Welcome

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

SIMOTION

Guideline
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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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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 und 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.

Two arrows must be visible when inserting the CF card
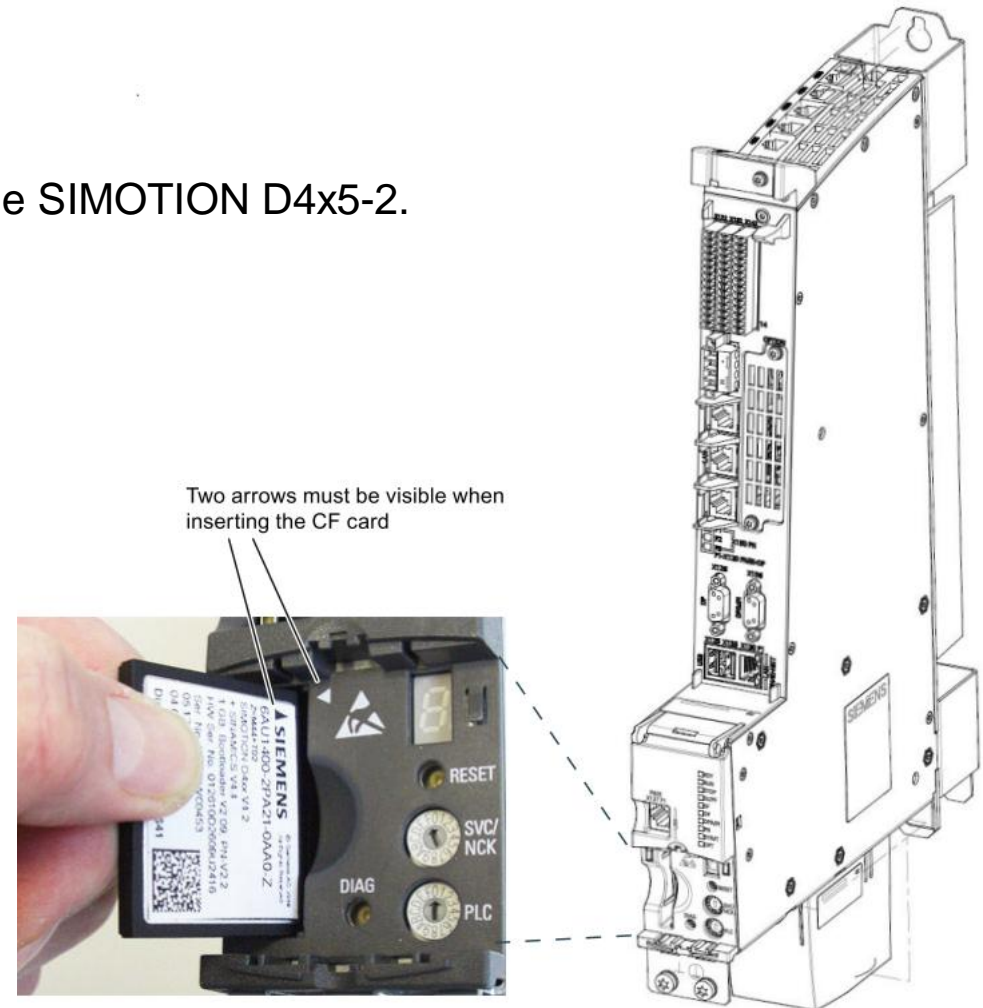
Create a new project

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**
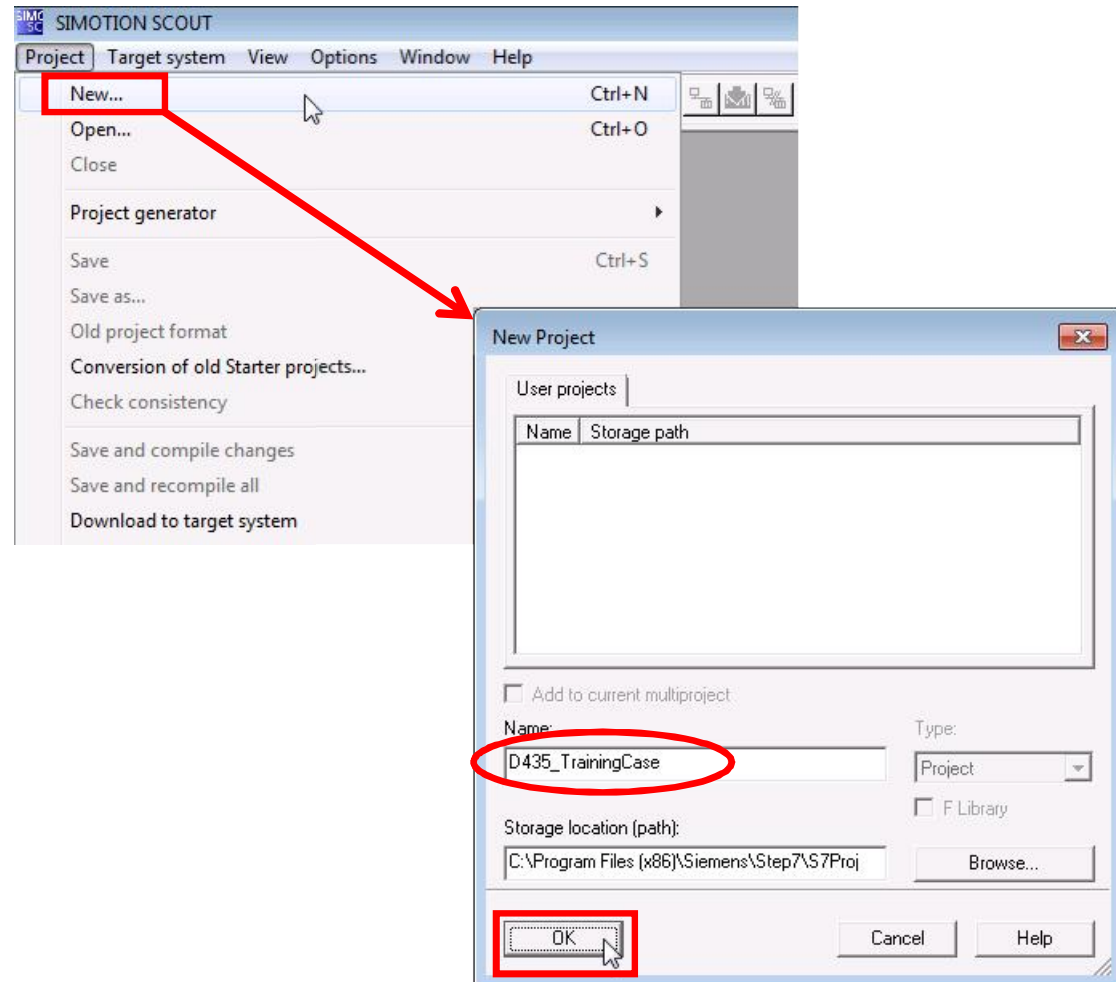
Insert new device

- 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.

Double click
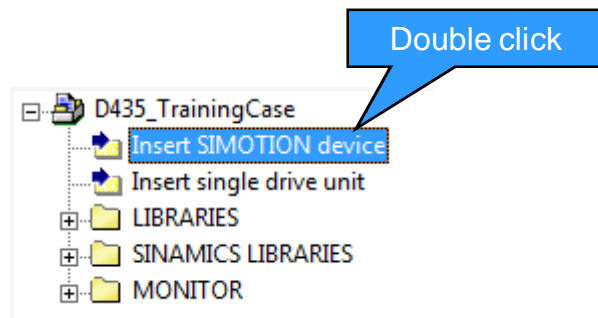
- Select device characteristic D435-2 DP/PN
- Select SIMOTION version V4.4
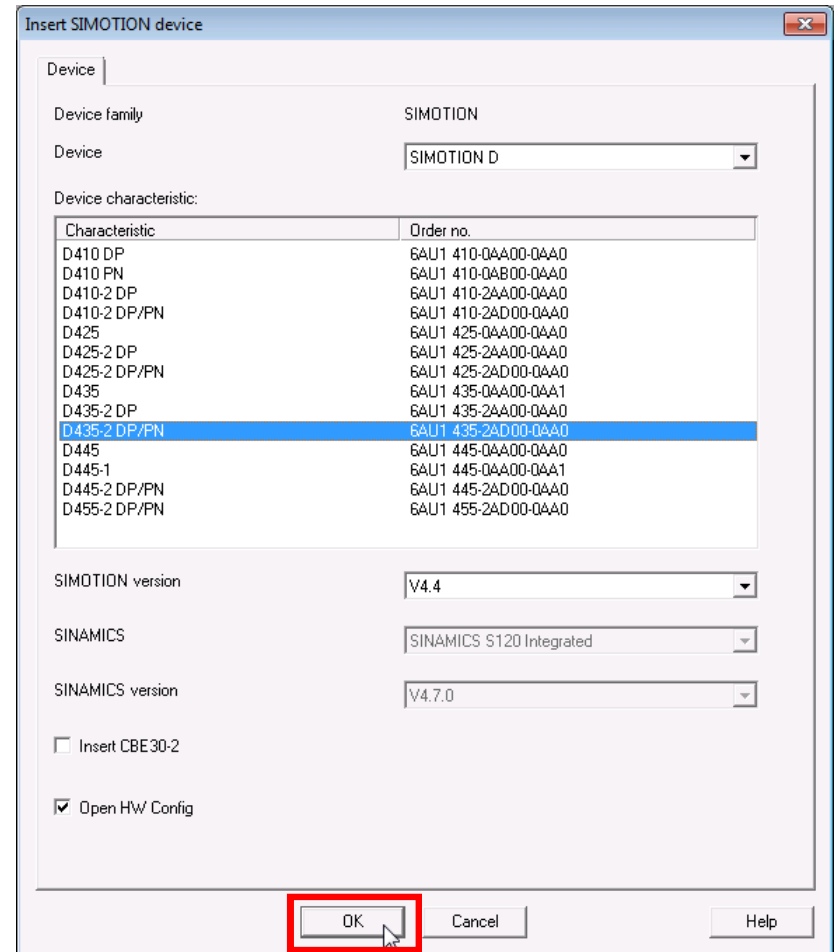
Interface Selection

- 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).

Industrial Ethernet

1) PN/IE-OP (X120 P1, only for D4x5-2 DP)

2) PN/IE-NET (X130 P1)

3) PN/IE (X127 P1)

Depending on your PC/PG another interface might be necessary.
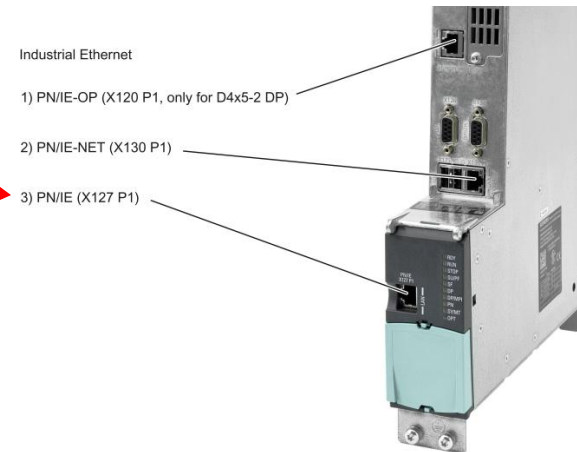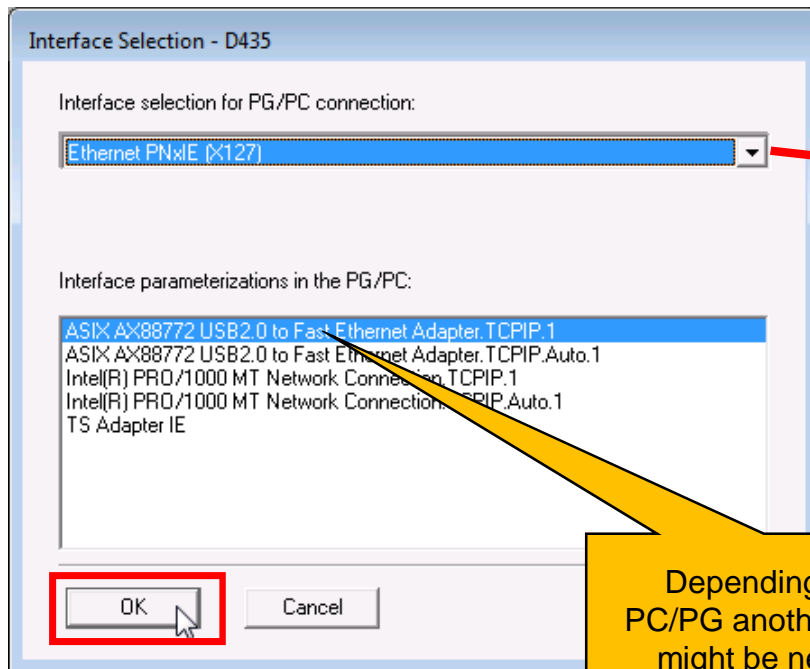
In case of connection problems check "Set PG/PC interface" and "Assign PG/PC" for correct settings.

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.

- 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

- 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
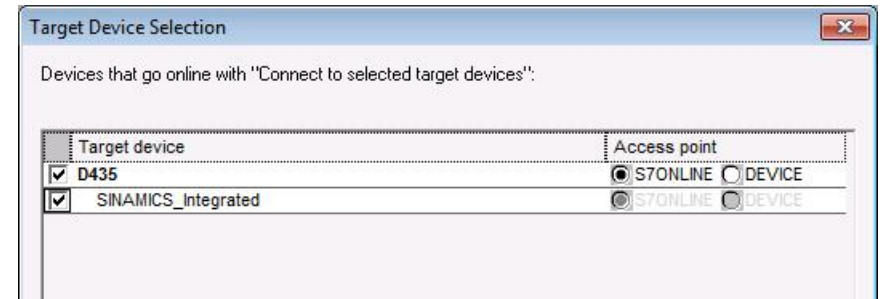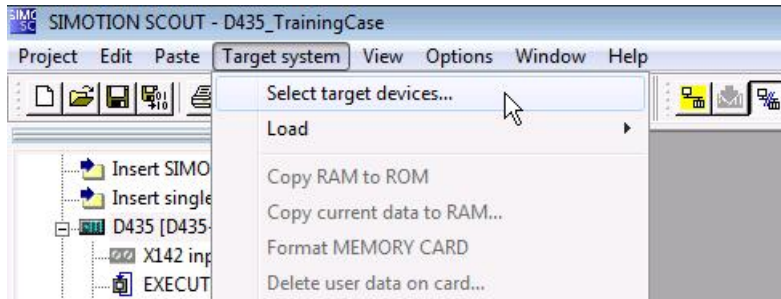
▪ Connect to selected target devices
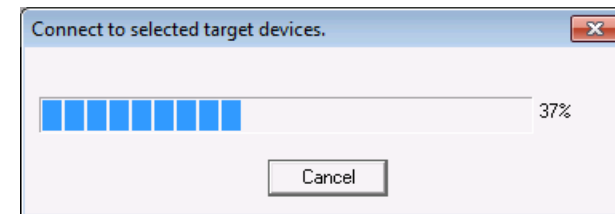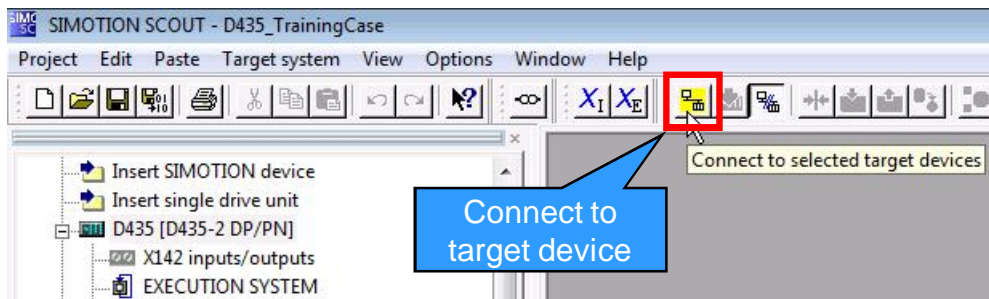
Restore factory settings of the SINAMICS_Integrated

