

Welcome

Guideline

**SIMOTION D4x5-2 Training Case
with SIMOTION V4.4**

SIMOTION

Guideline

SIMOTION D4x5-2 Training Case
with SIMOTION V4.4

Release 07/2014



Introductory Information

The procedure described here is meant to be used with the SIMOTION D4x5-2 training case. However, it can be easily adapted to other configurations.

There is a SIMOTION example project according to this documentation. It can be found on the Utilities & Application (U&A, part of SIMOTION Scout) at:

Examples → Guideline SIMOTION D4x5-2 Training Case

The Industry Online Support is available at: <http://support.automation.siemens.com>.

If an “Entry-ID“ is mentioned in the following it can be found under this address.

You will find this guideline and the corresponding example project, probably already in a revised version, under the Entry-ID [27774657](#).

Note: This slide set had been set up partly on the basis of SIMOTION V4.3 but also applies to newer versions. Hence figures may differ in detail.

For questions regarding this guideline please contact us at the following e-mail address:

<mailto:tech.team.motioncontrol@siemens.com>

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- Fault handling
- Start SIMOTION program with variable
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Introduction

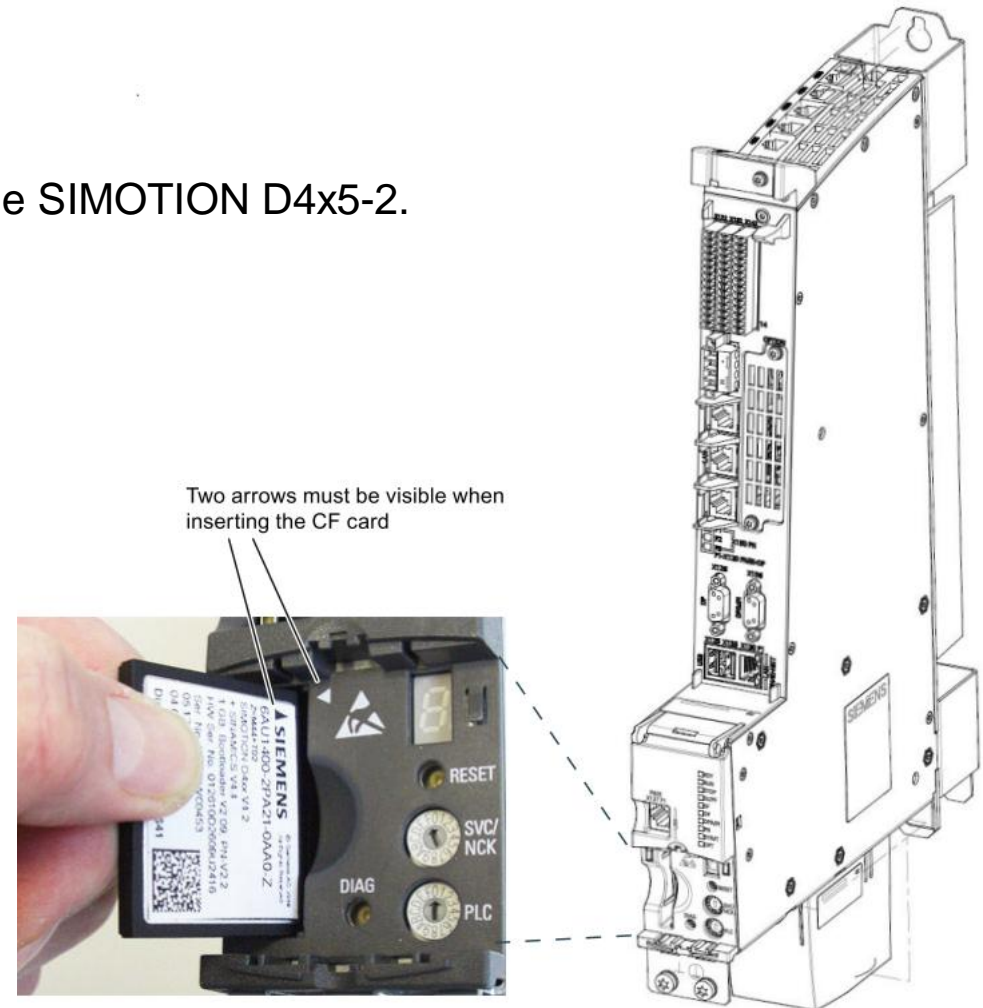
SIMOTION firmware

- You will find the SIMOTION firmware for SIMOTION D4x5-2 devices on the SIMOTION Scout installation medium under *VOL2\Addon\3_D4x5_2\Firmware*
- You will find the SIMOTION D4x5-2 firmware also in the Industry Online Support under the Entry-ID [31045047](#).
- Plug the CompactFlash card into a suitable card slot of your PG/PC.
- Extract the firmware and replace the current content of the CompactFlash card.
- Note: The firmware has to be replaced only if required.
- Note: For other possibilities to replace the firmware please refer to the Commissioning and Hardware Installation Manual SIMOTION D4x5-2.

Introduction

Preparation

- Plug the prepared CompactFlash card into the SIMOTION D4x5-2.
- Switch on the power supply.
- Start SIMOTION Scout V4.4.

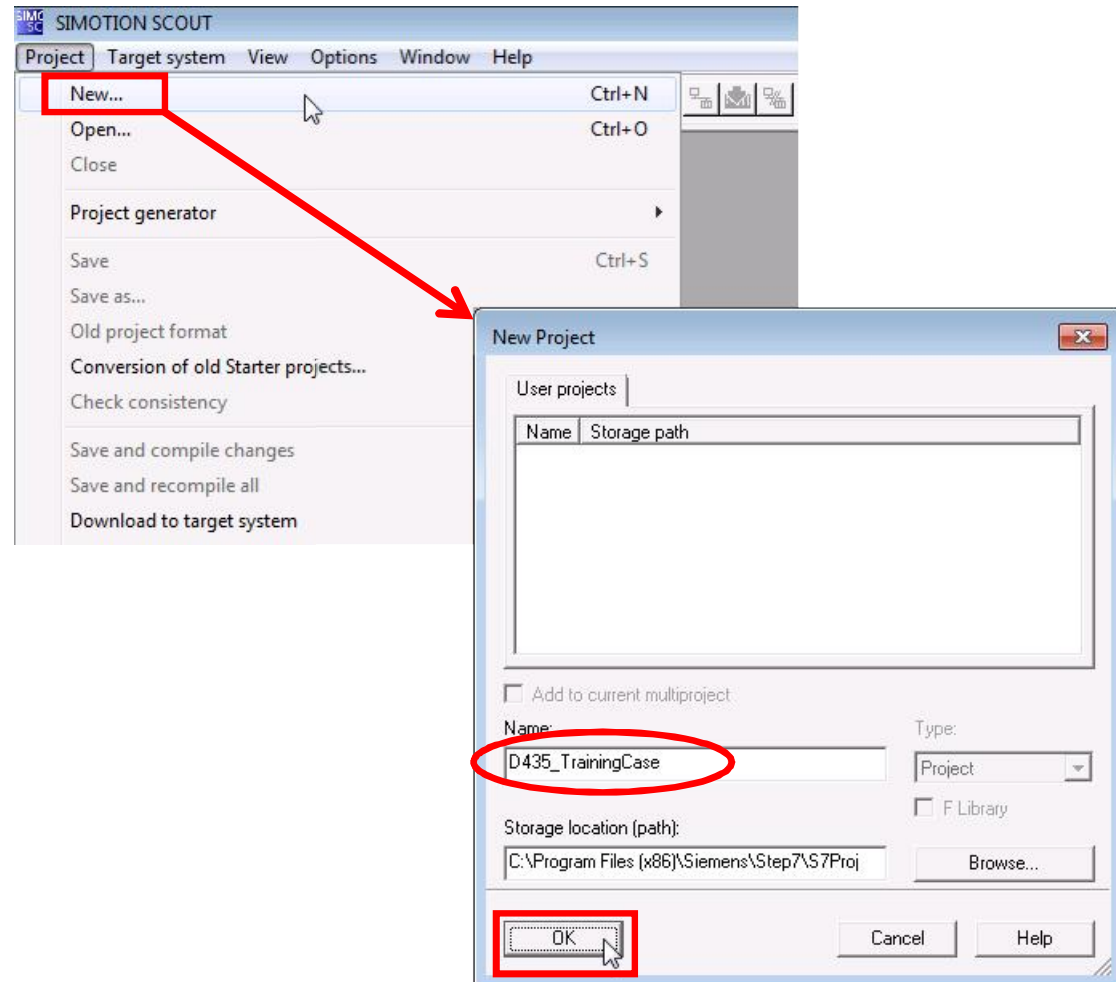


Create a new project

Note: The example shown here is generated on the basis of SIMOTION D435-2 DP/PN. If your hardware equipment differs you have to choose a different device characteristic.

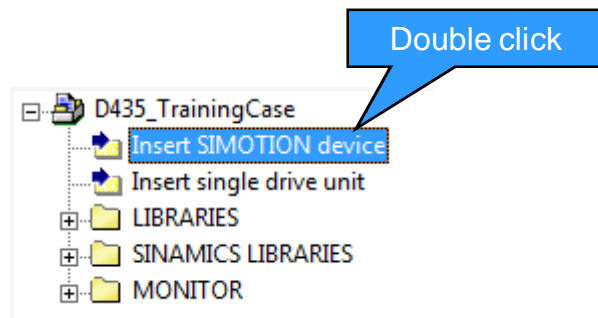


**SIMOTION D
Training Case**

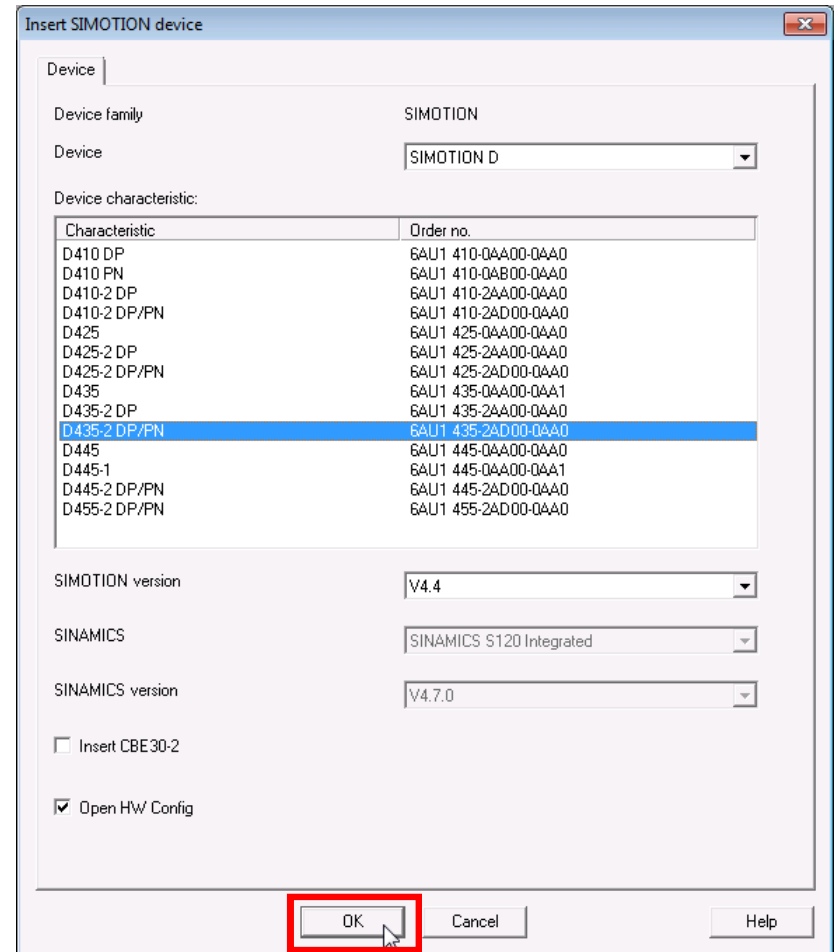


Insert new device

- The SIMOTION D device family combines the functionality of SIMOTION and SINAMICS.
- SIMOTION D435-2 can be inserted as a new device in Scout after creating a new project.

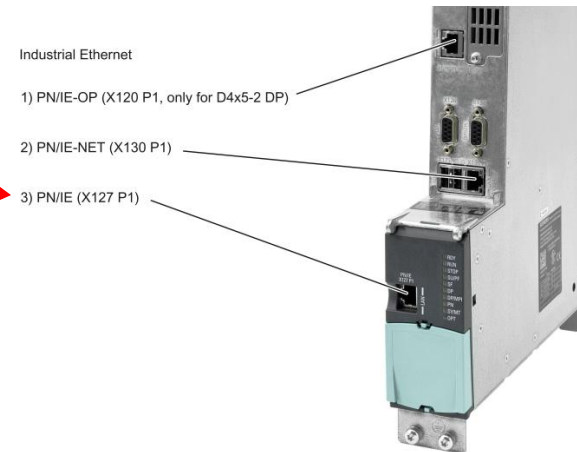
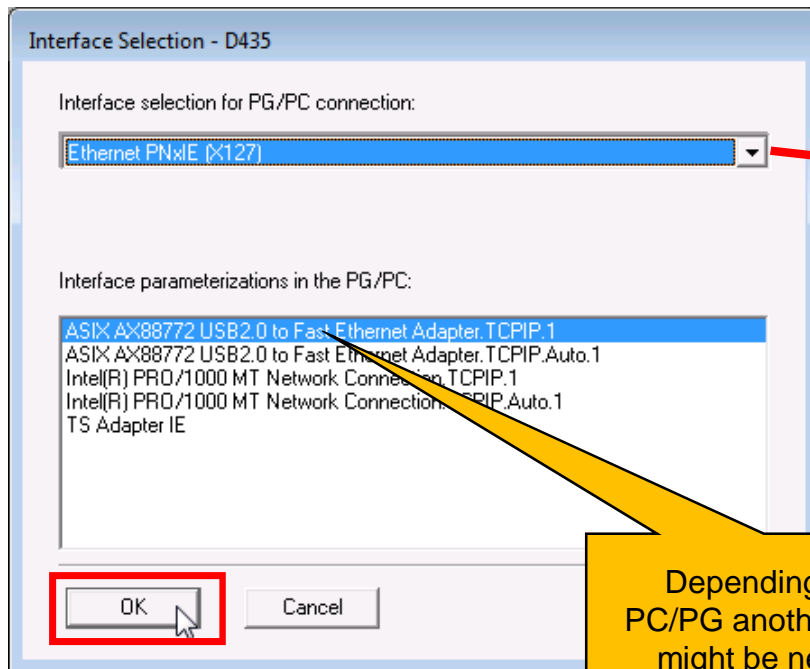



- Select device characteristic D435-2 DP/PN
- Select SIMOTION version V4.4



Interface Selection

- Here, the Scout access to the D435 is selected by the example Ethernet. The connection cable is plugged into the Ethernet interface of the D435 (X127, PNxIE).



In case of connection problems check “Set PG/PC interface“ and “Assign PG/PC“ for correct settings. 

Detailed instructions for this can be found as FAQ in the Utilities & Applications under **FAQs → Engineering → Establishing Online Connections**

or online at the Siemens Service & Support sites searching for the Entry-ID [22016709](https://www.siemens.com/press/en/22016709).

- The SIMOTION D435 appears on the project list and HW Config dialog will be open.

HW Config

- Download HW Config to module.

1. Download to module

2. Select target module

3. Check IP address

4. Stop controller (only in RUN mode)

Download progress

HW Config - [SIMOTION D (Configuration) -- D435_TrainingCase]

Station Edit Insert PLC View Options Window Help

PROFIBUS Integrated: DP master system

(0) SIMOTION D435-2

2	D435
X126	DP
X136	DP/MPI
PCI	DP Integrated
X130	PNxI-NET
X130 P1	Port 1
X150	PNxIO
X150 P1 R	Port 1
X150 P2 R	Port 2
X150 P3	Port 3
X1400	
X127	PNxIE
X127 P1	Port 1
X142	I/O

Target modules:

Module	
D435	

Select All OK Cancel Help

Select Node Address

Over which station address is the programming device connected to the module D435?

Rack: 0 Slot: 2

Target Station: Local Can be reached by means of gateway

Enter connection to target station:

IP address	MAC address	Module type	Station name
169.254.11.22			

Accessible Nodes

View OK Cancel Help

Stop Target Modules

The following modules will be stopped for loading of the system data.

Module	Racks	Slot
D435	0	2

OK Cancel Help

Download

Station: SIMOTION D

Module: [0/2/0] D435

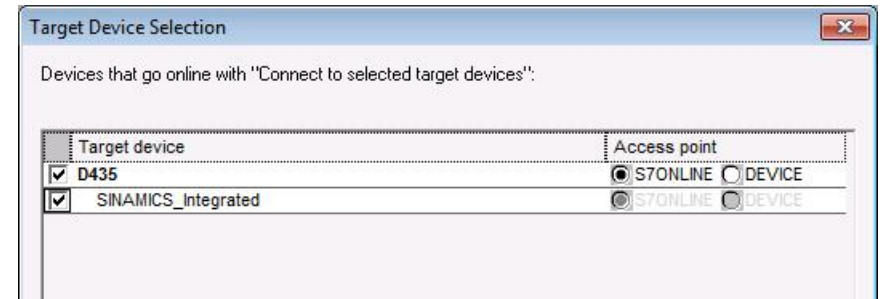
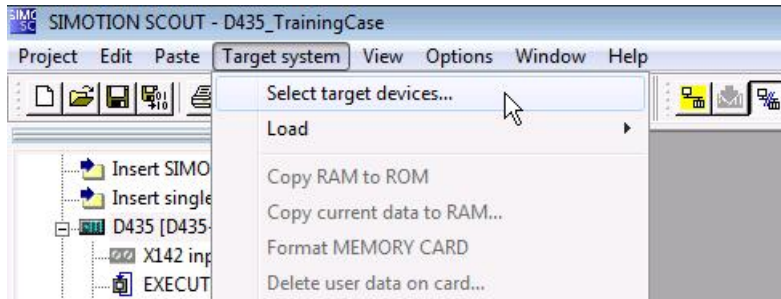
Download progress

Cancel

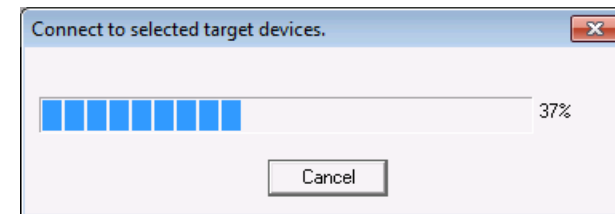
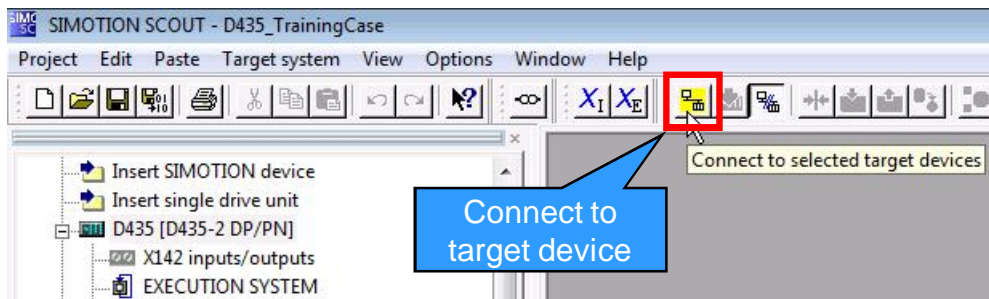
- Close HW Config after successful configuration download to module.
- Please wait until SIMOTION D435 reboot has finished and the green ready LED is on.

Establish connection to SIMOTION D435 and SINAMICS_Integrated

- Select target devices

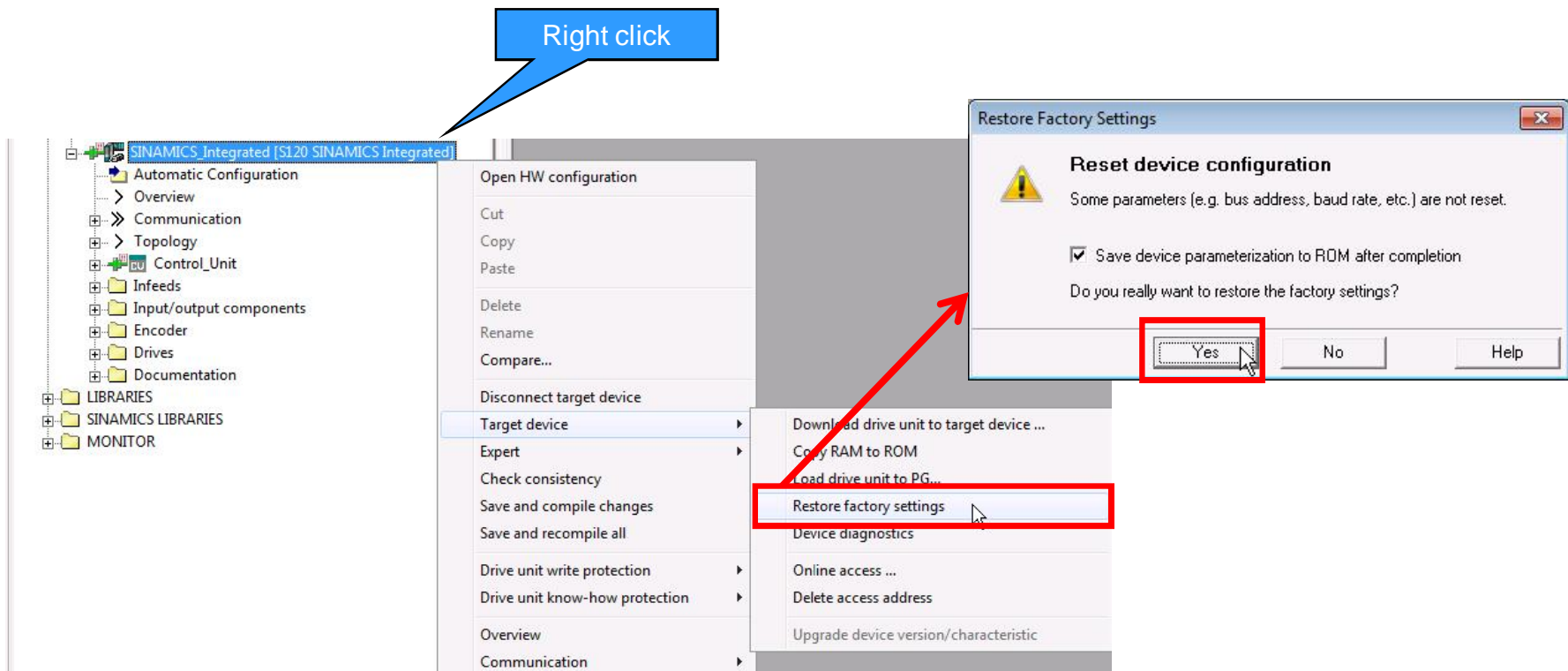


- Connect to selected target devices



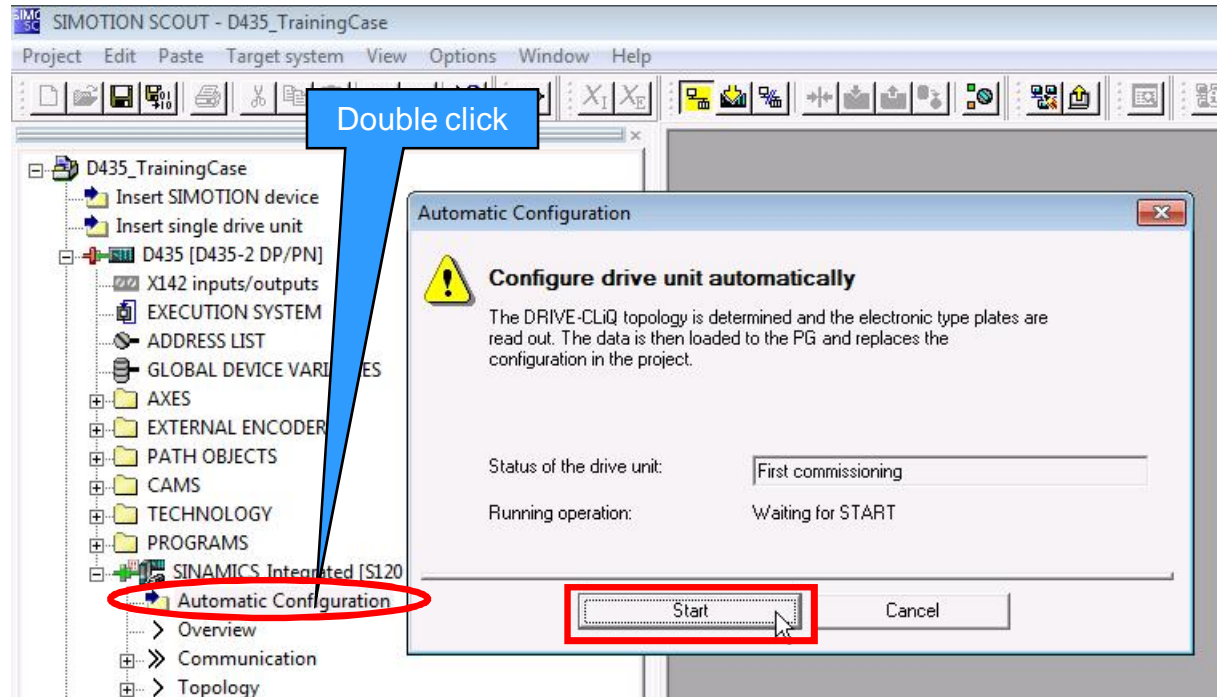
Restore factory settings of the SINAMICS_Integrated

