LinMot®

PROFINET PROFIdrive Interface

Manual

Documentation of the PROFIdrive Interface of the following Drives:

- **C1251-MI-XC-2S**
- **C1250-MI-XC-xS-x00**
- **C1250-MI-XC-xS-xPD**

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Note
The information in this documentation reflects the stage of development at the time of press and is therefore without obligation. NTI AG reserves itself the right to make changes at any time and without notice to reflect further technical advance or product improvement.

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Table of Contents

1 System overview

PROFINET is an open real-time Ethernet network. In this manual the PROFIdrive profiles of LinMot drives are described. The LinMot drive acts as a slave in this network and is implemented with the netX chip from Hilscher.

For further information on the PROFINET and PROFIdrive fieldbus protocols please visit:
http://www.profibus.com/

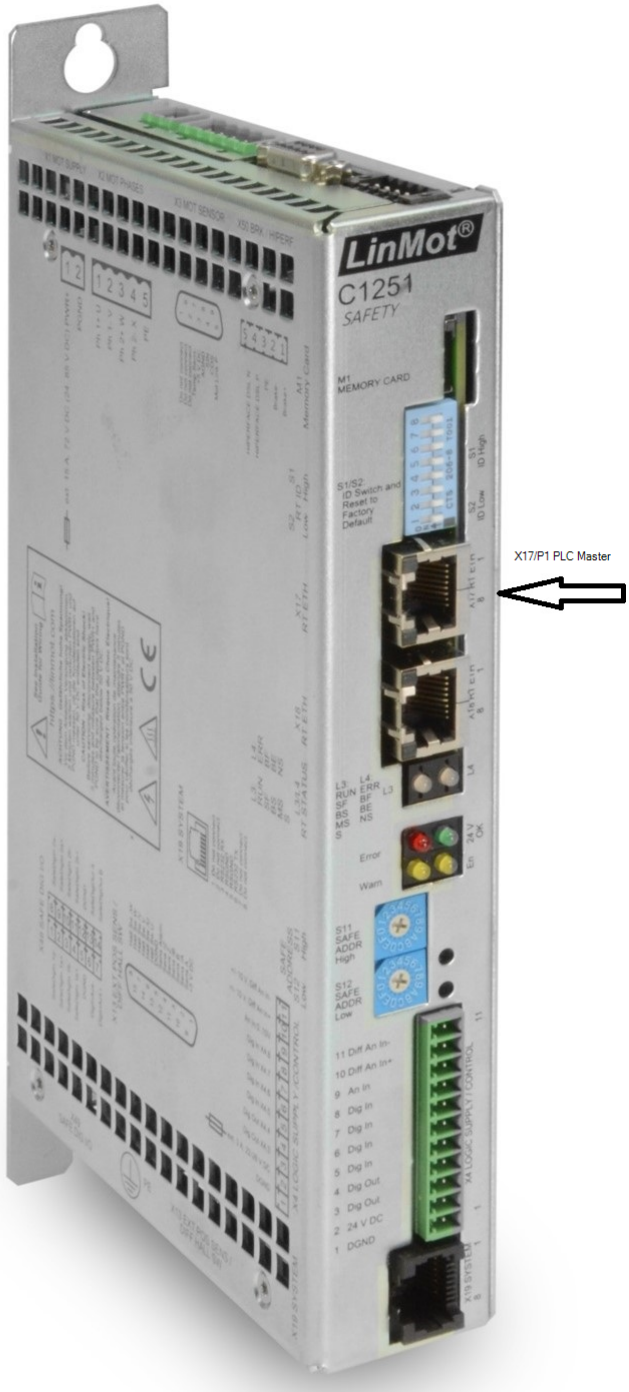
1.1 References

All user manuals are distributed with the LinMot-Talk software. The newest versions can be downloaded from the LinMot homepage in the download section.

Ref	Title	Doc Reference	Source
1	Safety Manual 2S Products	0185-1174-E	shop.linmot.com
2	User Manual Motion Control SW	0185-1093-E_6V8	shop.linmot.com
3	LinMot Drive Configuration over Fieldbus Interfaces SG5-SG7	0185-1074-E_1V7	shop.linmot.com
4	Sinamics S120 Safety Integrated Function Manual	6SL3097-5AR00-0BP3	https://support.industry.siemens.com/cs/document/109781722

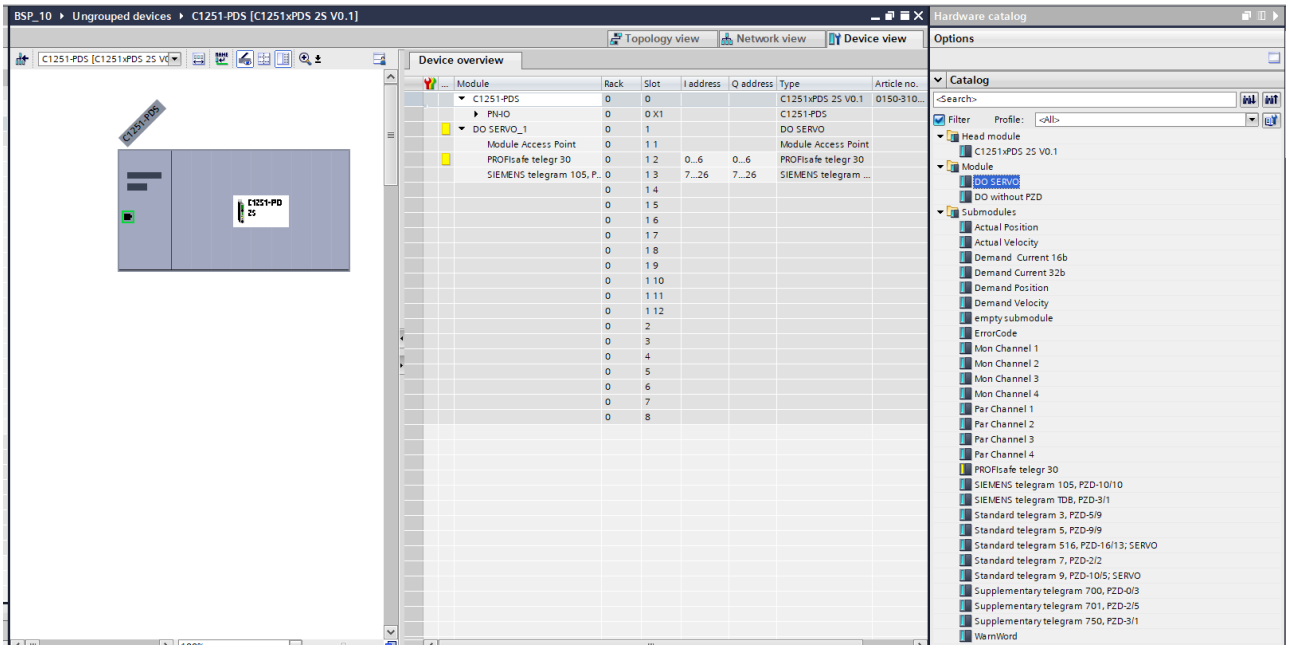
1.2 Port assignment

Attention: Within a PROFINET network normally the topology is defined for easy setup and replacement of devices. The real-time Ethernet RJ45 connector X17 is the P1 port and the real time RJ45 connector X18 is the P2 port in this context.


LinMot®
C1251
SAFETY
X17/P1 PLC Master

2 Process Data Object (PDO) Configuration

The cyclic process data is configured in the master and transmitted to the slave during start-up. The data object modules can be configured by drag and drop to any of the device slots from 1 to 8. The DO-SERVO can have its submodules in subslots from 1 to 12.



Overview of the supported Data Objects Modules.

2.1 Bidirectional PDO Modules

2.1.1 Standard telegram 3, PZD-5/9

The telegram content has speed-setpoint interface, 32 bit, with one sensor

Output Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 3	**10**	**-**	**Variables**	**RECORD**
1	2	0	STW1	Uint16
2, 3	4	2	NSOLL_B	Int32
4	2	6	STW2	Uint16
5	2	8	G1_STW	Uint16

Input Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 3	**18**	**-**	**Variables**	**RECORD**
1	2	0	ZSW1	Uint16
2, 3	4	2	NIST_B	Int32
4	2	6	ZSW2	Uint16

Index	Size [Byte]	Byte Offset	Name	Data Type
5	2	8	G1_ZSW	Uint16
6, 7	4	10	G1_XIST_1	Int32
8, 9	4	14	G1_XIST_2	Int32

2.1.2 Standard telegram 5, PZD-9/9

The standard telegram 5 is derived from standard telegram 3 for additional use of the Dynamic Servo Control (DSC). The telegram contain speed-setpoint interface, 32 bit with one sensor, additionally position difference and position controller gain in the setpoint direction for DSC.

Output Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 5	**18**	**-**	**Variables**	**RECORD**
1	2	0	STW1	Uint16
2, 3	4	2	NSOLL_B	Int32
4	2	6	STW2	Uint16
5	2	8	G1_STW	Uint16
6, 7	4	10	XERR	Int32
8, 9	4	14	KPC	Int32

Input data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 5	**18**	**-**	**Variables**	**RECORD**
1	2	0	ZSW1	Uint16
2, 3	4	2	NIST_B	Int32
4	2	6	ZSW2	Uint16
5	2	8	G1_ZSW	Uint16
6, 7	4	10	G1_XIST_1	Int32
8, 9	4	14	G1_XIST_2	Int32

2.1.3 Standard telegram 7, PZD-2/2

The standard telegram 7 is defined for positioning mode.
Content: Positioning interface (Program submode)

Output Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 7	**4**	**-**	**Variables**	**RECORD**
1	2	0	STW1	Uint16
2	2	2	SATZANW	Uint16

Input Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 7	**4**	**-**	**Variables**	**RECORD**
1	2	0	ZSW1	Uint16
2	2	2	AKTSATZ	Uint16

2.1.4 Standard telegram 9, PZD-10/5

The standard telegram 9 is also defined for positioning mode.
Content: Positioning interface (Program sub-mode plus Manual Data Input sub-mode)

2.1.4.1 Output Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 9	**20**	**-**	**Variables**	**RECORD**
1	2	0	STW1	Uint16
2	4	2	SATZANW	Uint16
3	2	4	STW2	Uint16
4, 5	2	6	MDI_TARPOS	Int32
6, 7	4	10	MDI_VELOCITY	Int32
8	2	14	MDI_ACC	Uint16
9	2	16	MDI_DEC	Uint16
10	2	18	MDI_MOD	Uint16

