

Guideline
D435 training case
with SIMOTION 4.1 SP1



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with SIMOTION 4.1 SP1

Release 11/2007



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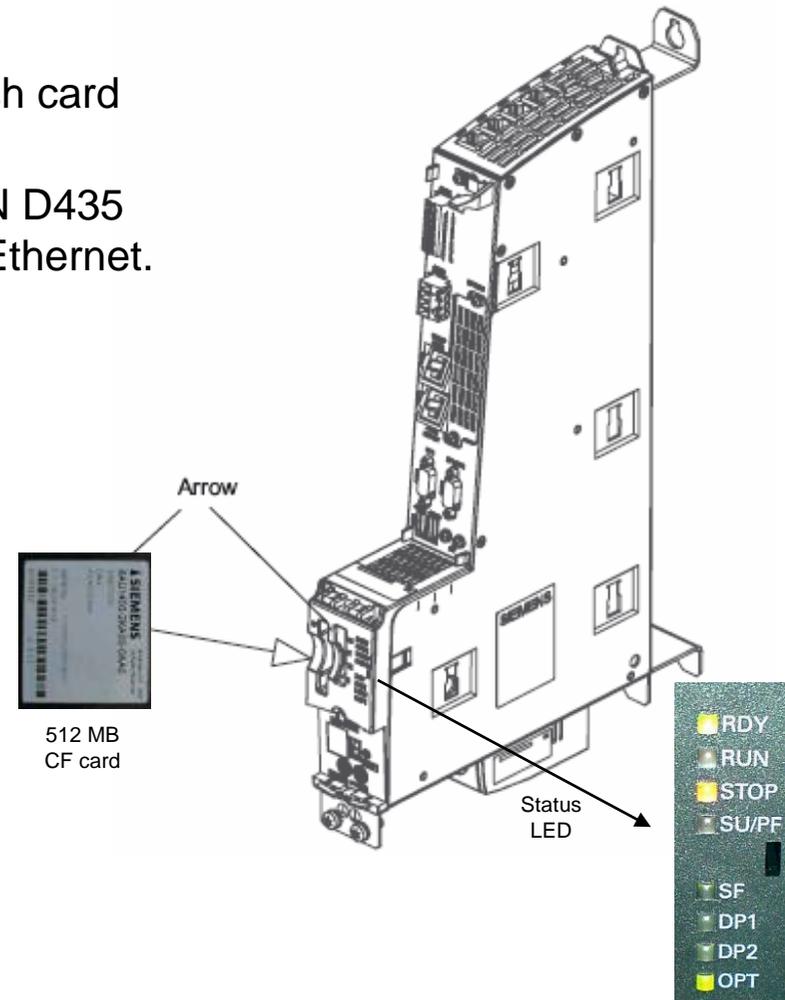
SIMOTION programming

- Insert new axis
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Preparation

How to Start

- Insert “empty” 512 MB SIMOTION V4.1 CompactFlash card
- For communication purposes, connect the SIMOTION D435 via PROFIBUS DP, PROFINET IO with IRT, MPI or Ethernet.
- Switch on power supply
- Start SIMOTION SCOUT V4.1



Create a new project



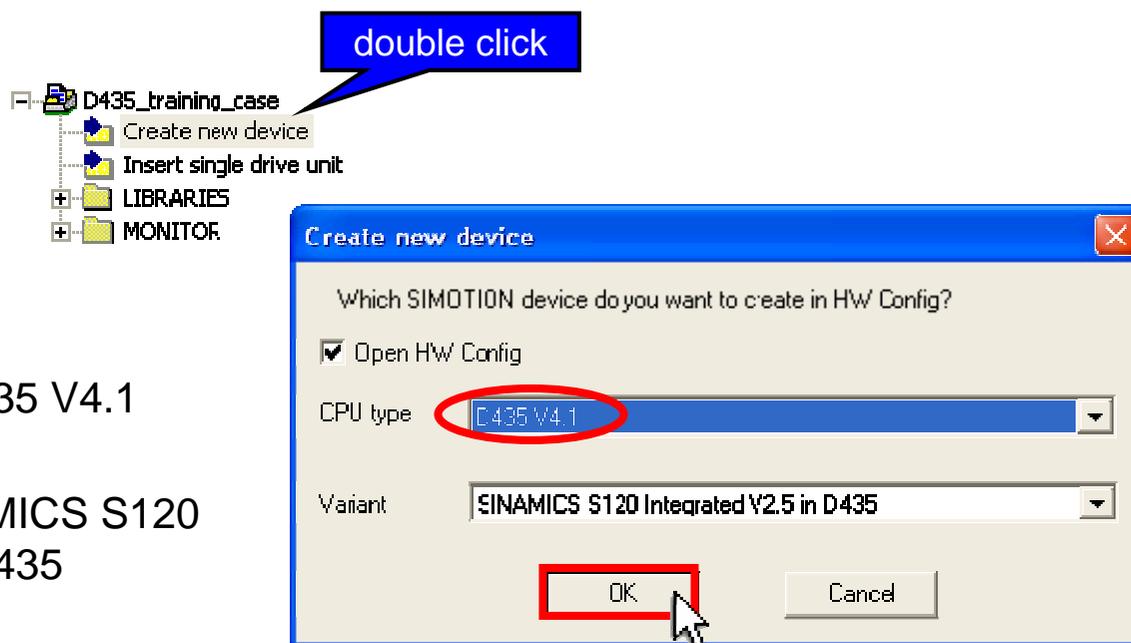
SIMOTION D435

The screenshot shows the SIMOTION SCOUT software interface. The title bar reads "SIMOTION SCOUT - D435_training_case". The menu bar includes "Project", "Edit", "Insert", "Target system", "View", "Options", "Window", and "Help". The "Project" menu is open, showing options like "New...", "Open...", "Close", "Save", "Save As...", "Save in old project format...", "Conversion of old Starter projects...", "Check consistency", "Save and compile", "Save and recompile all", "Download to target system", "Properties...", and "Know-how protection".

The "New Project" dialog box is open, showing a table with columns "Name" and "Storage path". Below the table, there is a checkbox for "Add to current multiproject". The "Name" field contains "D435_training_case" (circled in red). The "Type" dropdown is set to "Project". The "Storage location" field contains "C:\Program Files\Siemens\Step7\proj" with a "Browse..." button next to it. At the bottom, the "OK" button is circled in red, and a mouse cursor is pointing at it.

Insert new device

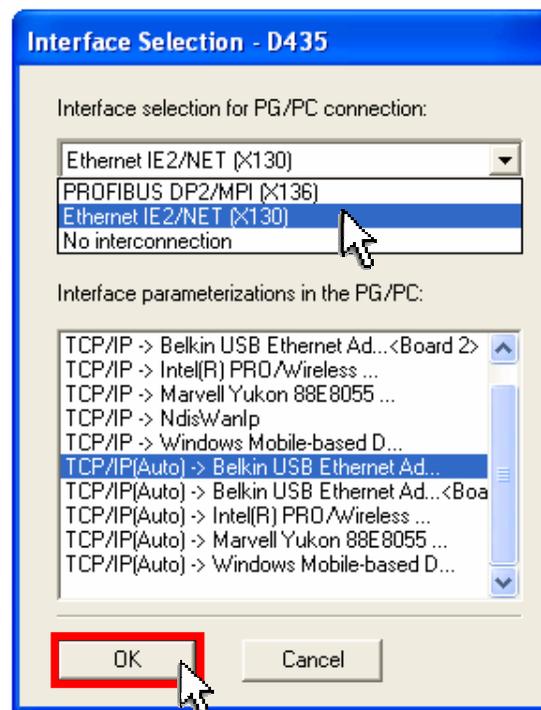
- New hardware, that combines the functionality of SIMOTION and SINAMICS.
- SIMOTION D435 can be inserted in SCOUT as the new device after creating a new project.



- Select CPU type D435 V4.1
- Select variant SINAMICS S120 Integrated V2.5 in D435

Configuration of the external ethernet interfaces

- Select your interface to D435.
The ethernet interface cable is connected to the lower slot of the D435 (-X130, IE2/NET).



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



Depending on your
PC/PG another interface
might be necessary.

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

HW Config

- Download configuration to Module D435

The screenshot illustrates the hardware configuration process in SIMATIC Manager. The main window shows a rack configuration for a SIMOTION D435 module (slot 2) and a SINAMII module (slot 3). The 'Download to Module' button is highlighted with a blue callout. A 'Select Node Address' dialog box is open, showing connection details for station 169.254.11.22. A 'Download' progress dialog is also visible, and a warning dialog asks if the module should be restarted.

Select Node Address

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

Station: 169.254.11.22

Enter connection to station:

IP address	MAC address	Module type	Station name	Module name	P
169.254.11.22		CPU435-0			

Accessible Nodes

Download

Station: SIMOTION D
Module: [0/2/0] D435

Download (13:4363)

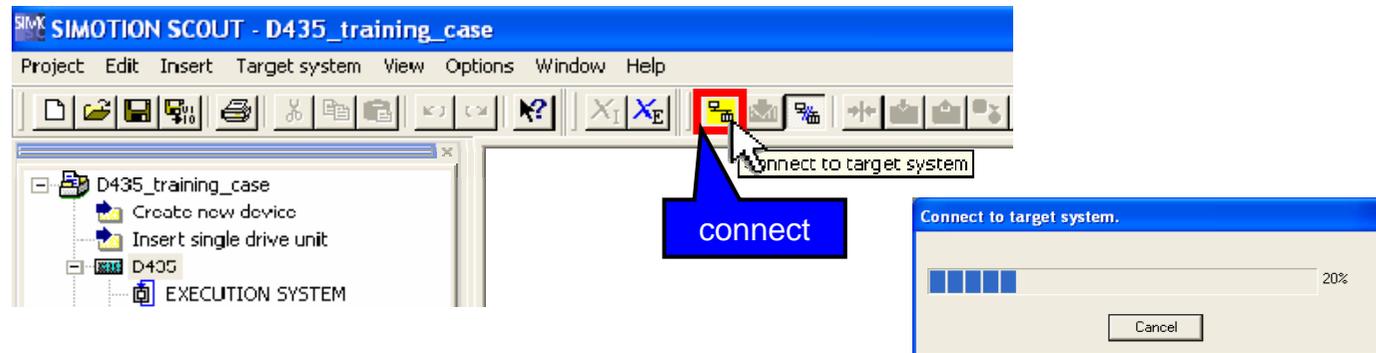
The module D435 (R O/S 2) is in the STOP mode. Do you want to start the module now (complete restart)?

Yes No

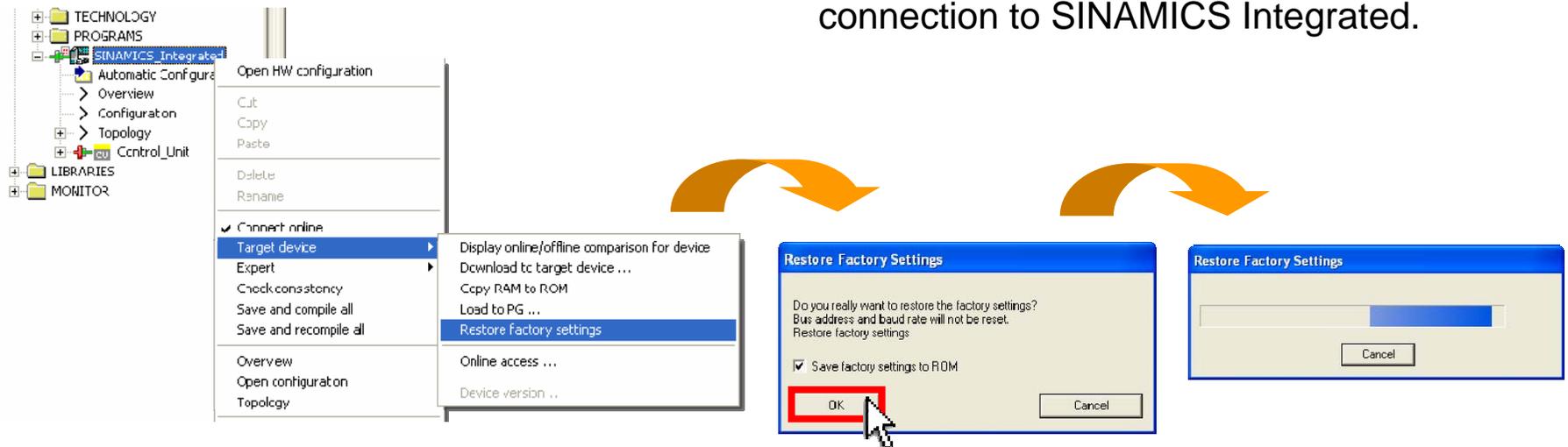
- Close HW Config after successful configuration download to Module.
- Wait until SIMOTION D435 reboot is finished. (green ready LED is on, compare page 5)

Establish connection with the target system

- Establish connection between the PG and D435

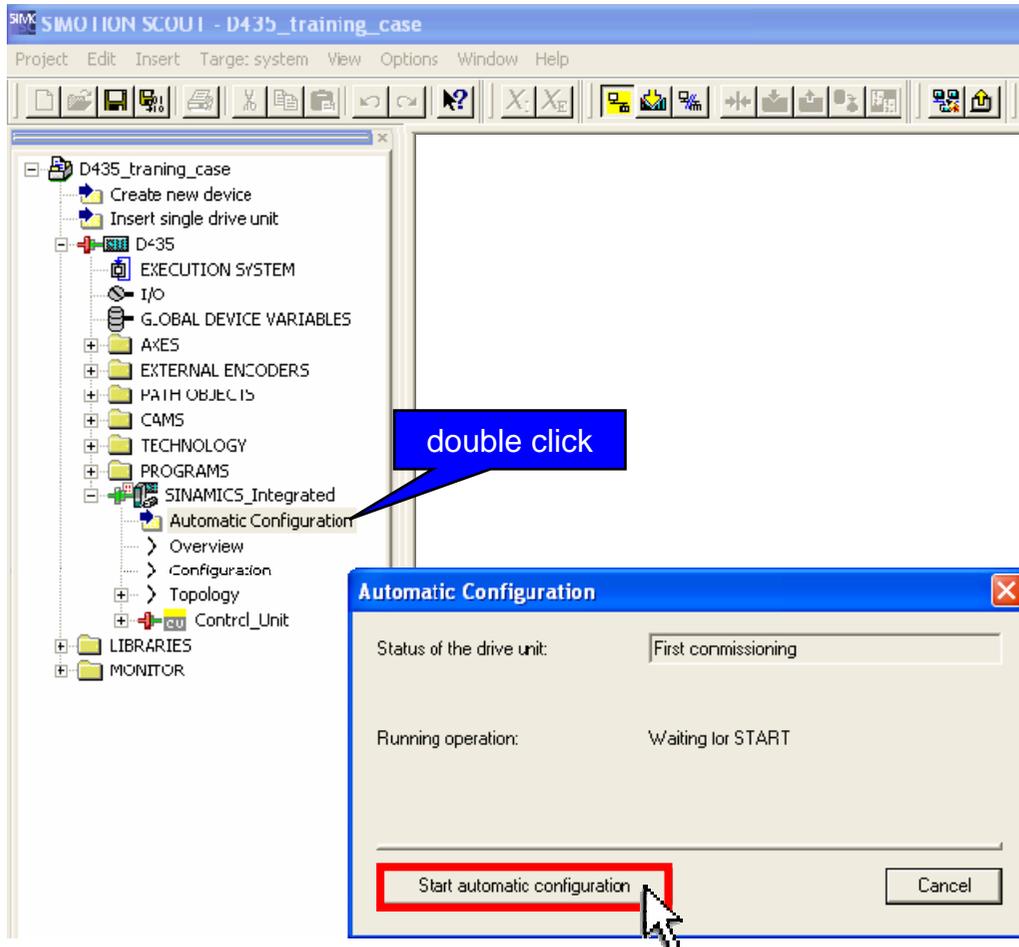


- Restore factory settings



You have established the connection to SINAMICS Integrated.