- Restore factory settings



Automatic configuration

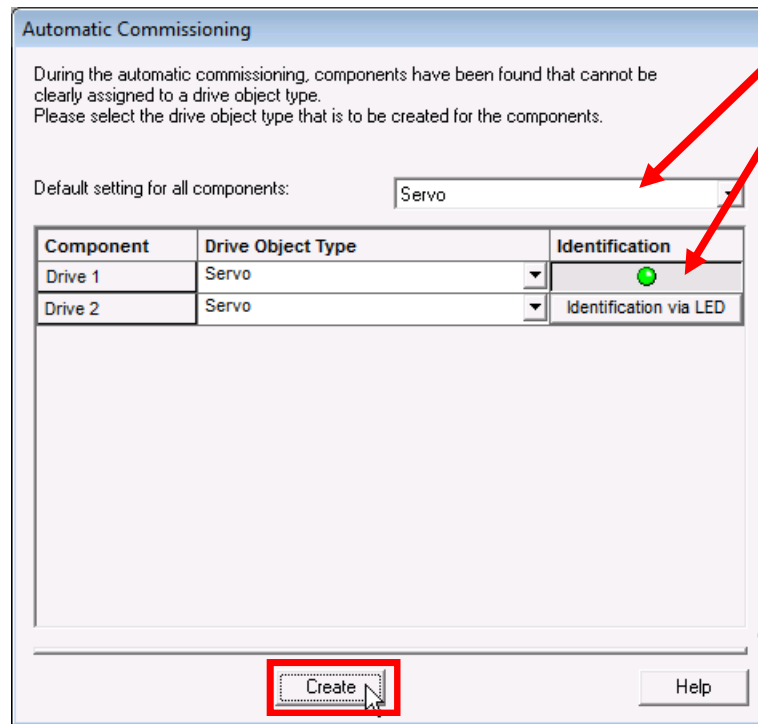
- Start automatic configuration



- Because the hardware is already wired in the training case, the automatic configuration can be used.
- If the SINAMICS_Integrated is not in factory setting, this can also be done in this step.
- An alternative procedure to the automatic configuration of drive objects is to use the configuration wizard as described at slide 23.

Automatic configuration

- Select “Servo” as drive object type for both drives.

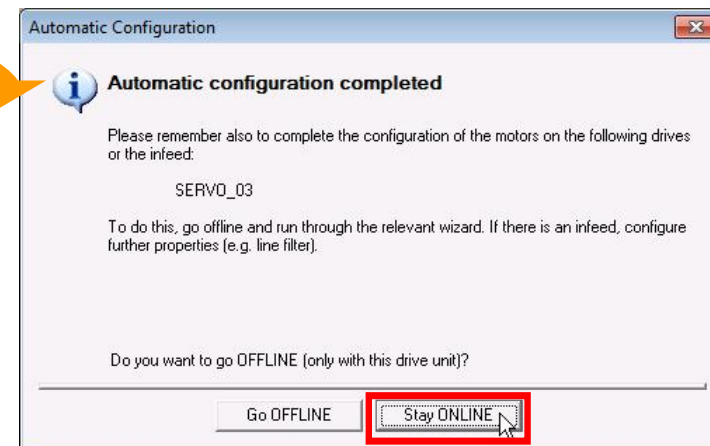


Select the drive object type.

Click “Identification via LED” to identify the power unit of the drive object by means of LED flashing.

Click “Create” to complete automatic commissioning.

The message window is a reminder to parameterize the drive offline with the drive wizard (SERVO_03 does not have an electronic type label).



If an automatic FW update of a DRIVE-CLiQ component (e.g. the motor module) are carried out after upgrading to SIMOTION V4.4, this process may take several minutes.

Set training case specific DC link voltage

Because the training case is powered by 230V, the setting of the DC link voltages have to be adapted for SERVO_02 and SERVO_03.

- Open the expert list for SERVO_02 and SERVO_03.
- Set for both drives p1244[0] = 715V
- Set for both drives p1248[0] = 279V

Right click

For fast parameter access enter the parameter number in the first column.

Set p1244[0] = 715V
Set p1248[0] = 279V

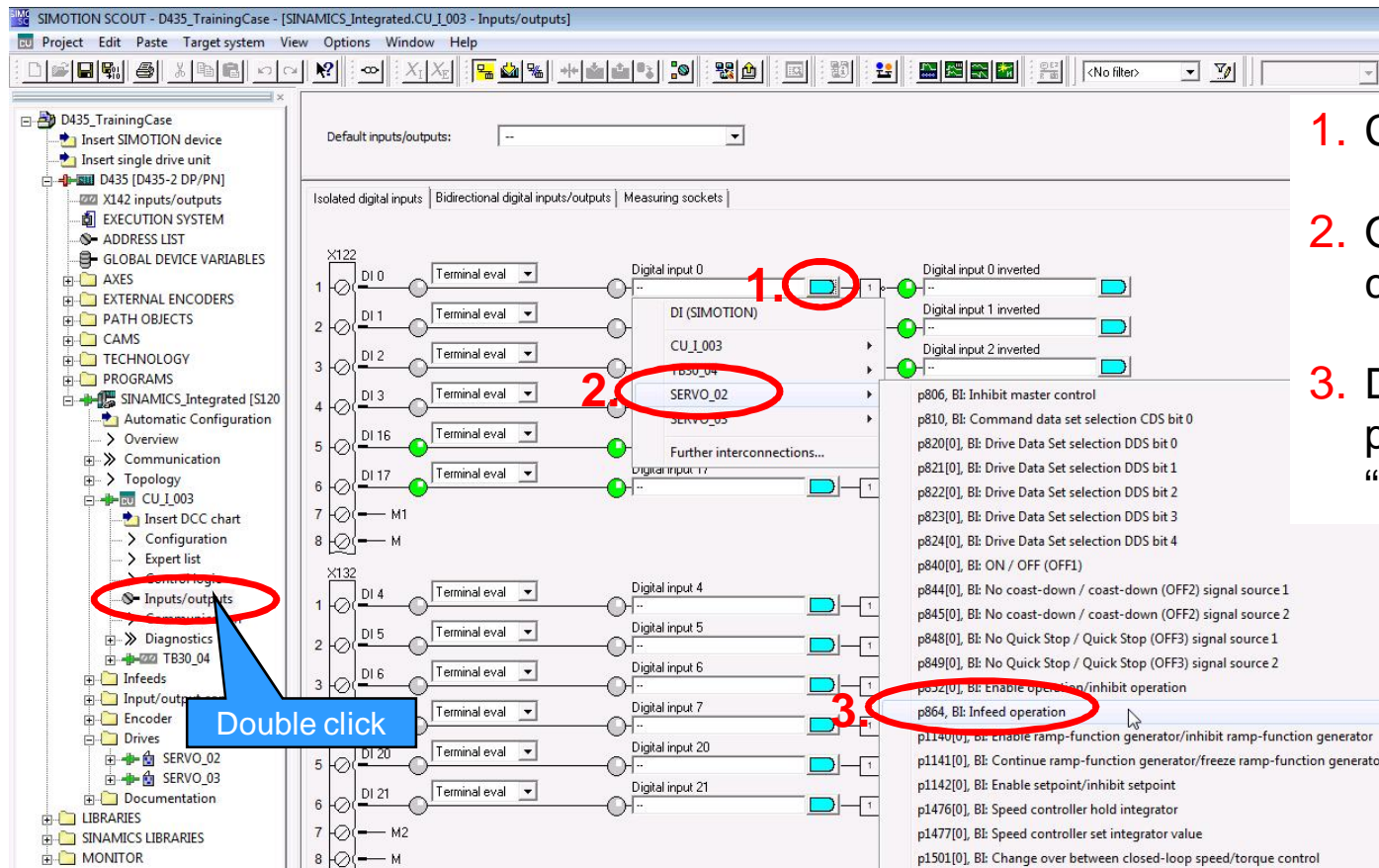
Param...	Parameter text	Online	SERVO_02	Unit	Modifiable to	Access level
p1244[0]	DC link voltage threshold upper	715		V	Operation	3
p1248[0]	DC link voltage threshold lower	279		V	Operation	3
p1250[0]	Vdc controller proportional gain	0.22		A/V	Operation	3
p1278	Brake control diagnostics evaluation	[0] Brake control with diag...			Operation	2
p1300[0]	Open-loop/closed-loop control operating mode	[21] Speed control (with e...			Ready to run	2

Right click for close

Close Ctrl+F4

Interconnection of digital I/O – Infeed operation

When using a Smart Line Module (SLM) without DRIVE-CLiQ connection the infeed operation is signaled via IOs.

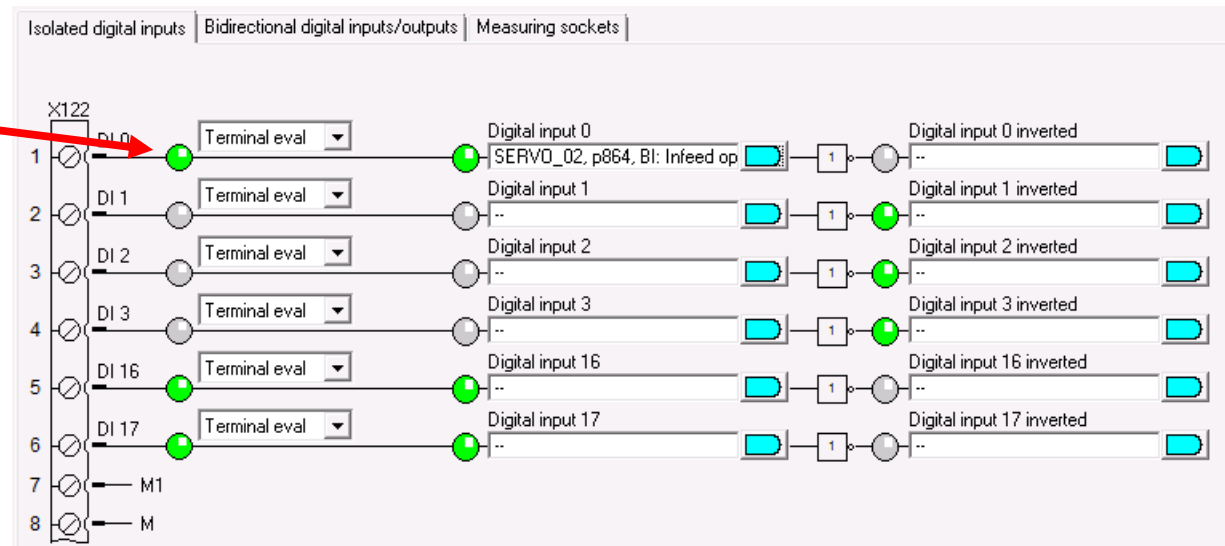


1. Connect digital input DI 0
2. Only SERVO_02 has to be connected
3. DI 0 is assigned to the parameter p864 "BI: Infeed operation"



Check wiring

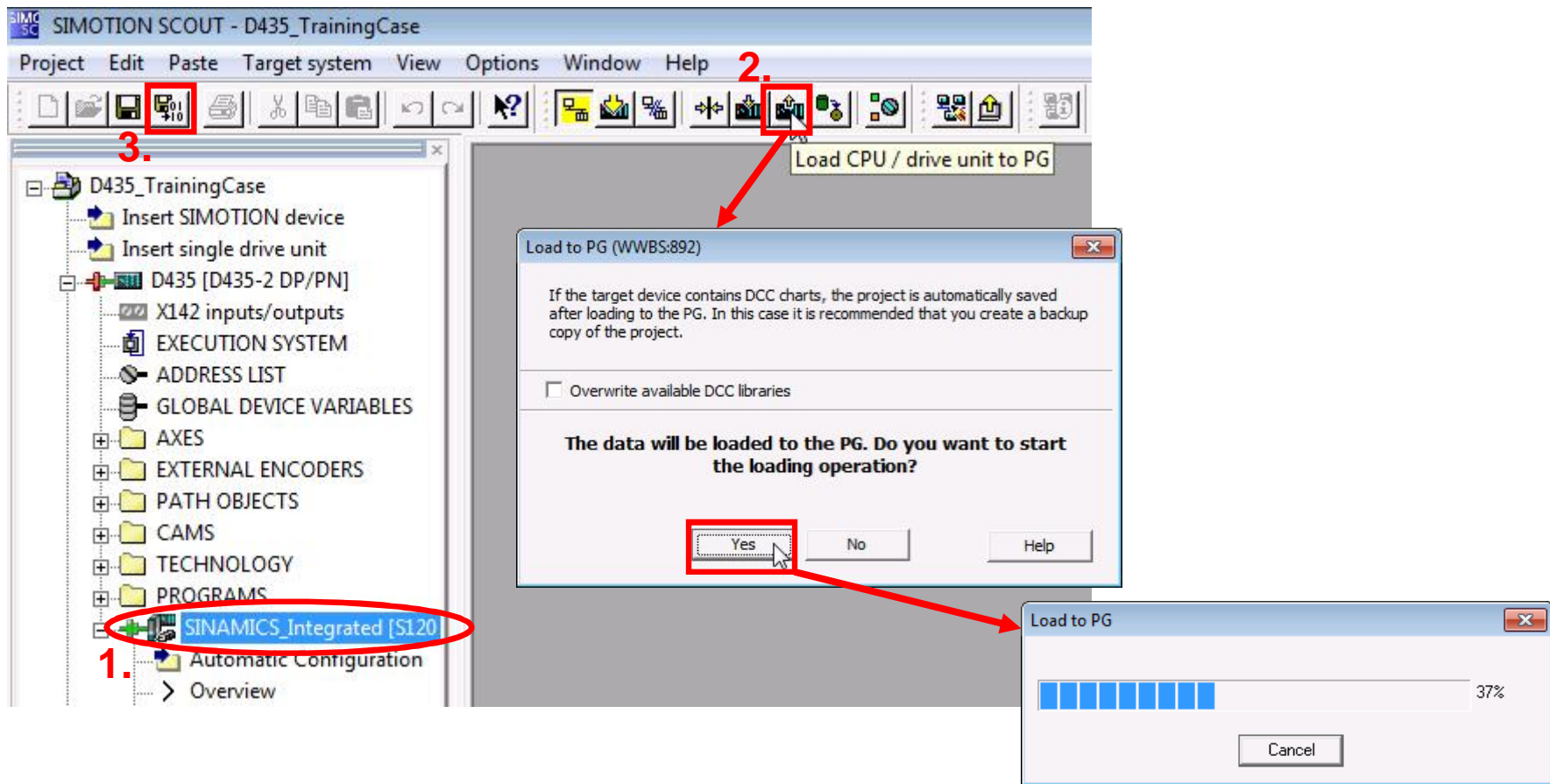


Infeed operation state via the control panel.
 Switch 0 (DI 0) means that infeed is in operation.

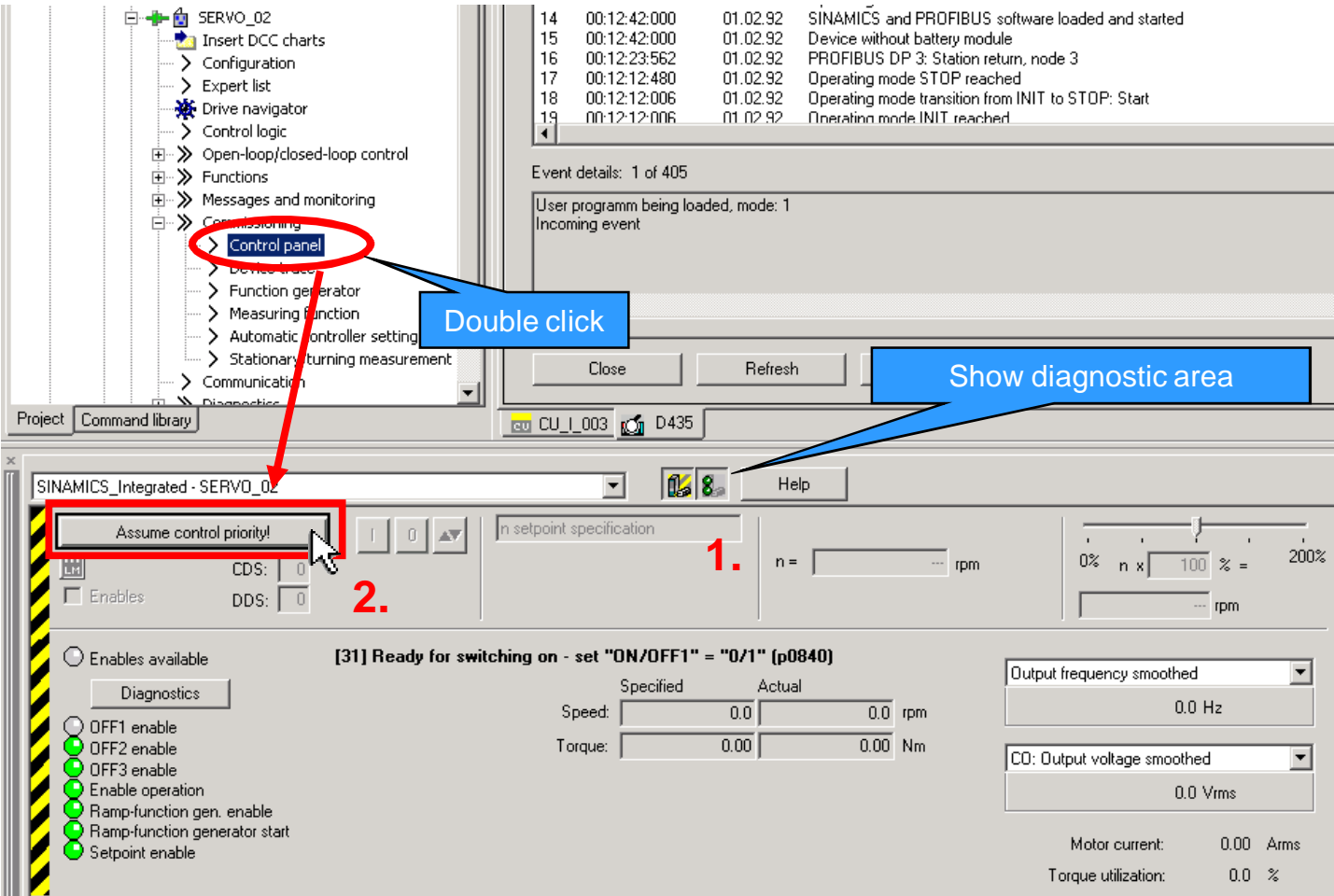


Save and compile

1. Select SINAMICS_Integrated
2. Load CPU / drive unit to PG 
3. Save and compile 



Operate SERVO_02 via drive control panel



Assume control priority for SERVO_02:

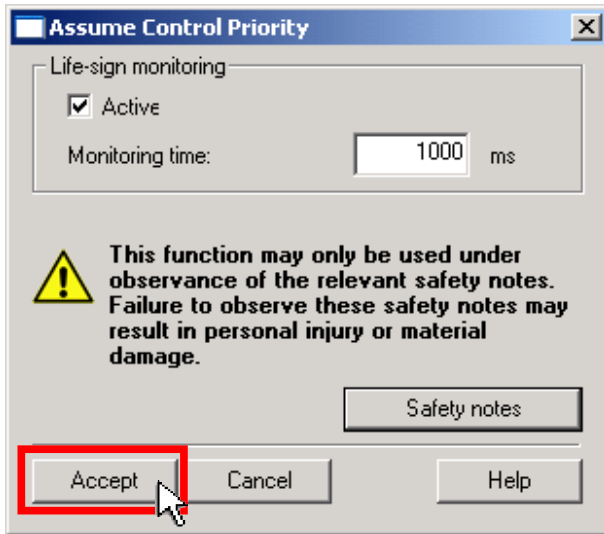
- SINAMICS_Integrated
- Drives
- SERVO_02
- Commissioning
- Control panel

Operate SERVO_02 via drive control panel

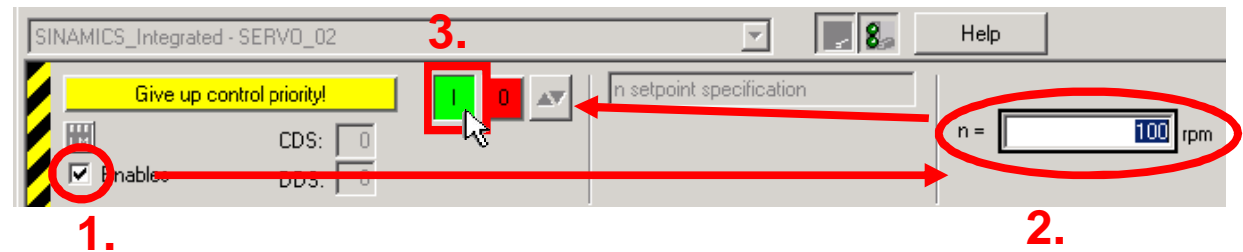
- Assume control priority



This function may only be used under observance of the relevant safety notes. Failure to observe these safety notes may result in personal injury or material damage.



To turn on the Infeed, DI 0 have to be set on the control panel (see slide 18).



- Enables (1.)
- Set speed setpoint (2.)
- Turn the Drive ON (3.)