Details Of STW1

Bit	Name	Significance
0	ON/OFF	Switched On (1) / Power-Down (0)
1	No STO active / STO active	No STO (1) / STO active (0)
2	No Quick Stop / Quick Stop	No Quick Stop (1) / Quick Stop (0)
3	Enable Operation / Disable Operation	Enable Operation (1) / Inhibit Operation (0)
4	Abort - forced by parameter	No Abort (1) / Abort (0)
5	Freeze - forced by parameter	No Freeze (1) / Freeze (0)
6	Go To Position	Activate traversing task or a new MDI setpoint (0 -> 1)
7	Error Acknowledge	The group signal is acknowledged with a positive edge (0 -> 1)
8	Jog Move +	Jog 1 signal source
9	Jog Move -	Jog 2 signal source
10	Control via PLC	Control by PLC (1) / No Control by PLC (0)
11	Home	Start Homing (1) / No Homing (0)

Details of SATZANW

Bit	Name	Significance
0 -9	The Command Table Entry ID is entered here	The Command Table Entry ID can be from 0 to 255. This is used in Command Table Entry mode
10 -14	Reserved	
15	MDI selection	Activation of MDI submode (1) / Deactivation of MDI submode (0)

STW2 - This is not used

MDI_TARPOS is MDI target position

MDI_VELOCITY is MDI target velocity

MDI_ACC is MDI acceleration

MDI_DEC is MDI deceleration

If MDI_MOD = 0, VAI Increment (Relative) Demand Position Command is used (011xh).
If MDI_MOD = 1, VAI Go to absolute positioning mode command (010xh) is used.

Telegram 9 supports the Command Table entry when the Traversing task is activated (STW1.bit6) along with No Abort and No Freeze and when no MDI is activated (SATZANW.bit 15). In this scenario "Set Command Table Command" 200xh is selected. The Command Table Entry ID which is taken as the parameter of the Command Table Command has to be programmed in SATZANW.bit 0-9.

2.1.4.2 Input Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 9	**10**	**-**	**Variables**	**RECORD**
1	2	0	ZSW1	Uint16
2	2	2	AKTSATZ	Uint16
3	2	4	ZSW2	Uint16
4, 5	4	6	XIST_A	Int32

Details of ZSW1

Bit	Name	Significance
0	Ready To Switch On	Ready for switching ON (1) / Not Ready for Switch ON (0)
1	Ready To Operate	Ready to Operate (1) / Not Ready to Operate (0)
2	Operation Enabled	Operation Enabled (1) / Operation Disabled (0)
3	Fault Present	Fault Present (1) / No fault (0)
4	Coast Stop Not activated	No Abort (1) / Abort (0)
5	QuickStop Not activated	No Freeze (1) / Freeze (0)
6	Switch ON Inhibited	Switch On Inhibited (1) / Switch On Not Inhibited (0)
7	Warning Present	Warning Present (1) / No Warning Present (0)
8	Within Tolerance Range	Following Error within tolerance range (1) / Following Error out of tolerance range (0)

Bit	Name	Significance
9	Control Request	Target Position Reached (1) / Not at Target Position (0)
10	Target Reached	Control by PLC (1) / No control by PLC (0)
11	Homing Position Set	Home Position Set (1) / Home Position Not set (0)
12	Traversing Task Acknowledgment	Using positive edge 0->1 , it is acknowledged that a new traversing task or MDI set-point was accepted
13	Drive Stopped	Drive Stopped (1) / Drive Moving (0)

Details of AKTSATZ

Bit	Name	Significance
0 -9	The evaluated Command Table Entry ID	This is active when telegram 9 is used for Command Table Command
10 -14	Reserved	
15	Status of sub-mode switch and currently active submode	1 if MDI sub-mode active, The input values for the motion command will be taken from MDI_TARPOS, MDI_VELOCITY, MDI_ACC and MDI_DEC.

XIST_A is position actual value.

2.1.5 Safety Standard telegram 30

This telegram is applicable only for the 2S drive - C1251-MI-XC-2S-XE.
Control of the Drive Safety Process inside the DO by the Safety Application Controller. The details of the safety telegram is described in Safety Manual for 2S drive.

2.1.5.1 Output Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 30	**7**	**-**	**Variables**	**RECORD**
1	2	0	S_STW1	Uint16
2	1	2	Control Byte in safety PDU	Uint8
3	4	3	CRC2	Int32

Details of PROFIsafe Control Word - S_STW1

Bit	Name	Significance
0	STO	No STO (1) / STO active (0)
1	SS1	No SS1 (1) / SS1 active (0)
2	SS2	No SS2 (1) / SS2 active (0)
3	SOS	No SOS (1) / SOS active (0)
4	SLS	No SLS (1) / SLS active (0)
5	Reserved	
6	Reserved	
7	Internal Event Ack	Safety Fault Buffer Fault Acknowledge (1-->0)
8	Reserved	

Bit	Name	Significance
9	Select SLS Bit 0	Selection of the speed limit for SLS - selection bit 0
10	Select SLS Bit 1	Selection of the speed limit for SLS - selection bit 1
11-15	Reserved	

For more details refer to the Safety Manual 2S [1].

2.1.5.2 Input Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 30	**7**	**-**	**Variables**	**RECORD**
1	2	0	S_ZSW1	Uint16
2	1	2	Status Byte in Safety PDU	Uint8
3	4	3	CRC2	Int32

Details of PROFIsafe Status Word - S_ZSW1

Bit	Name	Significance
0	STO	STO active (1) / STO not active (0)
1	SS1	SS1 active (1) / SS1 not active (0)
2	SS2	SS2 active (1) / SS2 not active (0)
3	SOS	SOS active (1) / SOS not active (0)
4	SLS	SLS active (1) / SLS not active (0)
5	Reserved	
6	Reserved	
7	Internal Event ACK	Internal Event (1) / No Internal Event (0)
8	Reserved	
9	Select SLS Bit 0	Selected SLS level - bit 0
10	Select SLS Bit 1	Selected SLS level - bit 1
11	SOS Selected	SOS selected (1) / SOS deselected (0)
12-15	Reserved	

For more details refer the Safety Manual 2S [1].

2.1.6 Siemens telegram 105, PZD-10/10

Siemens telegram 105 can only support IRT mode.

Output Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 105	**20**	**-**	**Variables**	**RECORD**
1	2	0	STW1	Uint16
2, 3	4	2	NSOLL_B	Int32
4	2	6	STW2	Uint16

Index	Size [Byte]	Byte Offset	Name	Data Type
5	2	8	TORQUERED	Uint16
6	2	10	G1_STW	Uint16
7, 8	4	12	XERR	Int32
9, 10	4	16	KPC	Int32

The telegram part TORQRED is mapped to the MC SW parameter with UPID 0x1399 “Motor relative Max Current Limit”.

Input Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 105	**20**	**-**	**Variables**	**RECORD**
1	2	0	ZSW1	Uint16
2, 3	4	2	NIST	Int32
4	2	6	ZSW2	Uint16
5	2	8	MELDEW	Uint16
6	2	10	G1_ZSW	Uint16
7, 8	4	12	G1_XIST_1	Int32
9, 10	4	16	G1_XIST_2	Int32

2.1.7 Siemens telegram TDB 200, PZD-3/1

The Siemens telegram 200 is used on Simotion PLC.

Output Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg TDB	**6**	**-**	**Variables**	**RECORD**
1	2	0	M_Add	Int16
2	2	2	(B+) pos torque Limit	Uint16
3	2	4	(B-) neg torque Limit	Uint16

The additional torque (M_Add) is calculated with UPID 0x119E (maximal Motor Current) and written to UPID 0x139C or 0x13B0 depending on which control parameter set is active.
The additional torque is standardised by 4000h. The unit of M_Add is N (or Nm if rotary).
Value at UPID 0x139C/ 0x13B0 = M_Add * maximal Motor Current / 4000h

The torque limits B+ and B- are also calculated with UPID 0x119E (maximal Motor Current) and written to UPID 0x13FC/0x13FD or 0x13FE/0x13FF depending on which control parameter set is active.
The unit of (B+) pos torque Limit and (B-) neg torque Limit are N (or Nm if rotary).
Value at UPID 0x13FC/0x13FE = (B+) pos torque Limit * maximal Motor Current / 4000h
Value at UPID 0x13FD0/x13FF = -(B-) neg torque Limit * maximal Motor Current / 4000h

Input Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg TDB	**20**	**-**	**Variables**	**RECORD**
1	2	0	M_act	Int16

M_act is the standardised actual torque/ force.
For linear motor, M_act = Motor Actual Force (UPID 0x1BFF) / Motor Maximim Force (UPID 0x1BB0)* 0x4000. The unit is N.
For rotary motor, M_act = Motor Actual Torque (UPID 0x1BBF) / Motor Maximim Torque (UPID 0x1BBE) * 0x4000. The unit is Nm.

2.1.8 Real Time Config telegram 404, PZD-4/4

Output Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 404	**8**	**-**	**Variables**	**RECORD**
1	2	0	Config Control Word	Uint16
2	2	2	Config Index/..	Uint16
4, 5	4	4	Config Value	Word32

Input Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 404	**8**	**-**	**Variables**	**RECORD**
1	2	0	Config Status Word	Uint16
2	2	2	Config Index/..	Uint16
4, 5	4	4	Config Value	Word32

Please refer to the document 0185-1074-E_1V7_MA_Drive-Configuration-Over-Fieldbus-SG5-SG7.pdf [3] from LinMot for more details.

2.1.9 LinMot telegram 516 PZD-16/13

Default-IO mapping with Config

Output Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 16	**32**	**-**	**Variables**	**RECORD**
1	2	0	ControlWord	Word16
2	2	2	Motion Command Header	Word16
3,4	4	4	Motion Command parameter 1	Word32
5,6	4	8	Motion Command parameter 2	Word32
7,8	4	12	Motion Command parameter 3	Word32
9,10	4	16	Motion Command parameter 4	Word32
11,12	4	20	Motion Command parameter 5	Word32
13	2	24	Config Header	Word16

Index	Size [Byte]	Byte Offset	Name	Data Type
14	2	26	Config Index	Word16
15,16	4	28	Config Value	Word32

For the meaning of the „Control Word“ and the „Motion Command interface“ refer to [2] , for the „Real Time Config Interface“ refer to [3].