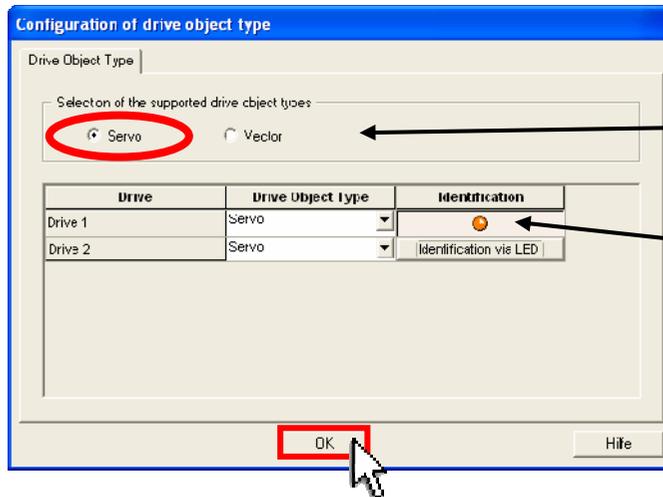
Automatic configuration



- Start automatic configuration

Automatic configuration

- Select “Servo” as object type for both drives

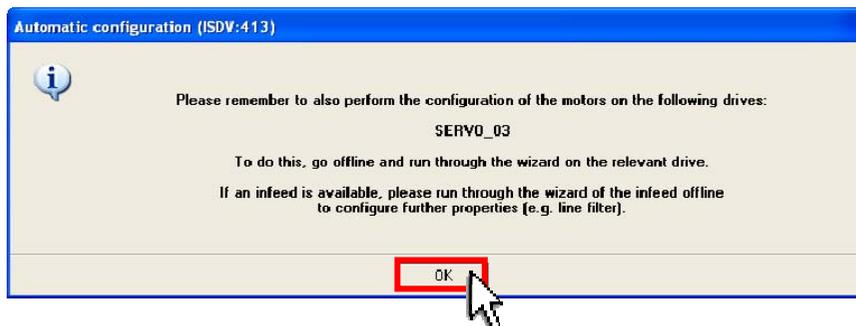


Select whether a servo- or vector-type drive object is to be used.

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

Click Ok to complete the automatic commissioning.

- Acknowledge with OK and close the message box.



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

As soon as automatic commissioning has run, an upload operation (Load to PG) is automatically performed. Close wizard.

Set training case specific line supply voltage & DC link voltage

- open Expert list for SERVO_02 and SERVO_03
- set p210 = 400 V
- set p1244[0] = 715 V and p1248[0] = 279 V

For quick parameter access enter number here (1st column).

set p210 = 400V

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

Parameter	Parameter text	Online value SERVO_03	Unit	Modifiable to
p210	Drive unit line supply voltage	400	V	Ready to run
p1244[0]	DC link voltage threshold upper	715	V	Operation
p1248[0]	DC link voltage threshold lower	279	V	Operation

right click

Expert list

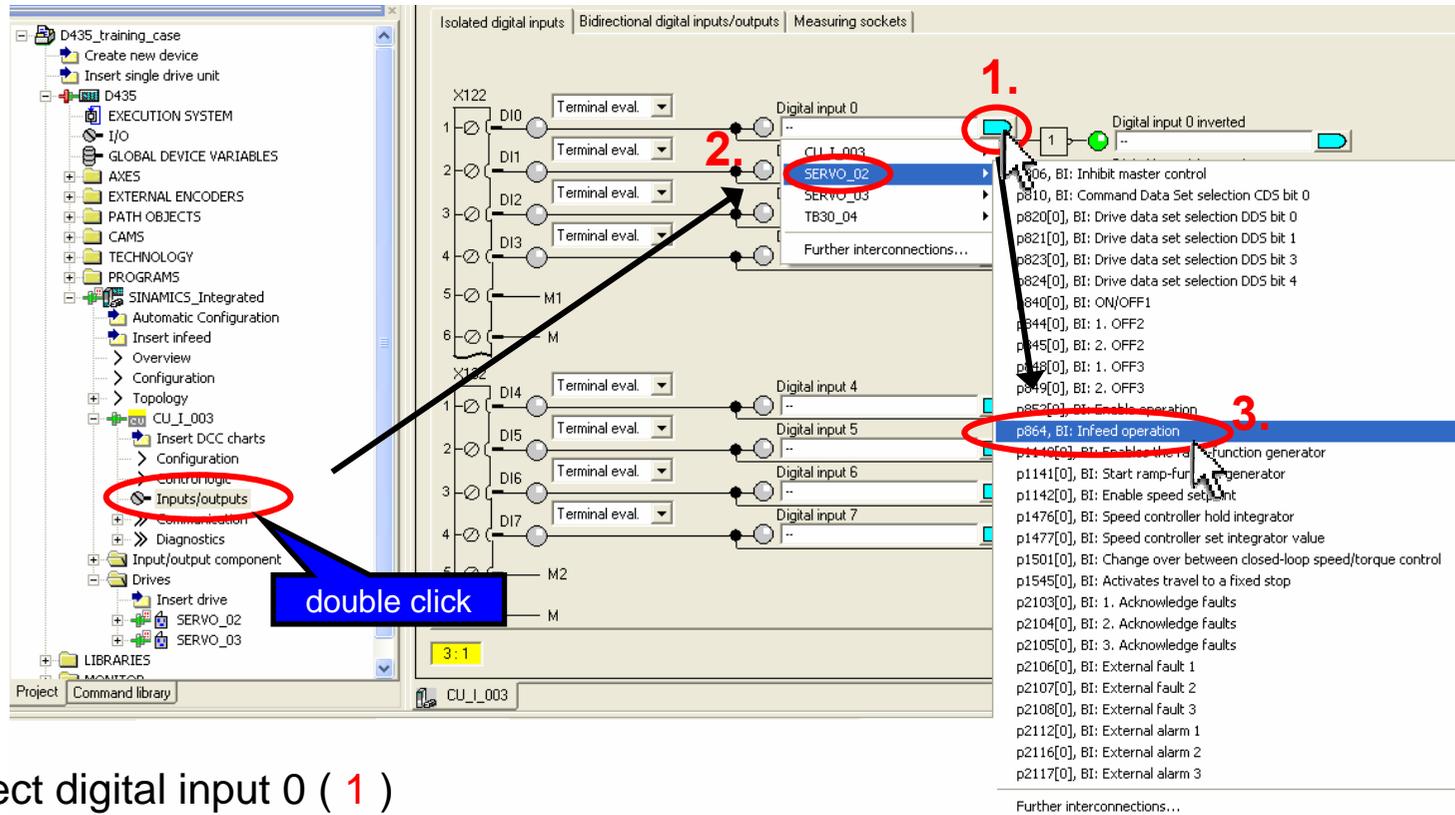
right click

Close window.

Close Strg+F4

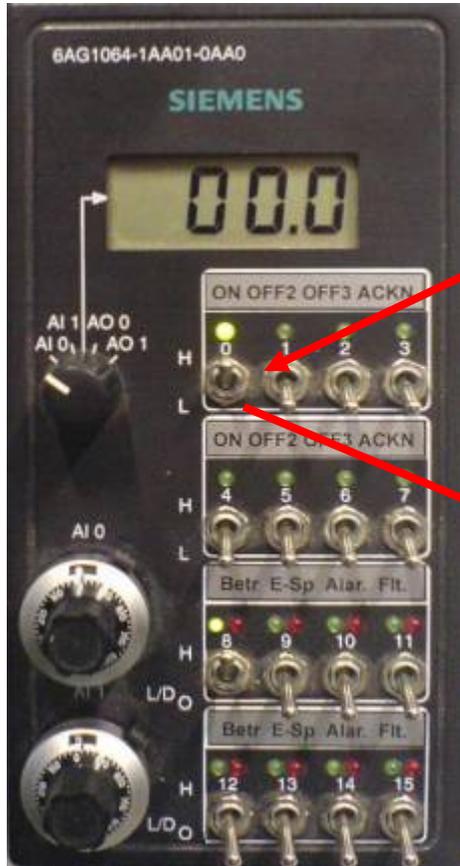
Setup of digital I/O – Infeed operation

- Wiring of the digital input DI0 (P864 Infeed Operation)



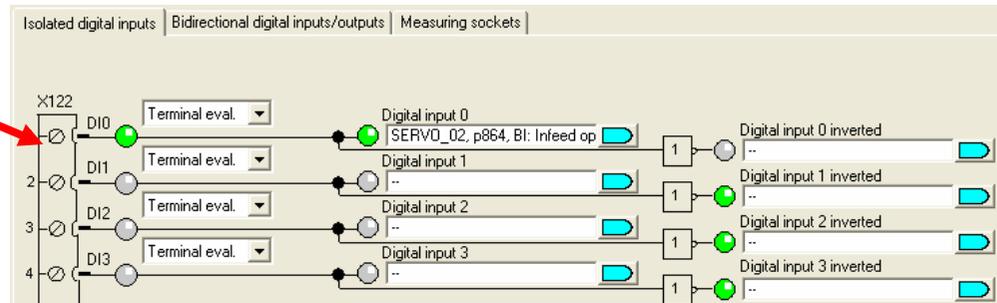
- Connect digital input 0 (1)
- The setup is to take place only for SERVO_02 (2)
- The signal “p864, BI : Infeed operation” (3) is assigned

Test setup with external panel



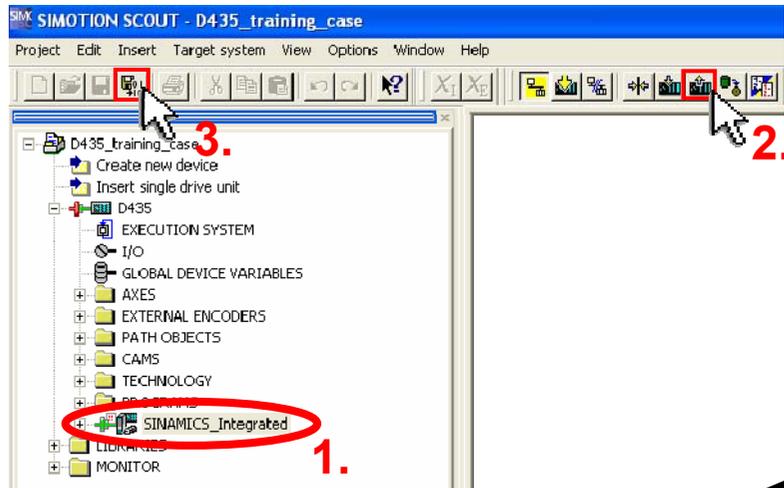
Enable infeed of SERVO_02 with SIEMENS control panel

- Switch 0 (DI 0) in up position to set infeed in operation
 → Result: Infeed operation enabled



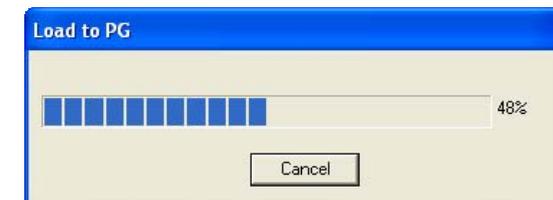
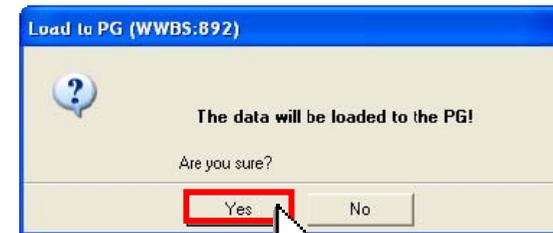
Load drive unit to PG

- Select SINAMICS_Integrated (1)



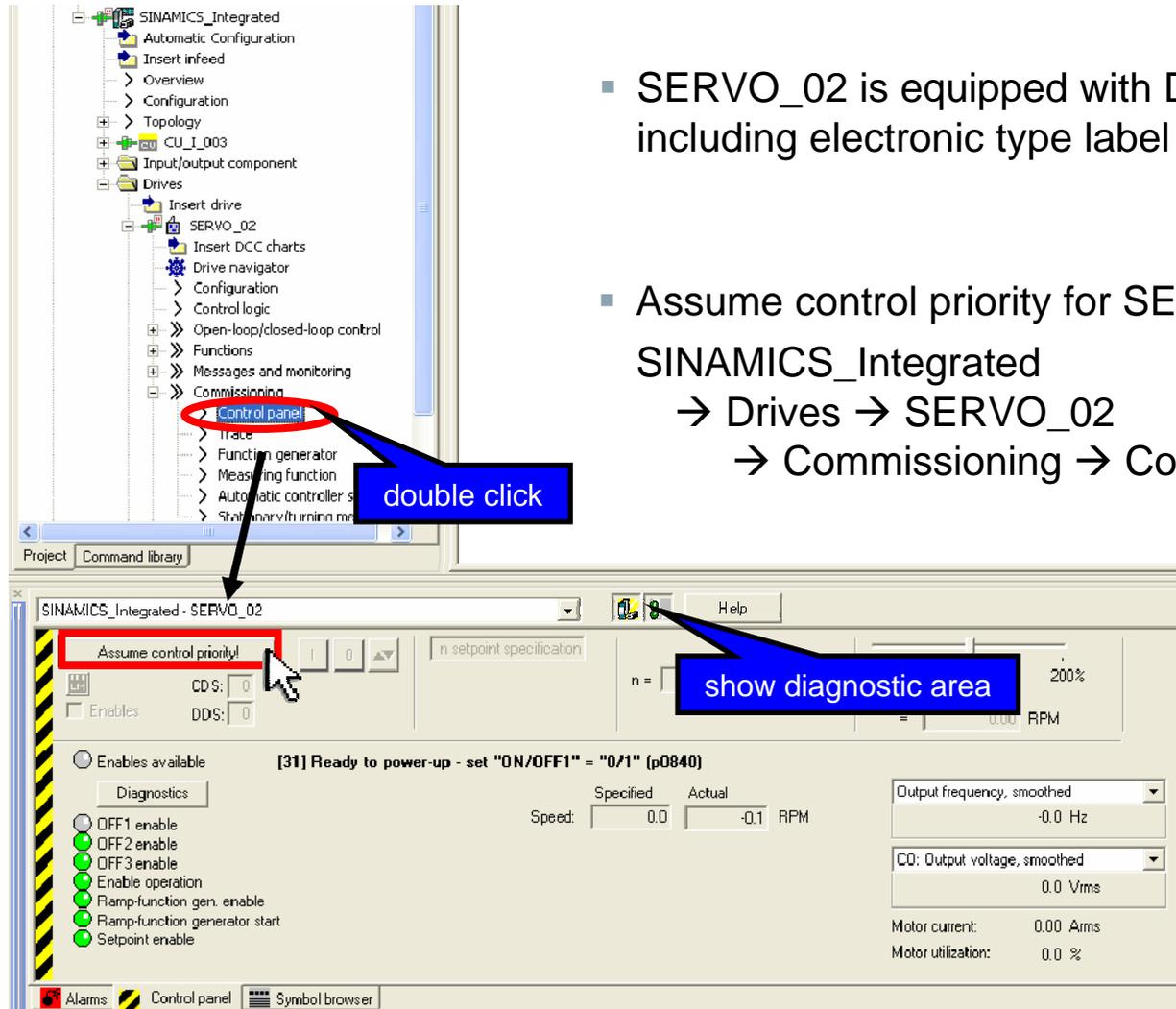
- Select  Load CPU / drive unit to PG (2)

- Save and compile (3) 



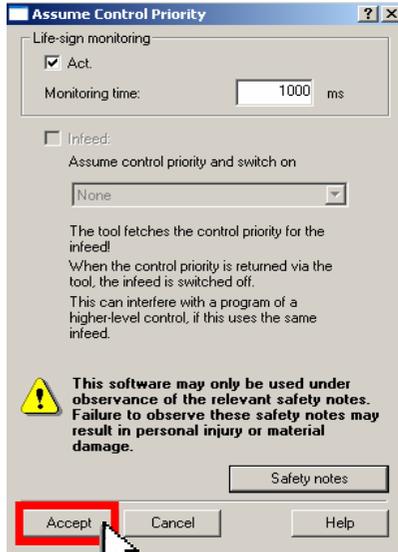
Operate SERVO_02 with the control panel

- SERVO_02 is equipped with DRIVE-CLiQ components including electronic type label → automatic commissioning.
- Assume control priority for SERVO_02:
 SINAMICS_Integrated
 → Drives → SERVO_02
 → Commissioning → Control panel



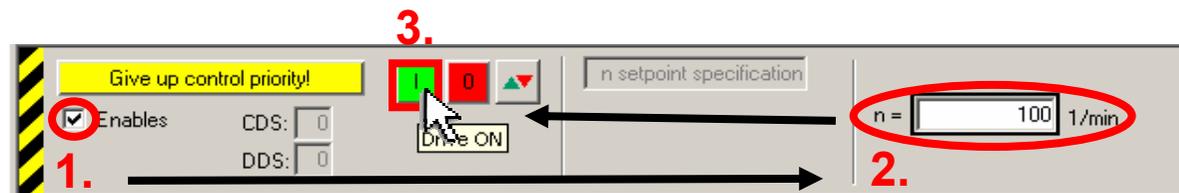
Operate SERVO_02 with the control panel

- Assume control priority



Warning: 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.