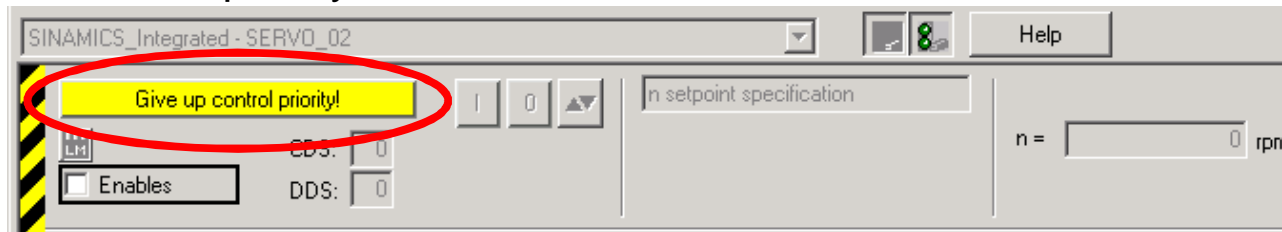
SERVO_02 is in Operation

Operate SERVO_02 via drive control panel

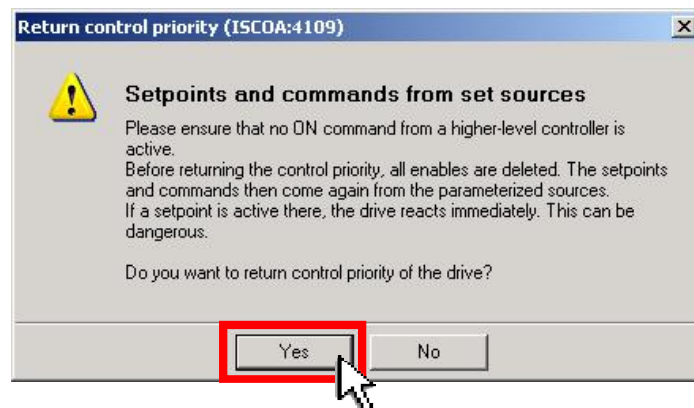
- Turn the Drive OFF



- Return control priority



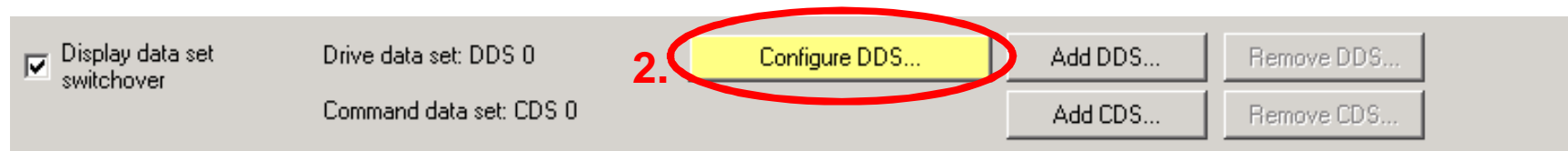
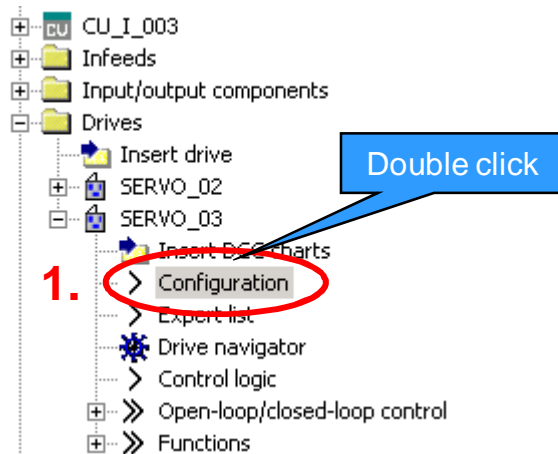
- Acknowledge the alert with “Yes”



- Go offline 

Complete configuration for SERVO_03

The drive SERVO_03 was created by the automatic configuration, but not configured because the motor and encoder don't have an electronic type label. Follow the configuration wizard for SERVO_03 under “Configure DDS...”.



Complete configuration for SERVO_03 – Control structure

- Setup Control structure and Power unit for SERVO_03.

Configuration - SINAMICS_Integrated - Control structure

Drive: SERVO_03, DDS 0

Control structure
 Power unit
 Motor
 Motor holding brake
 Encoder
 Process data exchange
 Summary

Function modules:

Extended setpoint channel
 Technology controller
 Extended signals/monitoring

Control type:
[21] Speed control (with encoder)

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Configuration - SINAMICS_Integrated - Power unit

Drive: SERVO_03, DDS 0

Control structure
 Power unit
 Motor
 Motor holding brake
 Encoder
 Process data exchange
 Summary

Configure the power section component:

Component name: Motor Module 3

Connection voltage: 510 - 720 VDC

Cooling method: Internal air cooling

Type: Double motor modules

Power unit selection:

Order no.	Rated power	Rated curr...	Execution
6SL3420-2TE11-7Axx	1 kW	1.7 A/1.7 A	DC/AC
6SL3120-2TE13-0Axx	1.6 kW	3 A/3 A	DC/AC
6SL3420-2TE13-0Axx	1.6 kW	3 A/3 A	DC/AC
6SL3120-2TE15-0Axx	2.7 kW	5 A/5 A	DC/AC
6SL3420-2TE15-0Axx	2.7 kW	5 A/5 A	DC/AC
6SL3120-2TE21-0Axx	4.8 kW	9 A/9 A	DC/AC
6SL3120-2TE21-8Axx	9.7 kW	18 A/18 A	DC/AC

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Complete configuration for SERVO_03 – Power unit

- Setup DI 4 for enable Infeed operation SERVO_03.

Wire Operation signal (ISWUI:17130)

The Operation signal must be wired!

Caution: If the infeed is controlled by another CU, the Operation signal of infeed r863.0 must be wired to "BI: Infeed operation" of drive p864 via a BICO interconnection.
If this is not taken into consideration, damage to the infeed may result!

Configuration - SINAMICS_Integrated - Power unit BICO

Drive: SERVO_03, DDS 0

Control structure
 Power unit
 Power unit BICO
 Power unit connection
 Motor
 Motor holding brake
 Encoder
 Process data exchange
 Summary

Infeed in operation

0 Drive in operation

1

CU_I_003

Further interconnections...

r722 : Bit0, CO/BO: CU digital inputs, status : DI 0 (X122.1/X121.1) (1=High / 0=Low)
r722 : Bit1, CO/BO: CU digital inputs, status : DI 1 (X122.2/X121.2) (1=High / 0=Low)
r722 : Bit2, CO/BO: CU digital inputs, status : DI 2 (X122.3/X121.3) (1=High / 0=Low)
r722 : Bit3, CO/BO: CU digital inputs, status : DI 3 (X122.4/X121.4) (1=High / 0=Low)
r722 : Bit4, CO/BO: CU digital inputs, status : DI 4 (X132.1) (1=High / 0=Low)
r722 : Bit5, CO/BO: CU digital inputs, status : DI 5 (X132.2) (1=High / 0=Low)
r722 : Bit6, CO/BO: CU digital inputs, status : DI 6 (X132.3) (1=High / 0=Low)
r722 : Bit7, CO/BO: CU digital inputs, status : DI 7 (X132.4) (1=High / 0=Low)

Further interconnections...

1.

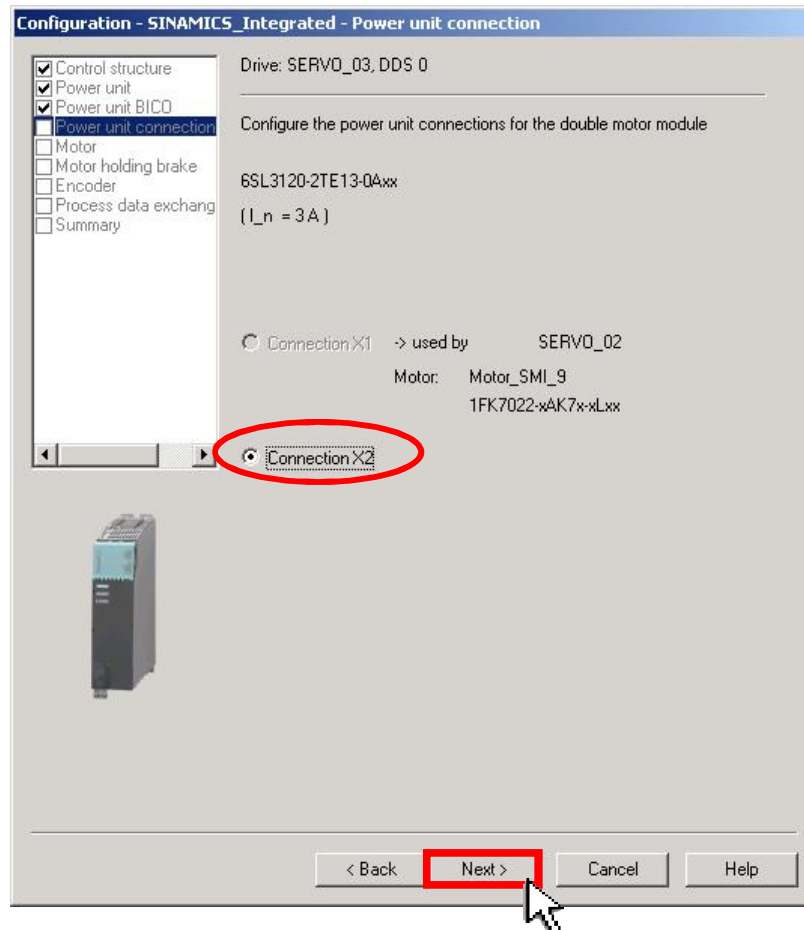
2.

3.

4.

Complete configuration for SERVO_03 – Power unit connection

- Check correct connection for double motor module.



Complete configuration for SERVO_03 – Motor configuration

- Select motor type (1FK7022-xAK7x-xxxx) and motor holding brake.

Configuration - SINAMICS_Integrated - Motor

Drive: SERVO_03, DDS 0, MDS 0

Configure the motor:

Motor name: Motor_6


Motor with DRIVE-CLIQ interface
 Read out motor data

Select standard motor from list
 Enter motor data

Motor type: **2.** [237] 1FK7 synchronous motor

Motor selection:

Order no.	Rated sp...	Rated tor...	Rated cur...
1FK7011-xAK2x-xxxx	6000 U/min	0.08 Nm	0.5 A
1FK7011-xAK7x-xxxx	6000 U/min	0.08 Nm	0.85 A
1FK7015-xAK2x-xxxx	6000 U/min	0.16 Nm	0.5 A
1FK7015-xAK7x-xxxx	6000 U/min	0.16 Nm	0.85 A
1FK7022-xAK2x-xxxx	6000 U/min	0.6 Nm	1.4 A
1FK7022-xAK7x-xxxx	6000 U/min	0.6 Nm	1.4 A
1FK7032-xAF2x-xxxx	3000 U/min	1 Nm	1.3 A
1FK7032-xAK7x-xxxx	6000 U/min	0.8 Nm	1.3 A
1FK7033-xAF2x-xxxx	3000 U/min	1.2 Nm	2 A
1FK7033-xAK7x-xxxx	6000 U/min	0.9 Nm	1.5 A
1FK7034-xAF2x-xxxx	3000 U/min	1.45 Nm	1.8 A
1FK7034-xAK7x-xxxx	6000 U/min	1 Nm	1.3 A
1FK7040-xAK7x-xxxx	6000 U/min	1.1 Nm	1.7 A
1FK7042-xAC7x-xxxx	2000 U/min	2.8 Nm	1.5 A

3. 

3rd party motor integration

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Configuration - SINAMICS_Integrated - Motor holding brake

Drive: SERVO_03, DDS 0

Control structure
 Power unit
 Power unit BICO
 Power unit connection
 Motor
 Encoder
 Process data exchange
 Summary

Motor holding brake activation:

Use a motor holding brake (internal or external)
 Do not use a motor holding brake

Motors with internal motor holding brake:

1FK7xxx-xxxx-xxBx
1FK7xxx-xxxx-xxHx

Motors without internal motor holding brake:

1FK7xxx-xxxx-xxAx
1FK7xxx-xxxx-xxGx

Holding brake configuration:

[0] No motor holding brake being used

Extended brake control

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Complete configuration for SERVO_03 – Encoder

- Select encoder (Sin/Cos incremental encoder, 2048 S/R, Code 2001).

Configuration - SINAMICS Integrated - Encoder

Drive: SERVO_03, DDS 0, MDS 0

Which encoder do you want to use?
 Encoder 1 Encoder 2 Encoder 3

Encoder 1

Encoder evaluation: SM_4

Encoder name: Encoder_5

Encoder with DRIVE-CLIQ interface
 Read encoder again

Select standard encoder from list Via order no.

Enter data Encoder data

Encoder type	Code number
Resolver 1 speed	1001
Resolver 2 speed	1002
Resolver 3 speed	1003
Resolver 4 speed	1004
2048, 1 Vpp, A/B C/D R	2001
2048, 1 Vpp, A/B R	2002
256, 1 Vpp, A/B R	2003
400, 1 Vpp, A/B R	2004
512, 1 Vpp, A/B R	2005

Encoder Selection via Motor Order Number

The encoders listed below are available for the selected listed motor.
 Select the relevant encoder via the motor order number.

Motor encoder selection:

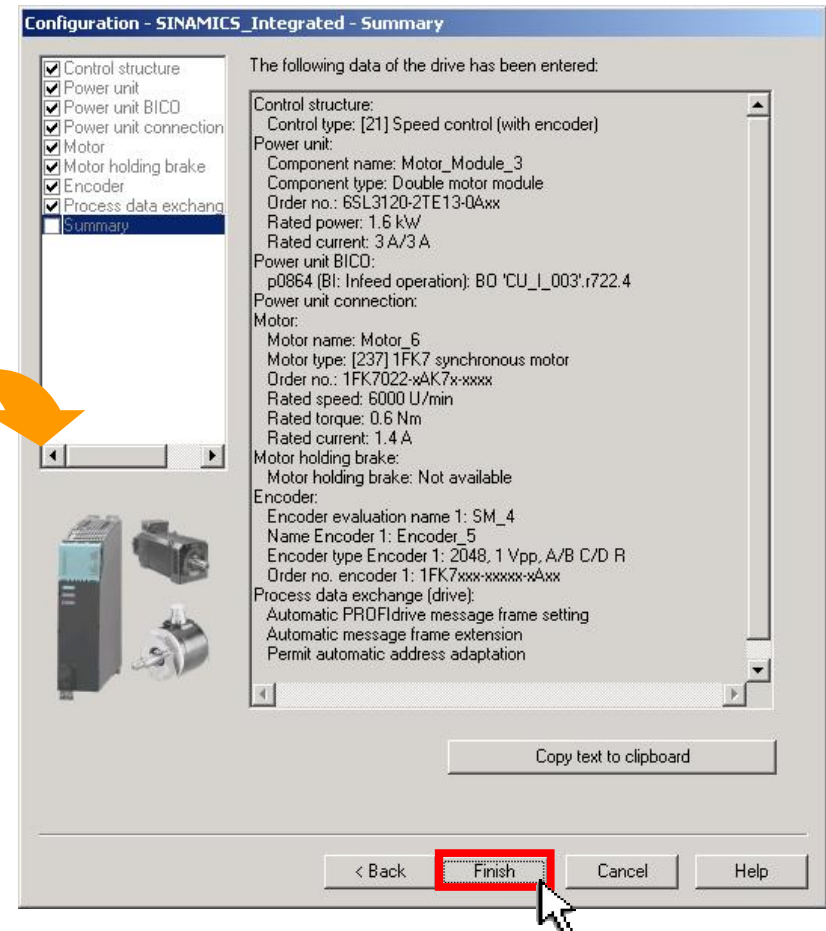
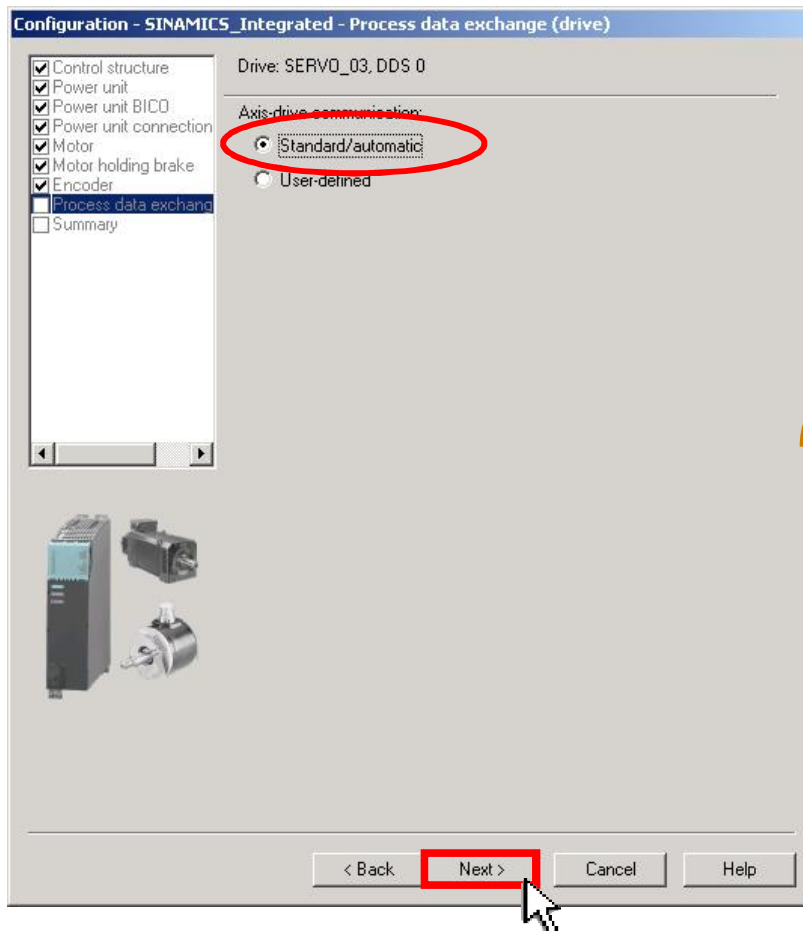
Order no.	Encoder type	Resolution	Code number
1FK7xxx-xxxx-xAxx	Sin/cos incremental C/D	2048 S/R	2001
1FK7xxx-xxxx-xExx	EnDat absolute	2048 S/R	2051
1FK7xxx-xxxx-xGxx	EnDat absolute	32 S/R	2052
1FK7xxx-xxxx-xHxx	EnDat absolute	512 S/R	2053
1FK7xxx-xxxx-xJxx	EnDat absolute	16 S/R	2054
1FK7xxx-xxxx-xSxx	Resolver	n-speed	1003
1FK7xxx-xxxx-xTxx	Resolver	1-speed	1001

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OK Cancel

Complete configuration for SERVO_03 – Process data / Summary

- Process data / Summary

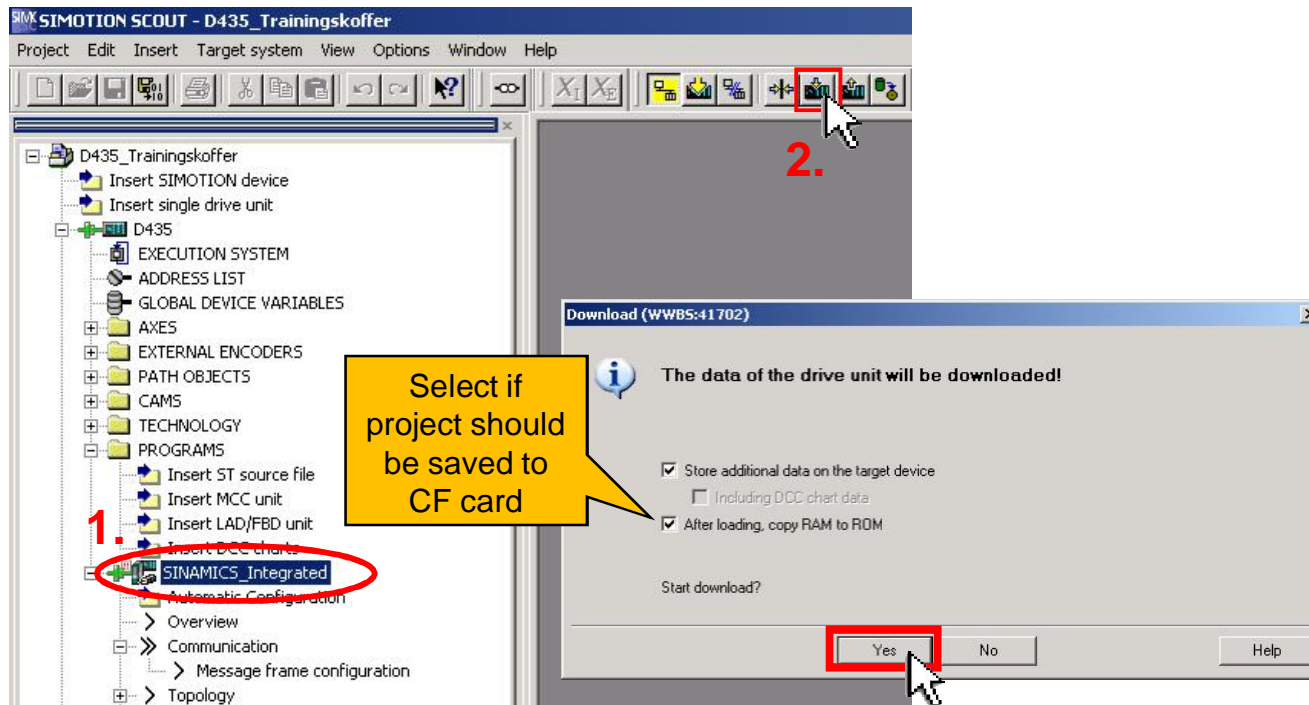


Load settings to target system

- Save project and connect to target system.



- Select SINAMICS_Integrated and load project to target system.

