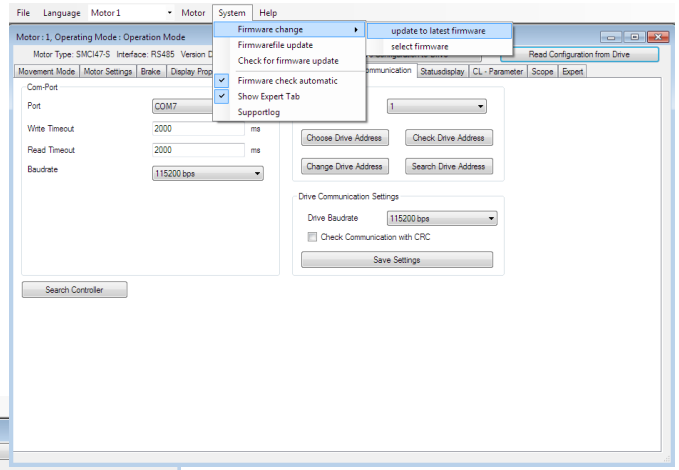
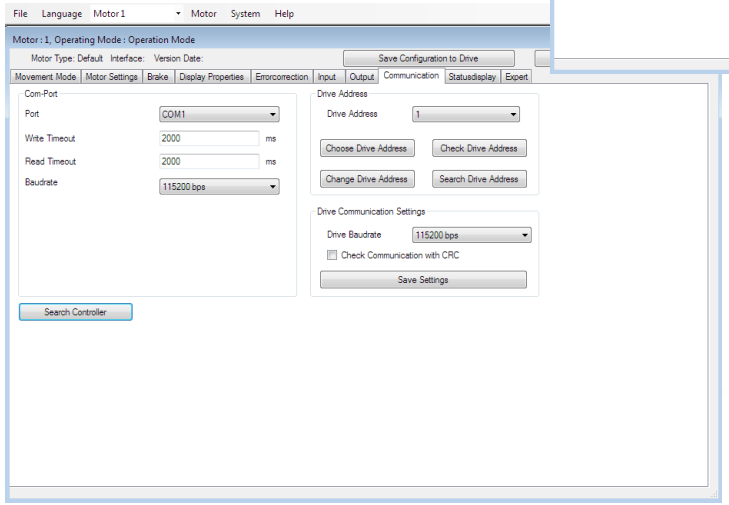
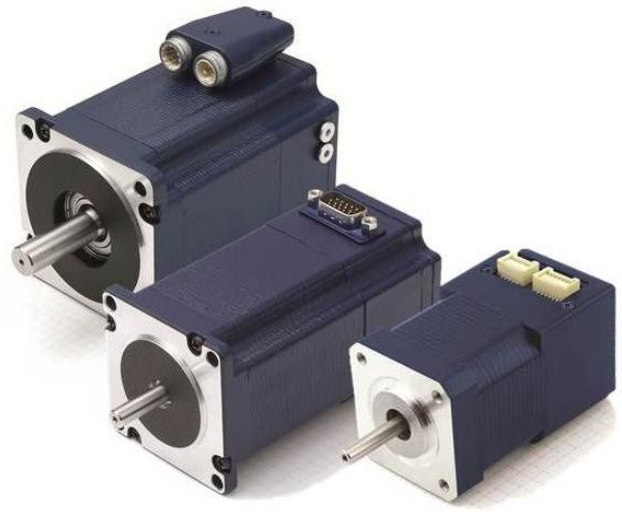
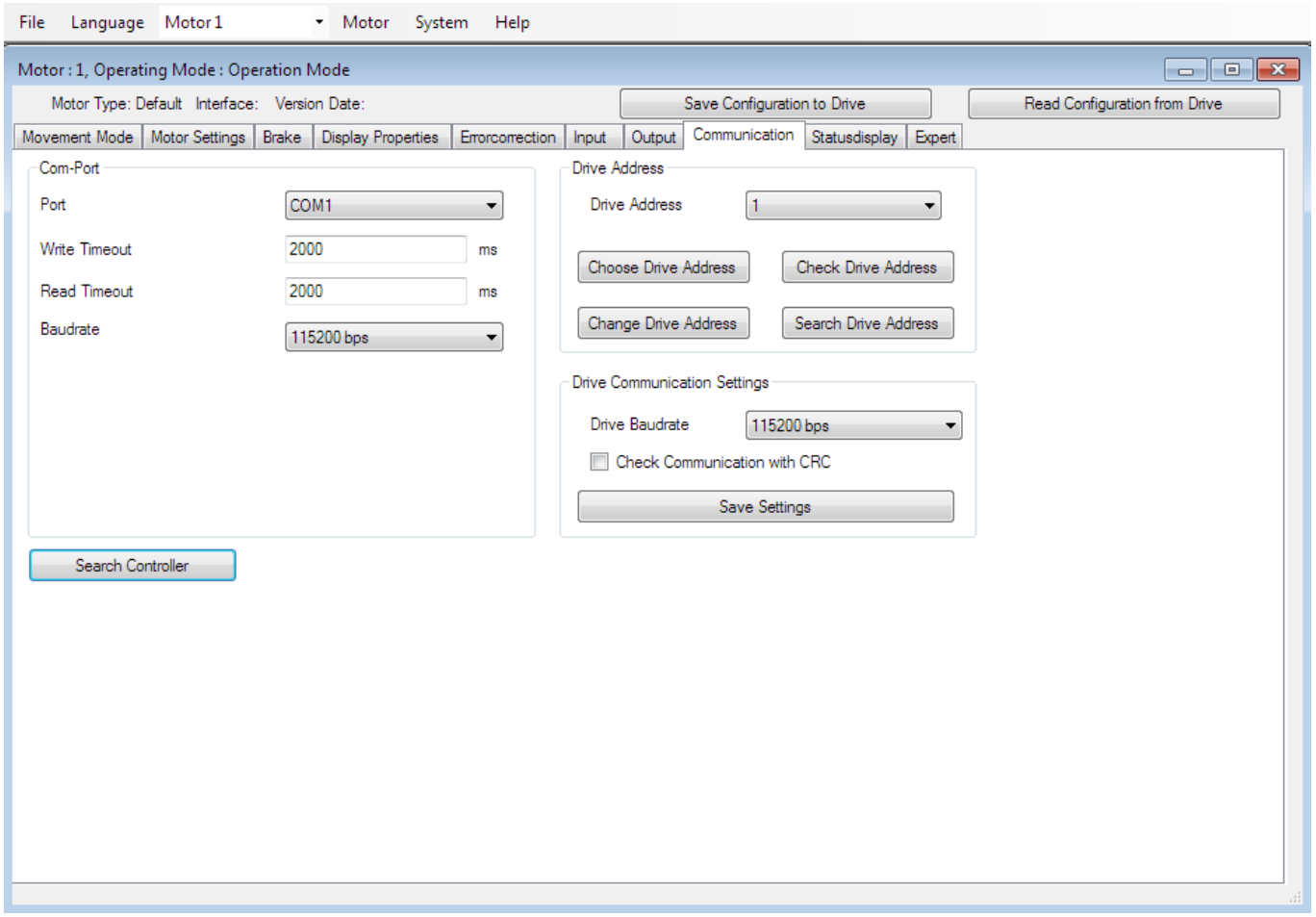
NanoPro Software Training









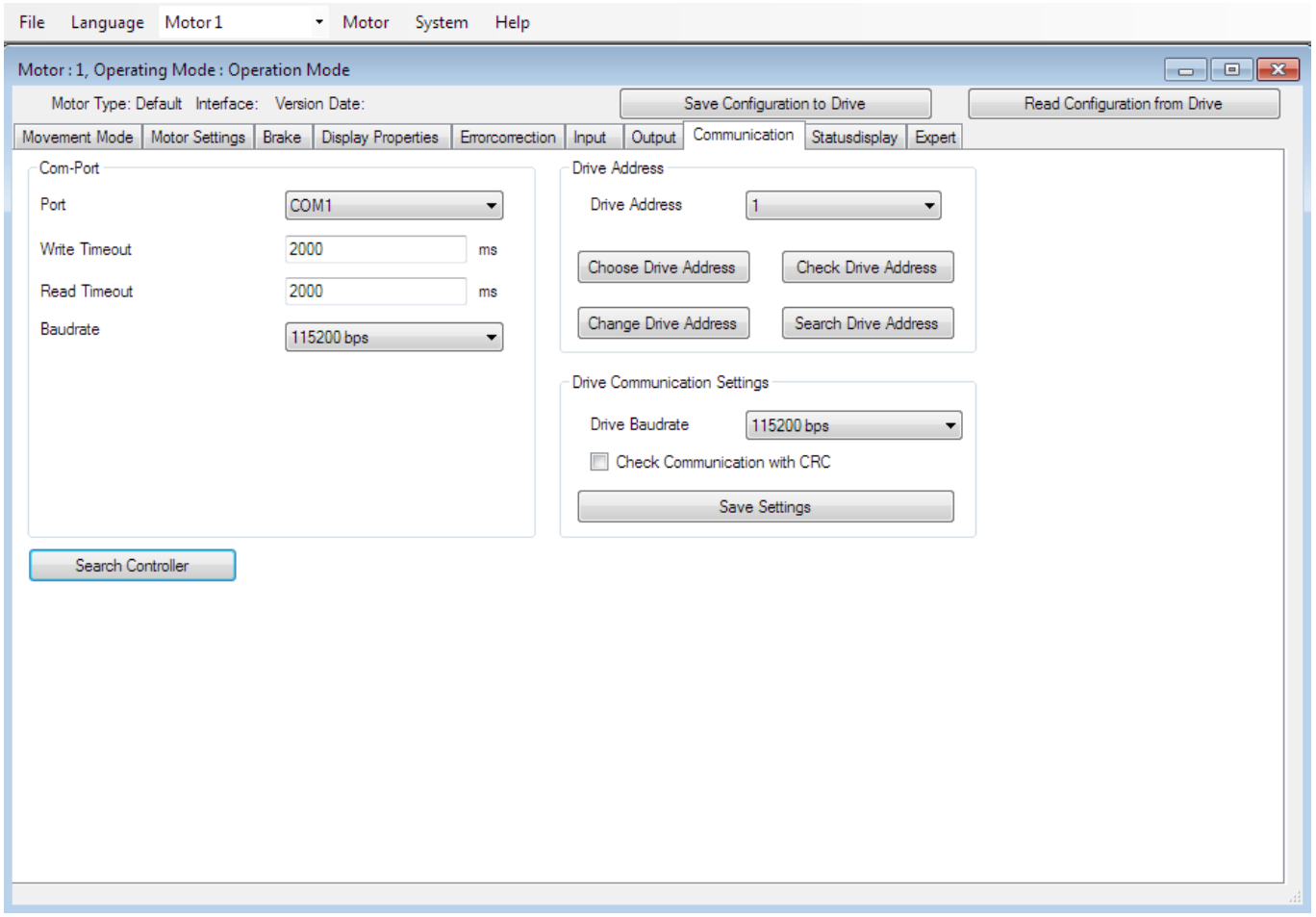
Our NanoPro software is a recommendable tool for:

- Configuration
- Testing
- Troubleshooting
- Firmware updates

Today, you'll learn how to use the NanoPro software properly.

In addition, you will get a good overview of all functions of our motor controllers

Communication



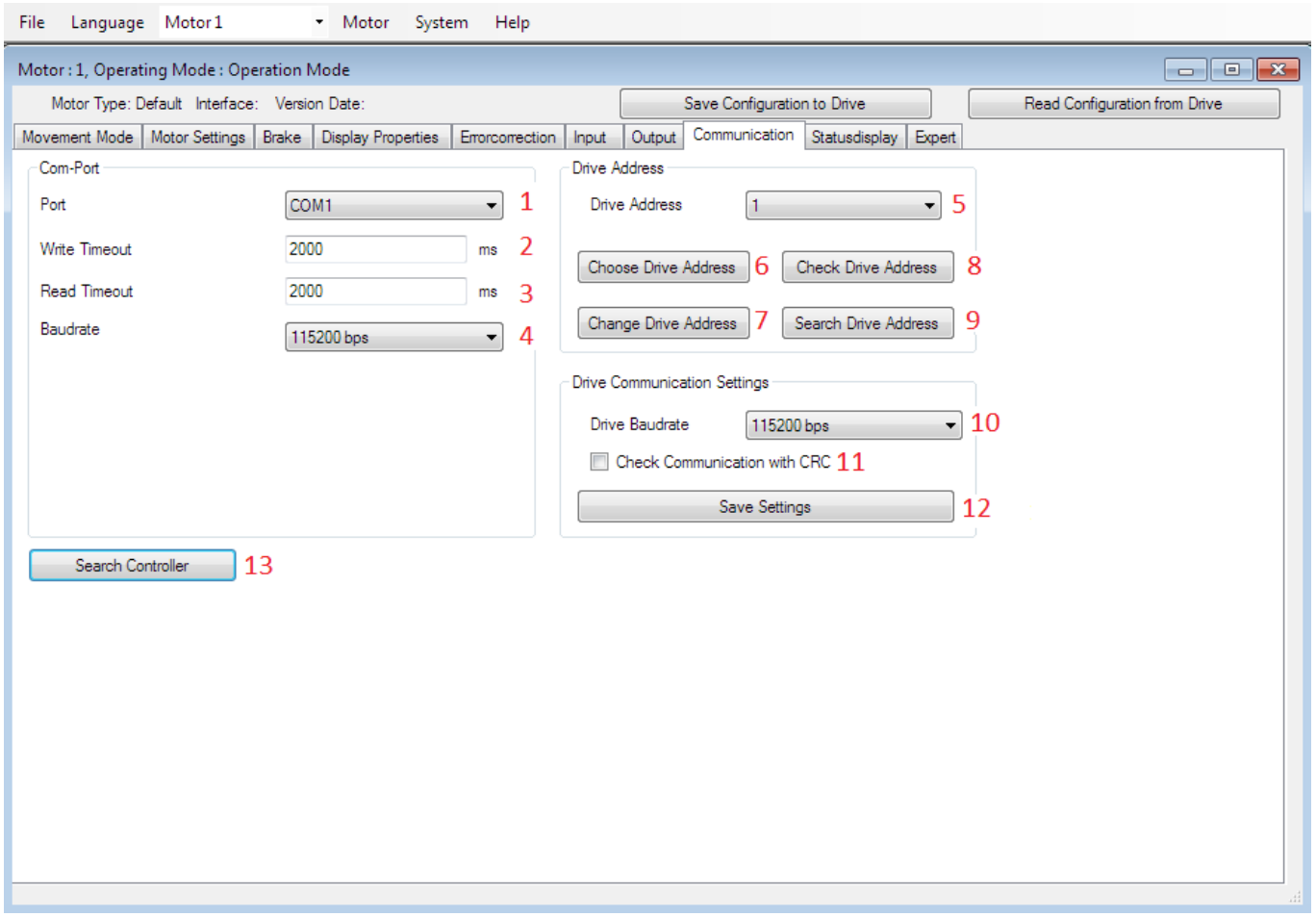
The Communication tab is the starting page of NanoPro.

You need to establish a communication here.

These communication parameters can be changed:

- Baudrate
- Drive address
- CRC check

Communication



1. Port: Comport of the PC to which the controller is connected.

2. Write Timeout: Time window before a communication error appears after writing.

3. Read Timeout: Time window before a communication error appears after reading.

4. Baudrate: The selected baud rate for the communication (default 115200).

5. Drive Address: The address you want to communicate with.

6. Choose Drive Address: Confirms a change of the drive address.

7. Change Drive Address: Changes the address of the controller connected to the software.

8. Check Drive Address: Checks if a controller with the selected address is communicating.

9. Search Drive Address: Searches for a connected controller.

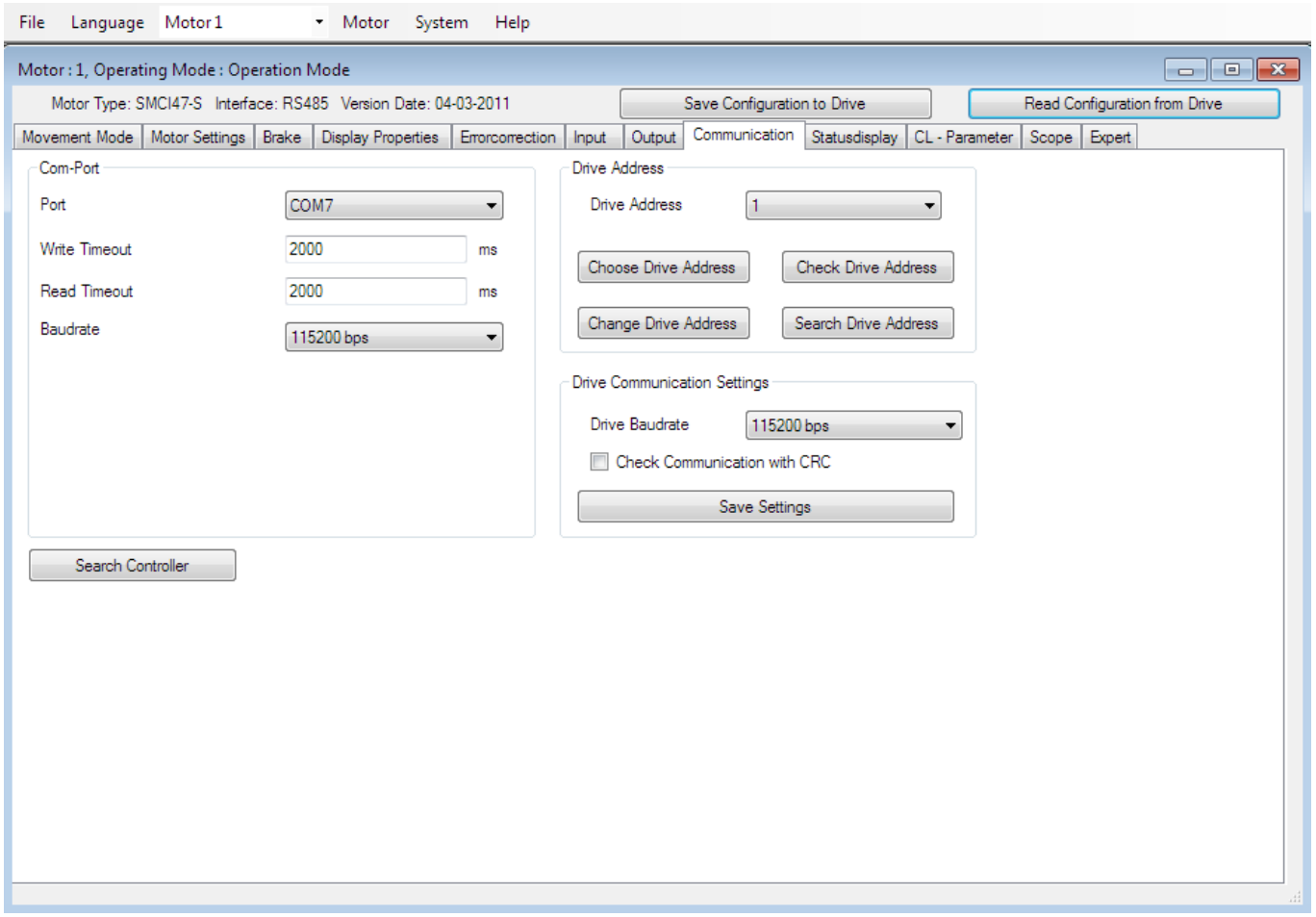
10. Drive Baudrate: Changes the baud rate of the connected controller.