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



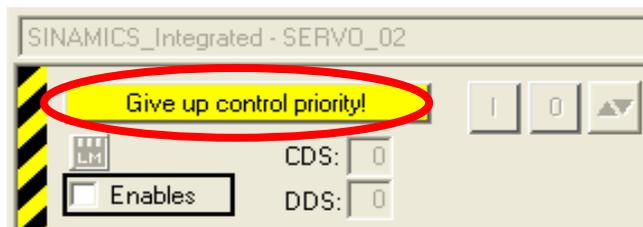
SERVO_02 is in Operation

STOP SERVO_02 with the control panel

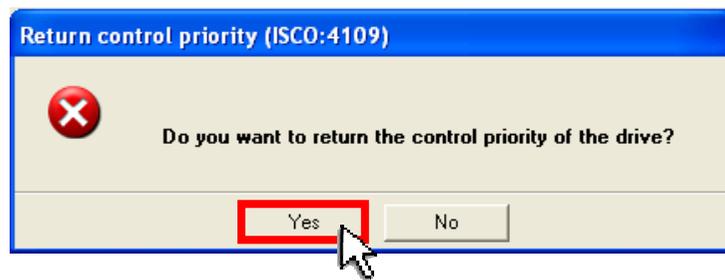
- Turn the drive off



- Return control priority



- Acknowledge the alert with "Yes"



Manual controller setting - Optimize speed controller

- Open measuring function (1) from menu bar
- Select SINAMICS_Integrated (2)
- Select “Speed controller setpoint jump (after speed setpoint filter)” (3)
- Four channels can be plotted depending on the measuring function. (4)

The screenshot shows the SIMOTION D435 software interface. The main configuration area is titled 'Measuring function inactive' and 'SINAMICS_Integrated'. The 'Measuring function' dropdown is set to 'Speed controller setpoint jump (after speed setpoint filter)'. The 'Drive' is set to 'SERVO_02'. The 'Amplitude' is set to 20.00 RPM. The 'Measuring time' is set to 50.000 ms. The 'Max. measuring time' is set to 682.500 ms. A graph shows a step response of the speed controller. The table below lists the channels that can be plotted:

No.	Active	Signal	Comment	Color
1	<input checked="" type="checkbox"/>	SERVO_02.r62	SERVO_02.r62: Speed setpoint after the filter	Orange
2	<input checked="" type="checkbox"/>	SERVO_02.r60	SERVO_02.r60: Torque actual value	Yellow
3	<input checked="" type="checkbox"/>	SERVO_02.r61	SERVO_02.r61: Speed actual value motor encoder	Green
4	<input type="checkbox"/>	...		Blue

Manual controller setting - Optimize speed controller

- Download modifications to the drive (1)
- Assume control priority (2) and accept (3)

Options Window Help

Measuring function set up SINAMICS_Integrated Assume control priority!

Measuring function Measurements Time diagram FFT diagram Bode diagram

Measuring function: Speed controller setpoint jump (after speed setpoint filter)

Drive: 1. SERVO_02 Repeated me.

Settling time: 0.000 ms

Amplitude: 20.00 RPM

Offset: 0.00 RPM

Ramp-up time: 0.000 ms

Measuring time: 50.000 ms

Max. measuring time: 682.500 ms

Values in %

Assume Control Priority

Life-sign monitoring

Act

Monitoring time: 1000 ms

Infeed:

Assume control priority

None

The tool fetches the control priority for the infeed!

When the control priority is returned via the tool, the infeed is switched off.

This can interfere with a program of a higher-level control, if this uses the same infeed.

! 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.

3. Safety notes

Accept Cancel Help

Manual controller setting - Start measuring function

- Switch Drive ON (1) and start measurement (2)
- The measurement will start after the alert has been read and understood (3)

The screenshot shows the 'Measuring function set up' dialog box in the SIMOTION D435 software. The 'Measuring function' is set to 'Speed controller setpoint jump (after speed setpoint filter)' and the 'Drive' is 'SERVO_02'. A yellow warning bar at the top right says 'Give up control priority!'. A mouse cursor is pointing at the 'ON' button (1) and the 'Start' button (2). A warning dialog box titled 'Measuring Function' is open, displaying a warning icon and the text: 'Take care when using the measuring function! When performing the measurement, the drive produces a movement in accordance with the parameterization of the measuring function (e.g. offset, amplitude, measuring time). Please ensure that no personnel are in the endangered area and that no damage to your plant or machine can result from these movements (e.g. from the mechanical endstops). Do you want to continue?'. A mouse cursor is pointing at the 'Yes' button (3).

Measuring function set up | SINAMICS_Integrated | Give up control priority!

Measuring function | Measurements | Time diagram | FFT diagram | Bode diagram

Measuring function: Speed controller setpoint jump (after speed setpoint filter)

Drive: SERVO_02 Repeated measurement

Settling time:

Amplitude:

Offset:

Ramp-up time:

Measuring time:

Max. measuring time:

No.	Active	
1	<input checked="" type="checkbox"/>	St
2	<input checked="" type="checkbox"/>	St
3	<input checked="" type="checkbox"/>	St
4	<input type="checkbox"/>	

Measuring Function

Take care when using the measuring function!

When performing the measurement, the drive produces a movement in accordance with the parameterization of the measuring function (e.g. offset, amplitude, measuring time).

Please ensure that no personnel are in the endangered area and that no damage to your plant or machine can result from these movements (e.g. from the mechanical endstops).

Do you want to continue?

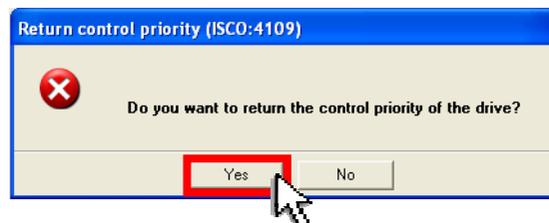
3. Yes No

Manual controller setting - Time diagram

- The recorded curves are displayed



- Switch Drive OFF (1)
- Return control priority (2)



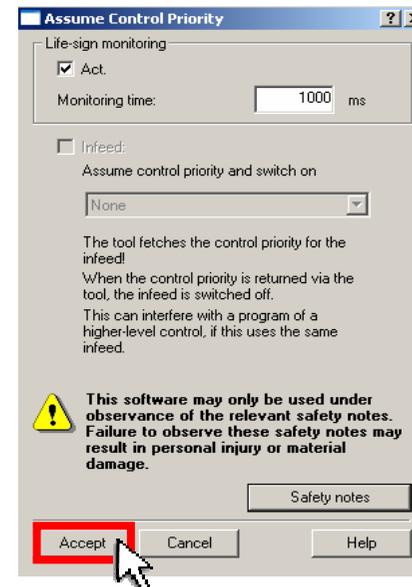
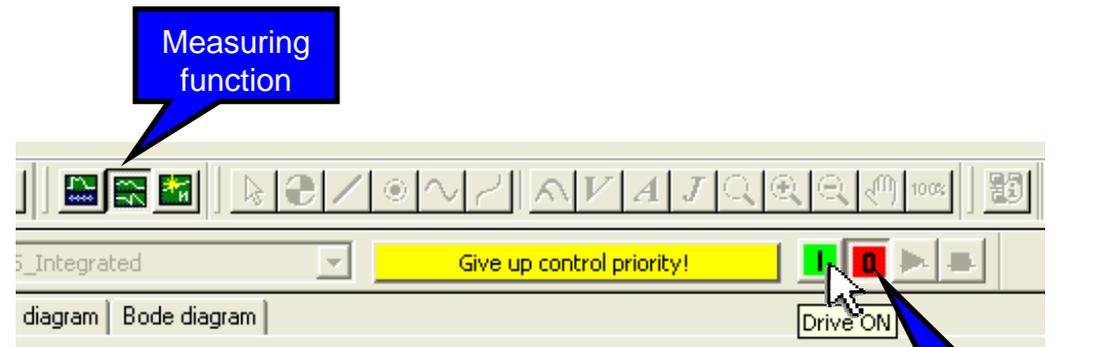
Manual controller setting - Adjust speed controller parameters

- The gain factor can be optimized by changing the value in the P gain = 0.1 Nms/rad input field (2) in the speed controller template (1)
- The values are immediately active! (after pressing ENTER)

The screenshot displays the Siemens SIMOTION D435 software interface for configuring a speed controller. On the left, the project tree shows the 'Speed controller' template selected, indicated by a red circle and the number '1.'. The main window shows the 'Speed controller with encoder' configuration page. The 'P gain' field is set to 0.100 Nms/rad, highlighted with a red box and the number '2.'. Other parameters include 'Reset time' at 10.00, 'Static speed setpoint' at 0.000 RPM, and 'Adaptation' at 125.00 µs. The control logic diagram shows a PI controller receiving a reference of 0.00 RPM and outputting 0.00 Nm. The status bar at the bottom shows '3:2' and active modules for CDS, DDS, and MDS.

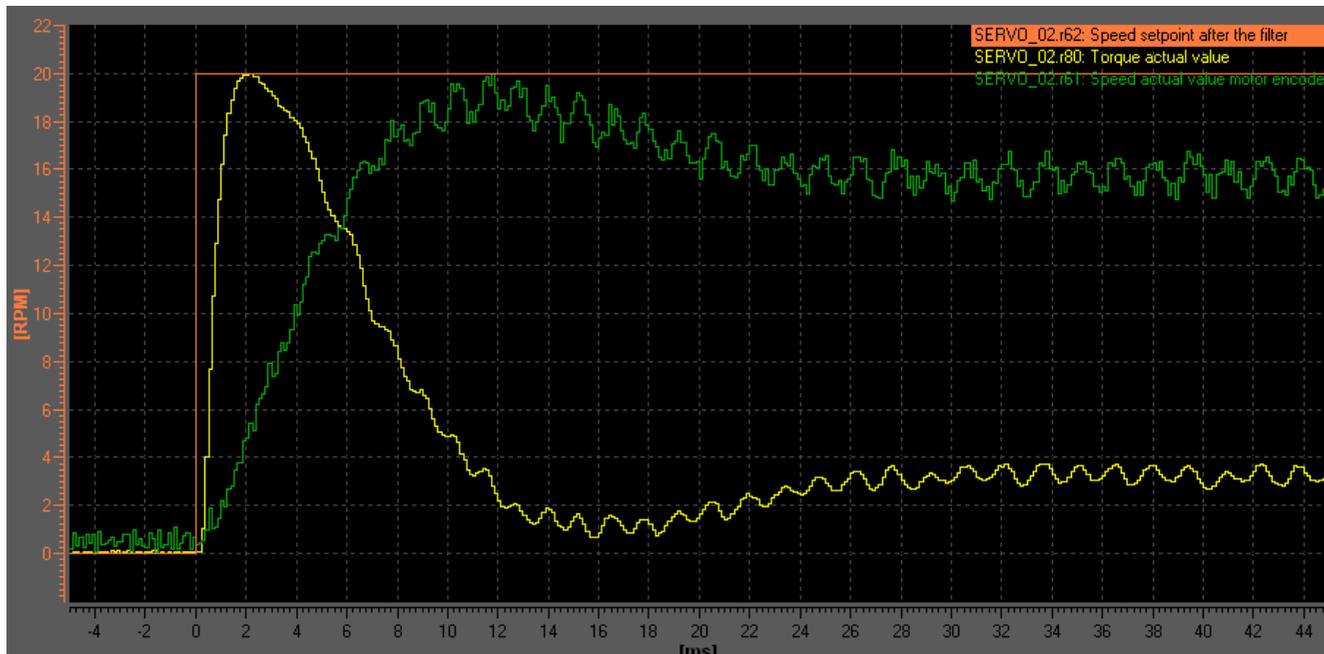
Manual controller setting – Control measurement

- Select a new measuring function 
- Press: Assume control priority
- Accept application monitoring time
- Switch Drive ON 
- Start measuring function 
- Acknowledge alert with “Yes”
- Switch Drive OFF 
- Press: Give up control priority!



Manual controller setting - Control measurement

- The control measurement with optimized controller values shows a much better transient response.



- Close the trace and don't save the curves.



Automatic controller setting¹

Assume control priority, Drive ON and Perform all steps

1. Give up control priority!

3. Perform all steps

4.

Controller: Speed controller

Drive: SERVO_02

Controller setting sequence:

- 1. Measurement of the mechanical system, Part 1
- 2. Measurement of the mechanical system, Part 2
- 3. Identification of the current control loop
- 4. Calculation of the speed controller setting

Result of the speed controller setting:

Parameter	Parameter text	Current value	Set value
p1400[0]	Speed control configuration	3a0H	
p1400[0].3	Reference model speed setpoint, I component	Off	
p1414[0]	Speed setpoint filter activation	0H	
p1414[0].0	Activate filter 1	No	
p1414[0].1	Activate filter 2	No	
p1441[0]	Actual speed smoothing time	0.000	ms
p1460[0]	Speed controller P gain adaptation speed, lower	0.100	Nm
p1462[0]	Speed controller integral time adaptation speed lower	10.000	
p1656[0]	Activates current setpoint filter	1H	
p1657[0]	Current setpoint filter 1 type	Low pass: PT2 (1)	
p1658[0]	Current setpoint filter 1 denominator natural frequency	1999.000	
p1659[0]	Current setpoint filter 1 denominator damping	0.700	
p1660[0]	Current setpoint filter 1 numerator natural frequency	4000.000	

All steps will be done automatically

new values will be calculated

To save settings scroll down and press "Accept".

Accept optimized settings in the drive?

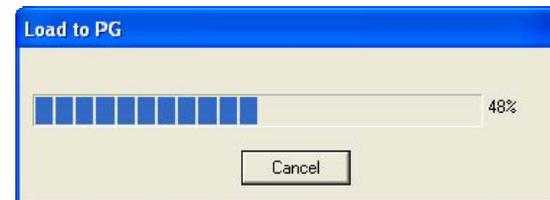
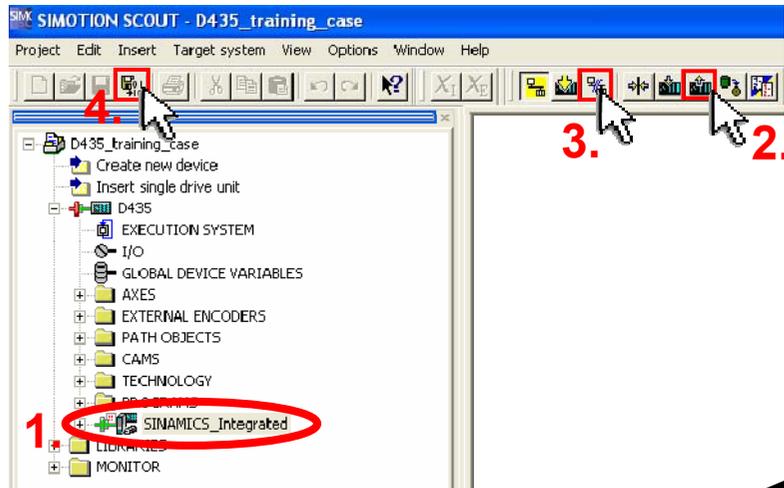
Accept

- Switch drive off and give up control priority after automatic controller setting has finished.

¹ in preparation

Load drive unit to PG and disconnect from target system

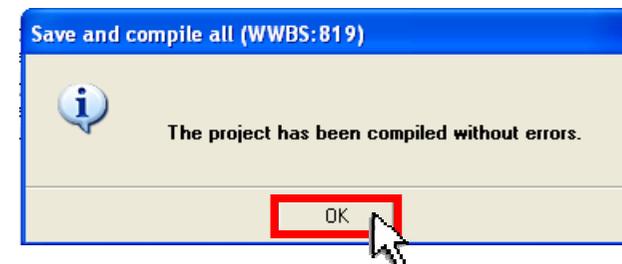
- Select SINAMICS_Integrated (1)



- Select  Load CPU / drive unit to PG (2)

- Disconnect from target system (3) 

- Save and compile (4) 



Set PROFIBUS Message frame aligning with HW Config

- Set correct message frame type (e.g. SIEMENS telegram 105 for drives, telegram 390 for CU)

The screenshot shows the SIMATIC Manager interface for configuring PROFIBUS message frames. On the left, a project tree shows the 'Drives' folder containing 'SERVO_02' and 'SERVO_03'. The main window displays the 'PROFIBUS message frame' configuration table. A red circle highlights the 'Message frame type' column, and an orange callout box points to it with the text 'Another message frame type is defined in HW Config'. A blue callout box explains: 'Before the alignment, you must move all drive objects without I/O addresses ("---.---") behind the objects with valid or still to be aligned ("???.??") I/O addresses.' A red box highlights the 'Transfer to HW Config' button. An 'Alignment with HW Config' dialog box is open, asking 'Do you want to carry out the alignment with HW Config now?' with 'Yes' and 'No' buttons. An orange callout box points to the 'Yes' button with the text 'Message frame has been aligned to HW Config'. Below the dialog, a table shows the updated configuration with checkmarks in the 'Message frame type' column.