- Restore factory settings
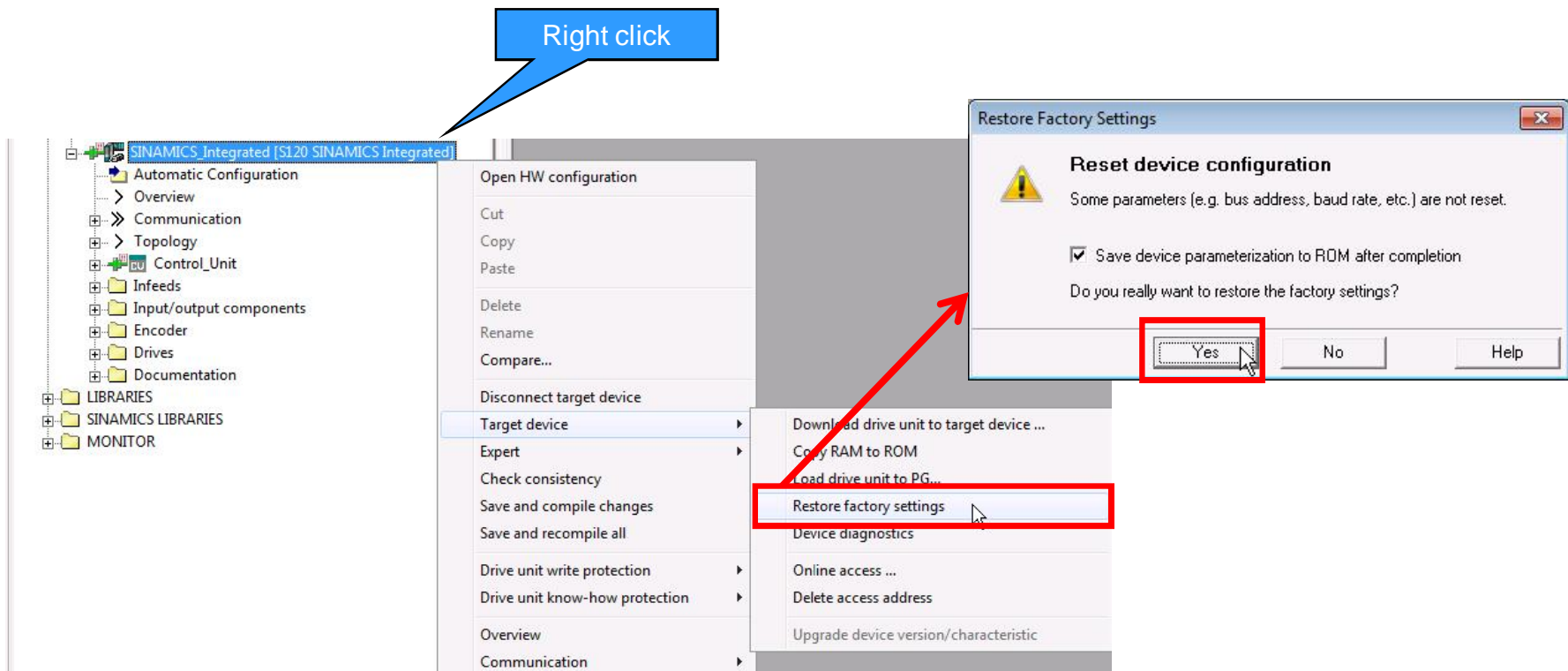
Automatic configuration

- Start automatic configuration
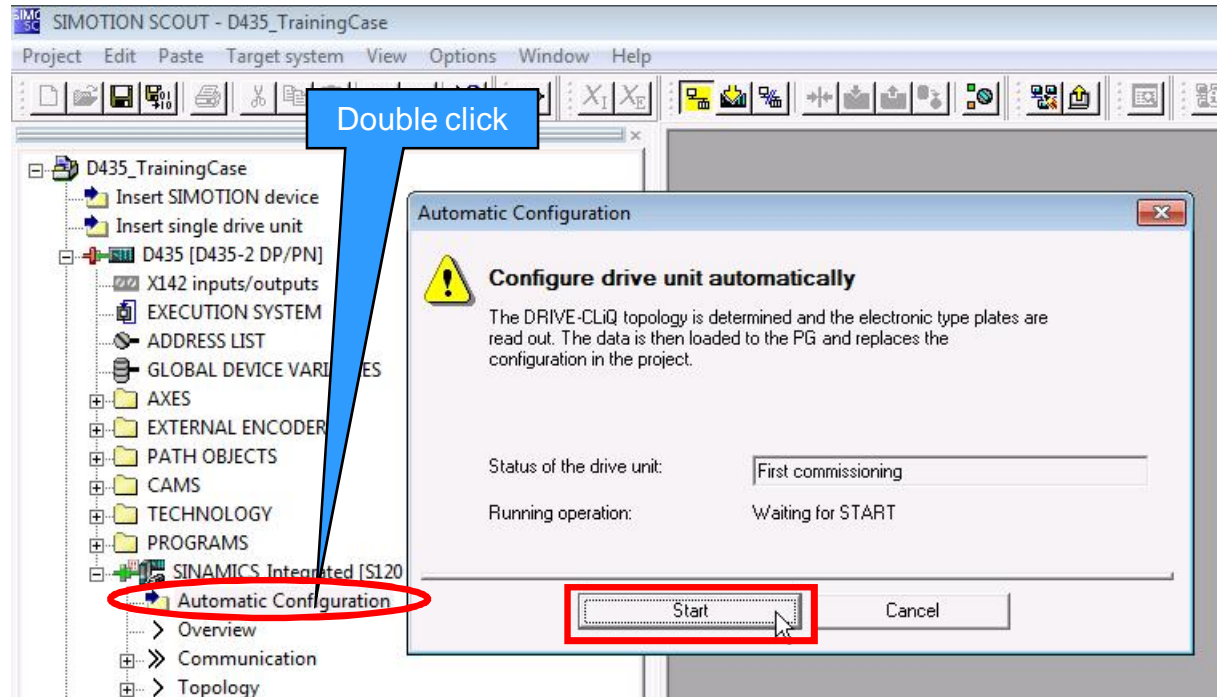
- Because the hardware is already wired in the training case, the automatic configuration can be used.

- 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.
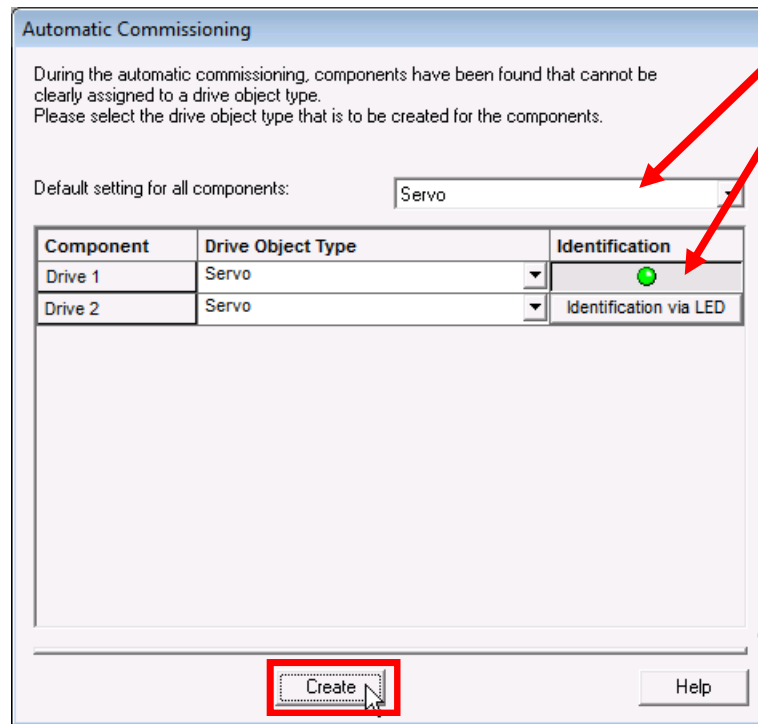
Select the drive object type.

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

Click "Create" to complete automatic commissioning.

Automatic Commissioning

During the automatic commissioning, components have been found that cannot be clearly assigned to a drive object type.
Please select the drive object type that is to be created for the components.

Default setting for all components: Servo

Component	Drive Object Type	Identification
Drive 1	Servo	🟢
Drive 2	Servo	Identification via LED

Create   Help

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

Automatic Configuration

Automatic configuration completed

Please remember also to complete the configuration of the motors on the following drives or the infeed:

SERVO_03

To do this, go offline and run through the relevant wizard. If there is an infeed, configure further properties (e.g. line filter).

Do you want to go OFFLINE (only with this drive unit)?

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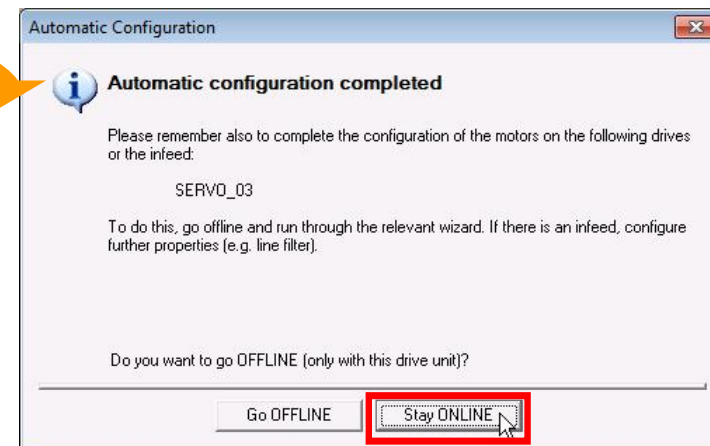
⚠️ If an automatic FW update of a DRIVE-CLiQ component (e.g. the motor module) are carried out after upgrading to SIMOTION V4.4, this process may take several minutes.

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

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

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

Right click

Right click for close

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.
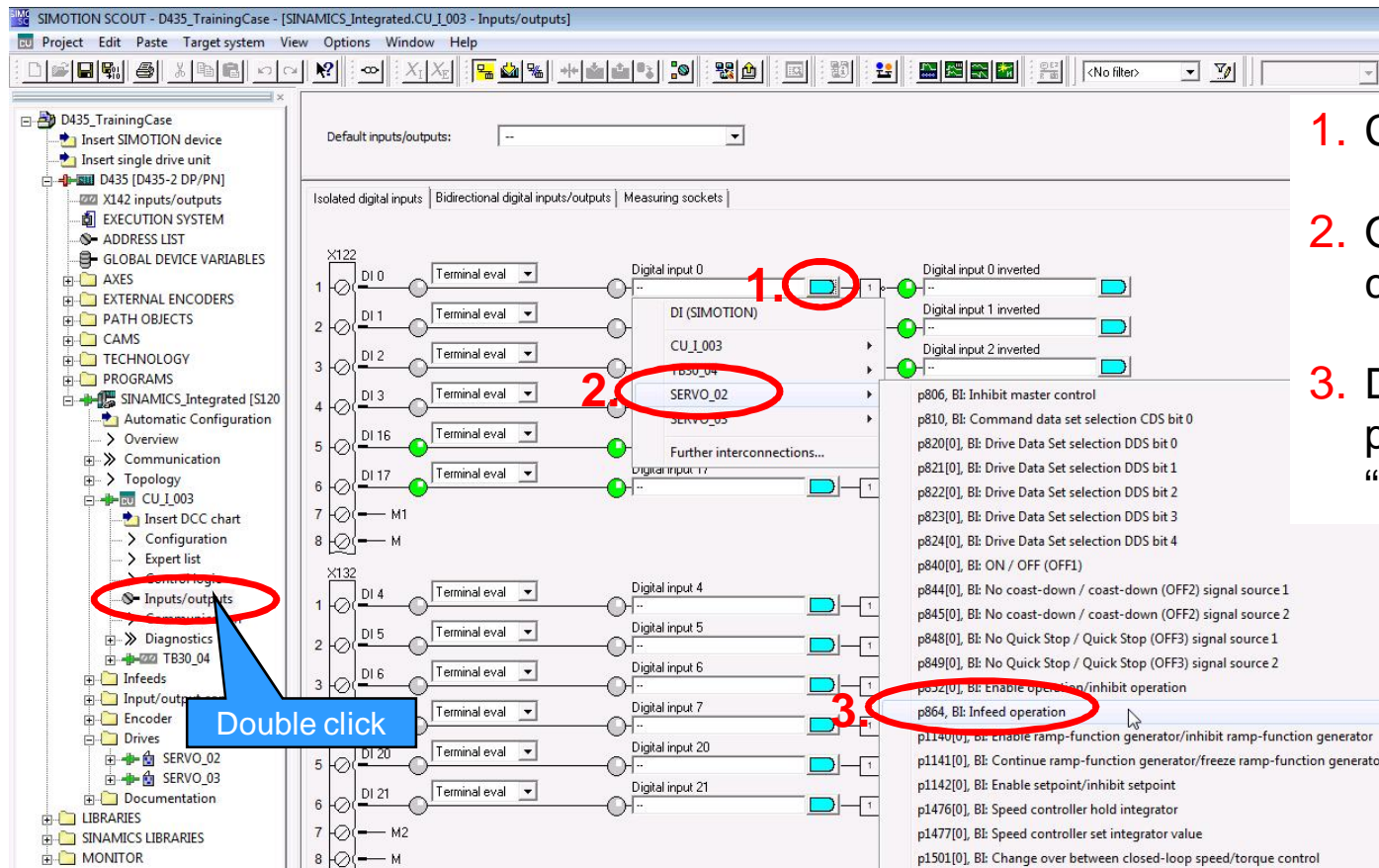
1. Connect digital input DI 0

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.
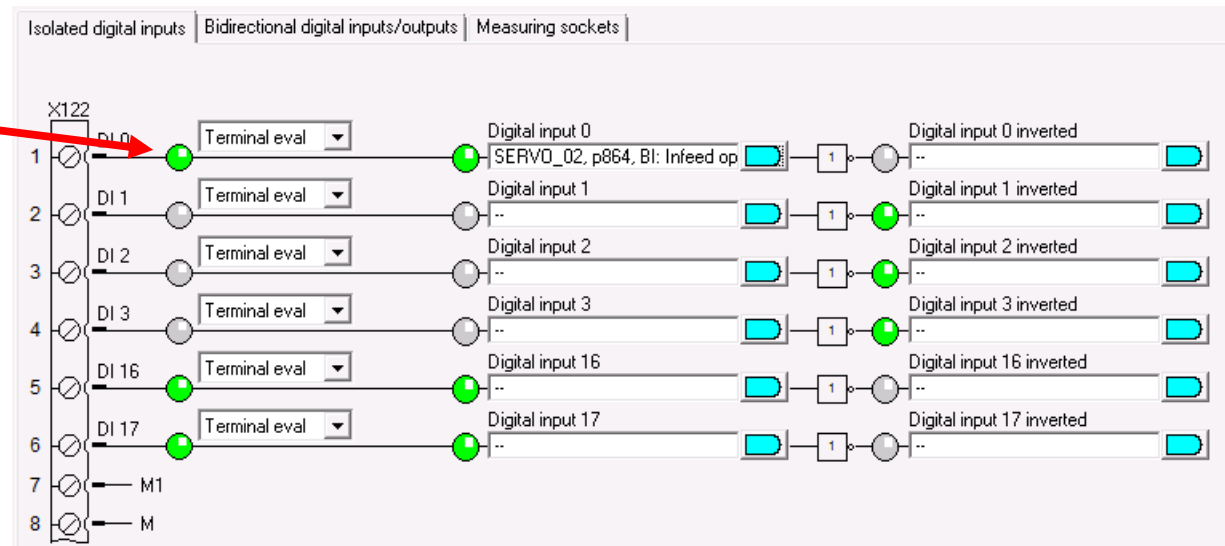
Save and compile