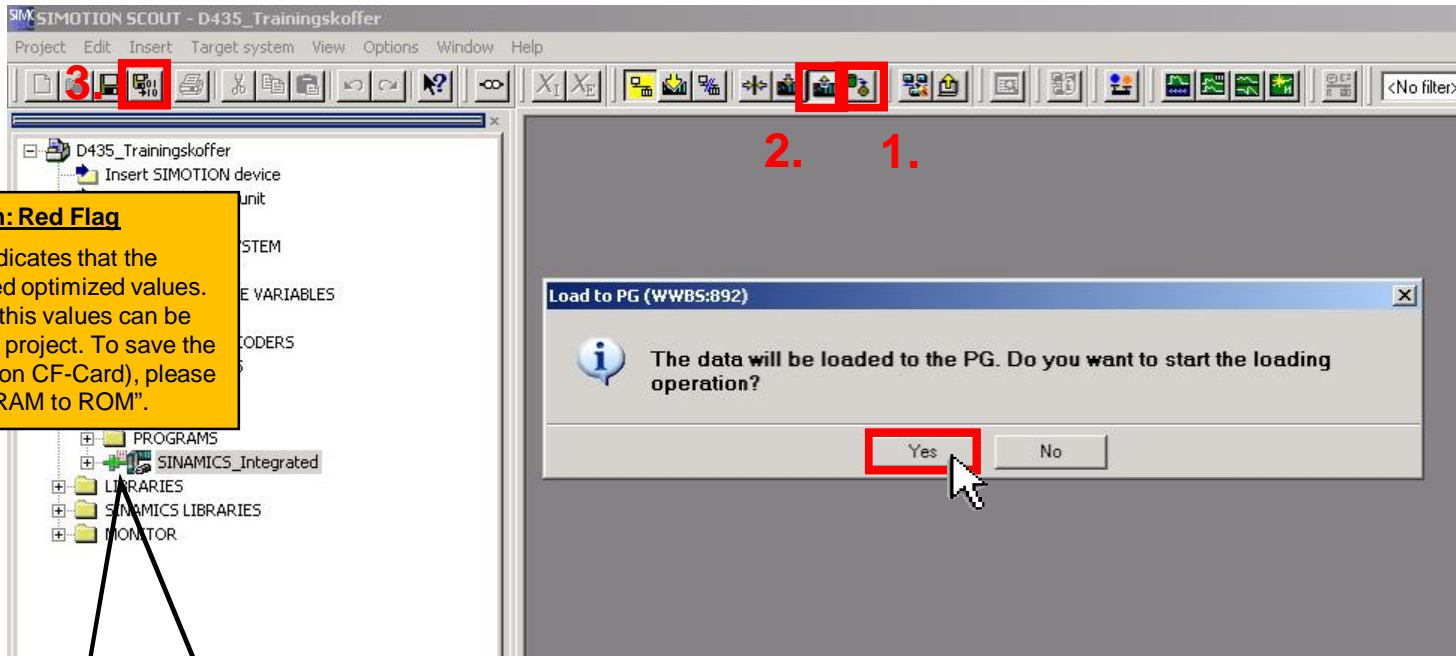


Select if project should be saved to CF card

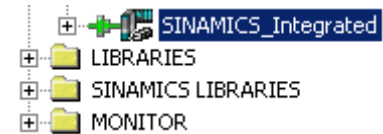
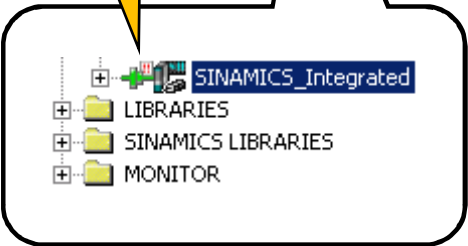
The setup is completed when the connecting symbol is green. The SINAMICS_Integrated is ready to run.



Load settings to target system



Information: Red Flag
 The red Flag indicates that the SINAMICS calculated optimized values. With "Load to PG" this values can be updated in the offline project. To save the values permanently (on CF-Card), please choose "copy RAM to ROM".



- Copy RAM to ROM (1.)
- Load CPU / drive unit to PG (2.)
- Save and compile (3.)



Note

Some D435 training cases (MLFB: 6SL3120-2TE13-0AA0) will show an error (P1244):

Level	Message
Information	SINAMICS_Integrated: Consistency check of the DO configuration...
Information	SINAMICS_Integrated: Determination of the charts to be loaded...
Information	SINAMICS_Integrated: Checking the global device data...
Information	SINAMICS_Integrated: Consistency check of the DO configuration...
Information	SINAMICS_Integrated: CU_I_003: TO SINAMICS_Integrated: CU_I_003 has been downloaded.
Information	SINAMICS_Integrated: SERVO_02: TO SINAMICS_Integrated: SERVO_02 has been downloaded.
Information	SINAMICS_Integrated: SERVO_03: TO SINAMICS_Integrated: SERVO_03 has been downloaded.
Information	SINAMICS_Integrated: TB30_05: TO SINAMICS_Integrated: TB30_05 has been downloaded.
Information	SINAMICS_Integrated: Initialization of the internal data structures of the drive is running...
Error	SINAMICS_Integrated:SERVO_03: Parameter P1244 [0]: Unterhalb der gültigen Werte
Error	SINAMICS_Integrated: Download error
Information	The following devices are not consistent online: SINAMICS_Integrated.
Error	Error on: Load
Error	Download error (ret = 0xbe0b0011)



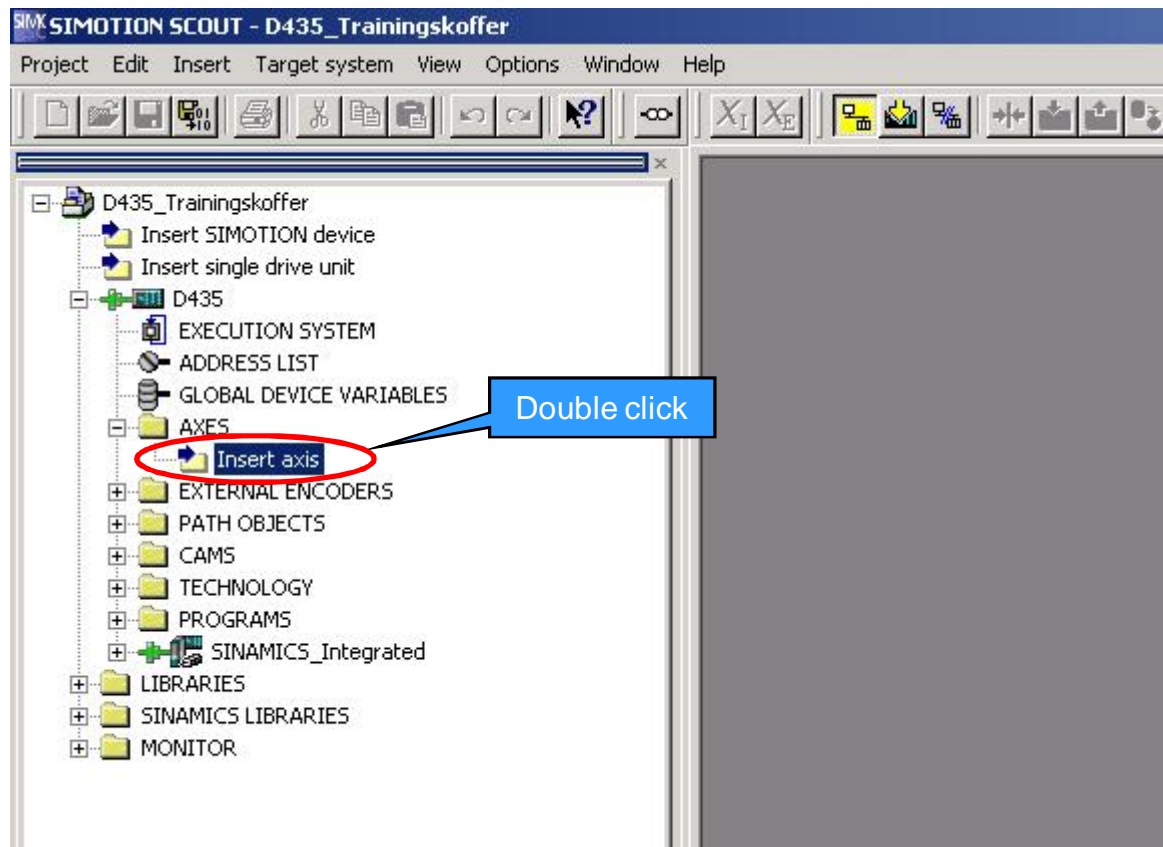
In this case:

- Open expert list for SERVO_03
- Set p1244[0] = 715 V and p1248[0] = 279 V
- Set p210 = 345 V
- Load CPU / drive unit to PG 
- Save and compile 

Note: Operation SERVO_03 via drive control panel is similar to operation SERVO_02. (see slide 20)
In this case DI 4 instead of DI 0 have to be switch on. (see slide 25)

SIMOTION D435 – Insert new axis

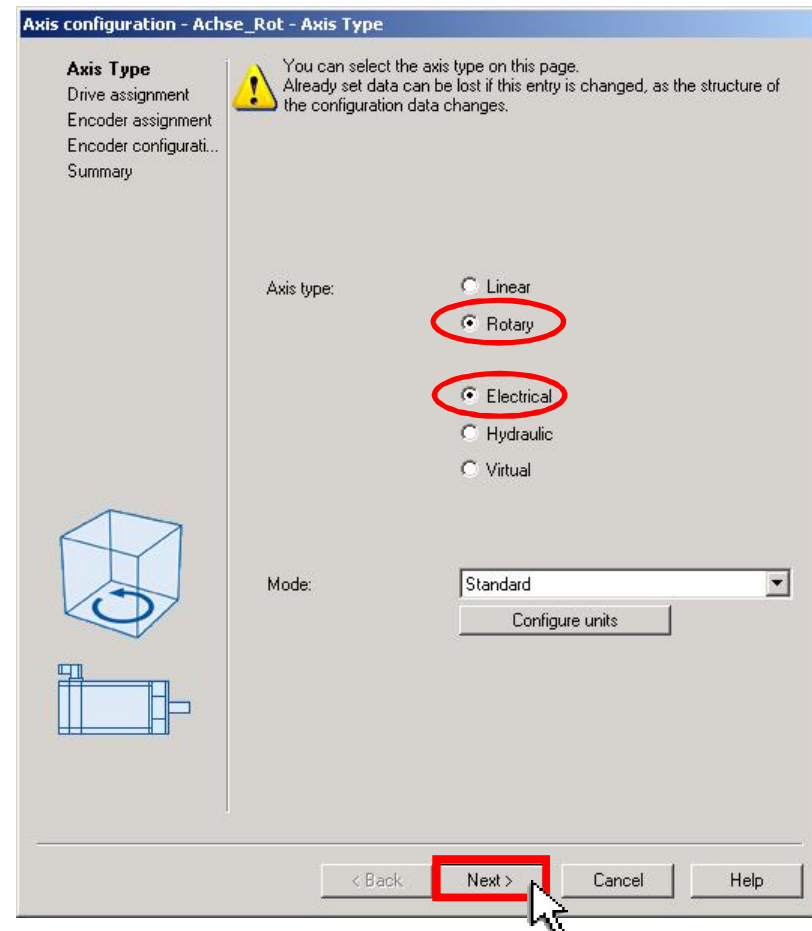
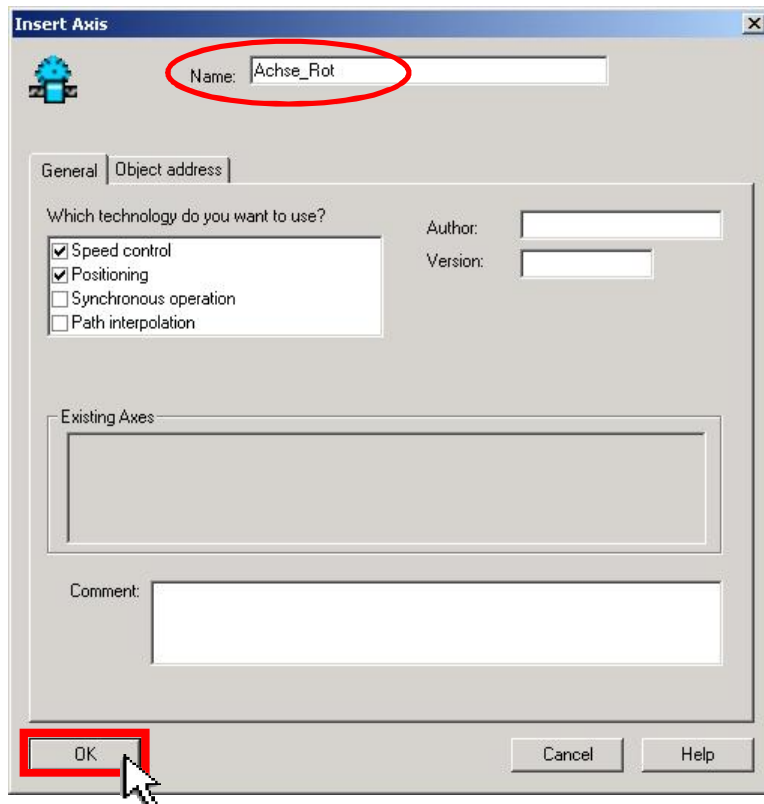
- Double click on “Insert axis”
- **Two axes** are to be inserted (“Red_Axis“ and “Blue_Axis”)



Note: Since SIMOTION V4.2 TOs can be insert in online mode too.

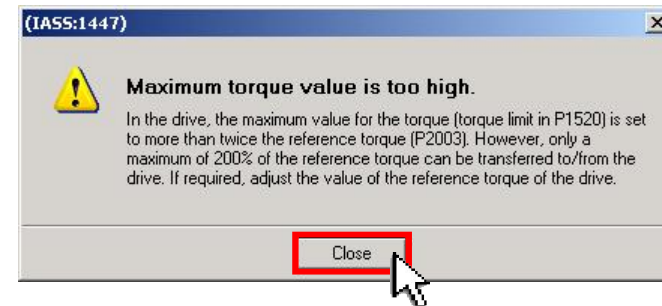
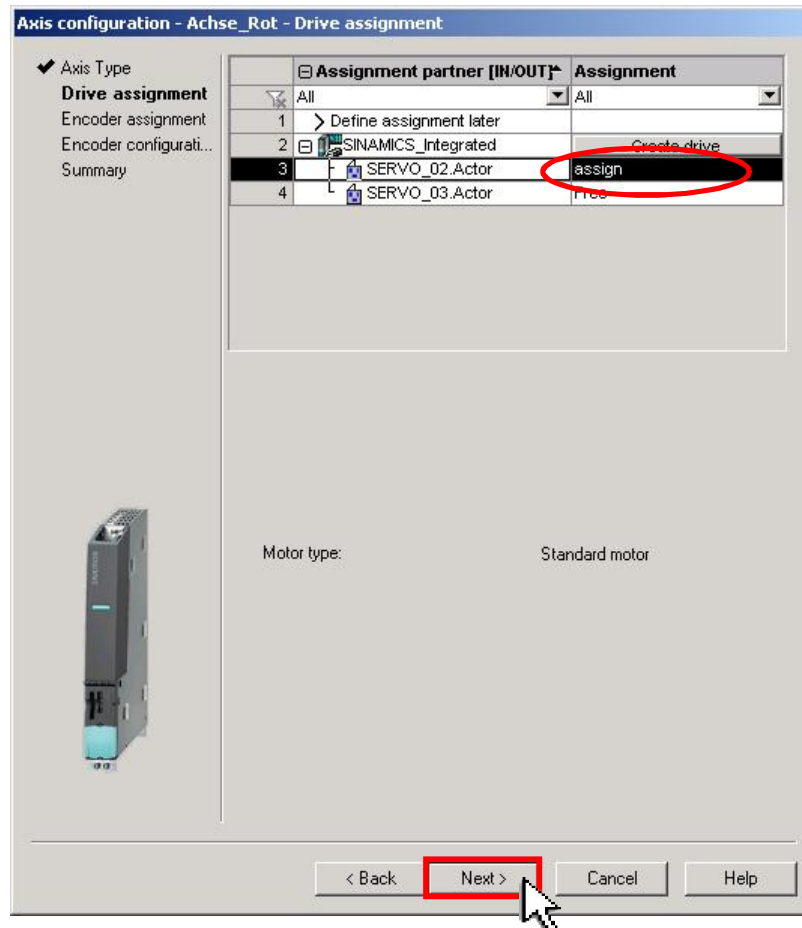
Configure Red_Axis

- Choose axis name “Red_Axis” (“Achse_Rot”) and select the necessary technologies
- Determine axis type: rotary, electrical



Configure Red_Axis

- Drive assignment: Red_Axis to SERVO_02



This message appears due to an error in the electronic type label of the motor. That means that an incorrect reference torque is parameterized. See slide 38 to correct this torque-value.

Configure Red_Axis

- Encoder assignment: Red_Axis to SERVO_02 → Encoder_1
- Summary of Axis configuration

Axis configuration - Achse_Rot - Encoder assignment

Axis Type
 Drive assignment
 Encoder assign...
 Summary

	Assignment partner [IN/OUT]	Assignment
1	> Define assignment later	All
2	SINAMICS_Integrated	
3	SERVO_02	
4	Encoder_1	assign
5	SERVO_03	

Encoder use in SIMOTION:

Enc. type: Absolute encoder, cyclic absolute

Encoder type in the drive: Absolute encoder, cyclic absolute



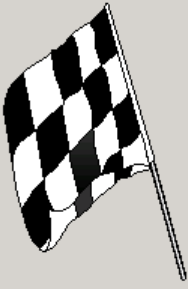
< Back **Next >** Cancel Help

Axis configuration - Achse_Rot - Summary

Axis Type
 Drive assignment
 Encoder assignment
Summary


All the necessary data for configuration has been entered:

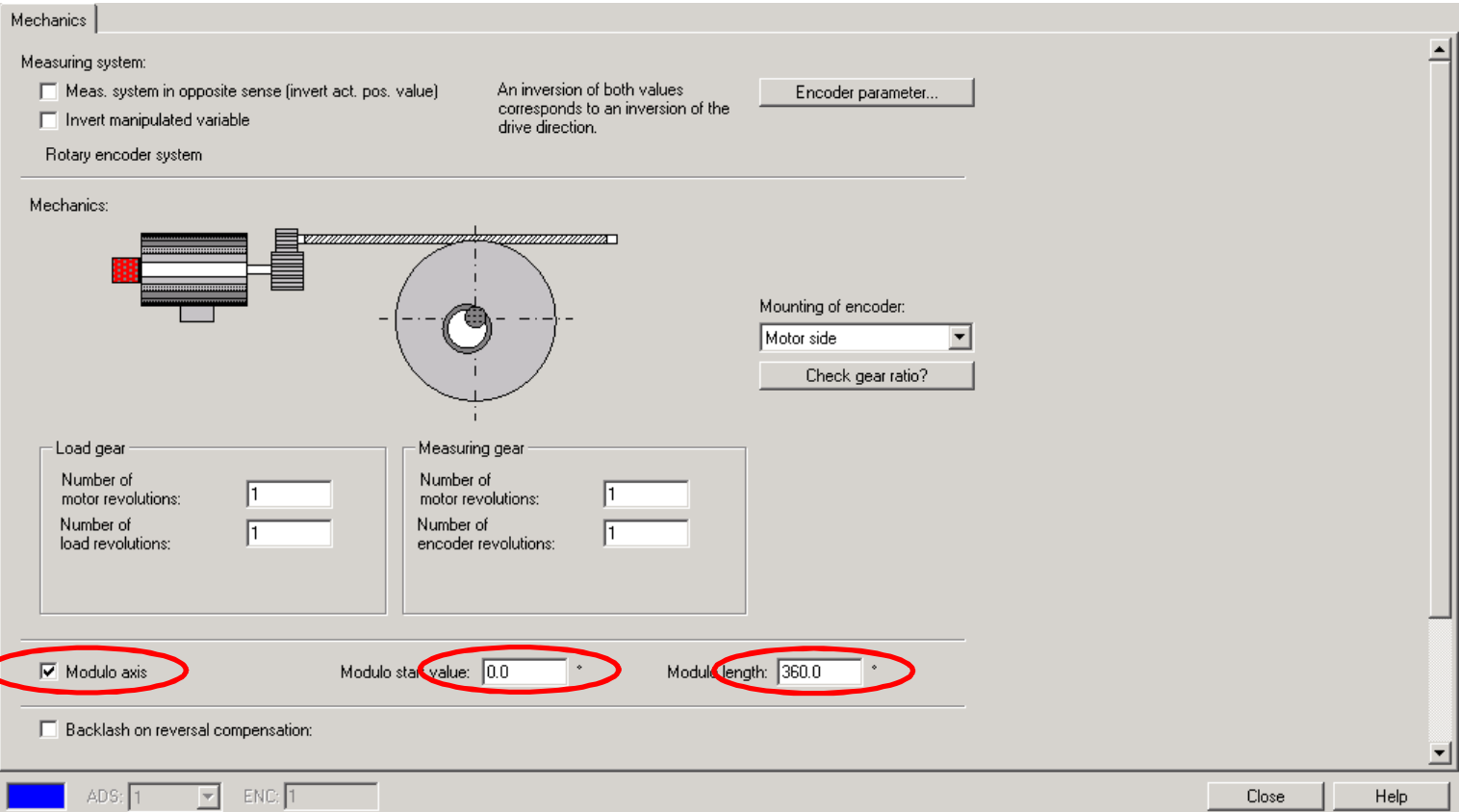
Name:
- Achse_Rot
Technology:
- Position axis
Axis type:
- Rotary axis
- Electric
Axis mode:
- Standard
Drive:
- SINAMICS_Integrated.SERVO_02.Actor
Encoder:
- SINAMICS_Integrated.SERVO_02.Encoder_1
Encoder type:
- Cyclic absolute



< Back **Finish** Cancel Help

Configure Red_Axis

- Modulo axis with 360° length: Go offline  → D435 → Axes → Red_Axis → Mechanics → Modulo axis (0,0° - 360°)



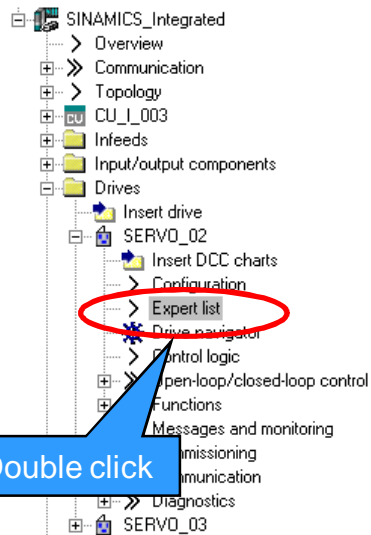
The screenshot displays the 'Mechanics' configuration window for a Modulo axis. The left-hand tree view shows the project structure under 'AXES', with 'Mechanics' selected and circled in red. The main window contains the following elements:

- Measuring system:** Includes checkboxes for 'Meas. system in opposite sense (invert act. pos. value)' and 'Invert manipulated variable'. A note states: 'An inversion of both values corresponds to an inversion of the drive direction.' An 'Encoder parameter...' button is also present.
- Rotary encoder system:** A section header.
- Mechanics:** A central diagram showing a motor and encoder assembly.
- Mounting of encoder:** A dropdown menu set to 'Motor side' and a 'Check gear ratio?' button.
- Load gear:** Fields for 'Number of motor revolutions' (1) and 'Number of load revolutions' (1).
- Measuring gear:** Fields for 'Number of motor revolutions' (1) and 'Number of encoder revolutions' (1).
- Modulo axis:** A checked checkbox, circled in red.
- Modulo start value:** A text box containing '0.0', circled in red.
- Modulo length:** A text box containing '360.0', circled in red.
- Backlash on reversal compensation:** An unchecked checkbox.
- Footer:** Includes 'ADS: 1', 'ENC: 1', and 'Close'/'Help' buttons.