11. Check Communication with CRC: Activates/deactivates the use of a CRC check.

12. Save Settings: Saves changes in baud rate and CRC check.

13. Search Controller: Searches all baud rates for a connected controller.

Communication



To establish a communication:

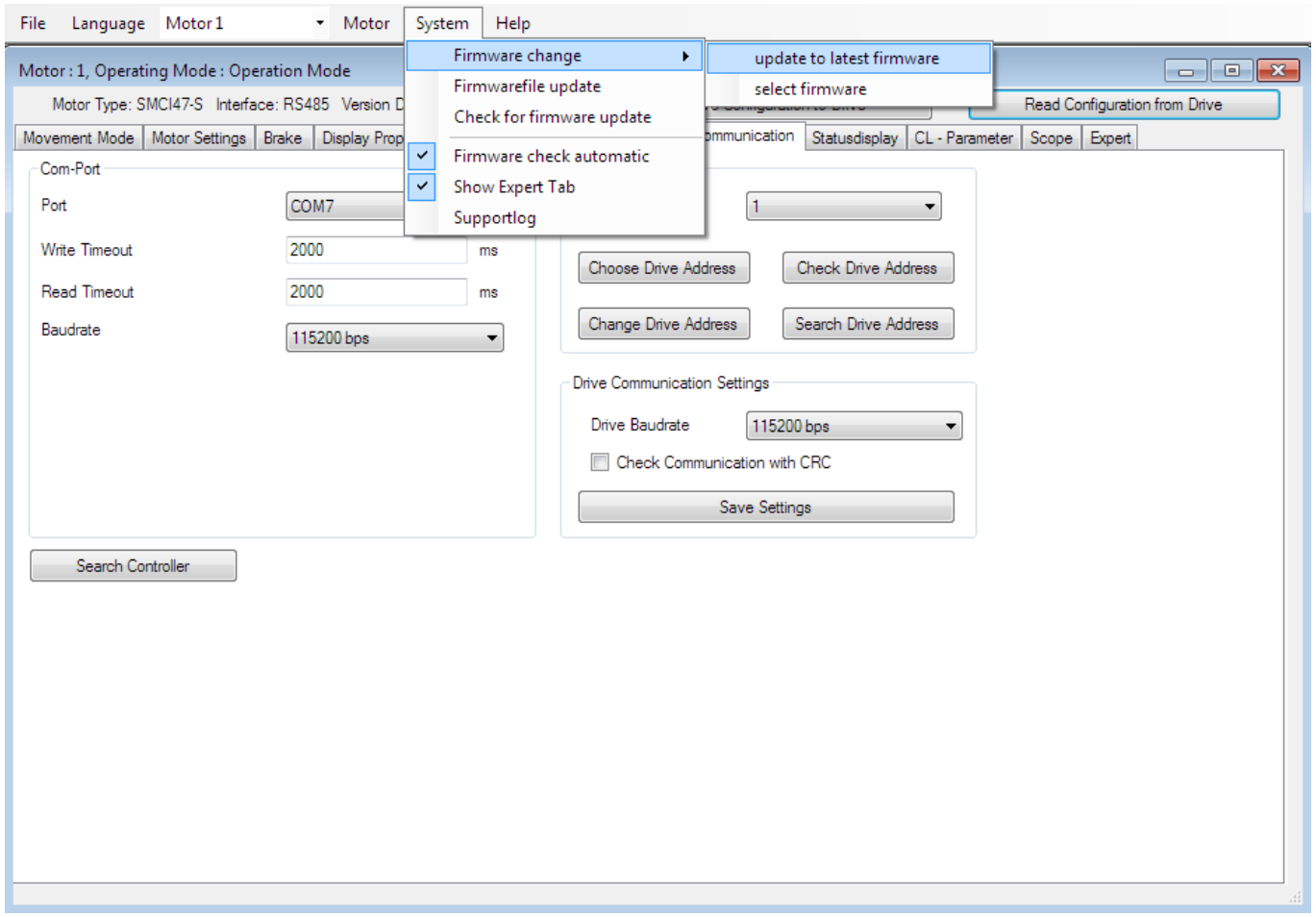
- Choose the port
- Choose the baud rate
- Choose the drive address
- Click on “read configuration from drive”

Or:

- Choose the drive address
- Click on “search controller”

Communication is established when “motor type”, “interface” and “version date” (firmware version) appear.

Firmware update



NanoPro automatically detects if a new firmware is available. In this case a message will appear.

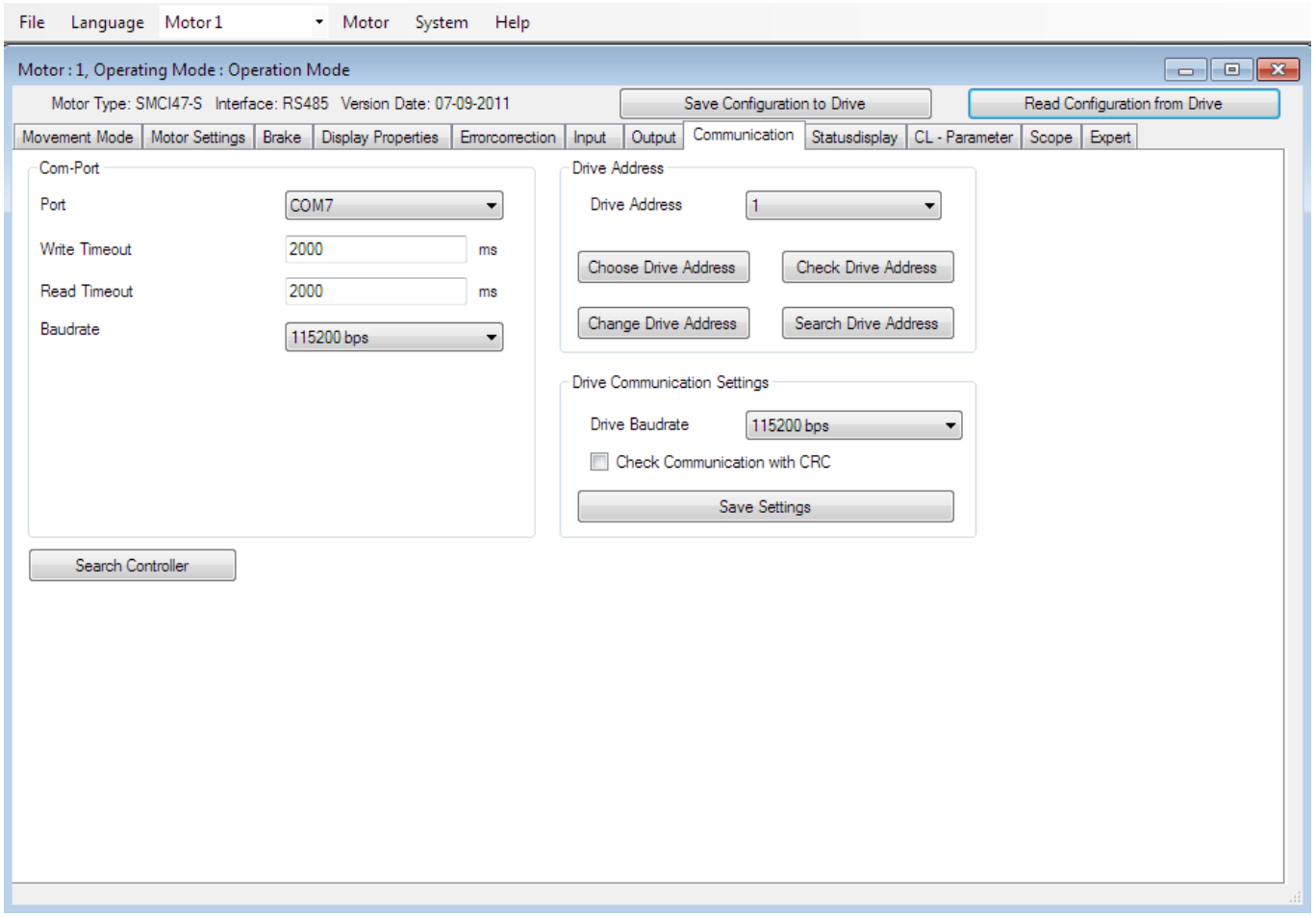
To update the firmware, click on “System” in the toolbar.

“Firmware change” -> “update to latest firmware” for the newest version.

You can also select a firmware, e.g. if you need to replace a damaged controller or switch to CANopen.

The firmware update will take about 1-2 minutes. An internet connection is not necessary.

Firmware update



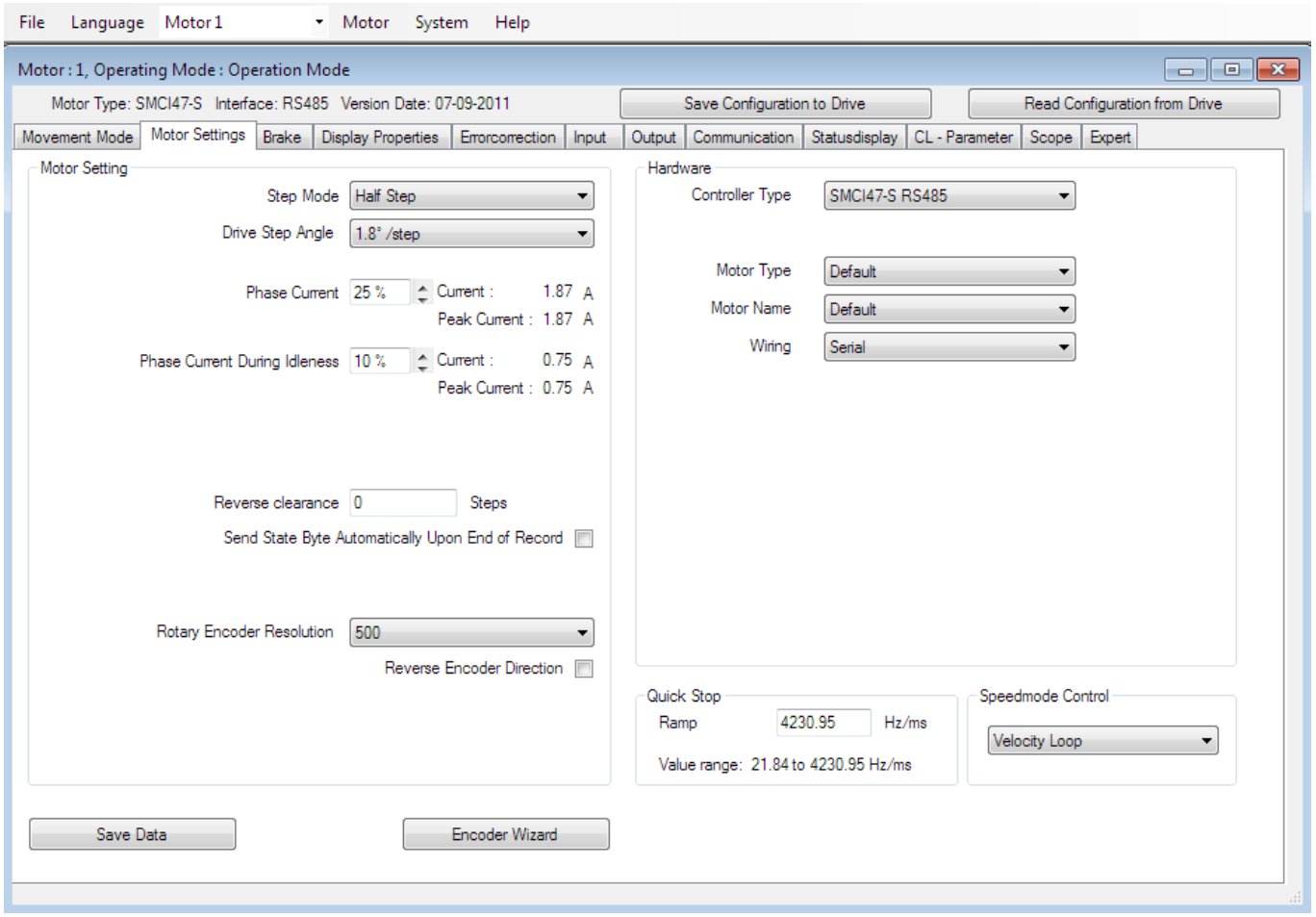
After the firmware update you will see a change in the "Version Date"

It is important that all devices of an application use the same firmware version!

Exercise:

Update the firmware of the controller in front of you.

Motor settings

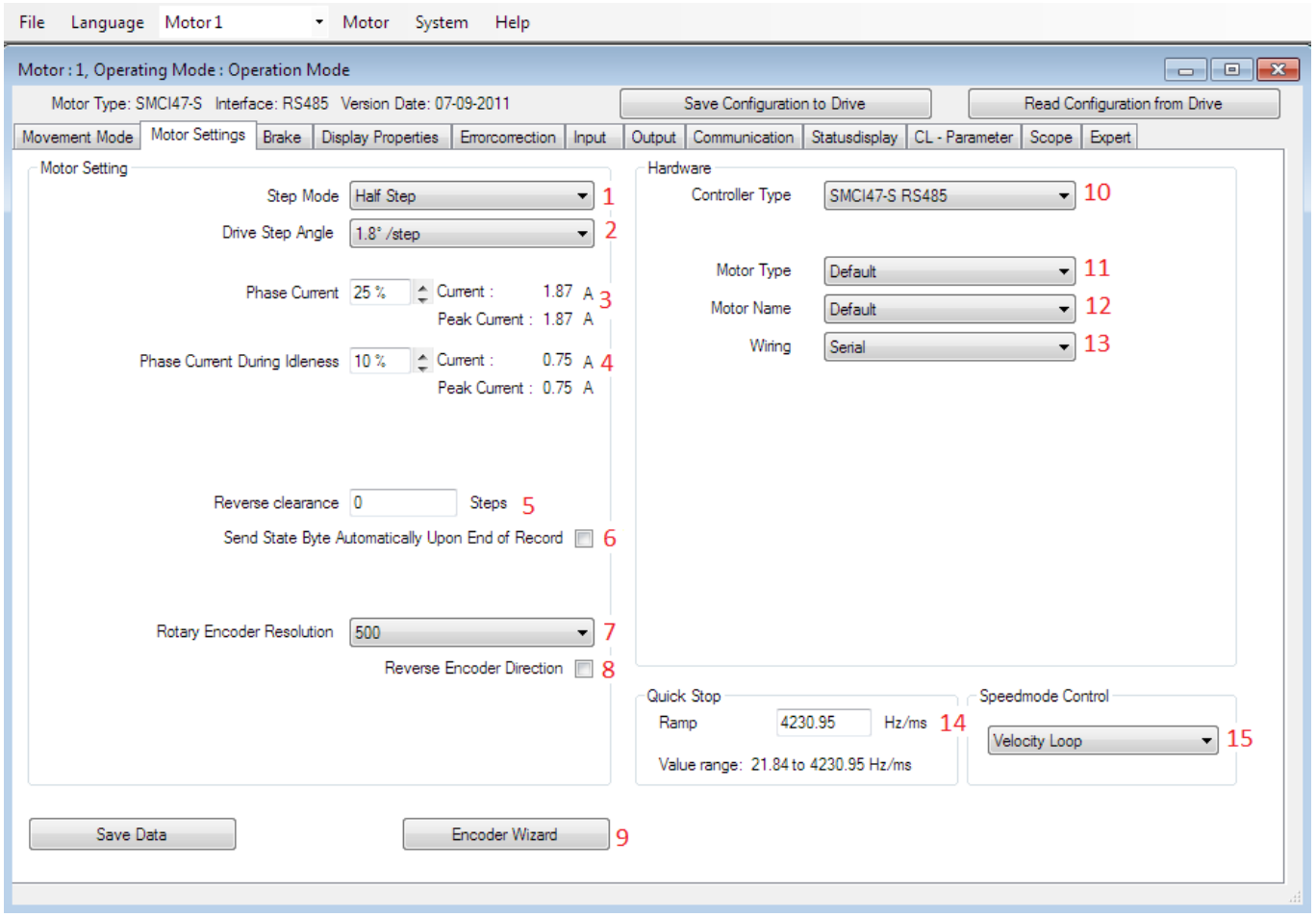


The Motor Settings tab contains the most important settings for the motor and encoder, e.g.:

- Step mode
- Current
- Encoder resolution

!! If you choose the wrong settings here, it might damage your motor and the controller !!

Motor settings



1. Step Mode: Changes the number of steps per revolution. (For the controller/input. For the motor, we always microstep!)