1. Select SINAMICS_Integrated
2. Load CPU / drive unit to PG
3. Save and compile
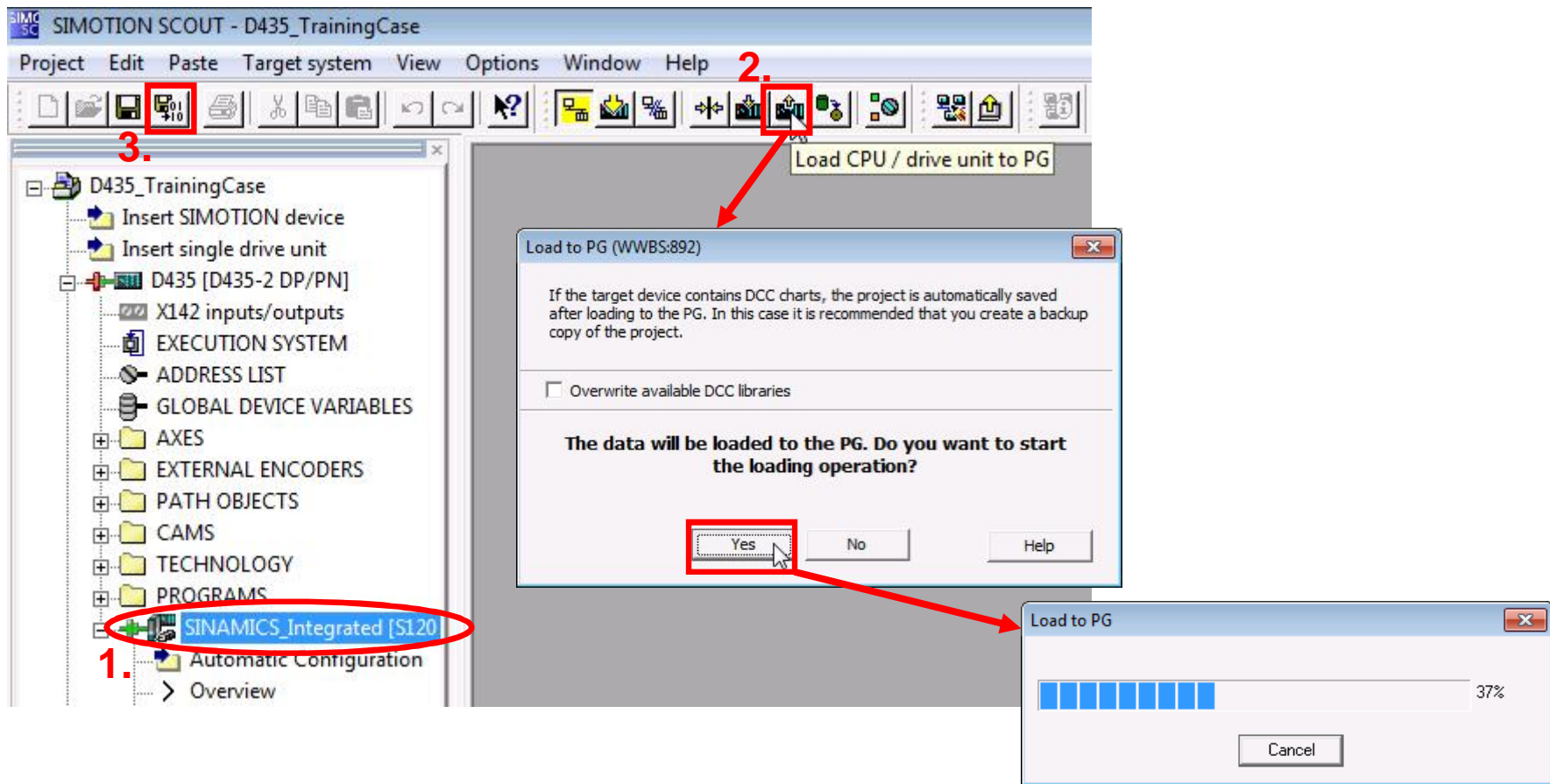
Operate SERVO_02 via drive control panel
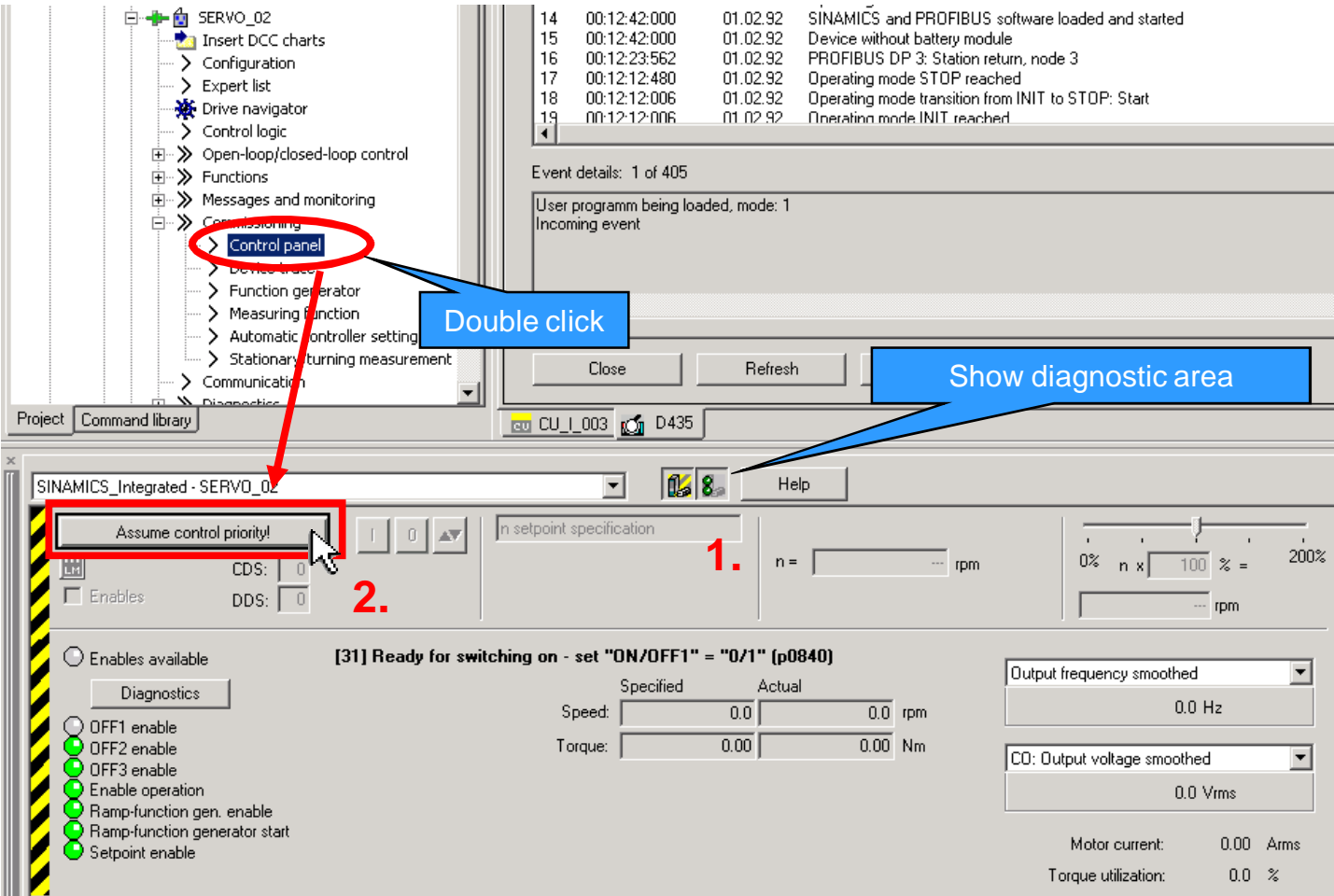
Assume control priority for SERVO_02:

SINAMICS_Integrated
→ Drives
→ SERVO_02
→ Commissioning
→ Control panel

Operate SERVO_02 via drive control panel

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.

- Assume control priority

Assume Control Priority

Life-sign monitoring
- ☑ Active

Monitoring time: 1000 ms

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.

Safety notes

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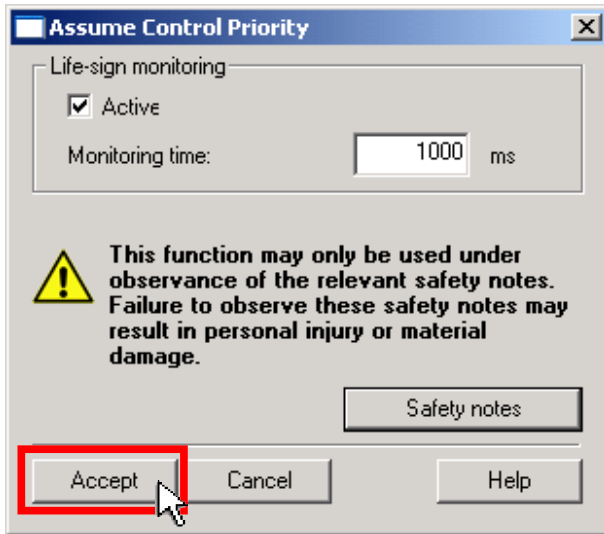
To turn on the Infeed, DI 0 have to be set on the control panel (see slide 18).

SINAMICS_Integrated - SERVO_02   **3.**   Help

Give up control priority!   I   0   n setpoint specification

CDS: 0   n = 100 rpm

☑ Enables   DDS: 8

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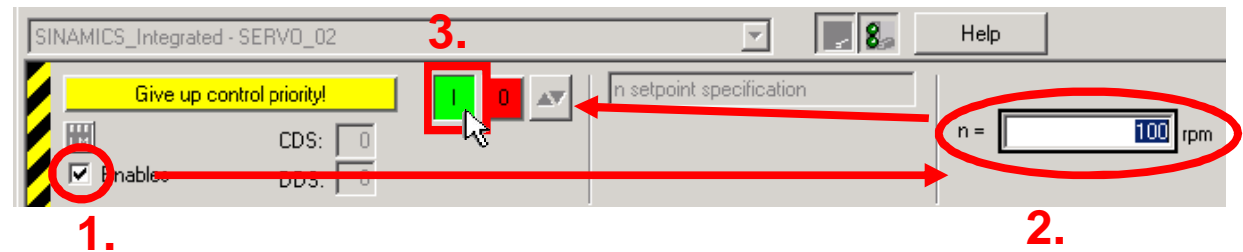
- Enables (1.)
- Set speed setpoint (2.)
- Turn the Drive ON (3.)

SERVO_02 is in Operation

Operate SERVO_02 via drive control panel

- Turn the Drive OFF

- Return control priority
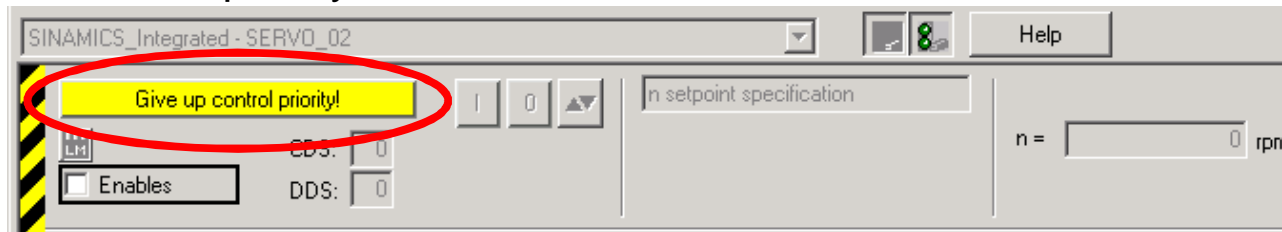
- Acknowledge the alert with "Yes"
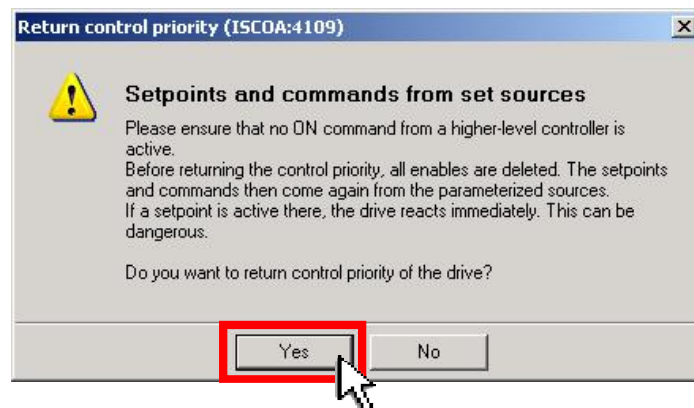
- Go offline

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…".
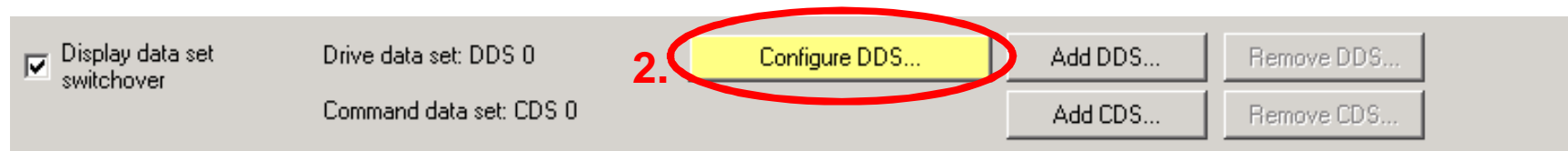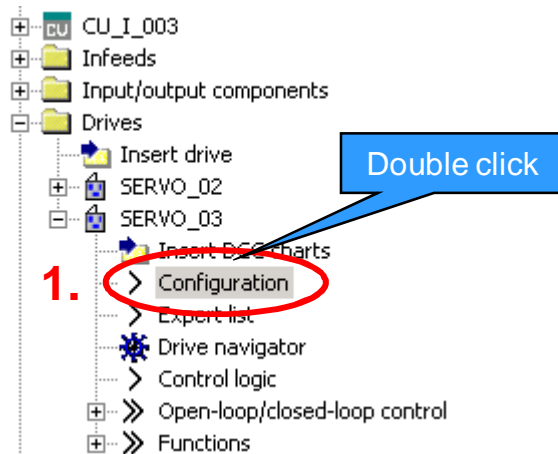
Complete configuration for SERVO_03 – Control structure

- Setup Control structure and Power unit for SERVO_03.

Complete configuration for SERVO_03 – Power unit

- Setup DI 4 for enable Infeed operation SERVO_03.

Complete configuration for SERVO_03 – Power unit connection

▪ Check correct connection for double motor module.
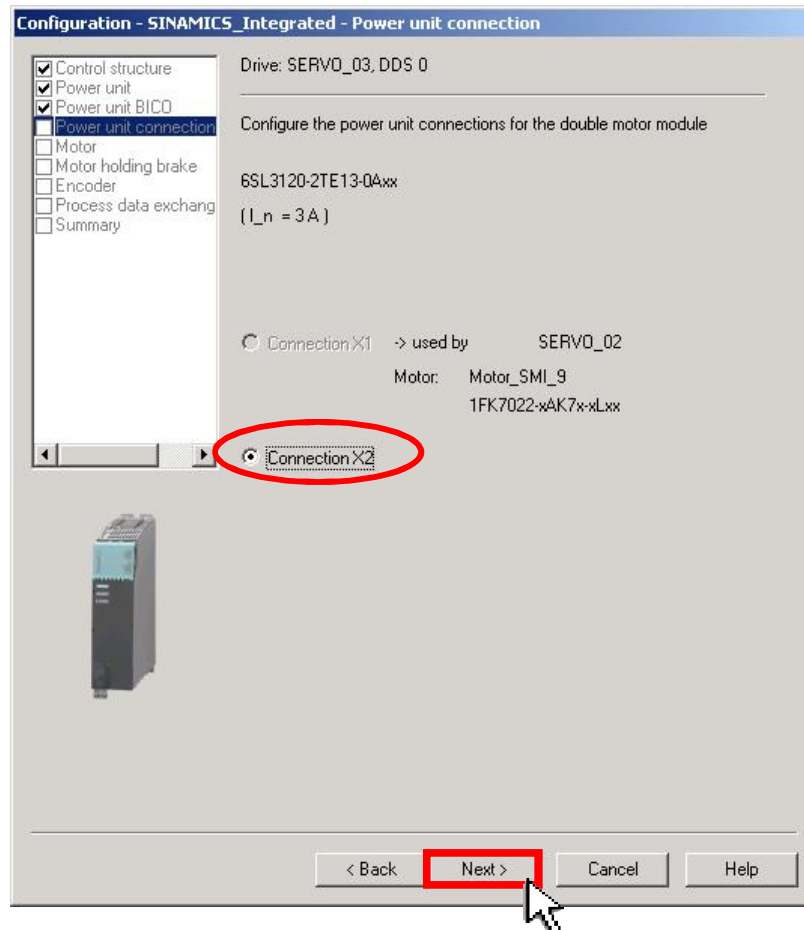
Complete configuration for SERVO_03 – Motor configuration

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

Complete configuration for SERVO_03 – Encoder

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

Complete configuration for SERVO_03 – Process data / Summary

■ Process data / Summary
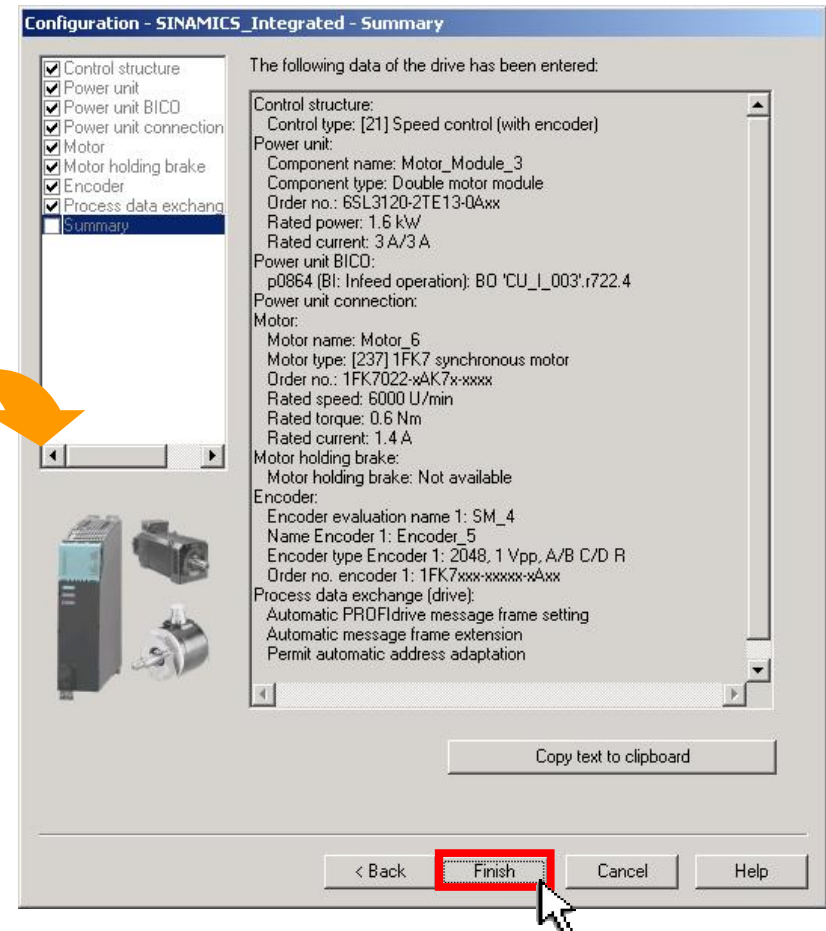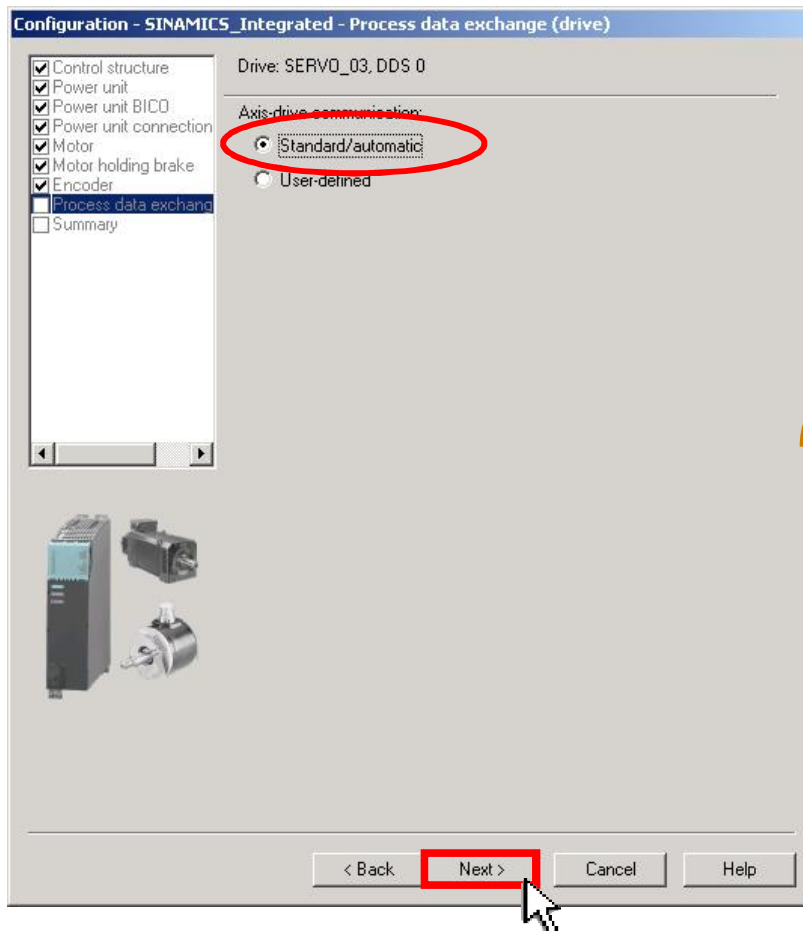
Load settings to target system

- Save project and connect to target system.

