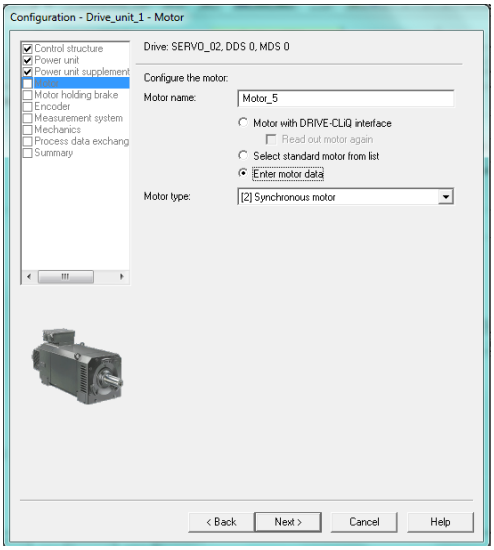
Tolomatic EXCELLENCE IN MOTION

Technical Note

IMA with DS1H1_ Encoder Configuration Using a Siemens Drive



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1 Basic integration of a Siemens Drive to a Tolomatic IMA with DS1H1_ encoder combination

Hardware:	Software
• Tolomatic IMA w/ DS1H1_ (IMA22) • Siemens Control Unit (CUA31) • Siemens Encoder Module (SMC20) • Siemens Power Module (PM240-2) • Line Reactor • Siemens Cables • PC	• Sinamics STARTER

Siemens Encoder Connector	IMA Encoder
1	A +
2	A -
3	Data +
4	-
5	Clock +
6	-
7	0V (M ENC)
8	TEMP
9	TEMP
10	Up (P ENC)
11	B +
12	B -
13	Data -
14	Clock -
15	0V SENSE
16	5V SENSE
17	-
SH	Shield

Siemens Power Module/CU	IMA Power
U2	U (R)
V2	V (S)
W2	W (T)
⏚	Shield/Ground
V+	+24V Brake
0V	0V Brake

Encoder Cable Tested: 6FX5002-2EQ10-1BA0

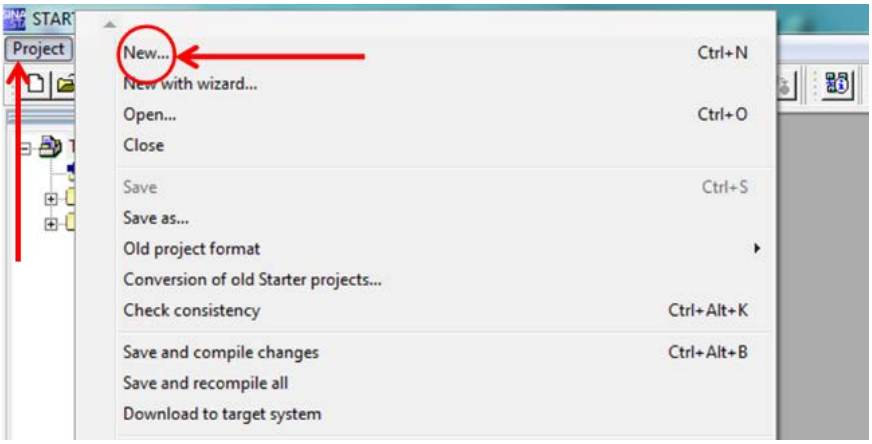
Power Cable Tested: 6FX5002-5CG01-1BA0

2 Setting up a new project

2.1 Creating a new project

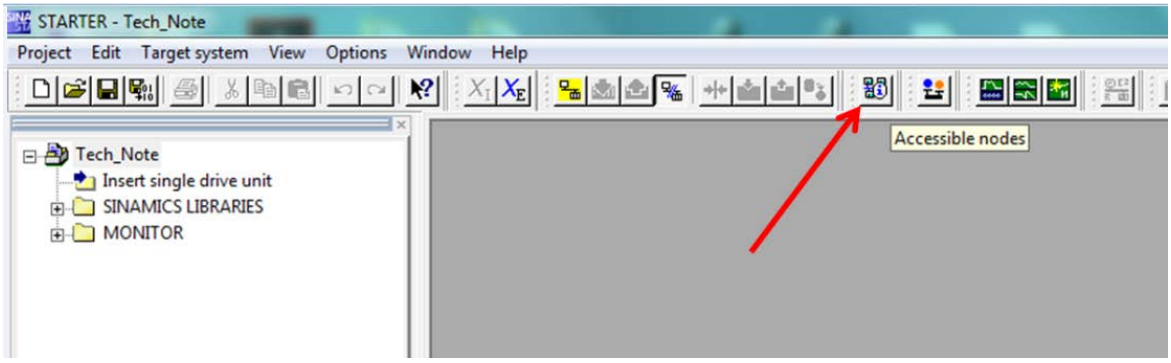
Open the Siemens Starter software.

Click on “Project”, select “New…”.

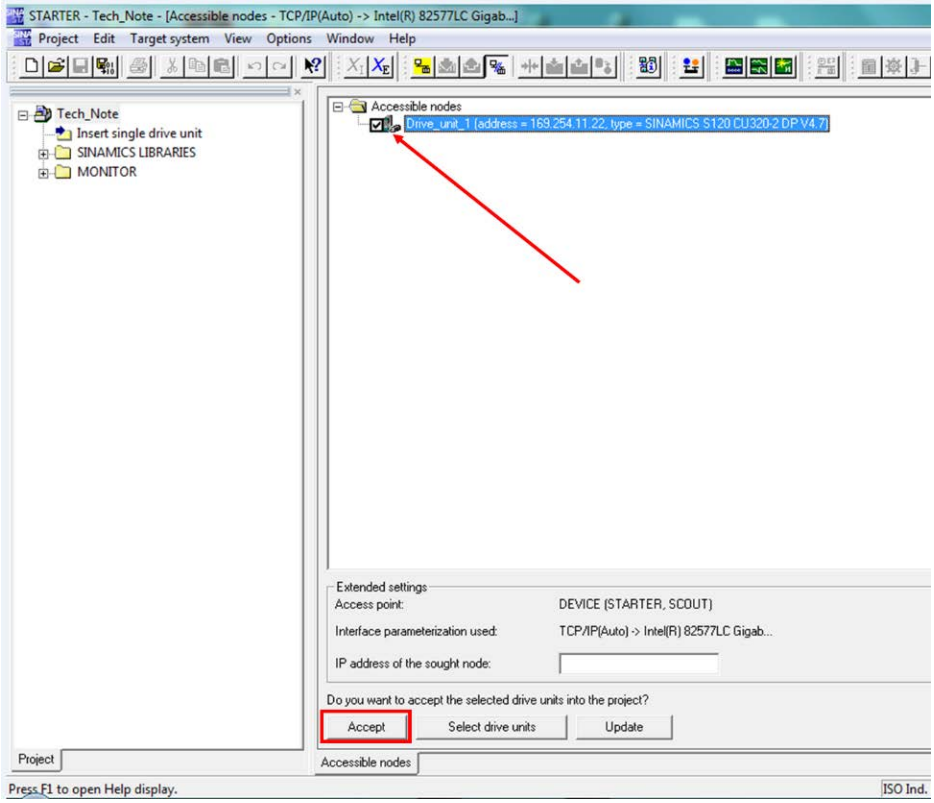


2.2 Selecting “Accessible nodes”

From the menu bar, select the "Accessible nodes" icon.

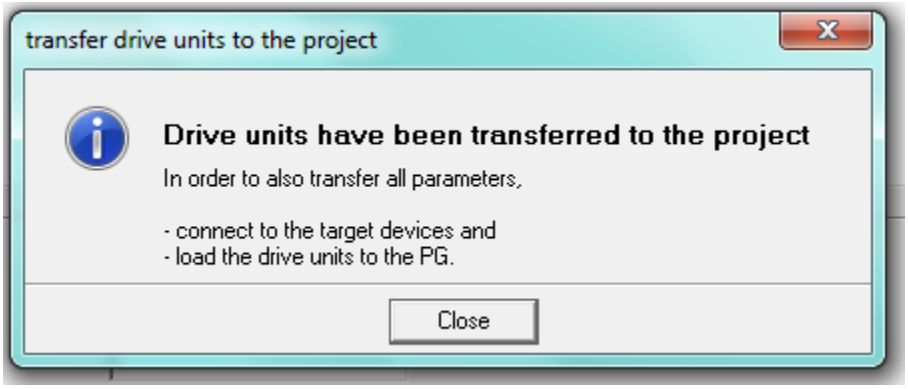


A list of Accessible Nodes will populate the window. Select the intended Drive, and then click “Accept”.



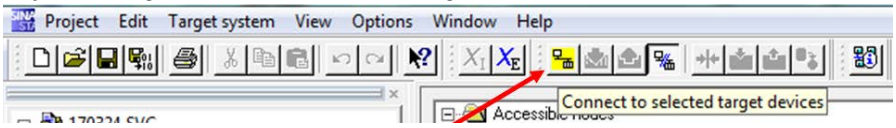
*Note: you may need to disable your firewall in order to view the drive

The Software will verify that the drive units have been transferred to the project.

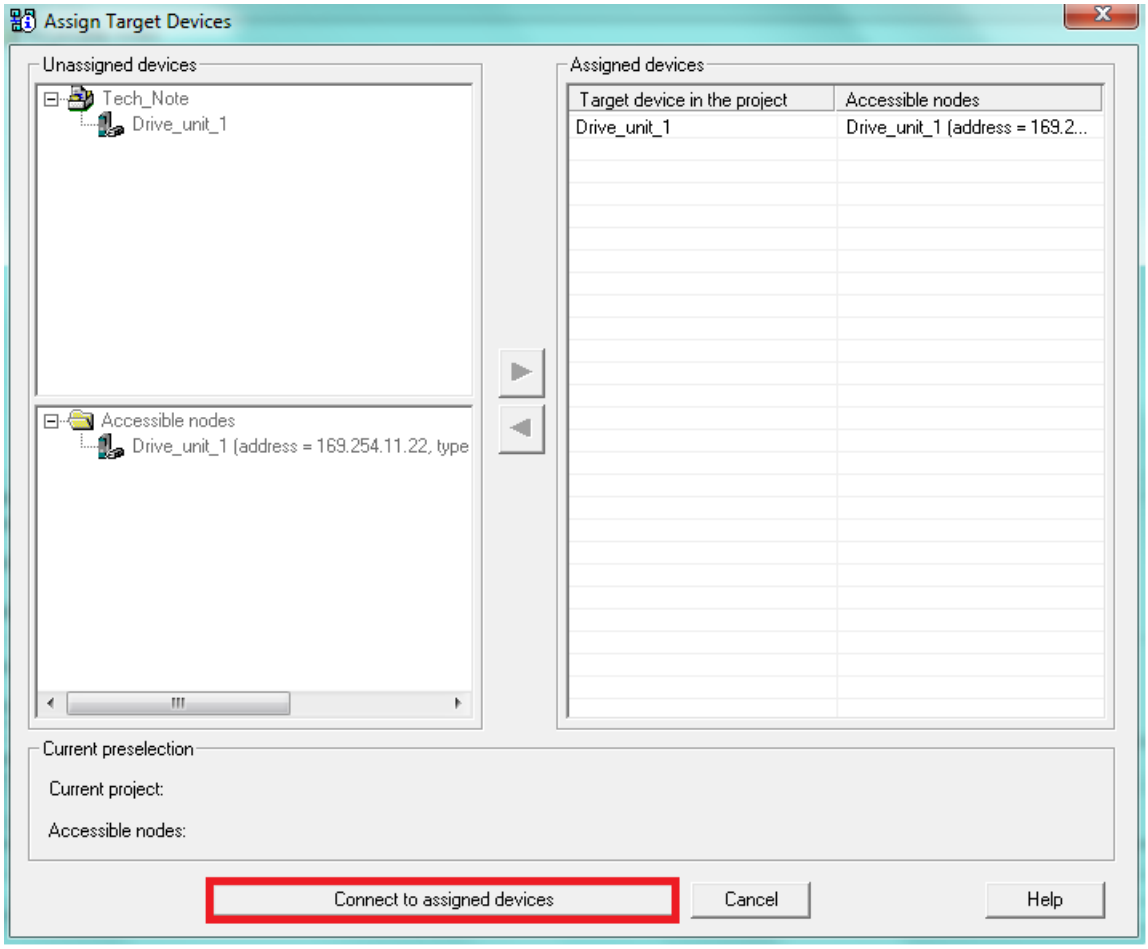


2.3 Bringing the drive online

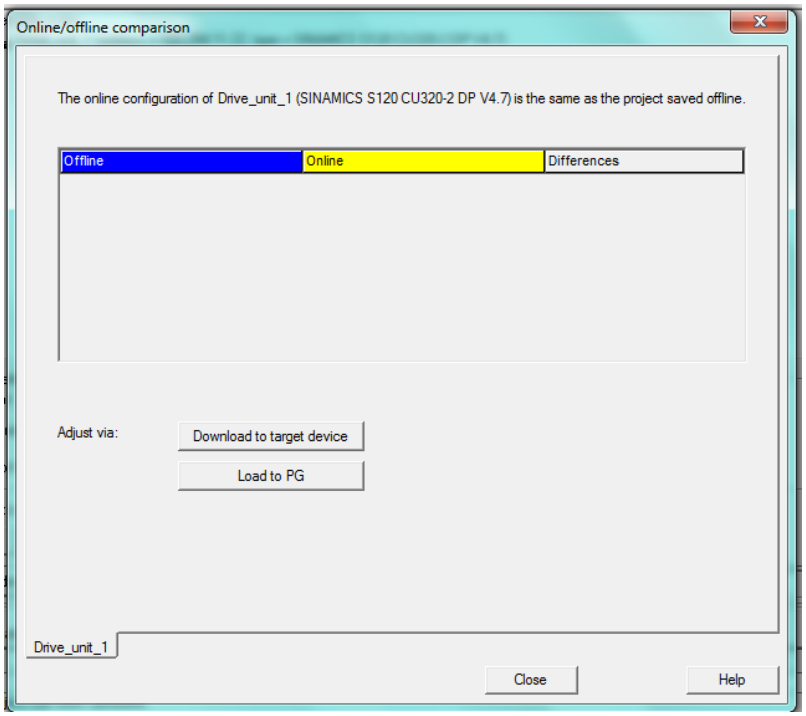
Bring the drive online by selecting “Connect to selected target devices” icon.



Then, connect to assigned devices…



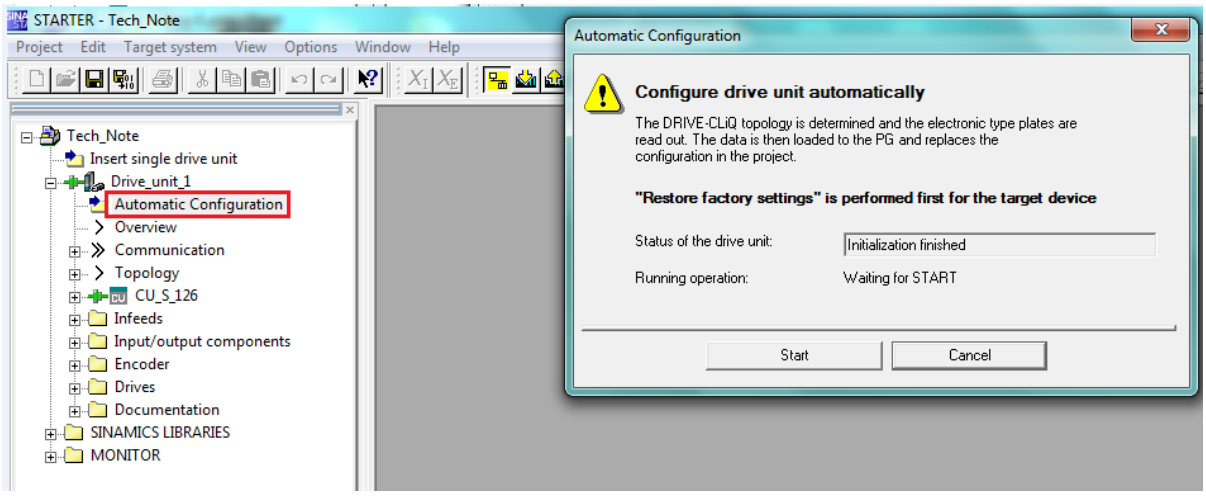
Select “Download to target device” to move forward with setting up the new project. *Please note: this will overwrite any configuration currently present on the drives memory. Make sure to save the present configuration to a separate file if you intend to use it again in the future.