2. Drive Step Angle: Choose the physical step angle of your motor.

3. Phase Current: Sets the used current for driving the motor or the max. current in closed loop mode.

4. Phase Current During Idleness: Sets the used current if the motor is not moving (holding torque).

5. Reverse clearance: Can be used to compensate backlash when using a gear.

6. Send Status Byte Upon End of Record: If activated, the device sends status information at the end of a profile.

7. Rotary Encoder Resolution: Sets the resolution of the encoder in counts per revolution.

8. Reverse Encoder Direction: Changes the direction the encoder counts.

9. Encoder Wizard: Automatically detects the direction and resolution of an encoder by running one motor-turn.

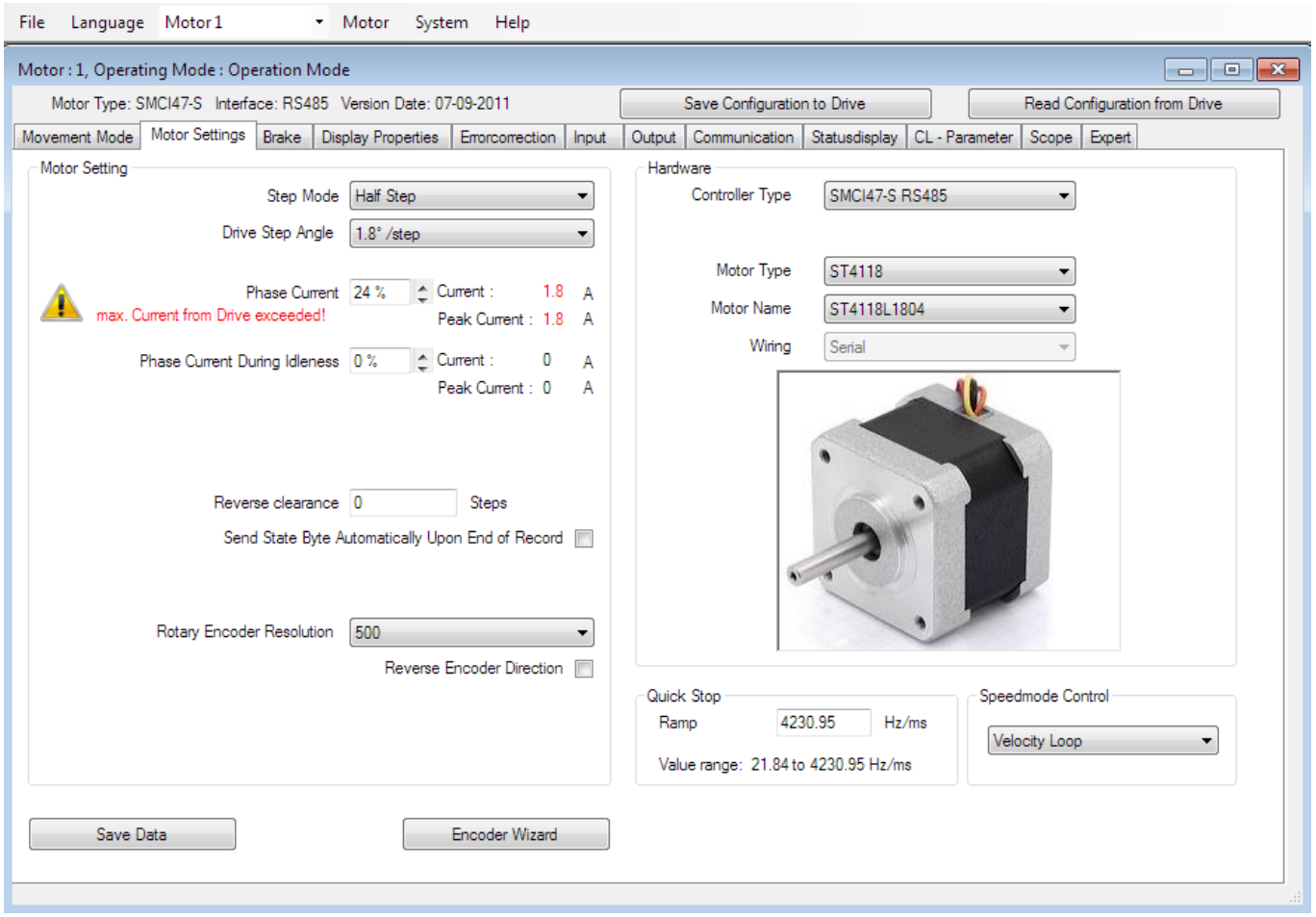
10. Controller Type: Shows the name and communication type of the connected device.

11-13. Hardware: You can select your motor type here for visual assistance.

14. Quick Stop: Sets the ramp for a quick stop.

15. Speedmode Control: Change between V- and P-Loop for Closed Loop (description at CL-Parameter)

Motor settings



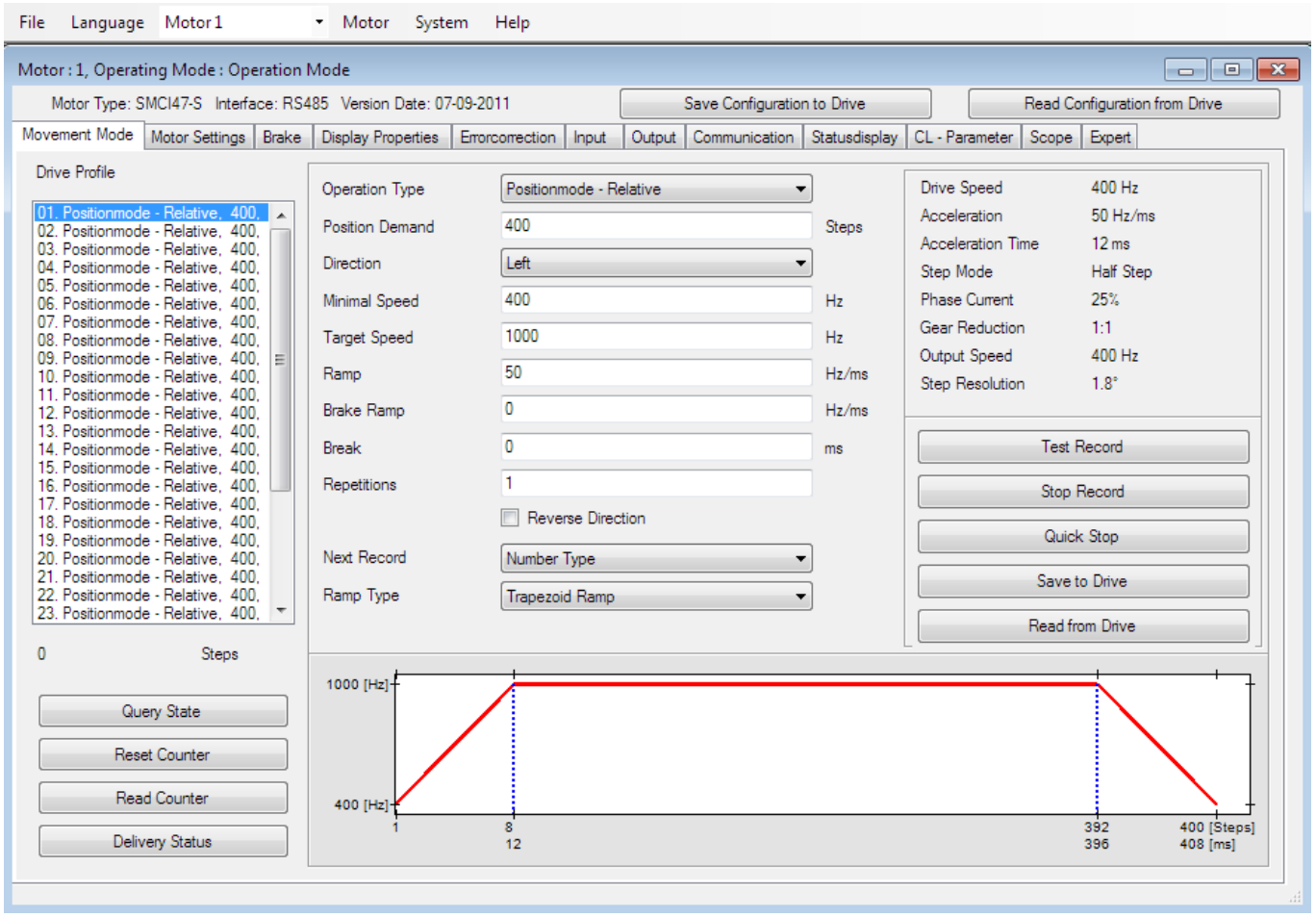
Selecting the correct motor settings:

- Get a datasheet of the motor
- Read out the step angle and make your setting
- Read out the current and make your setting
- Set the current during idle as low as possible
- Select your motor under hardware (only necessary for BLDCs)

Exercise:

Set up your motor and encoder.

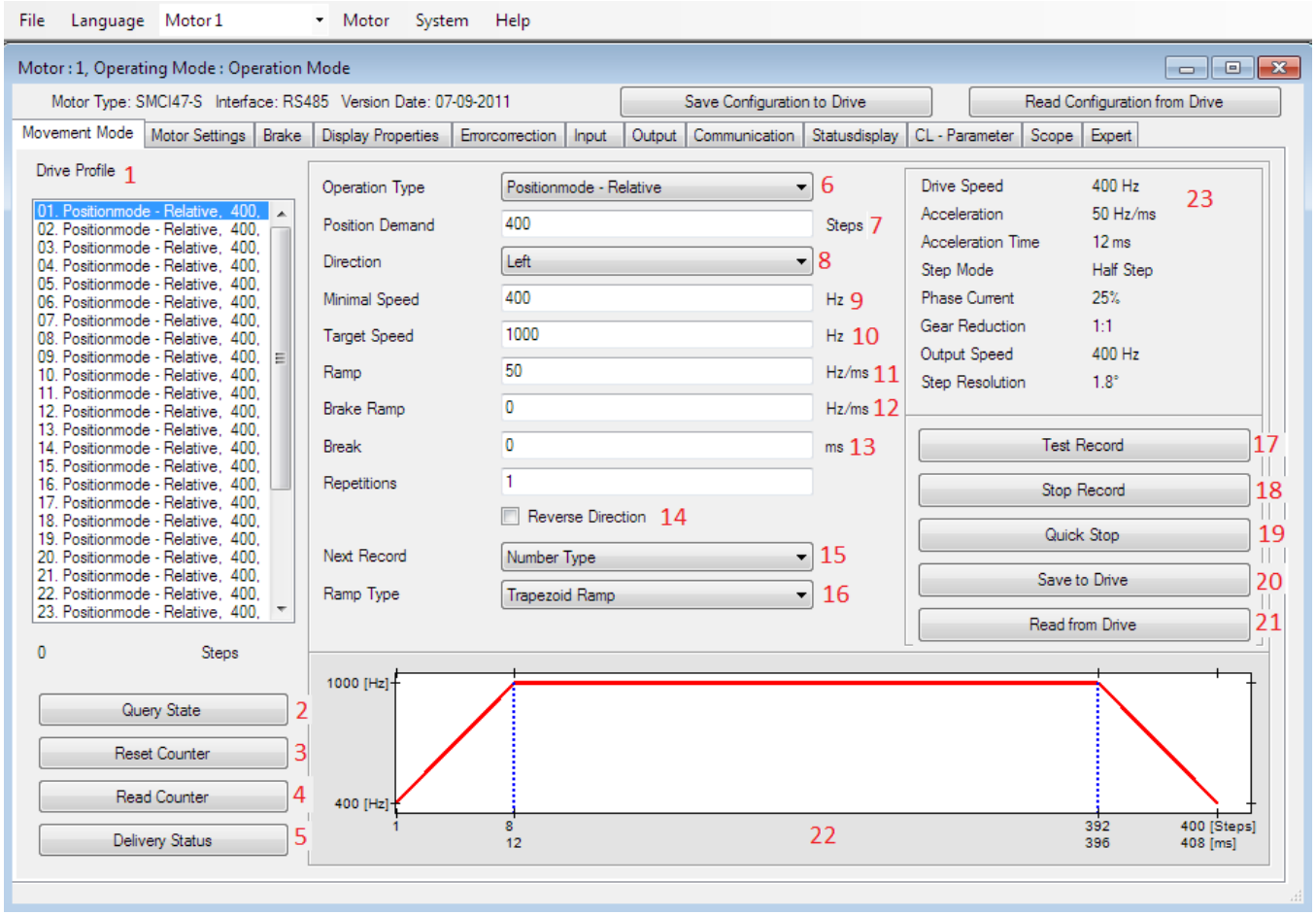
Step mode



The Movement Mode tab is the main tab of the NanoPro. It lets you

- Select the operation type
- Change driving conditions
- Create profiles
- Link profiles together
- Test our motor

Movement mode



1. Drive Profile: Select one of 32 profiles.

2. Query State: Get the status of the controller.

3. Reset Counter: Sets all positions to “0”.

4. Read Counter: Reads out the position.

5. Delivery Status: Set all parameter to its default The analogue input cannot be used by the controller in CANopen, but it is possible to read out the value on the input through a SDO.

6. Operation Type: Select your profile type.

7. Steps: Sets the target position if available.

8. Direction: Change between cw and ccw if available.

9. Minimal Speed: Starting speed of the motor.

10. Target Speed: Driving speed.

11. Ramp: Changes the acceleration of the motor.

12. Brake Ramp: Changes the deceleration of the motor.

13. Break: Time between two profiles.

14. Reverse Direction: Changes the direction after a profile.

15. Next Record: Defines the next record.

16. Ramp Type: Changes the ramp profile.

17. Test Record: Starts the selected profile

18. Stop Record: Stops the profile with the selected ramp.

19. Quick Stop: Stops the profile with the quick stop ramp.

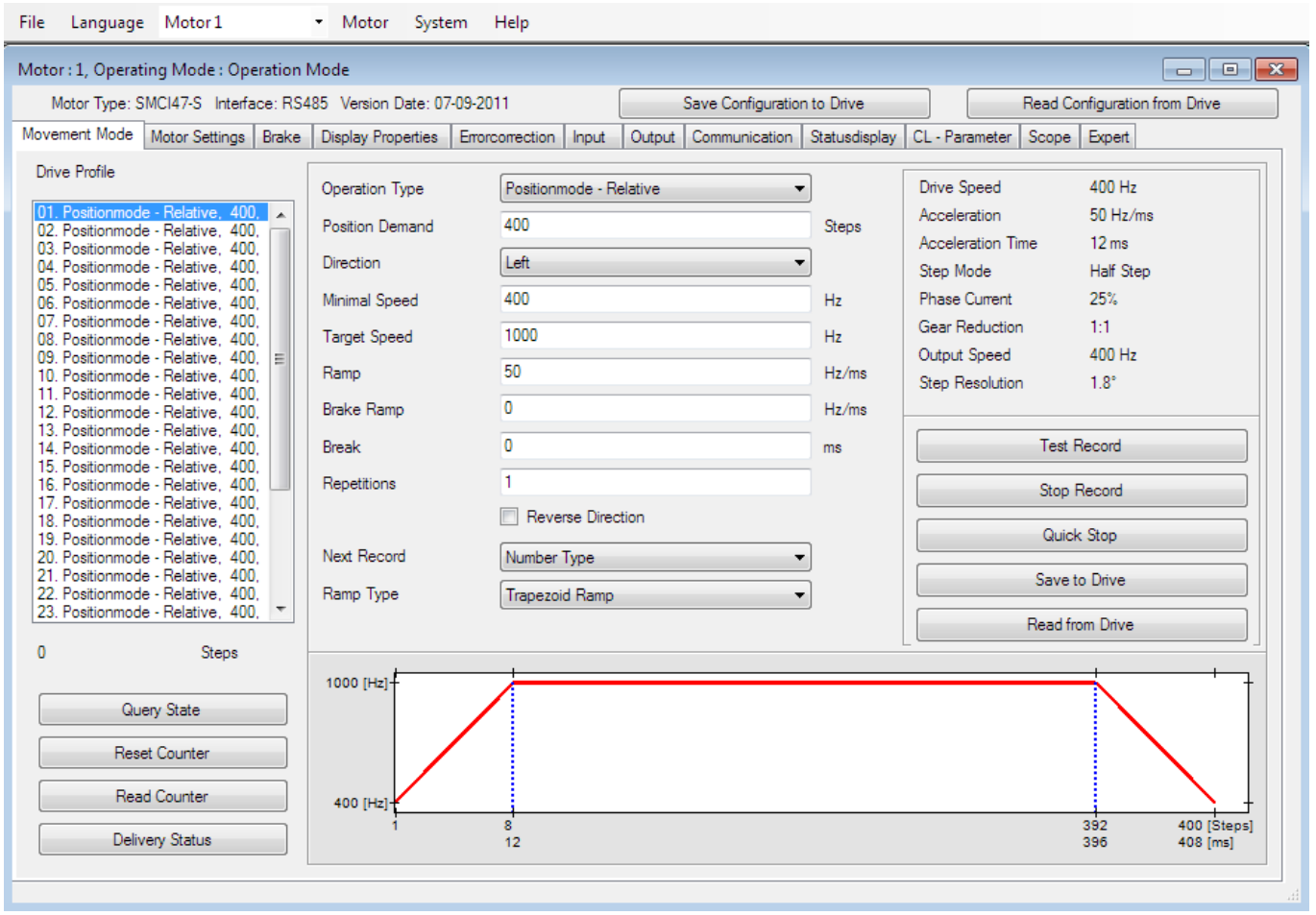
20. Save to Drive: Saves your profiles to the EEPROM

21. Read from Drive: Reads out the profiles from the EEPROM

22. Diagram: Shows the profile

23. Values: Shows the values of the movement

Position mode - relative



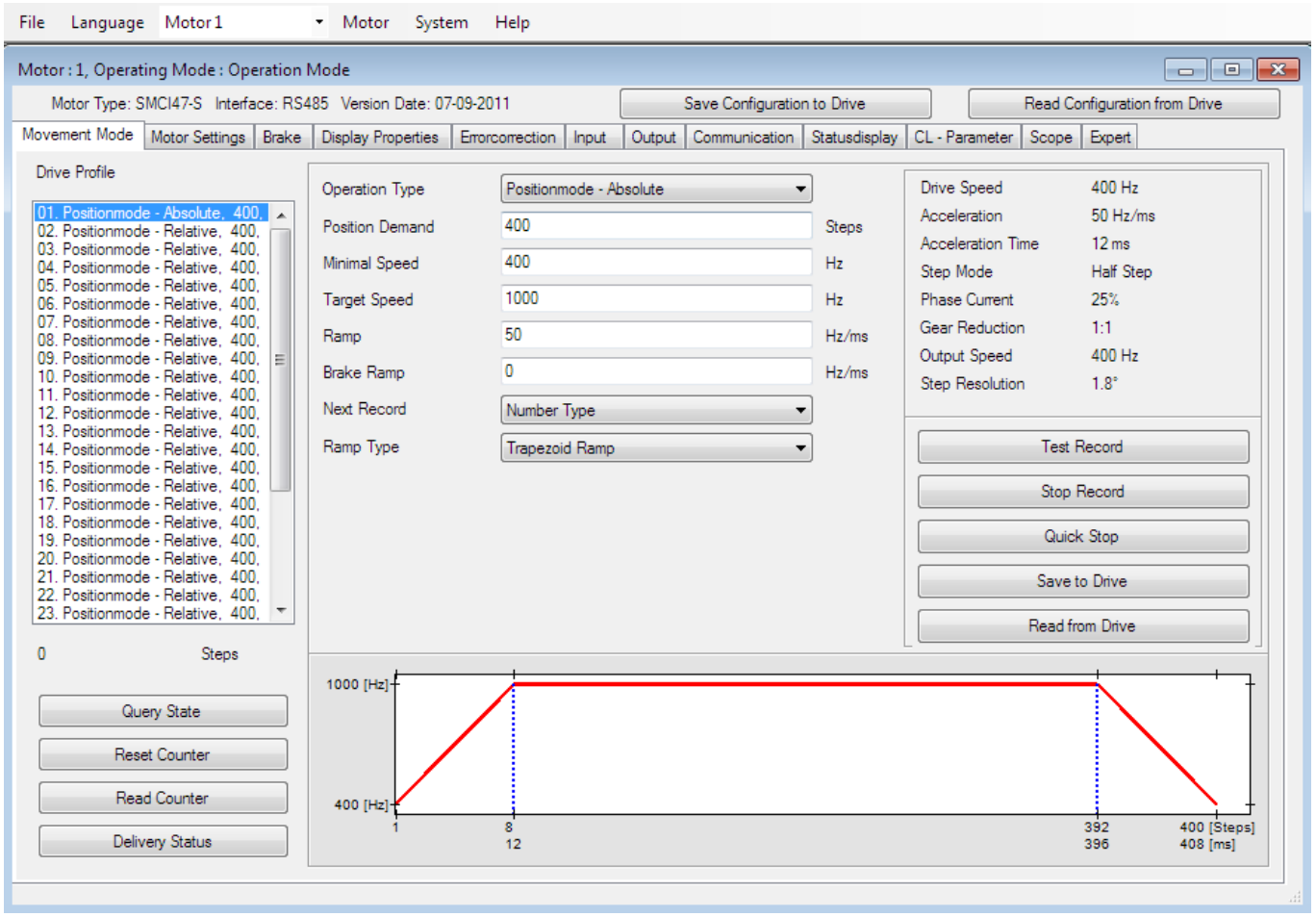
Your motor drives to a target position relative to the actual position with a defined speed and ramp.