- Select SINAMICS_Integrated and load project to target system.

The setup is completed when the connecting symbol is green. The SINAMICS_Integrated is ready to run.
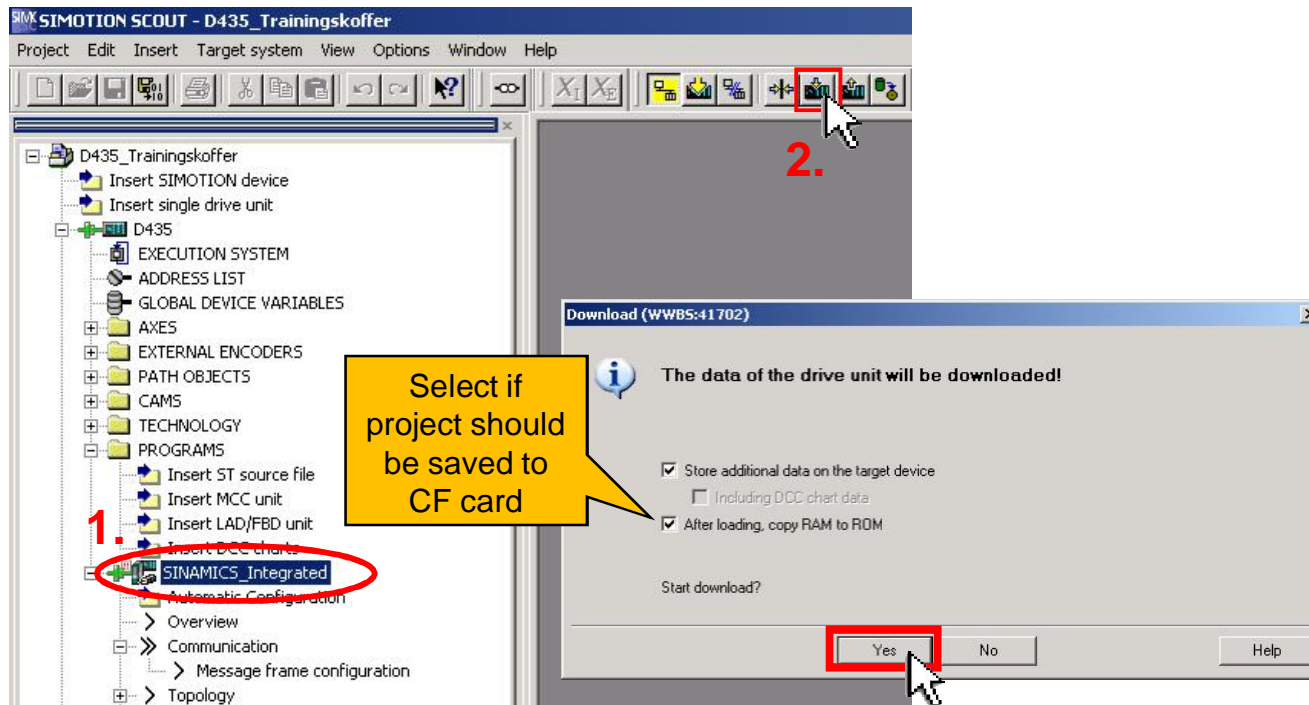
Select if project should be saved to CF card

Download (WWBS:41702)

The data of the drive unit will be downloaded!

☑ Store additional data on the target device
☐ Including DCC chart data

☑ After loading, copy RAM to ROM

Start download?

Yes   No   Help

SINAMICS_Integrated

Load settings to target system
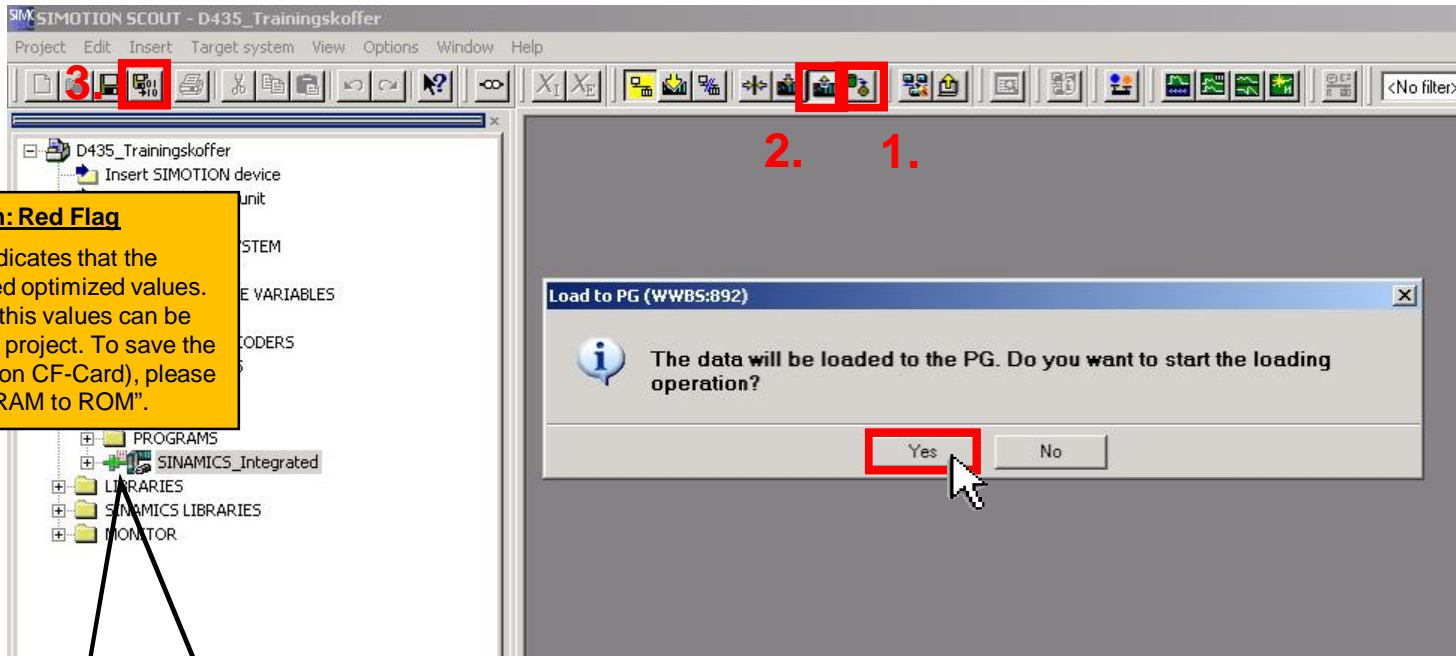
Information: Red Flag

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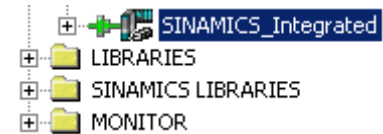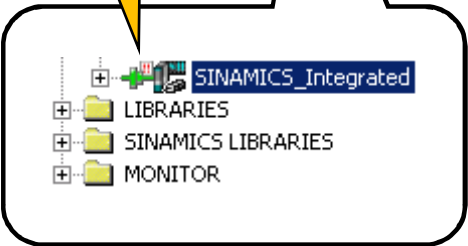
- Copy RAM to ROM (1.)
- Load CPU / drive unit to PG (2.)
- Save and compile (3.)

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)

Training cases contain different motor modules

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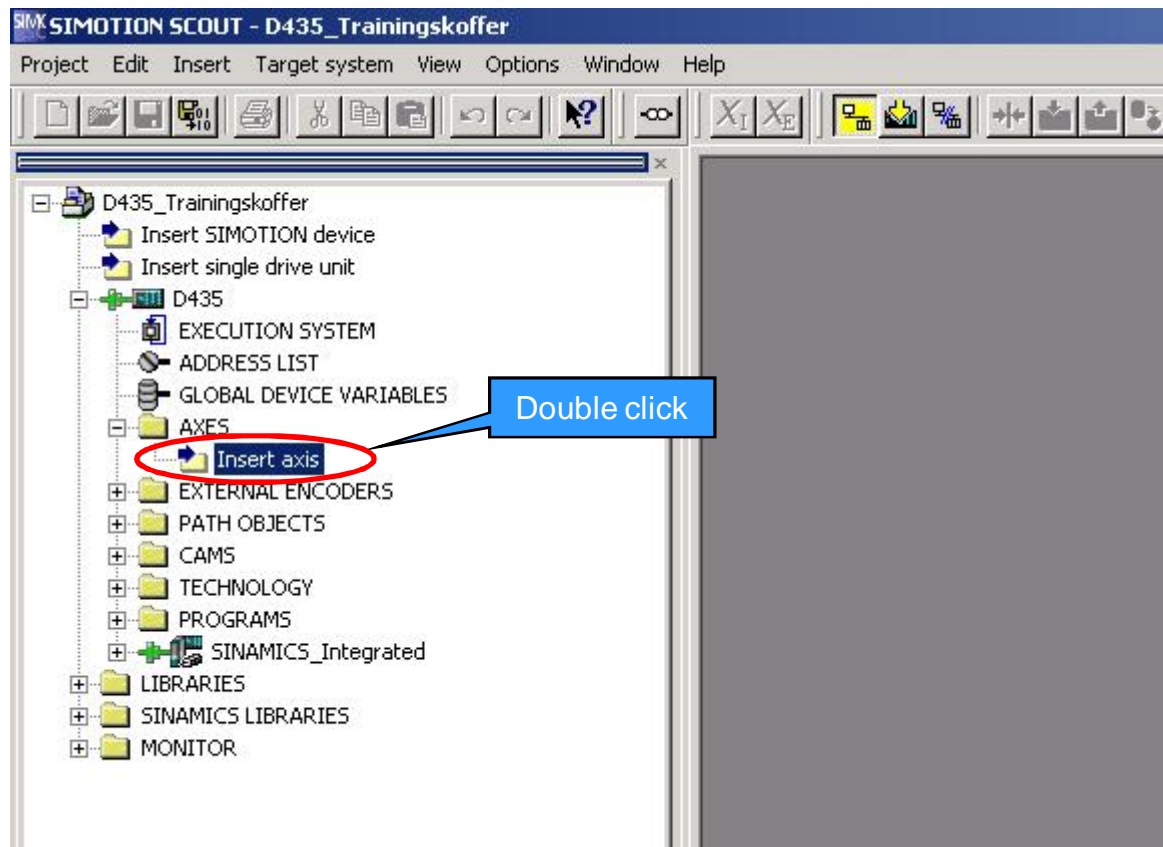
Note: Since SIMOTION V4.2 TOs can be insert in online mode too.

Configure Red_Axis

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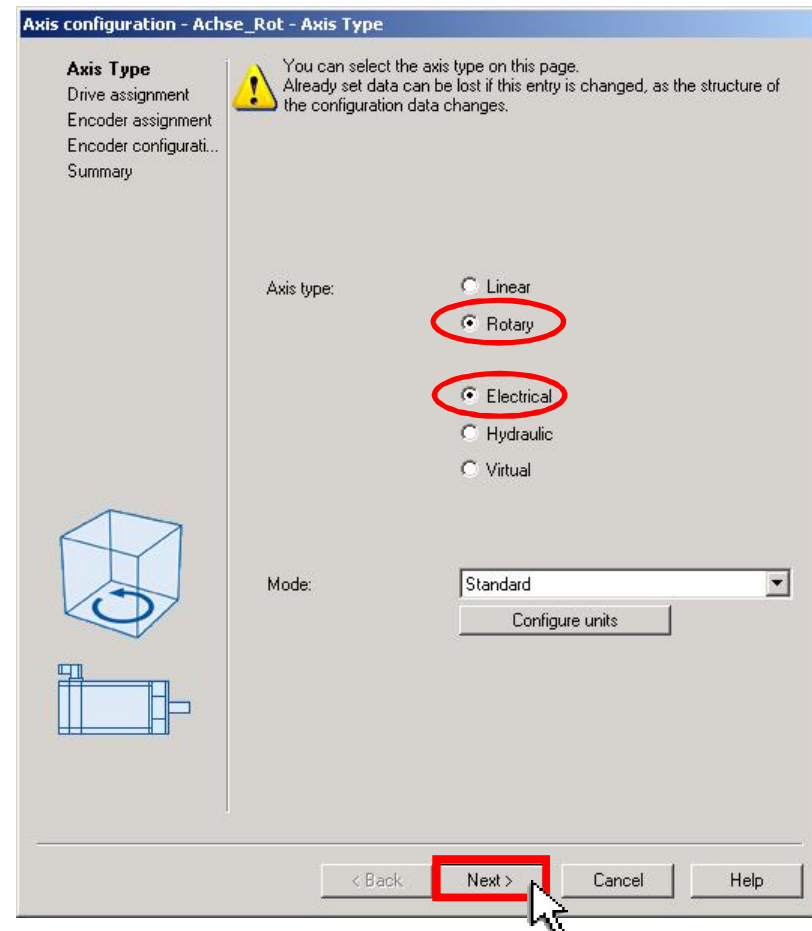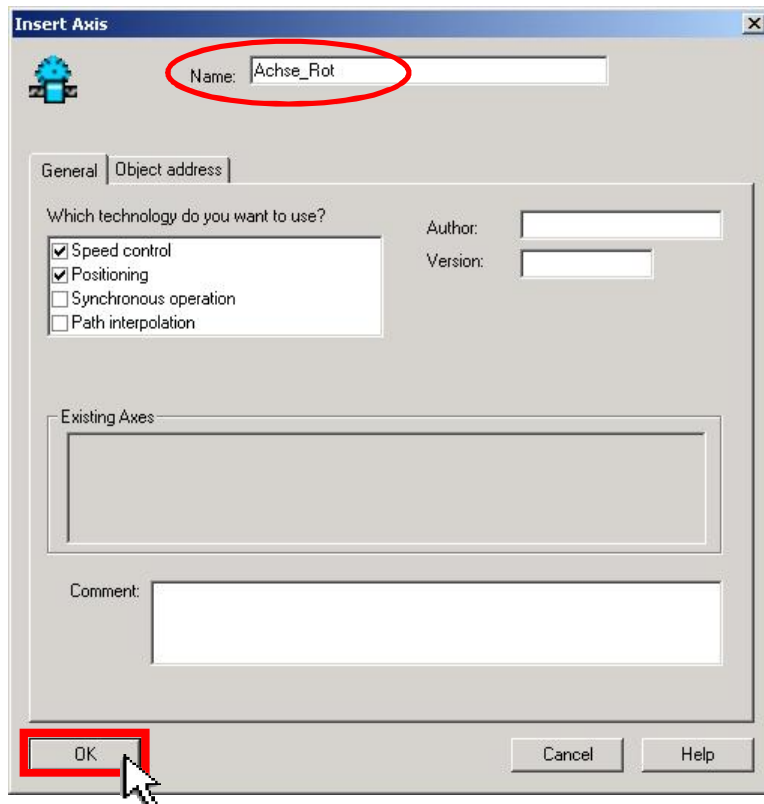
Configure Red_Axis

- Drive assignment: Red_Axis to SERVO_02
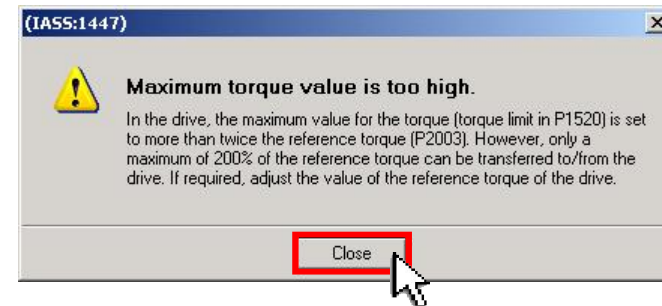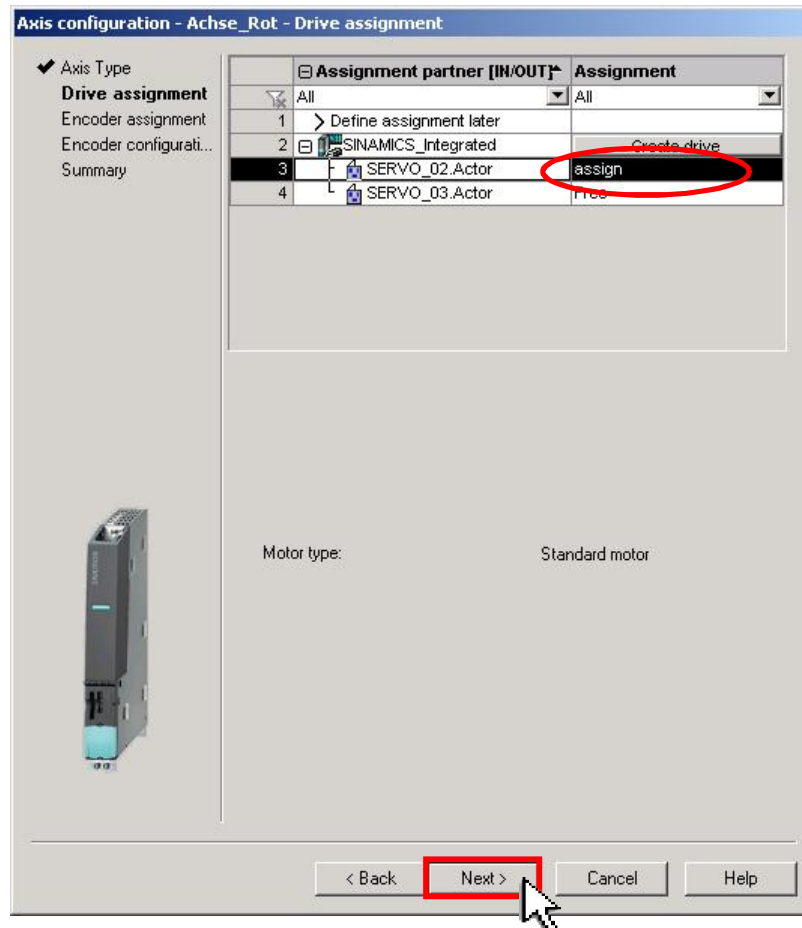
This message appears due to an error in the electronic type label of the motor. That means that an incorrect reference torque is parameterized. See slide 38 to correct this torque-value.

