



# LinMot PROFIdrive and Siemens SIMOTION

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Application Note

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#### Note

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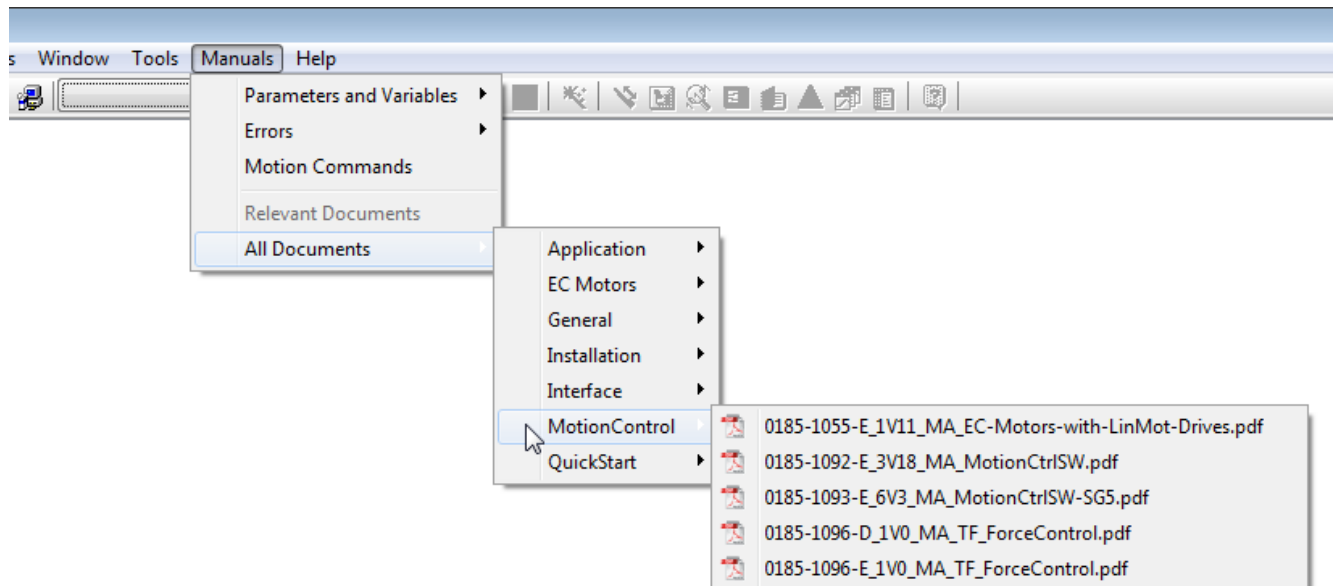
### Use of This Document

- Description:** Application note for commissioning a LinMot C1250-PD drive connected to a Siemens SIMOTION PLC.
- Drive:** C1250-PD-XC-xx-xxx
- Classification:**
- Application Note
  - Installation Guide
  - User Manual
  - Documentation
  - LinMot internally

### Recommended Documentation

Reading the following user manuals is essential to understand the communication between the PLC and the LinMot drive. The manuals are included in LinMot-Talk software (*Menu Manuals* → *All Documents* or *Relevant Documents* if logged in to a drive) or can be downloaded from the LinMot eCatalogue (search by document reference): <http://shop.linmot.com>

User Manual	Document Reference
LinMot-Talk	0185-1059
Motion Control Software	0185-1092 / 0185-1093
PROFIdrive	0185-1132



## General

Used components:

- LinMot C1250-PD-XC-0S / C1250-PD-XC-1S  
(Firmware 6.8 Build 20200120)
- SIMOTION D445-2 DP/PN, Control Unit D445-2 DP/PN; Firmware V5.2  
Part number: 6AU1 445-2AD00-0AA0
- TIA 15 Update 4 / SCOUT TIA V5.2.1.0 / SIMOTION SCOUT V4.4.0.6

Example project(s) for TIA15, SCOUT TIA: [http://download.linmot.com/plc\\_lib/preliminary/Simotion\\_PD/](http://download.linmot.com/plc_lib/preliminary/Simotion_PD/)



### Note:

From firmware 6.6 Build 20170522 the LinMot drive supports the SIEMENS Technology data block:

#### Functions

Technology data block:	Ja	<input type="button" value="Change..."/>
Response to alarm:	Remove all enables (default)	

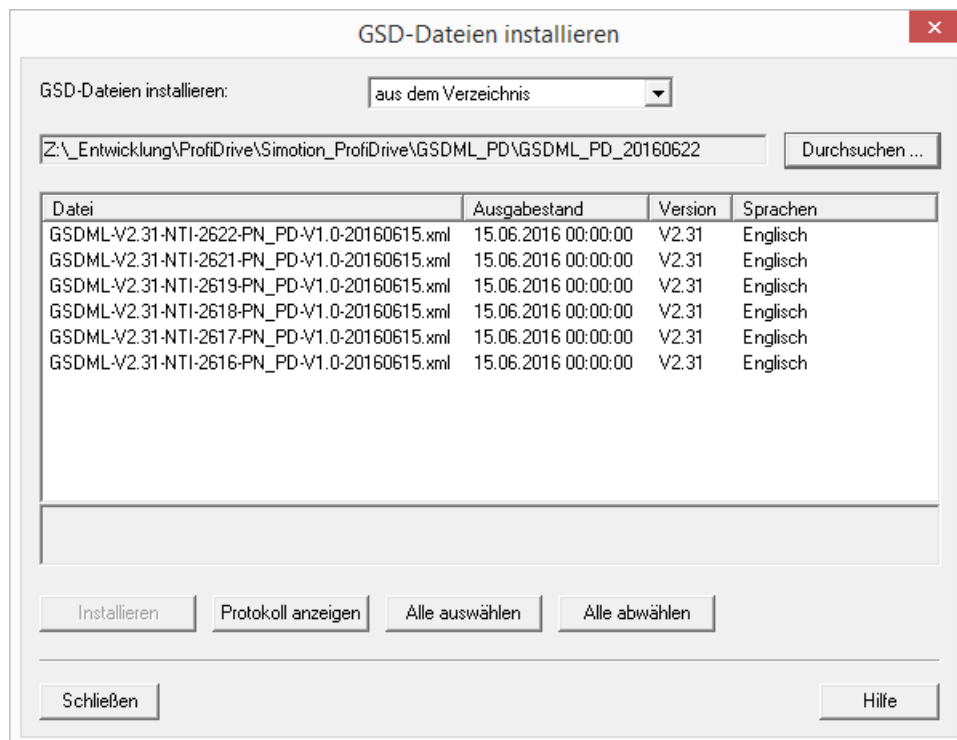
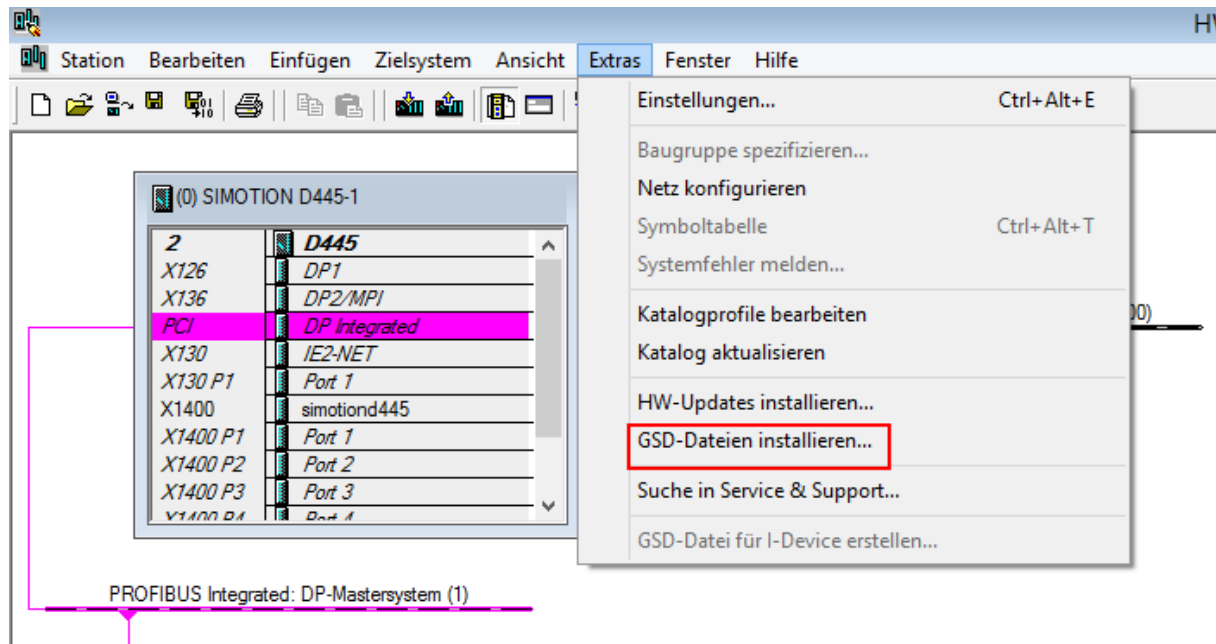
### 1 HW Config

In this application note the commissioning using SCOUT 4.4 is shown. For TIA example projects are available.