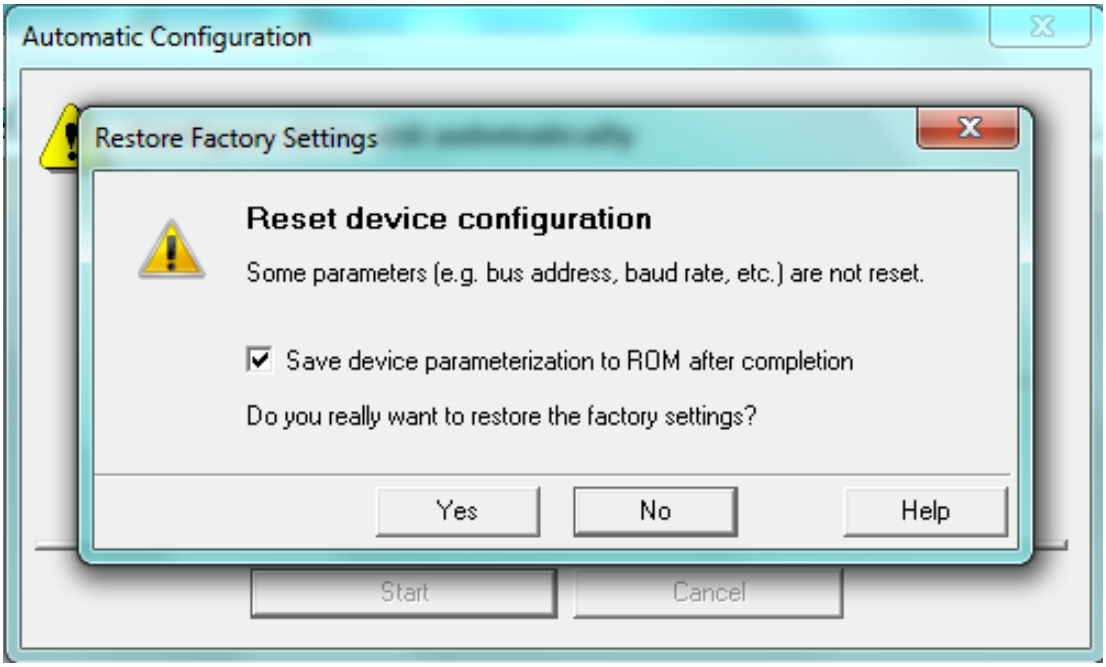
Check mark “copy RAM to ROM” and click YES.

2.4 Configuring the drive

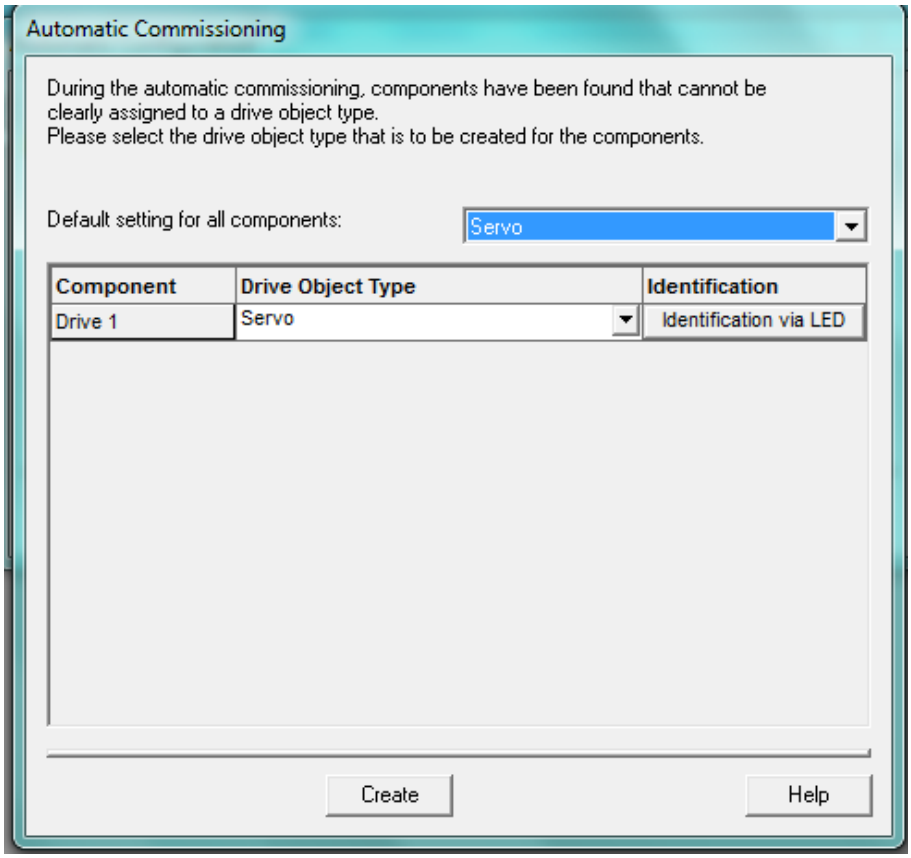
First double click the “Automatic Configuration” tab; using Drive Cliq, to locate compatible Siemens devices connected to the system.



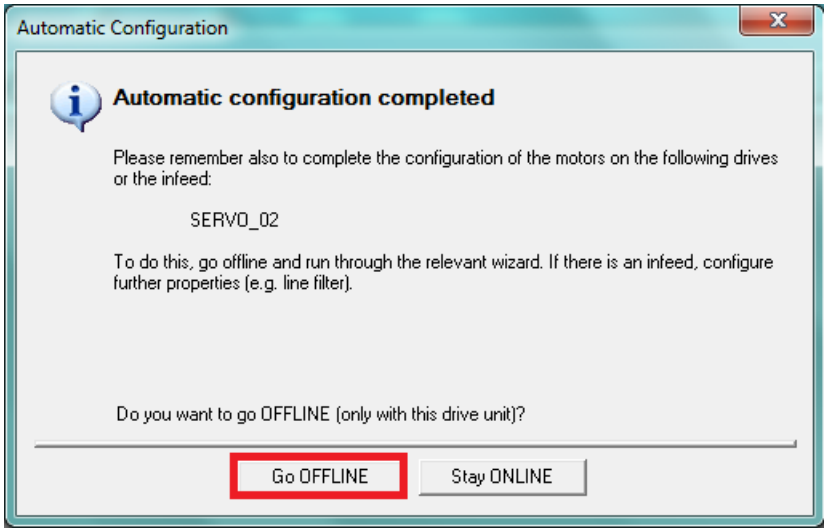
You will receive a prompt: “Reset Device Configuration?” Select “Yes”. This will reset any internal DRIVE-CLiQ device topology that is currently saved in the drive.



Select “Servo” as the default setting in the Automatic Commissioning drop down; click create.

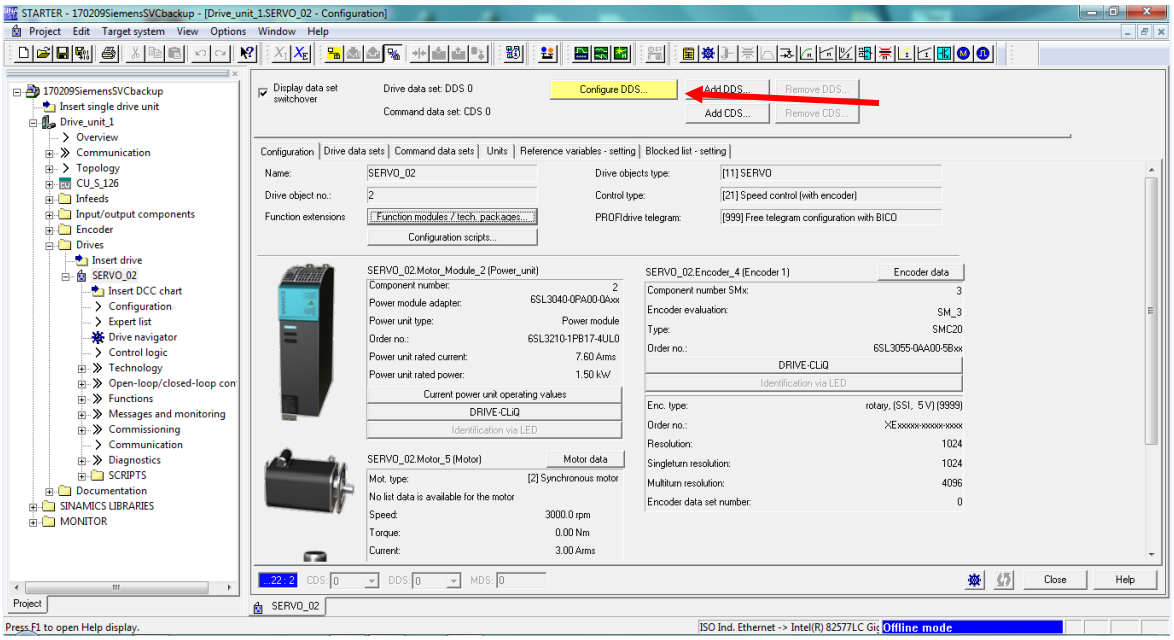


Then, follow the prompts to bring the drive offline.

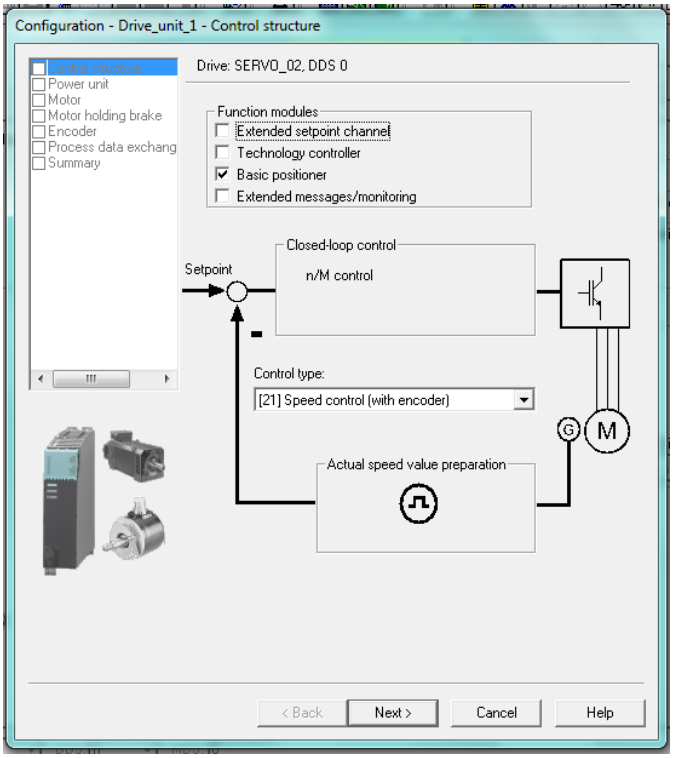


2.5 Opening the Drive Tree

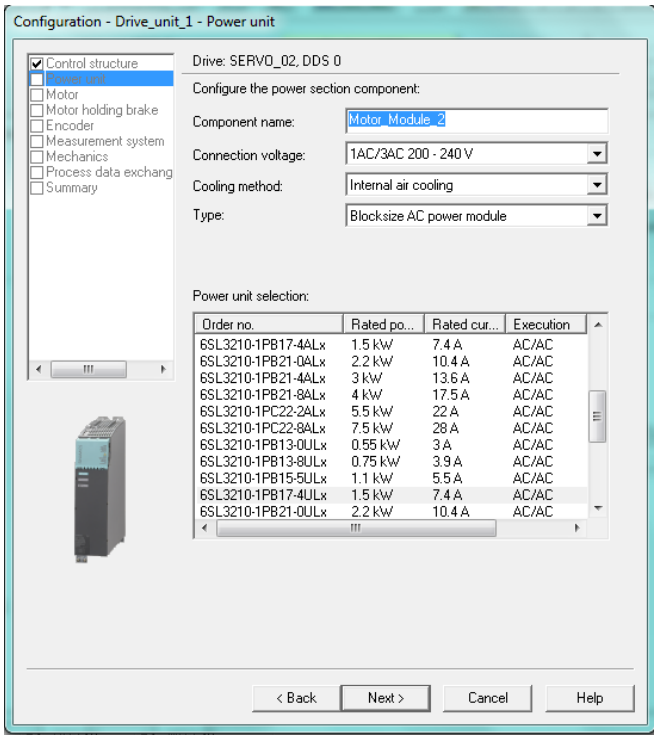
Open the “Drives” tree, then double-click on the drive folder (labeled “Servo_02” below) and select “Configure DDS”.

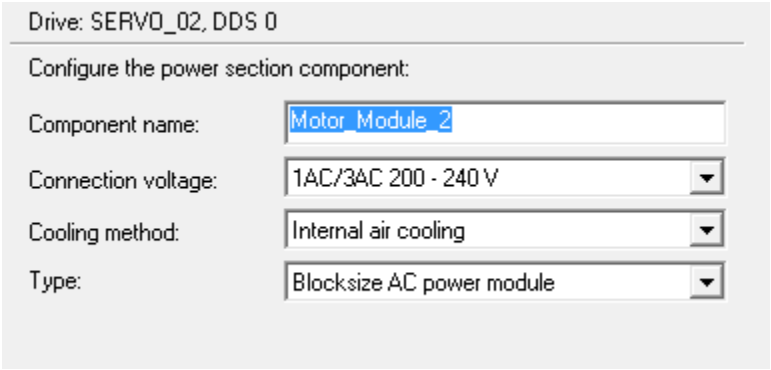


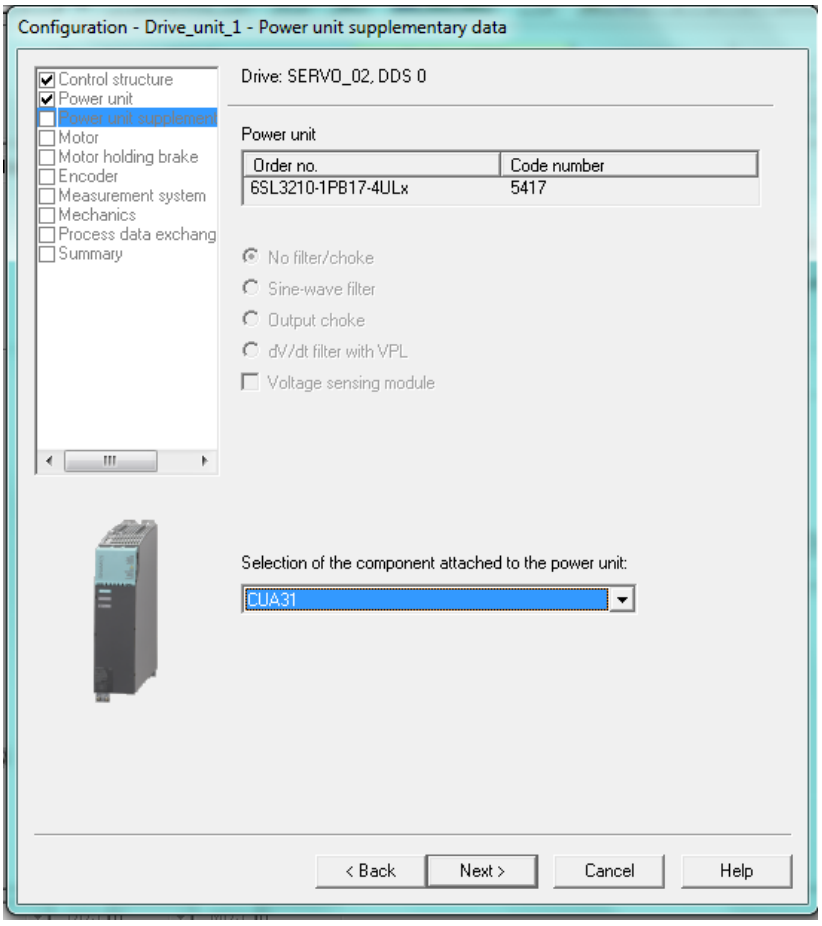
Under Function Modules select “Basic Positioner”. Under Control Type, select “[21] Speed Control (with encoder)”. After this click “next”.