Input Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 16	**26**	**-**	**Variables**	**RECORD**
1	2	0	StateVar	Word16
2	2	2	StatusWord	Word16
3	2	4	WarnWord	Word16
4,5	4	6	Demand Position	Word32
6,7	4	10	Actual Position	Word32
8,9	4	14	Demand Current	Word32
10	2	18	Config Status Word	Word16
11	2	20	Config Index Response	Word16
12,13	4	22	Config Value Response	Word32

For the meaning of the variables 1-6 refer to [2], for the „Real Time Config Interface“ refer to [3].

2.1.10 Supplement telegram 701, PZD-2/5

This telegram is applicable only for the 2S drive - C1251-MI-XC-2S-XE.
The predefined PROFIdrive supplementary safety telegrams 700 and 701 of Siemens are available for the transfer of the " Safety Info Channel" (SIC) and "Safety Control Channel" (SCC).
The Safety Info Channel enables Safety integrated functionality status information of the drive to be transmitted to higher level controller.
The Safety Control channel is used to sent the control information from the higher-level control to the safety functions of the drive.
(Reference to Function Manual Safety Integrated from Sinamics [4], section 5.8).

2.1.10.1 Output Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 701	**4**	**-**	**Variables**	**RECORD**
1	2	0	S_STW1B	Uint16
2	2	2	S_STW3B	Uint16

S_STW1B is not used for now.

Details of S_STW3B

Bit	Name	Significance
0	Select Brake Test	Brake test selected (1) / Brake test deselected (0)
1	Start Brake Test	Start brake test requested (1) / Start Brake test not requested (0)
2	Brake Selection	Not used, default 0
3	Select the direction of rotation	Is always 0 (Positive direction selected); The negative direction is selected in the SBT sequence
4	Select Test sequence	Not used, default 0
5	Status of External brake	Not used, default 0
6..15	Reserved	Not used, default 0

2.1.10.2 Input Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 701	**10**	**-**	**Variables**	**RECORD**
1	2	0	S_ZSW1B	Uint16
2	2	2	S_ZSW2B	Uint16
3,4	4	4	S_V_LIMIT_B	Int32
5	2	8	S_ZSW3B	Uint16

Details of S_ZSW1B

Bit	Name	Significance
0	STO	STO active (1) / STO not active (0)
1	SS1	SS1 active (1) / SS1 not active (0)
2	SS2	SS2 active (1) / SS2 not active (0)
3	SOS	SOS active (1) / SOS not active (0)
4	SLS	SLS active (1) / SLS not active (0)
5	SOS selected	SOS selected (1) / SOS deselected (0)
6	SLS selected	SLS selected (1) / SLS deselected (0)
7	Internal Event ACK	Internal Event (1) / No Internal Event (0)
8	Reserved	
9	Active SLS Bit 0	Selected SLS level - bit 0
10	Active SLS Bit 1	Selected SLS level - bit 1
11-15	Reserved	

Details of S_ZSW3B

Bit	Name	Significance
0	Brake test	Brake test selected (1) / Brake test deselected (0)
1	Reserved	
2	Active brake	Not used, default 0
3	Brake test active	Test active (1) / Test not active (0)

Bit	Name	Significance
4	Brake test result	Test successful (1) / Test error (0)
5	Brake test completed	Test run (1) / Test incomplete (0)
6	External brake request	Not used
7	Current load sign	Negative Sign (1) / Positive sign (0)
8	Reserved	
9	Reserved	

S_V_LIMIT_B is the SLS speed limit with 32- bit resolution and sign bit. SLS speed limit can be obtained from UPID 1A2Ah.
The speed set point values are transmitted normalized, by setting it into in relation to the "Linear Reference Velocity" value at UPID 2061h.
S_V_LIMIT_B = UPID 1A2Ah / UPID 2061h * 0x40000000

2.1.11 Siemens telegram 750, PZD-3/1

Telegram 750 is the same as telegram 200. Telegram 750 is used with S7-1500 PLC. This telegram is used for the 2S drive - C1251-MI-XC-2S-XE.

Output Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg TDB	**6**	**-**	**Variables**	**RECORD**
1	2	0	M_Add	Int16
2	2	2	(B+) pos torque Limit	Uint16
3	2	4	(B-) neg torque Limit	Uint16

The additional torque (M_Add) is calculated with UPID 0x119E (maximal Motor Current) and written to UPID 0x139C or 0x13B0 depending on which control parameter set is active.
The additional torque is standardised by 4000h. The unit of M_Add is N (or Nm if rotary).
Value at UPID 0x139C/ 0x13B0 = M_Add * maximal Motor Current / 4000h

The torque limits B+ and B- are also calculated with UPID 0x119E (maximal Motor Current) and written to UPID 0x13FC/0x13FD or 0x13FE/0x13FF depending on which control parameter set is active.
The unit of (B+) pos torque Limit and (B-) neg torque Limit are N (or Nm if rotary).
Value at UPID 0x13FC/0x13FE = (B+) pos torque Limit * maximal Motor Current / 4000h
Value at UPID 0x13FD0/x13FF = -(B-) neg torque Limit * maximal Motor Current / 4000h

Input Data

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg TDB	**20**	**-**	**Variables**	**RECORD**
1	2	0	M_act	Int16

M_act is the standardised actual torque/ force.
For linear motor, M_act = Motor Actual Force (UPID 0x1BFF) / Motor Maximim Force (UPID 0x1BB0)* 0x4000. The unit is N.
For rotary motor, M_act = Motor Actual Torque (UPID 0x1BBF) / Motor Maximim Torque (UPID 0x1BBE) * 0x4000. The unit is Nm.

2.2 Output PDO Modules

2.2.1 Par Channel 1 telegram 417, PZD 2/0

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 417	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Parameter Channel 1	Word32

2.2.2 Par Channel 2 telegram 418, PZD 2/0

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 418	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Parameter Channel 2	Word32

2.2.3 Par Channel 3 telegram 419, PZD 2/0

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 419	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Parameter Channel 3	Word32

2.2.4 Par Channel 4 telegram 420, PZD 2/0

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 420	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Parameter Channel 4	Word32

2.3 Input PDO Modules

2.3.1 Actual Position telegram 405, PZD 0/2

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 405	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Actual Position	Int32

2.3.2 Demand Position telegram 406, PZD 0/2

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 406	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Demand Position	Int32

2.3.3 WarnWord telegram 407, PZD 0/1

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 407	**2**	**-**	**Variables**	**RECORD**
1	2	0	WarnWord	Uint16

2.3.4 ErrorCode telegram 408, PZD 0/1

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 408	**2**	**-**	**Variables**	**RECORD**
1	2	0	ErrorCode	Uint16

2.3.5 Demand Current 32b telegram 409, PZD 0/2

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 409	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Demand Current 32b	Int32

2.3.6 Mon Channel 1 telegram 410, PZD 0/2

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 410	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Mon Channel 1	Word32

2.3.7 Mon Channel 2 telegram 411, PZD 0/2

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 411	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Mon Channel 2	Word32

2.3.8 Mon Channel 3 telegram 412, PZD 0/2

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 412	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Mon Channel 3	Word32

2.3.9 Mon Channel 4 telegram 413, PZD 0/2

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 413	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Mon Channel 4	Word32

2.3.10 Demand Current 16b telegram 414, PZD 0/1

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 414	**2**	**-**	**Variables**	**RECORD**
1	2	0	Demand Current 16b	Int16

2.3.11 Actual Velocity telegram 415, PZD 0/2

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 415	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Actual Velocity	Int32

2.3.12 Demand Velocity telegram 416, PZD 0/2

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 416	**4**	**-**	**Variables**	**RECORD**
1, 2	4	0	Actual Velocity	Int32

2.3.13 Supplement telegram 700, PZD-0/3

Index	Size [Byte]	Byte Offset	Name	Data Type
Tlg 700	**6**	**-**	**Variables**	**RECORD**
1	2	0	S_ZSW1B	Uint16
2,3	4	3	S_V_LIMIT_B	Int32

Please refer to telegram 701 for the details.

3 Asynchronous Configuration Protocol

For configuration purposes (Parameter Handling) the standard PROFINET Protocol is used.

3.1 PROFIdrive Profile Area

PNU	Name	Access
922	Telegram selection	r
924	Status word bit Pulses Enabled	r
925	Number of Controller Sign-Of-Life failures which may be tolerated	r
928	Control priority DO IO Data	r
930	Operating mode	r
944	Fault message counter	r
947	Fault number	r
950	Scaling of the fault buffer	r
951	Fault number list with text	r
952	Fault situation counter	r
953	Warning parameters	r
964	Drive Unit identification	r
965	Profile identification number	r
974	Base Mode Parameter Access service identification	r
975	DO identification	r
980	Number list of defined parameter	r
60000	Velocity reference value(not yet implemented)	r

LinMot PROFIdrive Object Dictionary.

3.2 Manufacturer specific Profile Area

The RAM and ROM values of the drive parameters can be accessed by their parameter number (UPID) added with an offset of 0x2000 (UPID+0x2000).

3.3 Supported Services

The table below shows the services (request IDs) which are supported for parameter acces.

Request ID	Description
0x01	Request Parameter, reads the RAM value of the parameter
0x02	Change parameter, changes the RAM value of the parameter
0x41	Read ROM value of parameter, only valid with value attribute

Request ID	Description
0x42	Write ROM value of parameter, only valid with the value attribute

4 PROFIdrive Parameters

4.1 Parameters

Attention: The PROFIdrive Interface has an additional parameter tree branch (Parameters → Profinet), which can be configured with the distributed LinMot-Talk software.

With these parameters, the PROFIdrive interface can be enabled or disabled.
The LinMot-Talk software can be downloaded from http://www.linmot.com under the section download, software & manuals.

4.1.1 PROFdrive/Dis-/Enable

With the Dis-/Enable parameter the LinMot Servo Drive can be run without the Ethernet PROFIdrive Interface going online. So in a first step the system can be configured and run without any bus connection.

PROFIdrive/Dis-/Enable	
Disable	Servo Drive runs without PROFINET.
Enable	**Servo Drive runs with PROFINET connection.**

IMPORTANT: If the PROFIdrive Interface is disabled, the integrated Netx-ASIC rests in reset state! No messages will be sent to other devices connected to the PROFINET-Network via the servo drive.

4.1.2 PROFdrive/Byte Order

With the Byte Order parameter the used Byte order of the transmitted data can be defined.