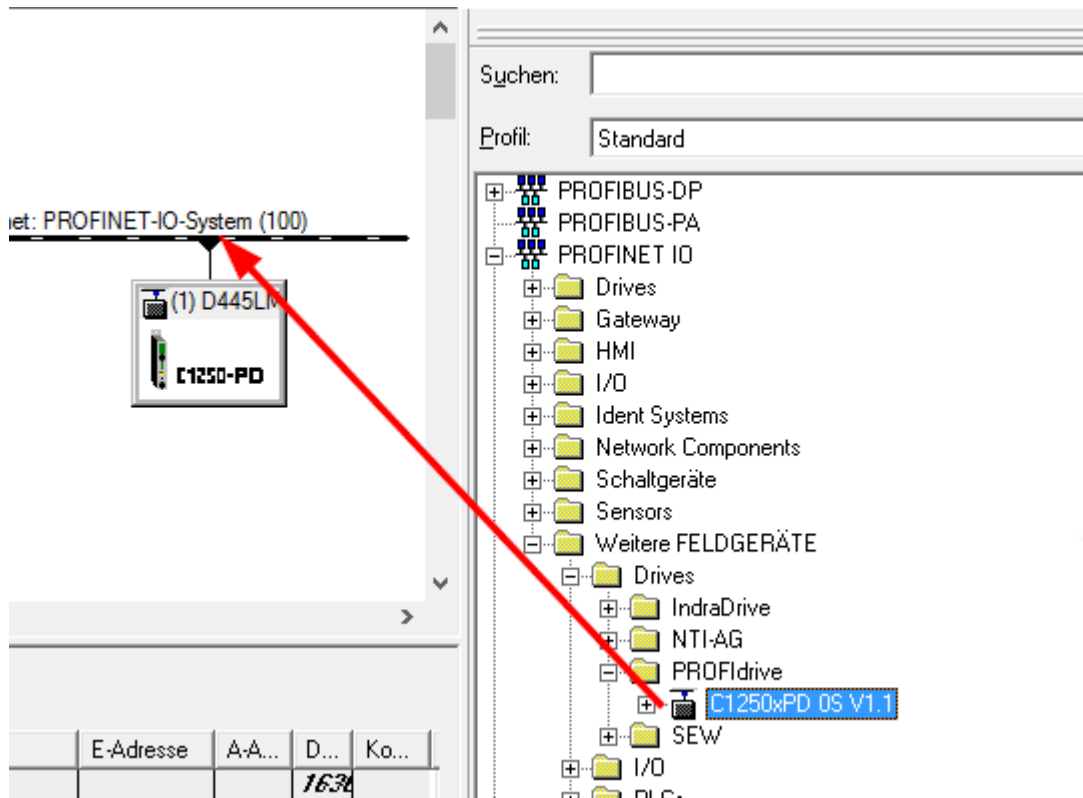
#### 1.1 Install GSDML file and add device

Install the GSDML file(s) that is part of the LinMot-Talk software/firmware you are using. The GSDML files are located by default in the installation path of LinMot-Talk:

\\LinMot-Talk X.X Build XXXXXXXX\Firmware\Interfaces\PROFINET\GSDML\_PD



Afterwards drag & drop the desired device on your PROFINET-IO-System:



By double-click on the device the name and IP address can be set:

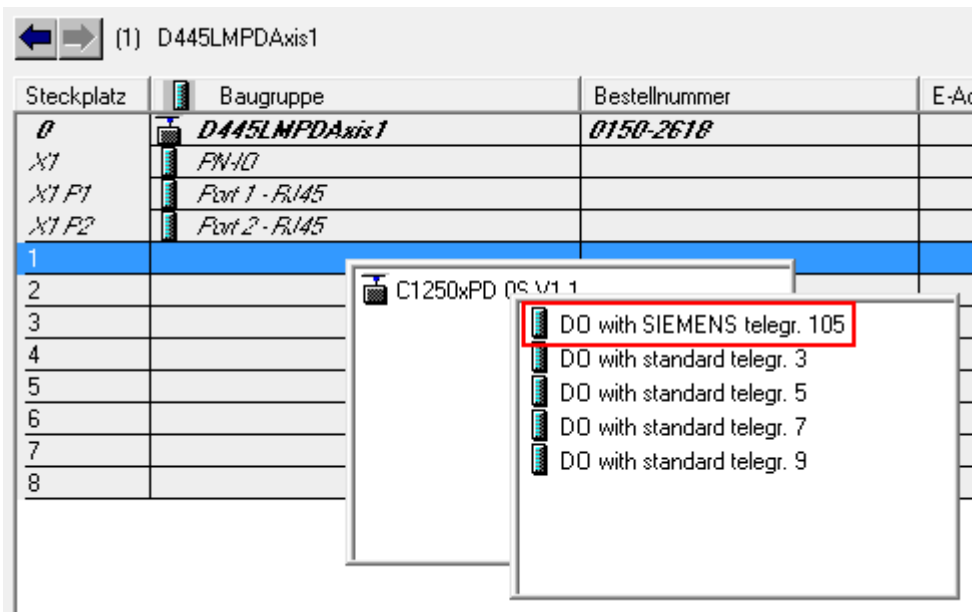
The screenshot shows a software dialog box titled "Eigenschaften - D445LMPDAxis1". It has two tabs: "Allgemein" and "Identifikation". The "Identifikation" tab is active. The dialog contains the following fields and controls:

- Kurzbezeichnung:** C1250-PD (with a list box below it containing "C1250-PD")
- Bestell-Nr. / Firmware:** 0150-2618 / V1.1r0
- Familie:** PROFIdrive
- Gerätename:** D445LMPDAxis1 (highlighted with a red box)
- GSD-Datei:** GSDML-V2.31-NTI-2618-PN\_PD-V1.0-20151208.xml
- Ausgabestand ändern...** (button)
- Teilnehmer PROFINET IO-System:**
  - Gerätenummer:** 1 (dropdown menu)
  - PROFINET-IO-System (100)** (text field)
  - IP-Adresse:** 10.3.8.111 (highlighted with a red box)
  - Ethernet...** (button)
  - IP-Adresse durch IO-Controller zuweisen
- Kommentar:** (empty text area)

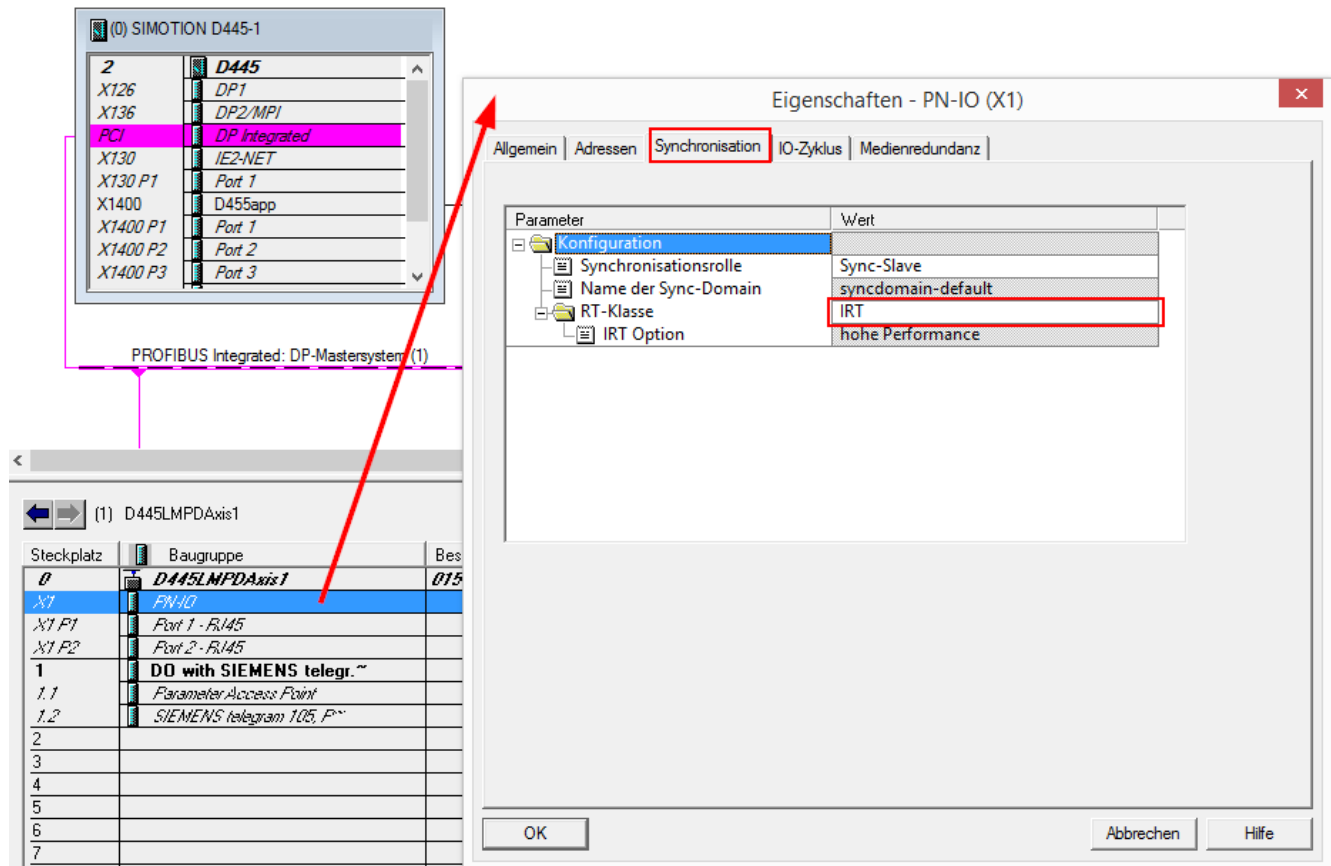
At the bottom, there are three buttons: "OK", "Abbrechen", and "Hilfe".

## 1.2 Insert Standard Telegram 5 / SIEMENS Telegram 105 and setup the Topology

By right-click on slot 1 select the desired telegram (standard telegram. 5 or SIEMENS telegram 105):



Afterwards double-click on X1 (PN-IO), open the tab *Synchronization* and set *RT-Klasse* to *IRT*:

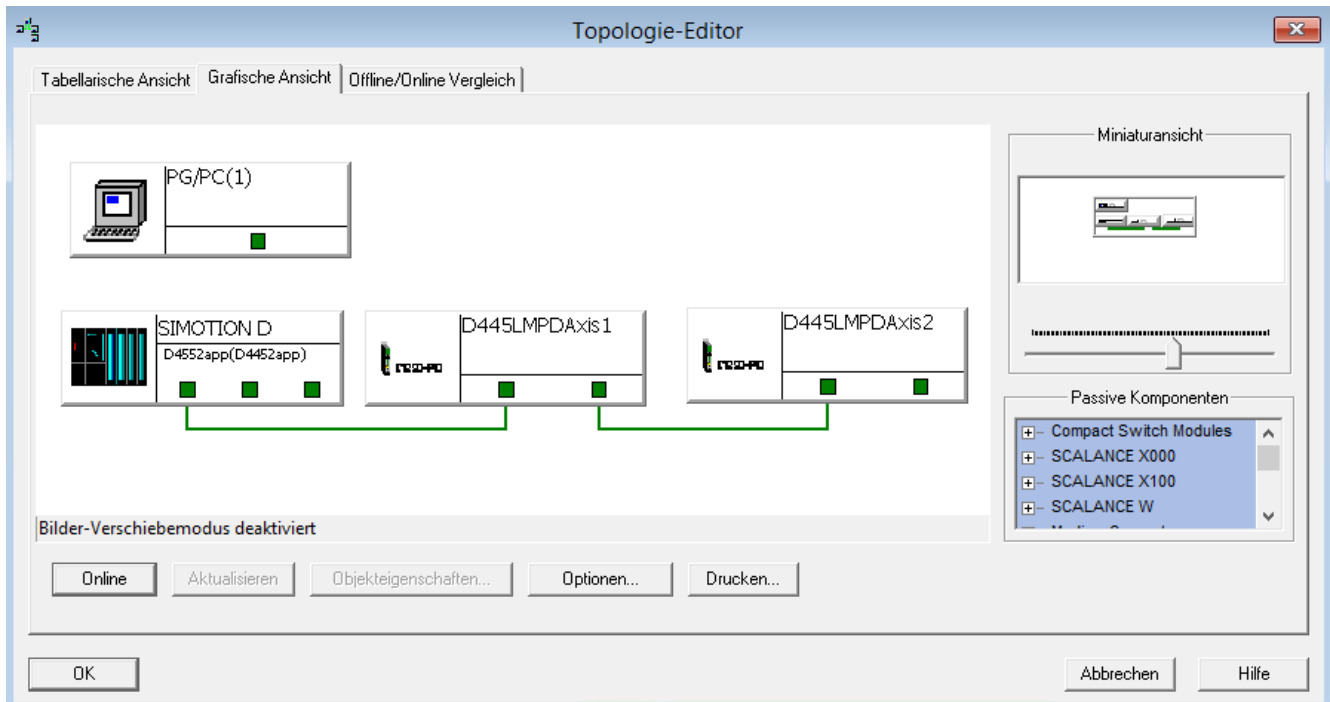


On tab *IO-Zyklus* select *Servo* for „IO-Device takt synchron zuordnen“:

The screenshot shows the 'Eigenschaften - PN-IO (X1)' dialog box with the 'IO-Zyklus' tab selected. The 'IO-Device takt synchron zuordnen' dropdown menu is highlighted with a red box and contains the value 'Servo'. Other settings include: 'Aktualisierungszeit' (Modus: fixierter Faktor, Aktualisierungszeit [ms]: 1.000, Faktor: 1, Sendetakt [ms]: 1.000), 'Ansprechüberwachungszeit' (Anzahl akzeptierter Aktualisierungszyklen mit fehlenden IO Daten: 3, Ansprechüberwachungszeit [ms]: 3.000), and 'Takt synchronität' (Applikationszyklus [µs]: 1000.000, Datenzyklus [µs]: 1000.000, Ti/To-Modus: im Netz, Zeit Ti (Prozesswerte einlesen) [µs]: 250.000, Zeit To (Prozesswerte ausgeben) [µs]: 250.000, Raster Ti/To [µs]: 125.000). Buttons for 'OK', 'Abbrechen', and 'Hilfe' are visible at the bottom.

Section	Parameter	Value
Aktualisierungszeit	Modus	fixierter Faktor
	Aktualisierungszeit [ms]	1.000
	Faktor	1
Sendetakt [ms]	Sendetakt [ms]	1.000
	Sendetakt [ms]	1.000
Ansprechüberwachungszeit	Anzahl akzeptierter Aktualisierungszyklen mit fehlenden IO Daten	3
	Ansprechüberwachungszeit [ms]	3.000
Takt synchronität	IO-Device takt synchron zuordnen	Servo
	Applikationszyklus [µs]	1000.000
	Datenzyklus [µs]	1000.000
	Ti/To-Modus	im Netz
	Zeit Ti (Prozesswerte einlesen) [µs]	250.000
	Zeit To (Prozesswerte ausgeben) [µs]	250.000
Raster Ti/To [µs]	125.000	

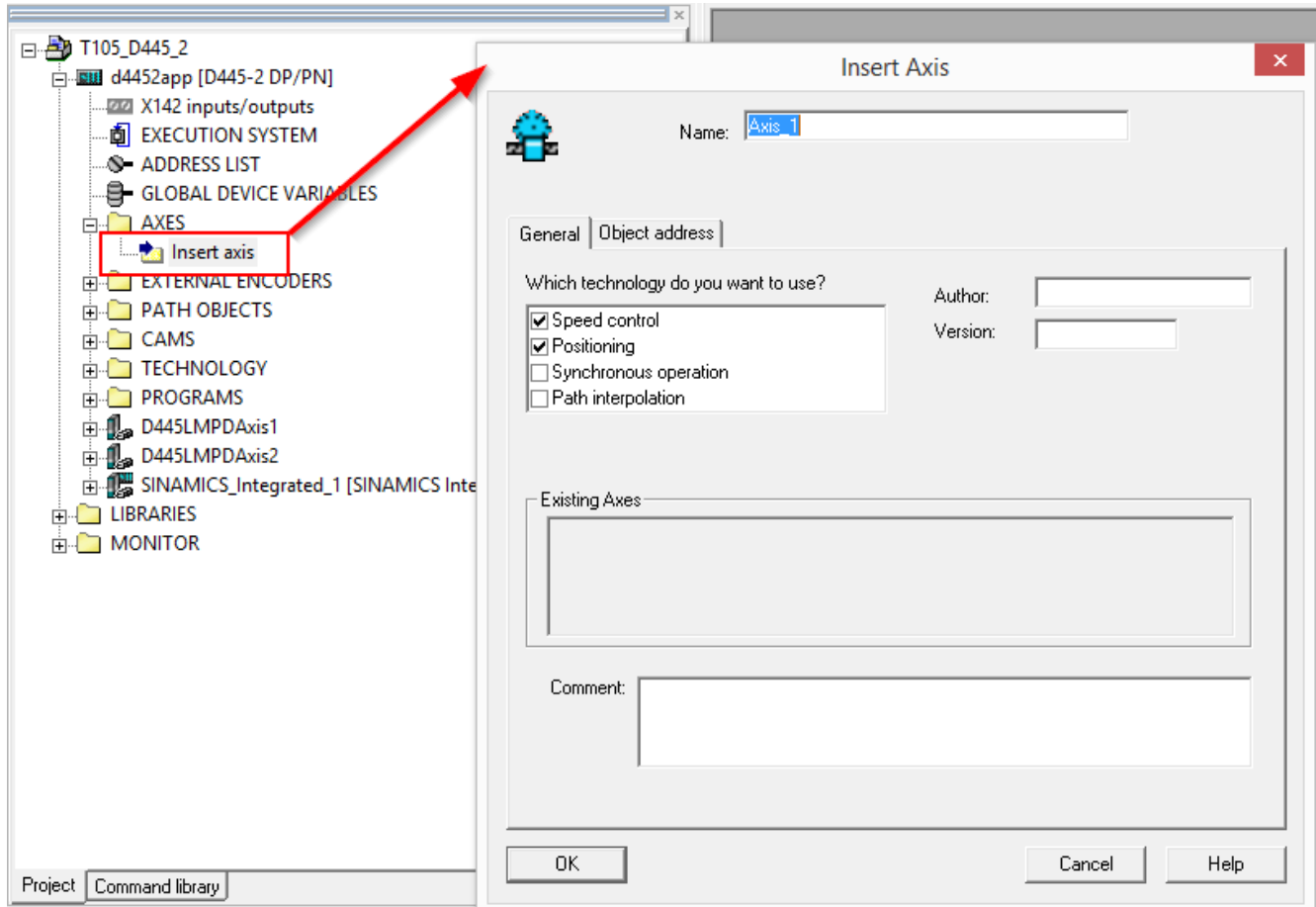
In the topology editor draw the connection between the SIMOTION PLC (Port 1 in this example) and the LinMot drive (Port 1).



### 2 SIMOTION SCOUT (as Linear Motor)

#### 2.1 Insert a new Axis

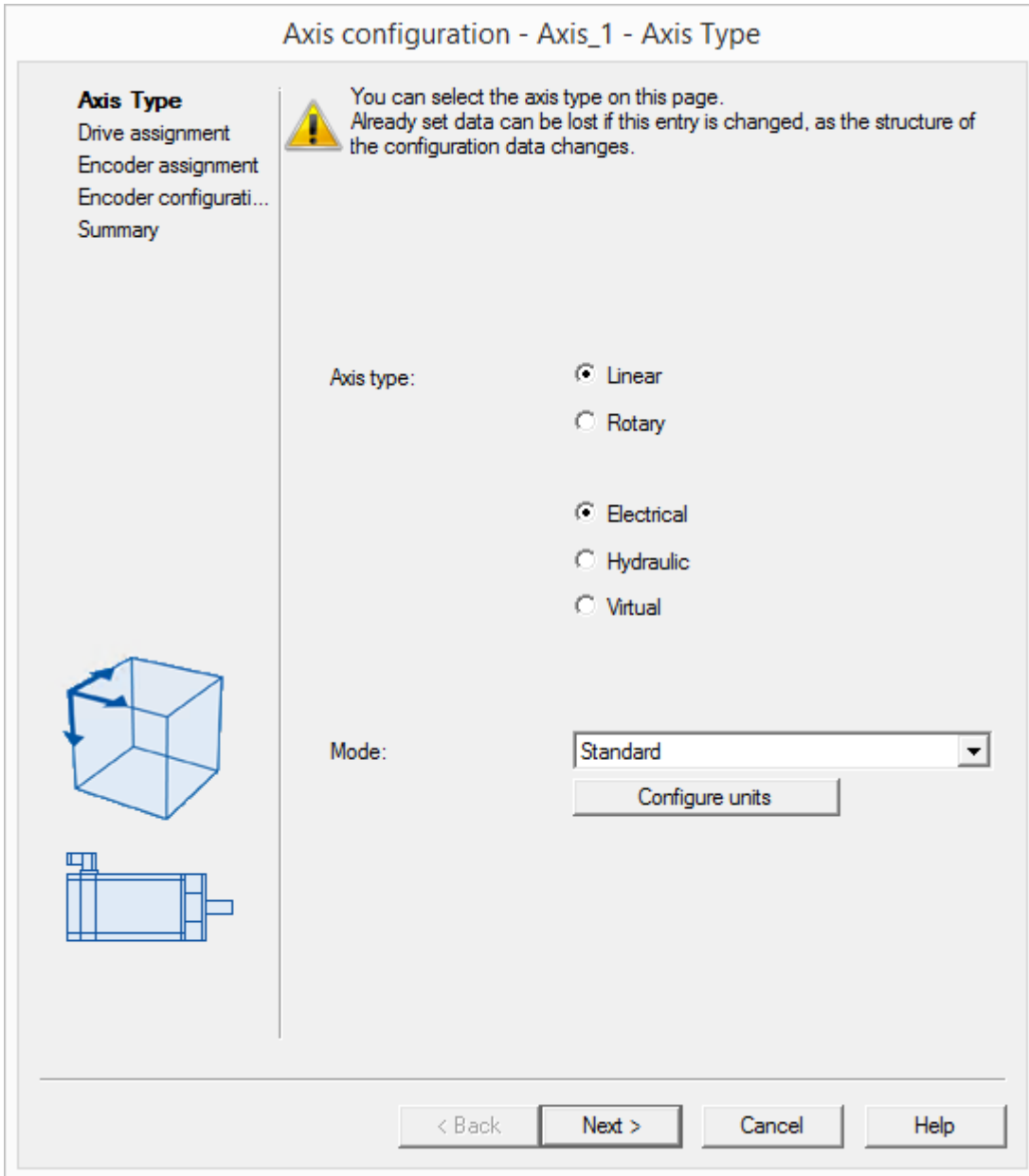
Double-click on Insert axis opens the Wizard:



After entering the name press OK to continue.