Configure Red_Axis

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

Configure Red_Axis

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

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
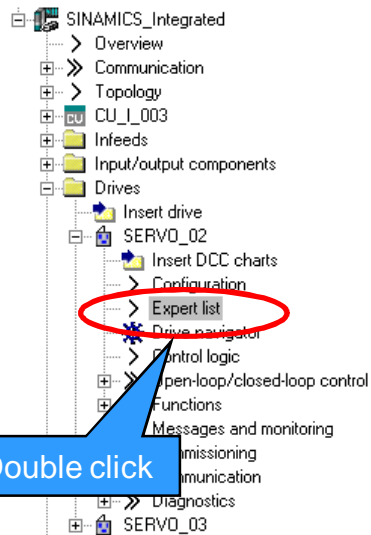
Wrong parameter after automatic configuration:

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

Correct parameter:

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

SINAMICS_Integrated
- Overview
- Communication
- Topology
- CU_I_003
- Infeeds
- Input/output components
- Drives
  - Insert drive
  - SERVO_02
    - Insert DCC charts
    - Configuration
    - Expert list
    - Drive navigator
    - Control logic
    - Open-loop/closed-loop control
    - Functions
    - Messages and monitoring
    - ...missioning
    - ...munication
    - Diagnostics
  - SERVO_03

Double click

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
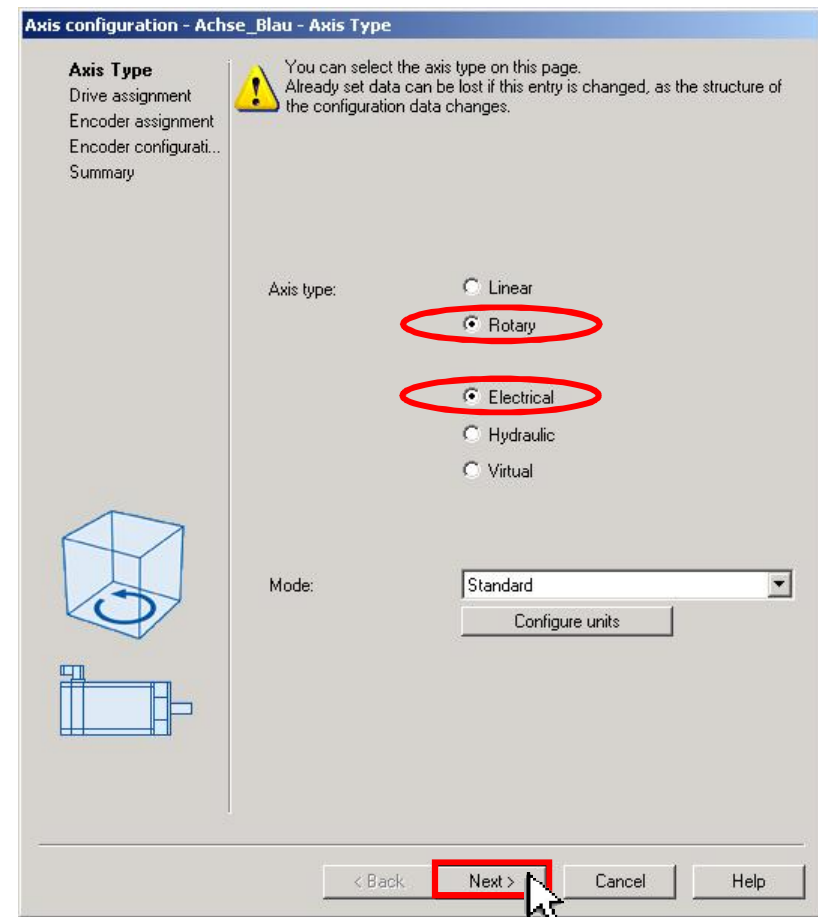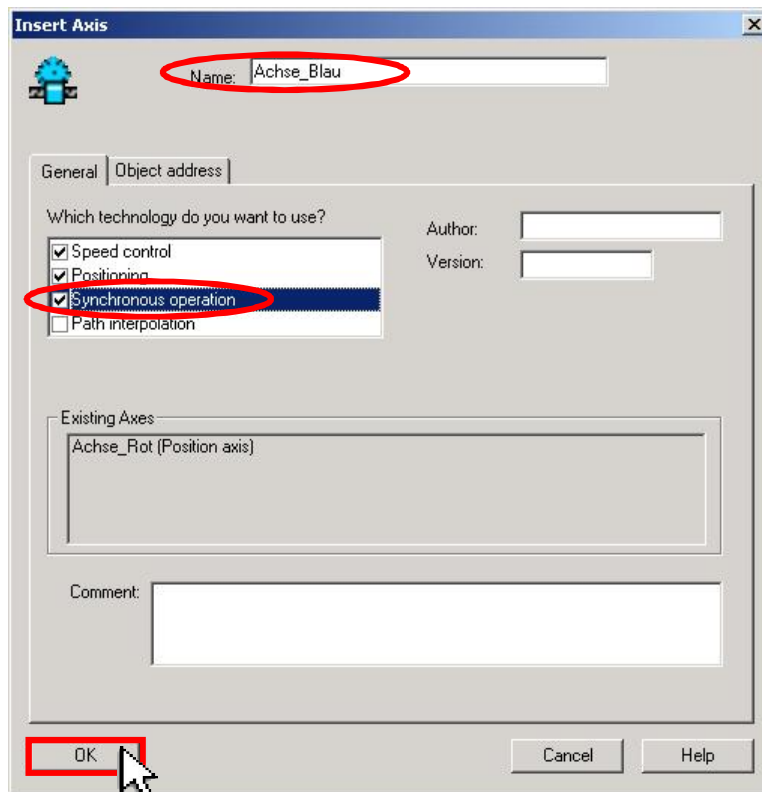
Configure **Blue_Axis**

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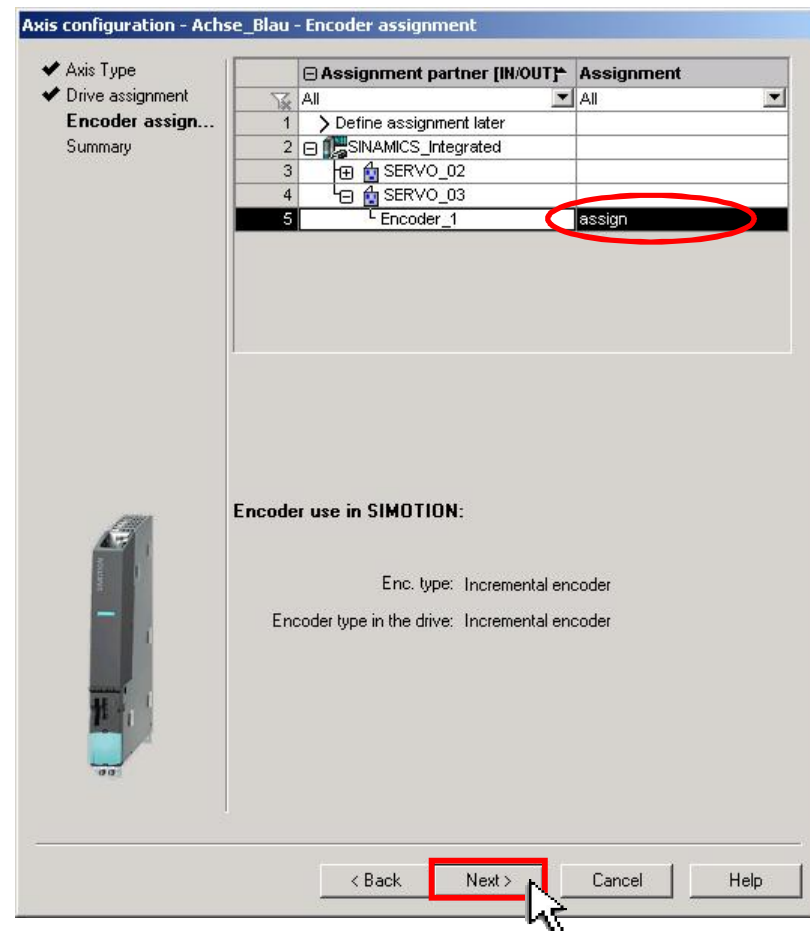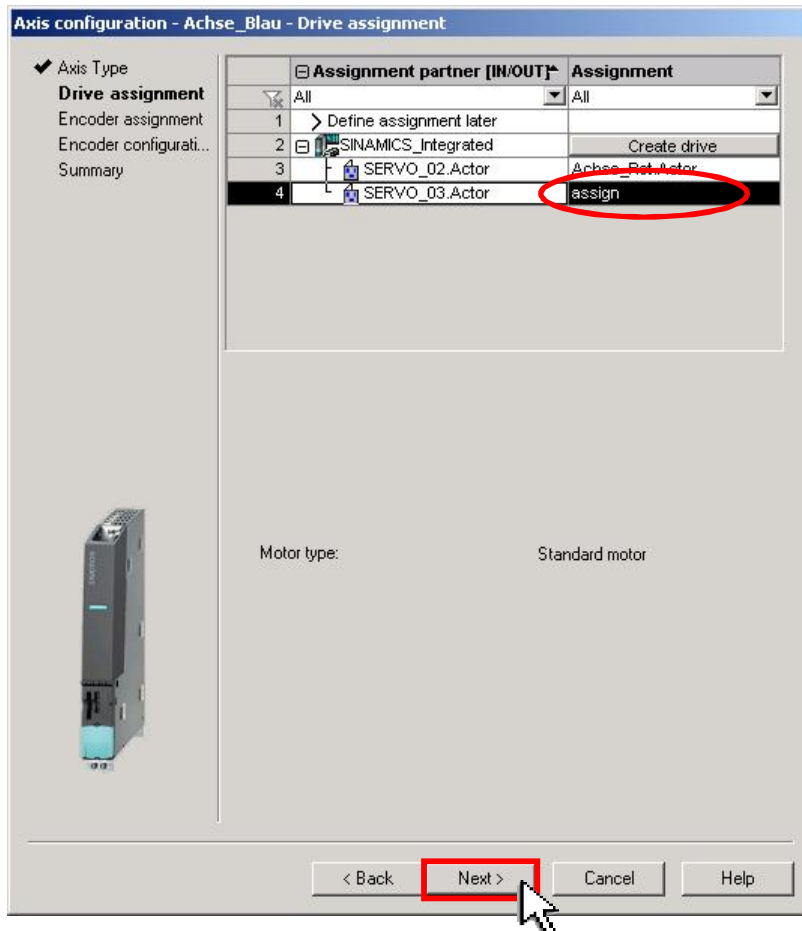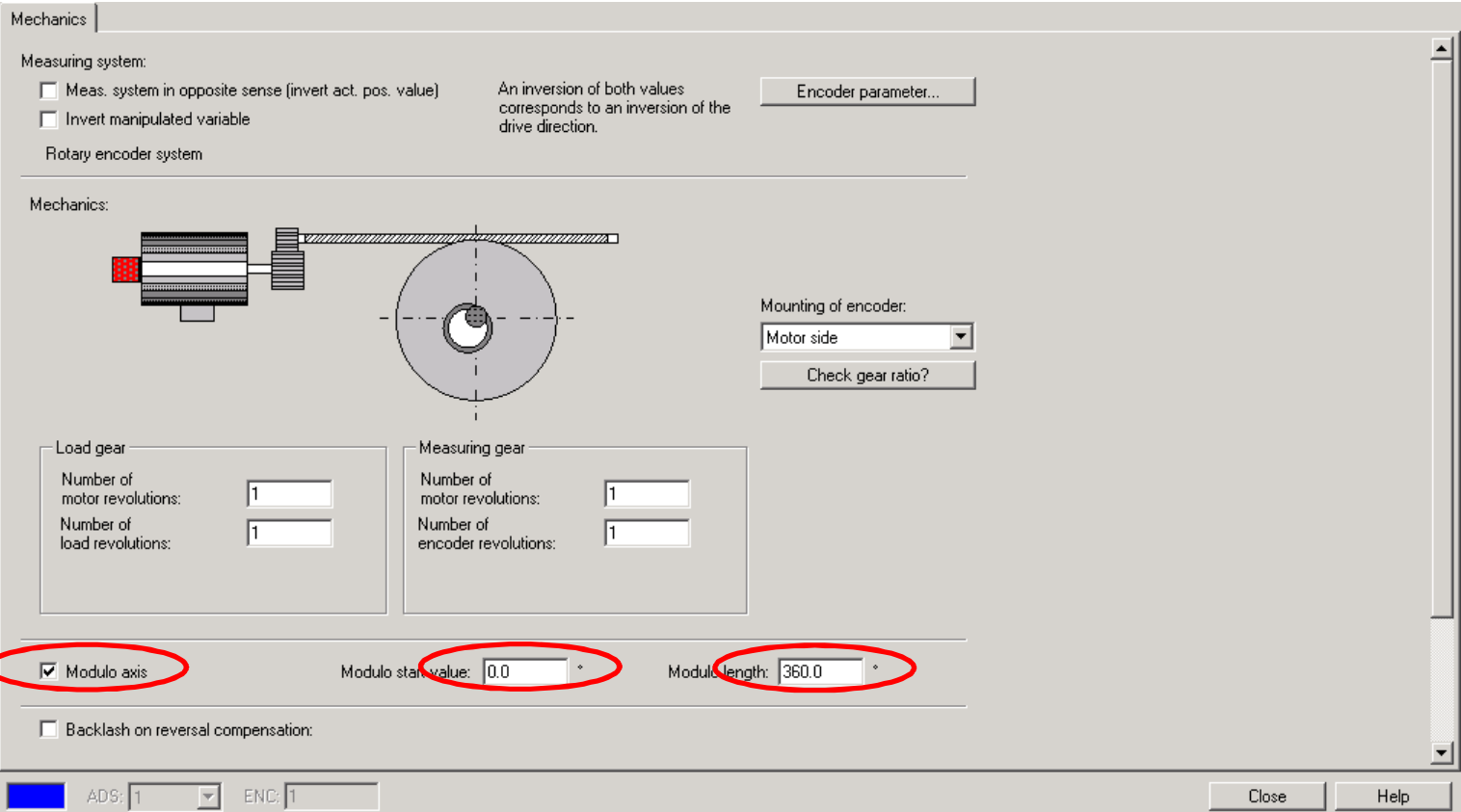
Configure Blue_Axis

- Summary of Axis configuration
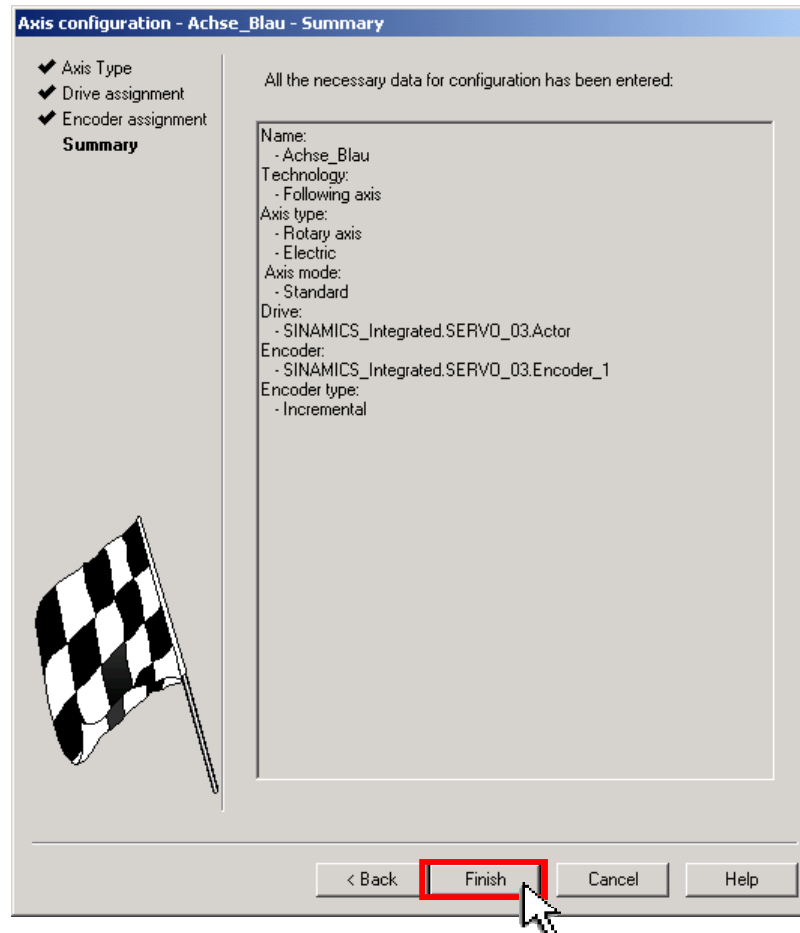
Configure **Blue_Axis**