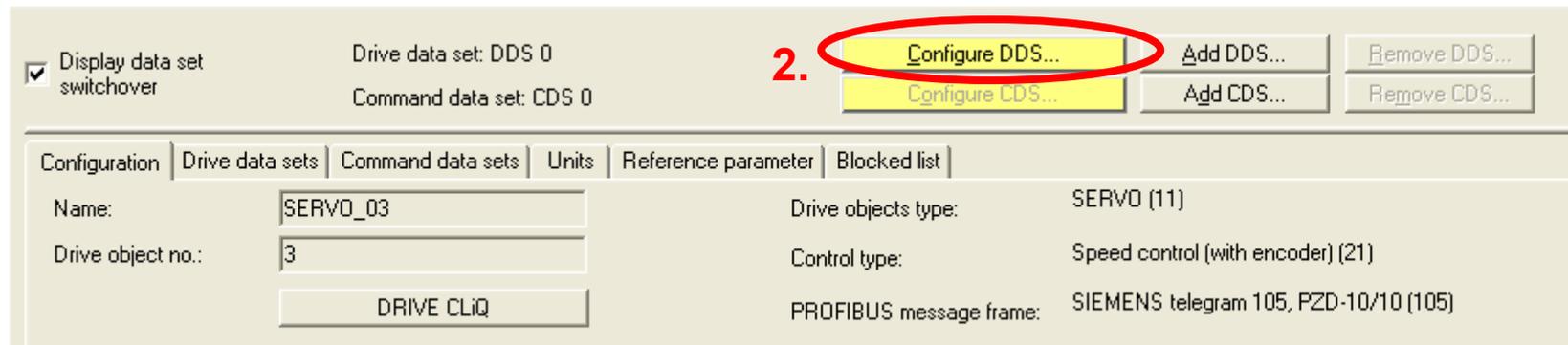
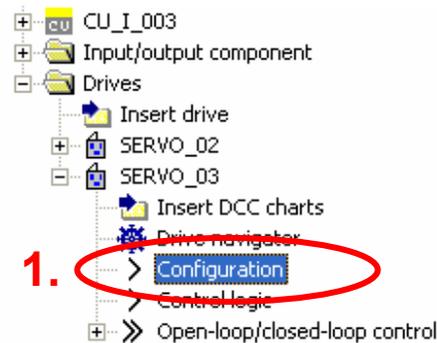
Object	Drive object	No.	Message frame type	Input data		Output data		SIMOTION axis
				Length	Address	Length	Address	
1	SERVO_02	2	SIEMENS telegram 105, PZD-10/10	10	256..275	10	256..275	---
2	SERVO_03	3	SIEMENS telegram 105, PZD-10/10	10	276..295	10	276..295	---
3	CU_I_003	1	SIEMENS telegram 390, PZD-2/2	2	296..299	2	296..299	---
4	TB30_04	4	Free message frame configuration with BICO technology	0	---	0	---	---

Without PZDs (no cyclic data exchange)

- Transfer configuration to HW Config

Completing configuration for SERVO_03

- Follow configuration templates for “SERVO_03”.
The motor and encoder don't possess an electronic type label (no sensor module integrated)



Configuration SERVO_03 control structure and power unit

- 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
- PROFIBUS process de
- Summary

Function modules

- Extended setpoint channel
- Technology controller
- Extended messages/monitoring

Setpt. → Closed-loop control (n/M control) → Motor

Control method: Speed control (with encoder)

Actual speed value preparation

< Back **Continue >** Cancel Help



Configuration - SINAMICS_Integrated - Power_unit

Drive: SERVO_03, DDS 0

Control structure

- Control structure
- Power_unit
- Motor
- Motor holding brake
- Encoder
- PROFIBUS process de
- 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

Only display double motor modules with free connections

Power unit selection:

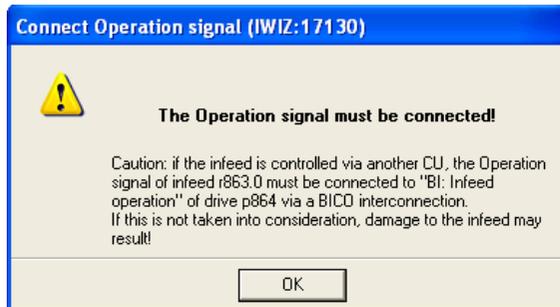
Order no.	Rated power	Rated curr...	Execution
6SL3420-2TE11-7Axx	1 kW	1.7 A / 1.7 A	DC/AC
6SL3120-2TE13-0Axx	1.6 kW	3 A / 3 A	DC/AC
6SL3420-2TE13-0Axx	1.6 kW	3 A / 3 A	DC/AC
6SL3120-2TE13-0Axx	2.7 kW	5 A / 5 A	DC/AC
6SL3420-2TE15-0Axx	2.7 kW	5 A / 5 A	DC/AC
6SL3120-2TE21-0Axx	9 kW	9 A / 9 A	DC/AC
6SL3120-2TE21-8Axx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

6SL3120-2TE13-0Axx (see label)

< Back **Continue >** Cancel Help

Setup of operating signal

- Setup DI 4 for enable infeed operation SERVO_03.



Configuration - SINAMICS_Integrated - Power unit BICO technology

Drive: SERVO_03, DDS 0

1. CU_I_003, r722: Bit 4, CO/BO: CU

2. CU_I_003

3. r722: Bit 4, CO/BO: CU digital inputs, status: : DI 4 (X132.1) (1=High / 0=Low)

r722: Bit 0, CO/BO: CU digital inputs, status: : DI 0 (X122.1/X121.1) (1=High / 0=Low)
 r722: Bit 1, CO/BO: CU digital inputs, status: : DI 1 (X122.2/X121.2) (1=High / 0=Low)
 r722: Bit 2, CO/BO: CU digital inputs, status: : DI 2 (X122.3/X121.3) (1=High / 0=Low)
 r722: Bit 3, CO/BO: CU digital inputs, status: : DI 3 (X122.4/X121.4) (1=High / 0=Low)
 r722: Bit 5, CO/BO: CU digital inputs, status: : DI 5 (X132.2) (1=High / 0=Low)
 r722: Bit 6, CO/BO: CU digital inputs, status: : DI 6 (X132.3) (1=High / 0=Low)
 r722: Bit 7, CO/BO: CU digital inputs, status: : DI 7 (X132.4) (1=High / 0=Low)

Further interconnections...

< Back **Continue >** Cancel Help

Determine power unit connection

- Check correct connection for double motor module



Motor and brake selection

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

Configuration - SINAMICS_Integrated - Motor

Drive: SERVO_03, DDS 0, MDS 0

Configure the motor:

Motor name: Motor_6

Motor with DRIVE-CLIQ
 Read out motor data
 Select standard motor from list
 Enter motor data

3rd party motor integration

1. Select standard motor from list

2. Motor type: 1FK7 synchronous motor

Motor selection:

Order no.	Rated speed	Rated torq...	Rated curr.
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	1.2 Nm	1.8 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-xAF2x-xxxx	3000 U/min	2.6 Nm	3.5 A

3. 1FK7022-xAK7x-xxxx

< Back **Continue >** Cancel Help



Configuration - SINAMICS_Integrated - Motor holding brake

Drive: SERVO_03, DDS 0

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:

No motor holding brake being used

Extended brake control

< Back **Continue >** Cancel Help

Select encoder

- Select encoder (sin/cos incremental encoder, code 2001)

The screenshot shows the 'Configuration - SINAMICS_Integrated - Encoder' window. The 'Encoder' tab is selected in the left-hand tree. The 'Drive: SERV0_03, DDS 0, MDS 0' is displayed. Under 'Which encoder do you want to use?', 'Encoder 1' is selected. The 'Encoder name' is 'Encoder_5' and the 'Encoder evaluation' is 'SMC20 - "SM_4" (4)'. The 'Select standard encoder from' radio button is selected. Below this is a list of encoder types, including '2048, 1 Vpp, A/B C/D R'. An 'Encoder Selection via Motor Order Number' dialog box is open, showing a table of available encoders for the selected motor. The first row is highlighted, showing a sin/cos incremental C/D encoder with a resolution of 2048 S/R and a code number of 2001. The 'OK' button in the dialog is highlighted with a red box. At the bottom of the main window, the 'Continue' button is also highlighted with a red box.

Encoder Selection via Motor Order Number

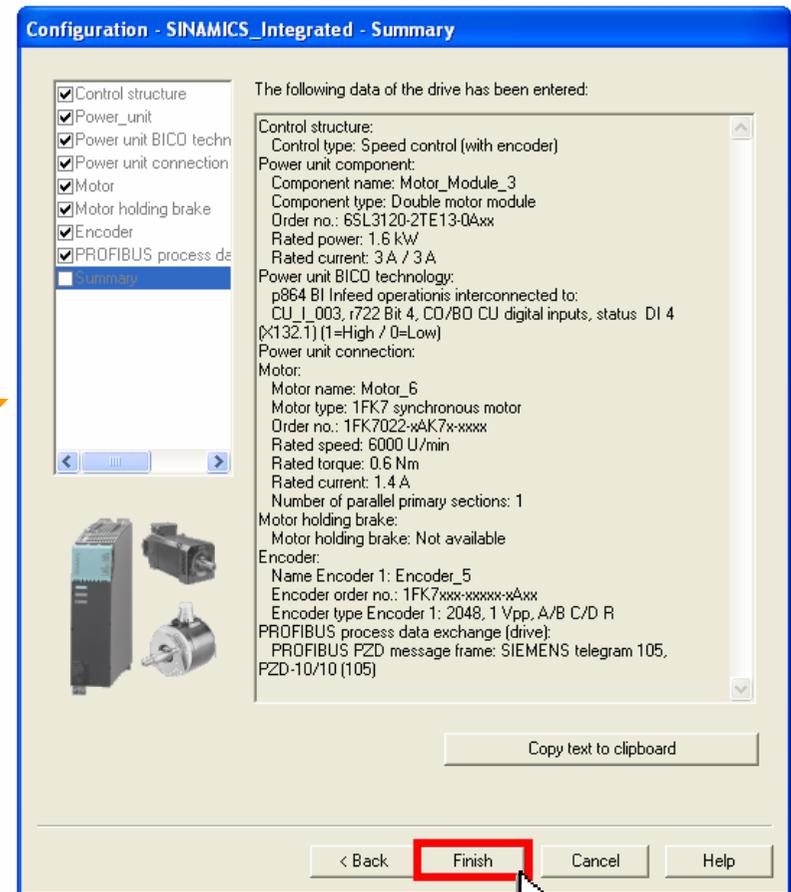
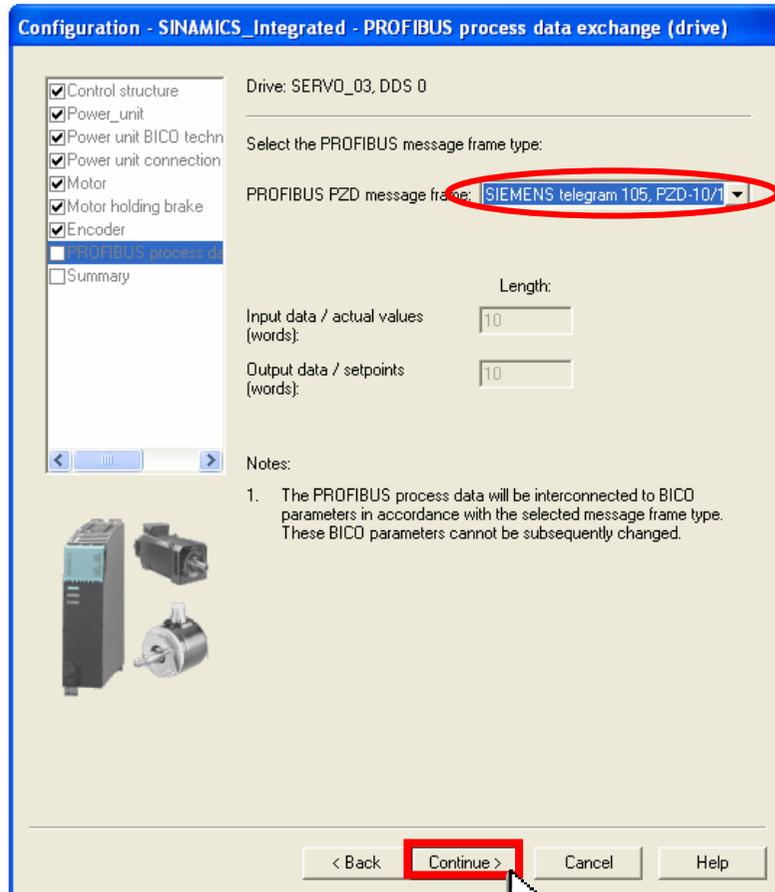
The encoders listed below are available for the selected listed motor. Select the relevant encoder via the motor order number.

Motor encoder selection:

Type (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

Message frame selection / Summary

- Control correct SIEMENS telegram 105 for PROFIBUS process data exchange

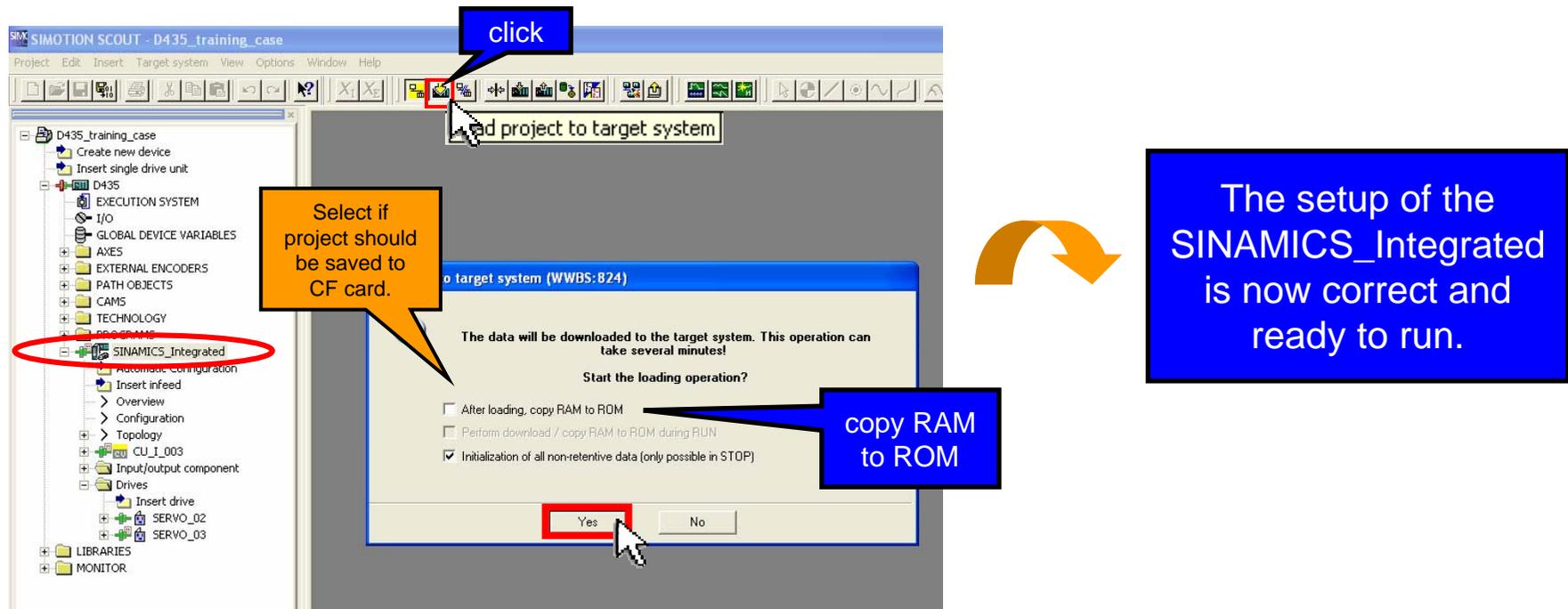


Load project to target system

- Save project and connect to target system



- Select SINAMICS_Integrated and load project to target system



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)

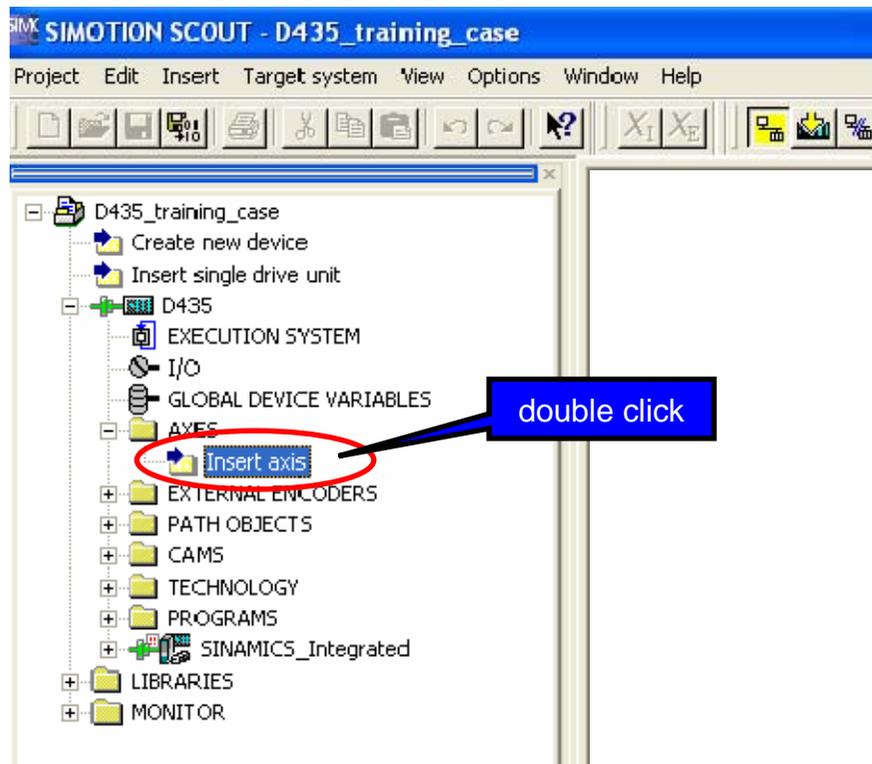


In this case:

- open expert list for SERVO_03 again
- set p1244[0] = 715 V and p1248[0] = 279 V
- Load CPU / drive unit to PG 
- Save and compile 

SIMOTION D435 - Insert a new axis

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

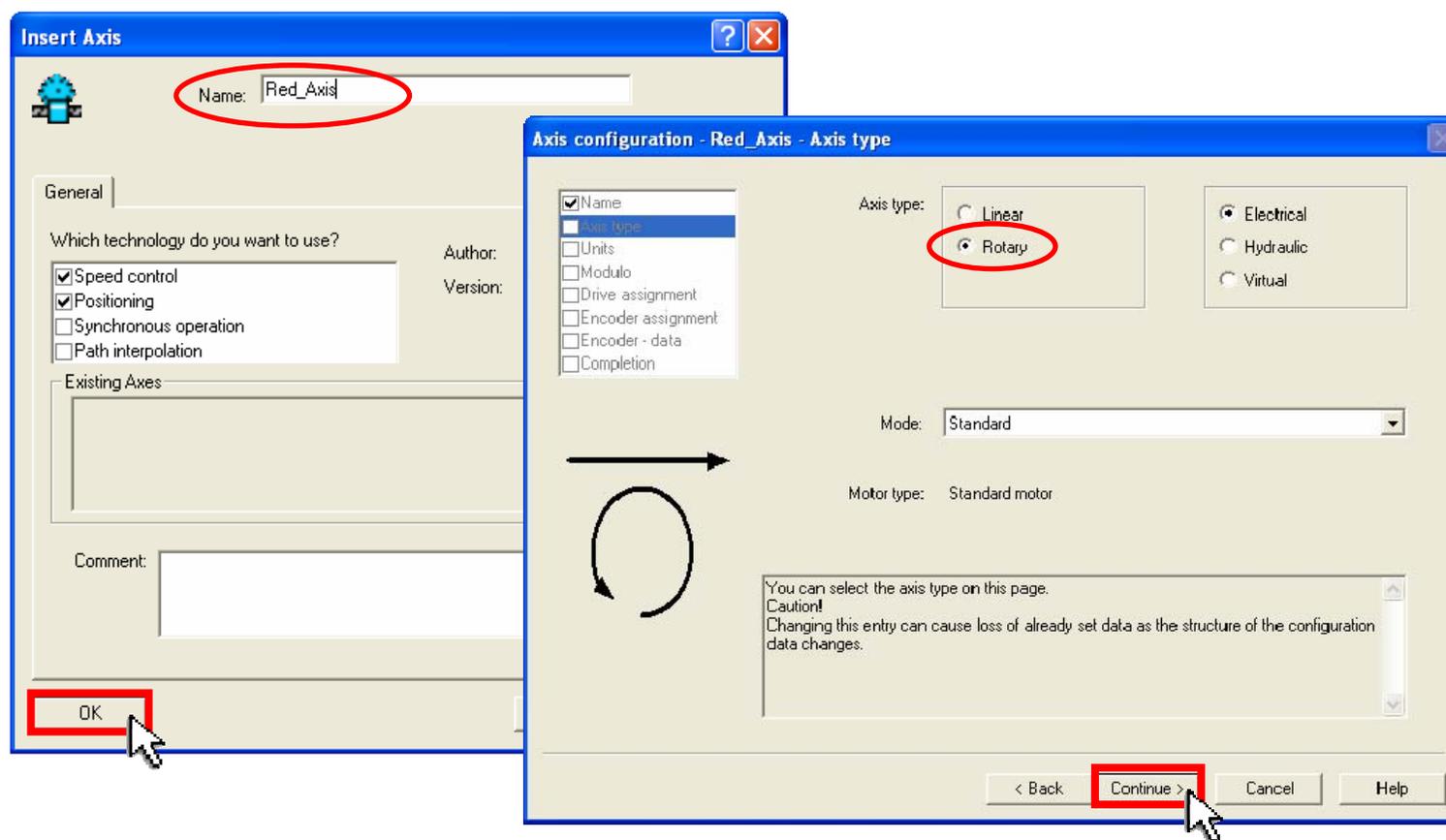


Information : Red Flag
The Red Flag shows that there are optimized SINAMICS values. Use “Load to PG” to update values.



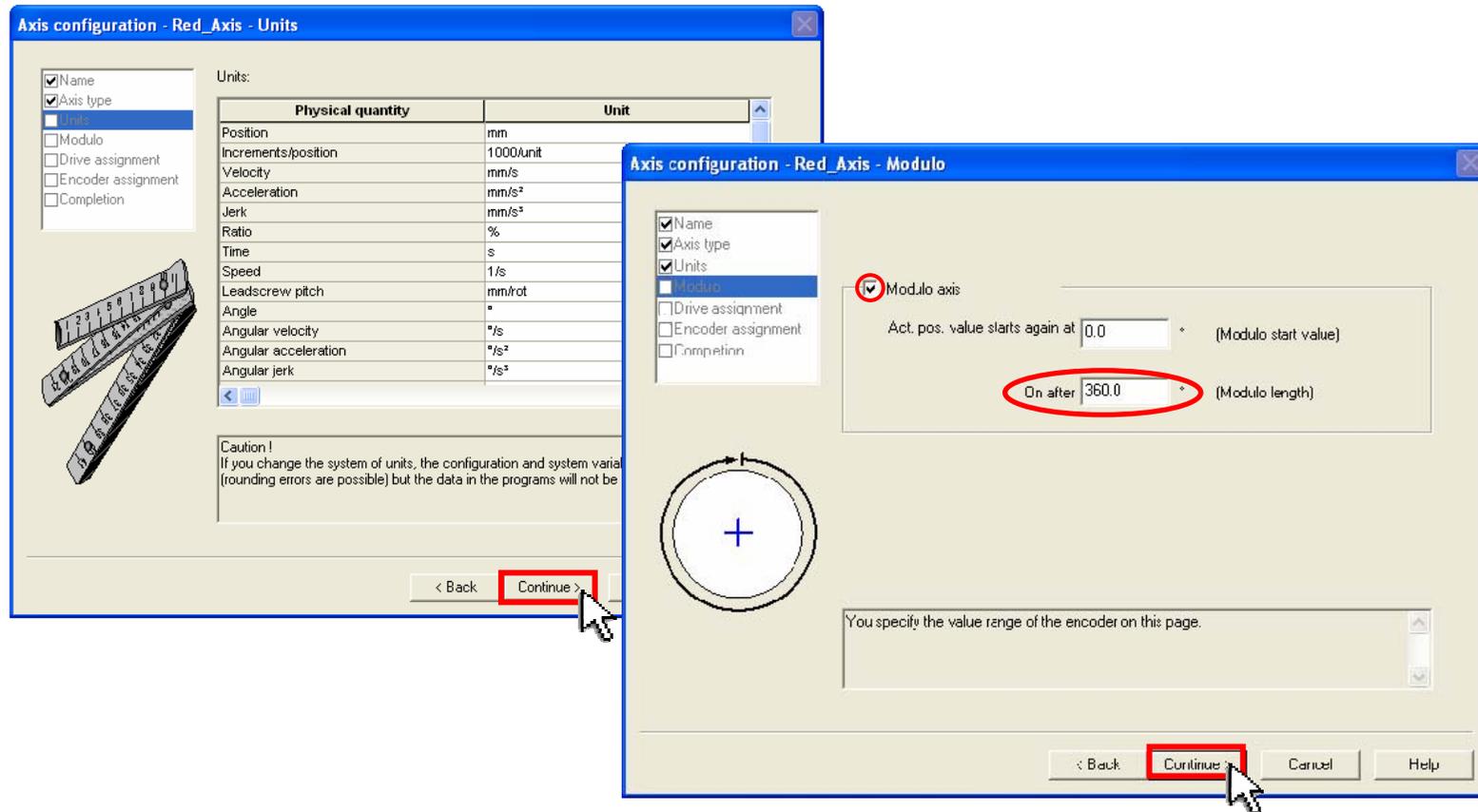
Configure “Red_Axis”

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



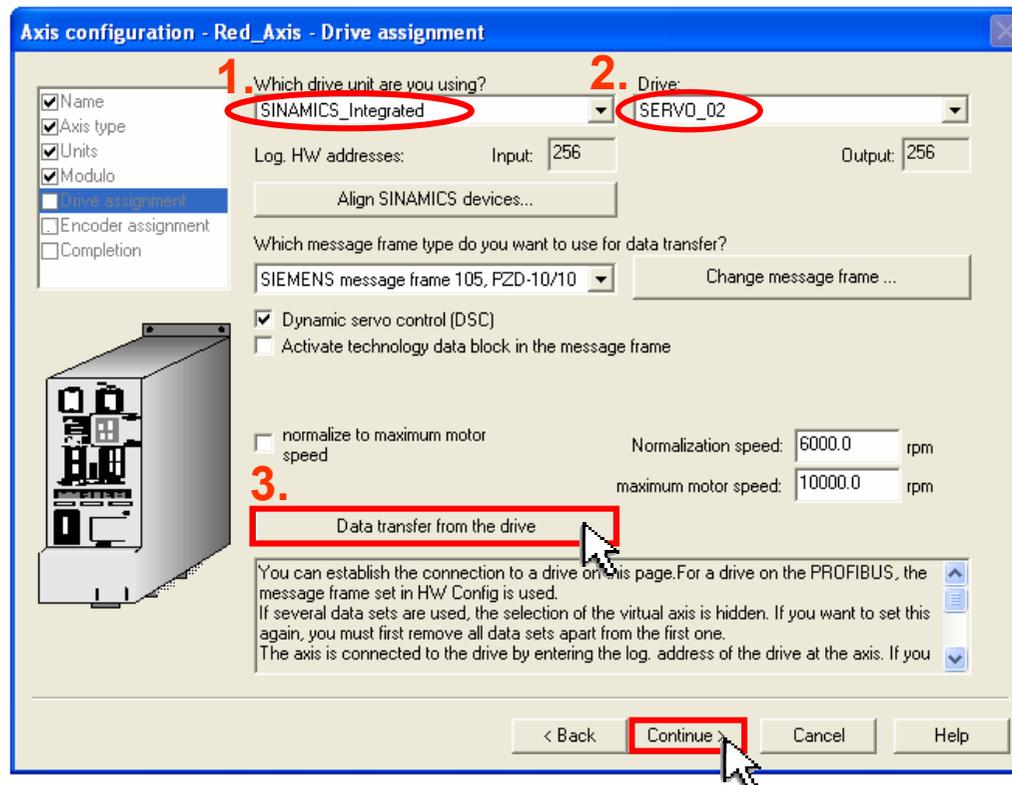
Configure “Red_Axis”

- Define units (standard settings) and select “modulo axis” with 360° modulo length.



Configure “Red_Axis”

- Select drive unit SINAMICS_Integrated (1) and select drive SERVO_02 (2)
- Check message frame type (message frame 105)
- Click “Data transfer from the drive” (3)



Configure “Red_Axis”

- Click “Data transfer from the drive” and control encoder properties

Axis configuration - Red_Axis - Encoder assignment

- Where is the position encoder connected?
SINAMICS_Integrated - Encoder 1 of SERV0_02
- Log. HW addresses: Input: 256
- Which message frame type do you want to use for data transfer?
SIEMENS message frame 105, PZD-10/10
- Encoder type: Absolute encoder, cyclic absolute
- Encoder mode: Endat
- Measuring system: Rotary encoder system
- Data transfer from the drive**

Axis configuration - Red_Axis - Encoder - data

- Encoder pulses per revolution: 512
- Fine resolution: 2048
- Fine resolution of absolute value in Gn X1S12: 512
- Data width of absolute value without fine resolution: 21
- Encoder monitoring active:

Encoder - data parameters:

- Encoder pulses / revolution: 512
- Fine resolution: 2048
- Number of data bits: 21

Encoder assignment parameters:

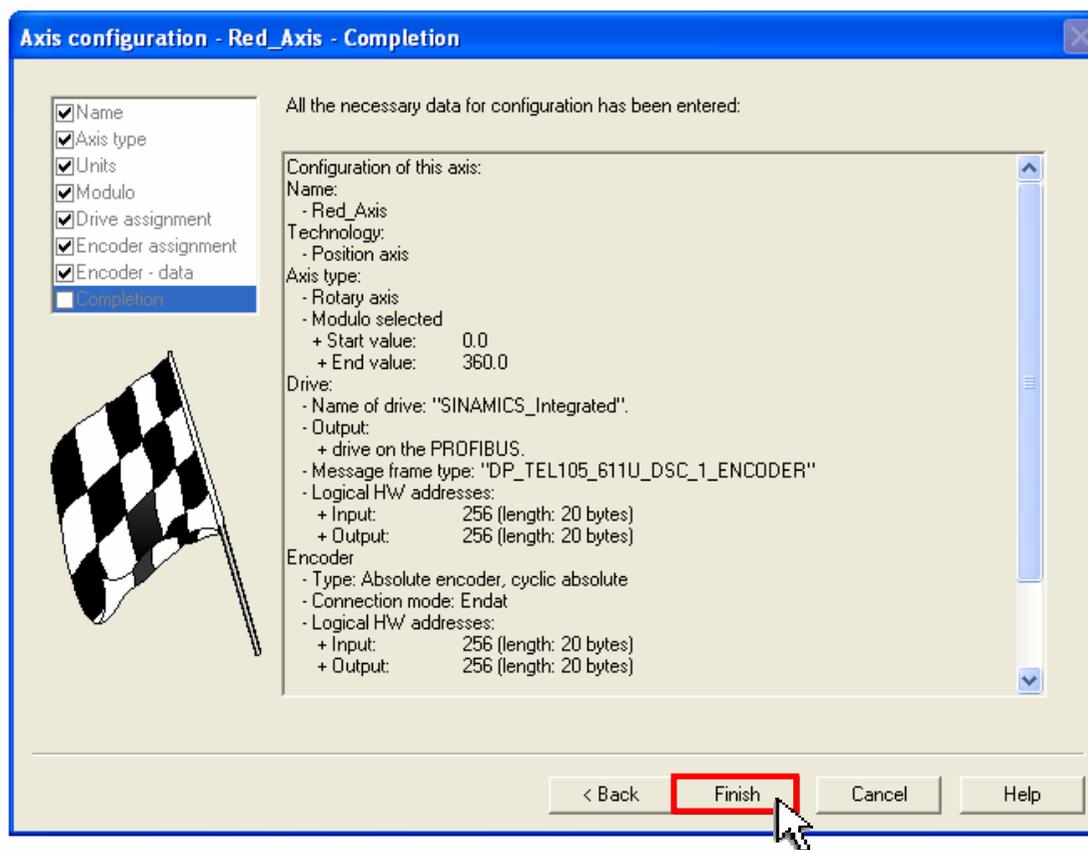
- Encoder type: Absolute encoder, cyclic absolute
- Encoder mode: Endat
- Measuring system: Rotary encoder system

- Encoder type: Absolute encoder, cyclic absolute
- Encoder mode: Endat
- Measuring system: Rotary encoder system

- Encoder pulses / revolution: 512
- Fine resolution: 2048
- Number of data bits: 21

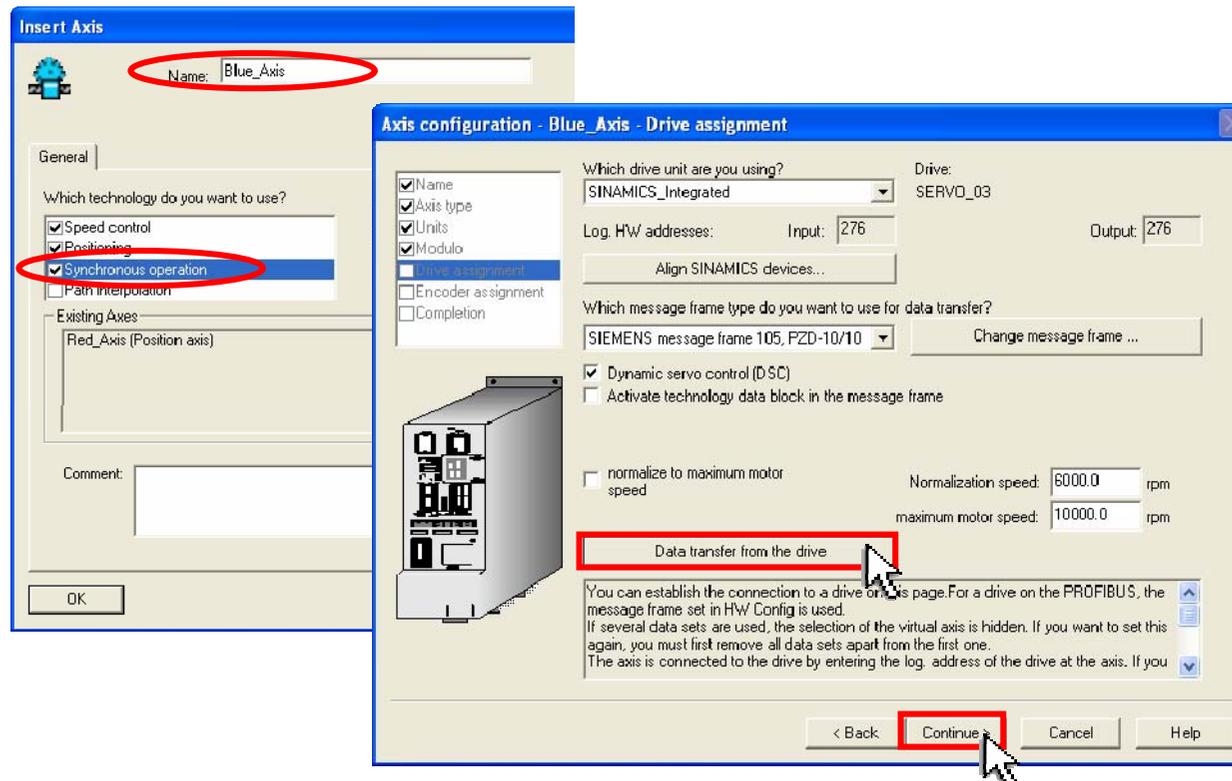
Configure “Red_Axis”

- Summary of axis configuration



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”
 - select technology: “Synchronous operation”
 - select axis type: rotary and modulo axis with 360 degrees modulo length



Configure “Blue_Axis”

- Click “Data transfer from the drive” and control encoder properties.