PROFIdrive/Byte Order	
reversed	**Byte order is reversed. For S7 PLC_s select reversed.**
not reversed	Byte order is not reversed.

4.1.3 PROFdrive/Word Order

With the Word Order parameter the used Word order of the transmitted data can be defined.

PROFIdrive/Word Order	
Reversed	Word order is reversed.
not reversed	**Word order is not reversed.**

4.1.4 PROFdrive/Monitoring Channels

With these parameters the parameters are defined which are copied to the corresponding monitoring channel.

PROFIdrive/Monitoring Channels	
Channel 1 UPID	Source UPID for monitoring channel 1
Channel 2 UPID	Source UPID for monitoring channel 2
Channel 3 UPID	Source UPID for monitoring channel 3

PROFIdrive/Monitoring Channels	
Channel 4 UPID	Source UPID for monitoring channel 4

4.1.5 PROFIdrive/Parameter Channels

With these parameters the parameters are defined which are copied to the corresponding parameter channel.

PROFIdrive/Monitoring Channels	
Channel 1 UPID	Destination UPID for parameter channel 1
Channel 2 UPID	Destination UPID for parameter channel 2
Channel 3 UPID	Destination UPID for parameter channel 3
Channel 4 UPID	Destination UPID for parameter channel 4

4.1.6 PROFdrive/Axis Configuration/ Axis Type

With this parameter the Axis type is defined.

Attention: It has to be the same as configured on the master side!

PROFIdrive/Byte Order	
Linear	**The axis is linear.**
Rotative	The axis is rotative.

4.1.7 PROFdrive/Axis Configuration/ Linear/Rotative Reference Velocity

With PROFIdrive telegrams the set-point values are transmitted normalized. For this reason they have to be set into relation to a reference value. The Parameter “Linear Reference Velocity” is the reference value for the NSOLL_B and NIST_B values used in telegrams 3, 5 and 105 if the axis is of type linear. If the axis is of type rotative the reference value is defined with the parameter “Rotative Reference Velocity”.

4.1.8 PROFdrive/Axis Configuration/ MDI Configuration

With PROFIdrive telegrams the set-point values are transmitted normalized. In the MDI mode the position and velocity is mapped directly without the use of a reference value for scaling.

The transmitted position has a resolution of [0.1um]. The transmitted velocity has a resolution of [1um/s].

Only for the acceleration and deceleration the reference parameter “MDI Acceleration Scale” is used for scaling the acceleration and deceleration of the MC-SW motion command.
With the default value of 1’000 the transmitted acceleration values have a resolution of [0.01m/s^3]. With a value of 100’000 they will have a resolution of [1m/s^3].

4.1.9 PROFIdrive/Axis Configuration/G1 Configuration

This gives the possibility to set the reference mark to get the position feedback information taken from the sensors.

Reference Mark1 Source	
Home Switch	Reference Mark 1 trigger Source is the configured home switch signal
Z on X13	Reference Mark 1 trigger Source is Z signal on X13
Range Indicator 1	Reference Mark 1 trigger Source is on status word bit Range Indicator 1
NOT Range Indicator 1	Reference Mark 1 trigger Source is on NOT of status word bit Range Indicator 1

4.1.10 PROFIdrive/Axis Configuration/Std Tlg 5/105 Anti Windup

Std telegram 5 /105 anti windup gain, higher values reduce the position error in the drive with blocked slider. This parameter has only an influence if KPC is zero. The PosDiff=(StreamedVel*StreamingPeriod*fa)/AntiWindupGain).

4.1.11 PROFIdrive/Axis Configuration/Monitoring

Life Sign Tolerance parameter of Axis.

5 Connecting to the PROFINET Network

5.1 Pin Assignment of the Connectors X17-X18

The PROFINET connector is a standard RJ-45 female connector with a pin assignment as defined by EIA/TIA T568B:

X17 - X18	RealTime Ethernet Connector		
	Pin	Wire color code	Assignment 100 BASE-TX
	1 2 3 4 5 6 7 8 case	WHT/ORG ORG WHT/GRN BLU WHT/BLU GRN WHT/BRN BRN -	Rx+ Rx- Tx+ - - Tx- - - -
RJ-45	Use standard patch cables (twisted pair, S/UTP, AWG26) for wiring. This type of cable is usually referred to as a “Cat5e-Cable”.		

6 Example Setup

This is an example of configuring the project with TIA for S7-1500 and C1251 drive.

6.1 Setup in S7-1500 System

In the following steps the integration of the *LinMot Safety PROFIdrive* with the LinMot linear motor into the S7-1500 is described. In this example, the PLC used is Siemens S7-1500 with CPU 1517F-3 PN/DP. The TIA portal V16.0 software with Step 7 safety is used for the development. The lower version of the software (for eg. TIA Portal 15.0 and TIA Portal 15.1) can also be used.

All the programs and the safety function block used in association with C1251-2S are also compatible with Siemens S120 safety drive.

Component	Quantity	Article Number	Note
CPU 1517F-3 PN/DP	1	6ES7 517-3FP00-0AB0	Firmware V2.8
C1251-MI-XC-2S-0E-C00	1	0150-4185	Firmware V0.1
PS01-37x120F-HP-C-2S	1	0150-21251	

6.1.1 Assumed preconditions

The S7-1500 is in factory reset condition. The programming PC is connected over P1. The LinMot drive is completely wired. The PROFINET is wired from the S7-1500 PN/IE to the LinMot X17 RT ETH.

It is supposed, that the motor and the drive have PnP functionality, means the motor is basically setup automatically. Otherwise the motor has to be setup manually with the Motor-Wizard of LinMot-Talk.

Attention: To achieve a good response of the master set-point, it is important to well tune the position controller in the LinMot drive!

6.1.2 Adding Safety Drive to System

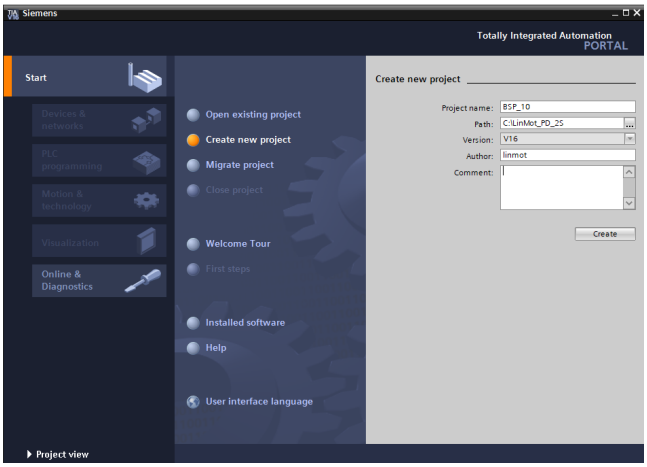
Please refer to the example setup at the end for more details about
1) How to configure a new TIA project
2) Details of adding a LinMot PROFIdrive drive as TO to the system
3) Details of configuring the safety telegram

- For the details about the safety word and the meaning of the safety status please refer the Safety Manual for LinMot 2S products.
- Please note that the vendor ID - "CD" in hex is appended with the safety address programmed with S11 and S12 switch (in hex), while configuring the safety address in TIA portal. Please check the section "Configure communication module to the LinMot PROFIdrive drive" for details.
- In this manual for PROFIdrive 2S, the telegram 30 for safety and telegram 700/701 for the brake test are introduced.

6.2 Configure the Project- TIA Configuration

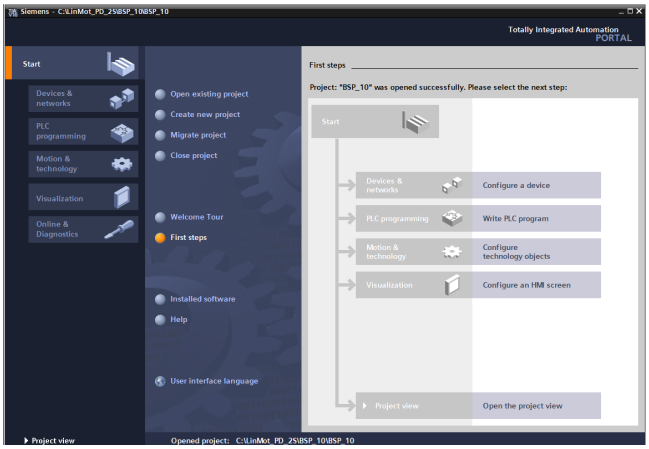
6.2.1 Create a new project

Start the TIA Portal and create a new project BSP_10.