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

Add output cam to Red_Axis

- Insert output cam
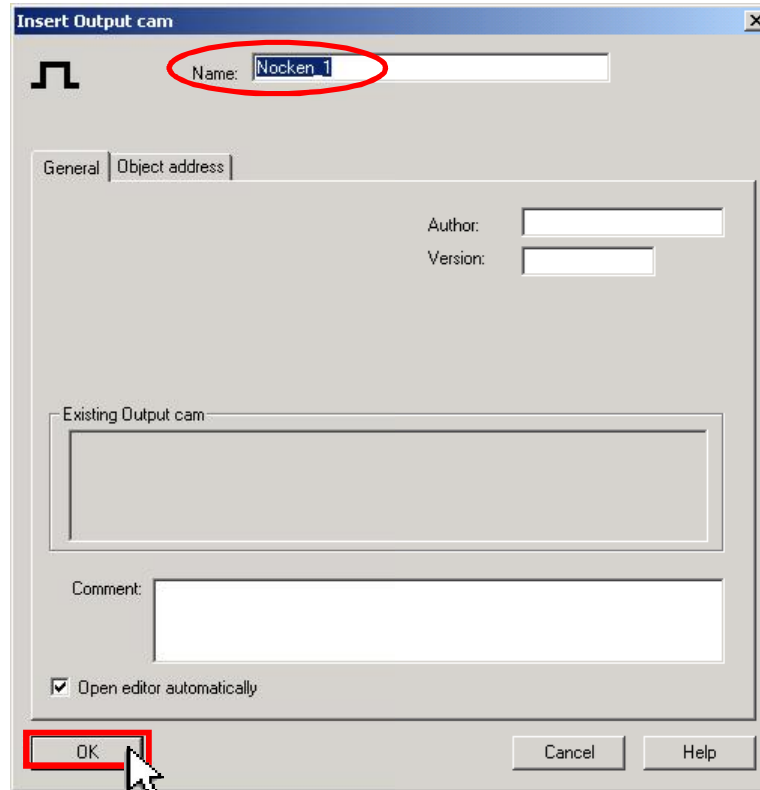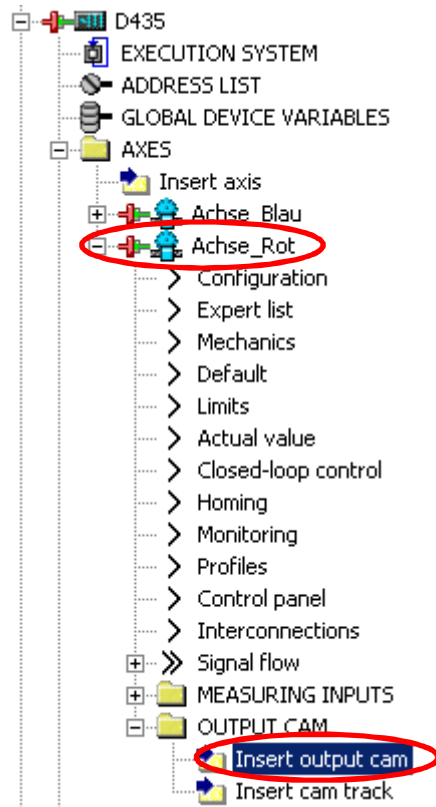
Standard settings
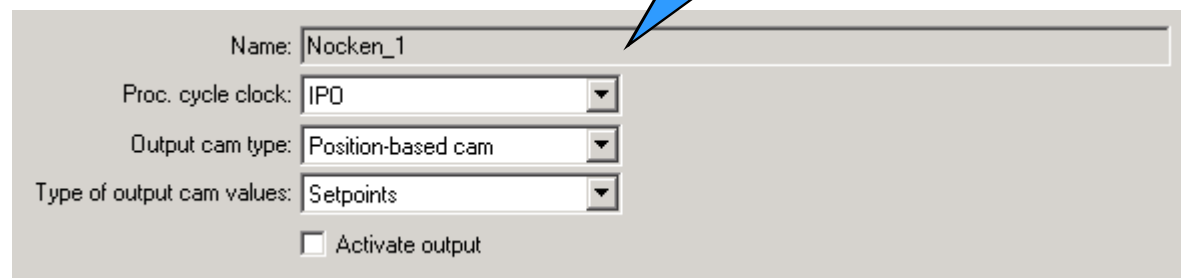
Download data to target device

- Download SIMOTION D435 project to target device.
  (The 1st download (incl. TPCAM) takes longer.)
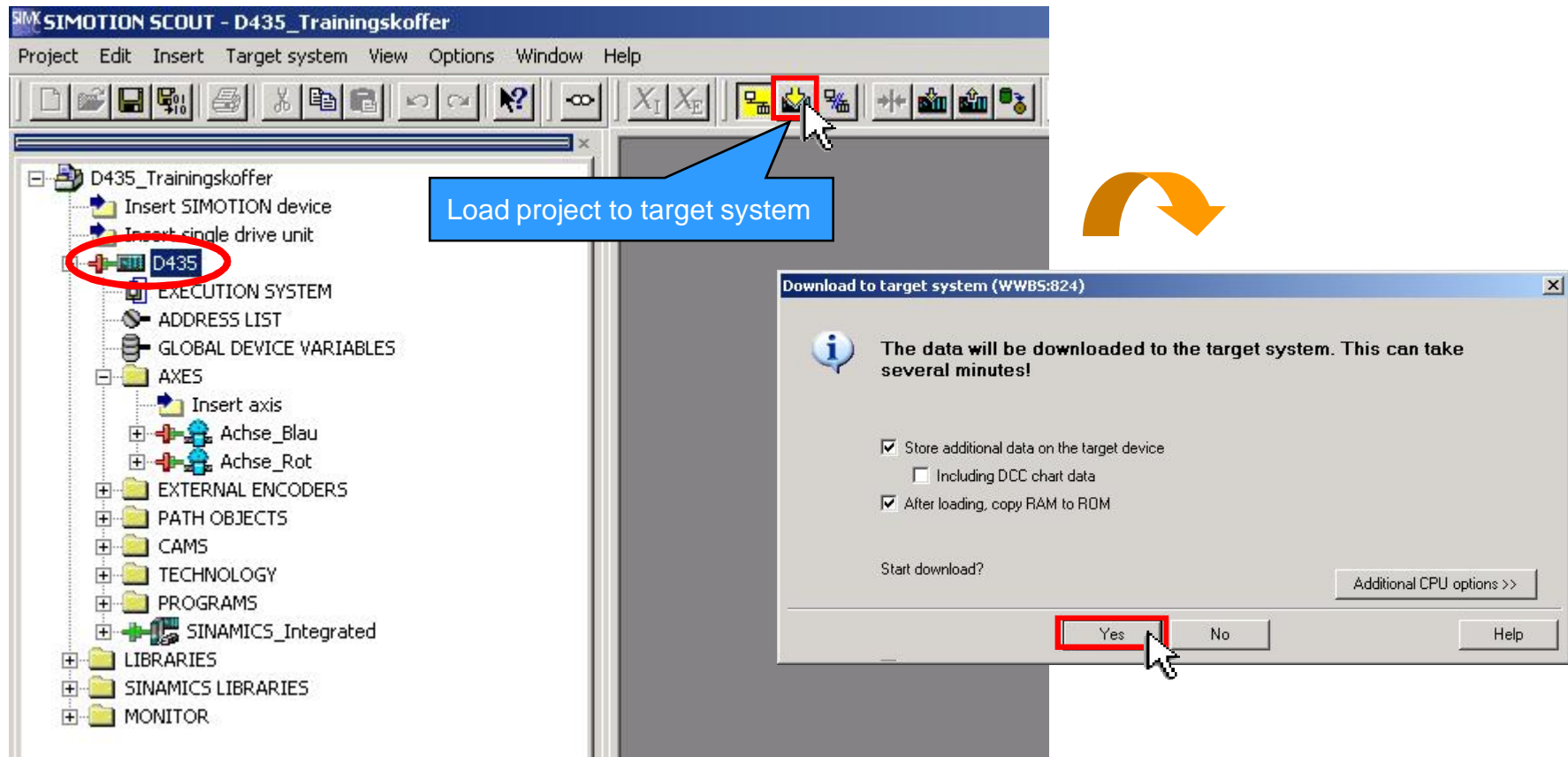
Automatic controller settings
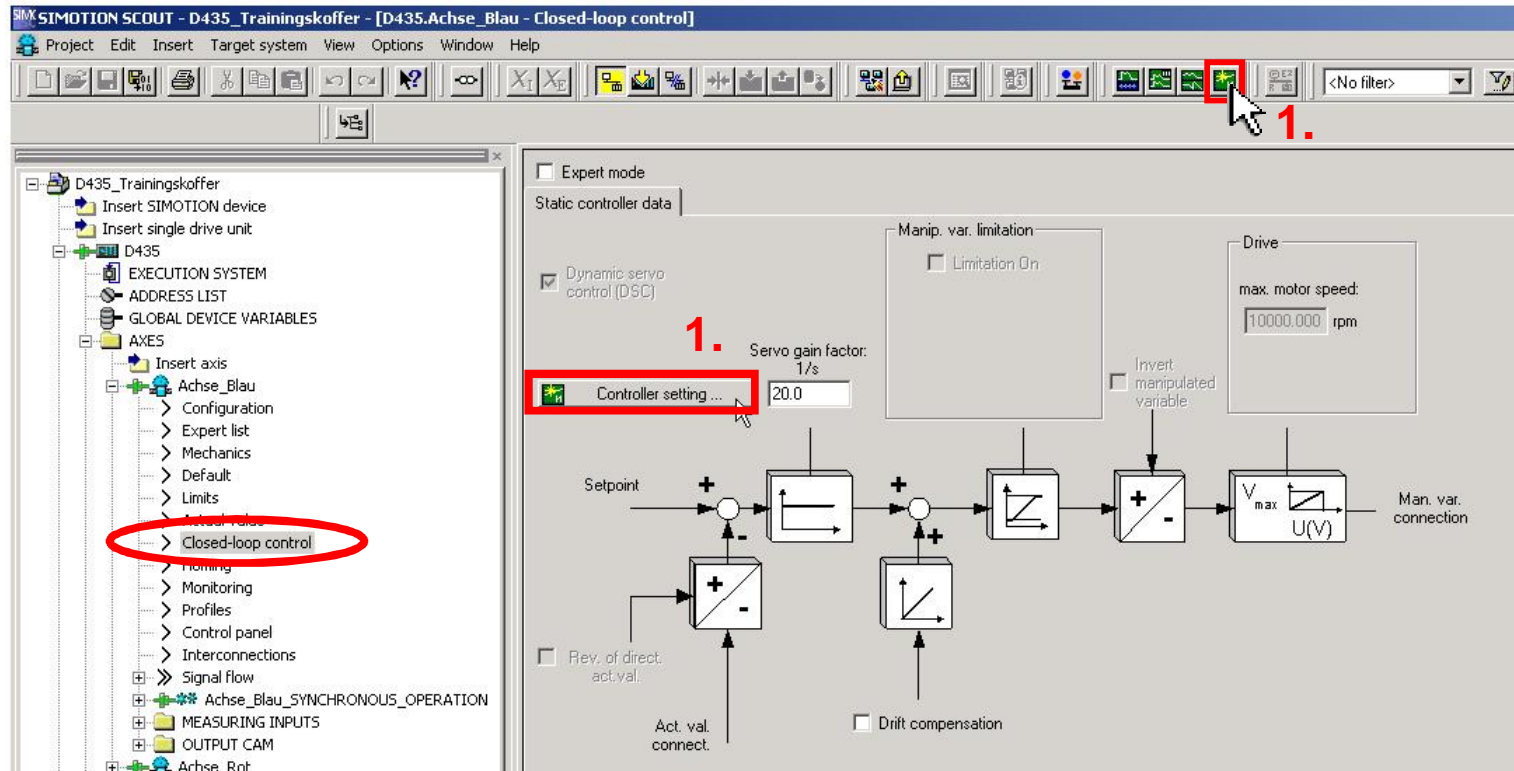
- By double clicking on (1.) the mask „Automatic controller setting" opens (see following two slides).
  You can use the pull-down-menu to choose the controller you want to set.
  Slide 46 → Speed controller
  Slide 47 → Position controller (DSC)

Automatic controller settings - speed controller

Assume control priority, Drive ON and perform all steps

Pull-down-menu

4. **5.**

2.

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

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

3. Accept

7. Yes

New values will be calculated

To save settings scroll down and press "Accept values"

6. Accept values

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

Automatic controller settings - position controller

Assume control priority, Drive ON and perform all steps

Pull-down-menu

2.

3.

4. **5.**

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

6.

New values will be calculated

To save settings scroll down and press "Accept values"

7.

- 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.)

Operate Red_Axis via SIMOTION axis control panel

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)
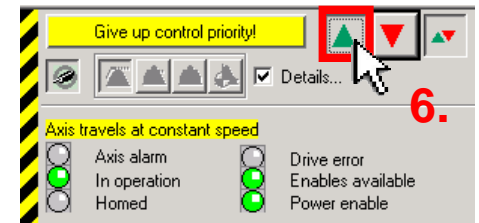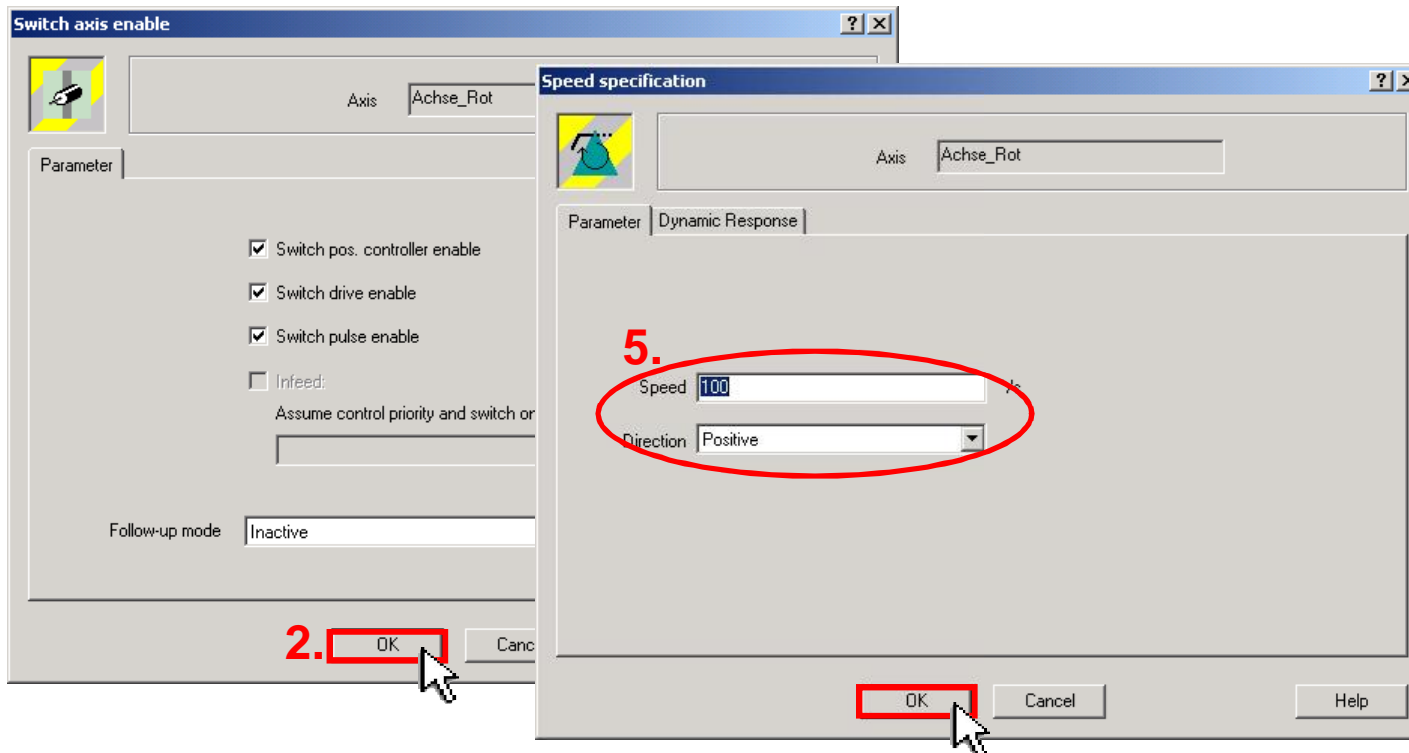
„Red_Axis" is in operation