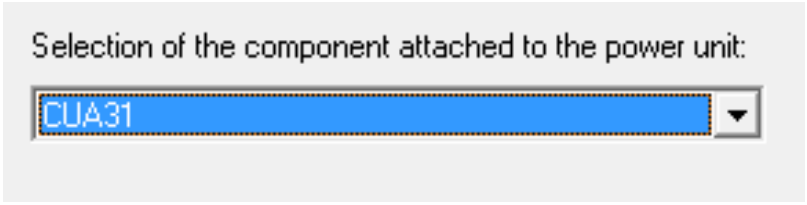


Refer to the selections below for the Tolomatic IMA. Click “Next” once all of the information is correct. Repeat this step for the next page. The selections are based on the hardware used in this system.



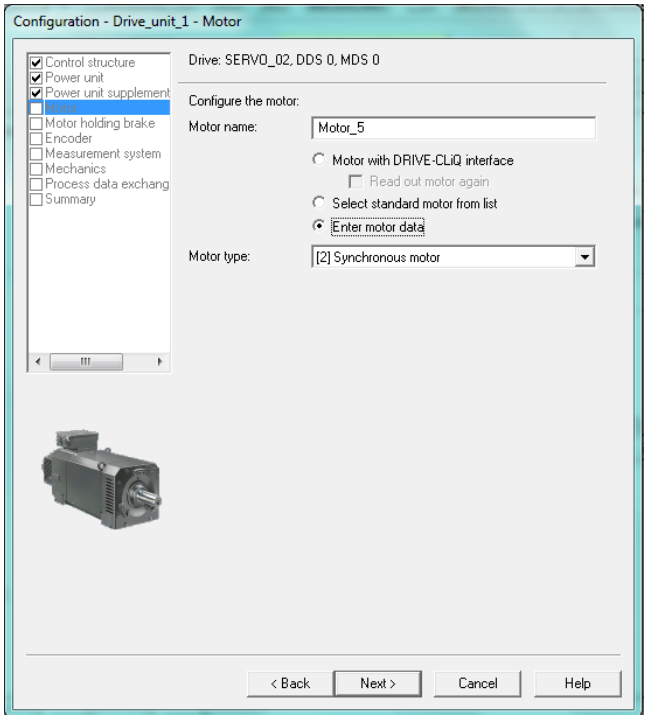


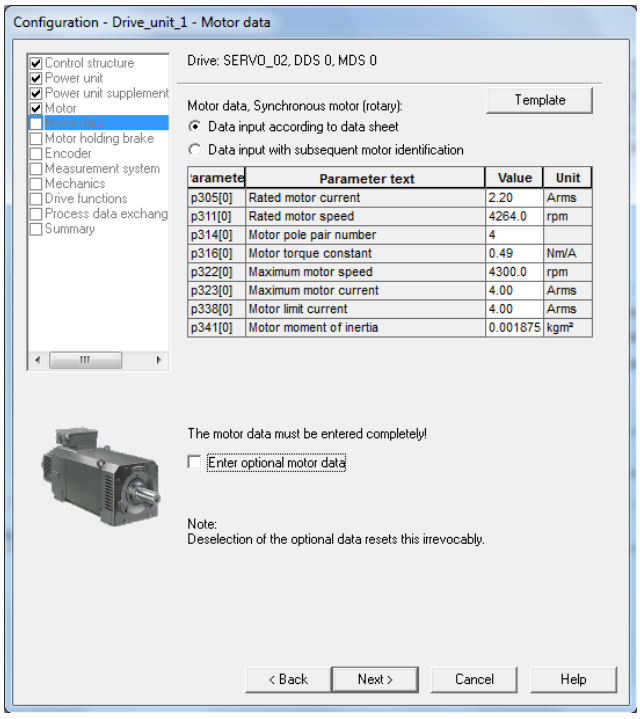

Configuration - Drive_unit_1 - Power unit supplementary data
Control structure
Power unit
Power unit supplement
Motor
Motor holding brake
Encoder
Measurement system
Mechanics
Process data exchang
Summary
Drive: SERVO_02, DDS 0
Power unit
Order no.
Code number
6SL3210-1PB17-4ULx
5417
No filter/choke
Sine-wave filter
Output choke
dV/dt filter with VPL
Voltage sensing module
Selection of the component attached to the power unit:
CUA31
< Back
Next >
Cancel
Help


Selection of the component attached to the power unit:
CUA31

2.6 Entering Motor Data

Select “[2] Synchronous Motor” for Motor Type; Check the “Enter motor data” tab. Then deselect: “Enter the optional motor data” (This data can be calculated), and enter the motor data for the Tolomatic IMA unit. Refer to the IMA Brochure 2700-4000 for the specific motor data.

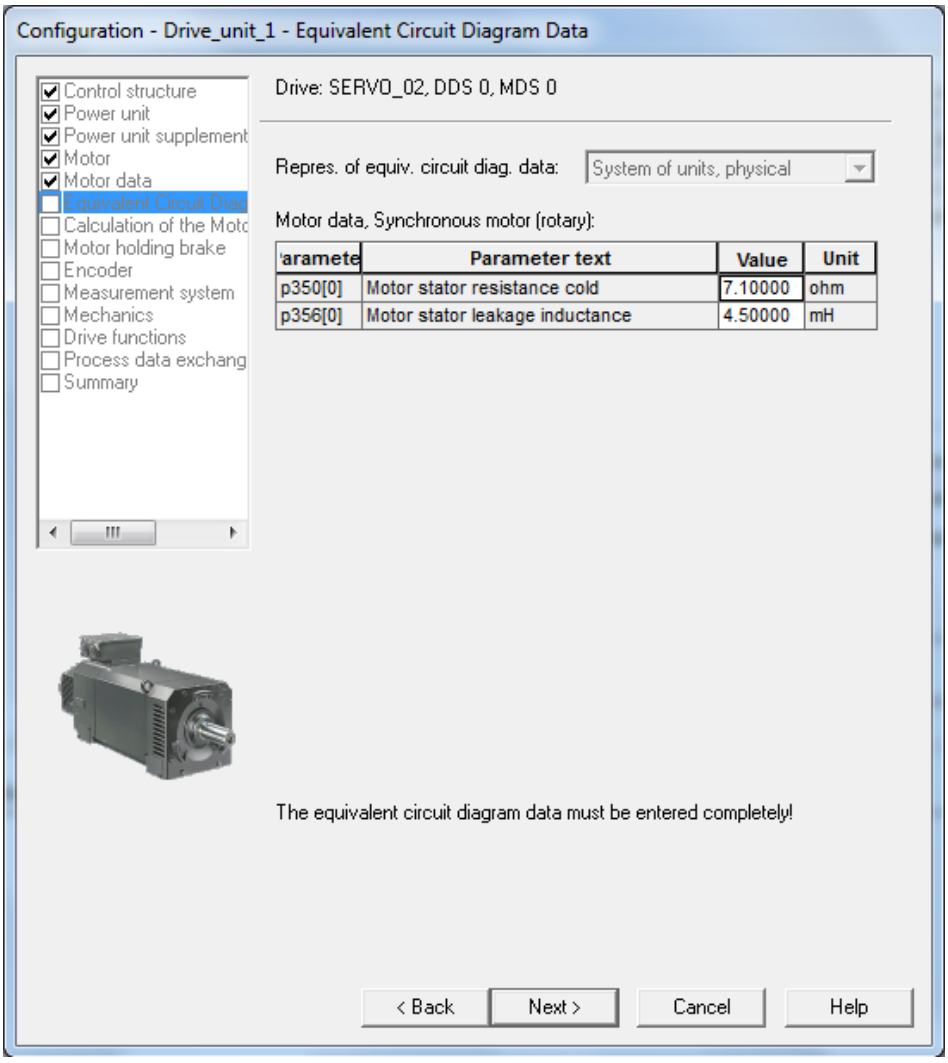




Example: IMA22 BN05 SM152.4 MV23

arameter	Parameter text	Value	Unit
p305[0]	Rated motor current	2.20	Arms
p311[0]	Rated motor speed	4264.0	rpm
p314[0]	Motor pole pair number	4	
p316[0]	Motor torque constant	0.49	Nm/A
p322[0]	Maximum motor speed	4264.0	rpm
p323[0]	Maximum motor current	6.60	Arms
p338[0]	Motor limit current	6.60	Arms
p341[0]	Motor moment of inertia	0.000151	kgm²

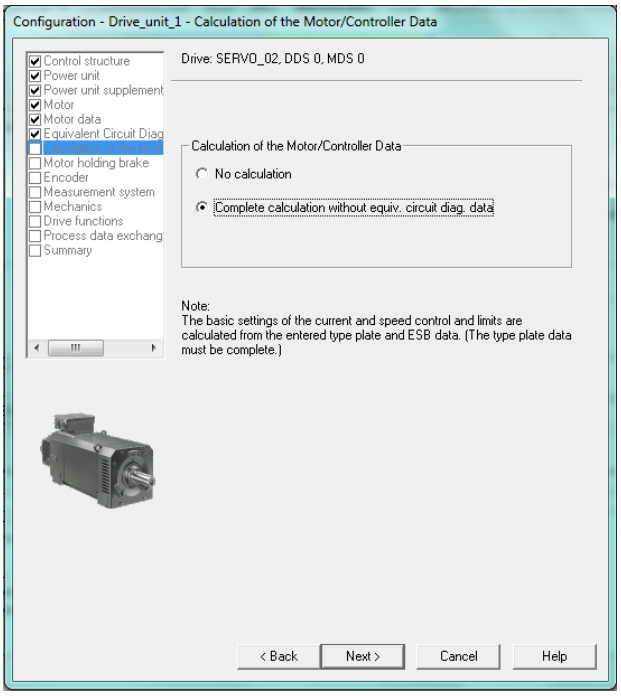
After clicking “Next”, enter the motor data for the Tolomatic IMA unit. Refer to the IMA Brochure 2700-4000 for the specific motor data.

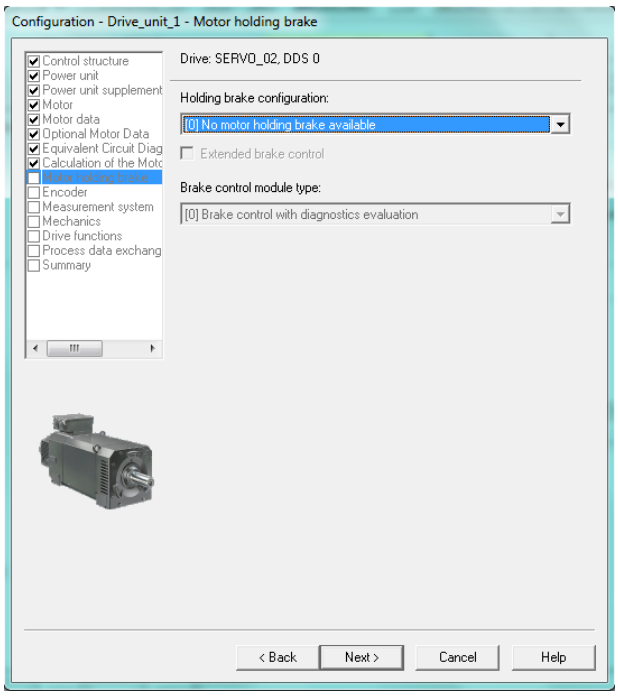


Example: IMA22 BN05 SM152.4 MV23

'aramete	Parameter text	Value	Unit
p350[0]	Motor stator resistance cold	7.10000	ohm
p356[0]	Motor stator leakage inductance	4.50000	mH

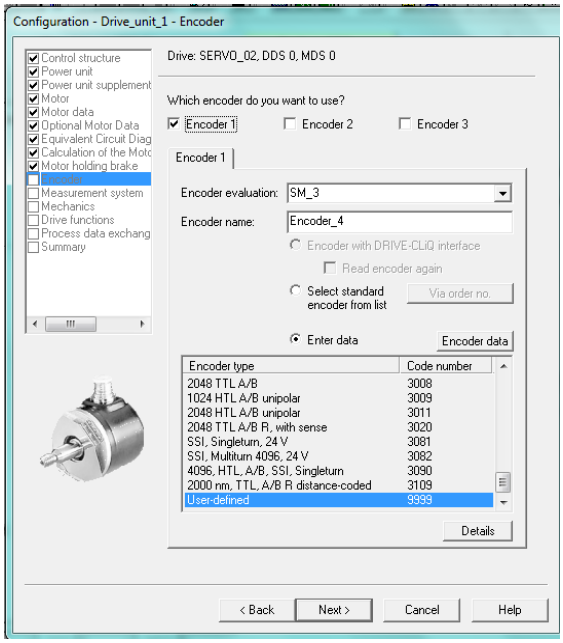
Select “Complete calculation without…”. Then, select the appropriate brake settings. Please note: Your brake settings may vary based on equipment.