Example:
Motor position is at 1000 steps.
Motor position is at 400 steps.
The motor will go to position 1400 by starting the profile.

Exercise:

Start your motor and try some changes in the profile setting of the position mode relative.
Read out the actual position by using the Read Counter button.

Position mode - absolute



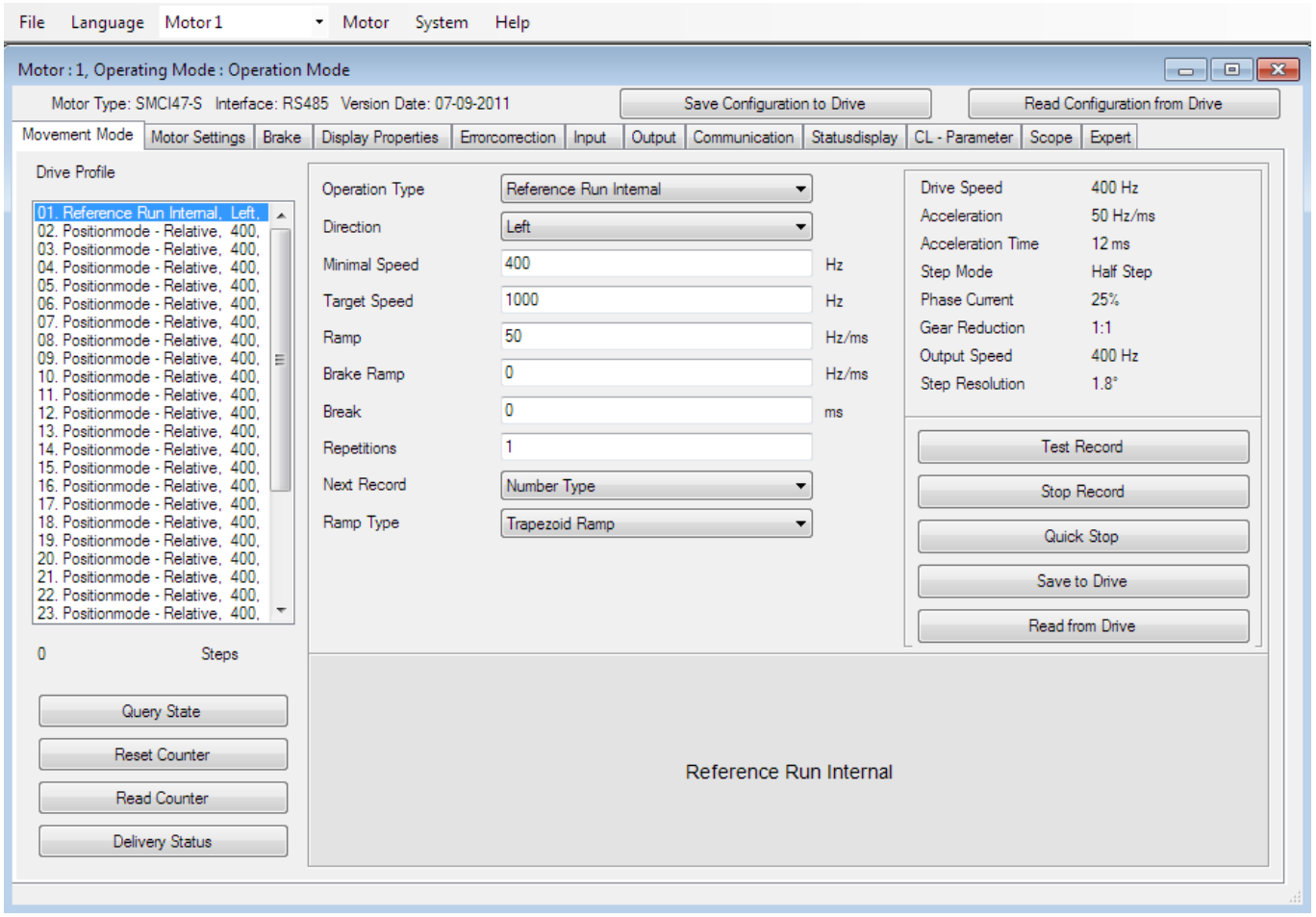
Your motor drives to a target position absolute to the actual position with a defined speed and ramp.

Example:
Motor position is at 1000 steps.
Target position is set to 400.
The motor will go to position 400 by starting the profile.

Exercise:

Play a bit with the motor to see the difference between the position mode relative and absolute.
Use the Reset Counter to set the actual position to zero.

Reference Run Internal



The Reference Run Internal can be used with an index-pulsed encoder.

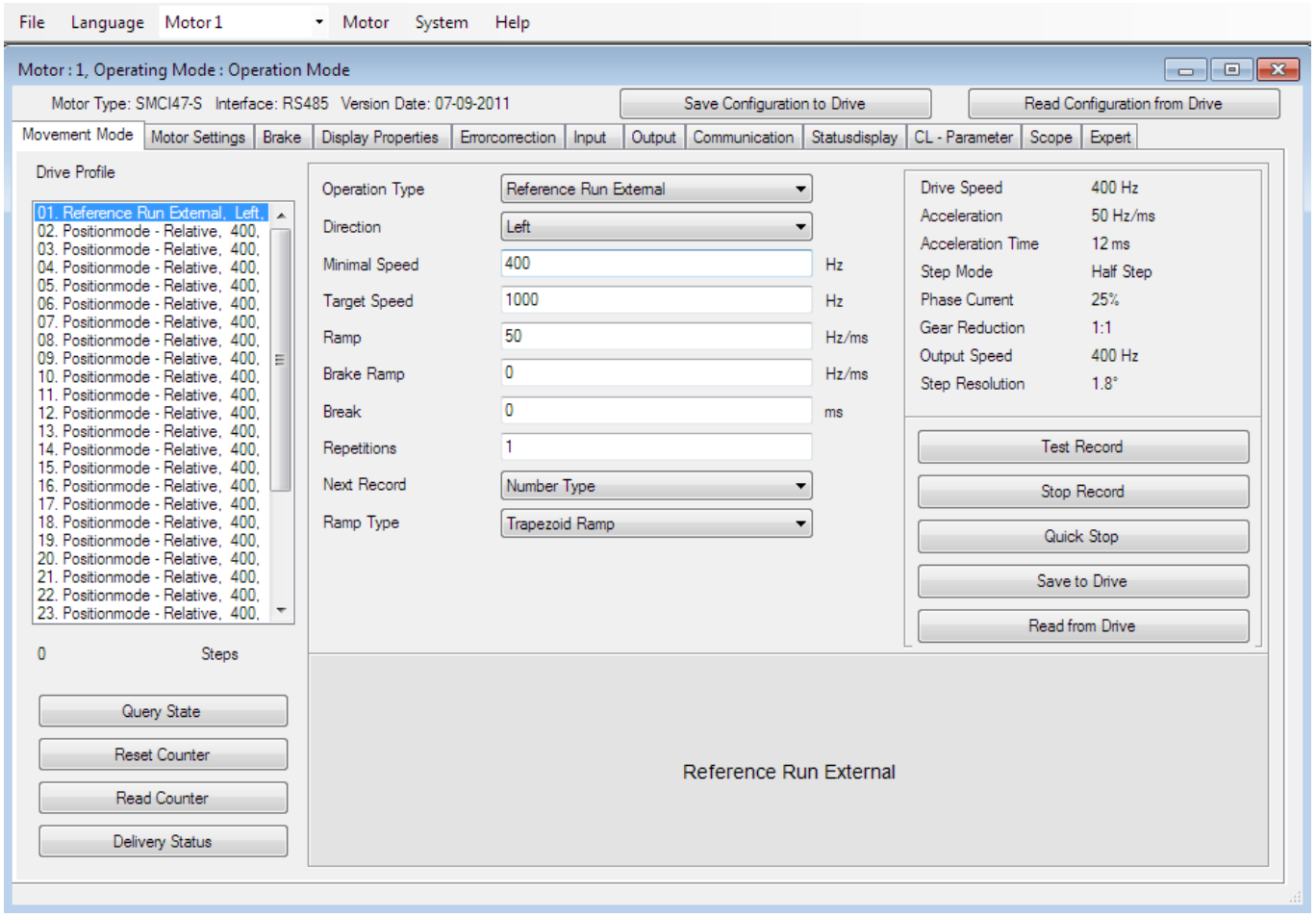
The motor will run cw or ccw until it reaches the signal of the encoder index, where it stops and sets the actual position to zero.

The Reference Run Internal turns once at a maximum.

Exercise:

Try the Reference Run Internal.

Reference Run External



If you have a sensor attached to your application, you can use it for a Reference Run External.

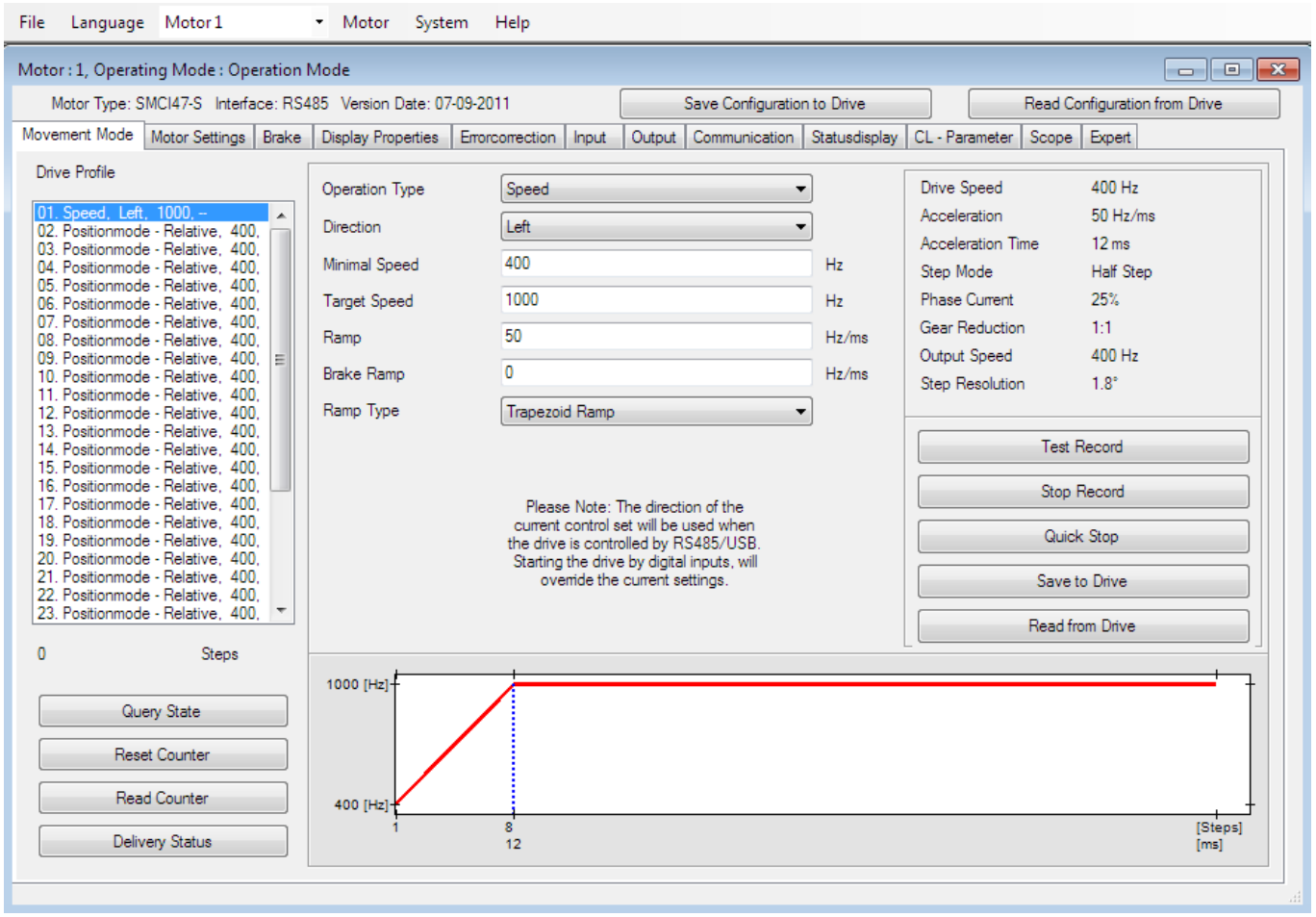
The motor will run cw or ccw until it reaches the signal of the sensor, where it stops and sets the actual position to zero.

Default input 6 is set as external reference switch.

Exercise:

Try the Reference Run External.

Speed mode



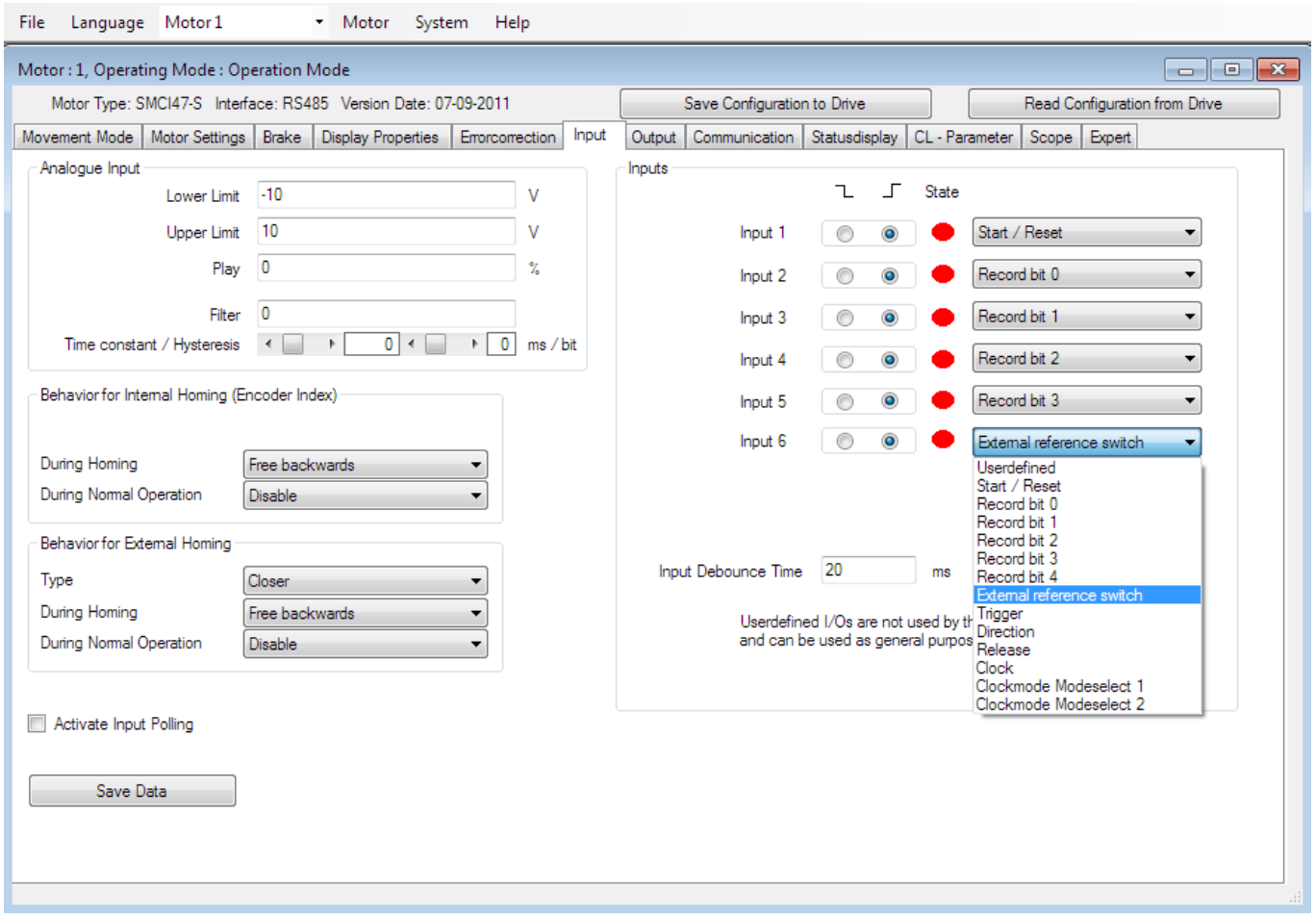
In speed mode, your motor will run non-stop until you stop it manually.

You can decrease and increase the speed by clicking on the buttons.

Exercise:

Try the speed mode.

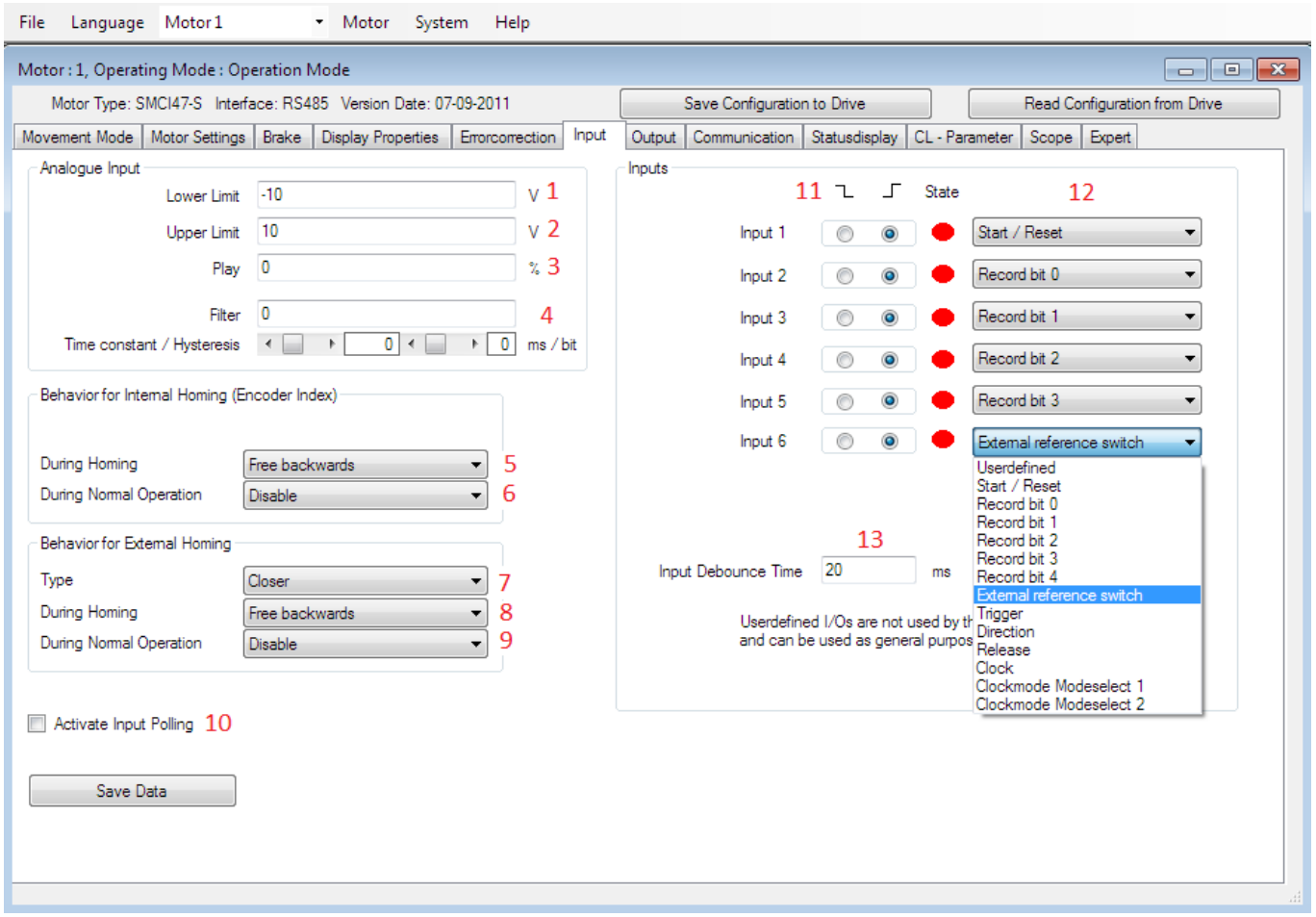
Input tab



The Input tab lets you

- change the functions of the inputs
- set the range for the analogue input
- tune the reaction of the analogue input
- set the behavior for limit switches
- see the state of the inputs in real-time.