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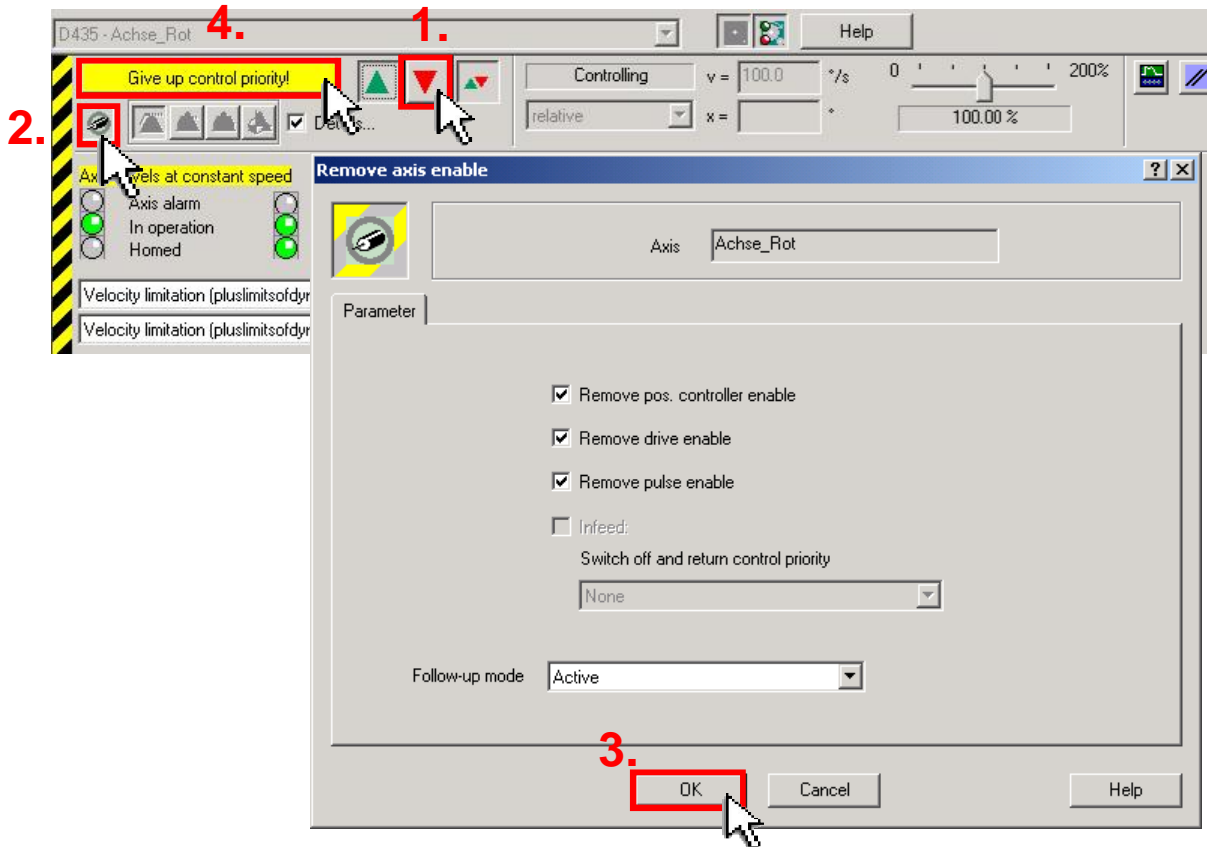
1. Stop motion
2. Remove enables
3. Acknowledge with OK → Error occurs (no PLC control) → Acknowledge Alarm
4. Give up control priority

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

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.

Time exposure
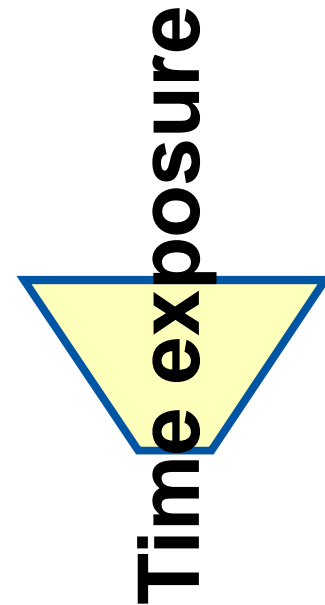
Create global variables

- Disconnect from target system
- Open global device variables and create the variables "enable_mcc" and "toggle"
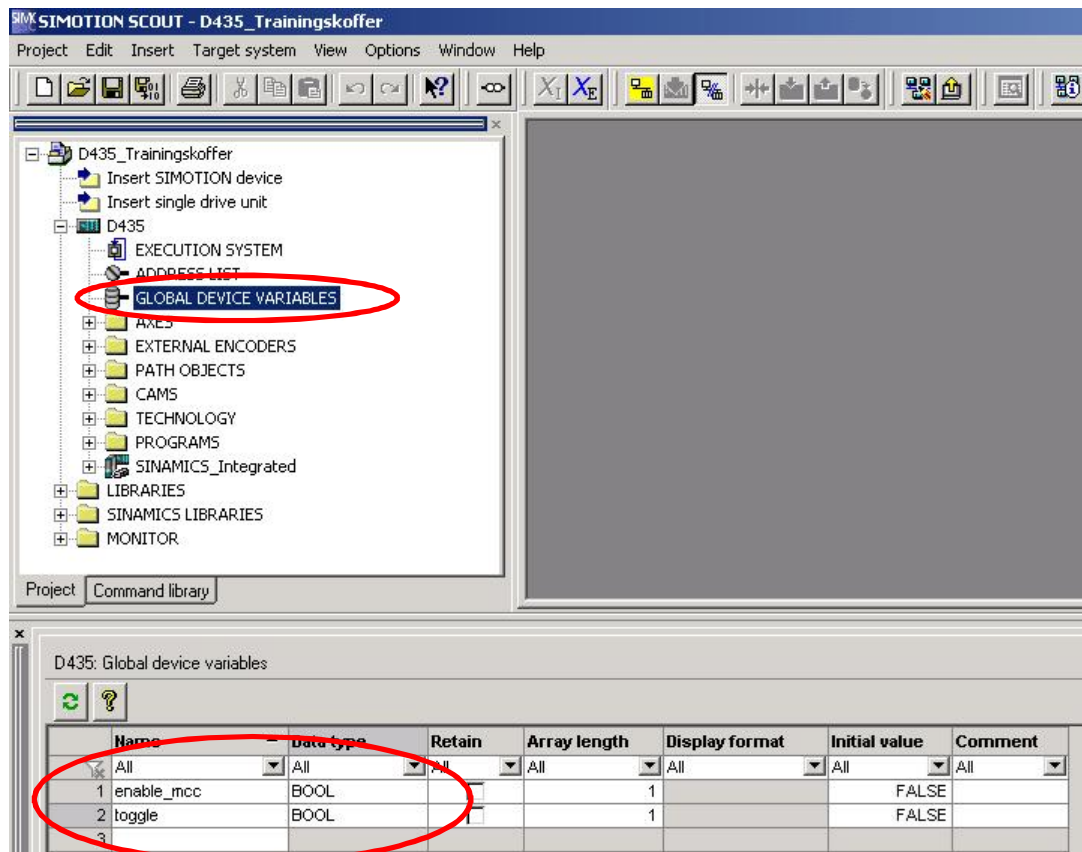
global variables:

- enable_mcc with data type: bool

- toggle with data type: bool

Insert geometry CAM

- Insert cam for MCC program

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)
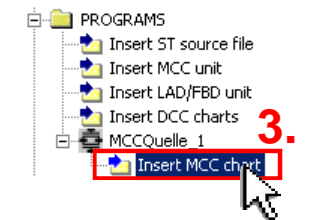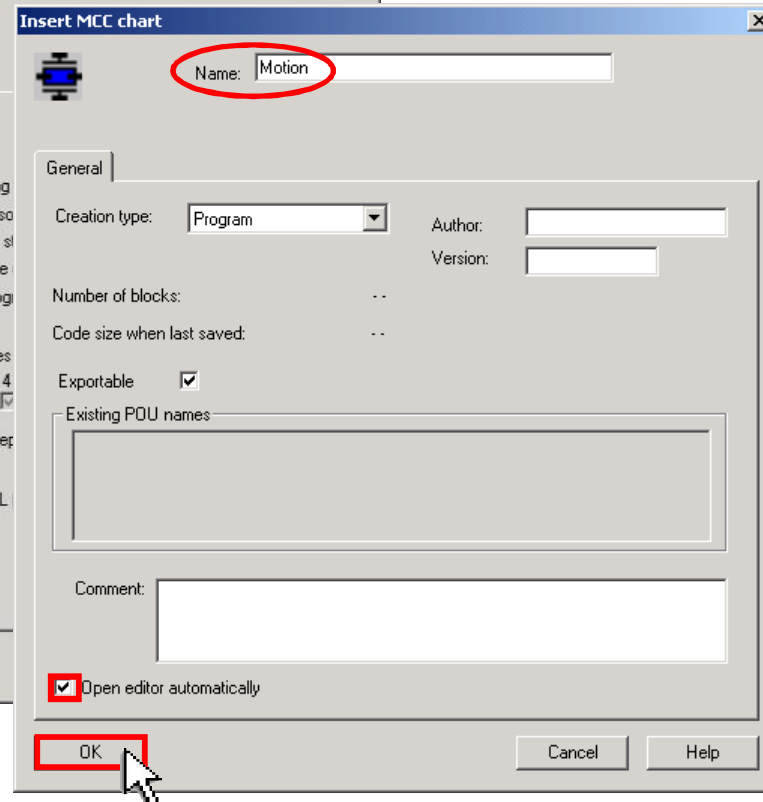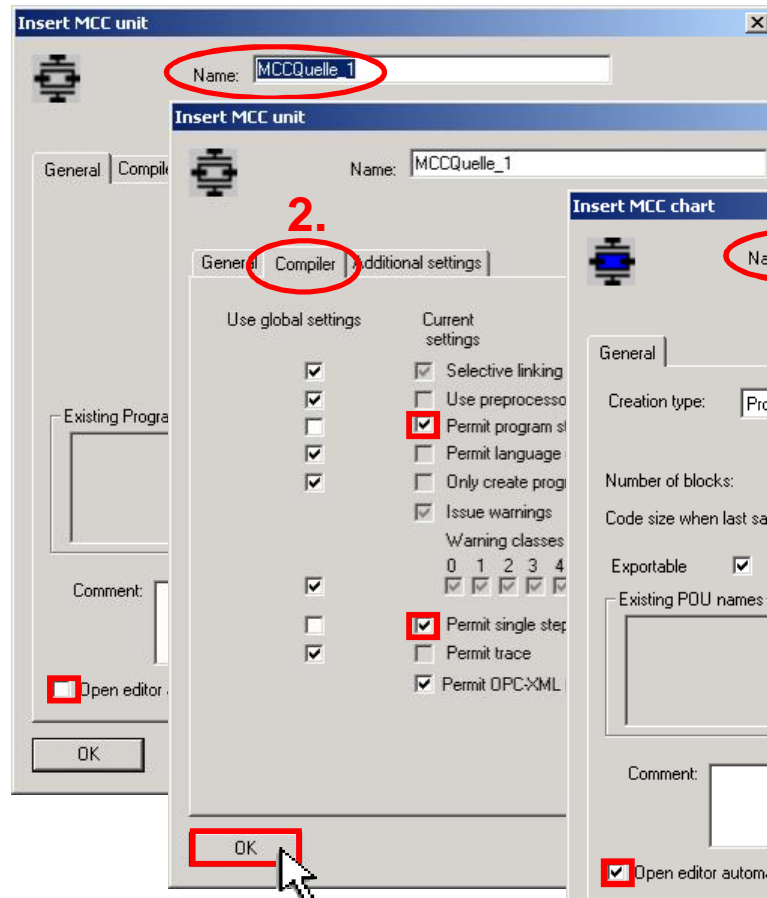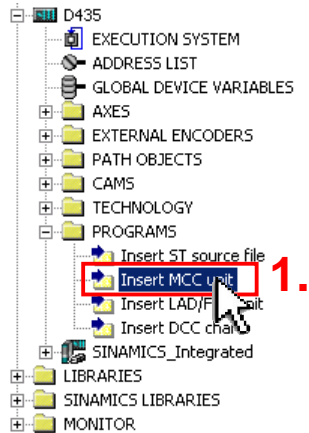
Create a SIMOTION MCC program

- When opening an MCC-Chart the toolbar for the MCC instruction groups appears.
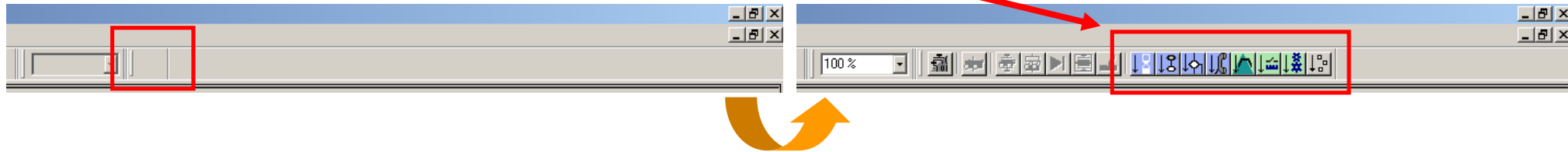
- The toolbar contains the following commands:

Basic commands

Task commands   **Program structures**

Communication

Single axis commands

Commands for ext. encoder, measuring input and ...

Gearing and camming commands   **Important commands**
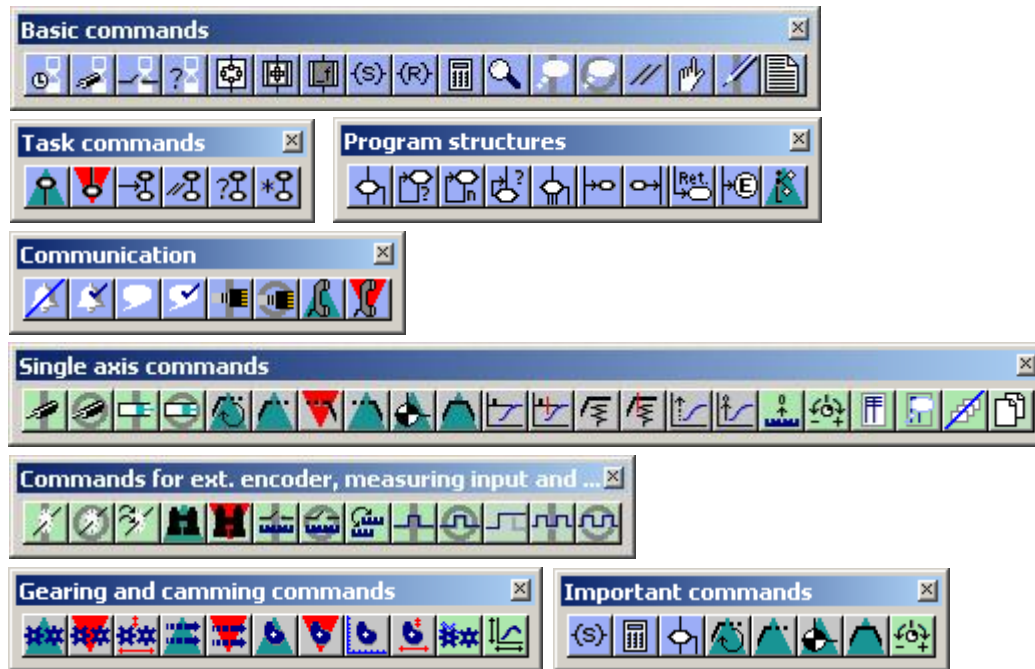
Create a SIMOTION MCC program

- 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.