2.1.1 Axis Type

The settings for Axis Type can be left on default for a LinMot linear motor:



Afterwards continue with *Next*

### 2.1.2 Drive Assignment

Assign the newly created axis to the LinMot drive.

- As *Motor type* select *Linear motor*
- Set *Normalization velocity* to 240 m/min (4 m/s -> motor depending)
- Set *maximum motor velocity* to 240 m/min (4 m/s -> motor depending).  
The *maximum motor velocity* can be set up to 200% of the *Normalization velocity* if the used motor supports it.

If PROFIdrive-telegram 105 (SIEMENS Telegram 105) is chosen, then additionally:

- Set *Maximum force* to 255 N (motor depending -> see motor data sheet)

### Axis configuration - Axis\_1 - Drive assignment

✓ Axis Type

**Drive assignment**

Encoder assignment

Encoder configurati...

Summary

	Assignment partner [IN/OUT↑]	Assignment
	All	All
1	> Define assignment later	
2	D445LMPDAxis1	
3	Slot_1_2	assign
4	D445LMPDAxis2	
5	d4452app	
6	SINAMICS_Integrated_1	Create drive

Properties:

PROFIdrive telegram	105
Input	PI 256
Output	PQ 256

Motor type: Linear motor

**Which normalization data do you want to set?**

normalize to maximum motor velocity

Normalization velocity: 240.0 m/min

maximum motor velocity: 240.0 m/min

Maximum force: 255.0 N

< Back
Next >
Cancel
Help

### 2.1.3 Encoder Assignment

Enc. type: Incremental encoder  
 Encoder mode: Rectangular  
 Measuring system: Linear encoder system (linear scale)

**Axis configuration - Axis\_1 - Encoder assignment**

- ✓ Axis Type
- ✓ Drive assignment
- Encoder assign...**
- Encoder configurati...
- Summary

	Assignment partner [IN/OUT]	Assignment
	All	All
1	> Define assignment later	
2	> Input module for encoder value	
3	D445LMPDAxis1	
4	Slot_1_2	
5	Ch_1	assign
6	D445LMPDAxis2	
7	d4452app	
8	SINAMICS_Integrated_1	Create encoder

Properties:

PROFdrive telegram	105
Input	PI 256
Output	PQ 256

**Encoder use in SIMOTION:**

Enc. type:

Encoder mode:

Measuring system:

< Back
Next >
Cancel
Help

### 2.1.4 Encoder Configuration

Grid line spacing: 1.e-004 (100nm)  
Fine resolution: 1

Axis configuration - Axis\_1 - Encoder configuration

- ✓ Axis Type
- ✓ Drive assignment
- ✓ Encoder assignment
- Encoder config...**
- Summary


**Reference variables**

Grid line spacing:  mm

Fine resolution:

**Additional settings**

Tolerate the encoder failure when it is not involved in the closed-loop control



< Back   Next >   Cancel   Help

Finish the wizard by pressing *Next* and then *Finish*

## 2.2 Setup the Axis Parameters

The following axis parameters have to be setup.

Select “Expert list -> selected parameters” to set the dynamics of the motor:

Parameter	Parameter text	Offline value	Unit
1	Configuration data		
2	TypeOfAxis.MaxVelocity.maximum	4000.0	mm/s
3	TypeOfAxis.MaxAcceleration.maximum	30000.0	mm/s²
4	TypeOfAxis.MaxJerk.maximum	20000000.0	mm/s³
5	TypeOfAxis.NumberOfDataSets.DataSet_1.Contr...	100.0	1/s
6	TypeOfAxis.NumberOfDataSets.DataSet_1.Contr...	[173] YES	-
7	TypeOfAxis.NumberOfDataSets.DataSet_1.Contr...	[173] YES	-
8	TypeOfAxis.NumberOfDataSets.DataSet_1.Dyna...	0.0	s
9	TypeOfAxis.NumberOfDataSets.DataSet_1.Dyna...	0.0	s

Increase the frequency limit of the encoder:

Configuration data -> TypeOfAxis -> NumberOfEncoders -> Encoder\_1 -> FrequencyLimit -> encoderFrequencyLimit

-> 100000000.0

Parameter	Parameter text	Offline value	Unit
6	Simulation		
7	TypeOfAxis		
8	ActualAccelerationMonitoring		
9	ActualVelocityMonitoring		
10	CommandValueQuantization		
11	DecodingConfig		
12	DistributedMotion		
13	Drift		
14	DriveControlConfig		
15	EmergencyRampGenerator		
16	Extrapolation		
17	FineInterpolator		
18	Friction		
19	HWEndPos		
20	Homing		
21	MaxAcceleration		
22	MaxJerk		
23	MaxVelocity		
24	NeutralBand		
25	NumberOfDataSets		
26	NumberOfEncoders		
27	Encoder_1		
28	AdaptDrive		
29	AdaptExtern		
30	AdaptLoad		
31	AssemblyBase		
32	DriverInfo		
33	Filter		
34	FrequencyLimit		
35	encoderFrequencyLimit	100000000.0	Hz
36	IncBackLash		
37	IncHomingEncoder		
38	InversCountDirection		
39	PathPerRevolution		

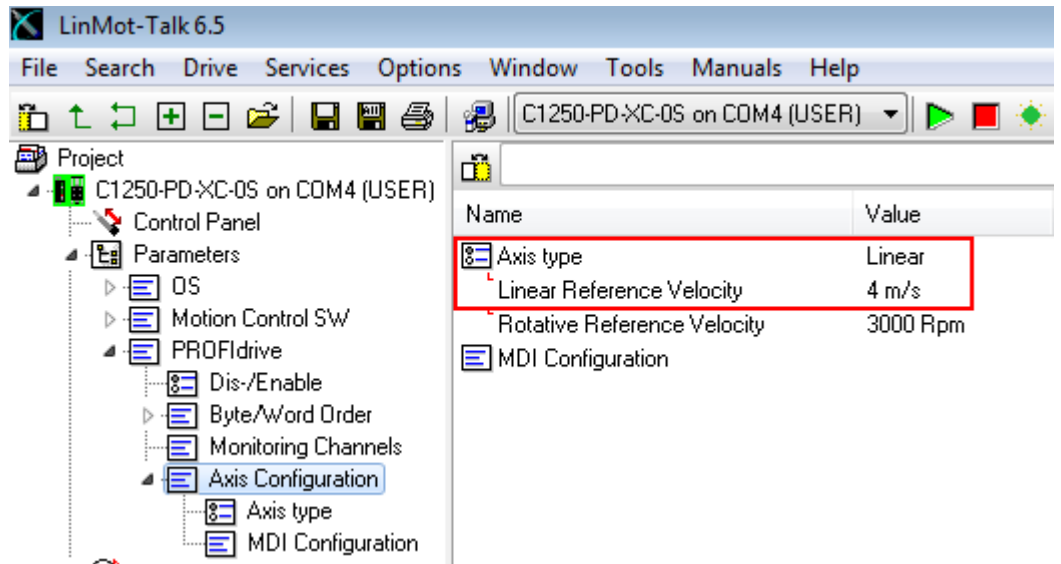
When using SIEMENS telegram 105 the fine resolution of the torque reduction (forceReductionGranularity) has to be set to [0] STANDARD.

Configuration data -> TypeOfAxis -> SetPointDriverInfo -> LinearMotorDriveData -> forceReductionGranularity

Configuration data		System variables	selected parameters		
	Parameter	Parameter text	Offline value	Unit	
	All	All	All	All	
6	Simulation	Process coupling			
7	TypeOfAxis	Axis type-specific configuration			
8	ActualAccelerationMonitoring	Actual acceleration monitoring			
9	ActualVelocityMonitoring	Actual velocity monitoring			
10	CommandValueQuantization	Quantization filter			
11	DecodingConfig	Command execution			
12	DistributedMotion	Distributed motion control			
13	Drift	Drift compensation			
14	DriveControlConfig	Drive-related settings			
15	EmergencyRampGenerator	Emergency stop ramp generator			
16	Extrapolation	Actual value smoothing			
17	FineInterpolator	Fine interpolator			
18	Friction	Friction compensation			
19	HWEndPos	Hardware limit switch			
20	Homing	Homing			
21	MaxAcceleration	Maximum acceleration			
22	MaxJerk	Maximum jerk			
23	MaxVelocity	Maximum velocity			
24	NeutralBand	Dead zone compensation			
25	NumberOfDataSets	Data sets for the controller configuration			
26	NumberOfEncoders	Configured encoders			
27	PathSyncAxisPosTolerance	Setpoint difference monitoring of the synchro...			
28	PositionMonitoring	Position monitoring			
29	ServoMonitoring	Activate control loop monitoring with active pr...			
30	SetPointDriverInfo	Drive interface			
31	InvertSetPoint	Direction of rotation adjustment			
32	LinearMotorDriveData	Drive characteristic values for linear motors			
33	- forceReductionGranularity	Fine resolution of the torque reduction	[0] STANDARD	-	
34	- forceReference	Selection setting for the normalization: Refere...	[0] MAX_VALUE	-	
35	- maxForce	Maximum force	255.0	N	