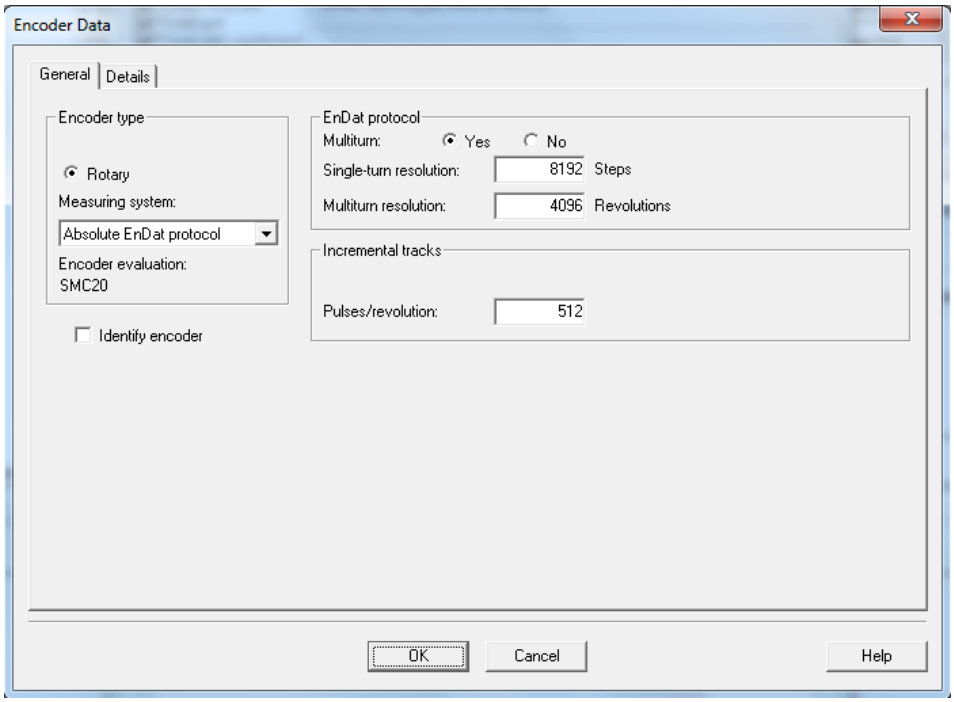


2.7 Configuring the Encoder

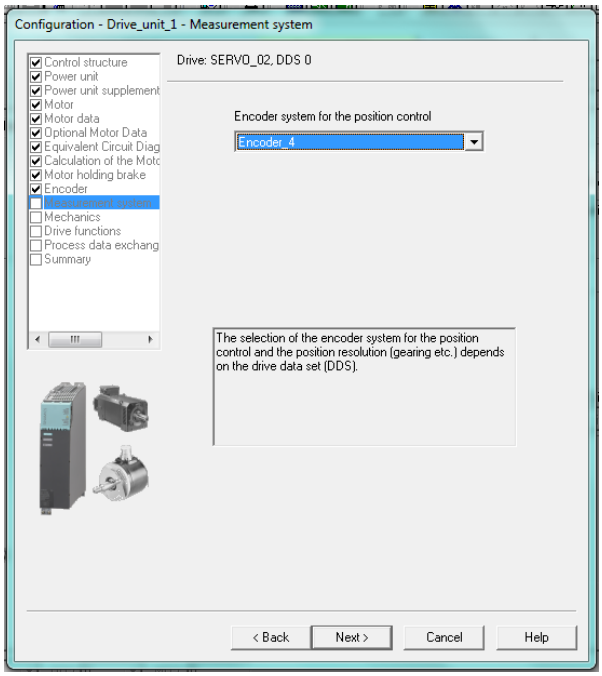
To configure the encoder, select “Enter Data” on the window below. Then, click “Encoder Data”.

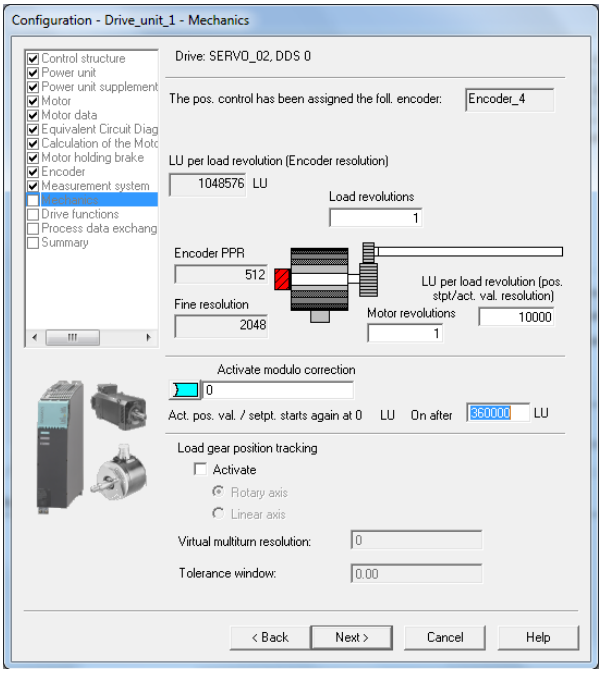


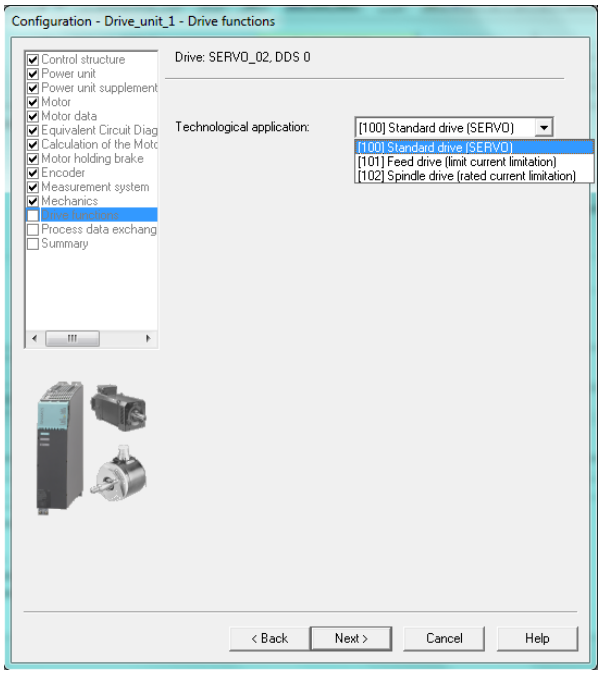
Select: “Absolute EnDat protocol” for the encoder type. Enter the encoder data as it is listed in the graphic below.

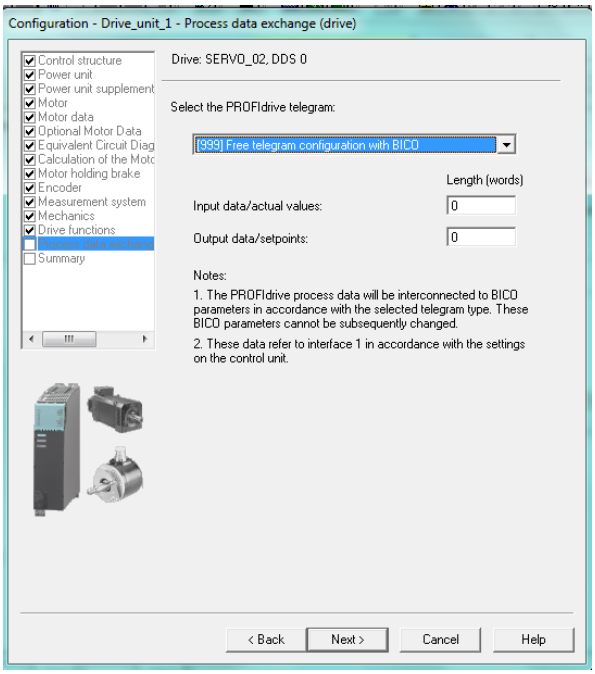


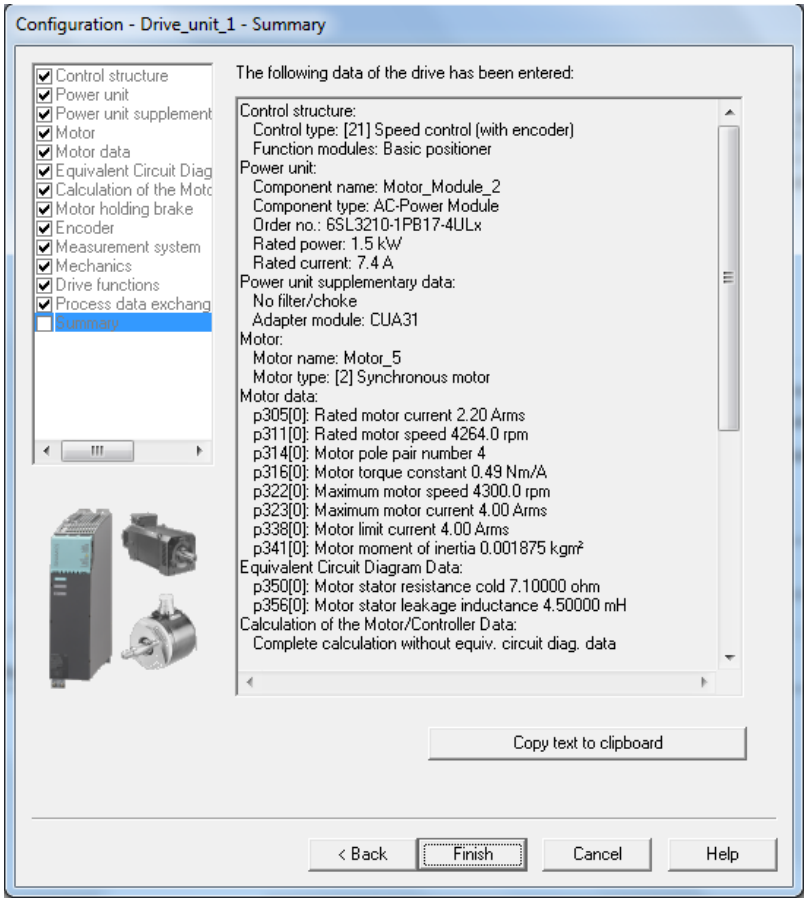
Click the Next button at the bottom of the screen a series of times to verify that the information shown in the screens below are correct.



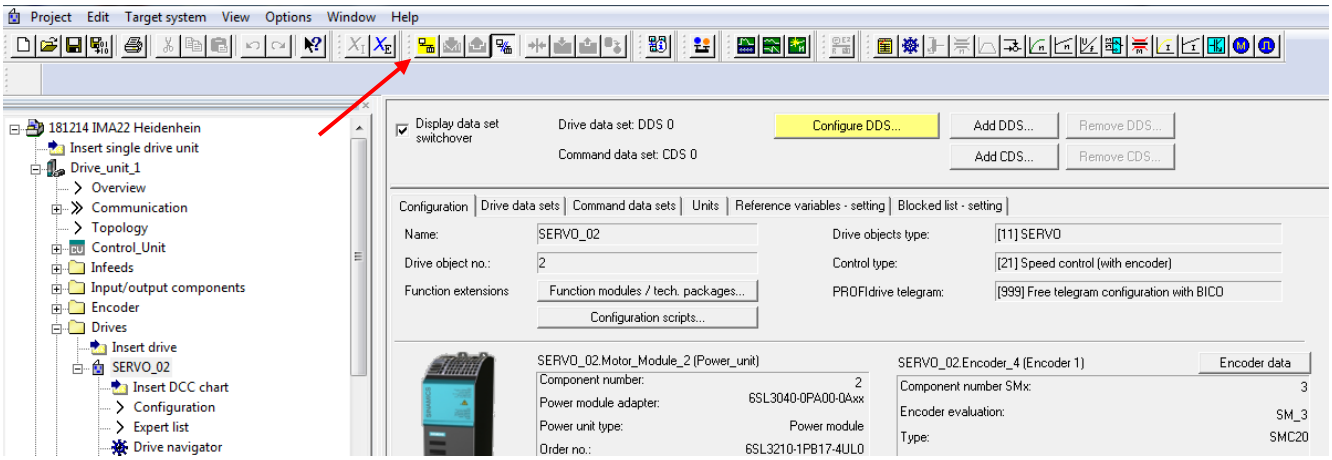



Configuration - Drive_unit_1 - Drive functions
Control structure
Power unit
Power unit supplement
Motor
Motor data
Equivalent Circuit Diag
Calculation of the Mot
Motor holding brake
Encoder
Measurement system
Mechanics
Drive functions
Process data exchang
Summary
Drive: SERVO_02, DDS 0
Technological application:
[100] Standard drive (SERVO)
[100] Standard drive (SERVO)
[101] Feed drive (limit current limitation)
[102] Spindle drive (rated current limitation)
< Back
Next >
Cancel
Help


Configuration - Drive_unit_1 - Process data exchange (drive)
Control structure
Power unit
Power unit supplement
Motor
Motor data
Optional Motor Data
Equivalent Circuit Diag
Calculation of the Mot
Motor holding brake
Encoder
Measurement system
Mechanics
Drive functions
Summary
Drive: SERVO_02, DDS 0
Select the PROFIdrive telegram:
[999] Free telegram configuration with BICO
Length (words)
Input data/actual values:
0
Output data/setpoints:
0
Notes:
1. The PROFIdrive process data will be interconnected to BICO parameters in accordance with the selected telegram type. These BICO parameters cannot be subsequently changed.
2. These data refer to interface 1 in accordance with the settings on the control unit.
< Back
Next >
Cancel
Help

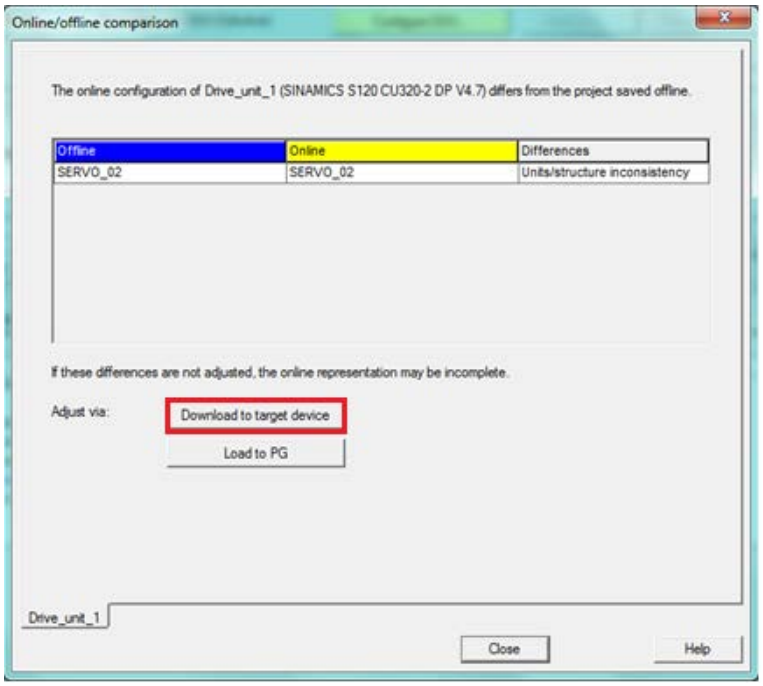

Configuration - Drive_unit_1 - Summary
Control structure
Power unit
Power unit supplement
Motor
Motor data
Equivalent Circuit Diag
Calculation of the Mot
Motor holding brake
Encoder
Measurement system
Mechanics
Drive functions
Process data exchang
Summary
The following data of the drive has been entered:
Control structure:
Control type: [21] Speed control (with encoder)
Function modules: Basic positioner
Power unit:
Component name: Motor_Module_2
Component type: AC-Power Module
Order no.: 6SL3210-1PB17-4ULx
Rated power: 1.5 kW
Rated current: 7.4 A
Power unit supplementary data:
No filter/choke
Adapter module: CUA31
Motor:
Motor name: Motor_5
Motor type: [2] Synchronous motor
Motor data:
p305[0]: Rated motor current 2.20 Arms
p311[0]: Rated motor speed 4264.0 rpm
p314[0]: Motor pole pair number 4
p316[0]: Motor torque constant 0.49 Nm/A
p322[0]: Maximum motor speed 4300.0 rpm
p323[0]: Maximum motor current 4.00 Arms
p338[0]: Motor limit current 4.00 Arms
p341[0]: Motor moment of inertia 0.001875 kgm²
Equivalent Circuit Diagram Data:
p350[0]: Motor stator resistance cold 7.10000 ohm
p356[0]: Motor stator leakage inductance 4.50000 mH
Calculation of the Motor/Controller Data:
Complete calculation without equiv. circuit diag. data
Copy text to clipboard
< Back
Finish
Cancel
Help

Click finish and select “Go Online”.

