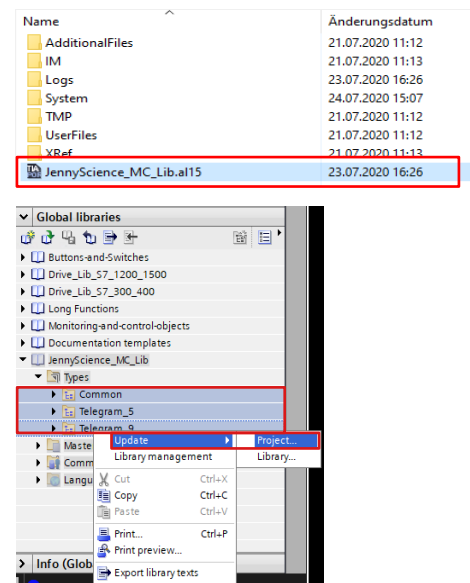
5.2 Open JennyScience_MC_Lib

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

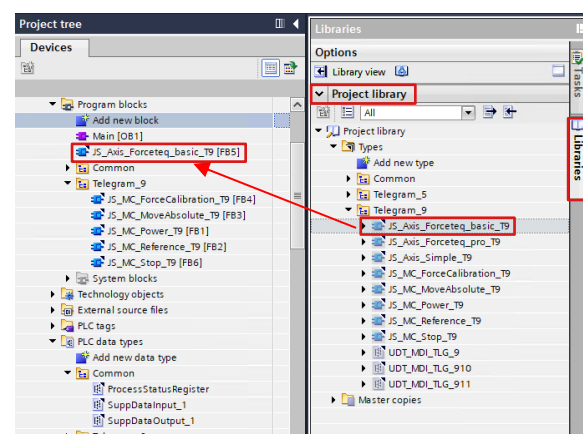
Sina_Para and Sina_Para_S function block are used for acyclic data communications. Sina_Para_S provides a single parameter access while Sina_Para alters multiple Parameters at once. Sina_Para_S V511 is provided in the JennyScience_MC_Lib. If you need a different version, it can be downloaded from [Siemens](#). 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:

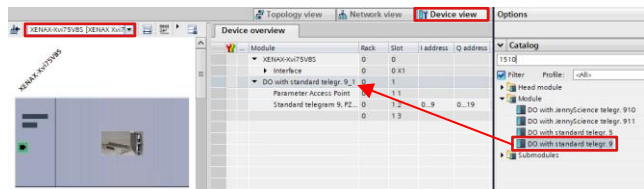
Do not copy JS_MC function blocks if you have already copied an axis block.



5.4 Add Telegram 9

In the “device configuration” change to the tap “Device view” select the XENAX® and add “DO with standard telegr. 9” from the Module folder in the “Hardware catalog”.

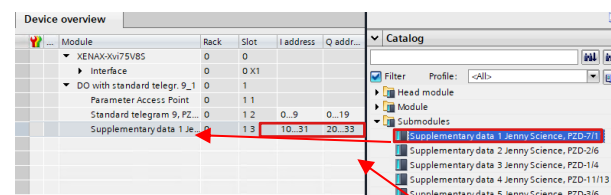
Note: Telegrams 910 and 911 are based on Telegram 9 with additional data. However, we recommend using the PROFIdrive standard Telegram 9 with supplementary data.



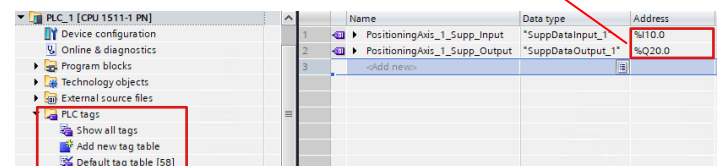
5.5 Add Supplementary Data

If additional data to the standard Telegram 9 is needed, these can be added via Supplementary Data. More information about this can be found in the chapter 2.2 Telegram 9, Supplementary Data.

Choose the needed Supplementary data from the Submodules folder and note the start address of "I address" (here 10) and "Q address" (here 20) for the definition of the new tags.



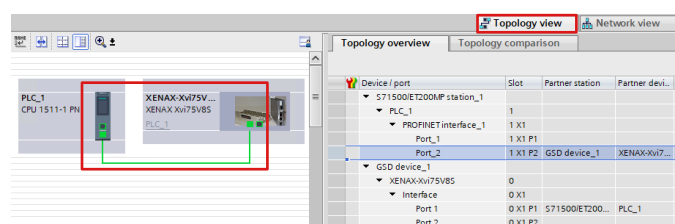
Define the new “PLC tags” for the Supplementary Data and enter the “I address” and “Q address” from the HW configuration in the step before.