## 2.3 LinMot Drive Settings

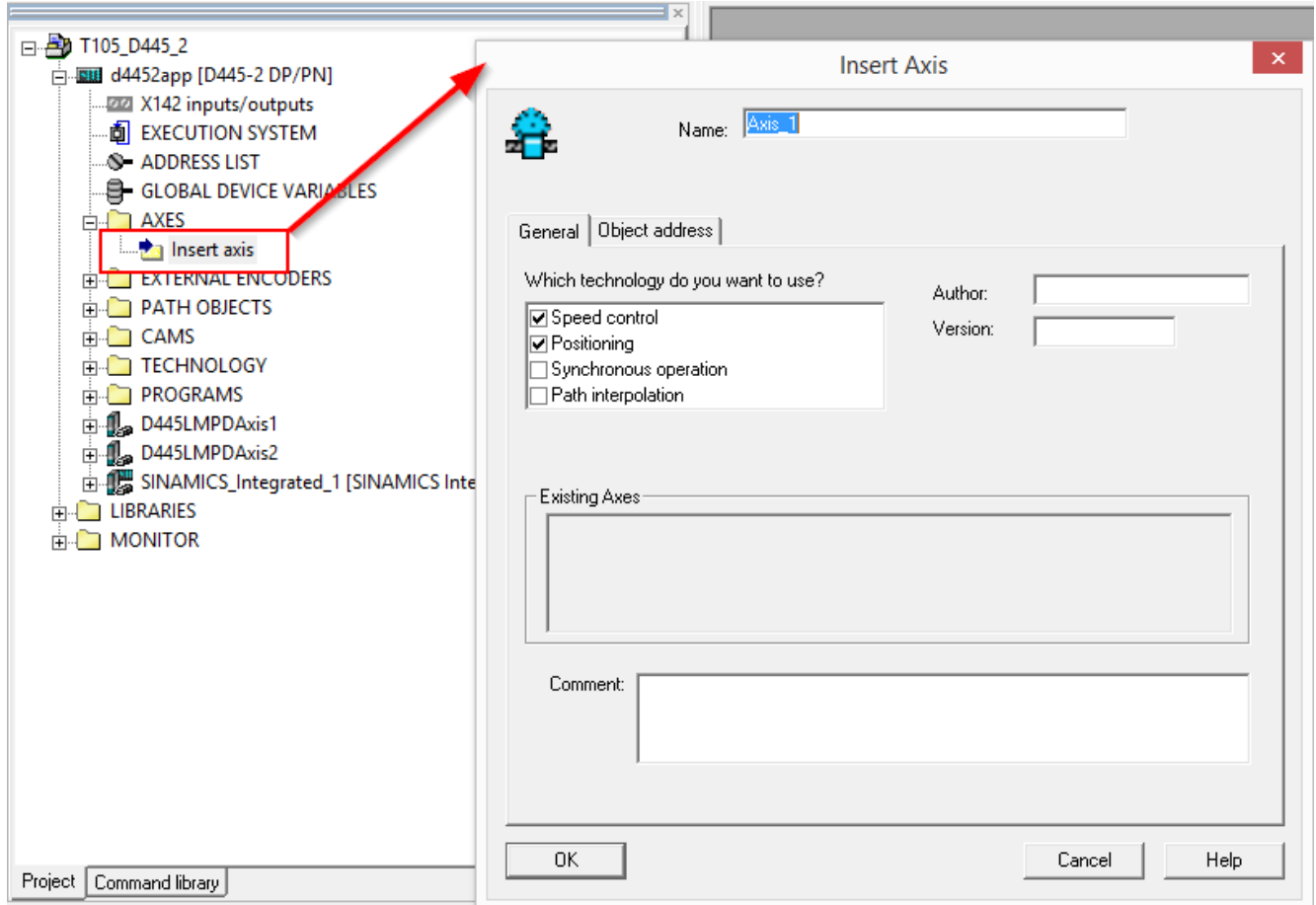
In chapter 2.1.2 the maximal motor velocity was set to 240m/min (4m/s). To scale correctly the demand velocity sent from the SIMOTION to the LinMot drive the *Linear Reference Velocity* (linear motor) or *Rotative Reference Velocity* (rotary motor) respectively has to be set to the maximal velocity in the SIMOTION axis. As we use a linear motor in this example *Axis type Linear* has to be selected.



### 3 SIMOTION SCOUT (as Rotary Motor)

#### 3.1 Insert a new axis

Double-click on Insert axis opens the Wizard:




After entering the name press OK to continue.

### 3.1.1 Axis Type

Set Axis Type to *Rotary*:


Axis configuration - Axis\_1 - Axis Type

**Axis Type**  
Drive assignment  
Encoder assignment  
Encoder configurati...  
Summary

 You can select the axis type on this page.  
Already set data can be lost if this entry is changed, as the structure of the configuration data changes.

Axis type:

Linear

  Rotary



Electrical

Hydraulic

Virtual

Mode: Standard

Configure units

< Back   Next >   Cancel   Help

Afterwards continue with *Next*

### 3.1.2 Drive Assignment

Assign the newly created axis to the LinMot drive.

In this example, a **LinMot EC02-40/140** motor is used (see data-sheet that can be found on <http://shop.linmot.com>)

- Set *Normalization speed* to 4000 1/min (motor depending -> see motor data sheet)
- Set *maximum motor speed* to 5000 1/min (motor depending -> see motor data sheet)

If PROFIdrive-telegram 105 (SIEMENS Telegram 105) is chosen, then additionally:

- Set *Maximum torque* to 1.55 Nm (motor depending -> see motor data sheet)

### Axis configuration - Axis\_1 - Drive assignment

- ✓ Axis Type
- Drive assignment**
- ✓ Encoder assignment
- Encoder configurati...
- Summary

	Assignment partner [IN/OUT↑]	Assignment
	All	All
1	> Define assignment later	
2	D445LMPDAxis1	
3	Slot_1_2	assign
4	D445LMPDAxis2	
5	d4452app	
6	SINAMICS_Integrated_1	Create drive

Properties:

PROFIdrive telegram	105
Input	PI 256
Output	PQ 256

Motor type: Standard motor

**Which normalization data do you want to set?**

normalize to maximum motor speed

Normalization speed:  rpm

maximum motor speed:  rpm


Maximum torque:  Nm

< Back
Next >
Cancel
Help

### 3.1.3 Encoder Assignment

Enc. type: Cyclic absolute encoder (**Important** as EC02 and PR01 have single-turn encoder)  
 Encoder mode: SSI

**Geberzuordnung**  
Geberkonfiguration



	Zuordnungspartner [IN/OUT]▲	Zuordnung
	Alle	Alle
1	> Zuordnung später definieren	
2	D445LMPDAxis1	
3	D445LMPDAxis2	
4	Slot_1_2	
5	Ch_1	LMR_PR01_5...Encoder_1
6	d4452app	
7	SINAMICS_Integrated_1	Geber anlegen

Eigenschaften:

PROFdrive-Telegramm	105
Ausgang	PQ 292
Eingang	PI 292

**Geberverwendung in SIMOTION:**

Gebertyp:

Gebemodus:

Messsystem: Gebersystem rotatorisch


< Zurück
Weiter >
Abbrechen
Hilfe

### 3.1.4 Encoder Configuration

Encoder pulses per rev: 524288 (When using default settings on the LinMot drive)  
Fine resolution: 0  
Fine resolution of absolute... 0  
Data width of absolute... 19

### Axis configuration - Axis\_1 - Encoder configuration

- ✓ Axis Type
- ✓ Drive assignment
- ✓ Encoder assignment
- Encoder config...**
- Summary



#### Reference variables

Encoder pulses per rev.:

Fine resolution:

Fine resolution of absolute value in Gn\_XIST2:

Data width of absolute value without fine resolution:

#### Additional settings

Tolerate the encoder failure when it is not involved in the closed-loop control

Activate encoder monitoring

< Back   Next >   Cancel   Help

Finish the wizard by pressing *Next* and then *Finish*



**Note:**

If the rotary part of a LinMot linear rotary motor (**PR01-...**) is setup the **Encoder pulses per rev** has to be set to **360000** (When using default settings on the LinMot drive)

## 3.2 Setup the Axis Parameters

The following axis parameters have to be setup.

Select "Expert list -> selected parameters" to set the dynamics of the motor:

Parameter	Parameter text	Offline value	Unit
1 Configuration data			
2 - TypeOfAxis.MaxVelocity.maximum	Maximum value of the permissible velocity	18000.0	1/s
3 - TypeOfAxis.MaxAcceleration.maximum	Maximum value of the permissible acceleration	360000.0	1/s <sup>2</sup>
4 - TypeOfAxis.MaxJerk.maximum	Maximum value of the permissible jerk	7200000.0	1/s <sup>3</sup>
5 - TypeOfAxis.NumberOfDataSets.DataSet_1.Contr...	P controller gain	20.0	1/s
6 - TypeOfAxis.NumberOfDataSets.DataSet_1.Contr...	DSC activation	[173] YES	-
7 - TypeOfAxis.NumberOfDataSets.DataSet_1.Contr...	Activation of the precontrol	[173] YES	-
8 - TypeOfAxis.NumberOfDataSets.DataSet_1.Dyna...	Replacement time constant of the velocity control loop	0.0	s
9 - TypeOfAxis.NumberOfDataSets.DataSet_1.Dyna...	Replacement time constant of the position control loop	0.0	s

Increase the frequency limit of the encoder:

Configuration data -> TypeOfAxis -> NumberOfEncoders -> Encoder\_1 -> FrequencyLimit -> encoderFrequencyLimit