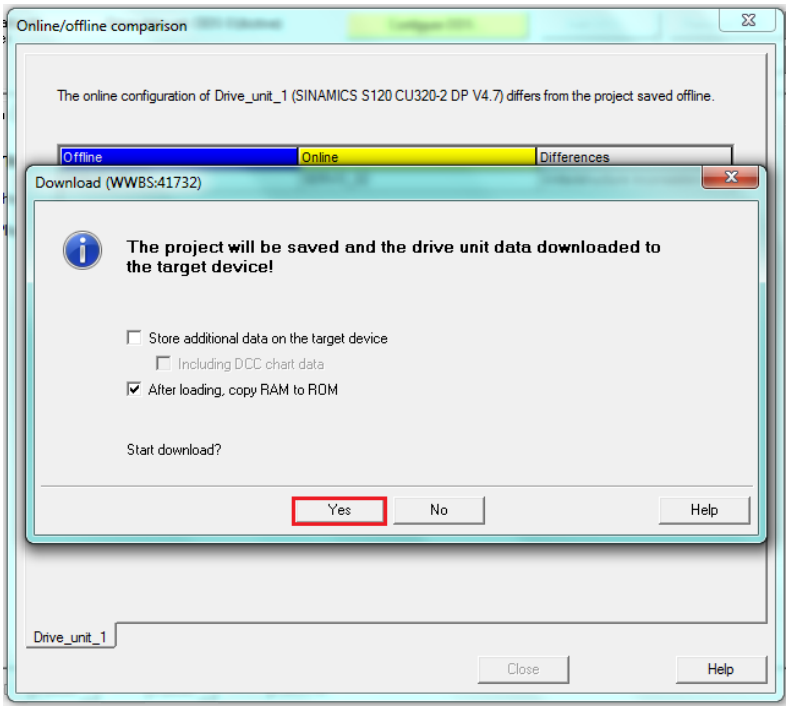


2.8 Downloading Data to Target Device

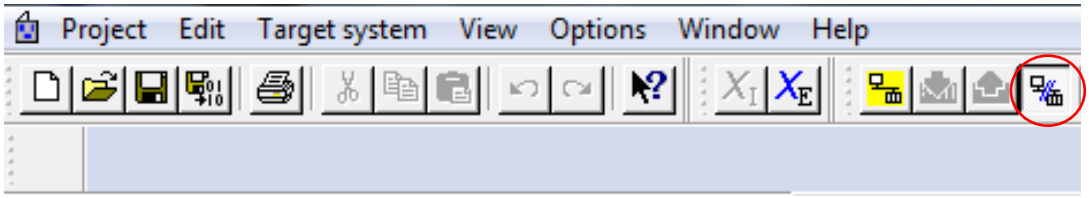
Select “Download to target device” in order to save the new information to the drive.



Follow the prompt below and select “Yes”



After downloading to the target device, take the drive “offline”



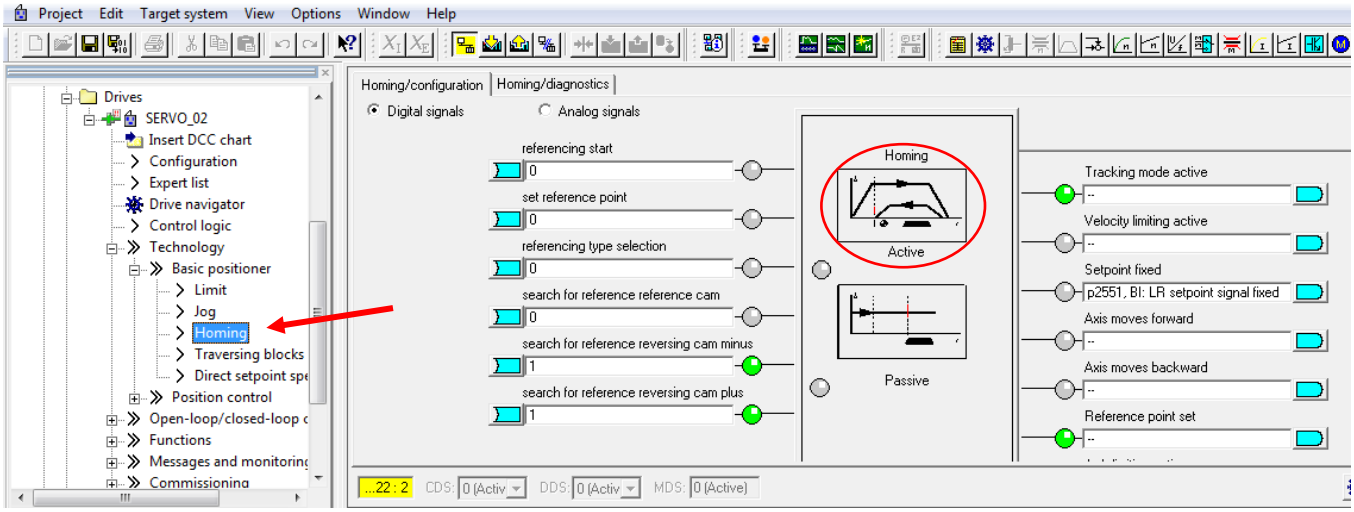
Then, perform a complete power cycle on the drive. The power must remain off for a minimum of 15 seconds to dissipate any remaining internal charge. Once it has powered back up, bring the drive back online.

The IMA unit is now ready for motor and encoder tuning.

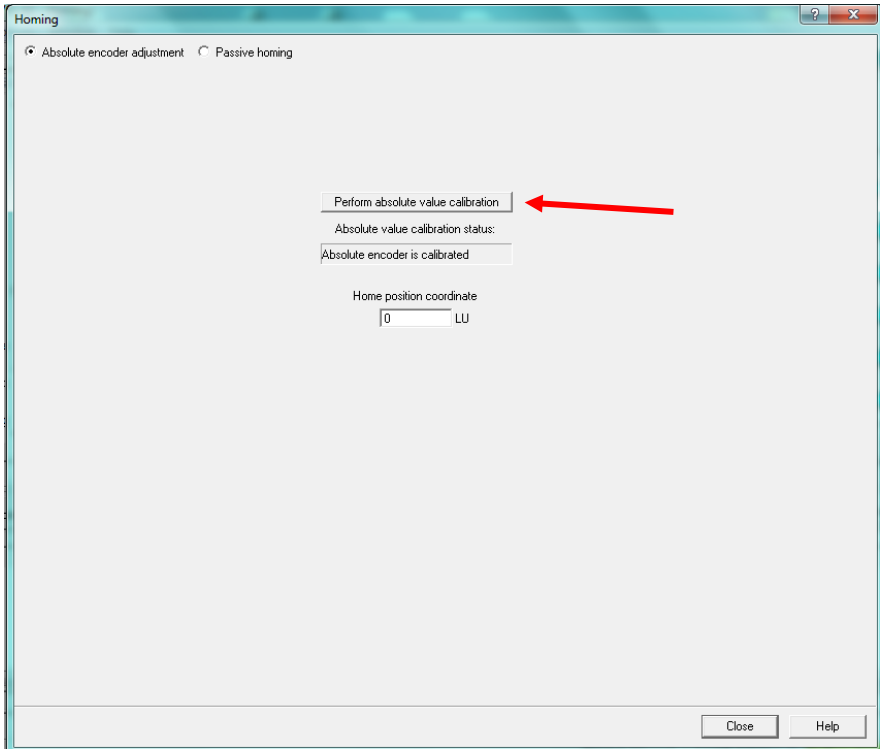
3 Tuning

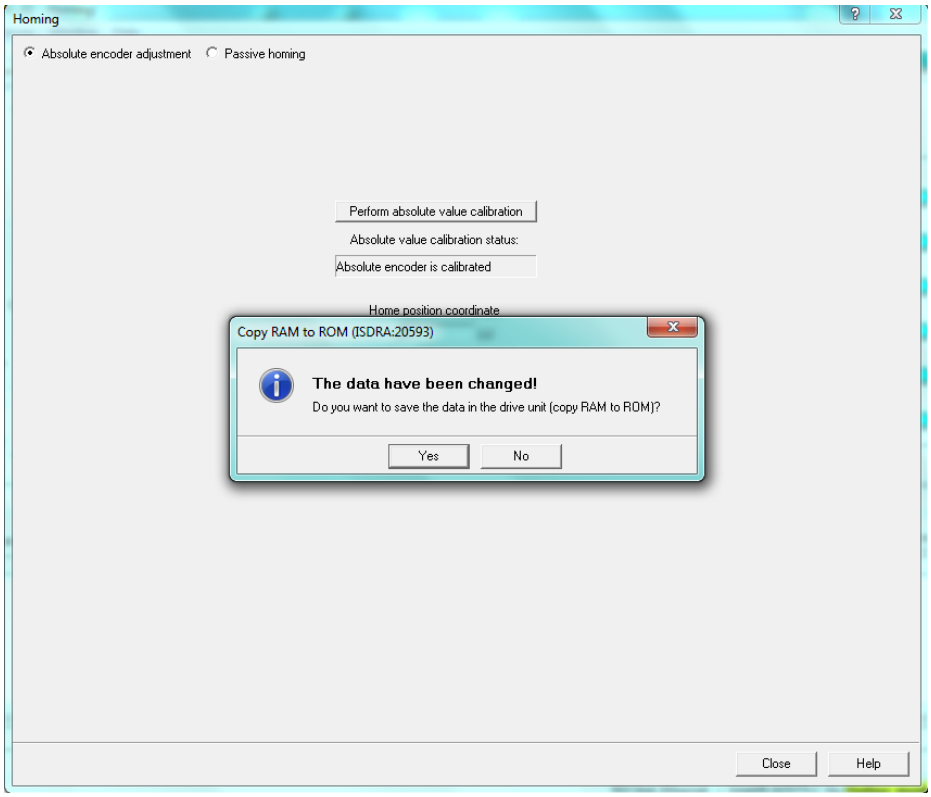
3.1 Encoder Adjustment

Set the encoder counts to zero and navigate to ‘Homing’ in the ‘Basic positioner’ tab under the ‘Technology’ tree. Select the ‘Active Homing’ graph illustration.

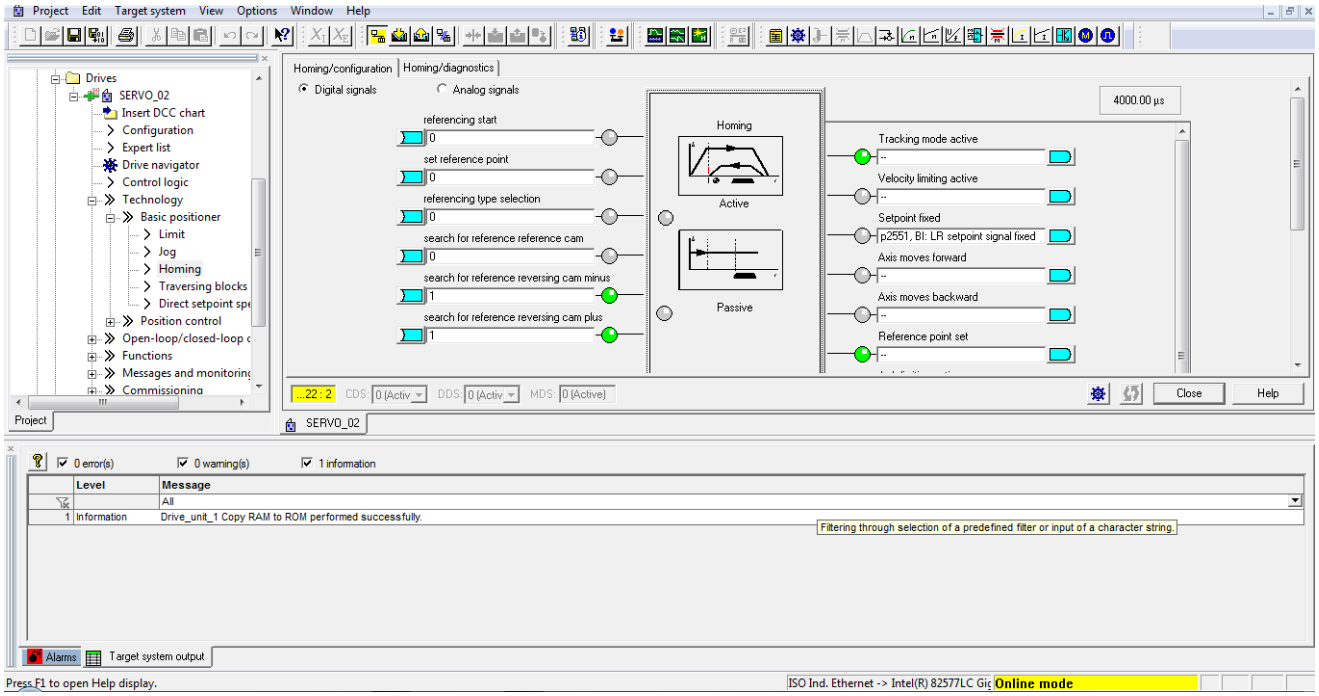


Click ‘Preform absolute value calibration’ to calibrate the encoder. Select ‘Yes’ in the prompt in order to save the data to the drive.

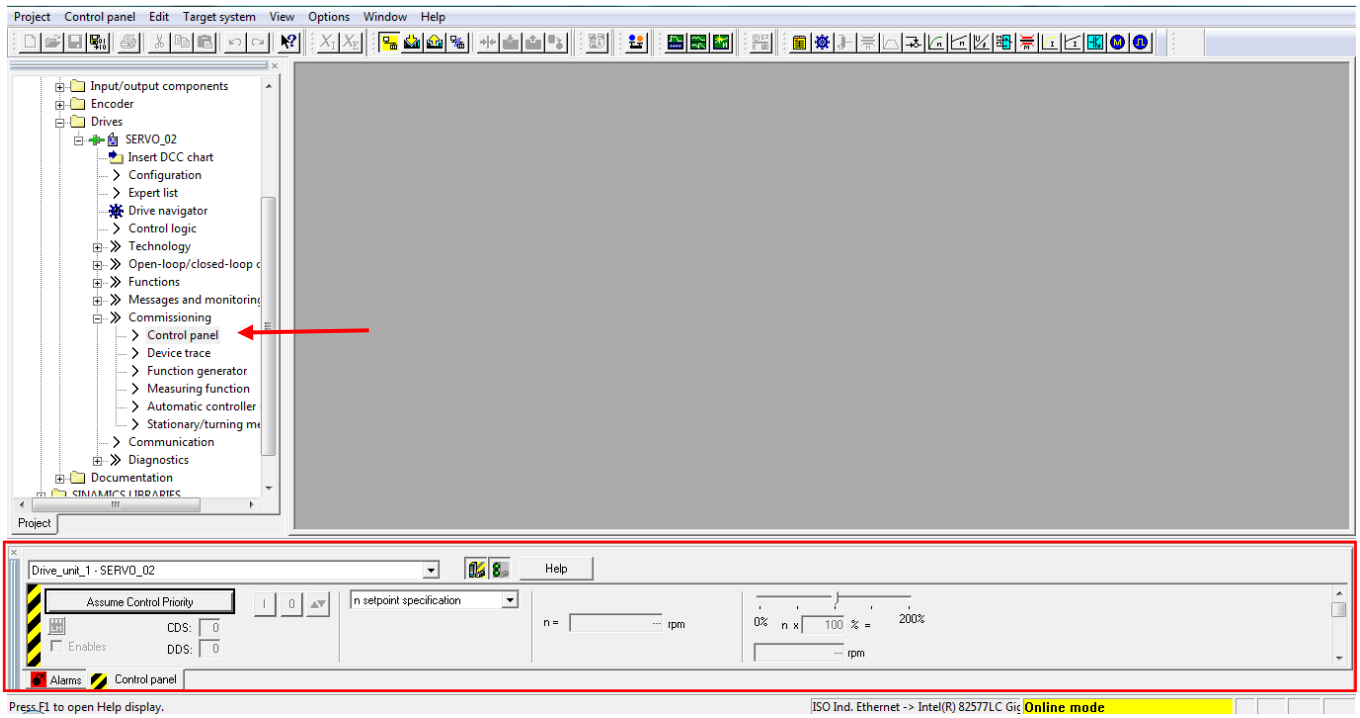




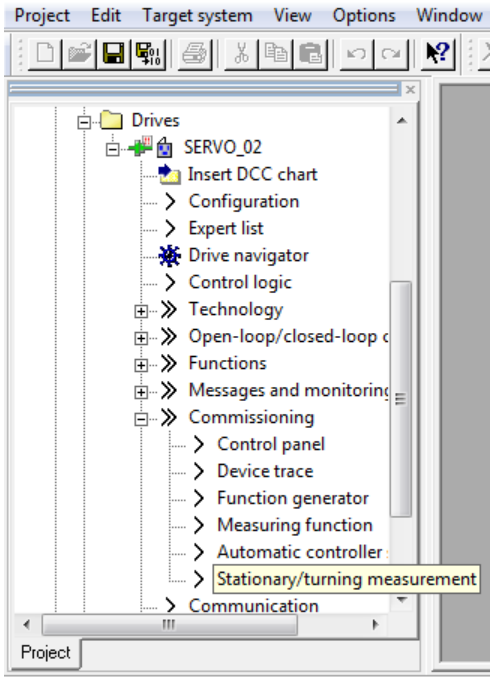
After it has been saved, close the 'Homing' screen.