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

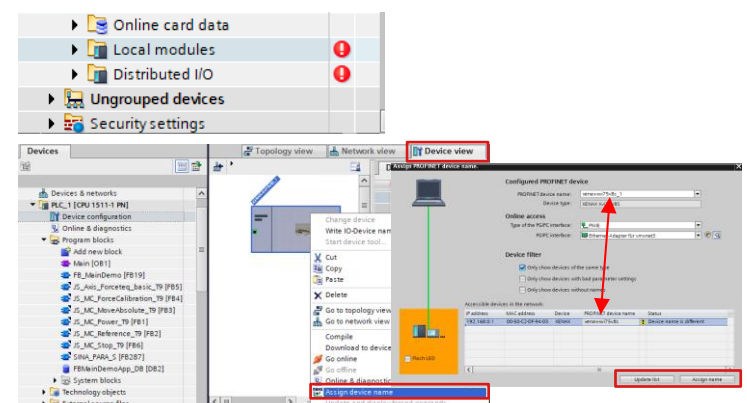
5.6 Topology connection and compile

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



5.7 Device name mismatch

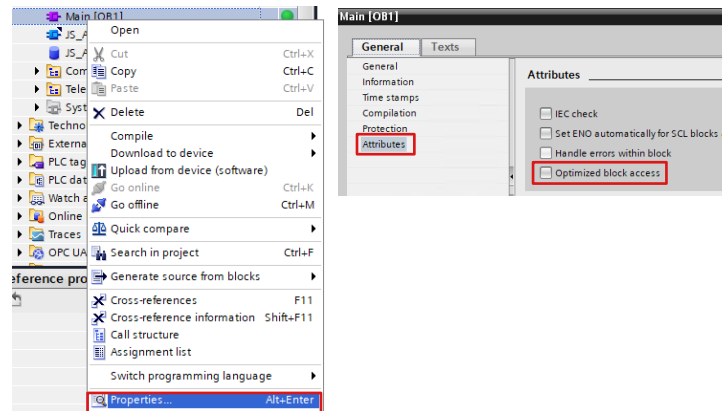
If you get an error message “Device not reachable” you may have not the same name of the device like in the Project. Please match the name by right click to the XENAX® under “Device view”, “Assign device name”, “Update list” and finally “Assign name”.



5.8 Deactivate Optimized block access

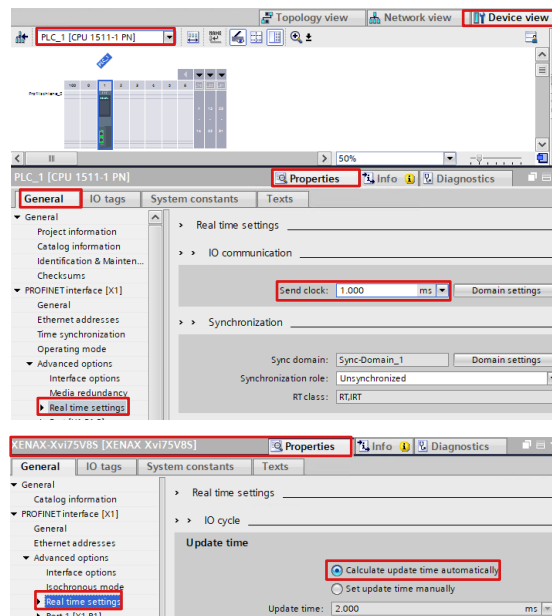
Note for optimized block access for S7-1200/S7-1500 Controller:

The data block in which the telegram data are stored and the telegram data are read respectively (here Main[OB1], must not have enabled the option „Optimized block access“. Otherwise, the telegram data might be stored in a mixed-up order.



5.9 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.

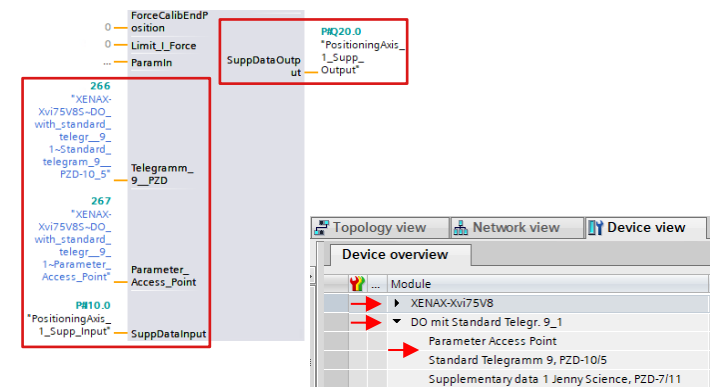


In the same menu item for the XENAX®, the "Update time" can be set to "Calculate update time automatically".

5.10 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_9_PZD" := "Device name~Telegram~Standard_Telegramm_9_PZD-1,,,"

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")

5.11 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 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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