The image shows two overlapping dialog boxes from the Siemens SIMOTION D435 configuration software. The background dialog is titled "Axis configuration - Blue_Axis - Encoder assignment" and the foreground dialog is titled "Axis configuration - Blue_Axis - Inc. encoder data".

Encoder assignment dialog:

- Left sidebar: Name, Axis type, Units, Modulo, Drive assignment, Encoder assignment, Inc. encoder data, Completion.
- Where is the position encoder connected?: SINAMICS_Integrated - Encoder 1 of SERVD_03
- ..oa. HW addresses: Input: 276
- Which message frame type do you want to use for data transfer?: SIEMENS message frame 105, PZD-10/10
- Encoder type: Incremental encoder
- Encoder mode: Sine
- Measuring system: Rotary encoder system
- A red box highlights the "Data transfer from the drive" option.
- Bottom buttons: < Back, Continue, Cancel, Help.

Inc. encoder data dialog:

- Left sidebar: Name, Axis type, Units, Modulo, Drive assignment, Encoder assignment, Inc. encoder data, Completion.
- Encoder pulses per revolution: 2048
- Fine resolution: 2048
- Bottom buttons: < Back, Continue, Cancel, Help.

Annotations:

- A blue callout bubble points to the "Encoder pulses / revolution: 2048" field in the foreground dialog.
- A blue callout bubble points to the "Data transfer from the drive" option in the background dialog.
- A blue callout bubble points to the "Continue" button in the foreground dialog.

- Encoder type: Incremental encoder
- Encoder mode: Sine
- Measuring system: Rotary encoder system

Encoder pulses / revolution: 2048

Add Output cam for “Red_Axis”

- Insert output cam

The screenshot shows the SIMOTION D435 software interface. On the left, a tree view displays the project structure, with 'Red_Axis' and 'Insert output cam' highlighted by red circles. The main window displays the 'Insert Output cam' dialog box. The dialog box has a 'Name' field containing 'Output_cam_1'. Below this, there are fields for 'Author' and 'Version'. The 'General' tab is active, showing the 'Existing Output cam' field, a 'Comment' field, and a checkbox for 'Oper editor automatically'. The 'Output' section has an 'Activate output' checkbox. A blue callout box points to the 'standard settings' section of the dialog, which includes the 'Output cam type' (Position-based cam), 'Processing cycle clock' (IPO), and 'Type of output cam values' (Setpoints). The 'OK' button is highlighted with a red box and a mouse cursor.

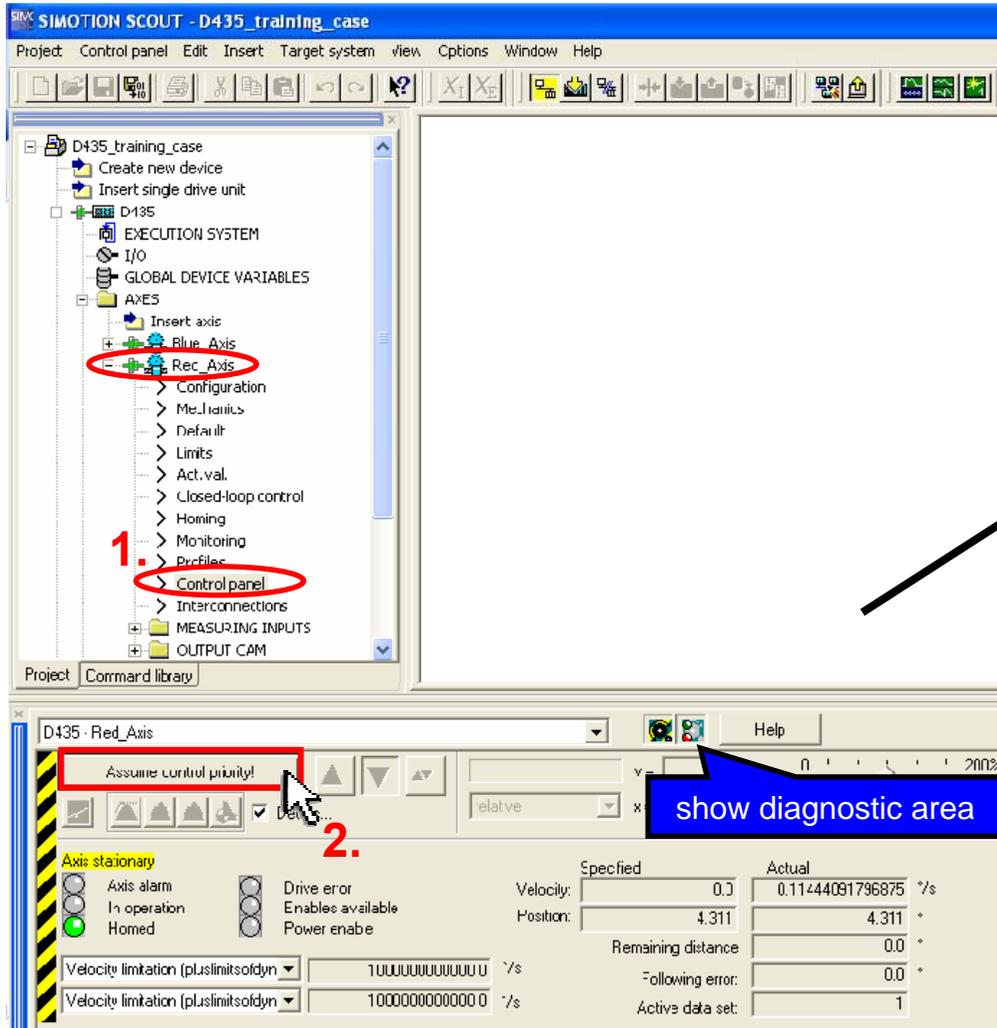
- Close window

Download data to target device

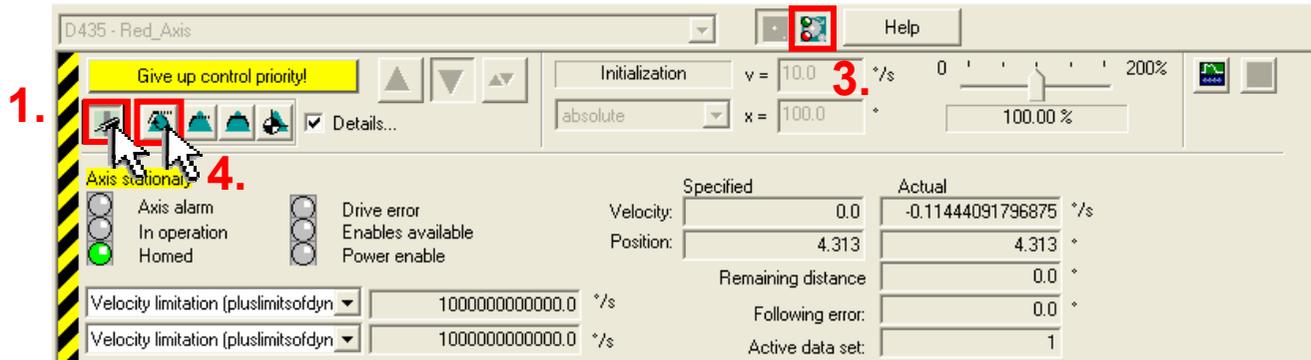
- Download SIMOTION D435 project to target device
(The 1st download (incl. TPCAM) takes longer.)

The screenshot shows the SIMOTION SCOUT software interface for a project named 'D435_training_case'. The 'D435' device is highlighted in the project tree. A context menu is open over the 'D435' device, with the 'Download ...' option circled in red. A blue arrow points from the 'Download ...' option to a blue callout box containing the text 'Load project to target system'. To the right, a confirmation dialog box titled 'Download to target system (WWBS:824)' is displayed, asking 'Start the loading operation?' with 'Yes' and 'No' buttons. The dialog box contains the following text: 'The data will be downloaded to the target system. This operation can take several minutes!' and 'Start the loading operation?'. Below this, there are three checked options: 'After loading, copy RAM to ROM', 'Perform download / copy RAM to ROM during RUN', and 'Initialization of all non-retentive data (only possible in STOP)'. The 'Yes' button is highlighted.

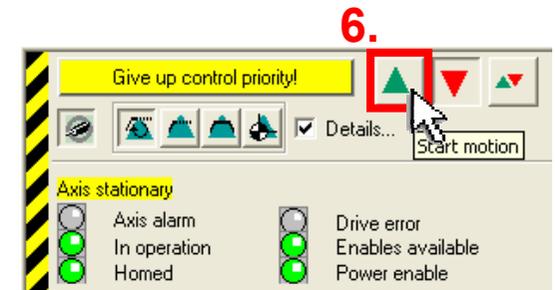
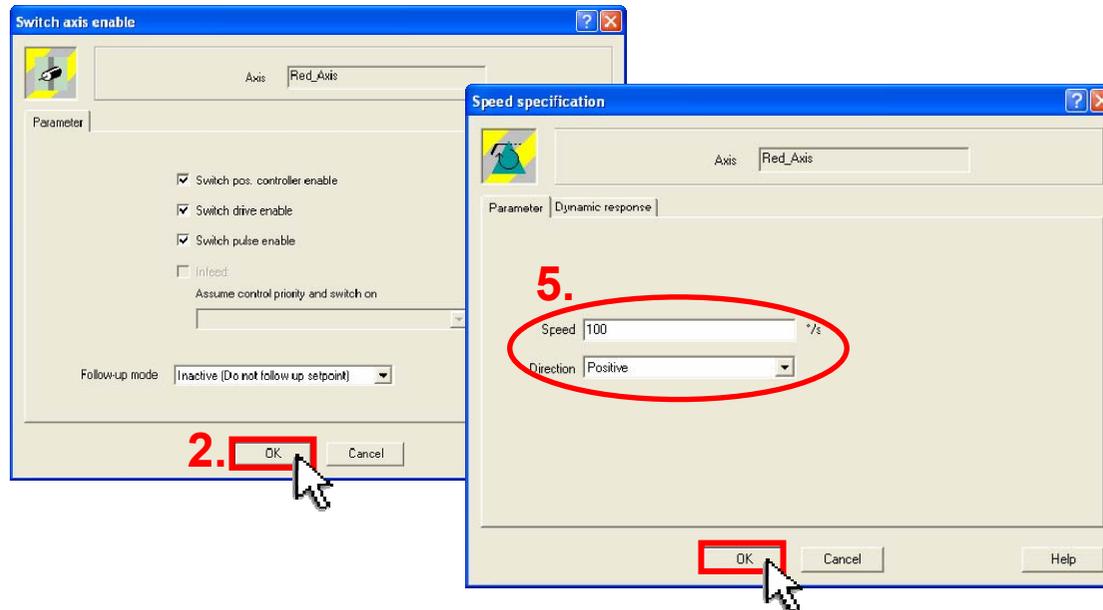
Operate "Red_Axis" with SIMOTION control panel



Start "Red_Axis" with SIMOTION control panel

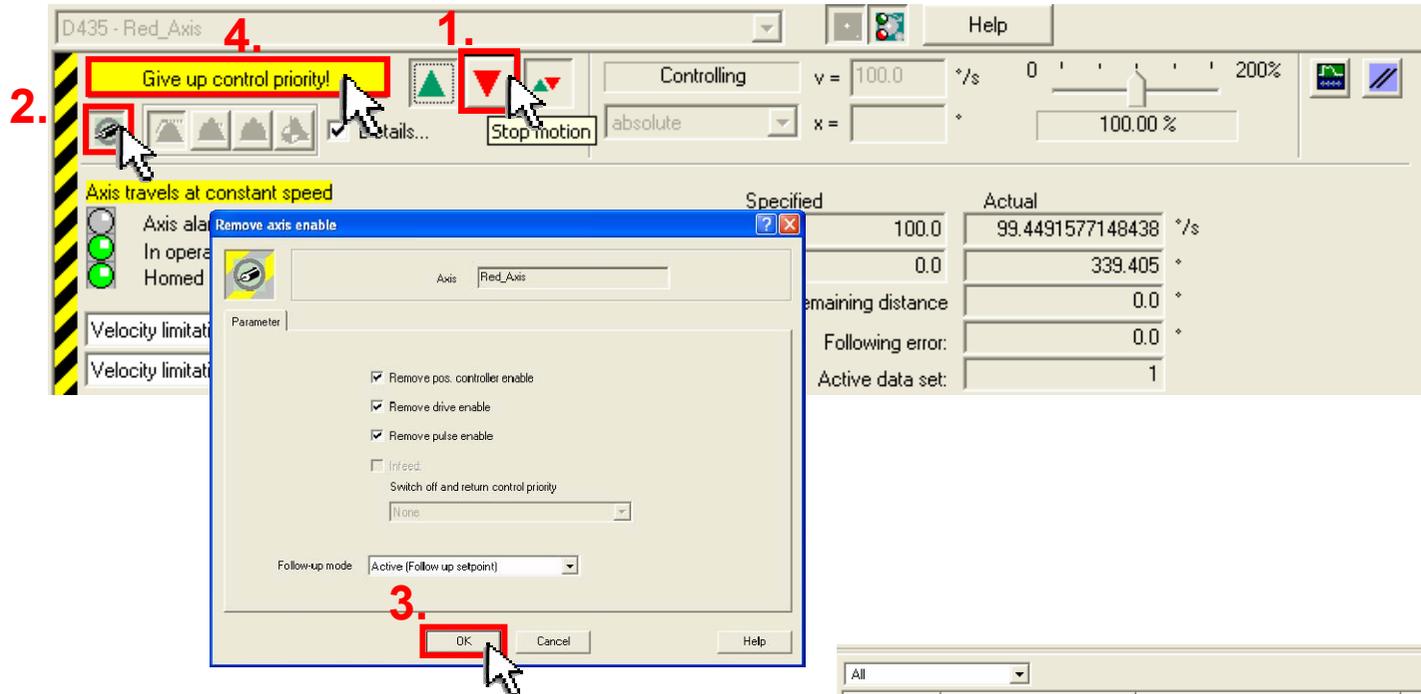


1. Set enables
2. Acknowledge with OK
3. Show Diagnostics
4. Select speed-controlled traversing of the axis
5. Enter desired speed and desired direction
6. Start motion



"Red_Axis" is in Operation

Stop "Red_Axis" with SIMOTION control panel



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

Level	Time	Source	Message
Information...	05.01.32 10:14:53.047	D435: Red_Axis	Information 30002: Command aborted (reason: 4, command type: 1001)
Fault: Imm...	000000:18:09:05:597	SINAMICS_Integrated : SERVO_02	Error 1910 : PROFIBUS: Setpoint timeout
Fault: Imm...	000000:18:09:05:597	SINAMICS_Integrated : SERVO_03	Error 1910 : PROFIBUS: Setpoint timeout
Fault: Imm...	000000:18:09:05:533	SINAMICS_Integrated : SERVO_02	Error 1912 : IF1: PB/PN clock cycle synchronous operation sign-of-life failure
Fault: Imm...	000000:18:09:05:533	SINAMICS_Integrated : SERVO_03	Error 1912 : IF1: PB/PN clock cycle synchronous operation sign-of-life failure