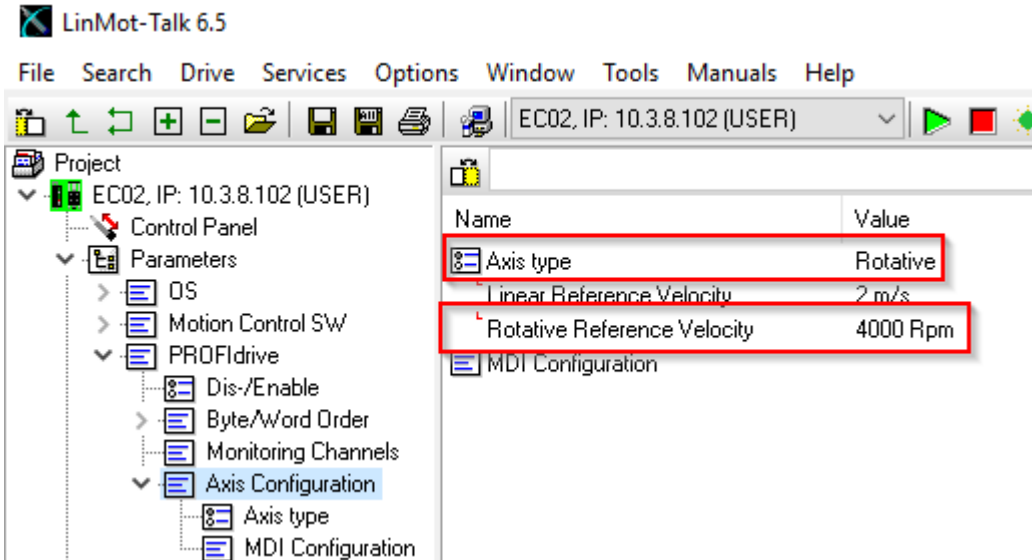
-> 100000000.0

Parameter	Parameter text	Offline value	Unit
All	All	All	All
6 Simulation	Process coupling		
7 TypeOfAxis	Axis type-specific configuration		
8 ActualAccelerationMonitoring	Actual acceleration monitoring		
9 ActualVelocityMonitoring	Actual velocity monitoring		
10 CommandValueQuantization	Quantization filter		
11 DecodingConfig	Command execution		
12 DistributedMotion	Distributed motion control		
13 Drift	Drift compensation		
14 DriveControlConfig	Drive-related settings		
15 EmergencyRampGenerator	Emergency stop ramp generator		
16 Extrapolation	Actual value smoothing		
17 FineInterpolator	Fine interpolator		
18 Friction	Friction compensation		
19 HWEndPos	Hardware limit switch		
20 Homing	Homing		
21 MaxAcceleration	Maximum acceleration		
22 MaxJerk	Maximum jerk		
23 MaxVelocity	Maximum velocity		
24 NeutralBand	Dead zone compensation		
25 NumberOfDataSets	Data sets for the controller configuration		
26 NumberOfEncoders	Configured encoders		
27 Encoder_1	Encoder 1		
28 AdaptDrive	Gear ratio of the measuring system for drive-...		
29 AdaptExtern	Gear ratio of the measuring system for extern...		
30 AdaptLoad	Gear ratio of the measuring system for load-si...		
31 AssemblyBase	Measuring system mounting type		
32 DriverInfo	Actual value interface		
33 Filter	Actual value filter		
34 FrequencyLimit	Measuring system limiting frequency		
35 encoderFrequencyLimit	Encoder limiting frequency	100000000.0	Hz
36 IncBackLash	Incremental measuring system backlash on re...		
37 IncHomingEncoder	Incremental measuring system homing		
38 InversCountDirection	Count direction inversion		
39 PathPerRevolution	Distance per revolution		

### 3.3 LinMot Drive Settings

In chapter 3.1.2 the *Normalization speed* was set to 4000 rpm.

To scale correctly the demand velocity sent from the SIMOTION to the LinMot drive *Rotative Reference Velocity* (rotary motor) has to be set to the normalization speed in the SIMOTION axis. As we use a rotary motor in this example *Axis type Rotative* has to be selected.



## 4 Homing

The reference move can be realised using the moving to end stop function (Via force/torque or Via following error), or by an external switch.



**Note:**

This is not required for motors with absolute feedback (e.g. LinMot EC02 or LinMot RS01)

### 4.1 Moving to End Stop (Via force/torque), recommended with Siemens Telegram 105

The screenshot shows the configuration interface for the 'Festanschlag' (End Stop) function. On the left is a project tree with 'D445 [D445-1]' expanded to 'ACHSEN' > 'LM\_Axis\_1' > 'Begrenzungen'. The main window has tabs for 'Position und Geschwindigkeit', 'Dynamisches Verhalten', and 'Festanschlag'. The 'Festanschlagserkennung' dropdown is set to 'ueber Kraft-/Drehmoment'. A diagram shows a mechanical part moving towards a stop, with labels for 'Sollposition', 'Istposition am Festanschlag', and 'Progr. Endposition'. A text box indicates 'Positionstoleranz nach Festanschlagserkennung: 10.0 mm'.

### 4.2 Moving to End Stop (Via following error), recommended with Standard Telegram 5

Konfigurationsdaten		Systemvariablen	ausgewählte Parameter		
Parameter	Parameterwert	Offlinewert	Einheit	Datentyp	
Alle	Alle	Alle	Alle	Alle	
101 swLimitState	Status SW-E...				
102 torqueLimitNegative	Programmiert...				
103 torqueLimitNegativeIn	Eingangs-Int...				
104 torqueLimitPositive	Programmiert...				
105 torqueLimitPositiveIn	Eingangs-Int...				
106 torqueLimitingCommand	Bearbeitung...				
107 typeOfAxis	Achseinstell...	[112] REAL_AXIS	-	'EnumAxisOperatingMode' = enum/DINT	
108 userDefaultClamping	Anwenderv...				
109 clampingValue	Klemmwert	5.0	-	LREAL	
110 userDefaultDynamics	Anwenderv...				
111 direction	Richtungsan...	[107] POSITIVE	-	'EnumDirection' = enum/DINT	

**4.3 Example Sequence for Homing using the Moving to End Stop Function (MCC):**

The following MCC chart is part of the example program.

Basically the axis is moved in negative/positive direction und the end stop is detected. Afterwards the axis is referenced and moved away from the end stop.

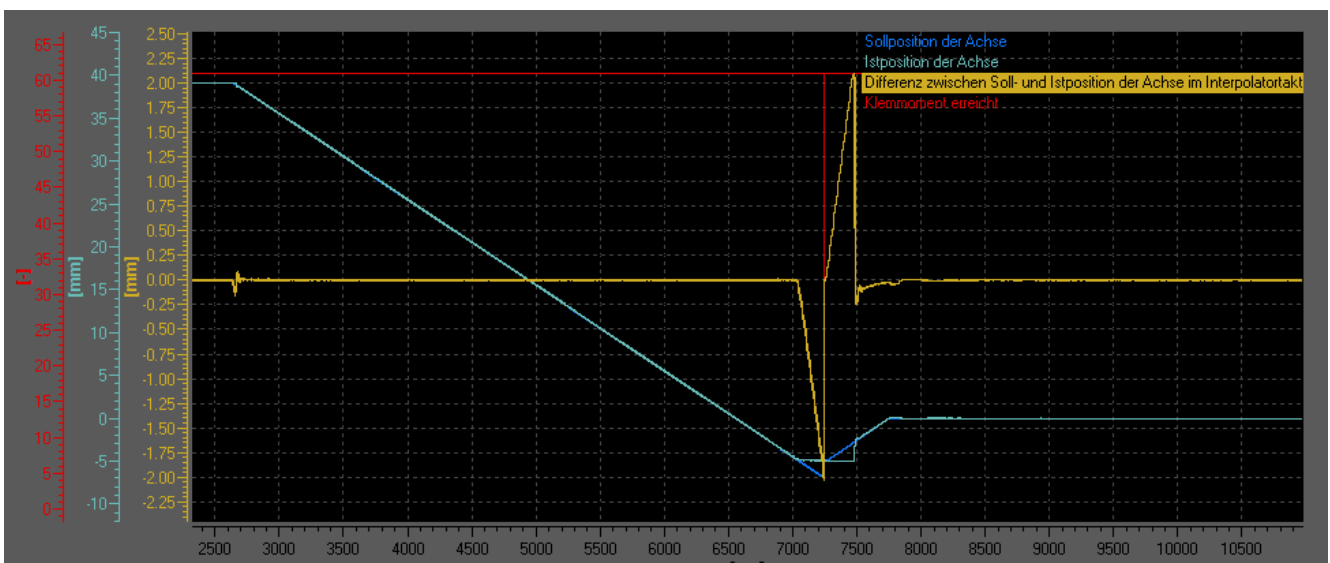
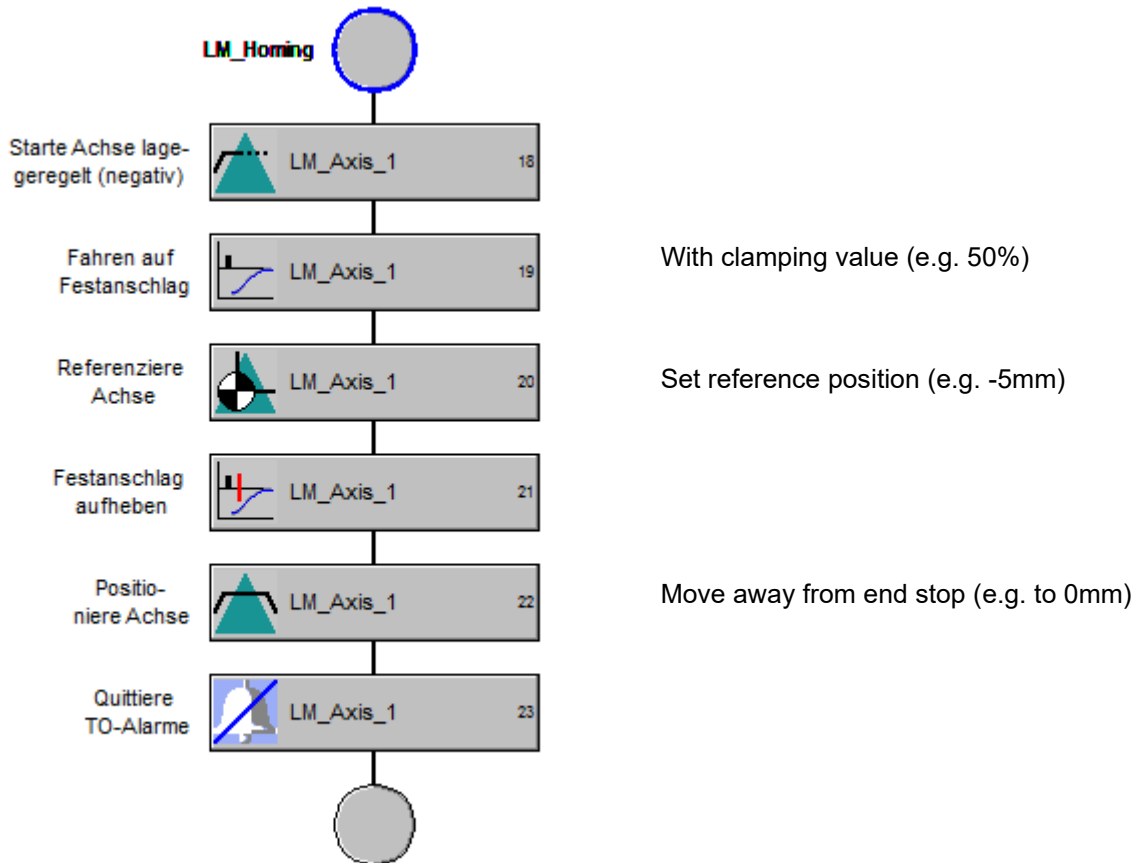


Figure 1: Homing the axis with moving to end stop (Via force/torque)

### 4.4 Homing using an External Switch

If you want to do the reference move using an external switch the settings for doing this could look as follows:

The screenshot shows the SIMOTION SCOUT interface for configuring an external switch homing method. The left sidebar shows the project tree with 'Referenzieren' highlighted. The main window displays the configuration for 'Geber\_1 - Inkrementeller Geber - Rechteck'.