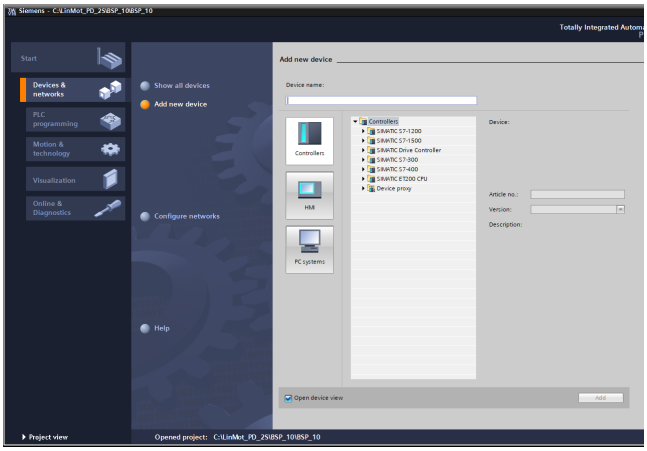
Create new project

6.2.2 Configure a Device



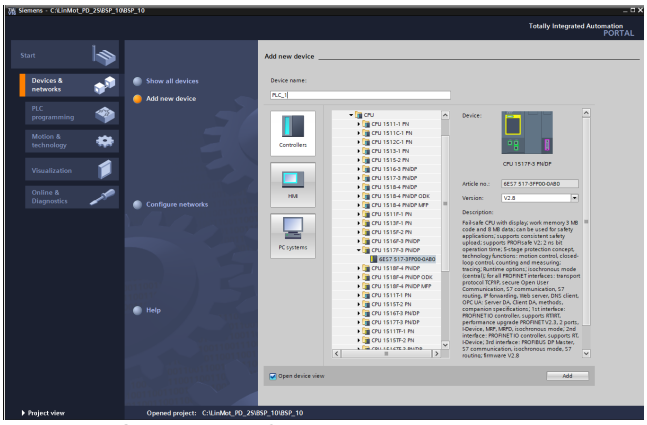
Configure the device

6.2.3 Add new Device



Select the PLC device

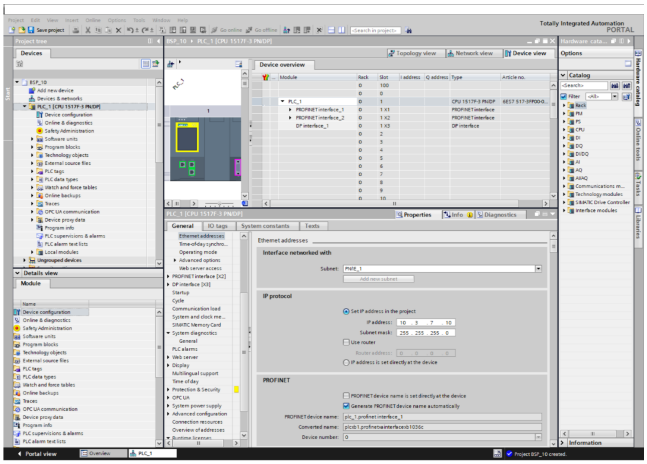
6.2.4 Select PLC Controller



Select the PLC device article number

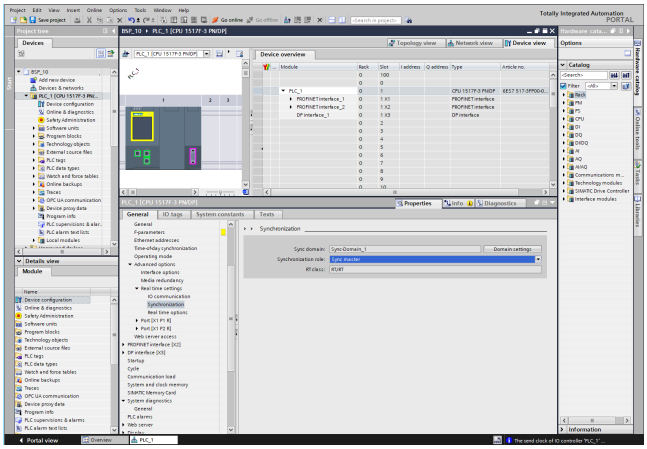
6.2.5 Configure PROFINET

Add the PROFINET network PN/IE_1 here and choose the IP-address and subnet netmask.



Configure the Profinet, set the PLC network address

Define the S7-1500 as Sync master in the real time settings.

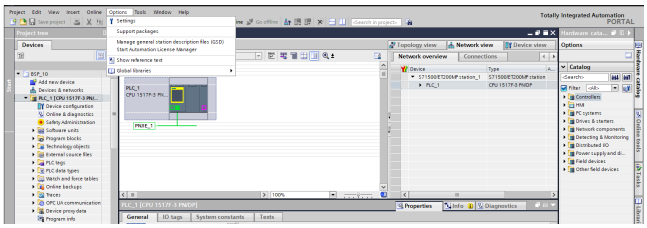


Configuring the PLC as Sync-master

6.2.6 Install LinMot GSDML device description file

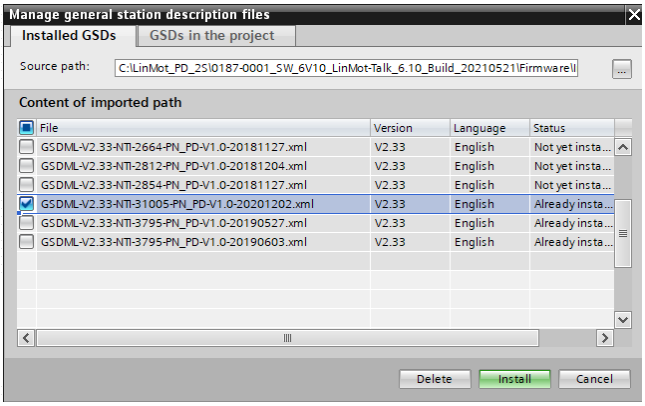
If not already installed, install the newest device description file of the device you want to use. The device description files are distributed together with the firmware under path:

LinMot\LinMot-Talk 6.10 - Build 2021xxxx\Firmware\Interfaces\ProfiNet\GSDML_PD

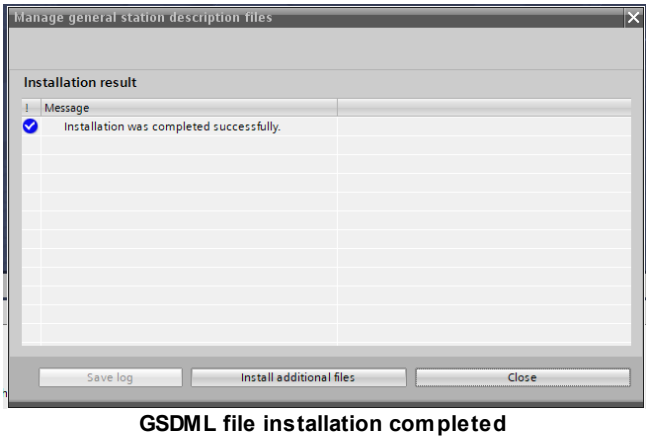


If not installed altready, install the LinMot GSDML file

Choose the source path and select the GSDML file. Please note that the article number of the drive "31005" is in the xml file name. Click on Install.



After installation there will be a notification. Click on "Close". The hardware catalog will be updated

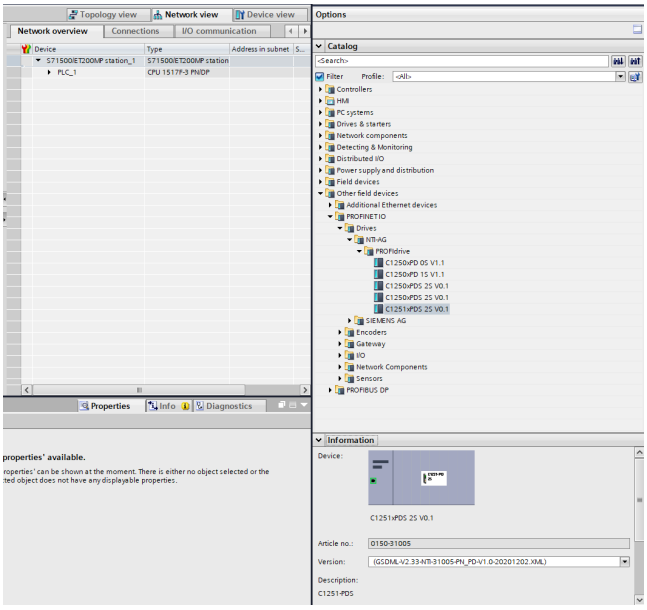


GSDML file installation completed

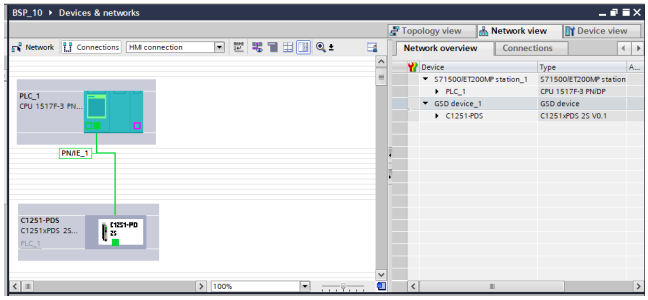
.

6.2.7 Configure LinMot PROFIdrive to PROFINET network

Now change to the network view and add the desired LinMot PROFIdrive device from the hardware catalogue.



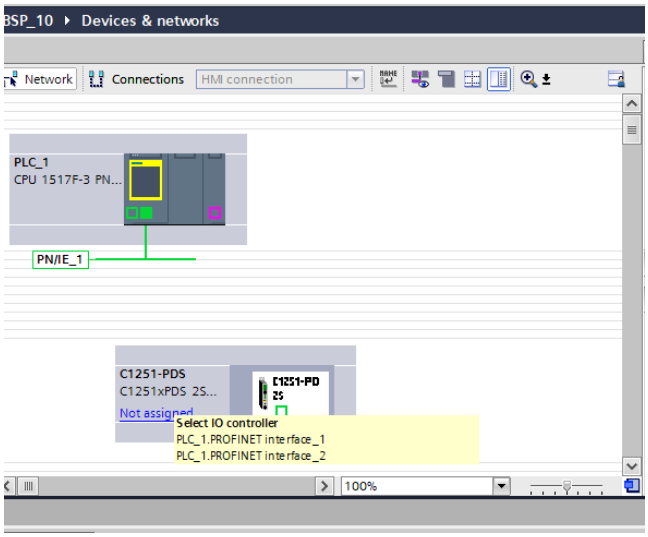
Select the LinMot drive and drag and drop it to the PN/IE1 network.



Connect to the PN/IE network

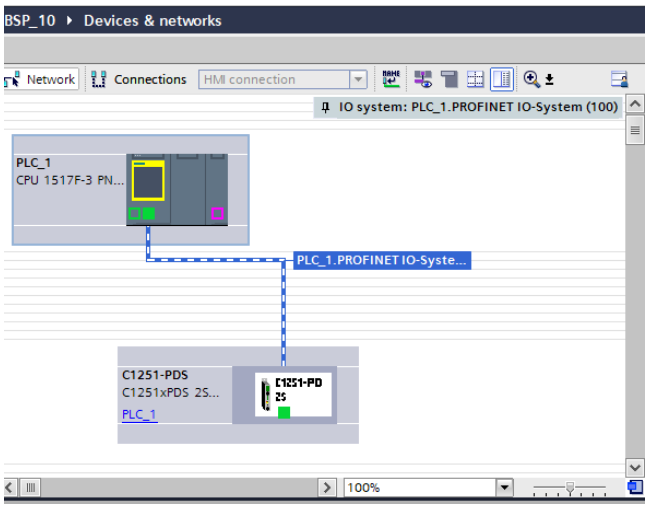
6.2.7.1 Assign LinMot drive to the PLC

Assign the LinMot drive to the PLC master- PLC_1.