Configure Red_Axis

- Error message: “Maximum torque value is too high.” (see slide 35)
 The set torque limits may exceed 200% of the reference torque, so they need to be adjusted as described below:

552	p2002	Reference current	3.00	Arms
553	p2003	Reference torque	1.38	Nm
554	r2004	Reference power	0.87	kW



Wrong parameter after automatic configuration:

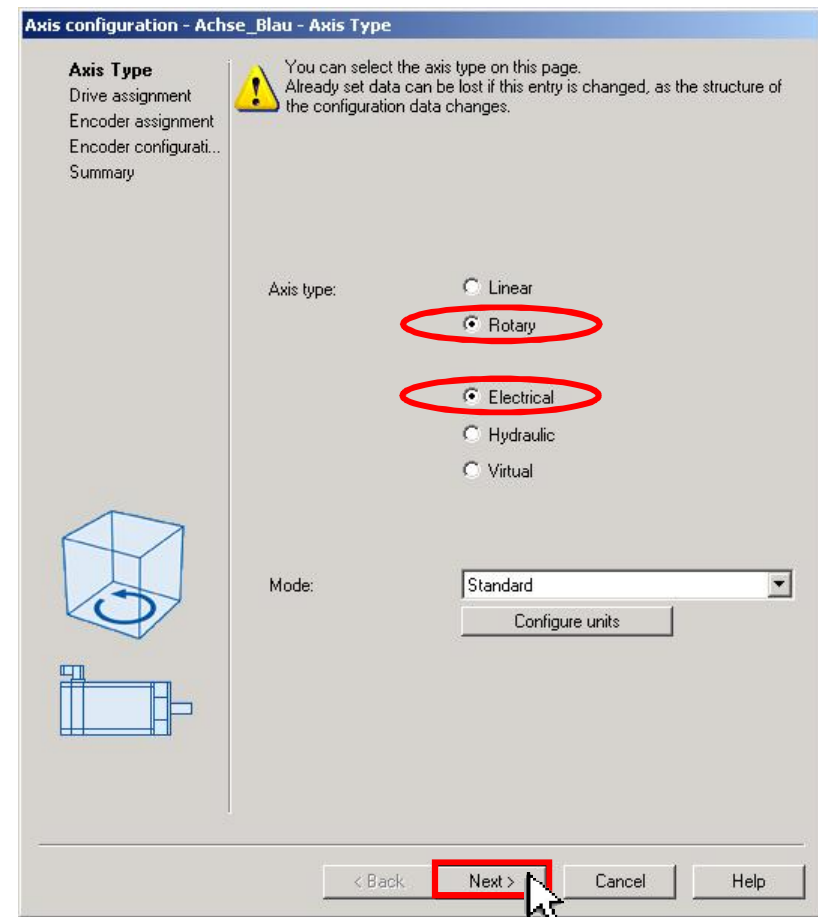
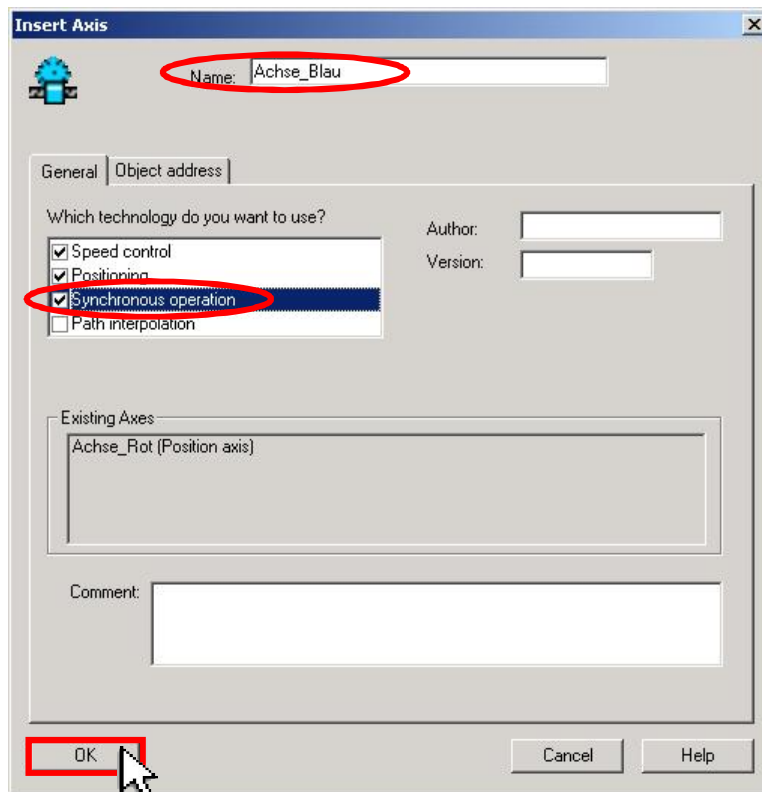
443	r1518[0]	Accelerating torque, Unsmoothed	0.00	Nm
444	p1520[0]	CO: Torque limit upper/motoring	3.45	Nm
445	p1521[0]	CO: Torque limit lower/regenerative	-3.45	Nm
446	p1522[0]	CI: Torque limit upper/motoring	SERVO_02 : p1520	

Correct parameter:

443	r1518[0]	Accelerating torque, Unsmoothed	0.00	Nm
444	p1520[0]	CO: Torque limit upper/motoring	2.70	Nm
445	p1521[0]	CO: Torque limit lower/regenerative	-2.70	Nm
446	p1522[0]	CI: Torque limit upper/motoring	SERVO_02 : p1520	

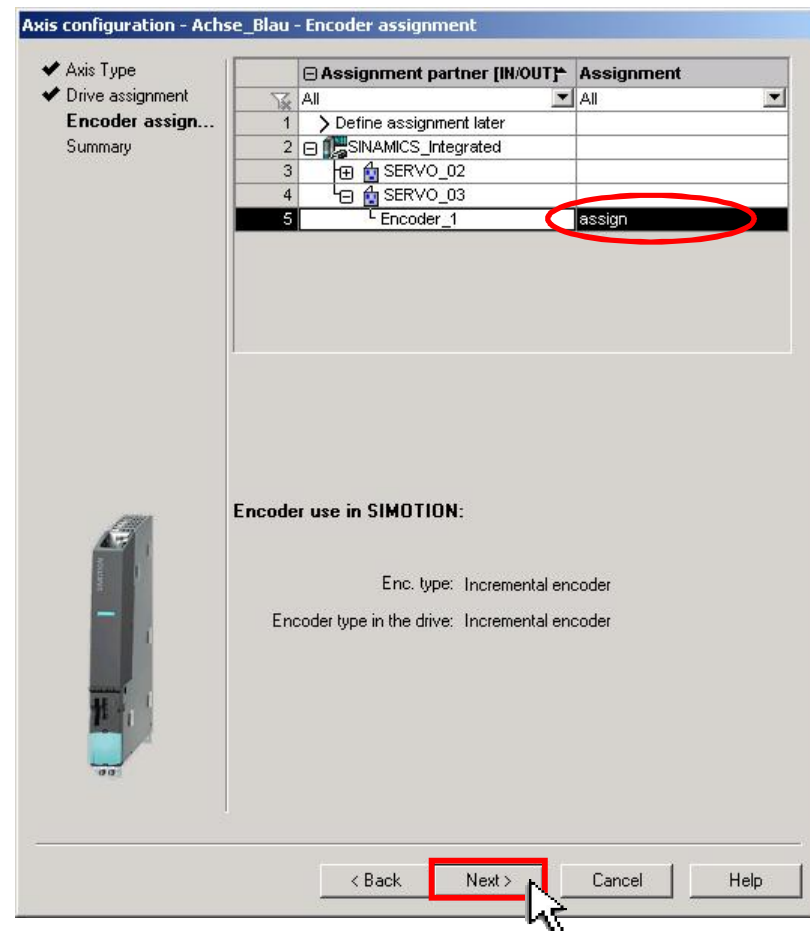
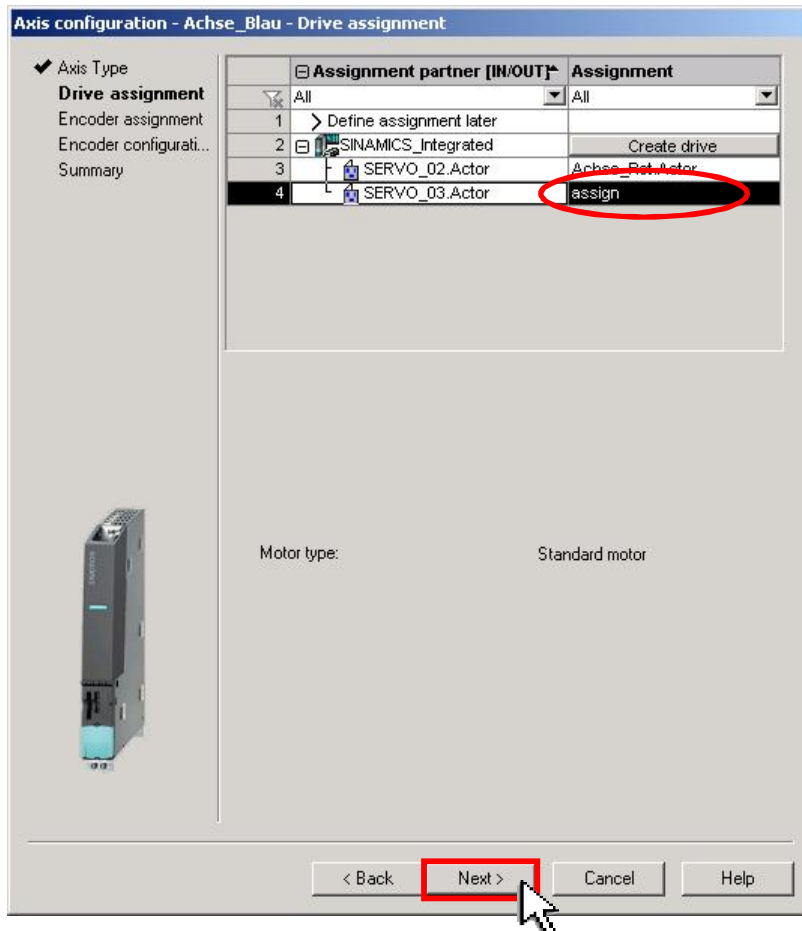
Configure the second axis: Blue_Axis

- The configuration of the second axis is similar to the first one “Red_Axis”.
 - click “Insert axis” and give axis name: “Blue_Axis” (“Achse_Blau”)
 - select technology: “Synchronous operation”
 - Select axis type: rotary, electrical



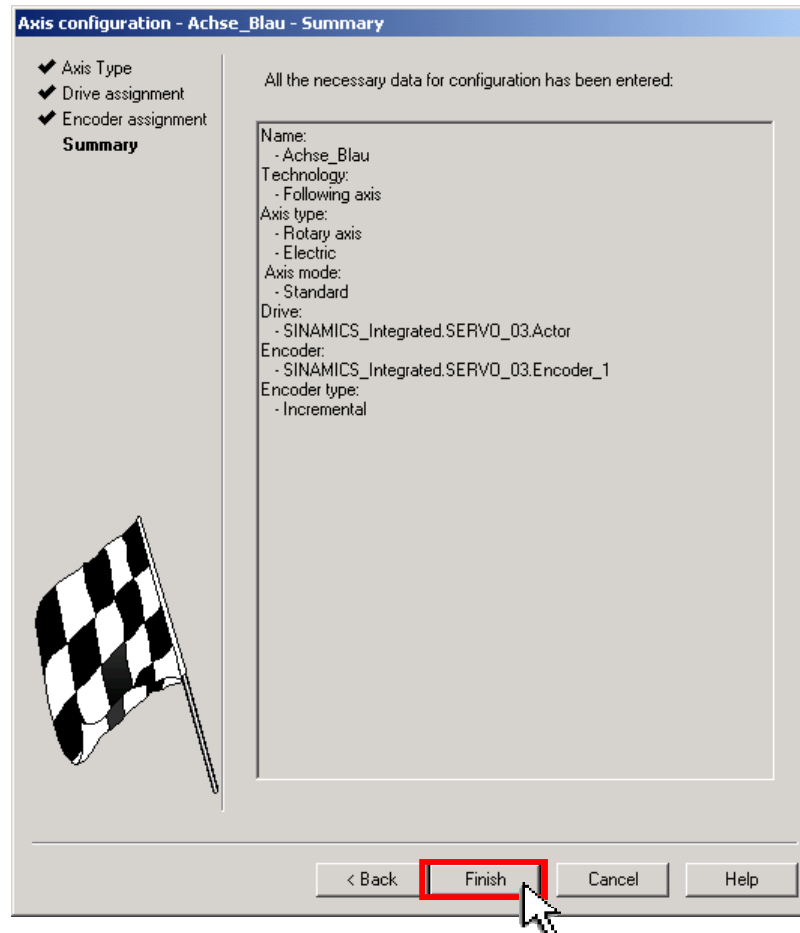
Configure Blue_Axis

- Drive assignment: Blue_Axis to SERVO_03
- Encoder assignment: Blue_Axis to SERVO_03 → Encoder_1





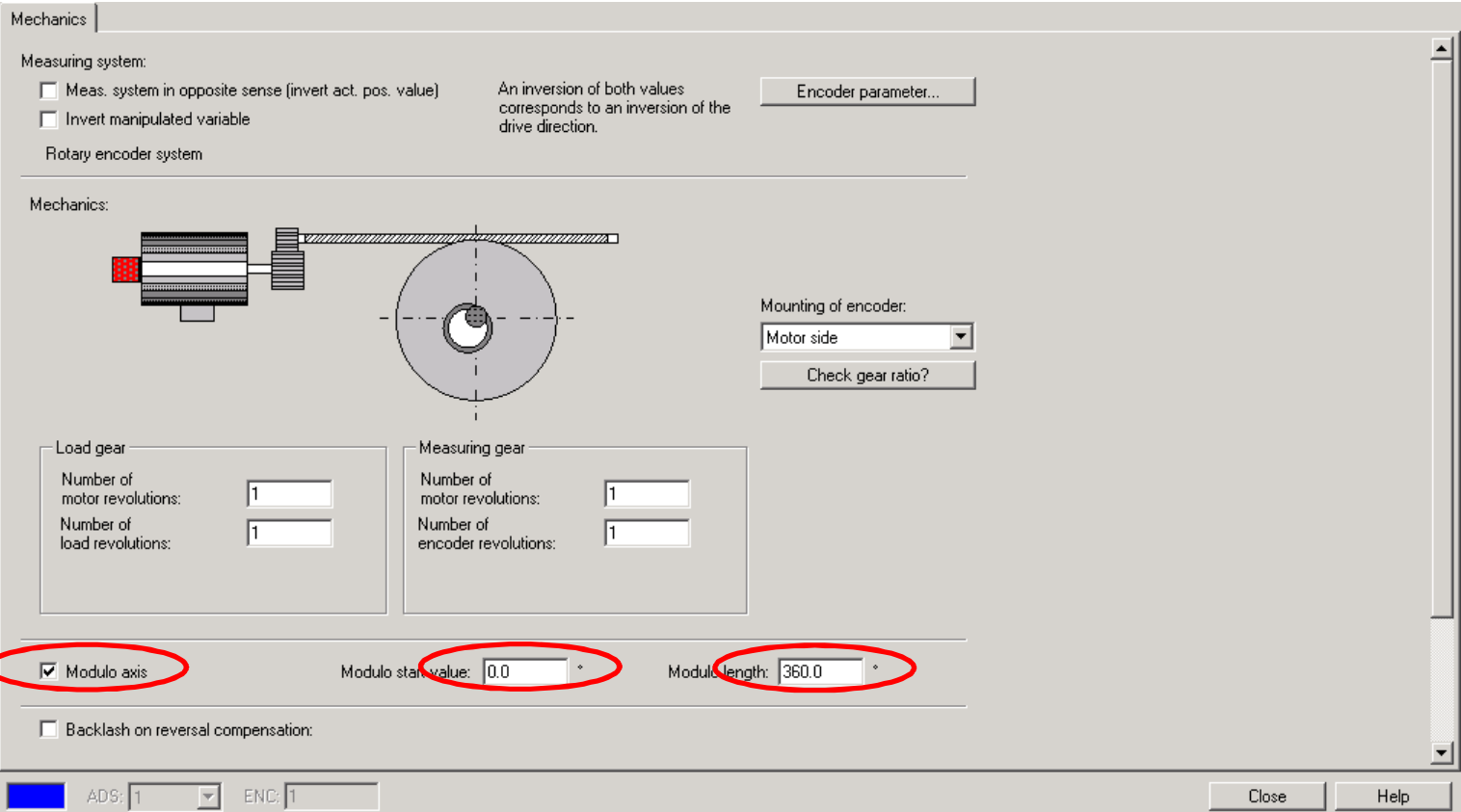
Configure Blue_Axis

- Summary of Axis configuration



Configure Blue_Axis

- Modulo axis with 360° length: D435 → Axes → Blue_Axis → Mechanics → Modulo axis (0,0° - 360°) → Save project  → Go online 

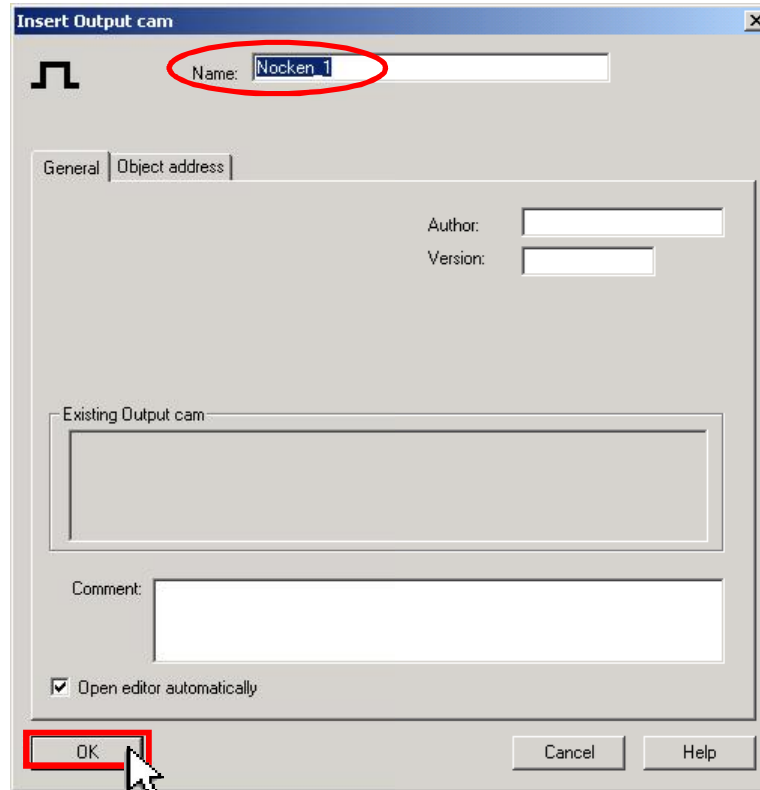
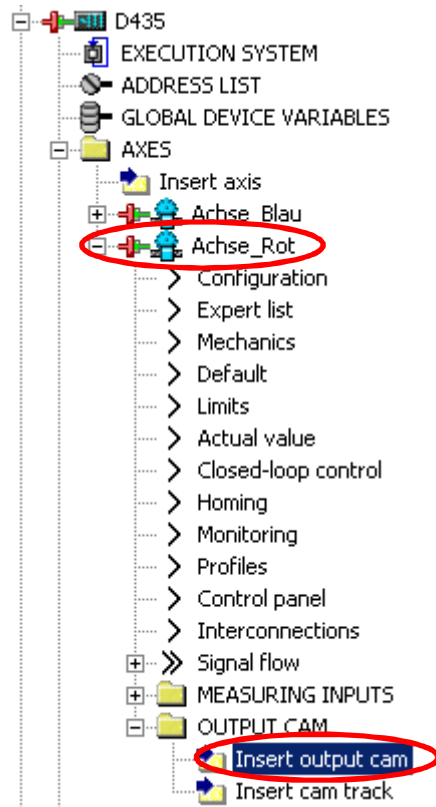


The screenshot shows the 'Mechanics' configuration window in the SIMOTION D435 software. The left sidebar shows a tree view with 'AXES' expanded, and 'Mechanics' under 'Achse_Blau' is selected and circled in red. The main window contains the following elements:

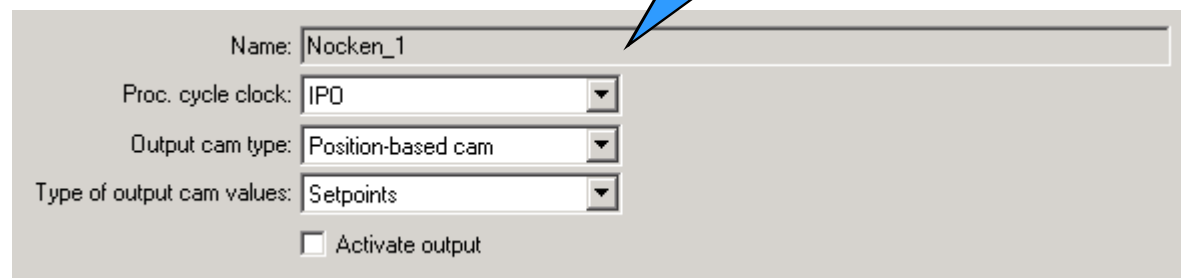
- Measuring system:** Two checkboxes: Meas. system in opposite sense (invert act. pos. value) and Invert manipulated variable. A note states: "An inversion of both values corresponds to an inversion of the drive direction." An 'Encoder parameter...' button is to the right.
- Rotary encoder system:** A section header.
- Mechanics:** A diagram of a motor and encoder assembly. To the right, a 'Mounting of encoder:' dropdown is set to 'Motor side', with a 'Check gear ratio?' button below it.
- Load gear:** Input fields for 'Number of motor revolutions:' (1) and 'Number of load revolutions:' (1).
- Measuring gear:** Input fields for 'Number of motor revolutions:' (1) and 'Number of encoder revolutions:' (1).
- Modulo axis:** A checked checkbox Modulo axis. To its right, 'Modulo start value:' is set to 0.0 and 'Modulo length:' is set to 360.0, both circled in red.
- Backlash on reversal compensation:** An unchecked checkbox .
- Footer:** A status bar with 'ADS: 1' and 'ENC: 1' dropdowns, and 'Close' and 'Help' buttons.