Input tab



10. Activate Input Polling: Shows the status of the inputs in real-time.

11. Polarity: Changes the polarity of the inputs.

12. Function: Choose between input functions.

13. Input Debounce Time: Defines the time between two signals.

Analogue Input:

1. Lower Limit: Sets lower range for the analogue input.

2. Lower Limit: Sets lower range for the analogue input.

3. Play: Defines the backlash at both ends of the analogue input.

4. Filter: Sets the sensitivity of the analogue input. (Very important for analogue position)

Behavior for Internal Homing:

5. During Homing: Defines the reaction for reaching the index during a reference run internal.

6. During Normal Operation: Defines the reaction for reaching the index during a position run.

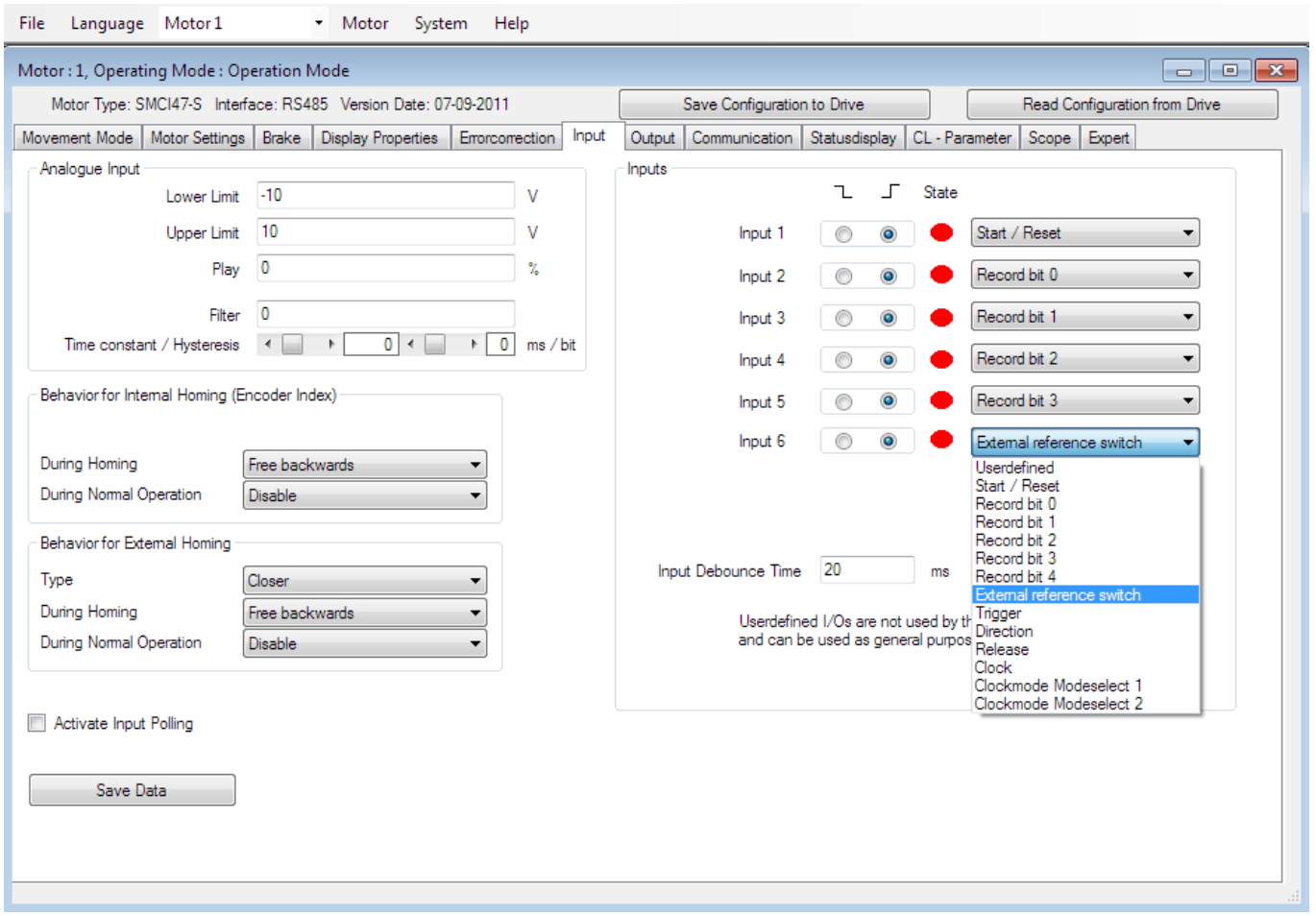
Behavior for External Homing:

7. Type: Sets the polarity of the used signals.

8. During Homing: Defines the reaction for reaching the signal when running a reference run external.

9. During Normal Operation: Defines the reaction for reaching the signal during a position run.

Input tab



Input-Functions:

1. User defined: Choose this if the input is unused or should not be used by the firmware.

2. Start/Reset: Starts a profile and resets position errors (at position profiles). Starts and stops a profile with a rising/falling edge (at speed modes).

3. Record bit 0-4: Load a record from the EEPROM using a bit mask, and start it with the start/reset function.

Bit 0	Bit 1	Bit 2	Profile
0	0	0	1
1	0	0	2
0	1	0	3
1	1	0	4
0	0	1	5
1	0	1	6
...	...	...	...

4. External reference switch: Limit switch and for reference run external.

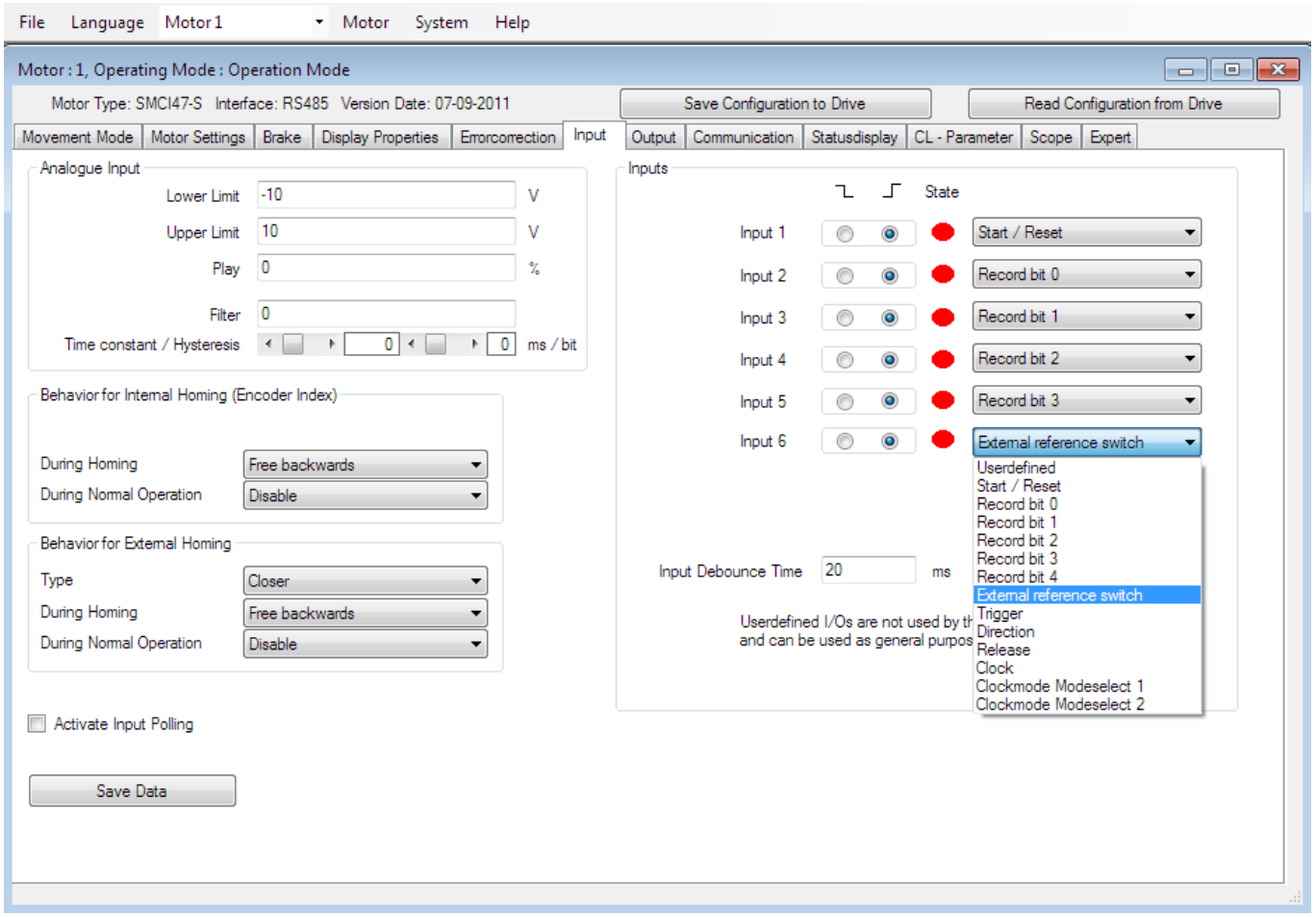
5. Trigger: For flag position mode.

6. Direction: For speed, analogue and clock direction mode.

7. Release: Enable function for the motor.

8. Clock: Clock input for clock direction (only available at input 6).

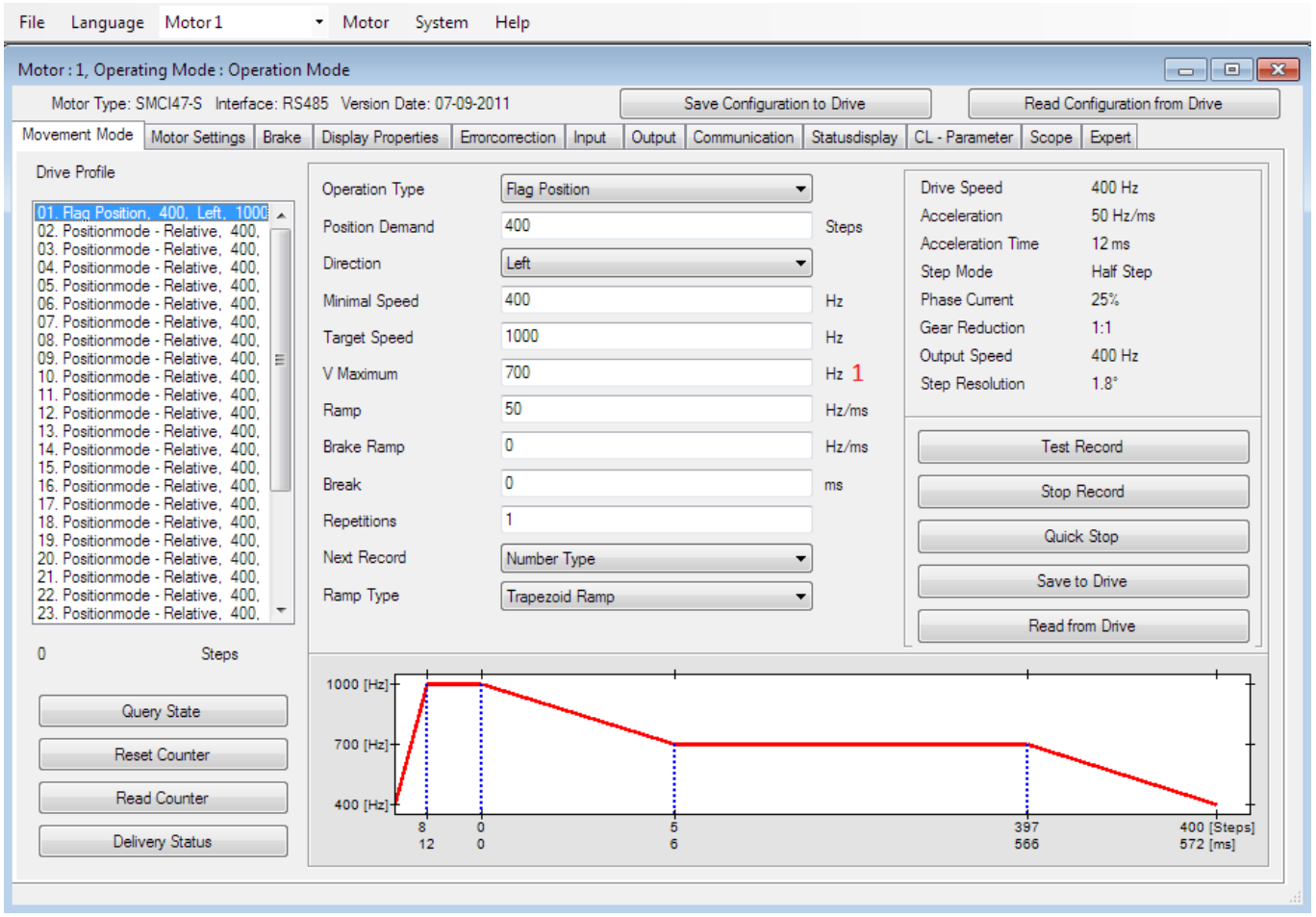
Input tab



Exercise:

- Change the function of the inputs and try out.
- Configure profiles 1-6 with different speeds and try to change between them with the record bit 0-4 function.
- Test start/reset for position and speed mode to see the difference.

Flag Position



1. V Maximum: This is the speed you will use for the positioning.

The flag position is a combination of speed mode and relative positioning.

The motor will turn in speed mode until it reaches a trigger - signal. From this point on, it will move the set number of steps and stop there.

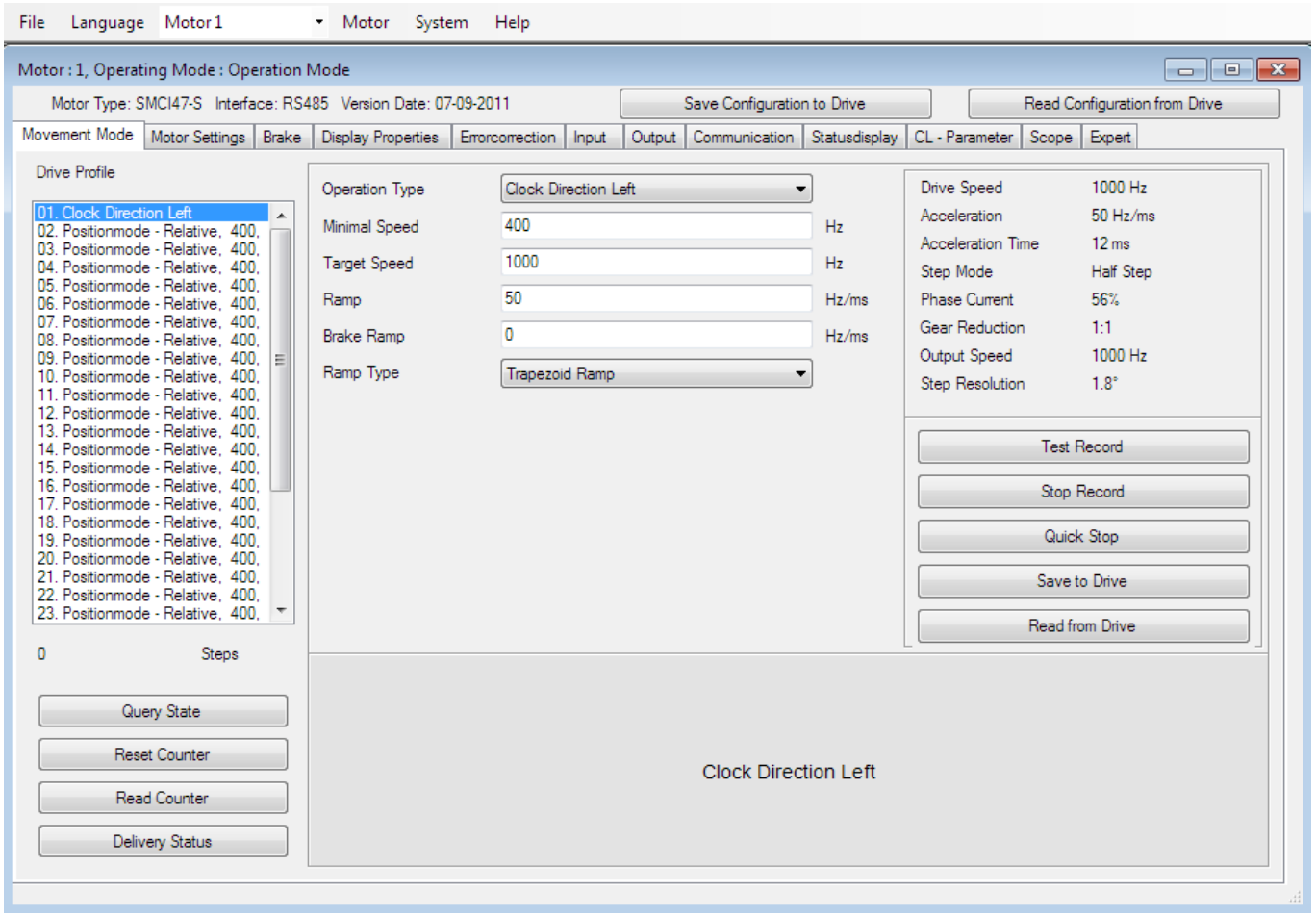
You can use different speeds before and after reaching the trigger.