Configuration details:

- Referenzieren notwendig: nein
- Referenziermodus: nur Externe Nullmarke
- Signalübergang: Low -> High (positiv)
- an Seite von Externer Nullmarke: rechts
- Referenzpunktfahrt: Start in negativer Richtung
- Anfahrgeschwindigkeit: 50.0 mm/s
- Einfahrgeschwindigkeit: 20.0 mm/s
- max. Weg bis Ext. Nullmarke: 1.e-003 mm
- Referenzpunktcoordinate: 0.0 mm
- Referenzpunktverschiebung: 0.0 mm
- neg. Umkehnnocken verwenden:
- neg. HW-Endschalter als Umkehnnocken verwenden:
- pos. Umkehnnocken verwenden:
- Eingang Umkehnnocken: SINAMICS\_Integra...DI\_0 ...

A diagram in the center shows a mechanical setup with a vertical axis and a horizontal axis, illustrating the homing process with arrows indicating the direction of travel.

## 5 Parameter Access

### 5.1 Read RAM Value of Drive Parameter

Read access to the RAM value of a LinMot drive parameter can be done using the function `_readDriveParameter()`. To the UPID an offset of 16#2000 has to be added.

**Example:** To read the LinMot parameter with UPID 16#13A6 (Maximal Current) the input `parameterNumber` of the function must be set to  $16\#13A6 + 16\#2000 = 16\#33A6$ .

Implementation example:

```
PROGRAM readDriveRAMParameter
VAR
  bParameterRead : BOOL;
  uiUPIDParameterRead : UINT;
  stRetParameterRead : StructRetReadDriveParameter;
  diValueParameterRead : DINT;
  CmdID : CommandIDType;
END_VAR
//*****
// Drive Parameter Access (Read Parameter RAM value by UPID)
//*****
IF bParameterRead THEN
  stRetParameterRead :=
  _readDriveParameter(
    logAddress:= 16365, //Address of the Parameter Access Point of the drive -> See HW Config > Select Drive > Slot 1.1
    parameterNumber:= 16#2000 + uiUPIDParameterRead, //16#2000 + UPID -> e.g. 16#2000 + 16#13A6 (maximal current) = 16#33A6
    nextcommand:=IMMEDIATELY,
    commandid:=CmdID
  );

  IF (stRetParameterRead.functionResult = 0) THEN
    bParameterRead := FALSE;
    diValueParameterRead := BIGEYTEARRAY_TO_ANYTYPE(stRetParameterRead.data,0);
  END_IF;
END_IF;
END_PROGRAM
```

### 5.2 Write RAM Value of Drive Parameter

Write access to the RAM value of a LinMot drive parameter can be done using the function `_writeDriveParameter()`. To the UPID an offset of 16#2000 has to be added.

**Example:** To write the LinMot parameter with UPID 16#13A6 (Maximal Current) the input `parameterNumber` of the function must be set to  $16\#13A6 + 16\#2000 = 16\#33A6$ .

Implementation example:

```
PROGRAM writeDriveRAMParameter
VAR
  bParameterWrite : BOOL;
  uiUPIDParameterWrite : UINT;
  stRetParameterWrite : StructRetWriteDriveParameter;
  diValueParameterWrite : DINT;
  CmdID : CommandIDType;
END_VAR
//*****
// Drive Parameter Access (Write parameter RAM value by UPID)
//*****
IF bParameterWrite THEN
  stRetParameterWrite :=
  _writeDriveParameter(
    logAddress:= 16365, //Address of the Parameter Access Point of the drive -> See HW Config > Select Drive > Slot 1.1
    parameterNumber:= 16#2000 + uiUPIDParameterWrite, //16#2000 + UPID -> e.g. 16#2000 + 16#13A6 (maximal current) = 16#33A6
    nextcommand:=IMMEDIATELY,
    commandid:=CmdID,
    datalength:=DINT_TO_UDINT(_sizeof(diValueParameterWrite)),
    data:=ANYTYPE_TO_BIGEYTEARRAY(diValueParameterWrite,0)
  );

  IF (stRetParameterWrite.functionResult = 0) THEN
    bParameterWrite := FALSE;
  END_IF;
END_IF;
END_PROGRAM
```

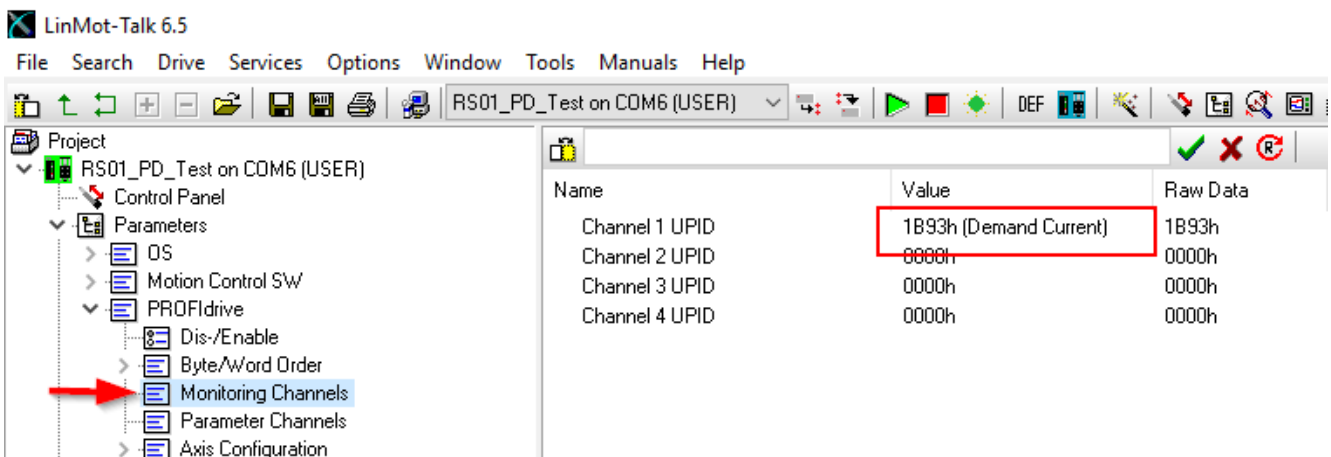
### 6 Adding Additional Parameters/ Variables to the Real Time Channel

It is possible to add additional parameters or variables of the drive to the real time channel to allow read and write access. There are 4 channels from the Drive to the PLC (32Bit each, Mon Channel 1-4) and 4 channels from the PLC to the Drive (32Bit each, Par Channel 1-4) available.

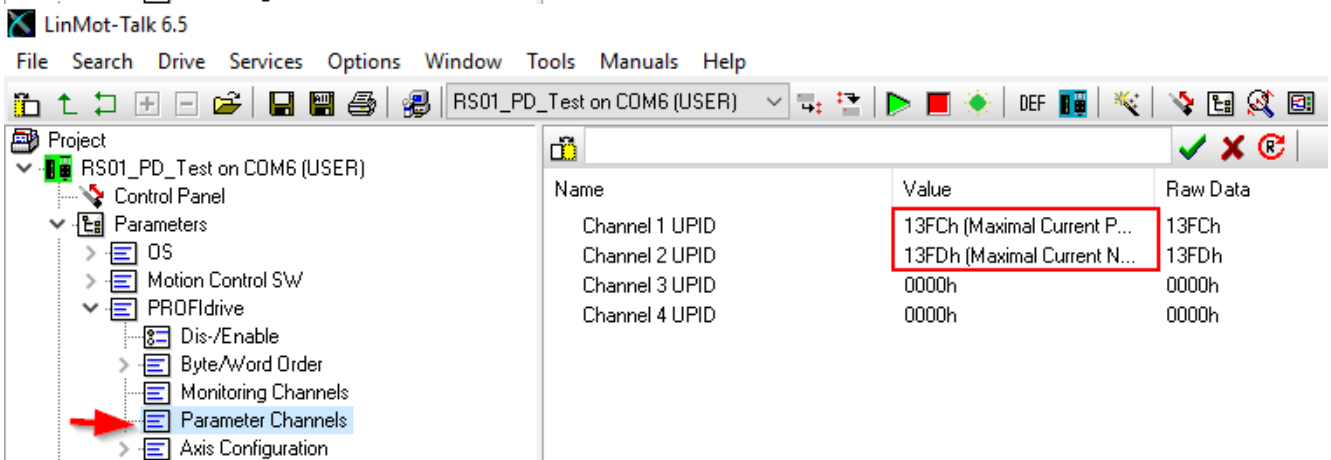
#### 6.1 Drive Configuration

In LinMot-Talk the UPID (parameter/variable address) is entered in the particular channel.

As example in Monitoring Channel 1 the UPID *1B93h (Demand Current)* and in Parameter Channel 1 & 2 the UPID *13FCh (Maximal Current Positive)* and *13FDh (Maximal Current Negative)* are entered.



Name	Value	Raw Data
Channel 1 UPID	1B93h (Demand Current)	1B93h
Channel 2 UPID	0000h	0000h
Channel 3 UPID	0000h	0000h
Channel 4 UPID	0000h	0000h



Name	Value	Raw Data
Channel 1 UPID	13FCh (Maximal Current P...)	13FCh
Channel 2 UPID	13FDh (Maximal Current N...)	13FDh
Channel 3 UPID	0000h	0000h
Channel 4 UPID	0000h	0000h



**Attention:**

The above used parameters are thought to be an example only.

If the parameters in Parameter Channel 1 & 2 have a value of 0 the motor cannot move as they limit the maximal allowed positive and negative motor current in the drive.