Add output cam to Red_Axis

- Insert output cam

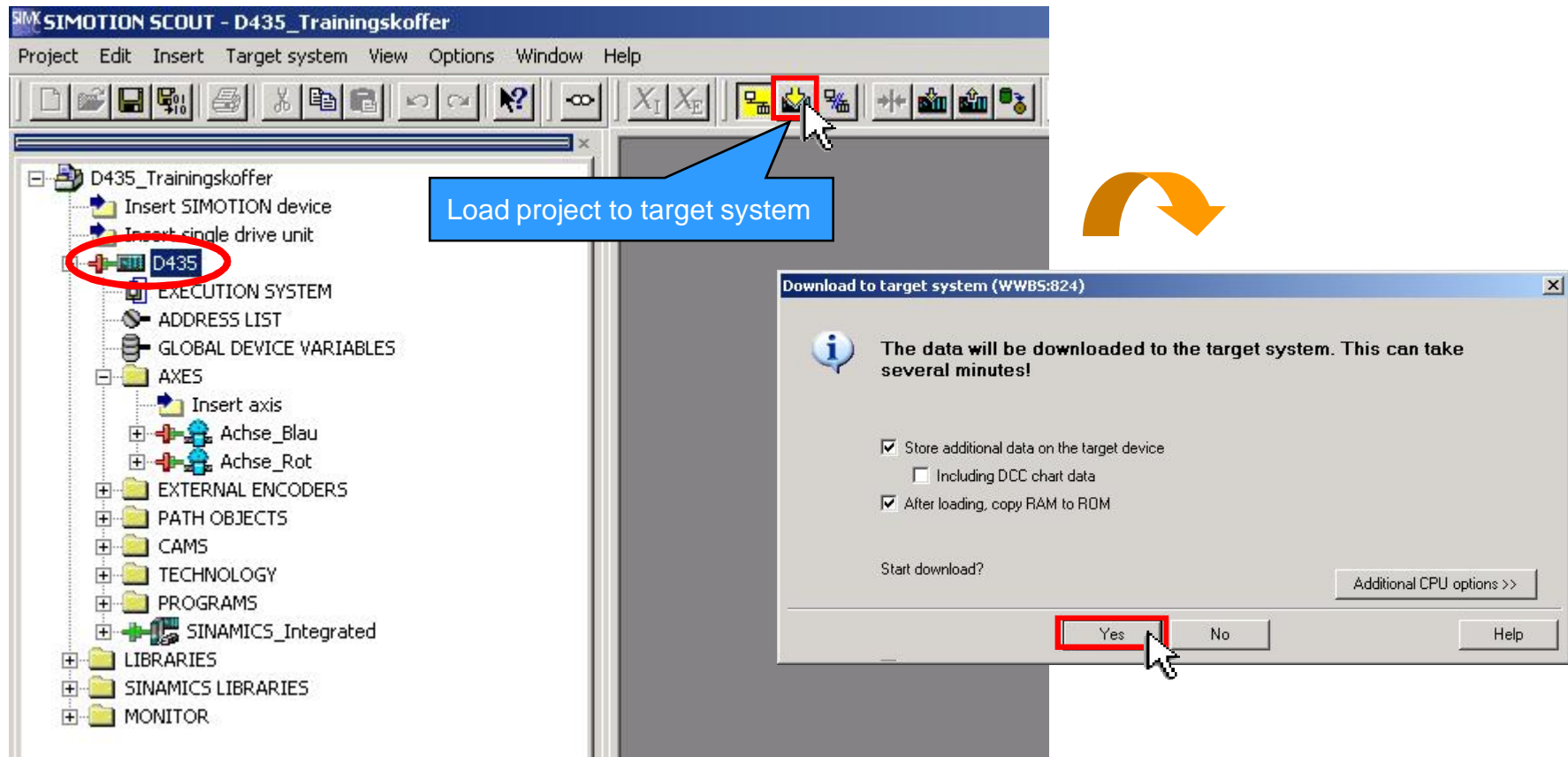


Standard settings

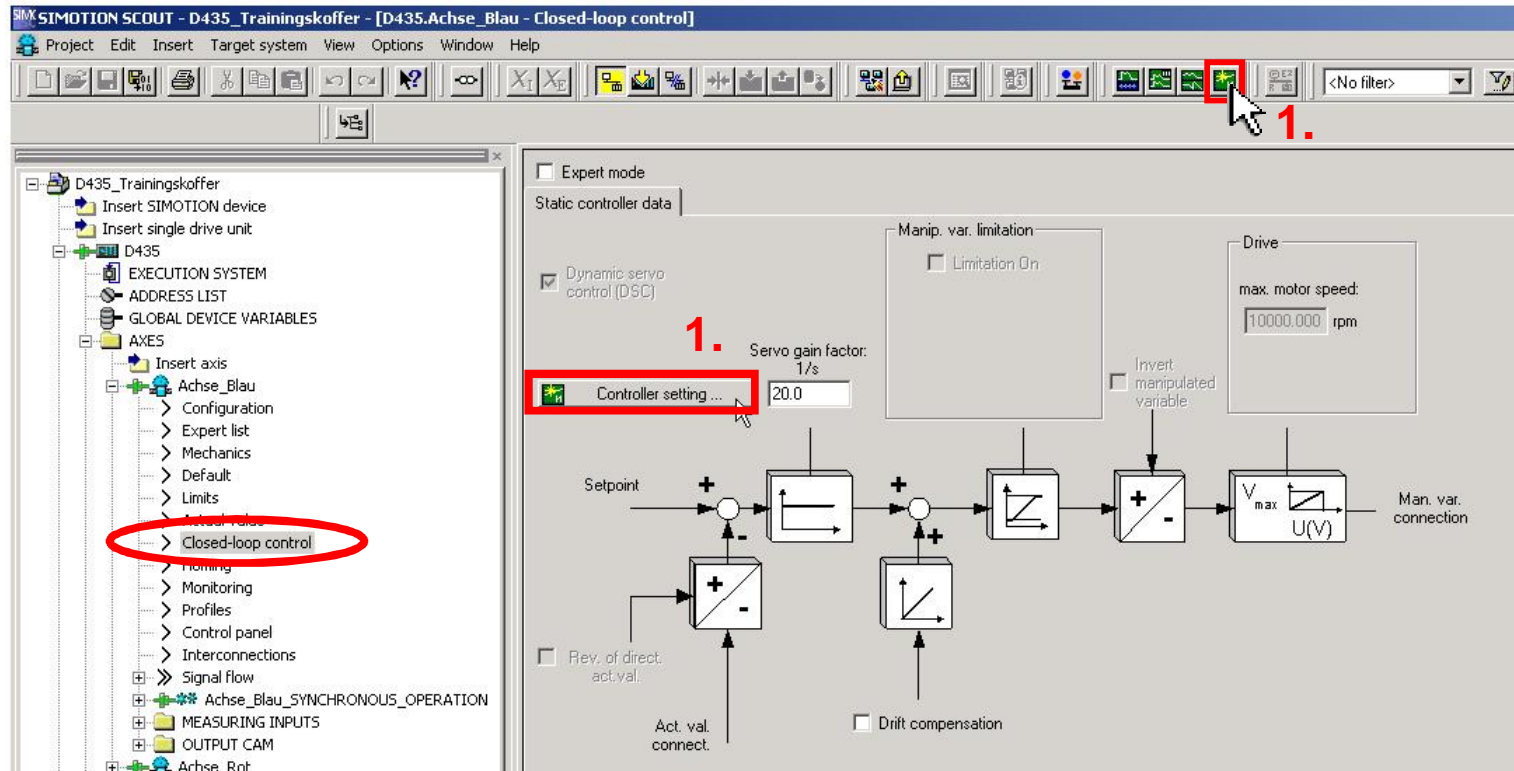


Download data to target device

- Download SIMOTION D435 project to target device.
(The 1st download (incl. TPCAM) takes longer.)



Automatic controller settings



- By double clicking on (1.) the mask „Automatic controller setting“ opens (see following two slides). You can use the pull-down-menu to choose the controller you want to set.
 Slide 46 → Speed controller
 Slide 47 → Position controller (DSC)

Automatic controller settings - speed controller

Assume control priority, Drive ON and perform all steps

Pull-down-menu

4. **5.**

2.

3.

7.

6.

Accept values

Take over speed controller settings in SERVO_02 (ITRC:26801)

Do you want to take over the determined controller settings in the drive?

The controller settings have been determined for the following drive configuration:
 DDS: 0 MDS: 0 EDS: 0
 Please note that after accepting, the settings have not been saved retentively on the CF card of the drive unit or PG.
 If required, perform the following actions:

1. Give up control priority
2. Copy RAM to ROM
3. Load to PG
4. Save project

All steps will be done automatically. Make sure that all safety precautions are observed.

New values will be calculated

p1400[0].3	Reference model speed setpoint, 1 component			
p1414[0]	Speed setpoint filter activation			
p1414[0].0	Activate filter 1			
p1414[0].1	Activate filter 2			
p1441[0]	Actual speed smoothing time			
p1460[0]	Speed controller P gain adaptation speed, lower	0.009	0.143	Nms/rad
p1462[0]	Speed controller integral time adaptation speed lower	10.000	87.357	ms
p1656[0]	Activates current setpoint filter	1H	1H	
p1100[0]	Low pass: PT	[1] 1999.000	[1] 1999.000	Hz
p1101[0]	Low pass: PT	[1] 0.700	[1] 0.700	Hz
p1102[0]	Low pass: PT	[1] 1999.000	[1] 1999.000	Hz
p1103[0]	Low pass: PT	[1] 0.700	[1] 0.700	Hz
p1104[0]	Low pass: PT	[1] 1999.000	[1] 1999.000	Hz
p1105[0]	Low pass: PT	[1] 0.700	[1] 0.700	Hz

- Switch Drive OFF and give up control priority after automatic controller setting has finished.

Automatic controller settings - position controller

2. Assume control priority!

3. Accept

4. Give up control priority!

5. Assume control priority, Drive ON and perform all steps

6. Yes

7. Accept values

8. New values will be calculated

9. To save settings scroll down and press "Accept values"

10. Pull-down-menu

11. All steps will be done automatically. Make sure that all safety precautions are observed.

12. Take care when using the measuring function!

13. This function may only be used under observance of the relevant safety notes. Failure to observe these safety notes may result in personal injury or material damage.

14. Controller setting sequence:

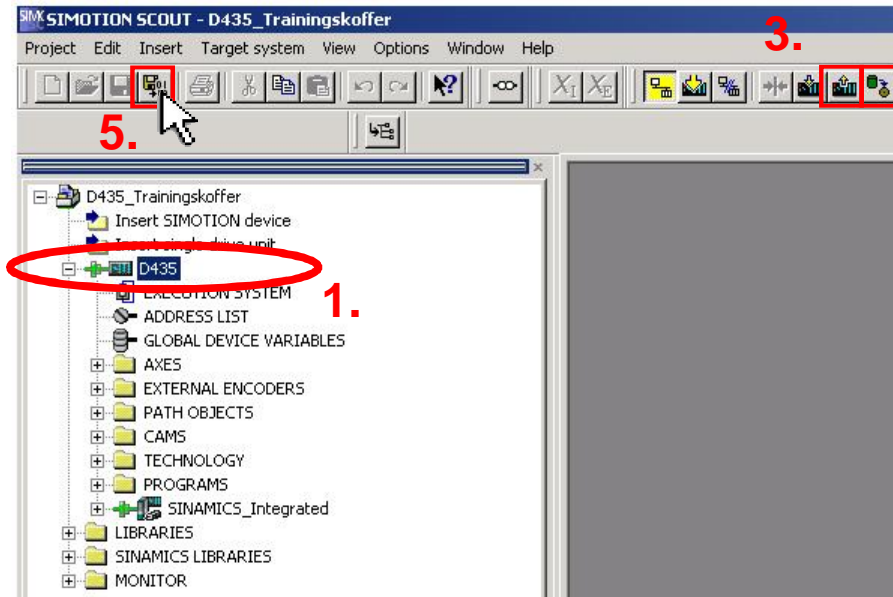
1. Measurement of the speed controller
2. Calculation of the position controller setting

Axis	Data set	Current value	Calculated value	Unit
D435.Achse_Blau	1	20.0	37.4	

- Switch Drive OFF and give up control priority after automatic controller setting has finished.

Save automatic controller settings

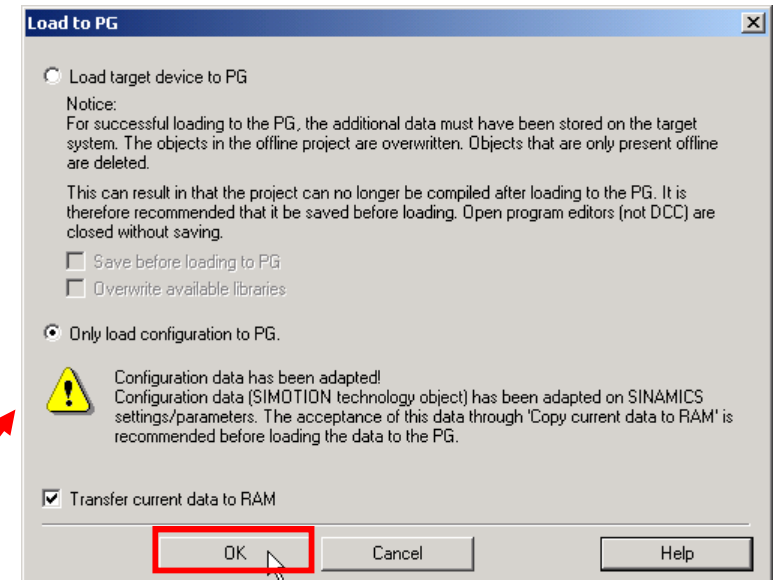
- Select D435 (1.)



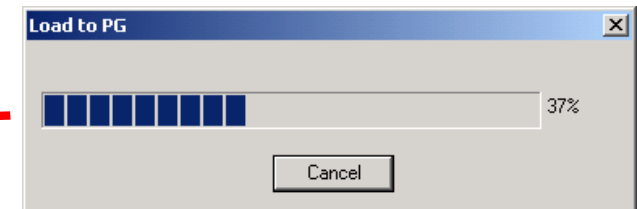
- Copy RAM to ROM (2.) 

- Select Load CPU / drive unit to PG (3.) 

- Save and compile (5.) 



4.



Operate Red_Axis via SIMOTION axis control panel

1. Control panel

2. Assume control priority!

3. Yes

4. Accept

Device in incorrect mode (ICPH:126)

The control is not in the 'STOPU' mode.
You can only use the axis control panel in this mode.
Should a software technical attempt be made to switch the control to 'STOPU' mode?

Assume control priority

Life-sign monitoring
 Active
Monitoring time: 1000 ms

! This software may only be used under observance of the relevant safety notes. Failure to observe these safety notes may result in personal injury or material damage.

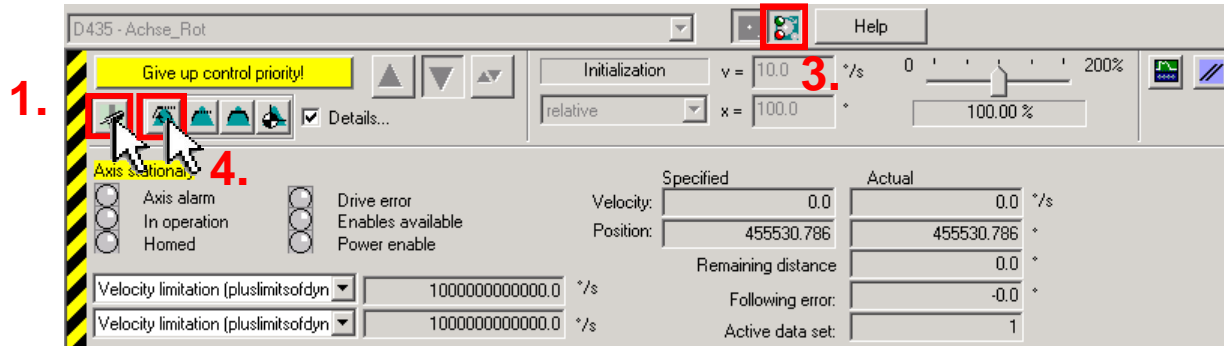
Safety notes

The following actions stop the axis and block the enable:

- Spacebar
- Change to a different Windows application
- Sign-of-life error

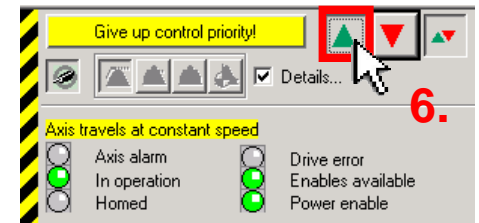
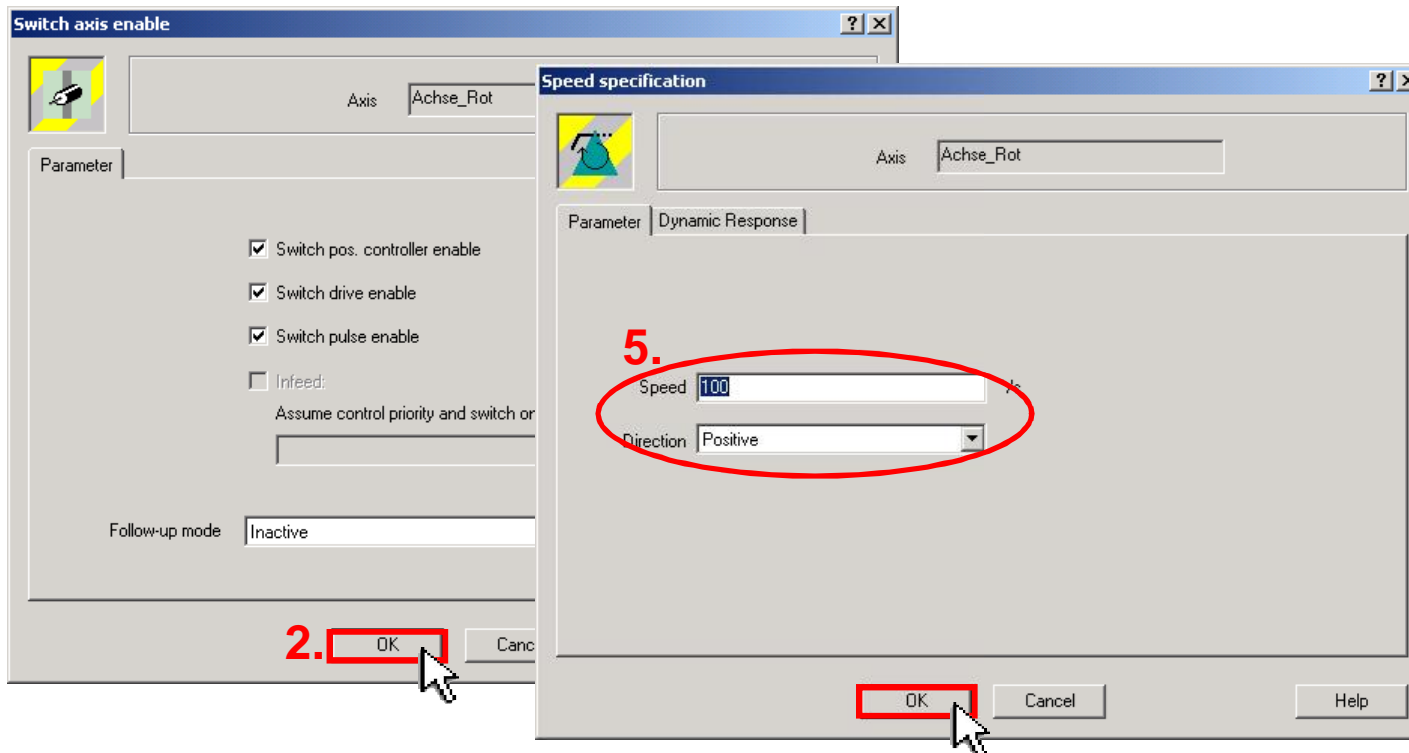
	Specified	Actual
Velocity:	0.0	0.0
Position:	0.0	0.0
Remaining distance:	0.0	0.0
Following error:	0.0	0.0
Active data set:		1

Start Red_Axis with SIMOTION axis control panel



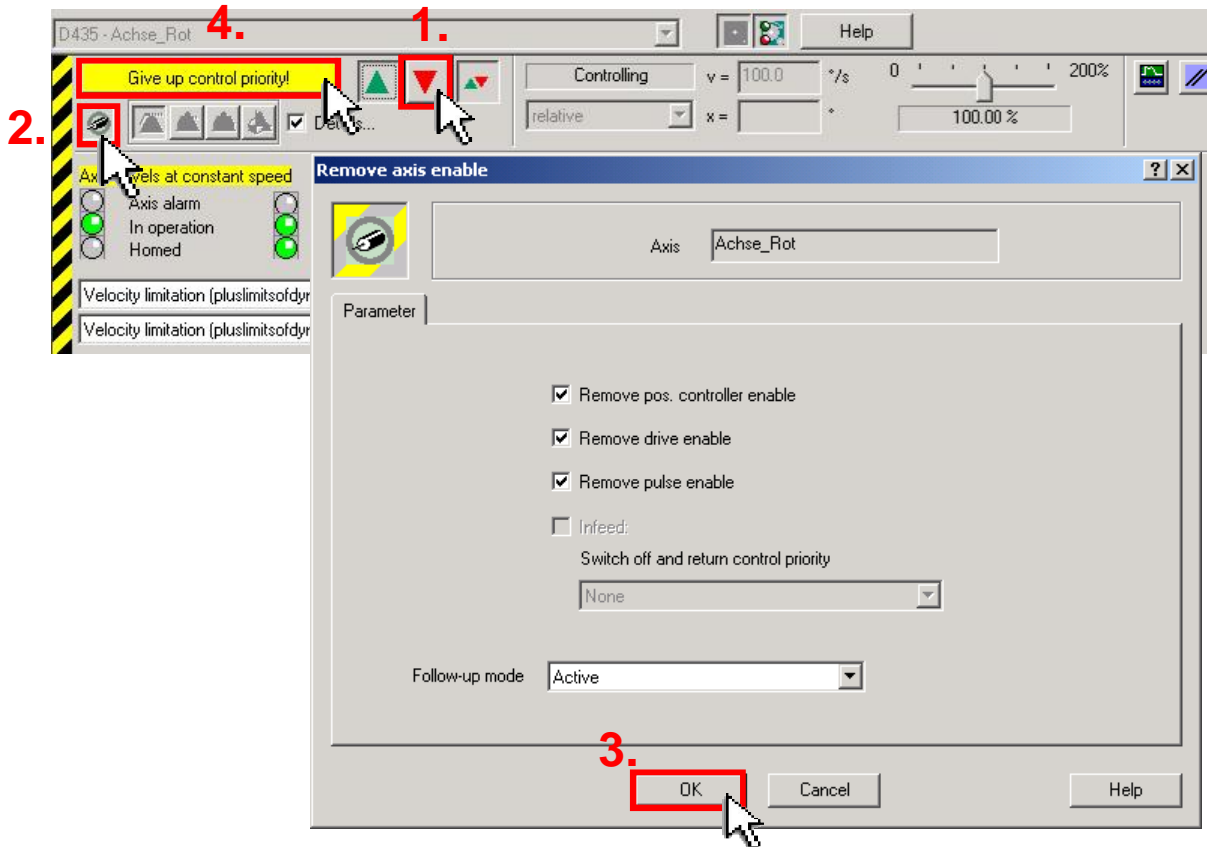
1. Set enables
2. Acknowledge with OK
3. Show Diagnostics
4. Select speed-controlled traversing of the axis
5. Enter desired speed
6. Start motion

Note: To start Red_Axis DI 0 have to be switched on (see slide 18)



„Red_Axis“
is in operation

Stop Red_Axis with SIMOTION axis control panel



1. Stop motion
2. Remove enables
3. Acknowledge with OK → Error occurs (no PLC control) → Acknowledge Alarm
4. Give up control priority

Note: Now you can operate the **Blue_Axis** in the same way. Remember that the DI 4 has to be turned on.