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**

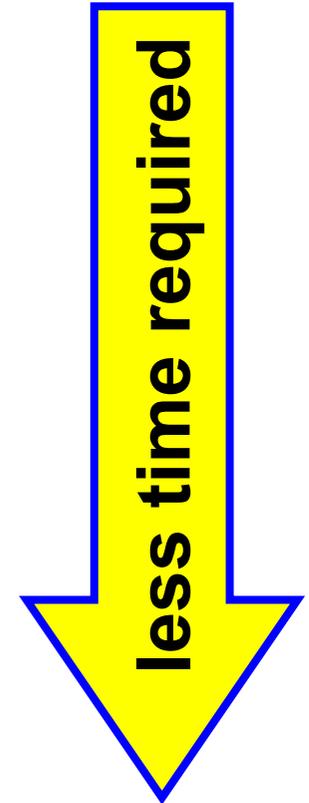
Start another SCOUT instance (open SCOUT a second time)

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,)

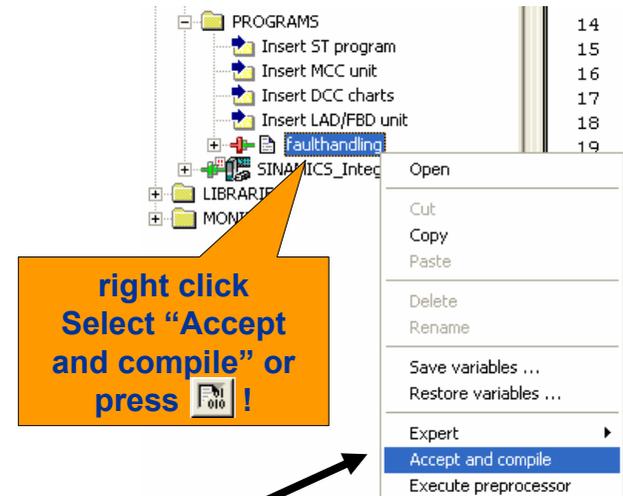
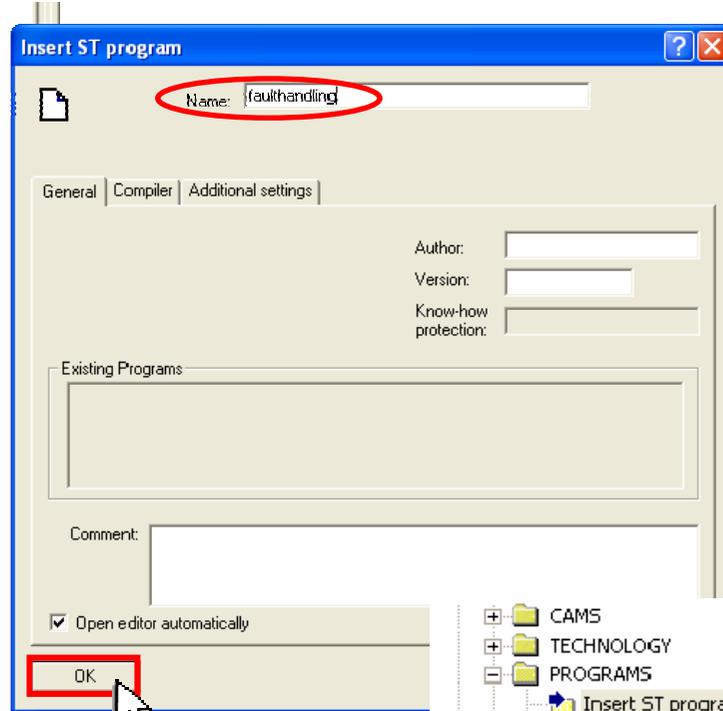
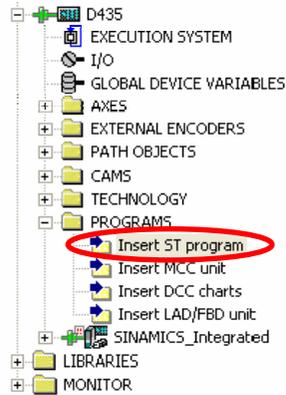
3. **Use demo project**

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

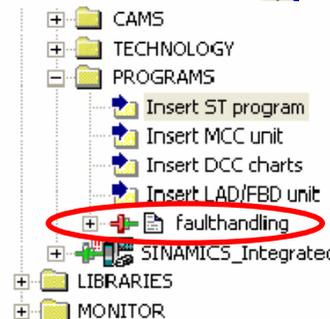


Fault Handling

- Insert ST program "fauhandling" and write program



- compile ST program



```

1 INTERFACE
2     PROGRAM TechFaultProg;
3     PROGRAM PerFaultProg;
4 END_INTERFACE
5
6 IMPLEMENTATION
7     PROGRAM TechFaultProg
8         ;
9     END_PROGRAM
10    PROGRAM PerFaultProg
11        ;
12    End_Program
13 END_IMPLEMENTATION
    
```

Fault Handling

- Open EXECUTION SYSTEM and add ST program to SystemInterruptTask → FaultTasks

Double Click on EXECUTION SYSTEM

Add ST program "TechFaultProg" to TechnologicalFaultTask
Add 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

Create global device variables

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



The screenshot shows the SIMOTION SCOUT interface for project 'D435_training_case'. In the left-hand tree view, the 'GLOBAL DEVICE VARIABLES' folder is highlighted with a red circle. Below the tree view, a table titled 'D435:' lists the variables created. The first two rows of the table are also highlighted with a red circle.

	Name	Data type	Retain	Field length	Initial value	Display format
1	enable_mcc	BOOL	<input type="checkbox"/>	1	FALSE	BOOL
2	toggle	BOOL	<input type="checkbox"/>	1	FALSE	BOOL
3			<input type="checkbox"/>	1		

global variables

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

Insert CAM

- Insert cam for MCC program

The screenshot shows the SIMOTION D435 software interface. On the left, a tree view shows the project structure, with 'Insert cam' highlighted under the 'CAMS' folder. In the center, the 'Geometry' table is displayed, showing the following data:

	Master	Slave
1	0	0
2	90	90
3	180	180
4	270	90
5	360	0
6		
7		
8		
9		
10		
11		
12		

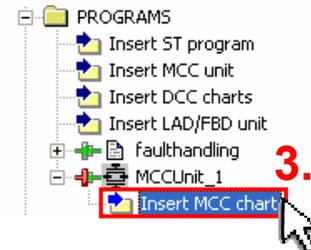
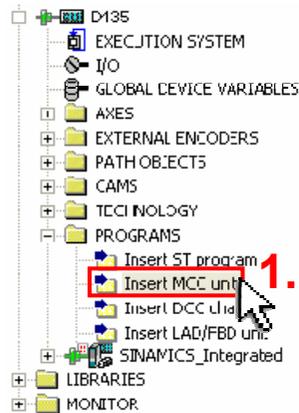
The 'Insert Cam' dialog box is open, showing the following fields:

- Name: Cam_1
- Type: Interpolation point table
- Author: (empty)
- Version: (empty)
- Existing Cam: (empty)
- Comment: (empty)
- Open editor automatically

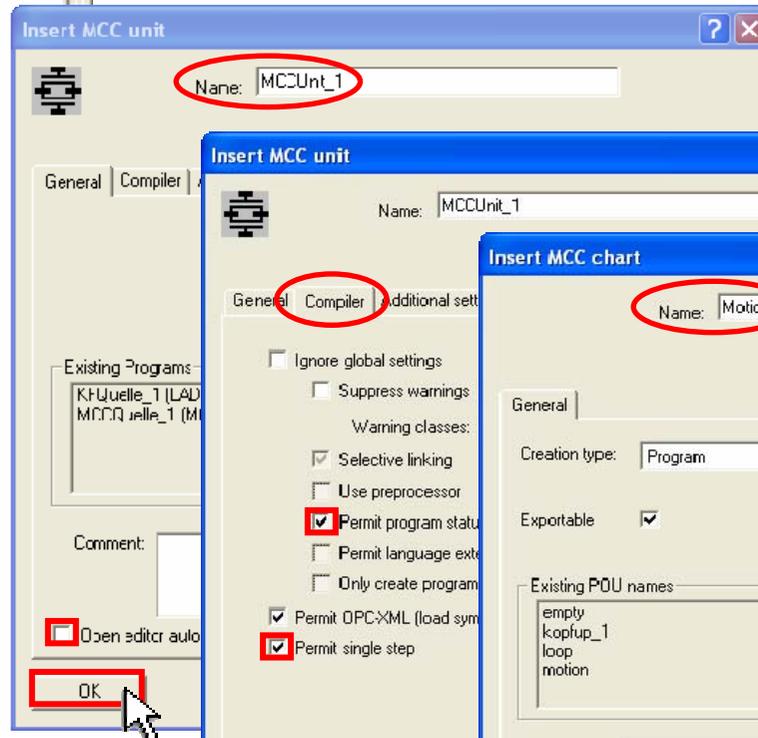
The 'OK' button is highlighted with a red box. A blue callout points to the 'Geometry' table with the text 'Enter geometry settings for Cam_1'. An orange callout points to the text 'Close Cam_1 to save settings.'.

Operate SIMOTION through a program

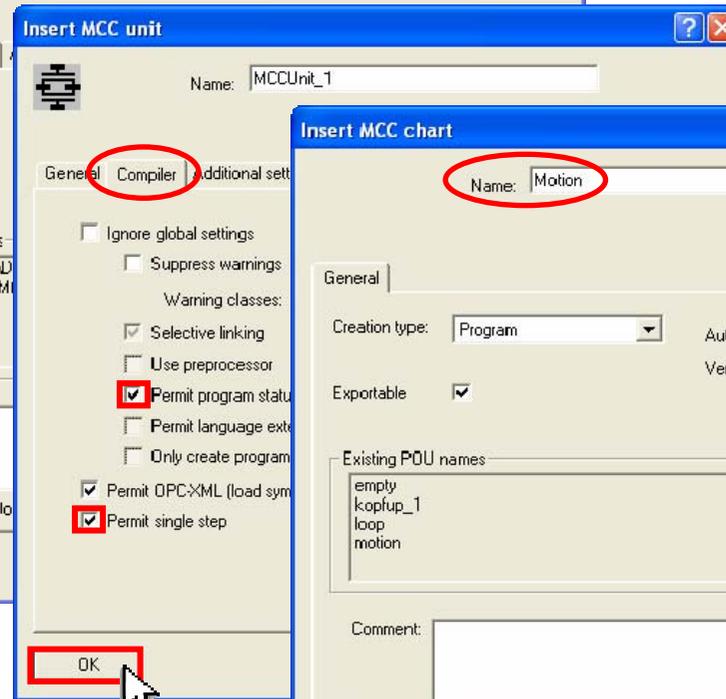
- Insert MCC unit



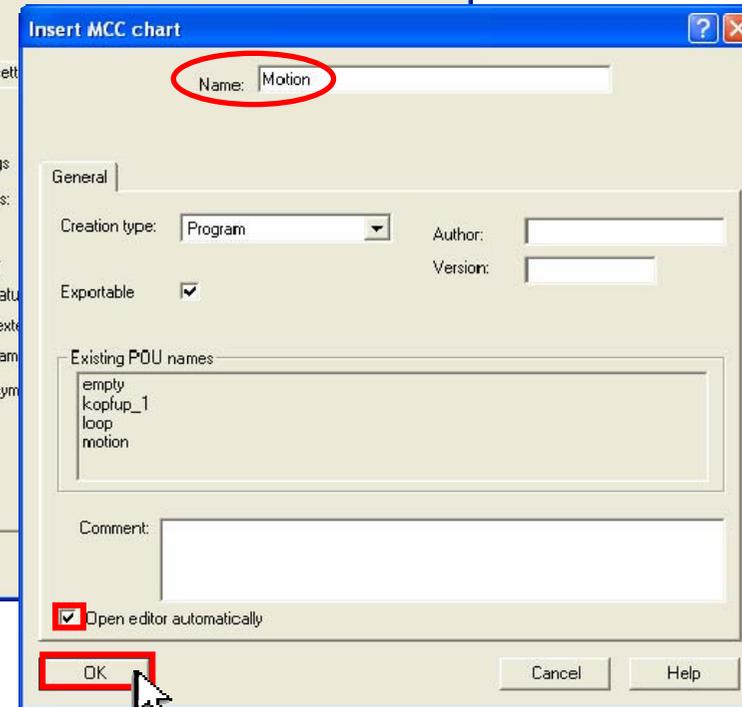
1. Insert a MCC unit (MCCUnit_1), uncheck Open editor automatically



2. Permit single step and program status



3. Insert MCC Chart (Motion)



Operate SIMOTION through a 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
 - Start Motion Task_2

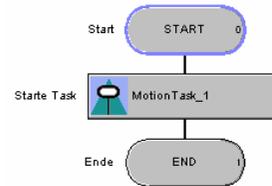
**Use standard settings,
change only specified
values.**

Save and compile.



Operate SIMOTION through a program

- Insert new MCC Chart and Construct the shown flow chart (program "loop")
 - Start Motion Task_1



- Insert LAD/FBD unit "LFunit_1", insert LAD/FBD program and permit program status

Insert LAD/FBD program "ladfd_1"

Construct the shown chart

- Compile and Save programs.



Operate SIMOTION through a program

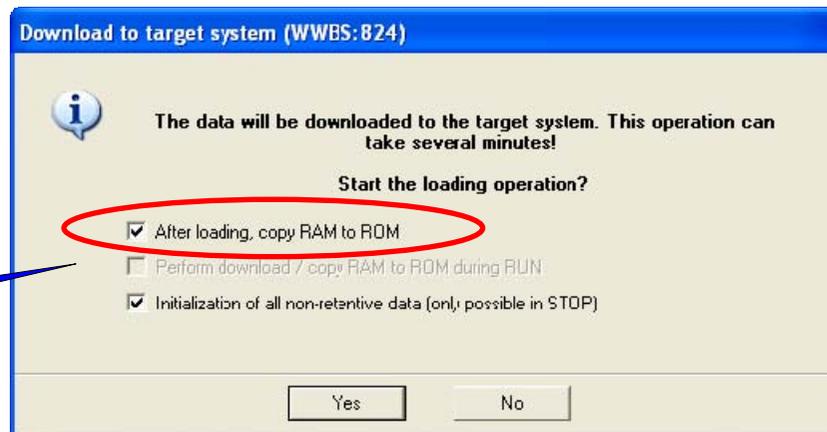
- Open execution system
- Assign program “Motion” to Motion Task 1 and “Loop” to Motion Task 2
- In task configuration, check “Activation after Startup task” for Motion Task 1
- Assign program “LFunit_1” to BackgroundTask

The screenshot illustrates the configuration process in SIMOTION. On the left, the 'Execution levels' tree shows 'EXECUTION SYSTEM' circled in red. The 'MotionTasks' list on the right has 'MotionTask_1' selected, with 'MCCUnit_1.motion' also circled in red. The main window shows the 'MotionTasks' configuration for 'MotionTask_1'. The 'Program assignment' tab is active, showing a list of programs with 'MCCUnit_1.motion' circled in red. A red box highlights the right arrow button (>>) used to move the program to the 'Programs used' list. A second, larger window shows the 'Task configuration' for 'MotionTask_1', with 'Task configuration' circled in red. The 'activation after StartupTask' checkbox is checked and circled in red. The 'Error reaction with program error' is set to 'CPU in STOP'. A red box highlights the 'Close' button at the bottom right.

- Leave EXECUTION SYSTEM and save new settings.

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 if desired

Start SIMOTION MCC program via global 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. A context menu is open over the 'D435' device, with the 'Operating mode ...' option selected and circled in red. Below the tree view, the 'D435:' window displays a table of global device variables. The 'enable_mcc' variable is circled in red, and its 'Control value' is set to 'TRUE', also circled in red. A blue callout box points to this 'TRUE' value 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	Field length	Initial value	Status value	Display format	Control value
1	enable_mcc	BOOL	<input type="checkbox"/>	1	FALSE	FALSE	BOOL	<input checked="" type="checkbox"/> TRUE
2	toggle	BOOL	<input type="checkbox"/>	1	FALSE	FALSE	BOOL	<input type="checkbox"/> FALSE
3			<input type="checkbox"/>	1				<input type="checkbox"/> TRUE

set true and control immediately

Monitoring SIMOTION MCC chart

- Enable Monitoring on/off for MCC

The screenshot illustrates the configuration and monitoring of a SIMOTION MCC chart. On the left, a project tree shows the 'motion' folder selected, with a context menu open. The 'Monitoring on/off' option is checked and highlighted with a red circle. A blue callout points to this option, stating 'blue status for single step'. In the center, a ladder logic diagram shows a 'START' button leading to a 'WHILE enable...' loop. The loop contains several steps: 'Warte Zeit T#2s', 'Achsfreigabe schalten Red_Axis', 'Starte Achse lagegeregelt Red_Axis', 'Schalte Nocken ein Output_cam_1', and 'Warte Zeit T#5s'. A blue callout points to the 'Motion' icon at the bottom of this diagram, stating 'yellow status for monitoring'. On the right, the 'MCC editor' window is shown with a red box around the 'MCC single step' icon. A yellow callout points to this icon, stating 'MCC single step'. Below the editor, a vertical MCC chart is displayed with steps: 'Kunvenscheibe ein Blue_Axis_SYNCHRON...11', 'Warte Zeit T#10s', 'Kunvenscheibe aus Blue_Axis_SYNCHRON...13', 'Achsfreigabe wegnehmen Blue_Axis', and 'Stoppe Achse Red_Axis'. The 'Blue_Axis_SYNCHRON...13' step is highlighted in yellow, with a yellow callout pointing to it, stating 'yellow status for monitoring'.