Assign the drive to PLC_1

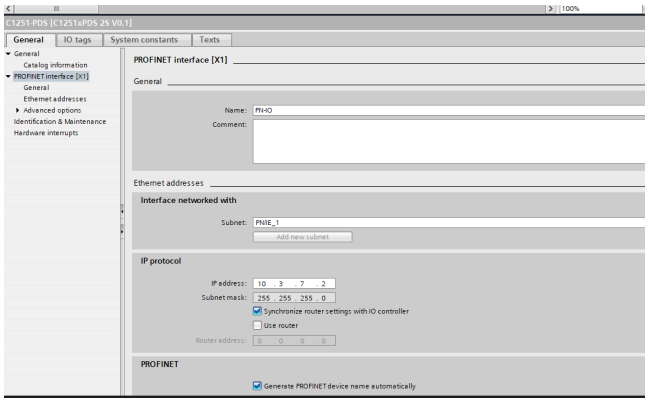
Select PLC_1 as IO Controller to the drive.



Assign PLC as IO controler to drive

Double click on the drive and go to the "Device view". Assign the name to the drive if required by clicking on the existing name and editing it.

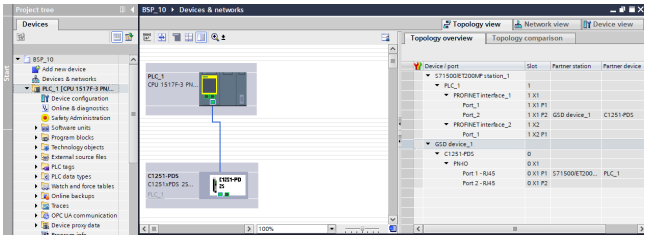
Edit the IP address by choosing " Properties > Profinet interface [X1] > Ethernet addresses" under IP protocol enter the required IP address and choose the Subnet mask.



Assign the IP address

6.2.7.1.1 Define the PROFINET Topology

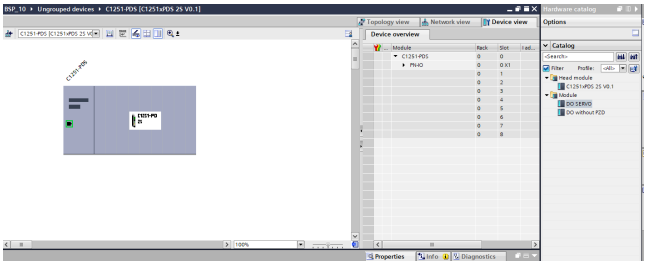
Change to Topology view, and wire the PROFINET connection from PLC- X1 P1 port to the C1251 port.



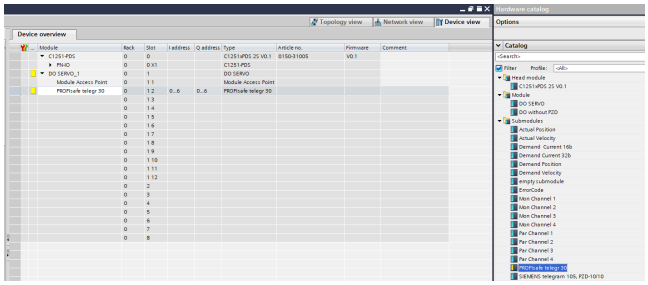
Assign the drive to PLC in topology view

6.2.8 Configure communication module to the LinMot PROFIdrive

Double click in the Topology view the LinMot drive, then automatically the device view of the LinMot drive opens. In the section Module, select DO SERVO. Double click on the item.



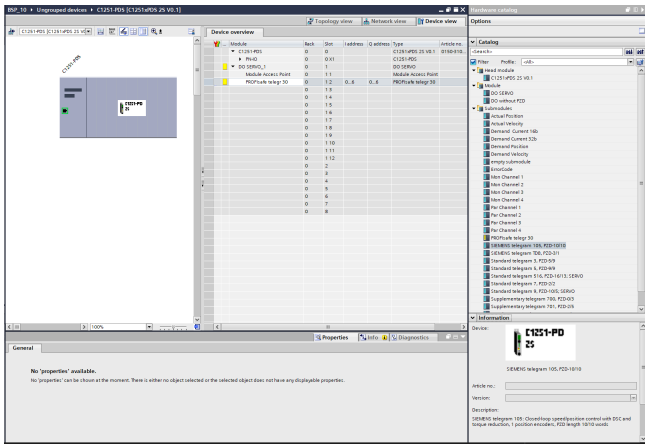
Under the section Submodules, double click on PROFIsafe telegram 30. Safety telegram 30 will be added to subslot 2. The input and the output addresses are automatically assigned.



Double click the PROFIsafe telegram and open the *PROFIsafe* tab under *General.* Choose the correct address under F_Dest_Add. To know the right address check the C1251 device drive safe address S12 and S11.
The address in S12 and S11 are in hex format. This will come as the lower byte. The higher byte is the vendor id which is ***CD*** in hex.
Example: If S11 = 2 , S12 = 0, the F_Dest_Addr should be 52512 in decimal (CD20h)

S11 / S12	Safe Address	
	S11	High nibble of safe address
	S12	Low nibble of safe address

Select the standard telegram 105 under the section Submodules in the Catalog. Double click on Siemens telegram 105. This standard telegram will be added to subslot 3

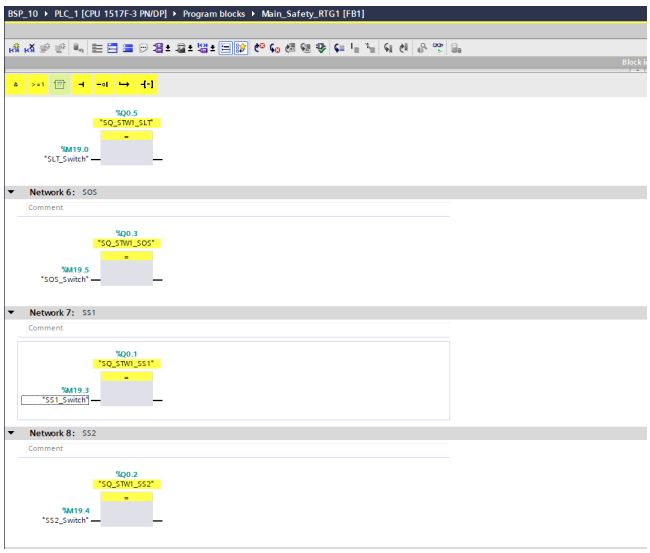


Go to the tab Properties > PROFINET Interface [X1] > Advanced options > Isochronous mode. Select the "Isochronous mode" check box.

6.2.8.1 Add Safety Telegram 30

The LinMot drive C1251 supports the following safety functions - STO, SOS, SS1, SS2, SLS0, SLS1, SLS2, SLS3. For details of the functionality, refer to the User Safety Manual.
The functional block for safety functions are added to PLC_1. This block is compatible (or reusable) with the functional block used for Siemens safety drive S120.

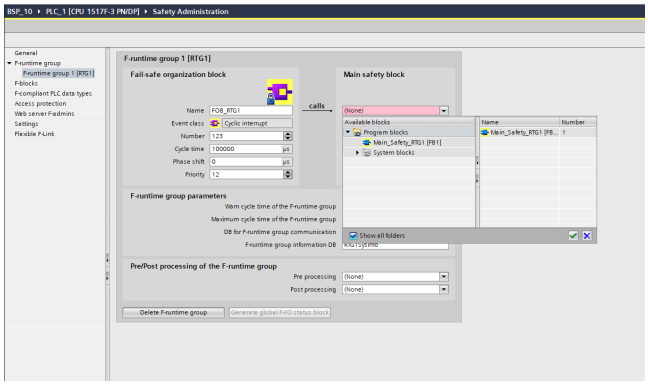
Double click on "PLC_1 > Program blocks > Main_Safety_RTG1". Add each functional blocks as required.



Assign safety function in function block for safety

Add the required tags in PLC tags by clicking on "PLC_1 > PLC tags"

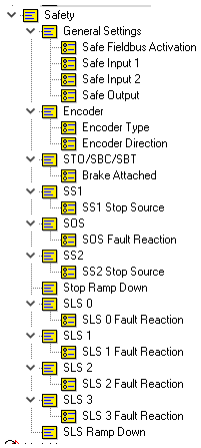
As the CPU is F-CPU (safety mode activated), there will be Safety Administration tab under the PLC_1. Double click on "Safety Administration". Choose the "Main_Safety_RTG1" under "Main safety block".



Safety Administartion configuration

6.2.8.2 Safety Parameters in LinMot Talk

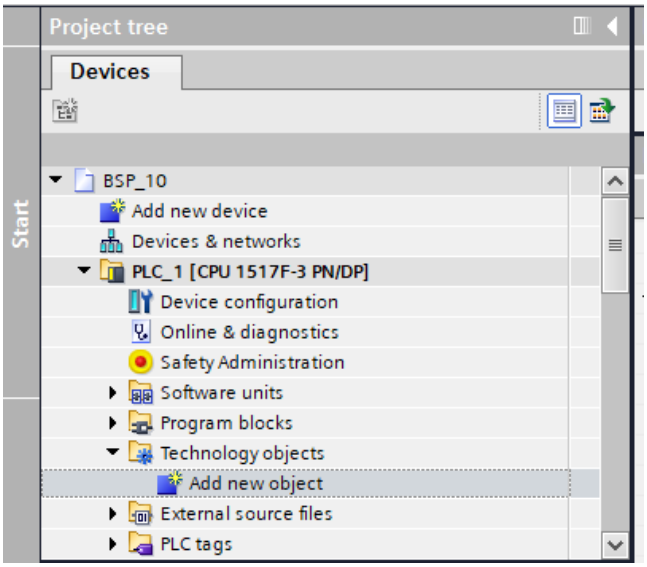
The safety parameters are programmed in the LinMot talk. They are given in yellow color under Parameters.



For the proper operation of the safe bus it is required to assign the parameter "Safety > General Settings > Safe Fieldbus Activation" to PROFIsafe.
Please check the Safety Manual for the program and validation steps of the safety parameters.