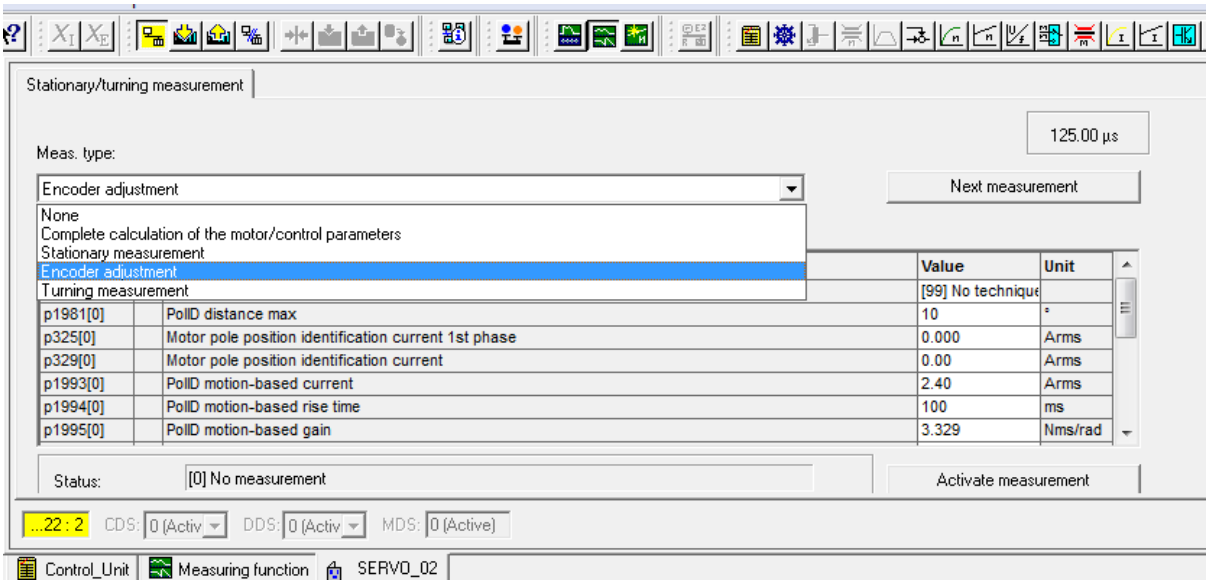
In the project tree, navigate to the ‘Commissioning’ tab and double-click on ‘Control panel’ to open the control panel menu.



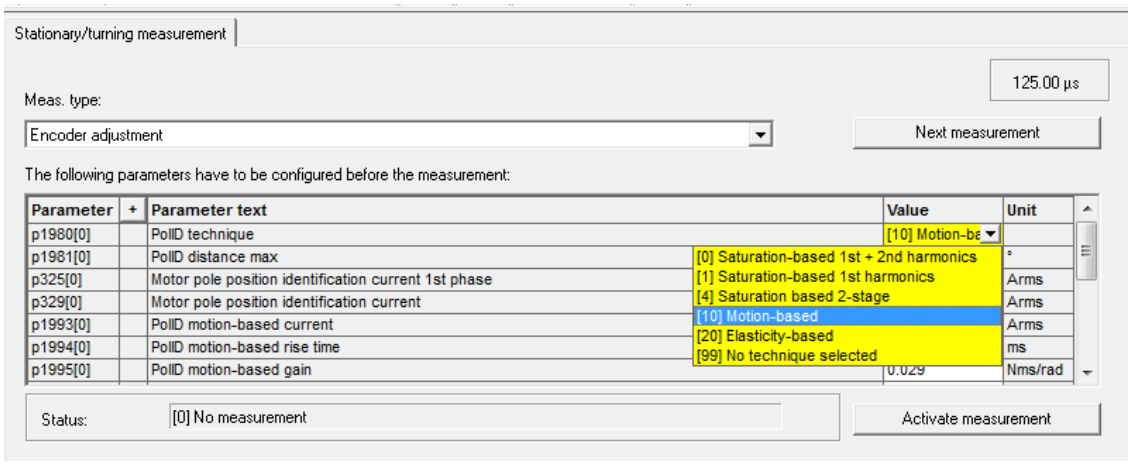
Under Commissioning, open the control panel and navigate to the ‘Stationary/tuning measurement’ tab.



In the ‘Meas. type’ menu, select ‘Encoder adjustment’.

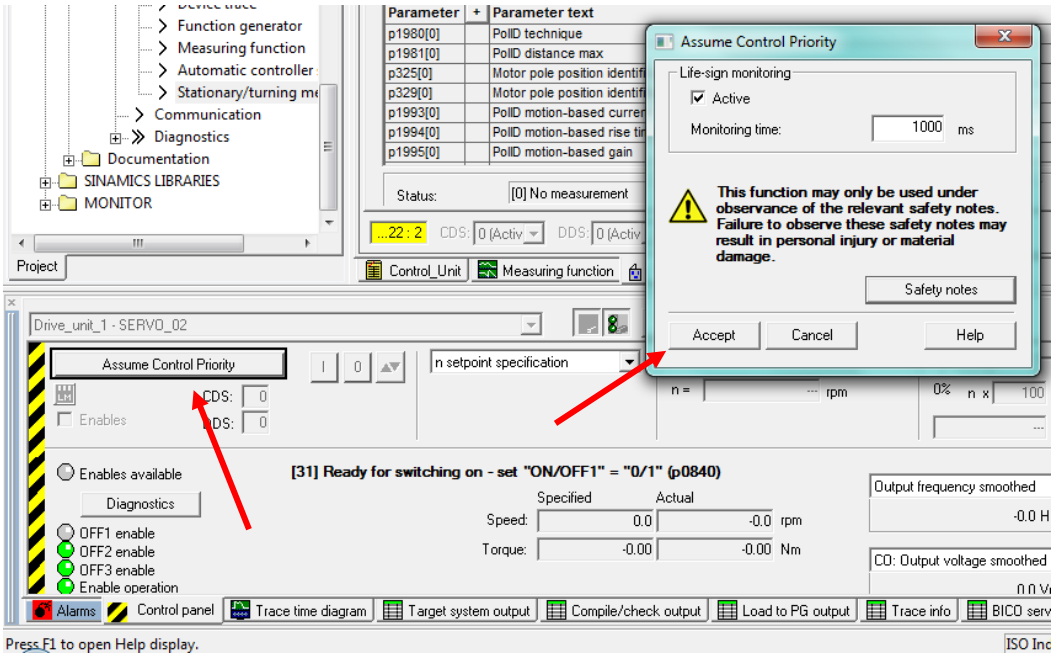


Select ‘[10] Motion-based’ technique under the value parameter selection menu.

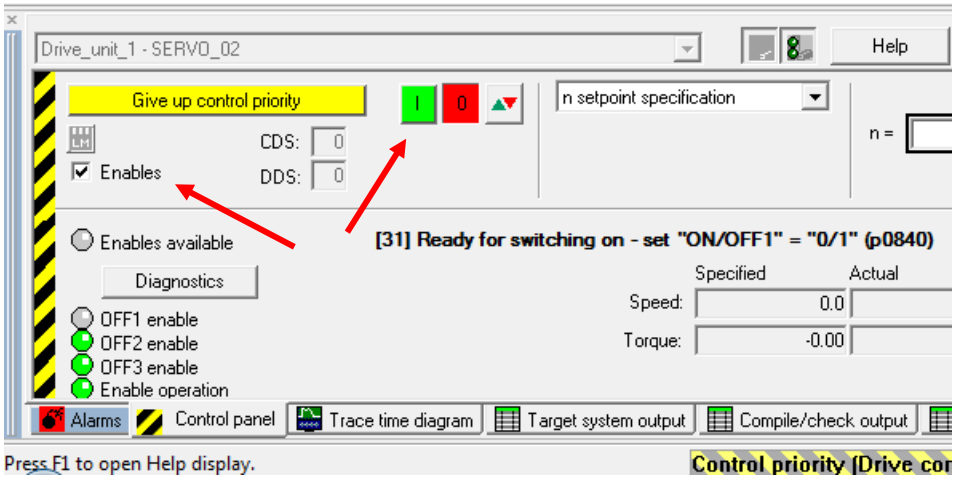


Activate the measurement, review and close the prompt.

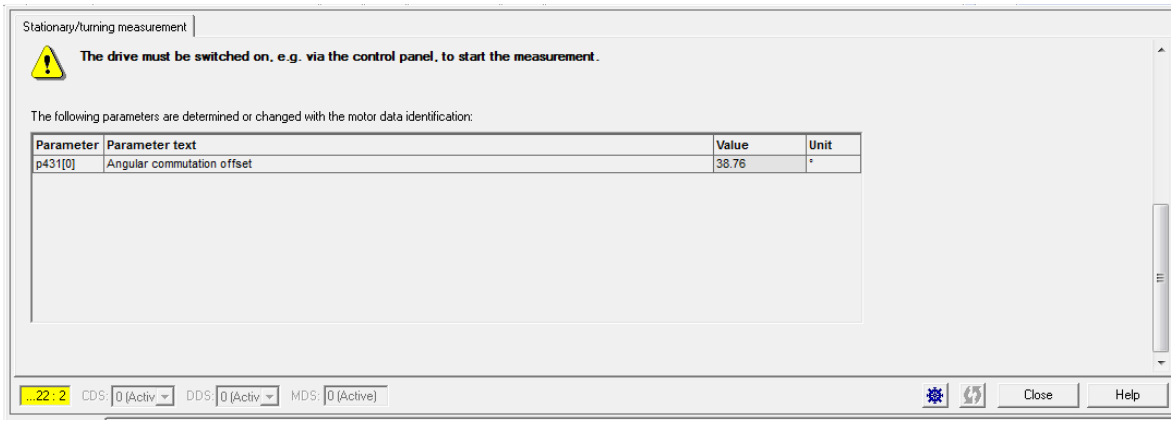
Assume control Priority and press “Accept” on the warning that pops up.



Check ‘Enables’ and turn the drive on by pressing the green ‘I’ box to perform measurement. The drive will momentarily turn on to initiate the measurement.

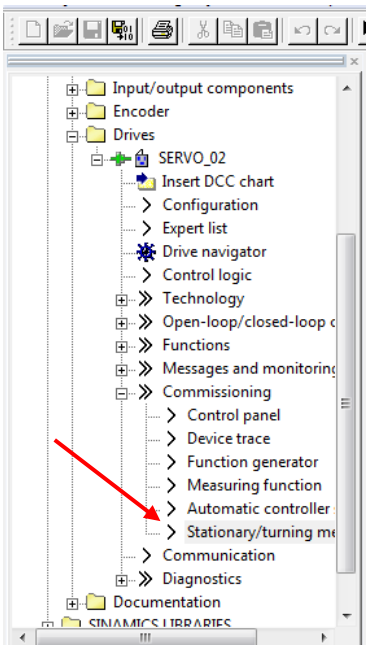


Scroll to the bottom of the 'Stationary/tuning measurement' screen and confirm that an 'Angular commutation offset' has been identified.

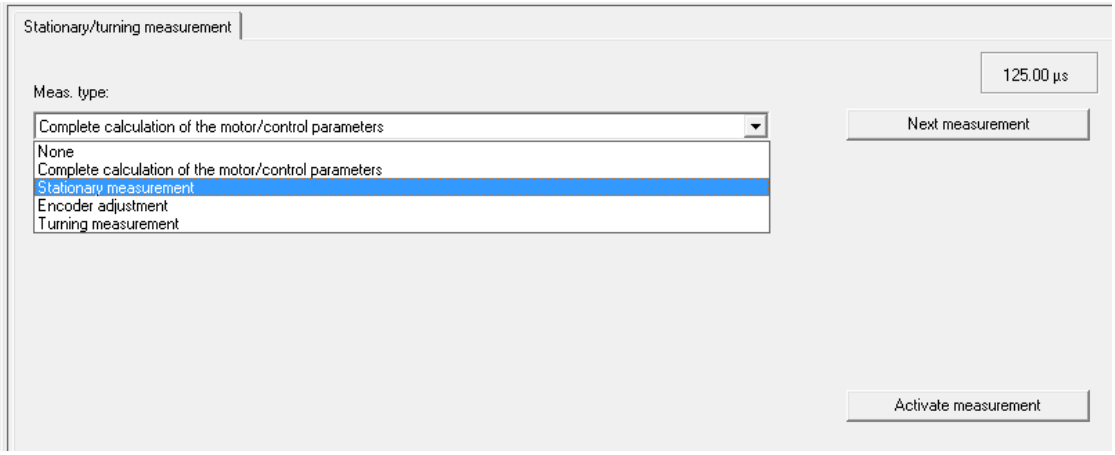


3.2 Stationary Tuning

Select 'Stationary/tuning measurement' within the commissioning tab.

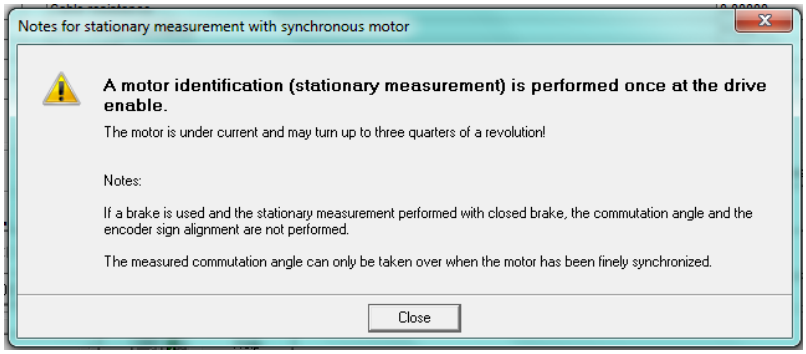


Then, select ‘Stationary measurement’ in the drop down.

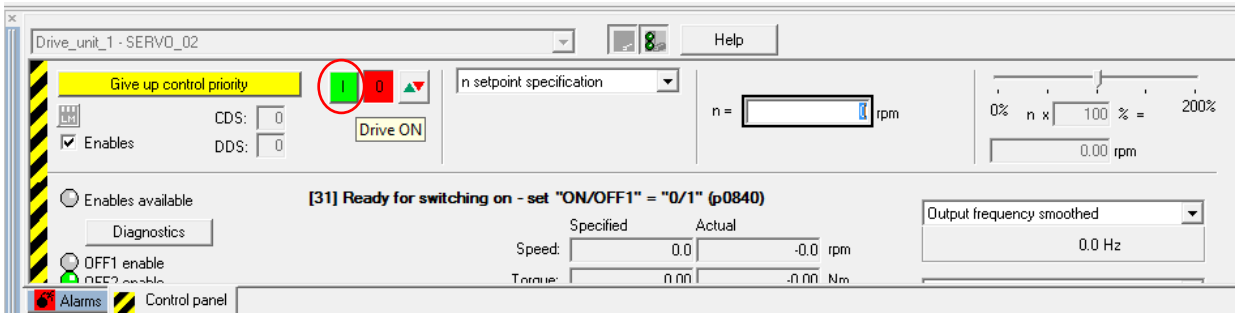


Assume Control Priority and check the ‘Enables’ box.