Monitoring SIMOTION LAD/FBD unit

- Enable Program status ON/OFF

The screenshot shows the SIMOTION software interface. On the left is the project tree for 'D435_training_case_'. The 'PROGRAMS' folder is expanded, and 'ladfbd' is selected. A right-click context menu is open over 'ladfbd', with 'Program status ON/OFF' highlighted. A blue callout box points to the right-click action with the text 'right click'. On the right, the 'Parameters/variables' table is shown:

	Name	Variable type	Data type
1	tmp	VAR	BOOL
2			

Below the table, the ladder logic diagram for '001 - Title' is displayed. It shows a network with two inputs labeled 'toggle' connected to an AND gate (&), which is connected to an assignment coil (=) for the variable 'tmp'. A blue callout box points to the variable 'tmp' with the text 'color indicator (blue and green)'. At the bottom, the 'Program status (Ctrl+F7)' toolbar icon is highlighted with a red box.

Trace online signals

- Open Trace / function generator



- Select D435, select signals

Trace 1 inactive: D435

FctGen 1 inactive: D435

Ilo.	Active	Signal
1	✓	_to.Blue_Axis.basicmotion.position
2	✓	_to.Red_Axis.basicmotion.position
3	✓	_to.Output_cam_1.state
4		
6		

Recording: Isochronous recording - endless trace

Cyc.clock: Position control cycle clock

Factor: 1

Maximum: 300000 ms

Name	Comment	Unit	Data type
activationmodechangedconfigdata	Activation of modified co	-	'enumtoacti
control	Operational status	-	'enumactive
countercamdata			
effectivedata			
error	Technological alarm at th	-	'enumyesn
errorgroup	Alarm group association	-	DWORD
errorreaction	Active reaction to techno	-	'enumoutput
internaltoTRACE			
reset	Execution status of '_res	-	'enumactive
restartactivation	Execution of a technolog	-	'enumtorest
simulation	Simulation mode	-	'enumactive
state	Switching state of the ou	-	'enumonoff'
toutput	Internal output delay of ths		LREAL
userdefault			

Accept selected variable in channel: 1 2 3 4 5 6 7 8

Channel	Signal name
1	
2	_to.Blue_Axis.basicmotion.position
3	_to.Red_Axis.basicmotion.position
4	
5	
6	
7	
8	

(2) assign signal to channel

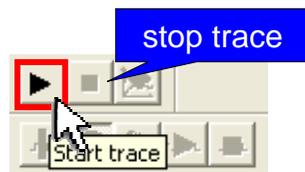
(1) open signal selection

(4) download parameterization

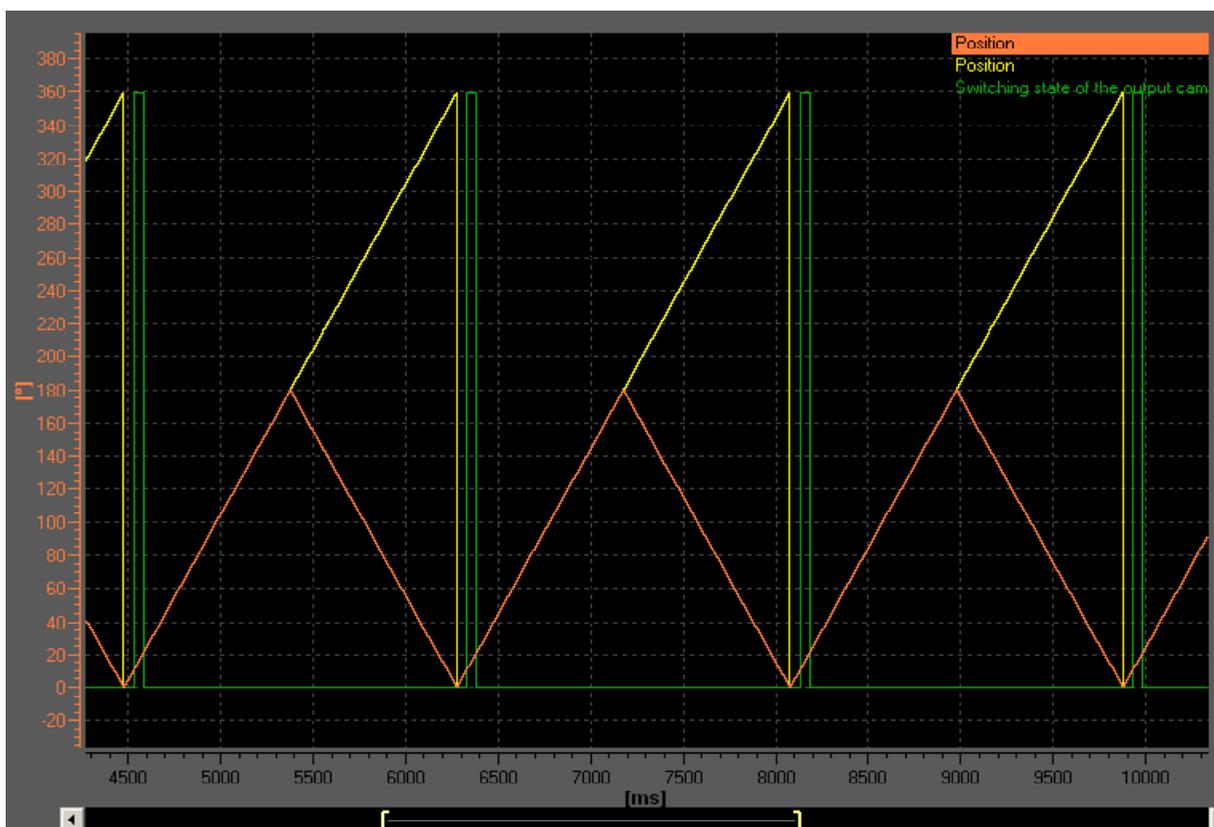
(3) endless trace

Trace online signals

- Start trace



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



Save MCC as ST and Import ST

- Export MCC Chart as ST source and Import

The image illustrates the workflow for exporting an MCC chart to ST source code and then importing it back into the project. It is divided into three main sections:

- Export Process:** On the left, the project tree shows the 'MCCQuelle_1' object selected. A context menu is open, and the 'Export as ST...' option is highlighted. A blue callout bubble labeled 'Save file' points to the 'Export MCC unit' dialog box. In this dialog, the filename is 'MCCQuelle_1.st' and the file type is 'ST programs (*.st)'. The 'Speichern' (Save) button is visible.
- Import Process:** In the center, a blue box labeled 'Import' with a curved arrow points to the right. Below it, the 'Export MCC unit' dialog box is shown again, but with the 'Import MCC.cns' option selected in the context menu.
- ST Source Code:** On the right, the project tree shows the 'PROGRAMS' folder expanded. A context menu is open, and the 'Import external source' option is selected, with a sub-menu showing 'ST source file' highlighted. Below this, a snippet of ST source code is shown, with a blue callout bubble labeled 'MCC Chart "Loop" as ST Source' pointing to the loop structure. The code includes task start and end commands for 'StartTask' and 'MotionTask_1'.

```

207     TSI#dwuser_2 := 2#1;
208     @SUSPENDTASKDEBUG();
209     TSI#dwuser_2 := 2#0;
210 END_IF;
211 (* =====
212 (* Starte Task ('StartTask') *)
213     _MccRetDWORD := _restartTaskId(_getTaskId(MotionTask_2));
214
215
216
217 END_PROGRAM
218 PROGRAM Loop
219 VAR
220 ( _U7_PoeBld_CompilerOption := warning:16026:off; )
221     _MccRetDWORD : DWORD;
222 ( _U7_PoeBld_CompilerOption := warning:16026:on; )
223 END_VAR
224 ;
225
226
227 (* Starte Task ('StartTask') *)
228     _MccRetDWORD := _restartTaskId(_getTaskId(MotionTask_1));
229
230
231 END_PROGRAM
    
```

Symbol browser

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

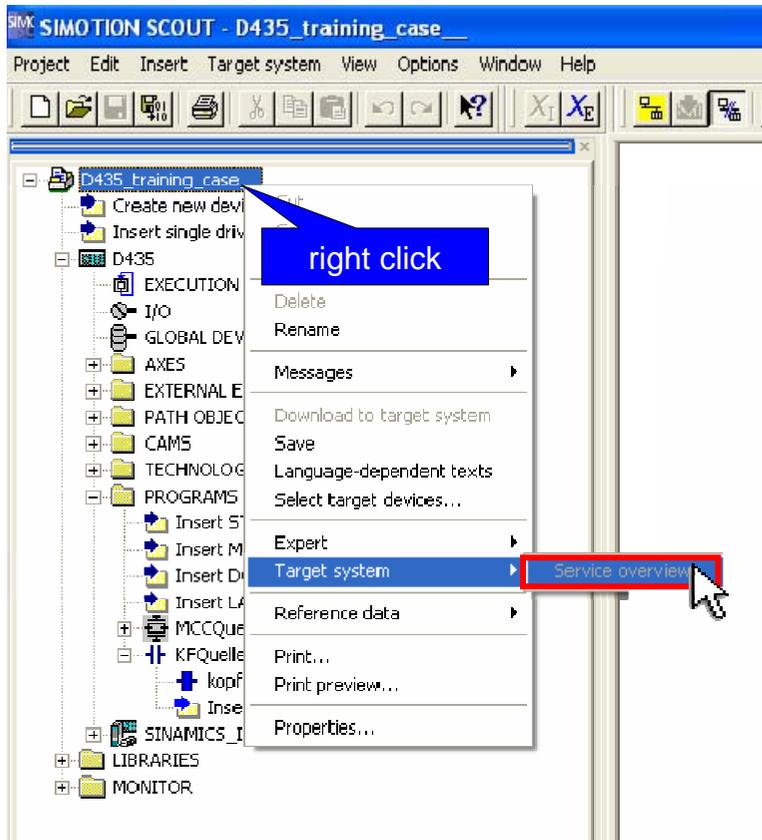
D435.Achse_Blau:

	Name	Plain text	Data type	Unit	Status value
1	internaltotrace	Internal trace variable	Array		
2	sensormonitoring	Monitoring of the active encoder system	'structaxis: sensormonitoring'		
3	actordata	Current manipulated variable values	'structaxis: actordata'		
4	actormonitoring	Monitoring of manipulated variable and drive	'structaxis: actormonitoring'		
5	motiontype	Axis motion type	'enumaxis: type'		rotatory T
6	typeofaxis	Axis setting	'enumaxis: operatingmode'		real_axis T
7	pluslimitsofdynamics	Limitation of dynamic response values of the axis for motion in a positive direction	'structaxis: dynamiclimit'		
8	minuslimitsofdynamics	Limitation of dynamic response values of the axis for motion in a negative direction	'structaxis: dynamiclimit'		
9	userdefaultofdynamics	User defaults for dynamic response values	'structaxis: defaulttype'		
10	override	Override settings	'structaxis: override'		
11	motionstatedata	Dynamic response status of the axis (current IPO)	'structaxis: motionstatedata'		
12	basicmotion	Motion state in the main coordinate system	'structaxis: motiondata'		
13	position	Position	LREAL	*	35.808 DEC
14	velocity	Velocity	LREAL	*/s	471.79 DEC
15	acceleration	Acceleration	LREAL	*/s*	1069.27 DEC
16	superimposedmotion	Motion state in the superimposed coordinate system	'structaxis: motiondata'		
17	movecommand	Execution status of '_move' command' at the axis	'structaxis: movecommand'		
18	stopemergencycommand	Execution status of '_stopEmergency' command' at the axis	'enumactive: inactive'	-	inactive TEXT
19	simulation	Simulation mode	'enumactive: inactive'	-	inactive TEXT
20	control	Operational status	'enumactive: inactive'	-	active TEXT
21	reset	Execution status of '_reset' command'	'enumactive: inactive'	-	inactive TEXT
22	error	Technological alarm at the axis	'enumyesno'	-	no TEXT
23	errorreaction	Active reaction to technological alarm	'enumaxis: errorreaction'	-	none TEXT
24	sensordata	Current encoder values	Array		

all symbols can be monitored online

Service overview

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



The 'Service overview' dialog box displays the following status indicators:

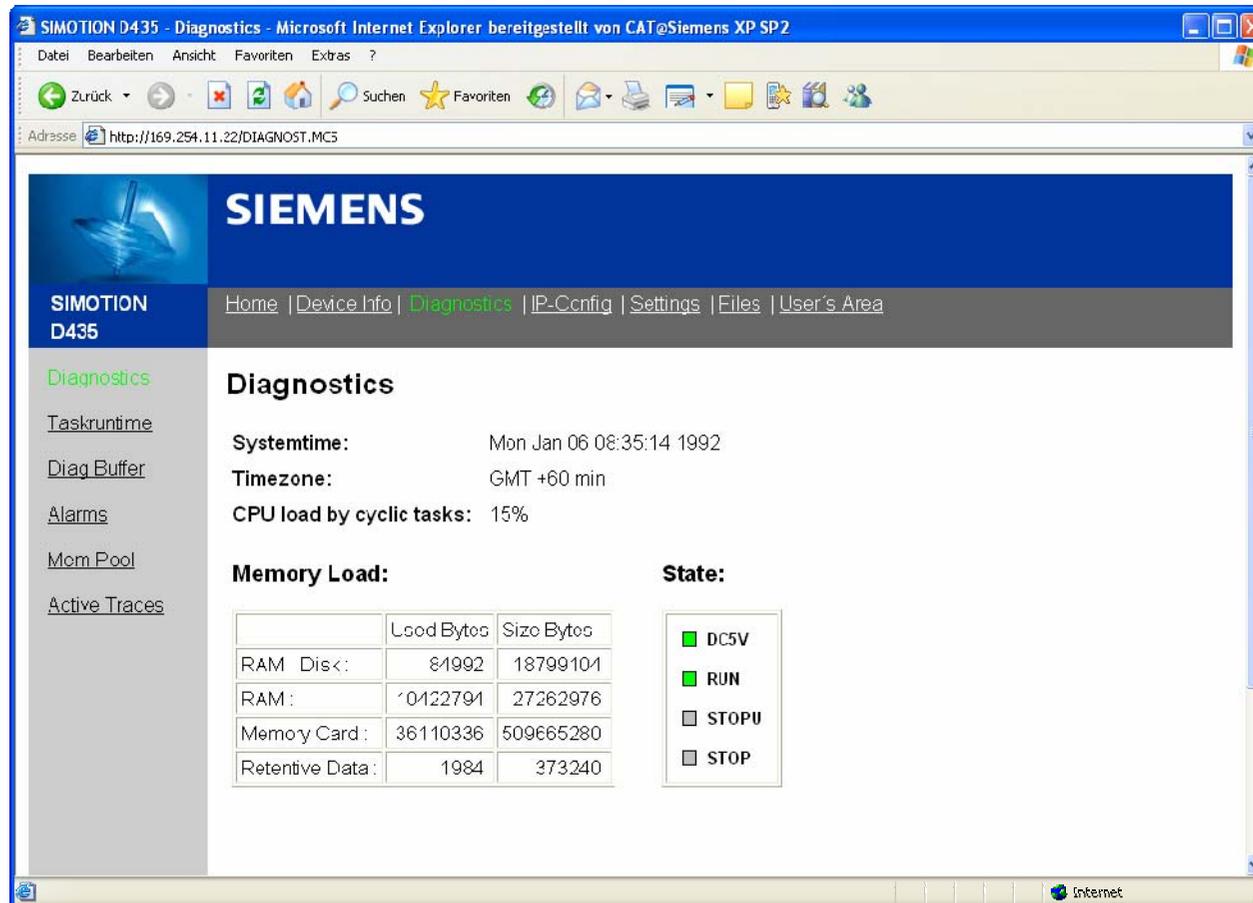
	D435	
	Red_Axis	Blue_Axis
Position control status		
Operational status		
Technological alarm at the axis		
Cyclic drive interface active		
Drive enable		
Power enable		
Actuator error		
Status of axis motion		

Buttons at the bottom: Extended..., Close, Help

IT DIAG – integrated SIMOTION Diagnostics

- Enter SIMOTION IP Address in Webbrowser (e.g. http://169.254.11.22)

NOTE: It might be necessary to disable the "automatic configuration script" first



SIEMENS