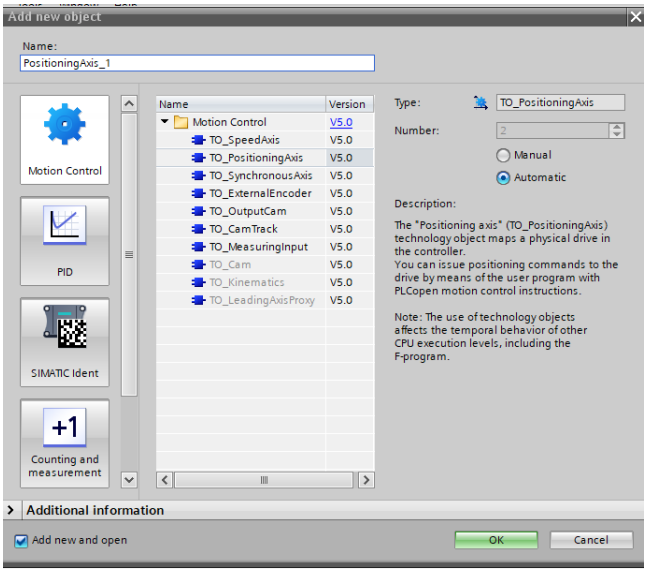
6.3 Creating Technology Objects

To configure the Positioning axis, go to PLC_1 > "Technology objects" folder in the project tree. Double click on "Add new object".



Open new technology object

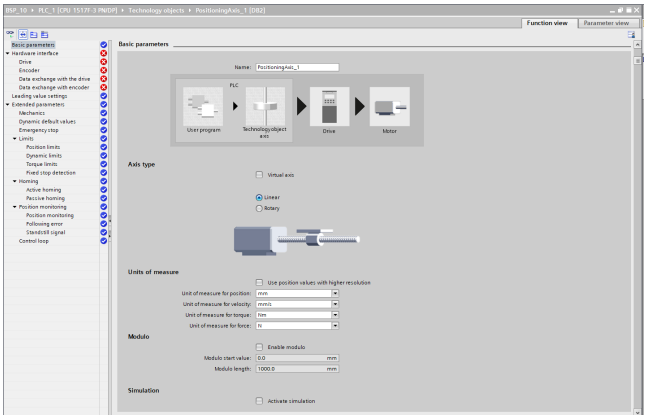
When the dialogue box opens, select the "TO_PositioningAxis". Also give the name of the technology object. Click on OK.



Select the postiioning axis

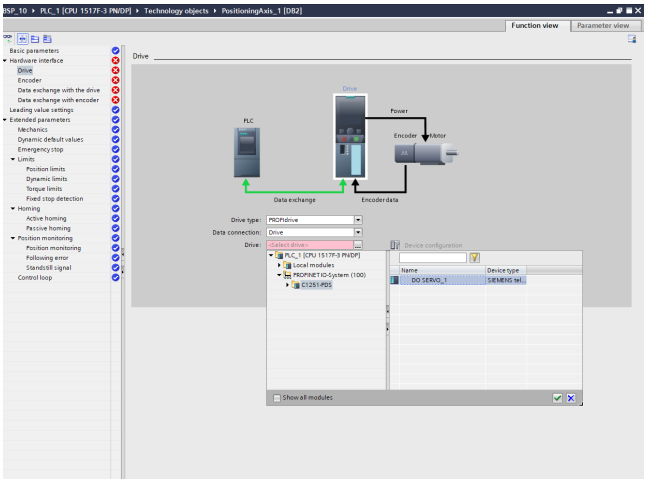
6.3.1 Configure axis

Open the "Configuration" window. Choose axis type as linear if linear motor is used. The basic parameters could be left as suggested.



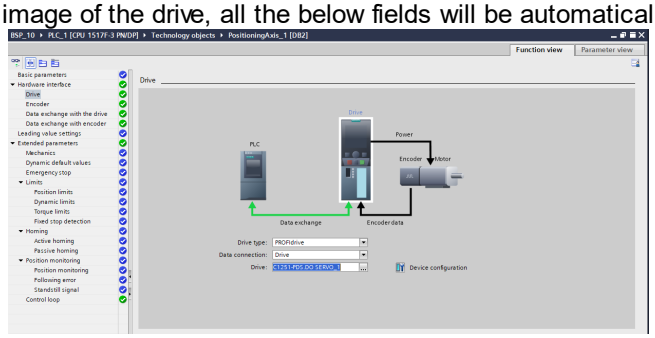
Basic parameter in TO

Open "Hardware interface > Drive". In the drive list select the drive C1251-PDS under Profinet IO-System and select the entry DO SERVO_1 and click on the tick mark.



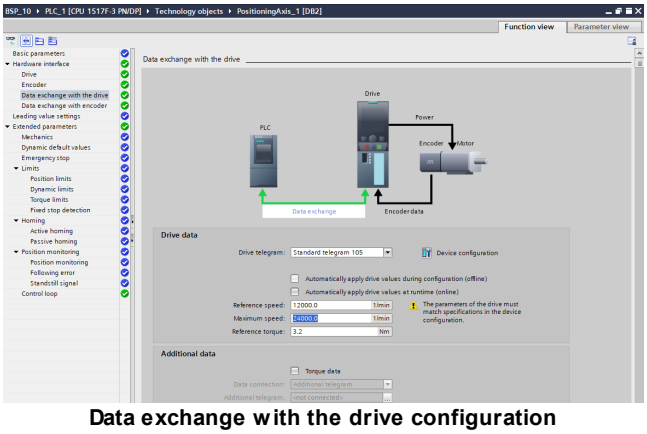
Drive configuration in TO

After assigning the process image of the drive, all the below fields will be automatically filled.



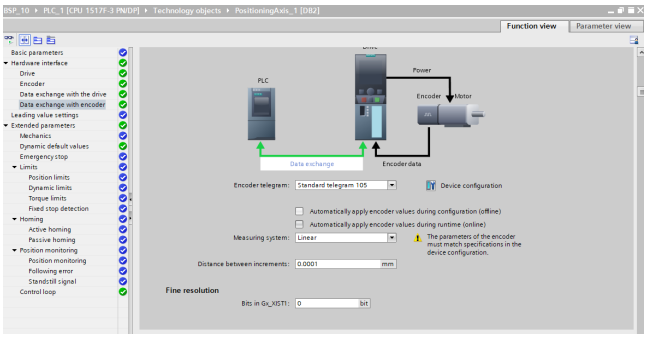
Drive configuration in TO

In the *Data exchange with drive* session, choose the reference speed as 12000.0 1/min and maximum speed as 24000.0 1/min.



Data exchange with the drive configuration

In the *Data exchange with encoder* session, choose the measuring system as linear.
The resolution should be 100nm under "Distance between increments" because the LinMot drive works with a fix resolution of 100nm.
Set the "Bits in Gx_XIST1" in fine resolution to 0.



Data exchange with the encoder

6.4 Compile and Download PLC_1 configuration

Compilation of the project is done by clicking the  Toolbox button.

For downloading the project first connect to the target system, by clicking the button  .

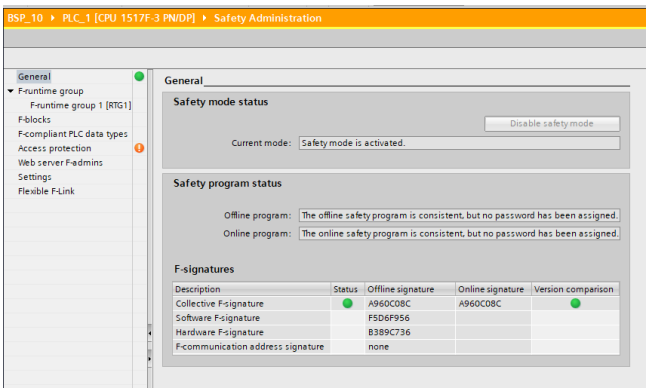
After searching the target device using "Start search", select the target system, then click Load

If there is an existing program running, you might have to stop the modules by selecting "stop all" in the "Load preview". After then click on "Load".

Finally click on Finish in the load results.

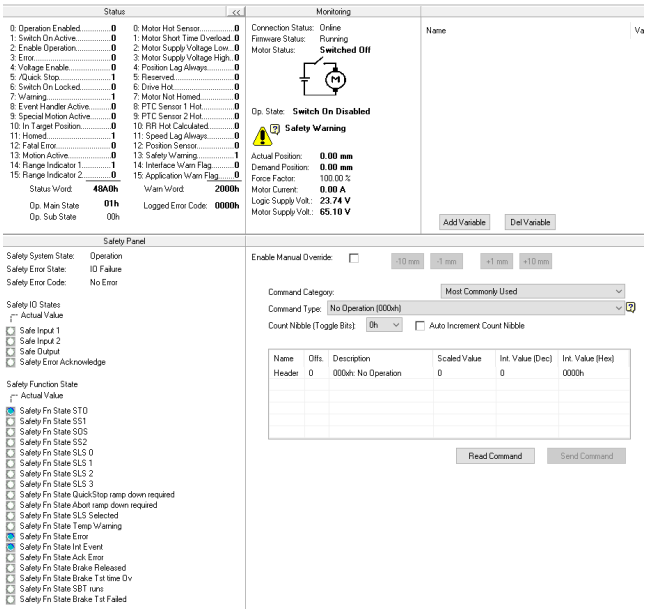
6.5 Move the Axis with the Commissioning panel

The safety mode activation can be confirmed from the "Safety Administration" window.



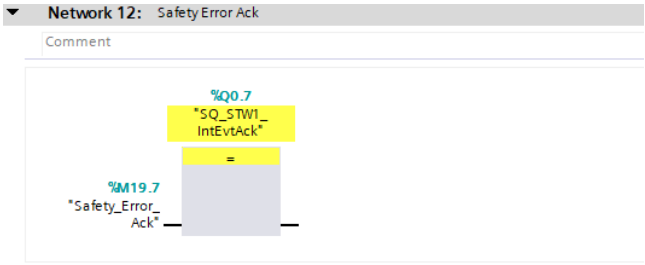
Safety administaration window

After the program is loaded the drive is in "Switch On Disabled" state. Safety panel has "Safety Fn State STO" and "Safety Fn State Int Event" active.



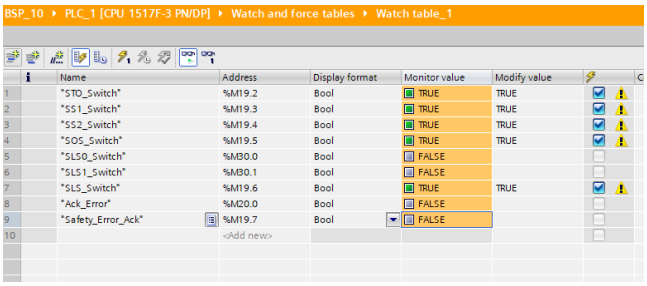
LinMot talk status

In the next step you have to acknowledge the safety internal event before enabling the drive. In this example the signal "Safety_Error_Ack" is assigned to the safety control word 0 bit 7.