**Note:**

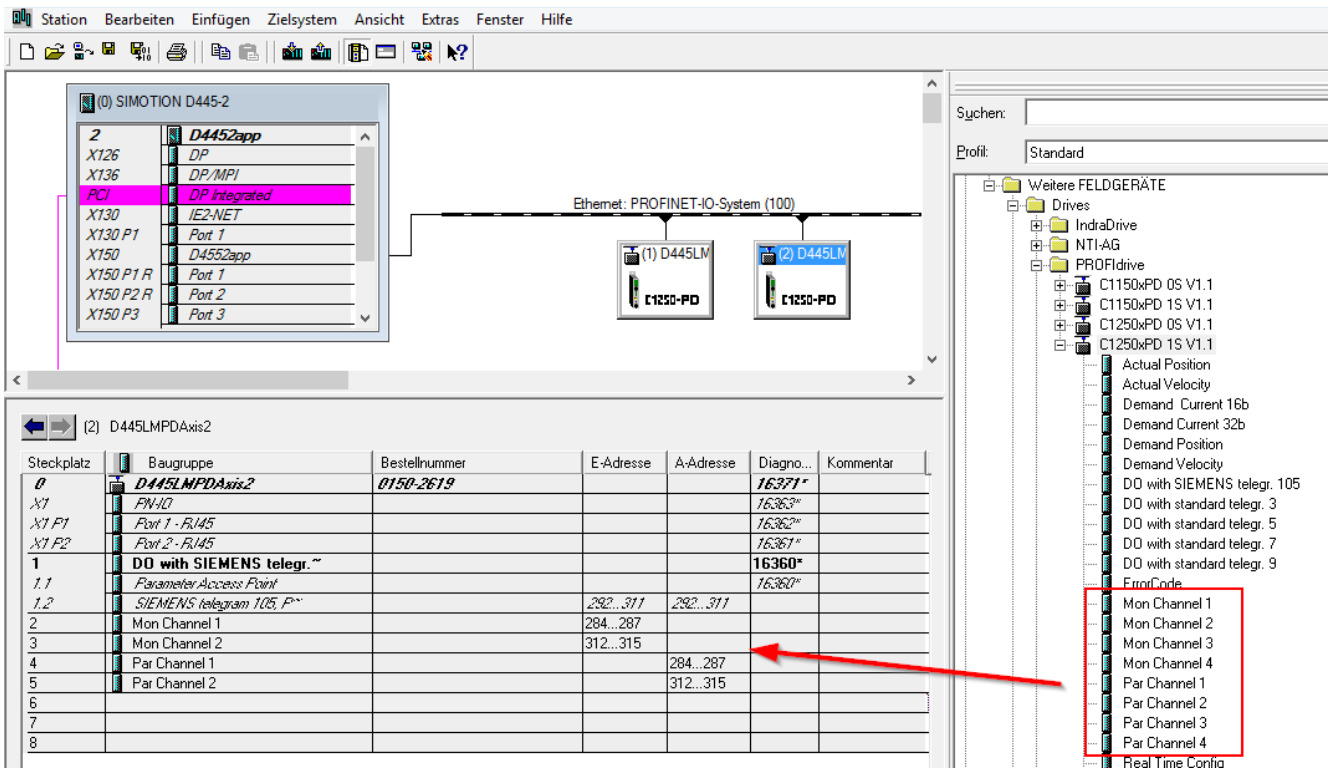
On Siemens PLCs the double words are transmitted in big endian organization. Therefore, it is required to swap the high and the low word.

This can be done by using the function ROR().

E.g. `DemandCurrent:=ROR(DemandCurrent,16);`

## 6.2 PLC Configuration

In the HW Config drag&drop the desired modules from the catalogue to the slots of the drive:



In SCOUT add new variables that access the addresses of the modules:

d4452app : Adressliste

Ansicht: Adressen gesamt

Name	I/O-Adresse	Nur les	Datentyp	Feldlän	Prozessabbild	Strategie	Anzeige	Ersatzwert
Alle	Alle	Alle	Alle	Alle	Alle	Alle	Alle	Alle
1 LMR_PR01_DemCurrent	PID 284	<input type="checkbox"/>	DWORD	1	ServoSynchronousTask	CPU-Stop	HEX	16#00_00_00_00
2 LMR_PR01_MaxCurrentNeg	PQD 312	<input type="checkbox"/>	DWORD	1	ServoSynchronousTask	CPU-Stop	HEX	16#00_00_00_00
3 LMR_PR01_MaxCurrentPos	PQD 284	<input type="checkbox"/>	DWORD	1	ServoSynchronousTask	CPU-Stop	HEX	16#00_00_00_00

### 7 Tuning the Control Loops

#### 7.1 Drive Control Loop

To start tuning use the **default soft** settings in the Motor Wizard within LinMot-Talk (motor depending). Then during operation increase the P and D Gains until you get a good positioning. It is also possible to start with the default stiff settings. But in case the motor becomes loud and vibrates reduce the P and D Gains.

The screenshot shows the 'Motor Wizard' interface at 'Step 6/10: PID Position Controller'. Under the 'PID Position Controller Setting' section, there are input fields for P Gain (7.5 A/mm), D Gain (12.5 A/(m/s)), I Gain (0 A/(mm\*s)), and D Filter Time (250 us). The D Filter Time field is highlighted with a red box. To the right, there are two buttons: 'Set To Default Soft' (P=3, D=5, I=0) and 'Set To Default Stiff' (P=7.5, D=12.5, I=0). The 'Set To Default Stiff' button is highlighted with a blue box and a red arrow points to it. Below this, under the 'Noise Filter' section, there is a 'Dead Band' field (0 mm) and an 'Enable Noise Filter' checkbox, which is unchecked and highlighted with a red box.

Make sure the "Enable Noise Filter" is unchecked. If the motor makes too much noise try to set the D Filter Time to 250us.

After finishing the motor wizard and restarting the drive, the control loop parameters can be tuned in the *Control Parameter Set A* (mainly P and D Gains):

Name	Value	Raw Data	UPID
FF Constant Force	0 A	00000000h	139Ch
FF Friction	0 A	00000000h	139Dh
FF Spring Compensation	0 A/m	0000h	139Eh
FF Damping	0 A/(m/s)	0000h	139Fh
FF Acceleration	0 A/(m/s <sup>2</sup> )	0000h	13A0h
Spring Zero Position	0 mm	00000000h	13A1h
P Gain	12 A/mm	0078h	13A2h
D Gain	17 A/(m/s)	00A4h	13A3h
D Filter Time	250 us	00FAh	13A8h
I Gain	0 A/(mm*s)	0000h	13A4h
Integrator Limit	15 A	00003A98h	13A5h
Maximal Current	15 A	00003A98h	13A6h
Maximal Current Positive	25 A	000061A8h	13FCh
Maximal Current Negative	25 A	000061A8h	13FDh
Noise Deadband Width	0 mm	0000h	13A7h

It's recommended to set all FF parameters except *FF Constant Force* to 0 in the beginning. They can be increased afterwards to improve the start/stop of the motion. Or just leave them on the values preset by the Motor Wizard and check if they work for you application.



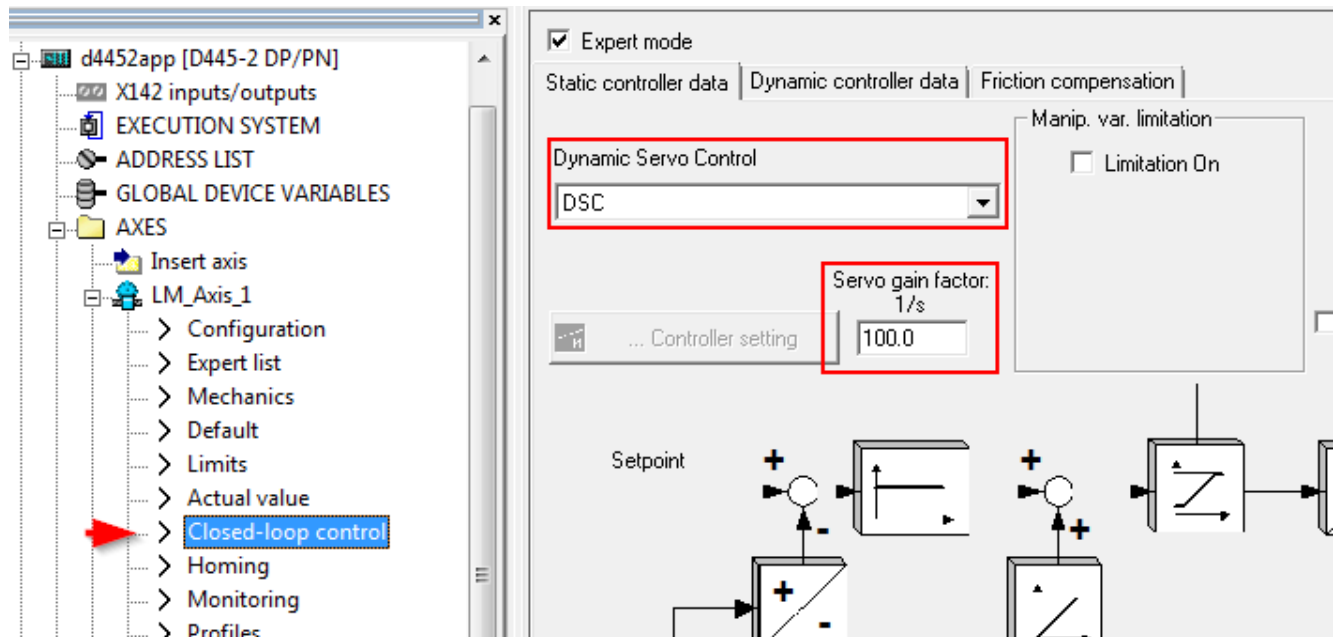
**Attention:**

**Up to firmware 6.6 Build 20170410 the I Gain in the Control Parameters Set A of the LinMot drive must be set to 0 (zero).**

**From firmware 6.6 Build 20170522 the I-Gain must be set to a value to exactly reach the end position.**

### 7.2 PLC Control Loop

Within the technology object configuration set the servo gain factor (Kv factor) to 100. From this value increase until you reach the required stiffness and accuracy.



Make sure DSC is enabled.

Now you are ready to enable the motor and start some movements to optimize the control parameters in both the drive and the PLC

## 8 Version History

Version	Date	Author	Description
1V0	05 Jul 2017	fj	First Release
1V1	18 Feb 2020	fj	Updated chapter Encoder Assignment



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