This is a typical mode for label printers, for example (wind labels until you see a certain mark (trigger), then wind a defined distance to reach the right printing position)

Exercise:

Try the flag position mode.

Clock direction left/right



If you are using a PLC, which should control the movement of your motor with TTL signals, you can use the clock direction mode.

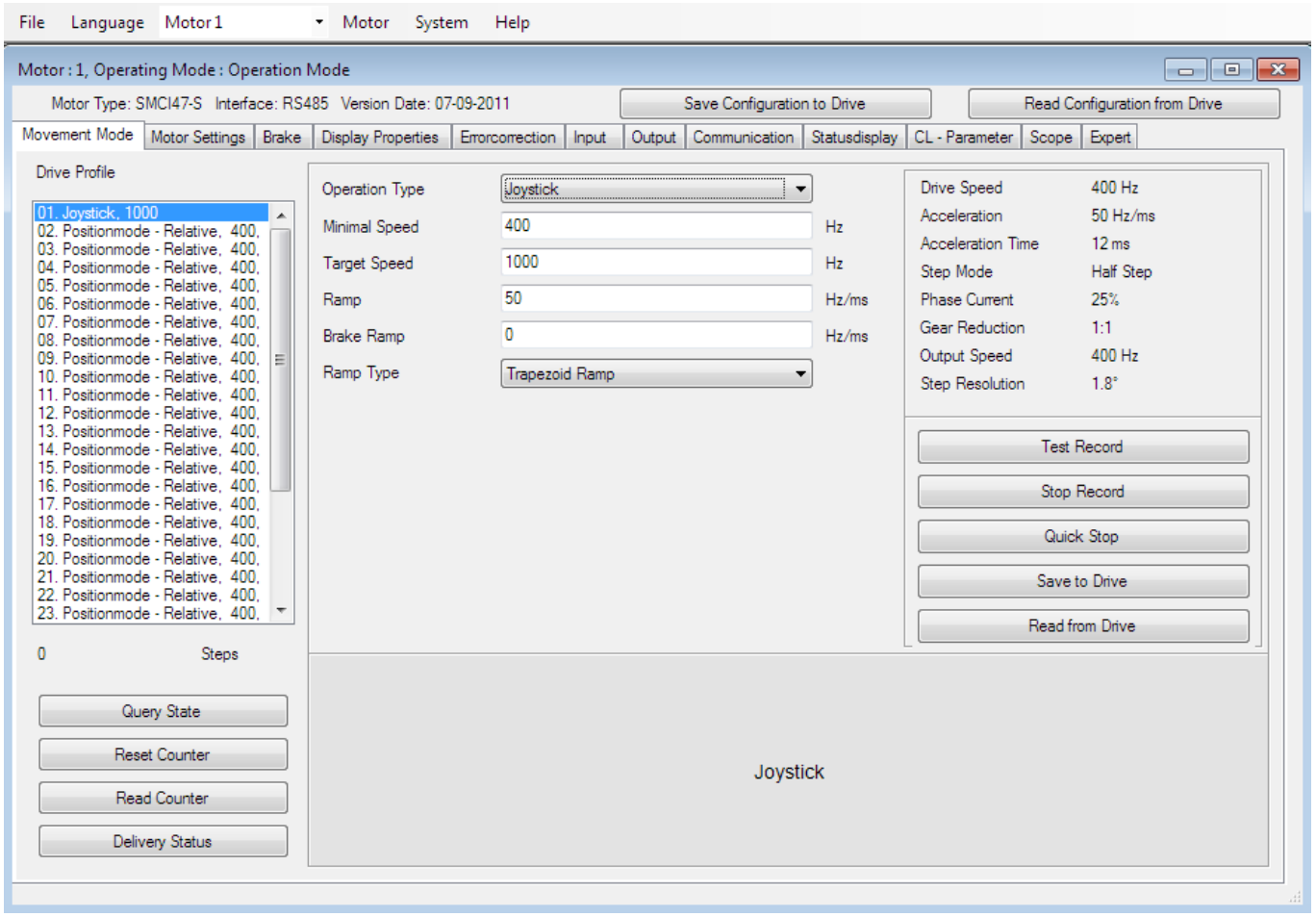
For each signal on the clock input, the motor moves one step.

You can choose between left and right.

You can also use an input signal to change the direction.

Please try this at home with a function generator.

Joystick



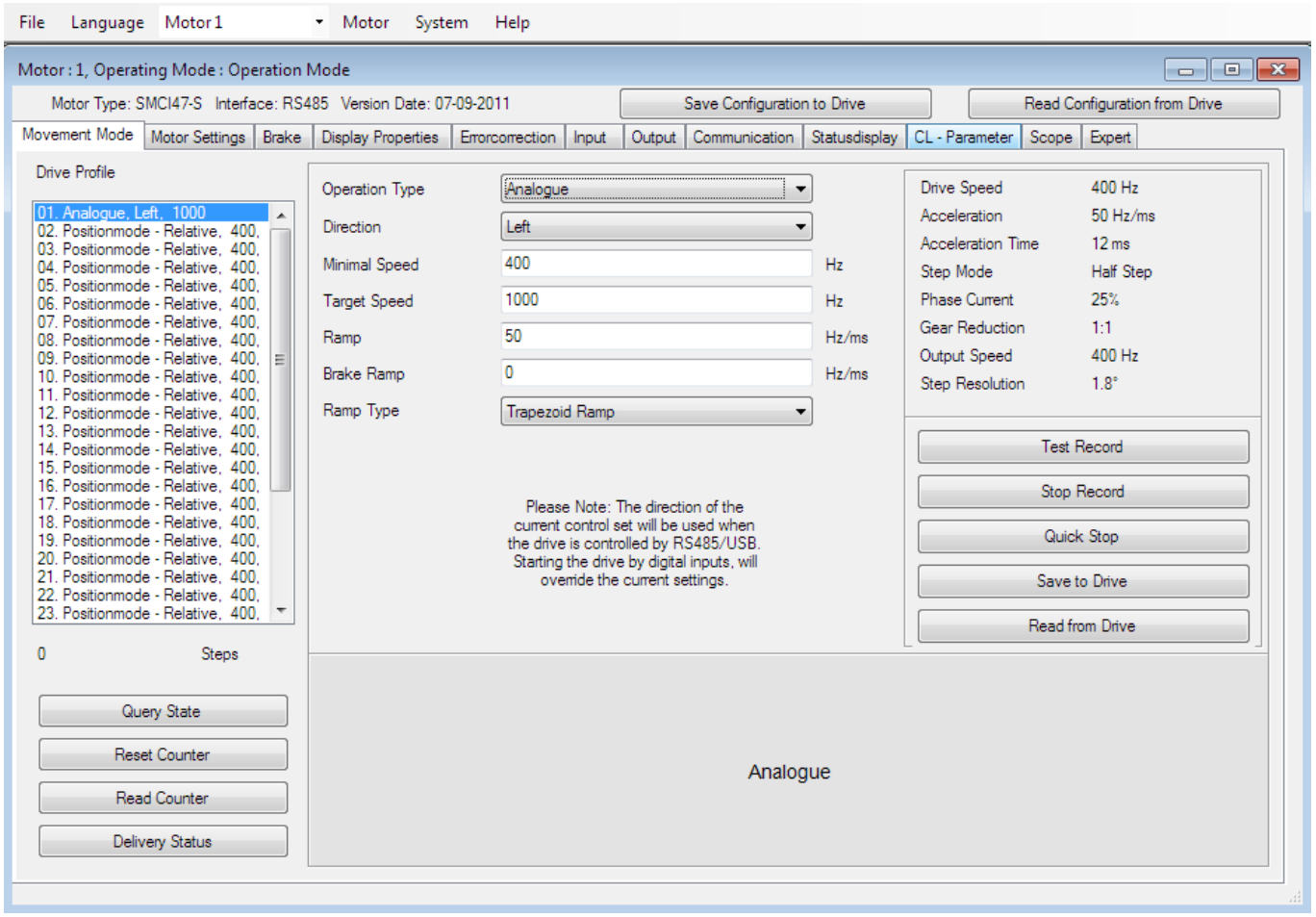
The joystick mode allows you to control the speed and direction with an analogue input signal.
(potentiometer or joystick)

The analogue input uses -10 to +10V, where -10V means target speed left, +10V means target speed right and 0V means stop.

Exercise:

Try the joystick mode using the potentiometer on your board to control speed and direction.

Analogue mode



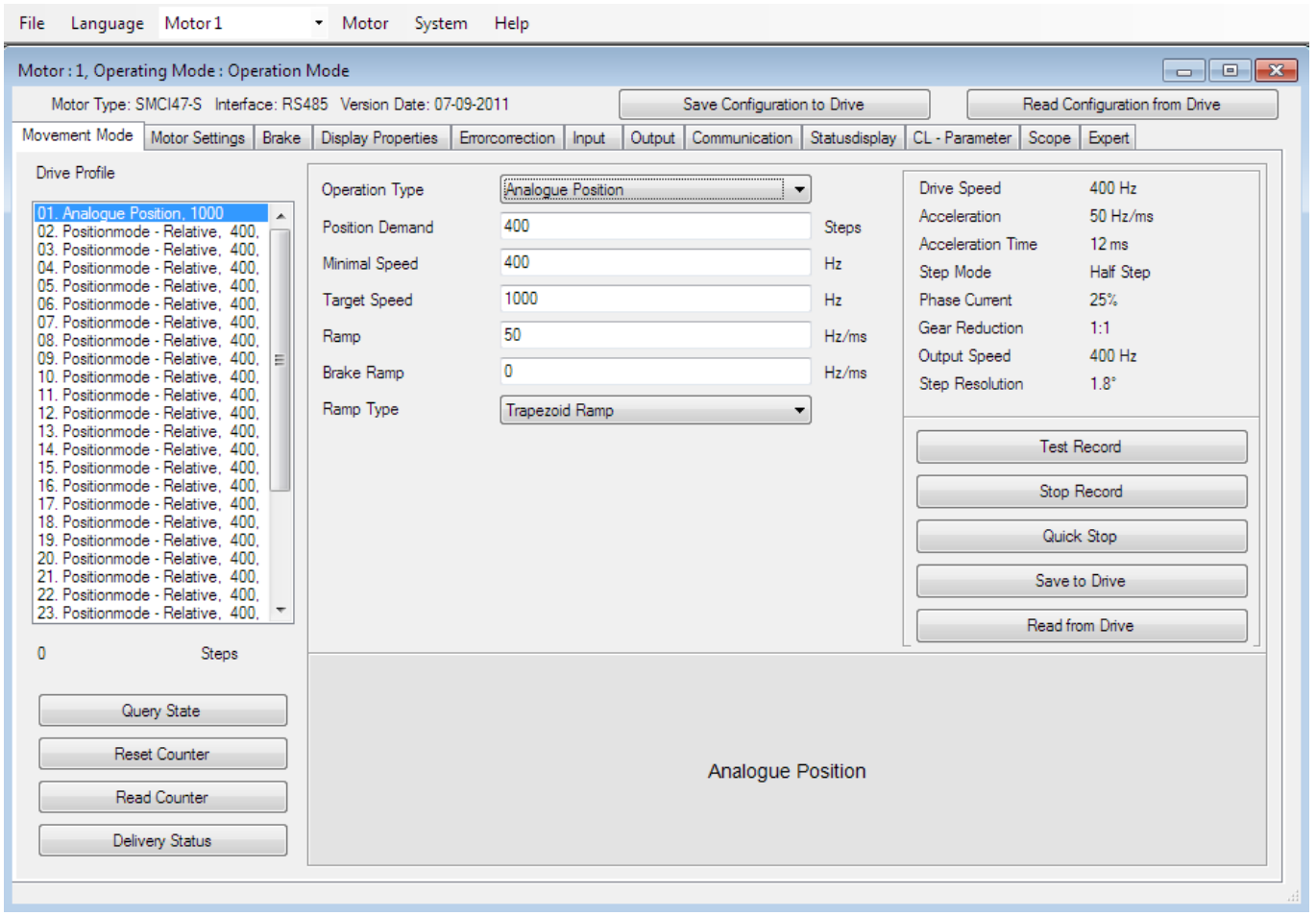
The analogue mode works the same as the joystick mode, but only in one direction. This gives you the possibility to use a higher range at the analogue input.

-10V to +10V are used only for one direction, -10V means stop, 0V means half target speed and +10V is target speed.

Exercise:

Try out the analogue mode to see how it differs from the joystick mode.

Analogue Position



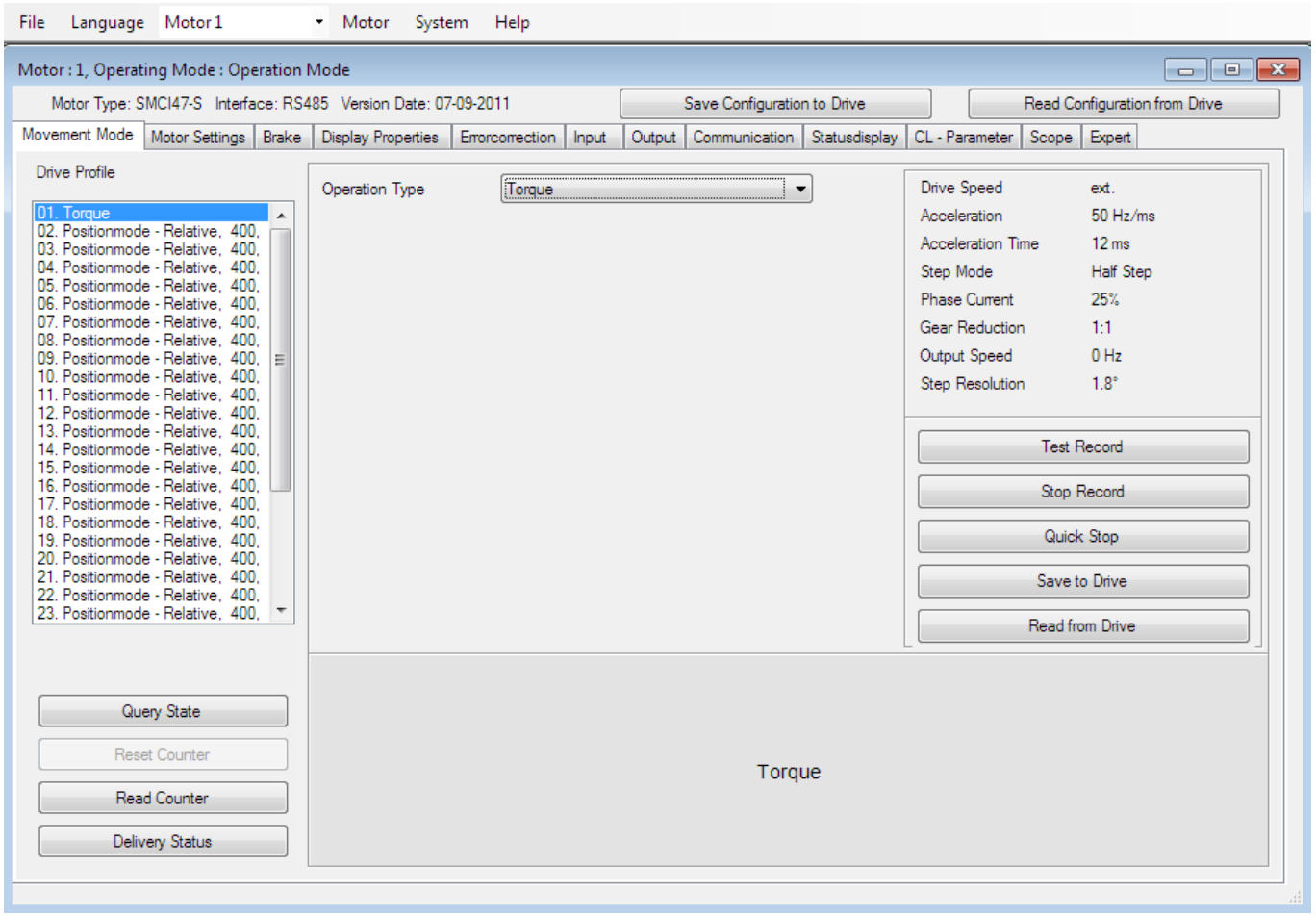
The analogue position mode works like the position mode absolute. However, instead of setting a fixed target position, the
analogue input is used.

Example:
If you use 400 as the position demand, the motor goes to position 400 at +10V, to 200 at 0V and to 0 at -10V.

Exercise:

Try the analogue position mode using one value below and one value far above 1000 steps.

Torque mode



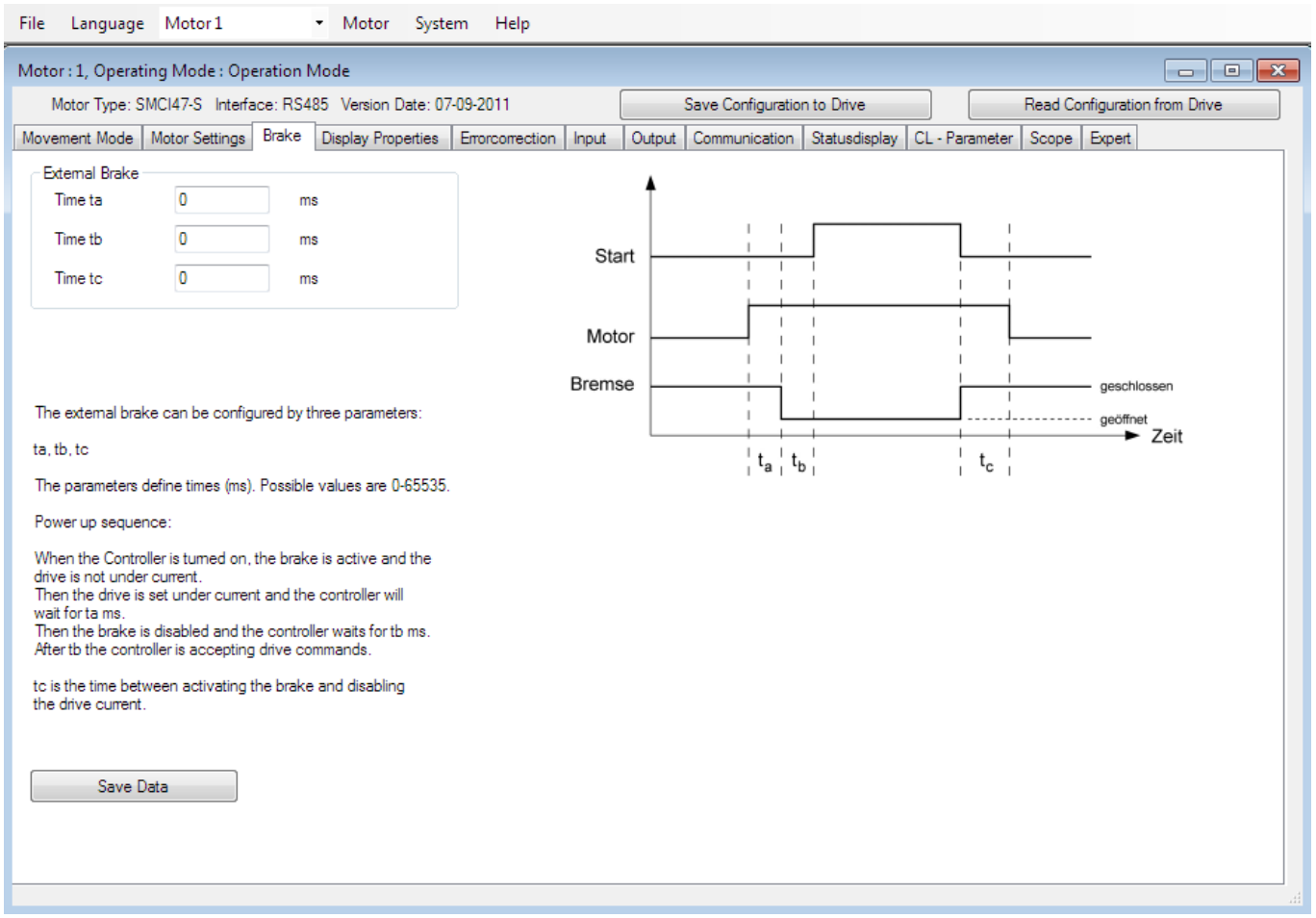
The torque mode supplies the motor with constant power.