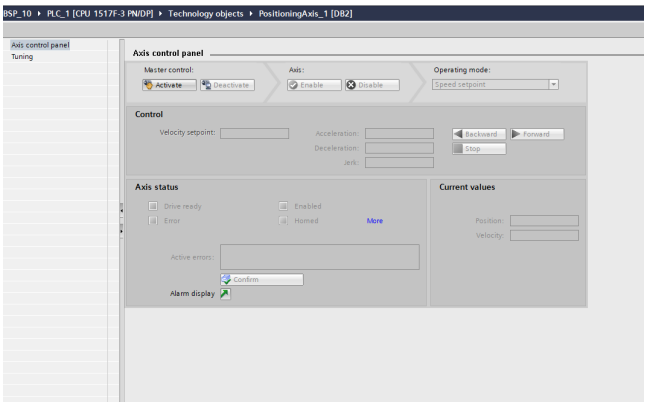
Safety internal event in the functioanl block

Acknowledge the event by assigning the falling edge to the signal. From the watch window, right click on the signal and change from TRUE to FALSE.



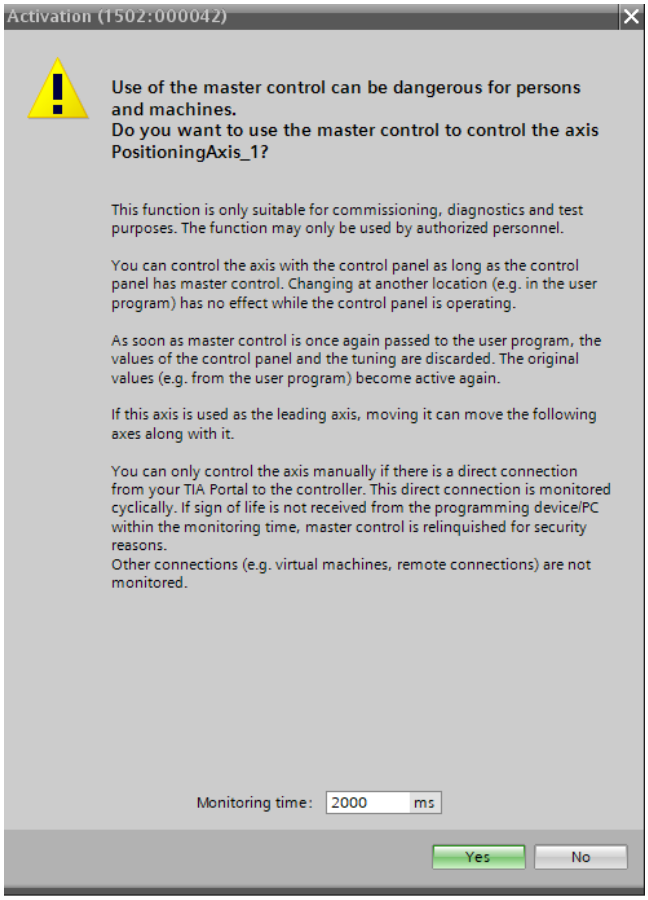
Watch table for assigning the signal

Now the system is ready for motion commands over the control panel, to do this click on the “Technology objects”.
Choose "Commissioning" under the positioning axes name. Double click on "Commissioning".
The axis control panel is shown as below.



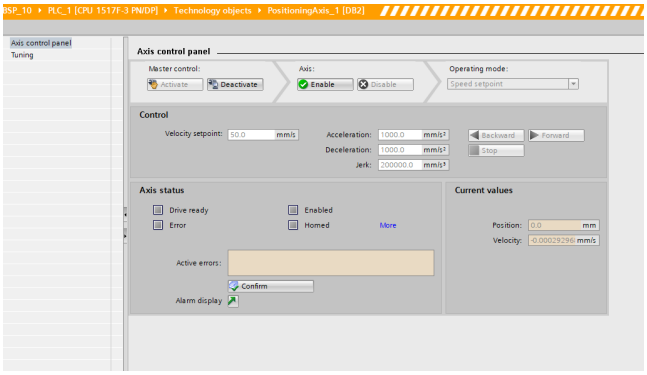
Axis control panel for commissioning

We have to get the master control by clicking on activate.
After clicking the system will go online automatically. Click on "yes" and accept the activation.



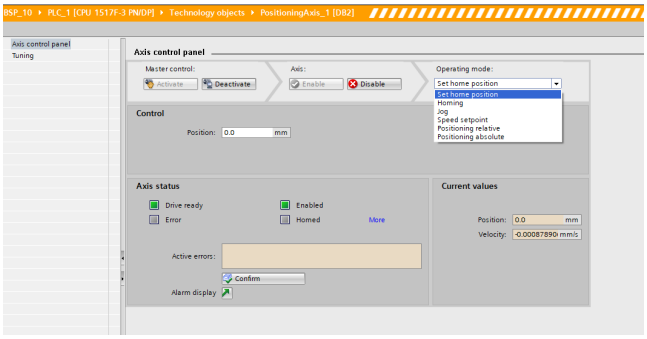
Axis control panel for commissioning

In the next step you have to set the enables, click the "Enable" button.



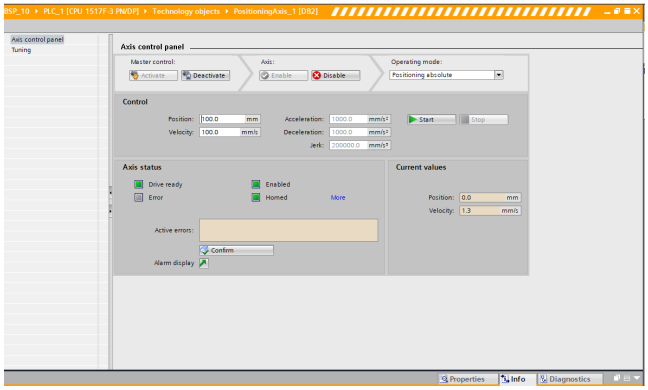
Axis control panel for commissioning

The LinMot talk shows the "Operation Enabled" state in the monitoring panel.
Set the home position by choosing the "Set home position" command from the drop down list under "Operating mode". Then click on Start.



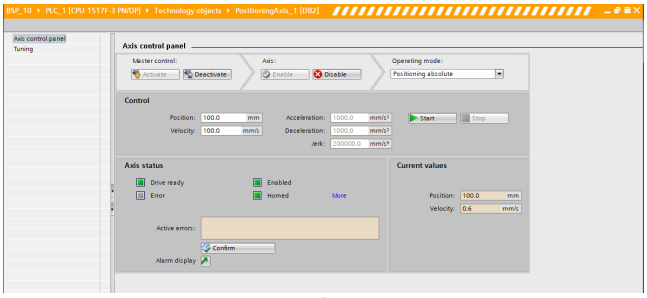
Axis control panel for commissioning

Now the homing is done and the "Homed" in the axis status should be green.
The axis is ready for absolute position moves.
Go to operation mode and choose "Positioning absolute" from the drop down menu.
Select the absolute motion. The position can be left at 100mm if your motor has enough position range.
Otherwise reduce this value.
Then click Start.



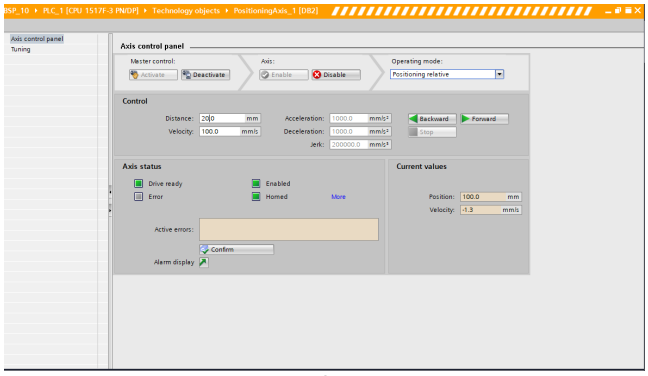
Axis control panel for commissioning

Check the position in the current value of position in the axis control panel.



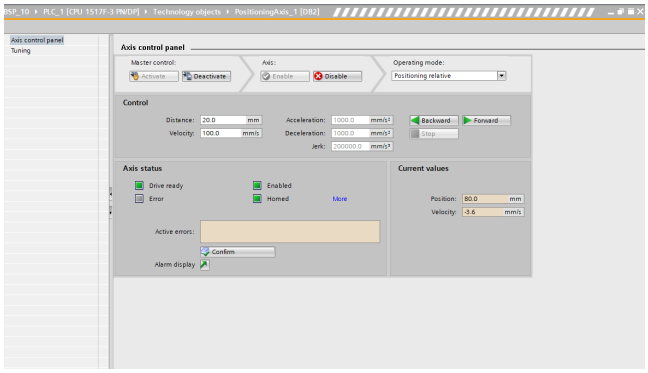
Axis control panel for commissioning

To start the relative motion, choose "Positioning relative" from the Axis control panel > Operating mode. Set the relative distance as 20.0mm and move backward or forward as required.



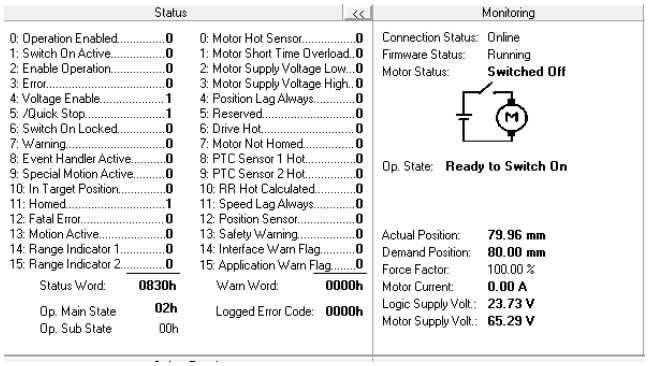
Axis control panel for commissioning

In this example the axis is moved backward and reached the position 80.0 mm.



Axis control panel for commissioning

Before leaving the control panel click the "Axis > Disable button" . Then click on "Master control > Deactivate". Now the LinMot-Talk is in "Ready to Switch On" state.



LinMot talk status after deactivation

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