Display information: Acknowledge all

Level	Time	Source	Message
Information	17 03 11 09:35:45:000 (PG)	D435	OK
Fault	06.01.70 16:05:11:037	SINAMICS_Integrated : SERVO_02	1910 : PROFIBUS: Setpoint timeout
Fault	06.01.70 16:05:11:037	SINAMICS_Integrated : SERVO_03	1910 : PROFIBUS: Setpoint timeout
Fault	06.01.70 16:05:11:005	SINAMICS_Integrated : SERVO_02	1912 : IF1: PB/PN clock cycle synchronous operation sign-of-life failure
Fault	06.01.70 16:05:11:005	SINAMICS_Integrated : SERVO_03	1912 : IF1: PB/PN clock cycle synchronous operation sign-of-life failure

Programming

For the next steps there are three possibilities:

1. **Programming yourself**

Follow the instructions how to program SIMOTION
(needs time for writing the programs)

2. **Use your own project but copy programs from demo project**

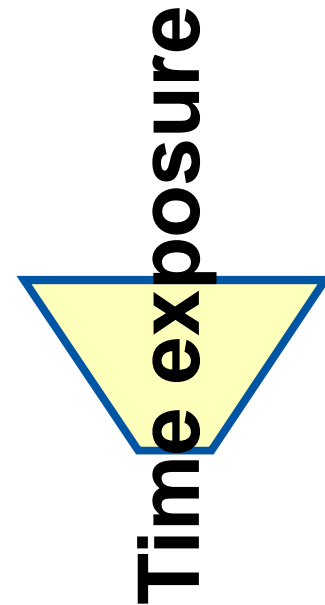
Start another SCOUT instance (open SCOUT a second time)

Open the demo project with the second SCOUT

Copy the required programs from the demo project to your own project
(change names, if you are using other names for axes,)

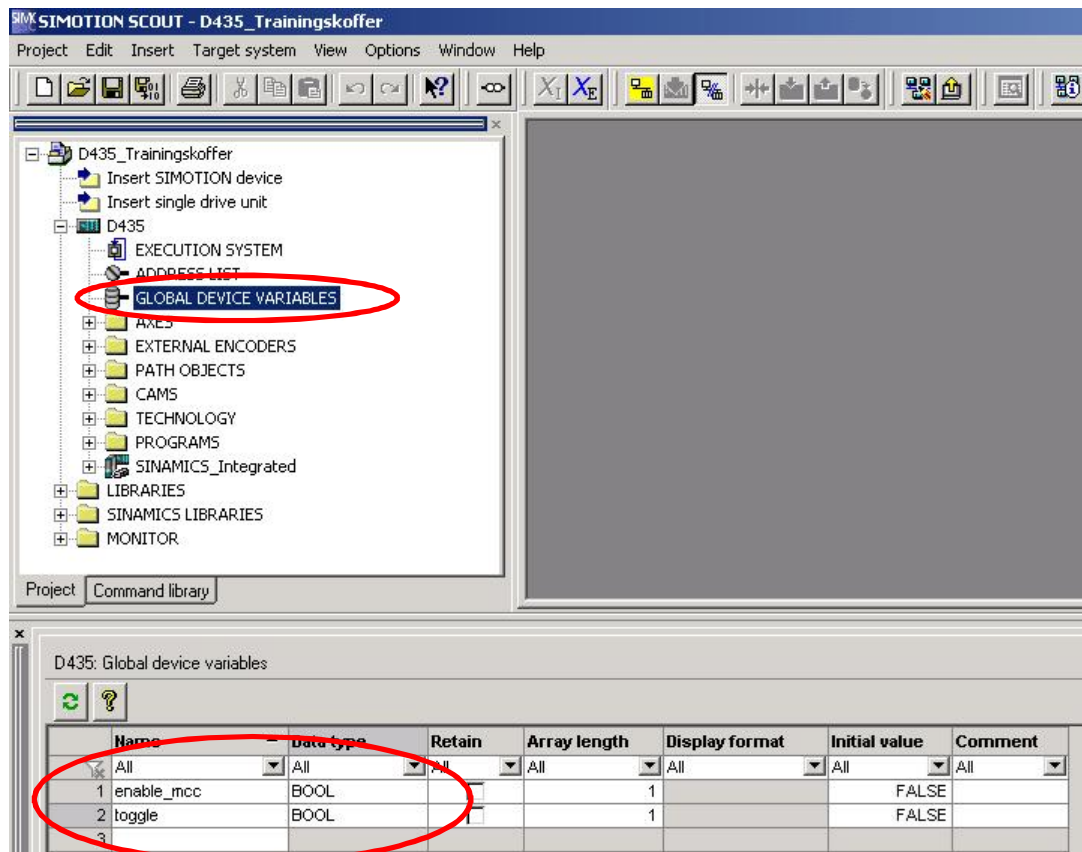
3. **Use demo project**

Open the sample project and just follow the next steps with the demo project.



Create global variables

- Disconnect from target system
- Open global device variables and create the variables “enable_mcc” and “toggle”



global variables:

- enable_mcc with data type: bool
- toggle with data type: bool

Insert geometry CAM

- Insert cam for MCC program

The screenshot shows the SIMOTION SCOUT software interface. On the left, the project tree is visible with 'Insert cam' highlighted. In the center, the 'Geometry' table is shown with the following data:

	Master	Slave
1	0	0
2	90	90
3	180	180
4	270	90
5	360	0
6		
7		
8		

The 'Insert Cam' dialog box is open, showing the 'Name' field set to 'Kurvenscheibe_1'. The 'Type' is set to 'Interpolation point table'. The 'OK' button is highlighted. A 'Close editor (wwbs:791)' warning dialog is also present, with the 'Yes' button highlighted.

Create a SIMOTION MCC program

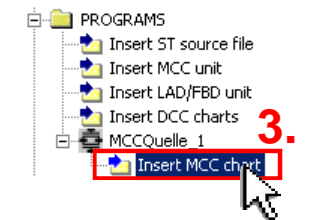
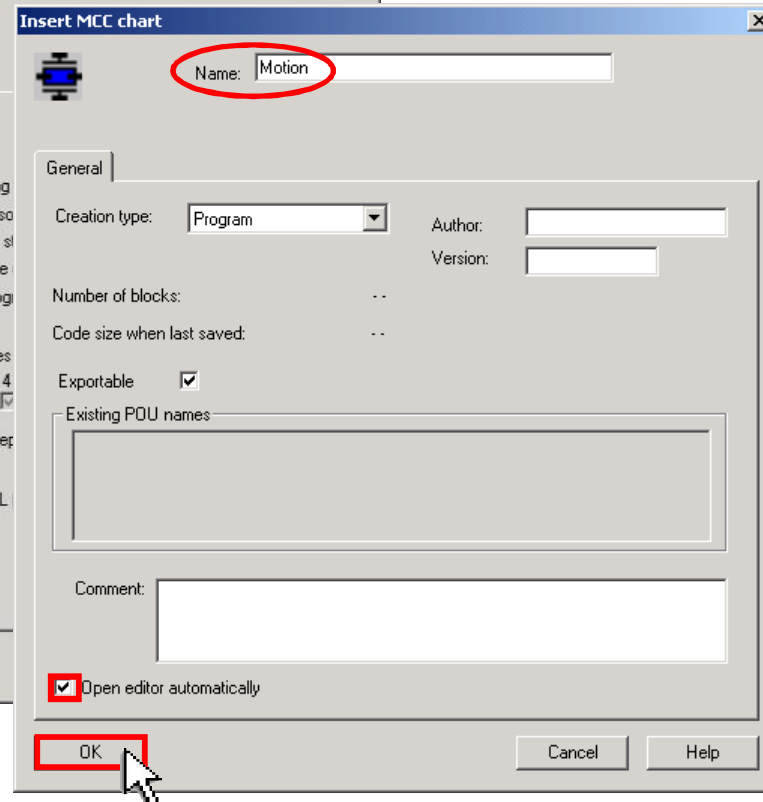
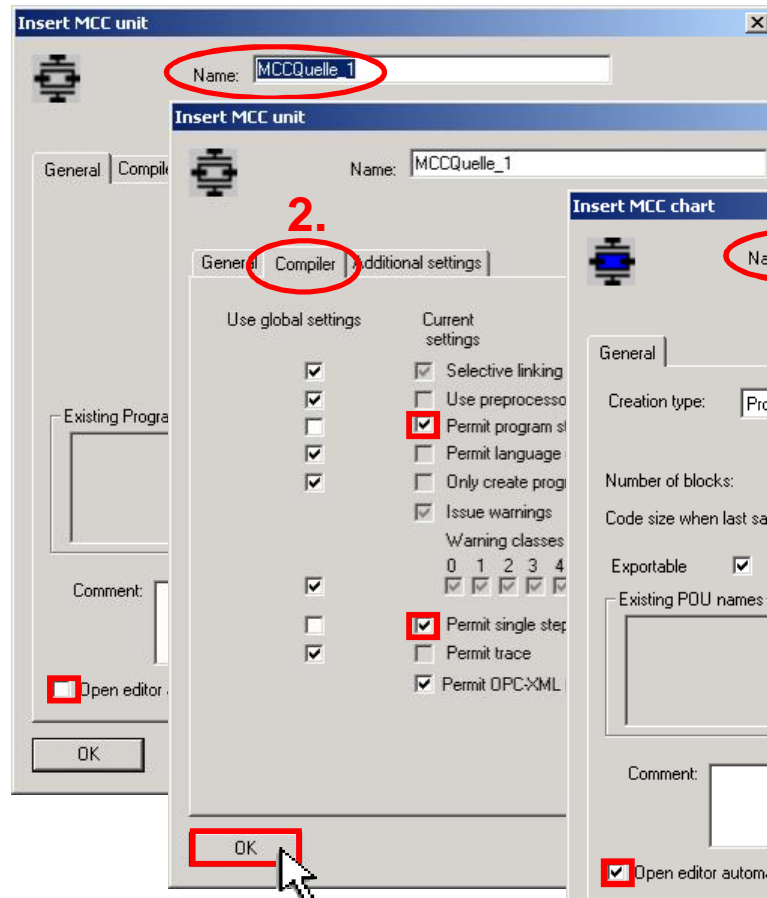
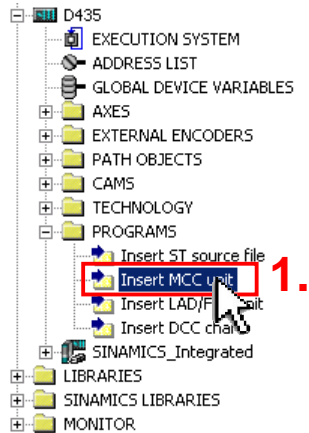
- Insert MCC unit

1. Insert a MCC unit (MCCQuelle_1)

2. Compiler settings:

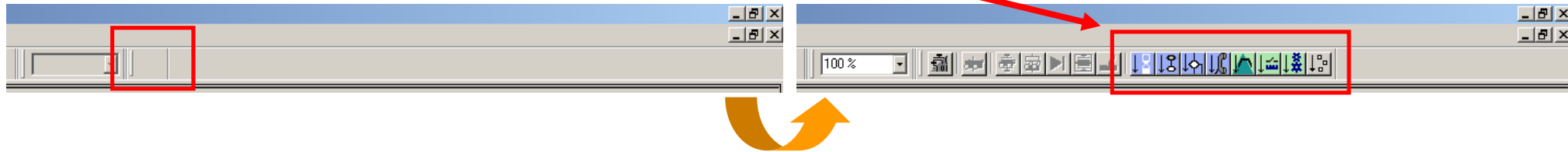
Permit program status and single step

3. Insert MCC Chart (Motion)

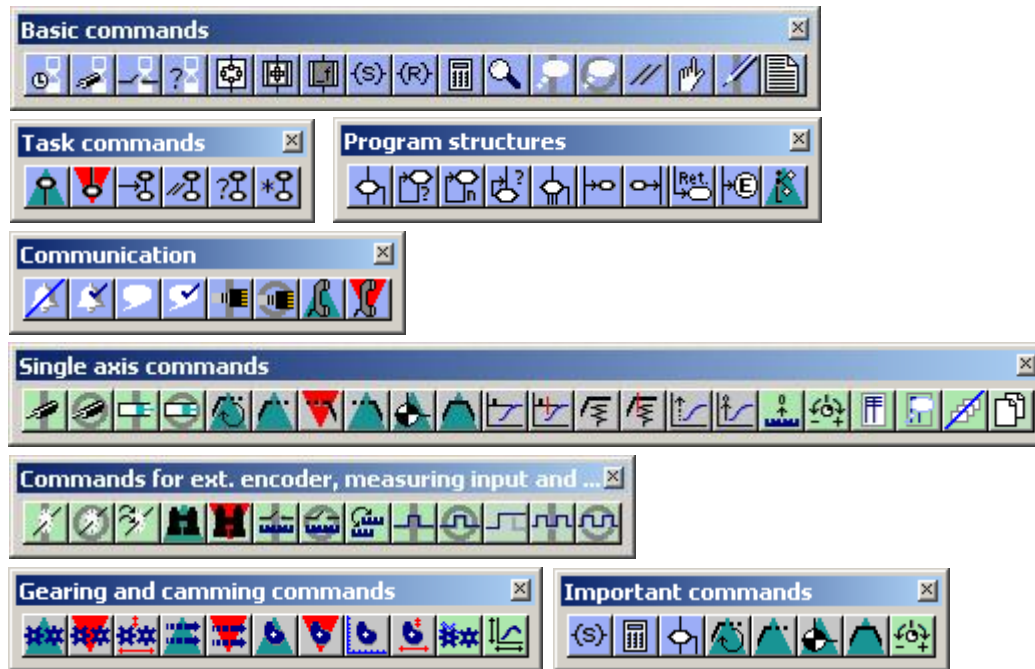


Create a SIMOTION MCC program

- When opening an MCC-Chart the toolbar for the MCC instruction groups appears.



- The toolbar contains the following commands:

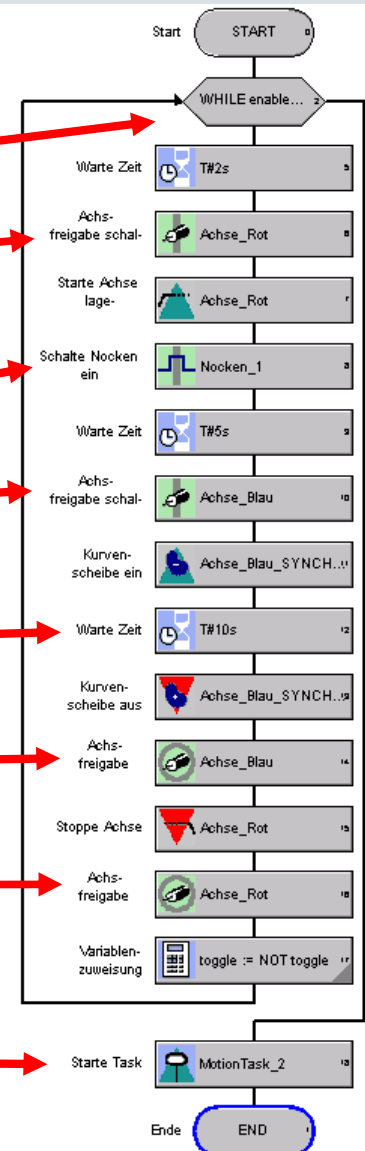


Create a SIMOTION MCC program

- Construct the shown flow chart (program "Motion")

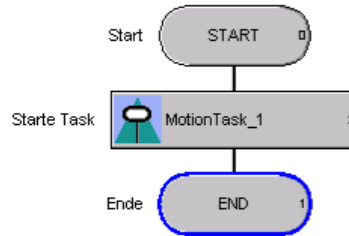
- While variable "enable_mcc" = true start MCC
- Wait 2 seconds
- Switch Red_Axis enable
- Start Red_Axis position-controlled, velocity 200°/s
- Switch output cam on Red Axis (switch between 10° – 20°)
- Wait 5 seconds
- Switch Blue_Axis enable
- "Cam on" with Blue_Axis and 180° synchronization length
- Wait 10 seconds
- "Cam off" with Blue_Axis and 180° desynchronization length
- Disable Blue_Axis
- Stop Red_Axis
- Disable Red_Axis
- Set variable toggle = NOT toggle
- Start Motion Task_2

Use standard settings,
change only specified
values.
Save and compile.



Create a SIMOTION LAD/FBD program

- Create MCC Chart „loop”
 - Start Motion Task_1



- Insert LAD/FBD unit (1.) „KFQuelle_1”, insert LAD/FBD program (6.) „KOPFUP_1”

1. Insert LAD/FBD unit

2. Name: KFQuelle_1

3. Use global settings

4. Permit program sta

5. OK

6. Insert LAD/FBD program

7. Name: KOPFUP_1

8. Open editor automatically

9. OK

Create program:

	Name	Variable type	Data type
1	tmp	VAR	BOOL
2			

Enter variable „tmp“

KOPFUP_1 - Title
Comment

001 - title
Comment

```

    toggle --- 1 --- & --- tmp --- =
    
```

- Save and compile

SIMOTION programs – Task assignment

- Open execution system
- Assign program “Motion” to Motion Task 1 and “Loop” to Motion Task 2
- In task configuration, check “Activation after Startup task” for Motion Task 1
- Assign program “kopfup_1” to BackgroundTask

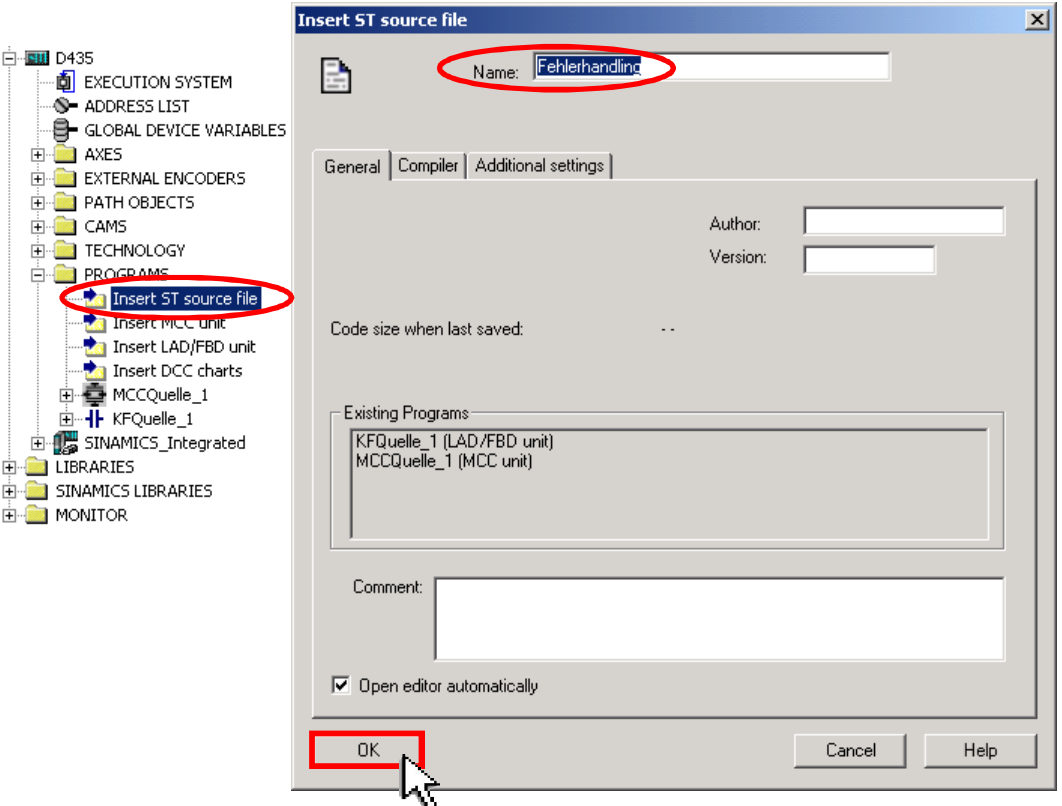
Double click

Close and save

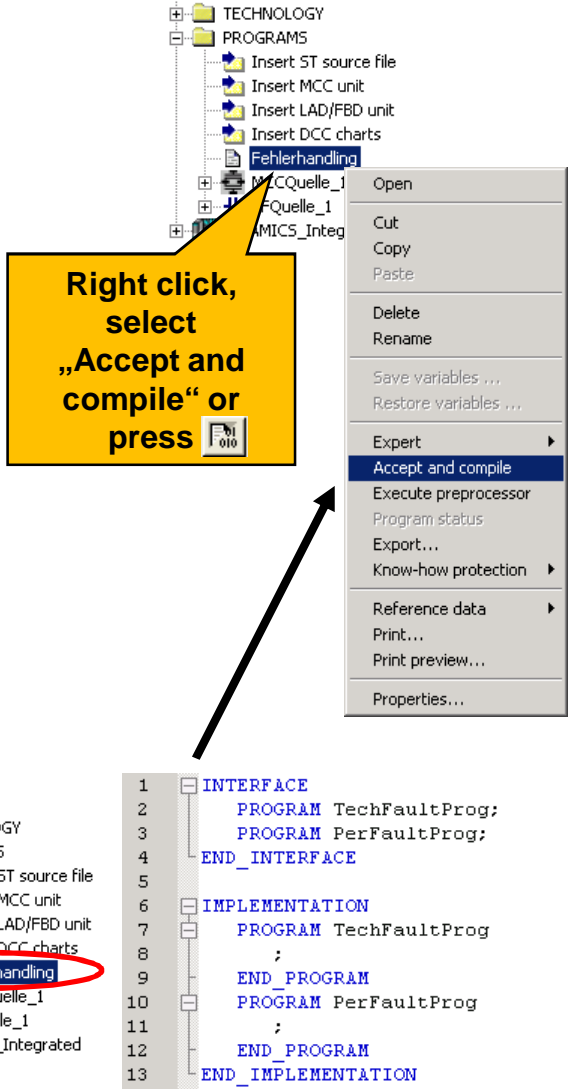
Close editor (wwbs:791)
 D435 - EXECUTION SYSTEM has been changed.
 Would you like to accept the changes to the project?
 Yes No Cancel

Fault handling

- Insert ST program "Fehlerhandling" („Fault handling“).



- Compile and save.



Fault handling - Task assignment

- Assignment of the ST programs to SystemInterruptTask → FaultTasks in execution system



Double click

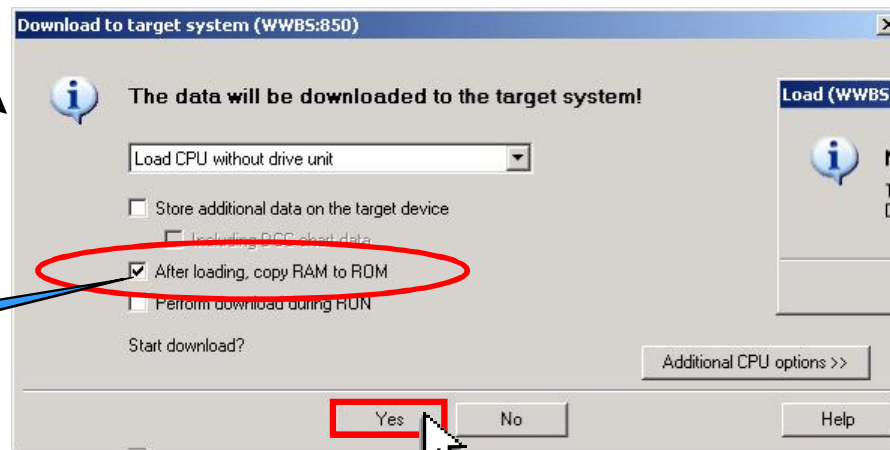
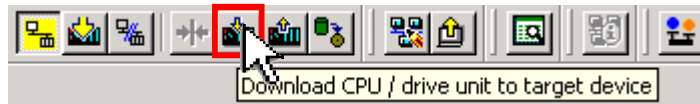
**Assignment ST program "TechFaultProg" to TechnologicalFaultTask
Assignment ST program "PerFaultProg" to PeripheralFaultTask**

Close editor (wwbs:791)
 ⚠ D435 - EXECUTION SYSTEM has been changed.
 Would you like to accept the changes to the project?
 Yes No Cancel

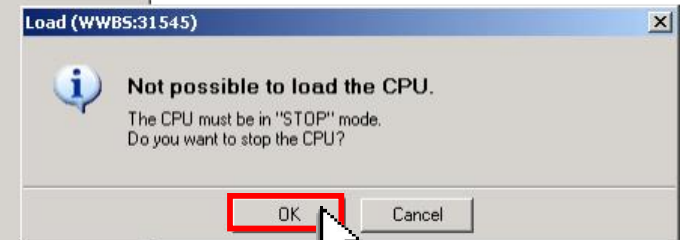
Close Help

Download SIMOTION program to target system

- Save settings and compile 
- Connect to target system 
- Download SIMOTION D435 project to target device



Copy RAM to ROM



Start SIMOTION MCC program with variable

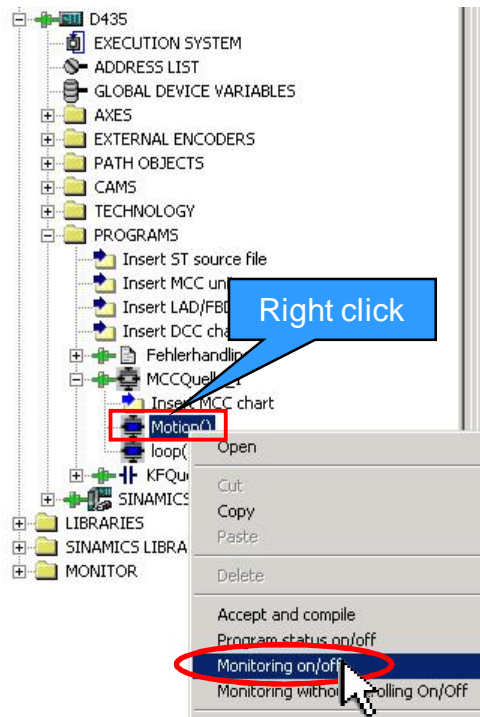
- Open "GLOBAL DEVICE VARIABLES" and control variable "enable_mcc" = true to start MCC Chart

The screenshot shows the SIMOTION SCOUT interface. In the left-hand tree view, the 'GLOBAL DEVICE VARIABLES' folder is highlighted with a red box and a blue callout bubble that says 'Double click'. A context menu is open over the 'D435' folder, with 'Operating mode ...' selected and circled in red. Below the main window, the 'D435: Global device variables' table is visible. The 'enable_mcc' variable is circled in red, and its 'Control value' is set to 'TRUE', also circled in red. A blue callout bubble points to the 'Control' button in the table header, with the text 'Set „True“ and „Control immediately“'. To the right, the 'D435 : Operating mode ...' dialog box is shown, with the 'RUN' button circled in red.