Motor "cracks" during the run. By increasing the torque, the motor will lower its speed.

The maximum torque is controlled by the analogue input.

You need to be in closed loop mode to run the torque mode, so we will try this later.

Brake tab

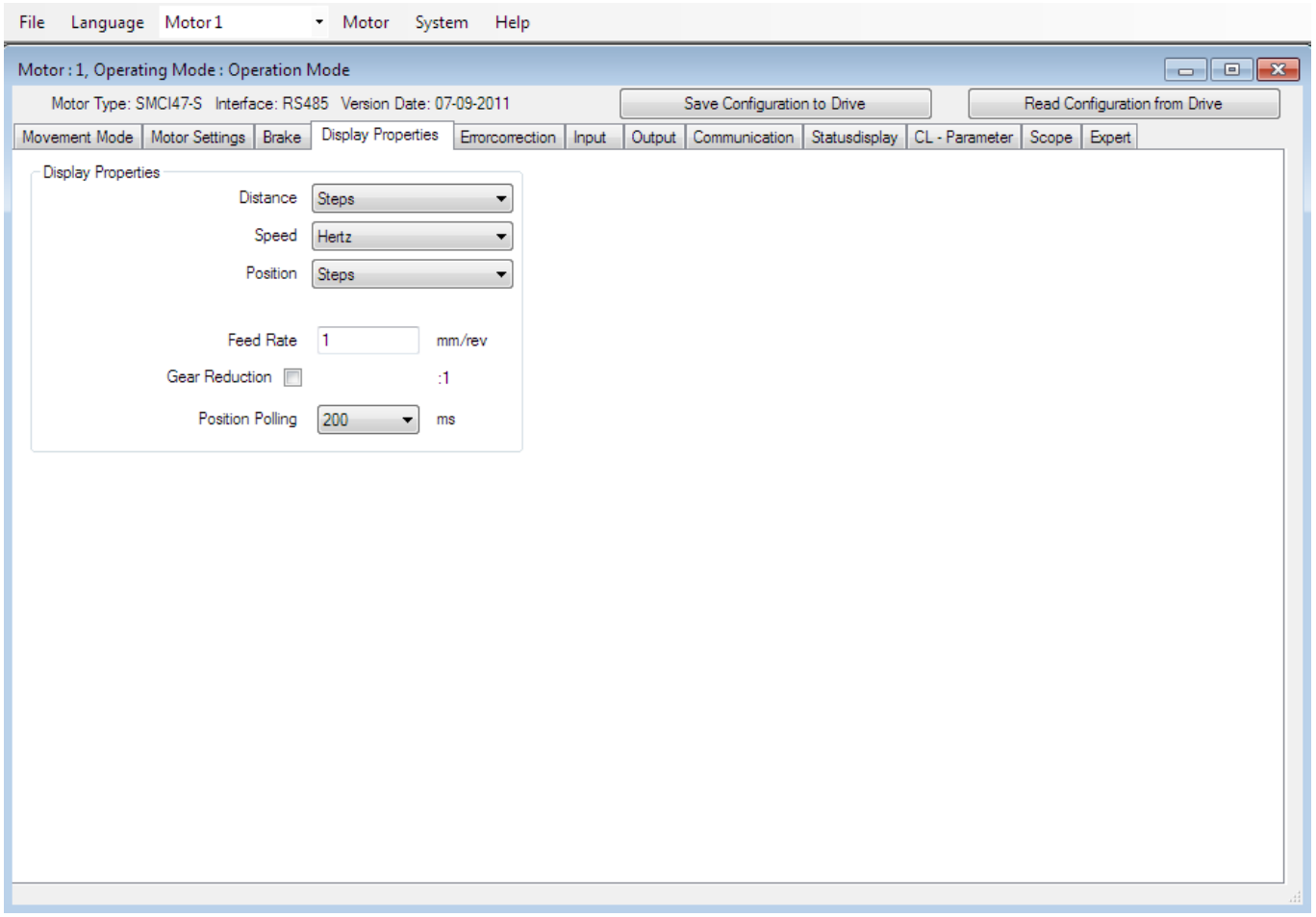


The Brake tab is solely for the SMCI47-S to change the behavior of the brake output.

The release input function opens and closes the brake in this case.

You can change the time between powering on/off the motor and opening/closing the brake.

Display properties



Display properties are for

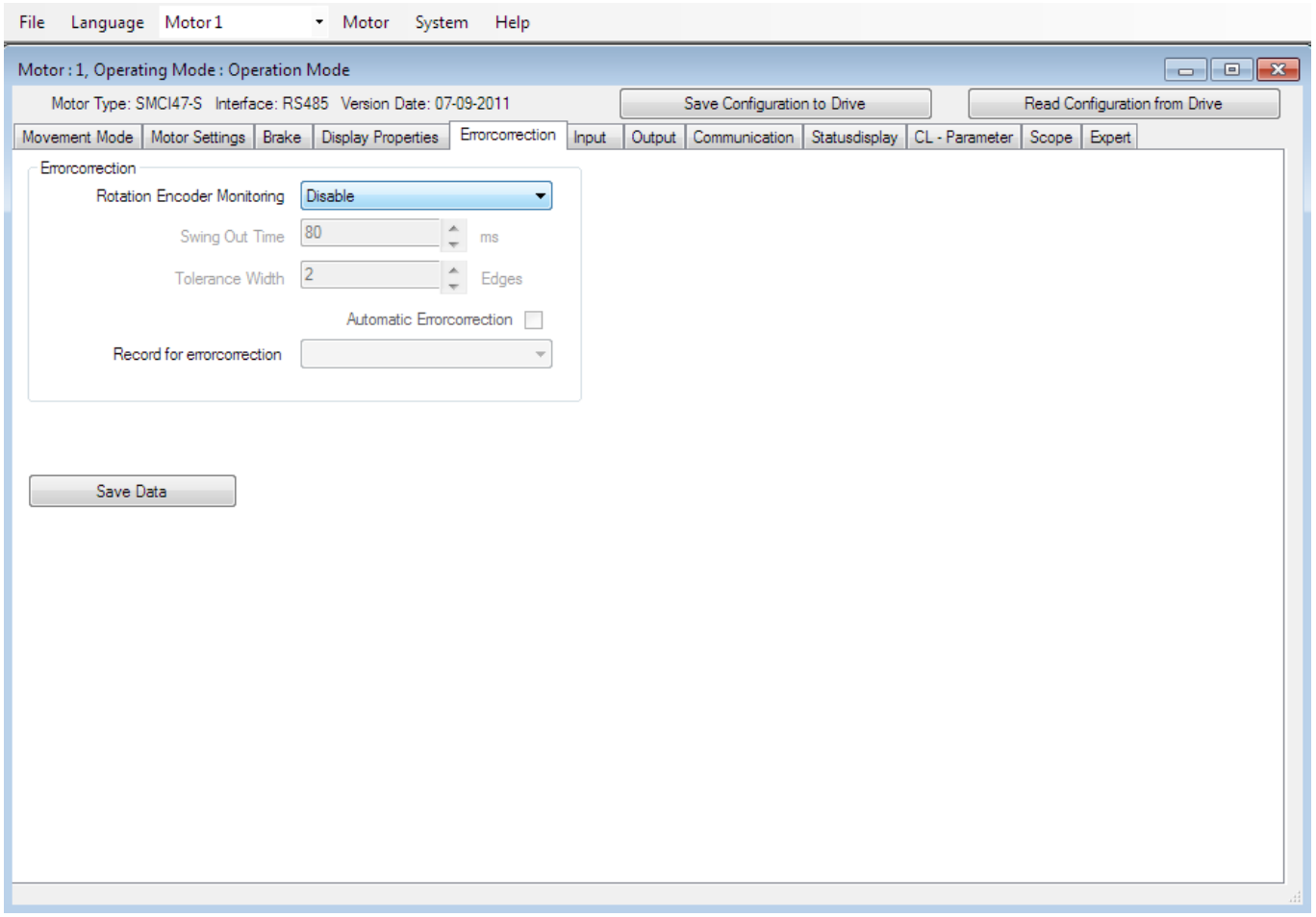
- changing units of some values in NanoPro
- working with a gear ratio
- setting a feed rate

only in NanoPro, not on the controller

Exercise:

Test different unit settings, the feed rate and the gear reduction

Error correction



Error correction has to be activated for position surveillance or even to automatically correct a position error.

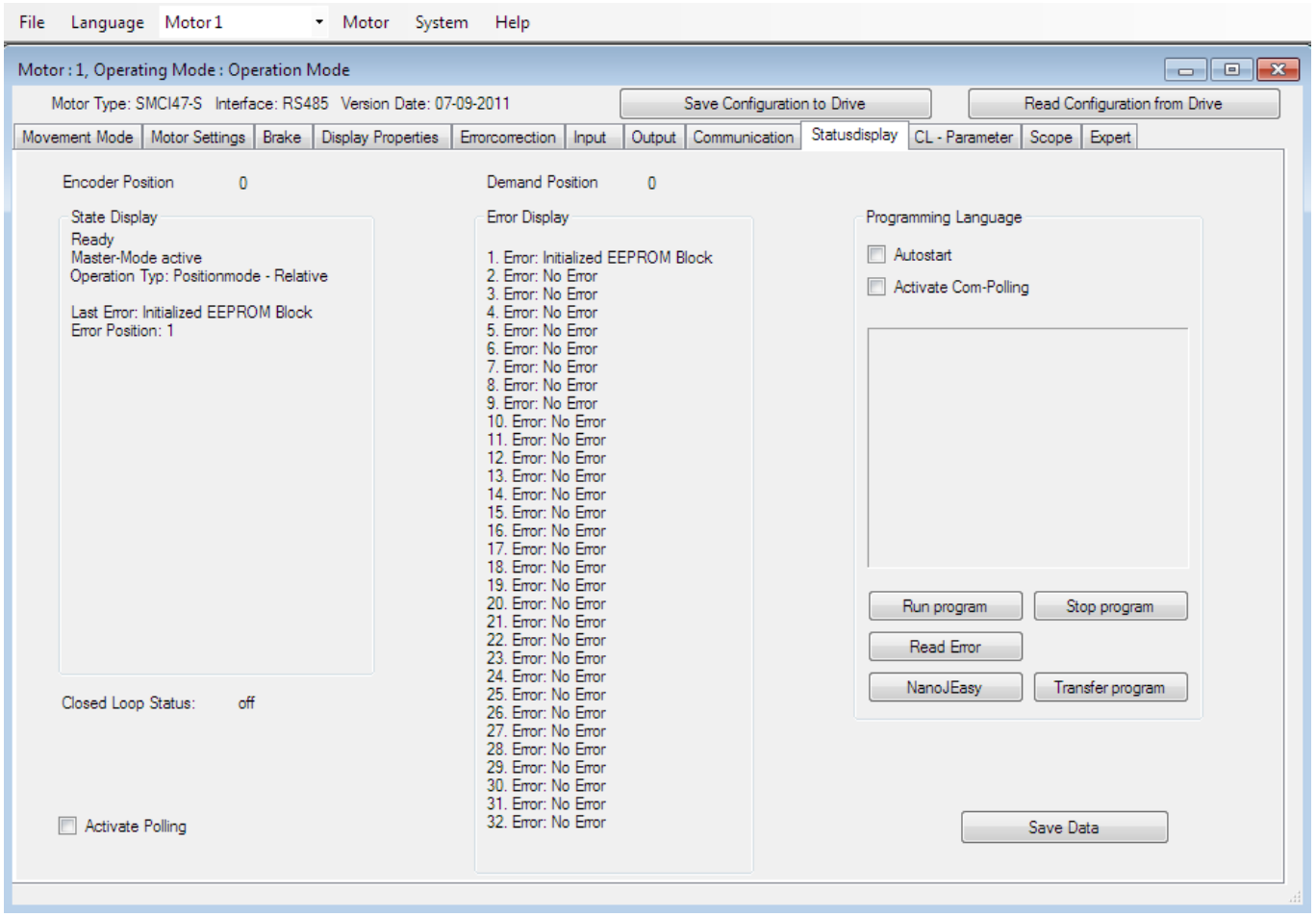
In this case an allowed tolerance, a swing out time and a profile (only speed and acceleration are used from this profile) have to be chosen.

If some steps are lost at a position profile, the controller checks if the demand and target position are equal at the end of travel. If not, it starts a second travel to retrieve the lost steps.

(only possible with an encoder)

This is the “simple” closed loop, no FOC, only position correction. Never activate this together with Closed Loop.

Status display

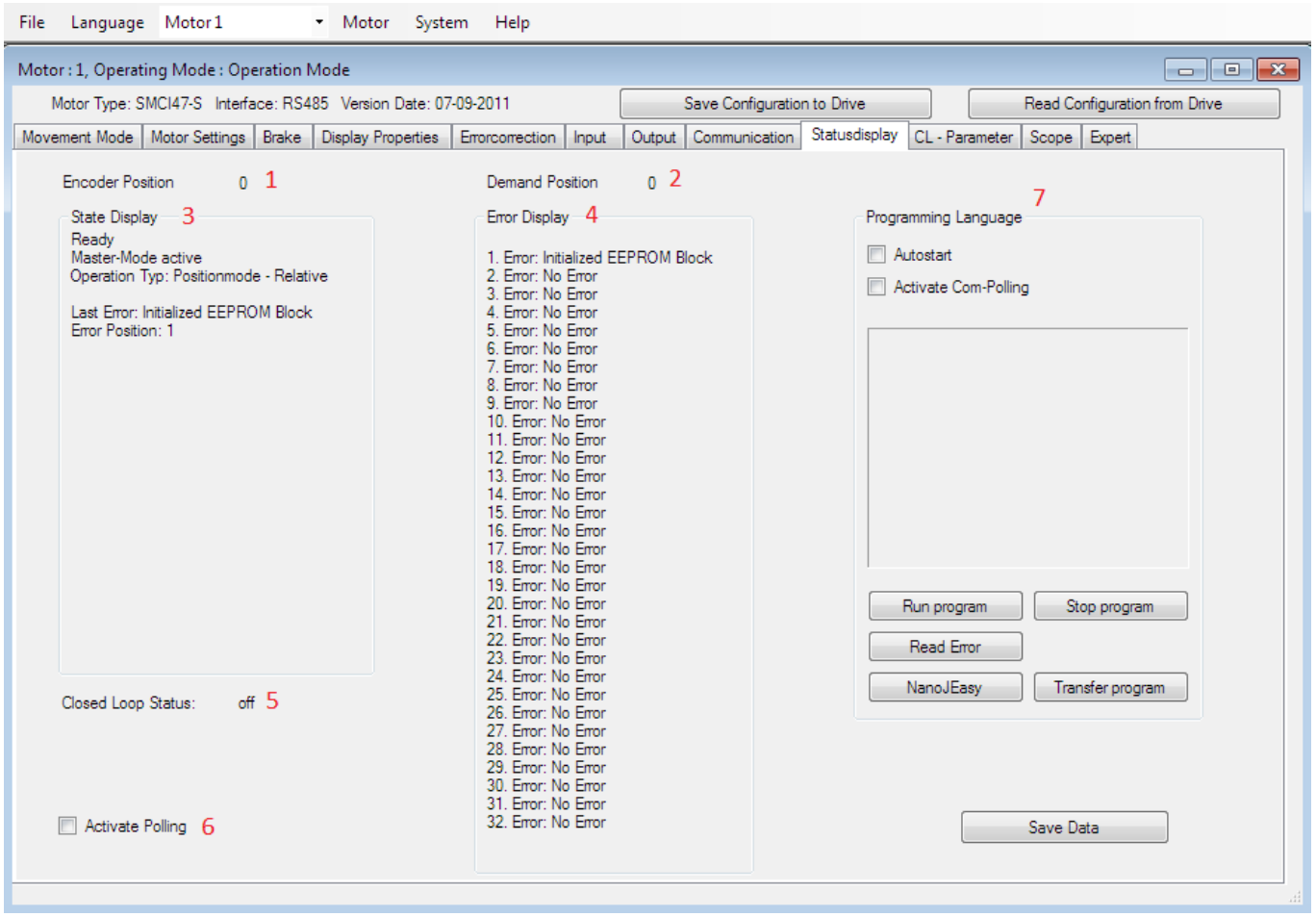


The Status display is used especially for troubleshooting.

On the left side, it shows the controller status and allows you to read out the encoder and demand positions, in case there is an active error and the error history.

By uploading a Java program to the controller, special functions that go beyond the firmware functionality are displayed on the right side of the tab.

Status display



1. Encoder Position: Displays the actual position.

2. Demand Position: Displays the position the motor is supposed to be in.

3. State Display: Shows
- the driving state of the motor (ready, busy, at reference)
- the selected operating mode
- the last reported error.