Start	START
	WHILE enable...
Warte Zeit	T#2s
Achs-freigabe schal-	Achse_Rot
Starte Achse lage-	Achse_Rot
Schalte Nocken ein	Nocken_1
Warte Zeit	T#5s
Achs-freigabe schal-	Achse_Blau
Kurven-scheibe ein	Achse_Blau_SYNCH...
Warte Zeit	T#10s
Kurven-scheibe aus	Achse_Blau_SYNCH...
Achs-freigabe	Achse_Blau
Stoppe Achse	Achse_Rot
Achs-freigabe	Achse_Rot
Variablen-zuweisung	toggle := NOT toggle
Starte Task	MotionTask_2
Ende	END

Create a SIMOTION LAD/FBD program

- Create MCC Chart „loop"
  - Start Motion Task_1
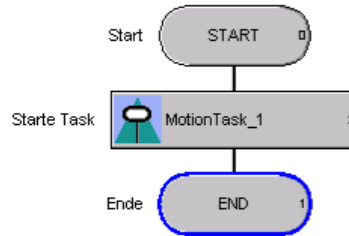
- Insert LAD/FBD unit (1.) „KFQuelle_1", insert LAD/FBD program (6.) „KOPFUP_1"

Create program:

Enter variable „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

- Close and save

Fault handling

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

Right click, select „Accept and compile" or press
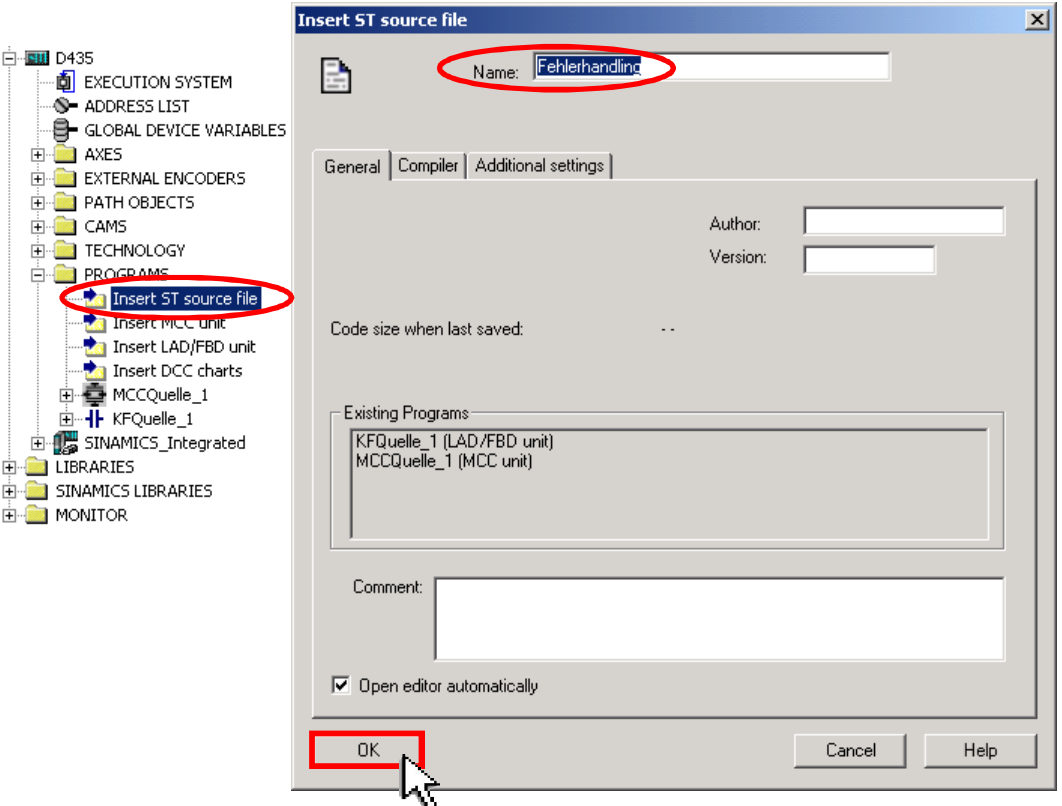
- Compile and save.
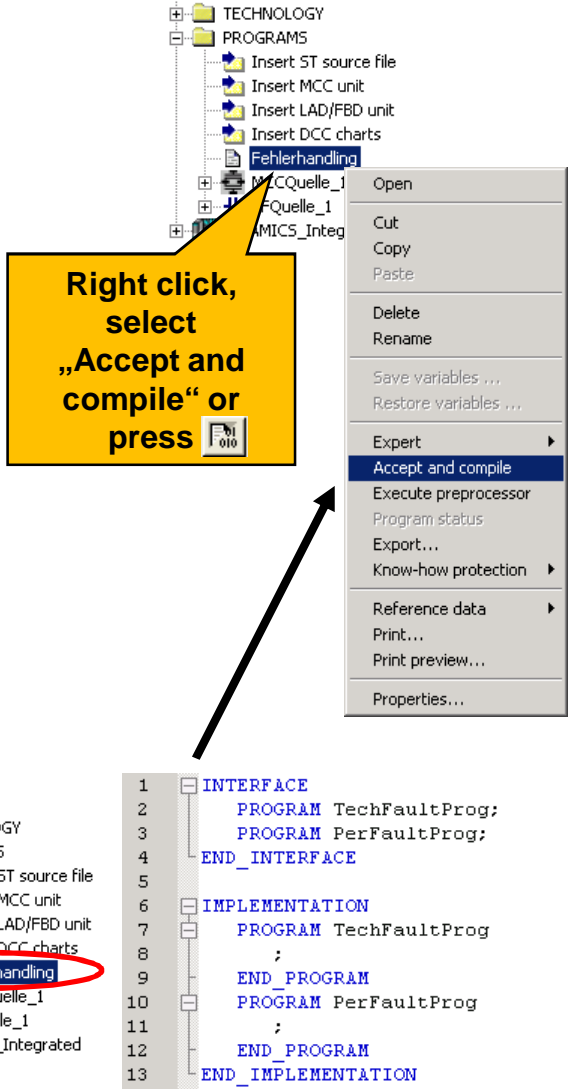
Fault handling - Task assignment

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

Download SIMOTION program to target system

- Save settings and compile

- Connect to target system

- Download SIMOTION D435 project to target device
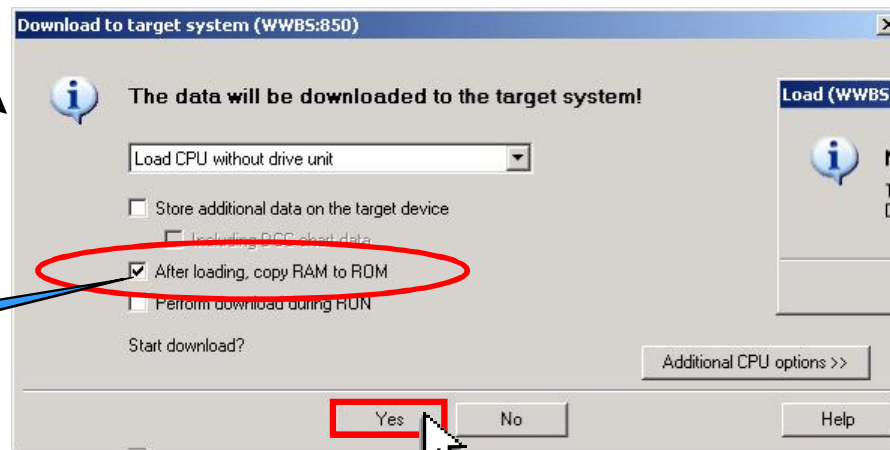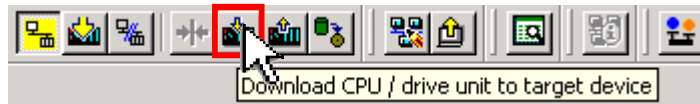
Copy RAM to ROM
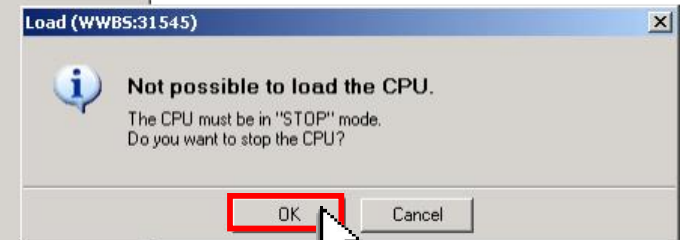
Start SIMOTION MCC program with variable

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

Monitoring SIMOTION MCC chart

- Enable Monitoring on/off

MCC editor
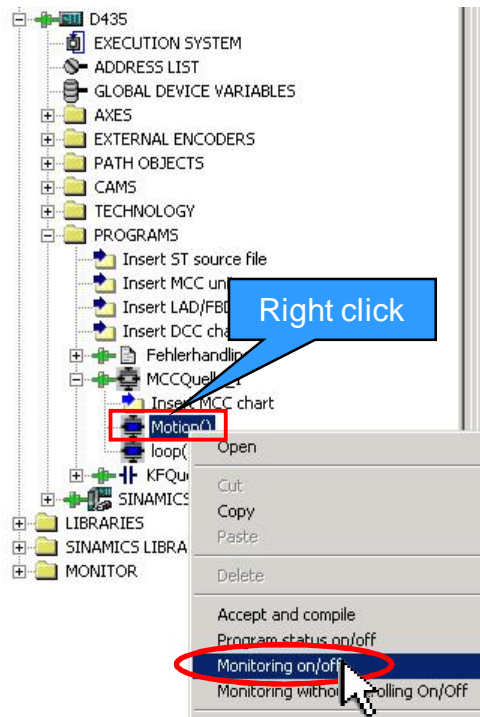
MCC monitoring

MCC single step

Right click

Open

Cut
Copy
Paste

Delete

Accept and compile
Program status on/off
Monitoring on/off
Monitoring without Polling On/Off
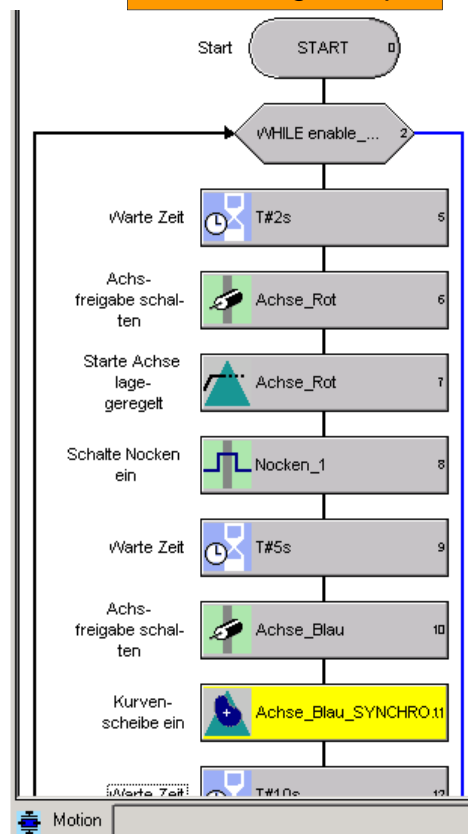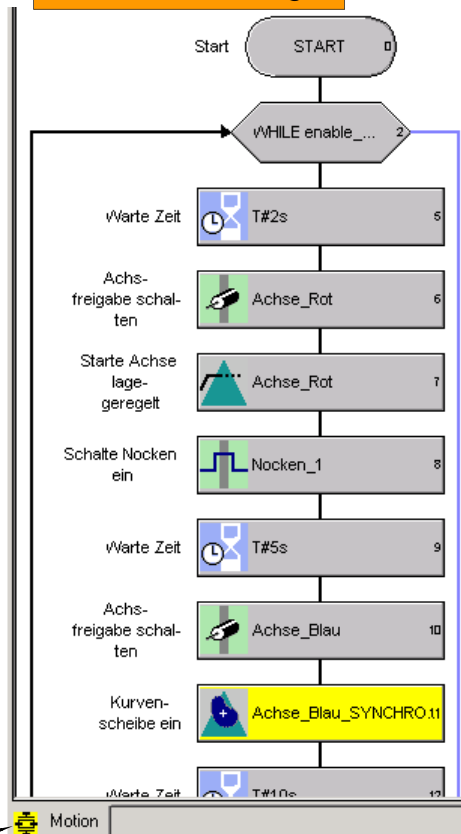
Yellow status for monitoring

Blue status for single step

Monitoring SIMOTION LAD/FBD unit

- Enable Program status ON/OFF

Right click

Color indicator
(red und green)

Trace signals

- Open Trace

- Select D435, select signals

Trace signals

Stop trace

- Start trace

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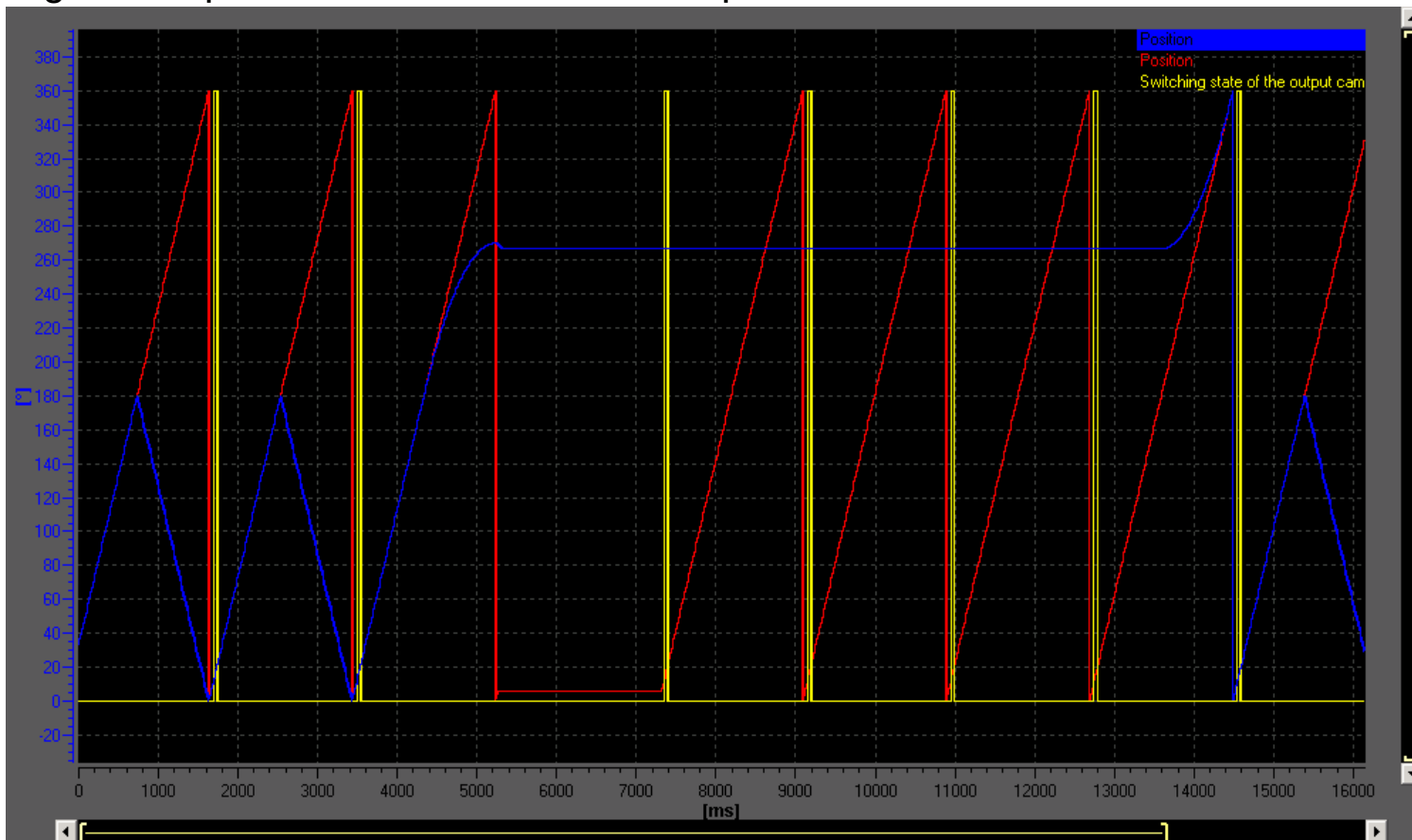
Symbol browser

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

All symbols can be monitored online

Watch table

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

Watch table

- 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.
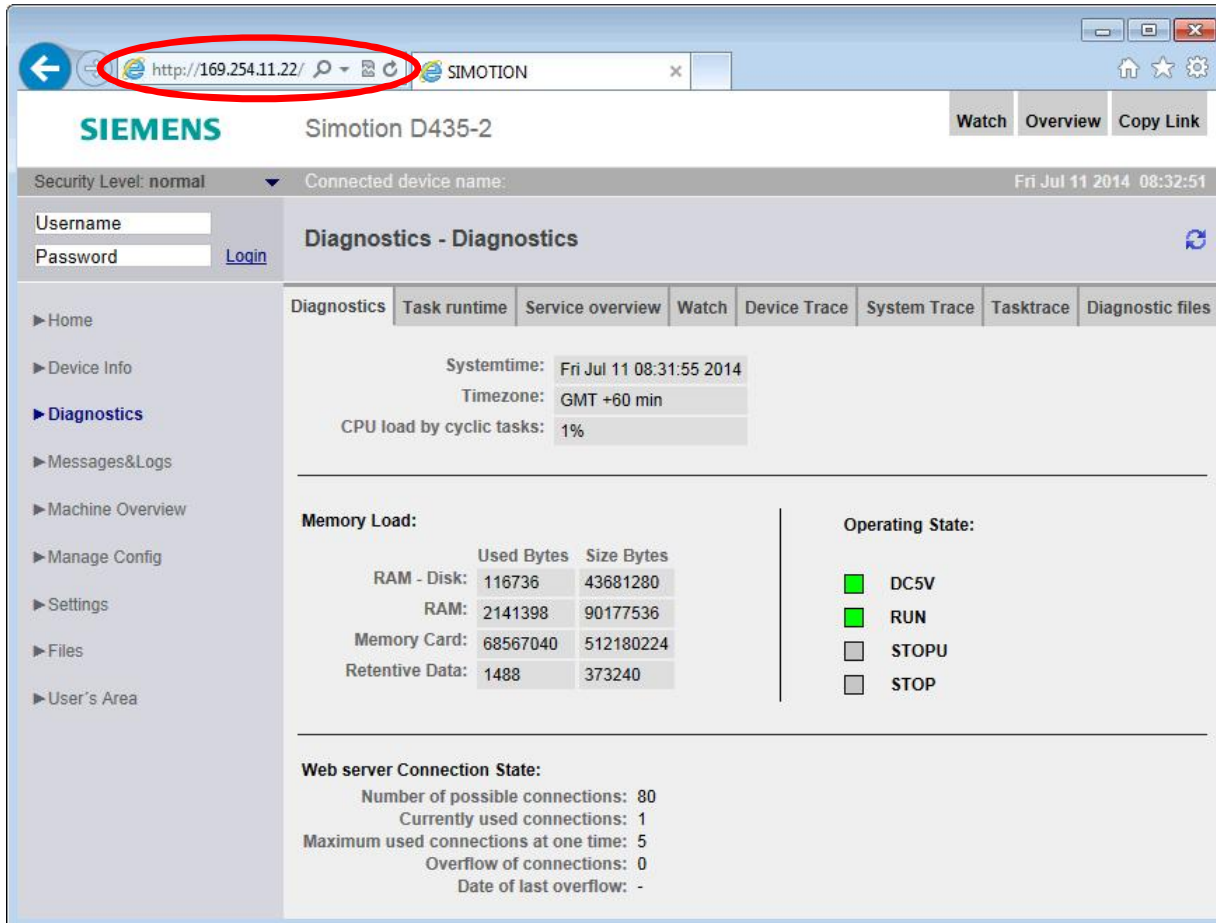
Service overview

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

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 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

SIEMENS