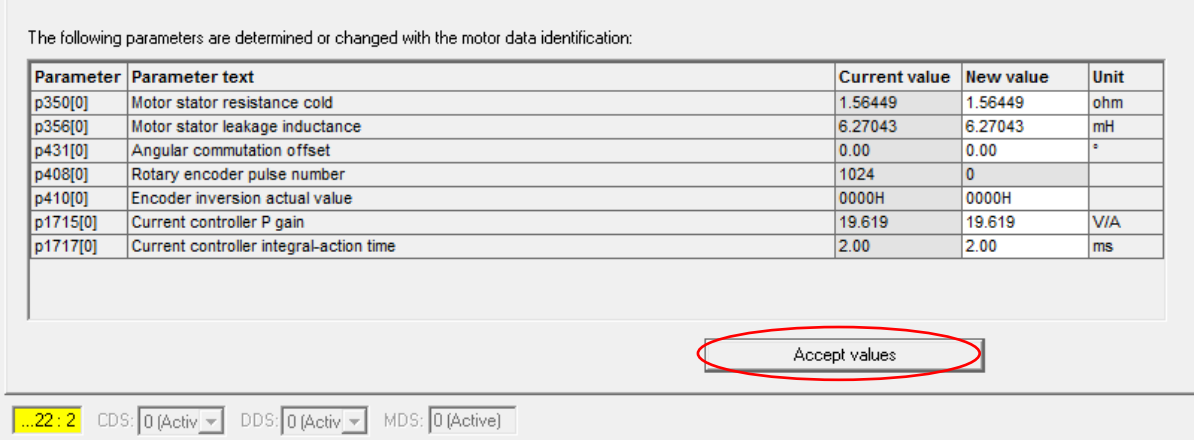
Click ‘Activate measurement’. Review and close the prompt.



Turn the drive on by clicking the green box to perform the measurement. The drive will automatically power down after completing the measurement, this should take <5 seconds.



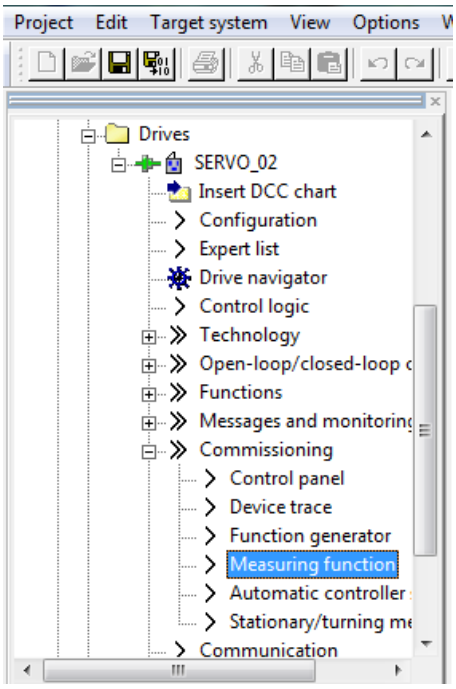
Scroll to the bottom of the measurement window and select: 'Accept values'.



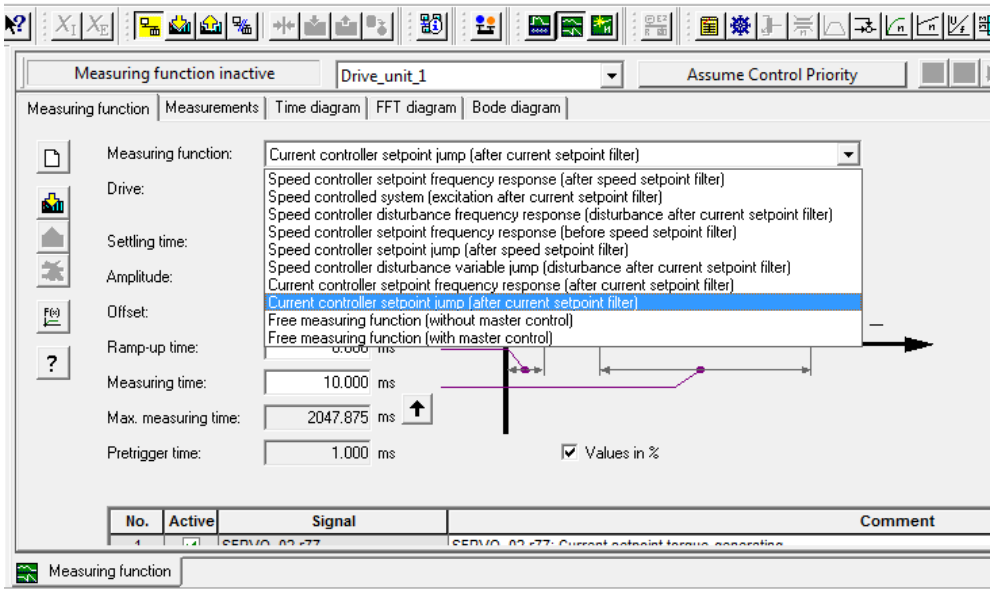
Stationary tuning is now complete. Adjusting the P-gain is the next step in tuning the actuator.

3.3 Adjusting the P Gain

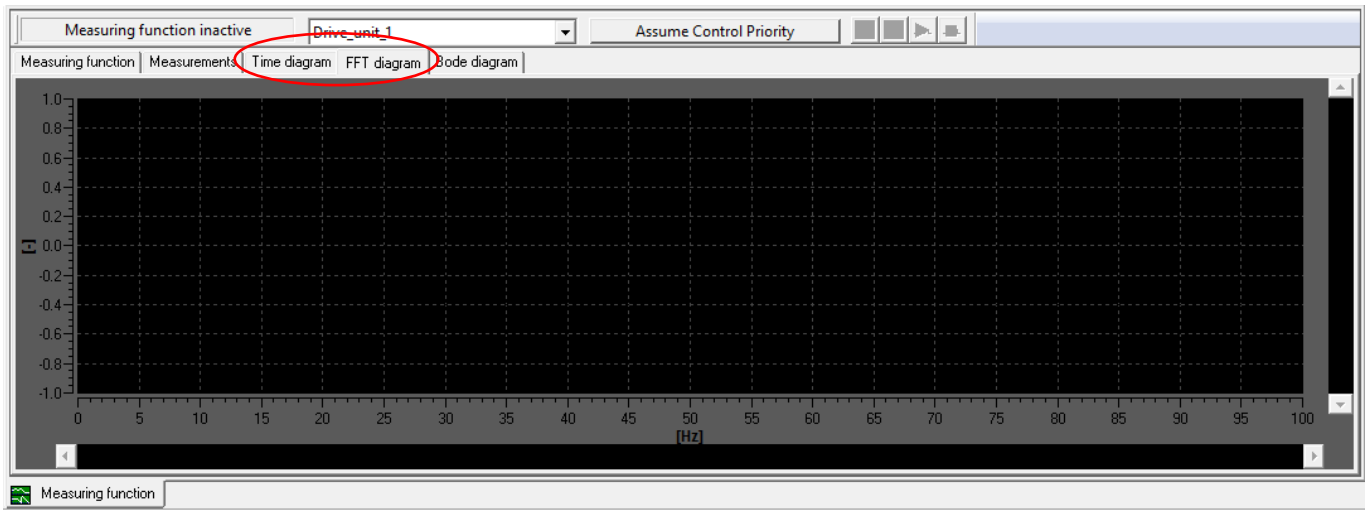
Please Note: The IMA brake must be powered and disengaged prior to tuning. Not all units have a brake.
In order to ensure proper operation, it is necessary to first properly adjust the P Gain feedback of the system.
First, navigate to the 'Measuring Function' within the drive tree.



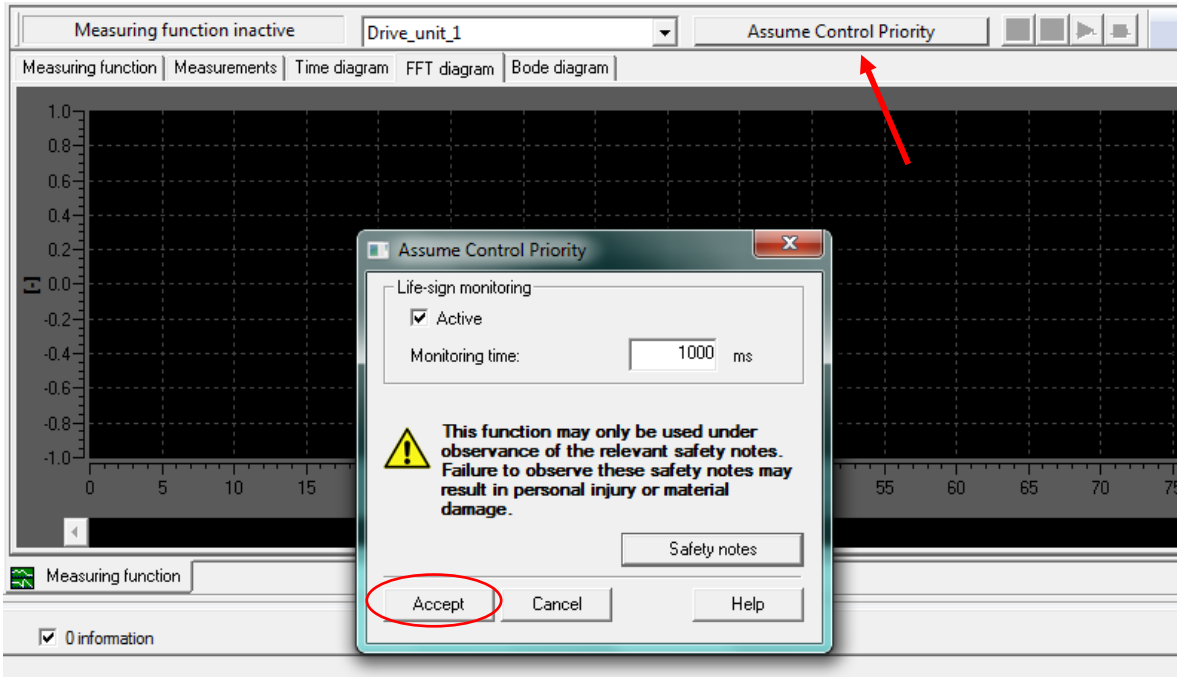
Next, under Measuring Function select: 'Current controller set point jump (after current setpoint filter)'



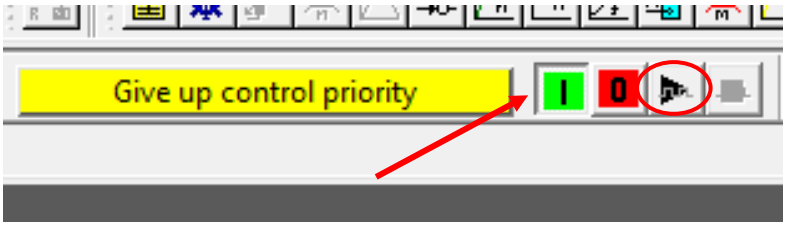
Navigate to the ‘FFT Diagram’ tab on the top of the current screen.

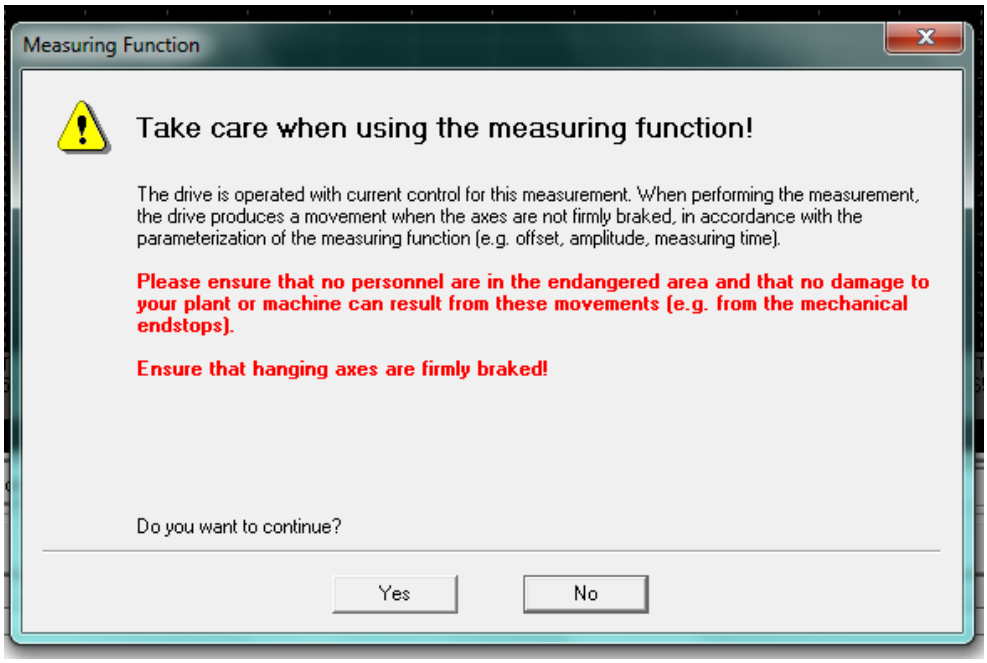


Assume Control Priority of the system, and press accept.