Name	Data type	Retain	Array length	Display format	Initial value	Status value	Control value	Comment
1 enable_mcc	BOOL	<input type="checkbox"/>	1	All	FALSE	FALSE	<input checked="" type="checkbox"/> TRUE	
2 toggle	BOOL	<input type="checkbox"/>	1	All	FALSE	FALSE	<input type="checkbox"/>	

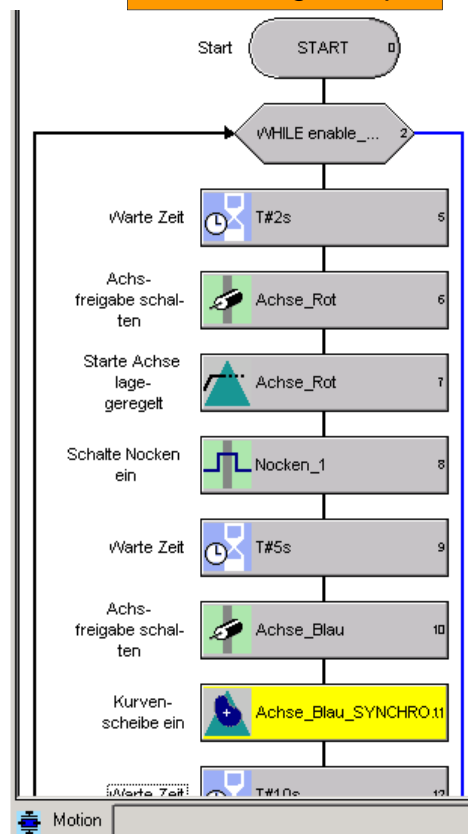
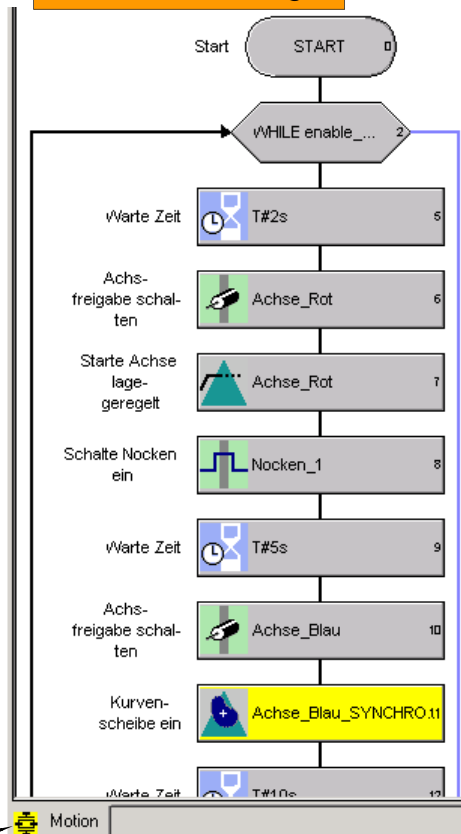
Monitoring SIMOTION MCC chart

- Enable Monitoring on/off



MCC monitoring

MCC single step



Yellow status for monitoring

Blue status for single step

Monitoring SIMOTION LAD/FBD unit

- Enable Program status ON/OFF

Parameters/variables | I/O symbols | Structures | Enumerations

	Name	Variable type	Data type
1	tmp	VAR	BOOL
2			

KOPFUP_1 - Title
Comment

001 - Title
Comment

```

toggle --> [ & ] --> [ tmp = ]
    
```

Right click

Color indicator (red und green)

LAD/FBD toolbar

Trace signals

- Open Trace



- Select D435, select signals

The screenshot shows the 'Signal selection Trace' dialog box with the following table of signal assignments:

Channel	Signal name
1	_to.Achse_Blau.basicMotion.position
2	_to.Achse_Rot.basicMotion.position
3	_to.Nocken_1.state
4	
5	
6	
7	
8	

The 'Signals' list in the background shows the following signals:

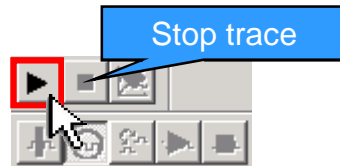
No.	Active	Signal
1	✓	_to.Achse_Blau.basicMotion.position
2	✓	_to.Achse_Rot.basicMotion.position
3	✓	_to.Nocken_1.state
4		
5		
6		

Annotations in the image:

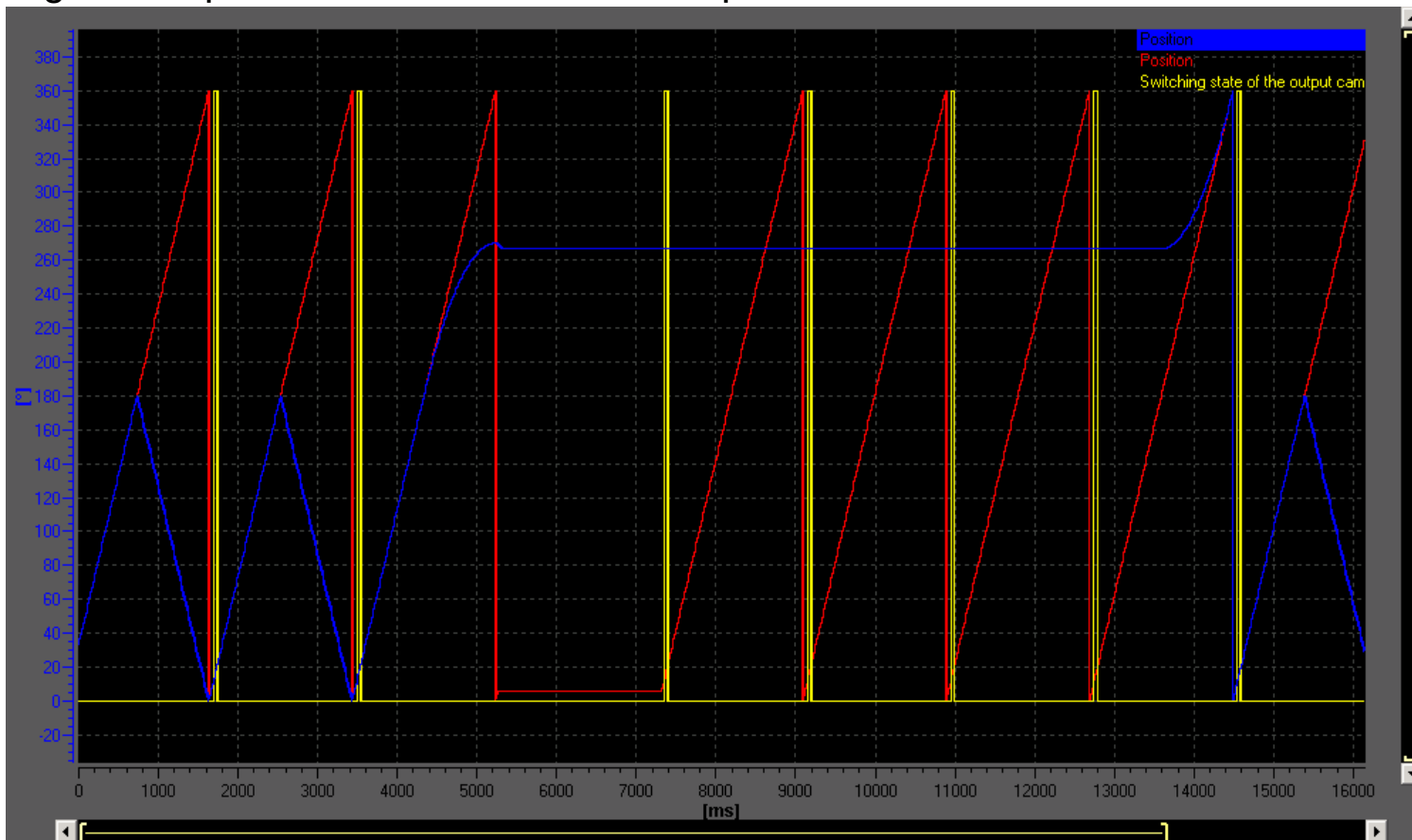
- (1.) Open signal selection: Points to the '...' button next to 'Switching state of the output cam' in the signal list.
- (2.) Assign signal to channel: Points to the '3' button in the 'Accept selected variable in channel' row.
- (3.) Isochronous endless trace: Points to the 'Isochronous recording - endless trace' dropdown menu.
- (4.) Download parameterization: Points to the download icon in the 'Signals' toolbar.

Trace signals

- Start trace



- Time diagram for position of both axes and output cam state



Symbol browser

- Control system variables at symbol browser
→ e.g. select symbol browser and then the axis

All symbols can be monitored online

The screenshot displays the SIMOTION D435 software interface. The top-left pane shows a project tree with the following structure:

- D435
 - EXECUTION SYSTEM
 - ADDRESS LIST
 - GLOBAL DEVICE VARIABLES
 - AXES
 - Inert axis
 - Achse_Blau** (highlighted with a red circle)
 - Achse_R1
 - EXTERNAL ENCODERS
 - PATH OBJECTS
 - CAMS
 - TECHNOLOGY
 - PROGRAMS
 - SINAMICS_Integrated
 - LIBRARIES
 - SINAMICS LIBRARIES
 - MONITOR

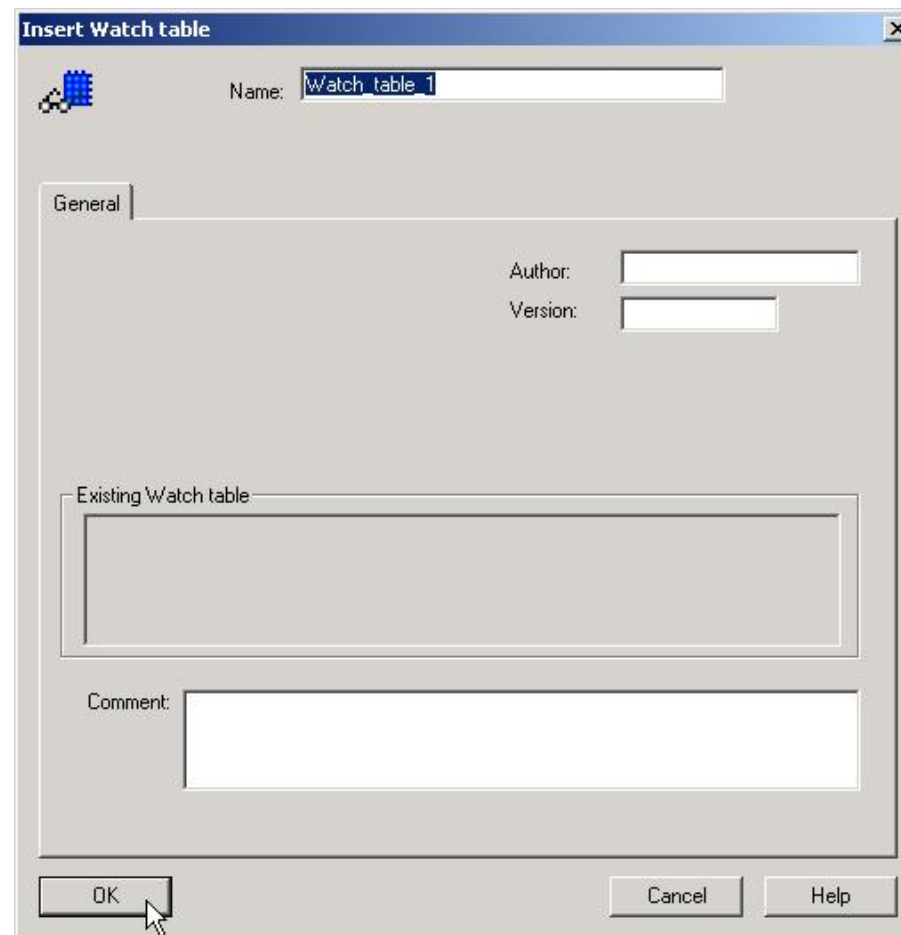
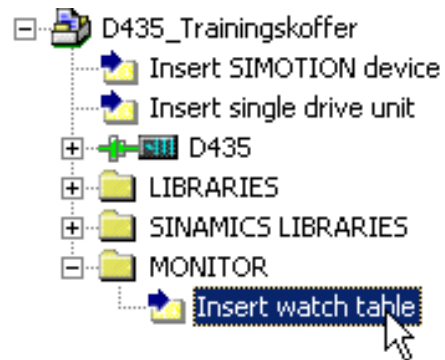
The bottom pane, titled "D435.Achse_Blau: Symbol browser", displays a table of symbols. The table has four columns: Name, Information, Data type, and Display format. The row for "position" is highlighted with a red border.

Name	Information	Data type	Display format
13	override	Override settings	'StructAxisOverride'
14	motionStateData	Dynamic response status of the axis (current IPO)	'StructAxisMotionStateData'
15	basicMotion	Motion state in the main coordinate system	'StructAxisMotionData'
16	position	Position	LREAL DEC-16
17	velocity	Velocity	LREAL DEC-16
18	acceleration	Acceleration	LREAL DEC-16
19	superimposedMotion	Motion state in the superimposed coordinate system	'StructAxisMotionData'
20	moveCommand	Execution status of '_move command' at the axis	'StructAxisMoveCommand'
21	stopEmergencyCommand	Execution status of '_stopEmergency command' at ...	'EnumActiveInactive'
22	simulation	Simulation mode	'EnumActiveInactive'
23	control	Operational status	'EnumActiveInactive'
24	reset	Execution status of '_reset command'	'EnumActiveInactive'
25	error	Technological alarm at the axis	'EnumYesNo'
26	errorReaction	Active reaction to technological alarm	'EnumAxisErrorReaction'
27	sensorData	Current encoder values	'ARRAY [1..8] OF StructAxisSensorData'
28	sensorSettings	Actual value via system variable	'StructAxisSensorSettings'
29	servoSettings	Setpoint influence	'StructAxisServoSettings'
30	dataSetMonitoring	Information for data set switchover	'StructDataSetMonitoring'
31	userDefaultTorqueLimiting	User default torque limitation	'StructAxisUserDefaultTorqueLimit'
32	velocityTimeProfileCommand	Execution status of the speed profile motion on the...	'StructAxisVelocityTimeProfileCommand'
33	torqueLimitingCommand	Torque limitation execution status	'StructAxisTorqueLimitingCommand'
34	activationModeChangedCon...	This system variable activates changed configurati...	'EnumToActivationModeSetConfigData'

At the bottom of the interface, there are two icons: "Alarms" and "Symbol browser". The "Symbol browser" icon is highlighted with a red circle and a mouse cursor.

Watch table

- An alternative to the symbol browser is a watch table. In this you can observe variables from different objects/programs:



Watch table

The screenshot shows the 'Symbol browser' window for 'D435.Achse_Rot'. A context menu is open over the 'basicMotion' variable, with the 'Add to watch table' option selected. A sub-menu is visible, showing 'New watch table' and 'Watch_table_1' (which is highlighted by the mouse cursor).

Name	Information	Data type	Display format	Offline value
All	All	All	All	All
17 minusLimitsOfDynamics	Limitation of dynamic response values of the axis for motio...	'StructAxisDynamicLimit'		
18 userDefaultDynamics	User defaults for dynamic response values	'StructAxisDefaultType'		
19 override	Override settings	'StructAxisOverride'		
20 motionStateData	Dynamic response status of the axis (current IPO)	'StructAxisMotionStateData'		
21 basicMotion	Motion state in the main coordinate system	'StructAxisMotionData'		
22 position		LREAL	DEC-16	0.0000000000
23 velocity		LREAL	DEC-16	0.0000000000
24 acceleration		LREAL	DEC-16	0.0000000000
25 superimposed	Coordinate system	'StructAxisMotionData'		
26 moveCommand	Command at the axis	'StructAxisMoveCommand'		
27 stopEmergency		'EnumActiveInactive'		[4] ACTIVE
28 simulation		'EnumActiveInactive'		[4] ACTIVE
29 control		'EnumActiveInactive'		[4] ACTIVE
30 reset		'EnumActiveInactive'		[4] ACTIVE
31 error	Technological alarm at the axis	'EnumYesNo'		[91] NO
32 errorReaction	Active reaction to technological alarm	'EnumAxisErrorReaction'		[93] NONE
33 sensorData	Current encoder values	'ARRAY [1..8] OF StructAxisSensorData'		
34 sensorSettings	Actual value via system variable	'StructAxisSensorSettings'		
35 servoSettings	Setpoint influence	'StructAxisServoSettings'		

At the bottom of the window, there are tabs for 'Alarms', 'Symbol browser', and 'Watch table'. The status bar at the bottom indicates 'Press F1 to open Help display.'

- Right click on variable → Add to watch table → Watch_table_1
- Now you can observe all variables which you previously added to the Watch_table_1.

Service overview

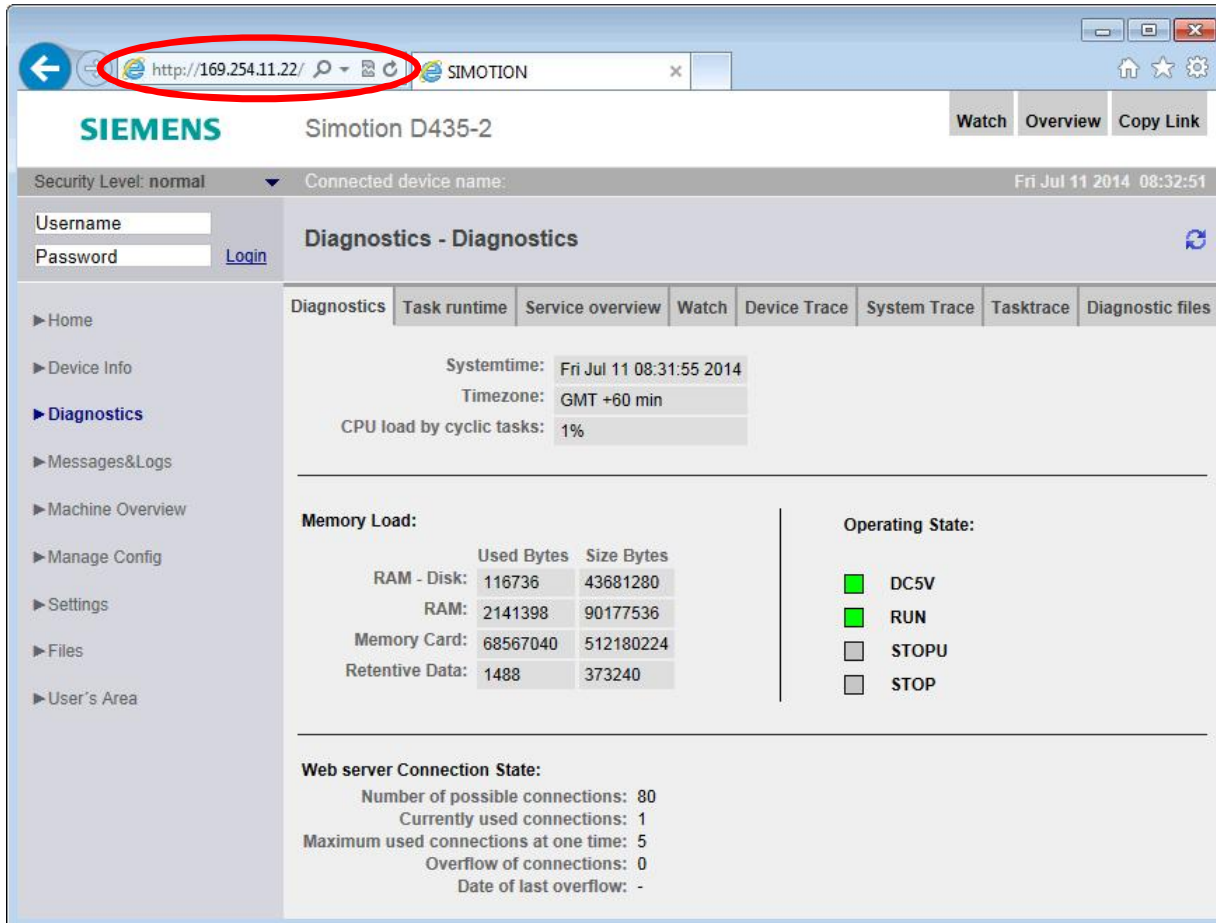
- The axis status can be observed by right clicking on project name, selecting Target system.

Right click

D435		
	Achse_Blau	Achse_Rot
Position control status	●	●
Operational status	●	●
Technological alarm at the axis	○	○
Cyclic drive interface active	●	●
Drive enable	●	●
Power enable	●	●
Actuator error	○	○
Status of axis motion	●	●

IT DIAG – Integrated SIMOTION diagnostics

- Enter the IP address of the SIMOTION device in the web browser (e.g. <http://169.254.11.22>).



NOTE: It might be necessary to disable the “automatic configuration script” first.

NOTE: There must be an Ethernet connection to use IT DIAG

NOTE: For more information about SIMOTION IT, see SIMOTION documentation or the Utilities & Applications.



Further information of SIMOTION programming can be obtained using the sample application

“SIMOTION Example for Beginners”.

The corresponding project and a detailed documentation can be found in the Utilities & Applications under: Examples → Example for Beginners