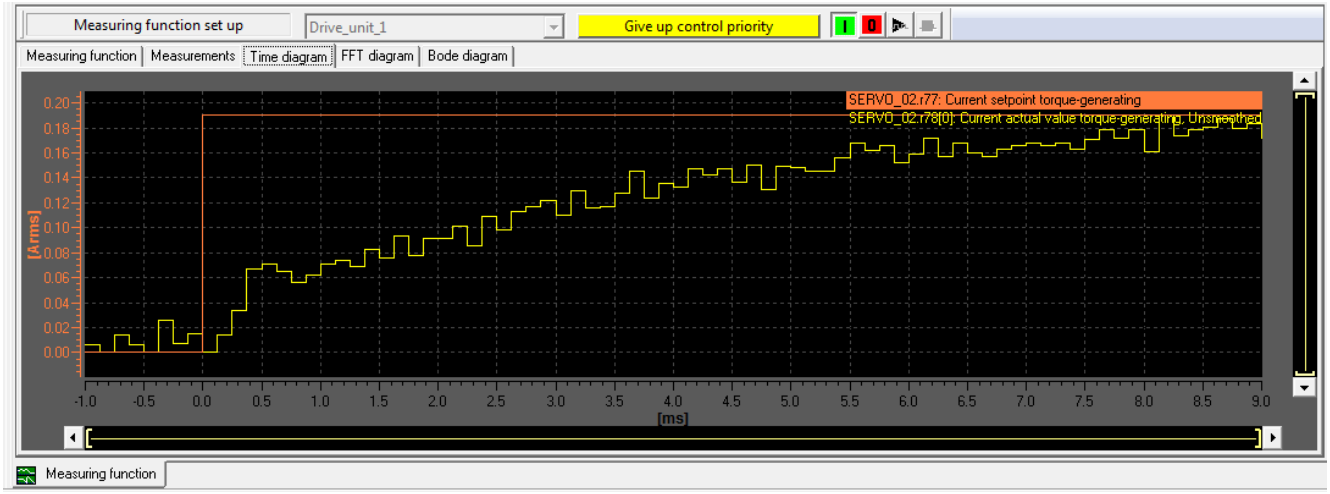


Enable the Drive, select 'Yes' after reviewing the prompt, then press the play button

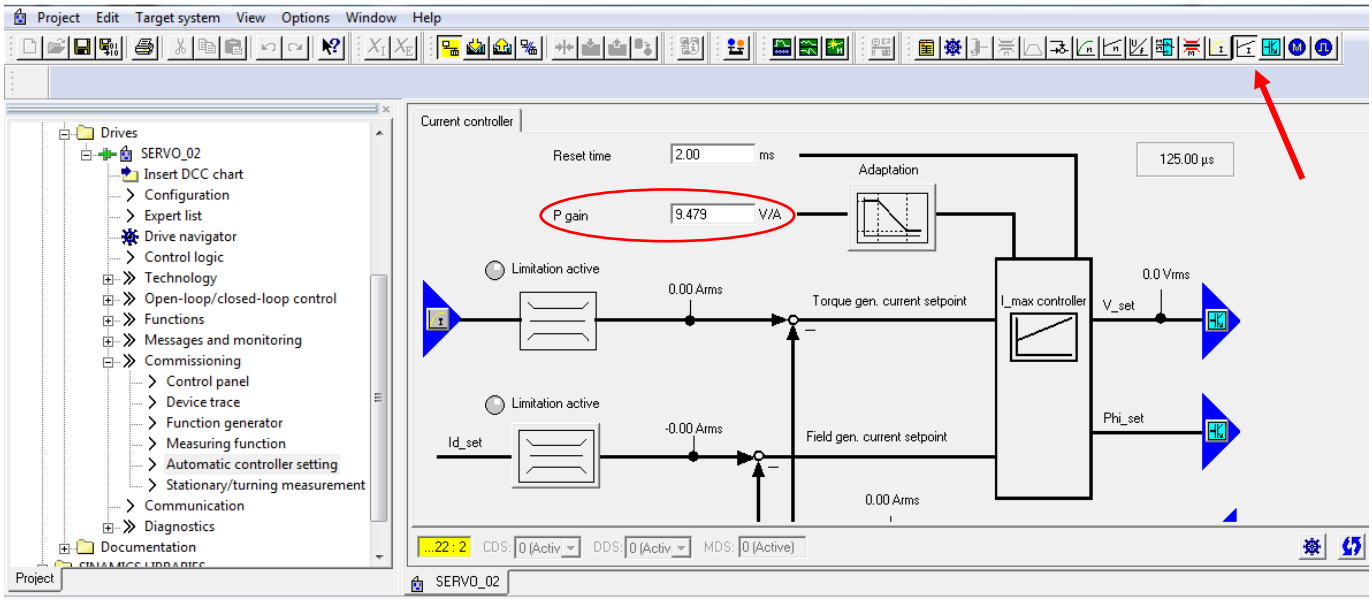




Resulting graph should appear similar to the illustration below.



If the graph does not appear to match this graph, adjust the P gain in the motor menu until the measurement produces sufficient results.



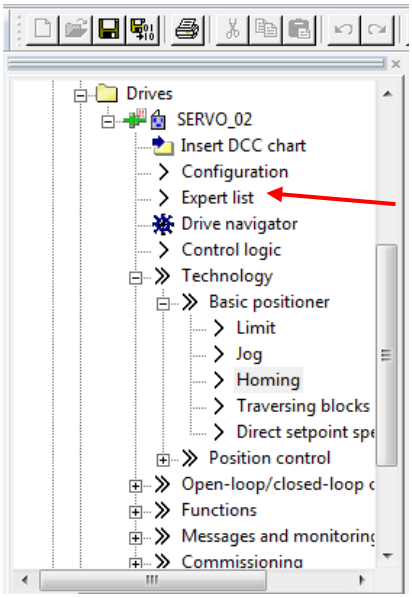
Tuning is now complete.

Appendix A: Additional Info

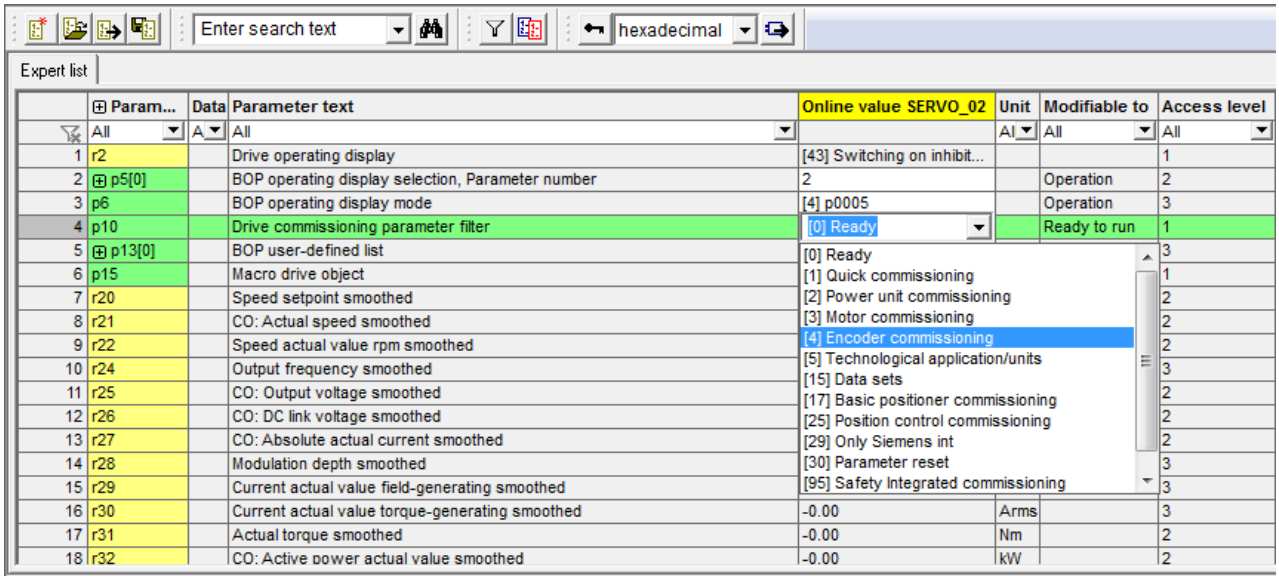
A.1 Eliminating Encoder Serial Number Alarm

If you get an “Encoder Serial Number Alarm” take the following steps to resolve the issue.

First select “Expert List” under the motors tab.

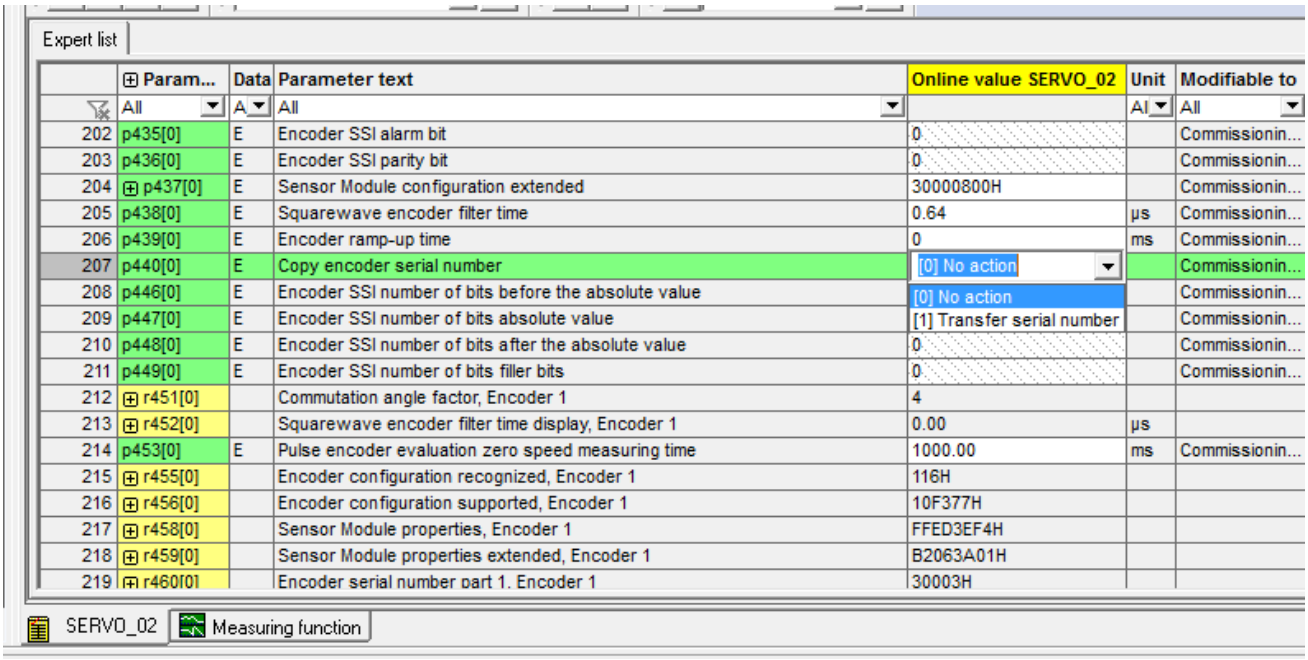


Then change the value of “P10” Drive commissioning parameter filter from “[0] Ready” to “[4] Encoder Commissioning”



	Param...	Data	Parameter text	Online value SERVO_02	Unit	Modifiable to	Access level
	All	A	All		Al	All	All
1	r2		Drive operating display	[43] Switching on inhibit...			1
2	p5[0]		BOP operating display selection, Parameter number	2		Operation	2
3	p6		BOP operating display mode	[4] p0005		Operation	3
4	p10		Drive commissioning parameter filter	[0] Ready		Ready to run	1
5	p13[0]		BOP user-defined list				3
6	p15		Macro drive object				1
7	r20		Speed setpoint smoothed				2
8	r21		CO: Actual speed smoothed				2
9	r22		Speed actual value rpm smoothed				2
10	r24		Output frequency smoothed				3
11	r25		CO: Output voltage smoothed				2
12	r26		CO: DC link voltage smoothed				2
13	r27		CO: Absolute actual current smoothed				2
14	r28		Modulation depth smoothed				3
15	r29		Current actual value field-generating smoothed				3
16	r30		Current actual value torque-generating smoothed	-0.00	Arms		3
17	r31		Actual torque smoothed	-0.00	Nm		2
18	r32		CO: Active power actual value smoothed	-0.00	kW		2

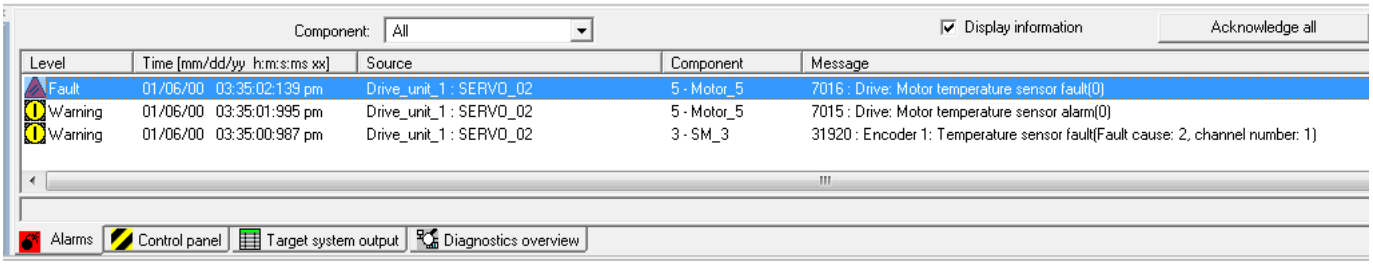
After this scroll down and find “P440[0]” Copy encoder serial number, then change the value from “[0] No action” to “[1] Transfer serial number”



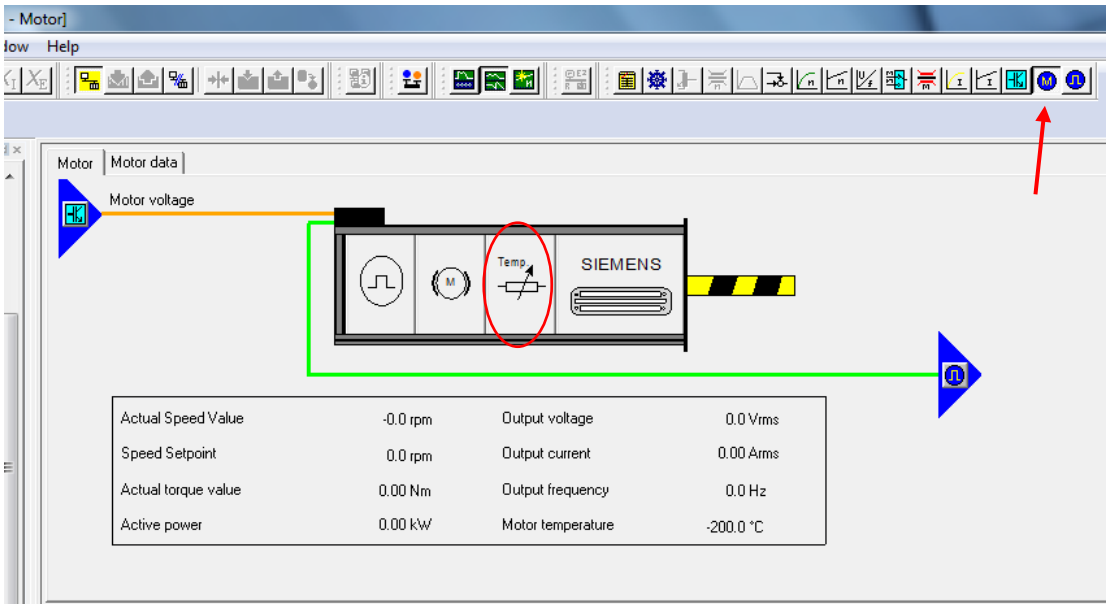
Next go back to “P10” and change the value back to “[0] Ready”. After this acknowledge the fault and the alarm will disappear.

A.2 Eliminating Temperature sensor fault.

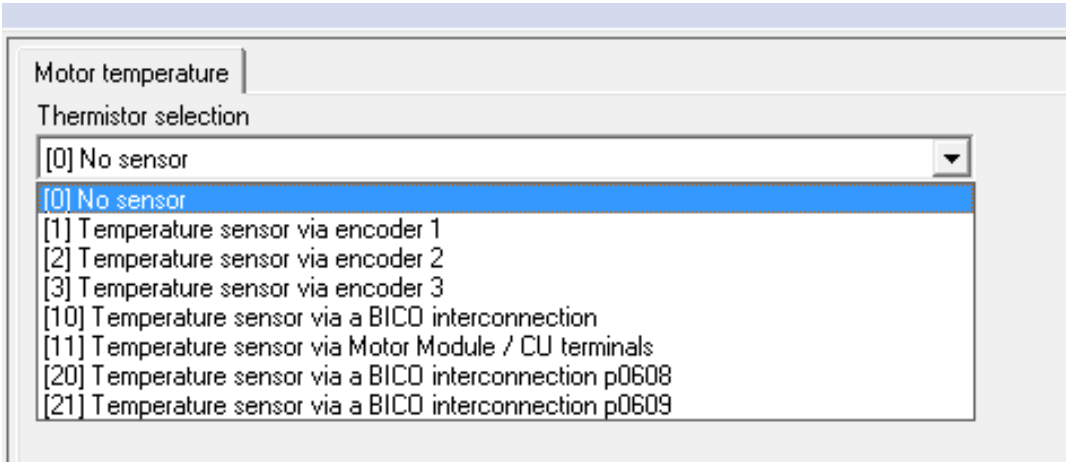
With the IMA22 demo PN: 27220711, WO: 1108419.1. There is no temperature sensor installed so the following fault will show up under the alarms tab.



To remove this error click on the motor tab at the top right of the Siemens software. And once there click on the motor temperature icon.



Once there change the Thermistor selection to "[0] No sensor.



After this acknowledge the alarm, and the alarm will not show up again.

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