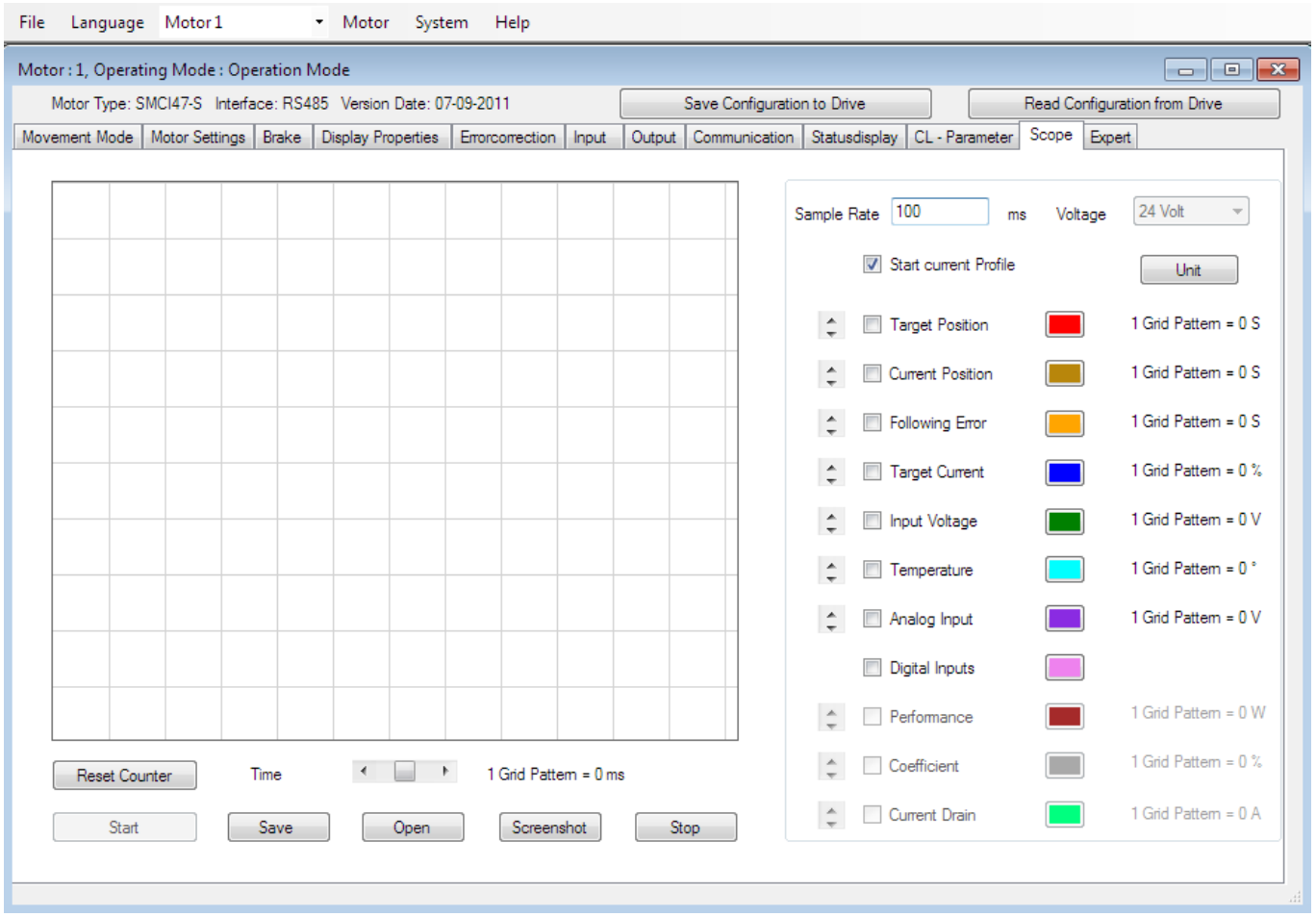
4. Error Display: Shows the error history of the controller.

5. Closed Loop Status: Active or non-active

6. Activate Polling: If activated, you can see the status in real-time.

7. Programming Language: If you are working with NanoJEasy, you can upload and start programs from here.

Scope

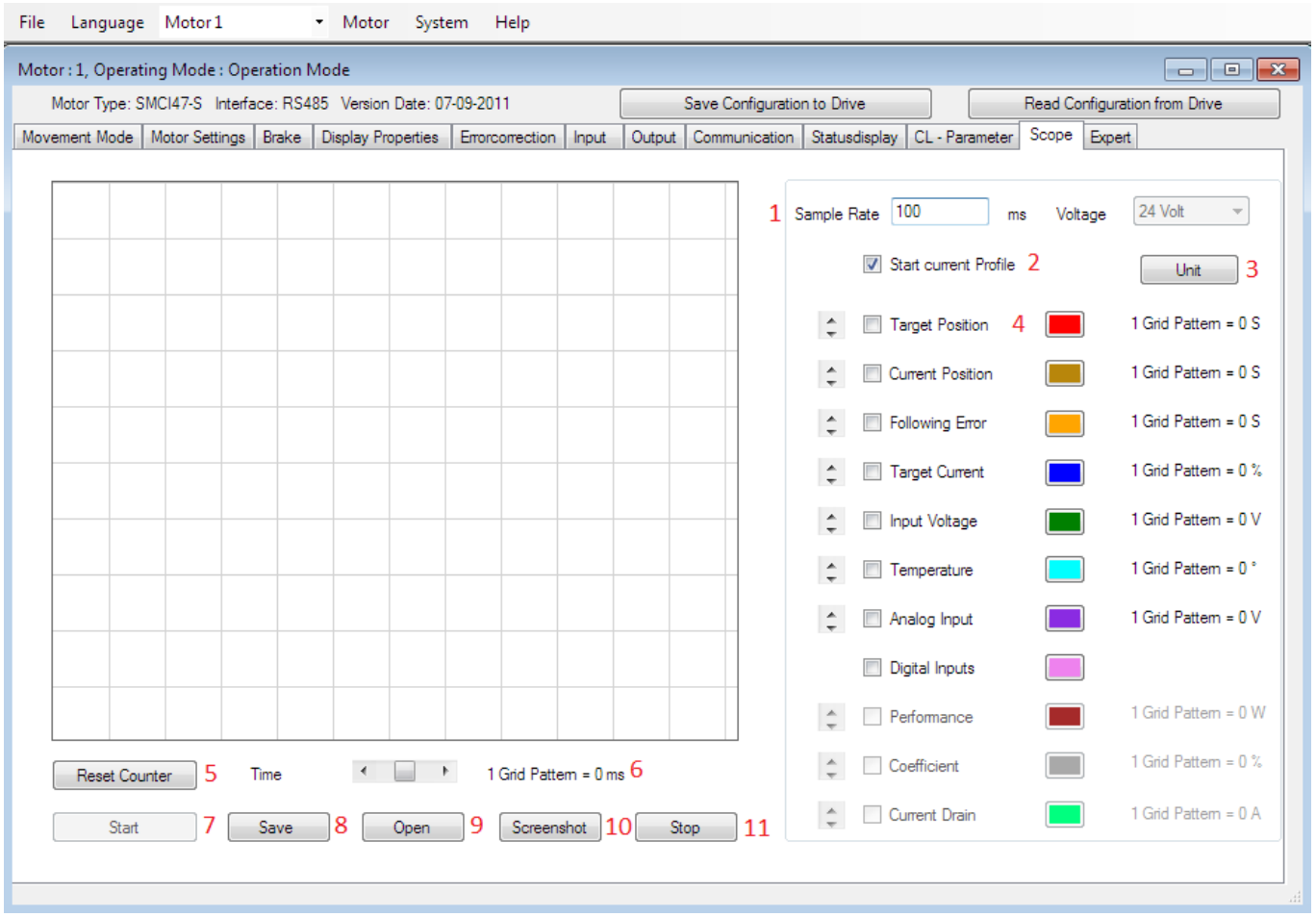


NanoPro can also be used as a scope for some values of the controller.

It is possible to log some parameters like

- the target position
- the temperature of the controller
- the analogue input
- the digital inputs
- …

Scope



1. Sample Rate: Change the number of samples.

2. Start current Profile: Start a profile by starting the measurement if activated

3. Unit/Value: Change between the unit per pattern and an absolute value.

4. Curves: Activate the curves you want to measure and change the color of the curves.

5. Reset Counter: Clears the window.

6. ms per Grid Pattern: Stretch the curves by changing the time per pattern

7. Start: Start your measurement (and a profile if selected).

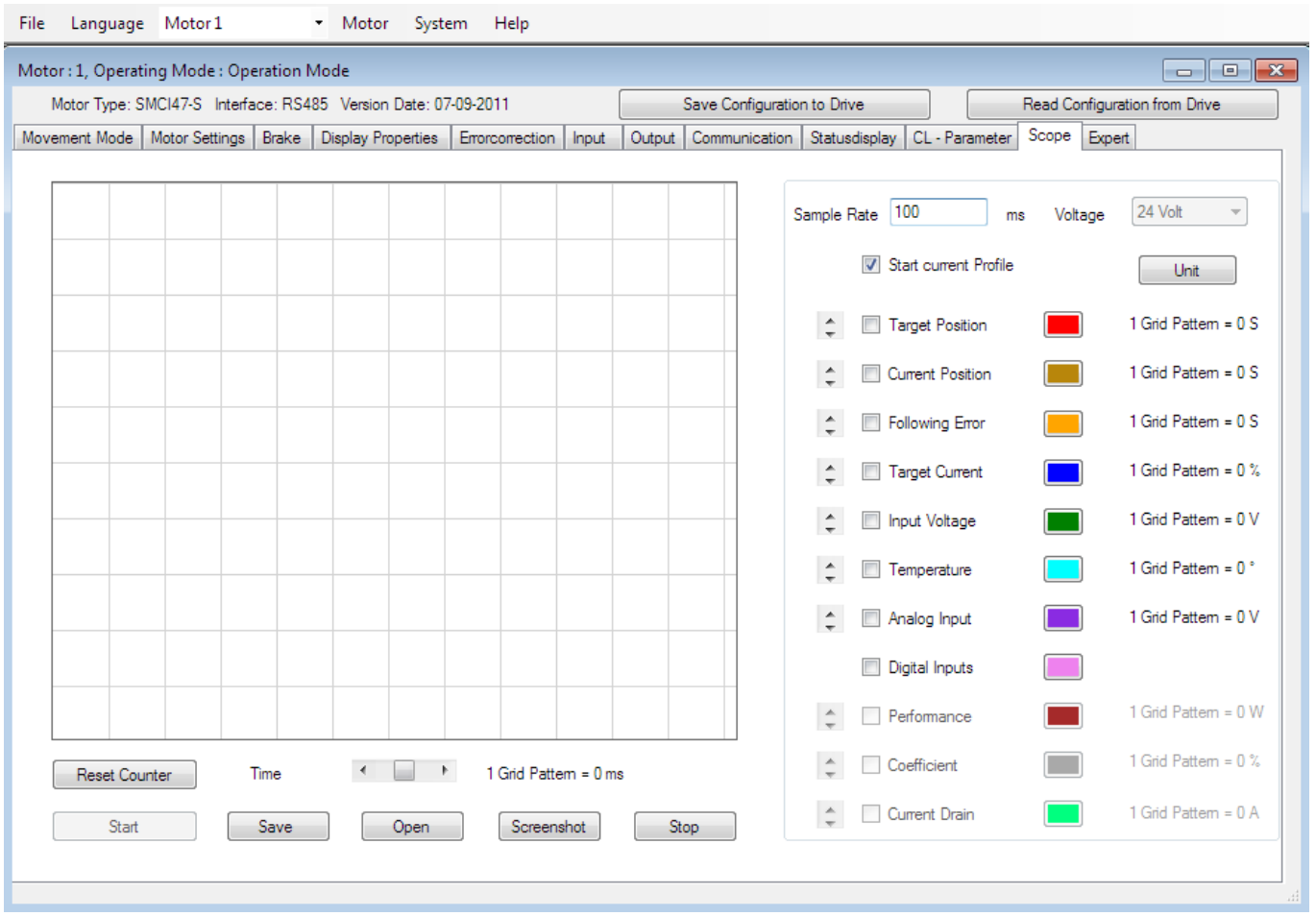
8. Save: Save the measured points to a file.

9. Open: Open a file with measured points.

10. Screenshot: Save the curves to a picture file.

11. Stop: Stop the measurement (and the profile if selected).

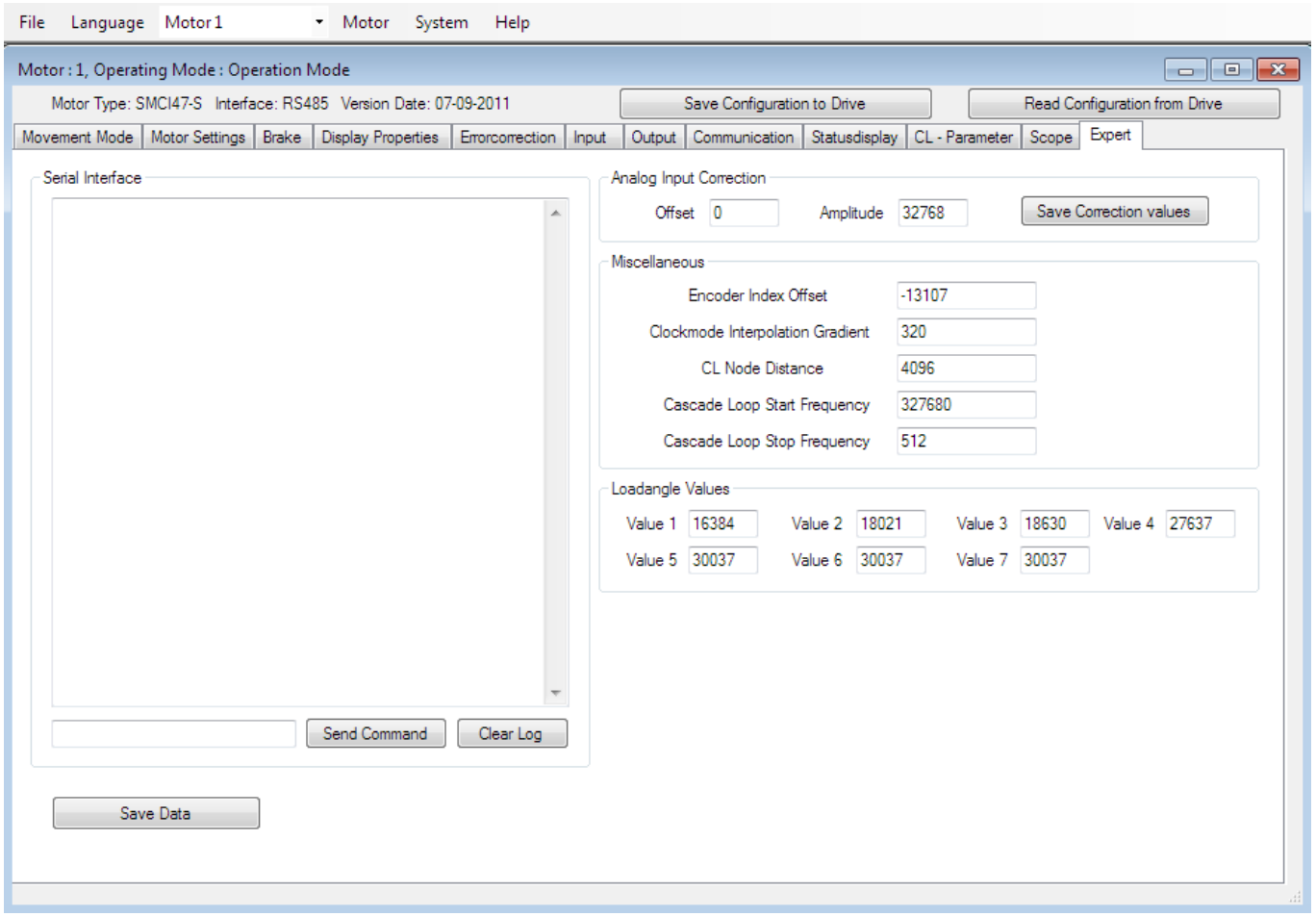
Scope



Exercise:

Measure the digital and analogue input (without starting a profile).
Measure the target and current position (start a profile).

Expert tab

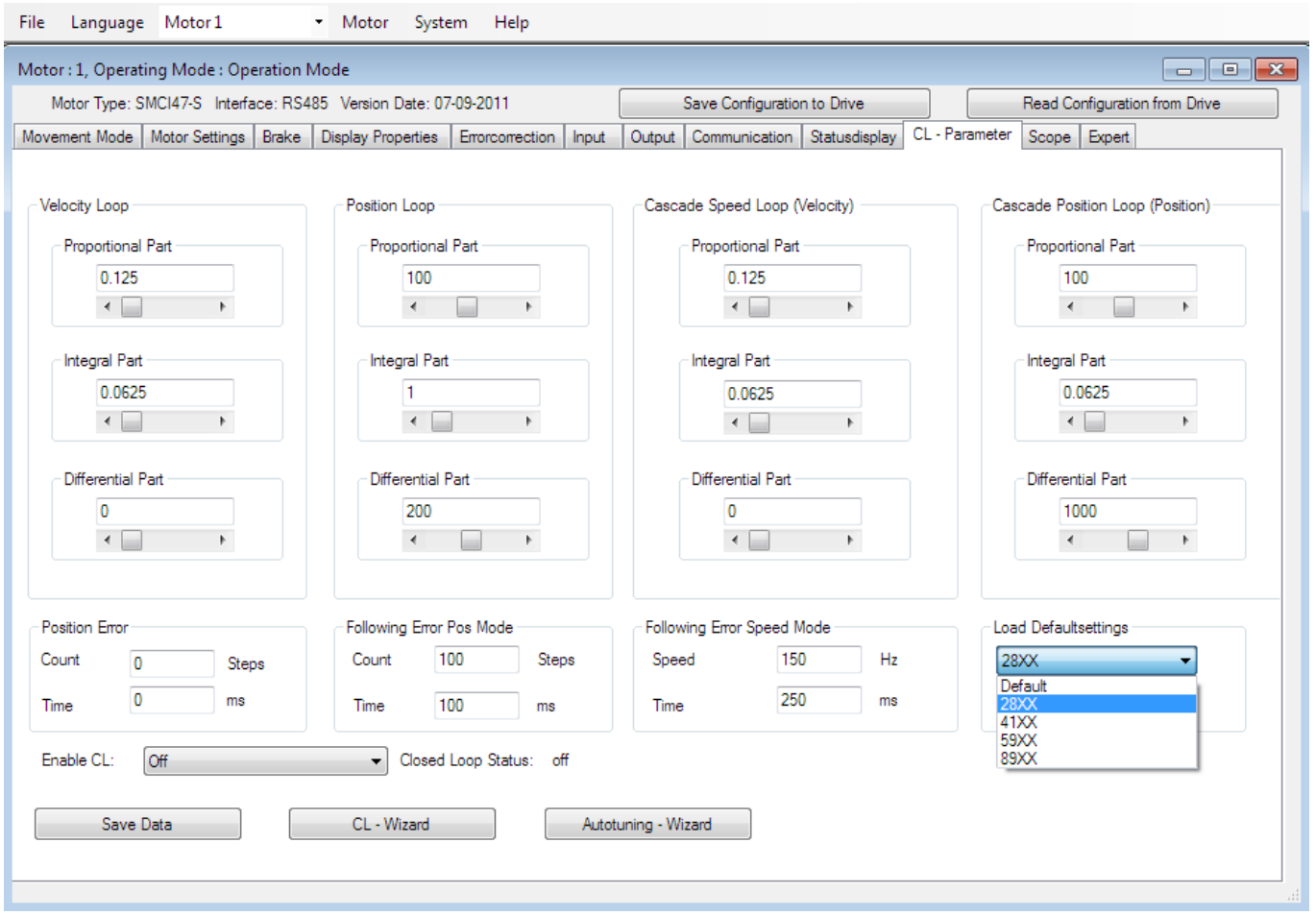


The Expert tab allows some very special configurations, which normally should not be changed by the customer.

You can find the load angle values and the encoder index offset here, which are determined by the CL-Wizard.

On the left side is a serial interface for using our ASCII commands.

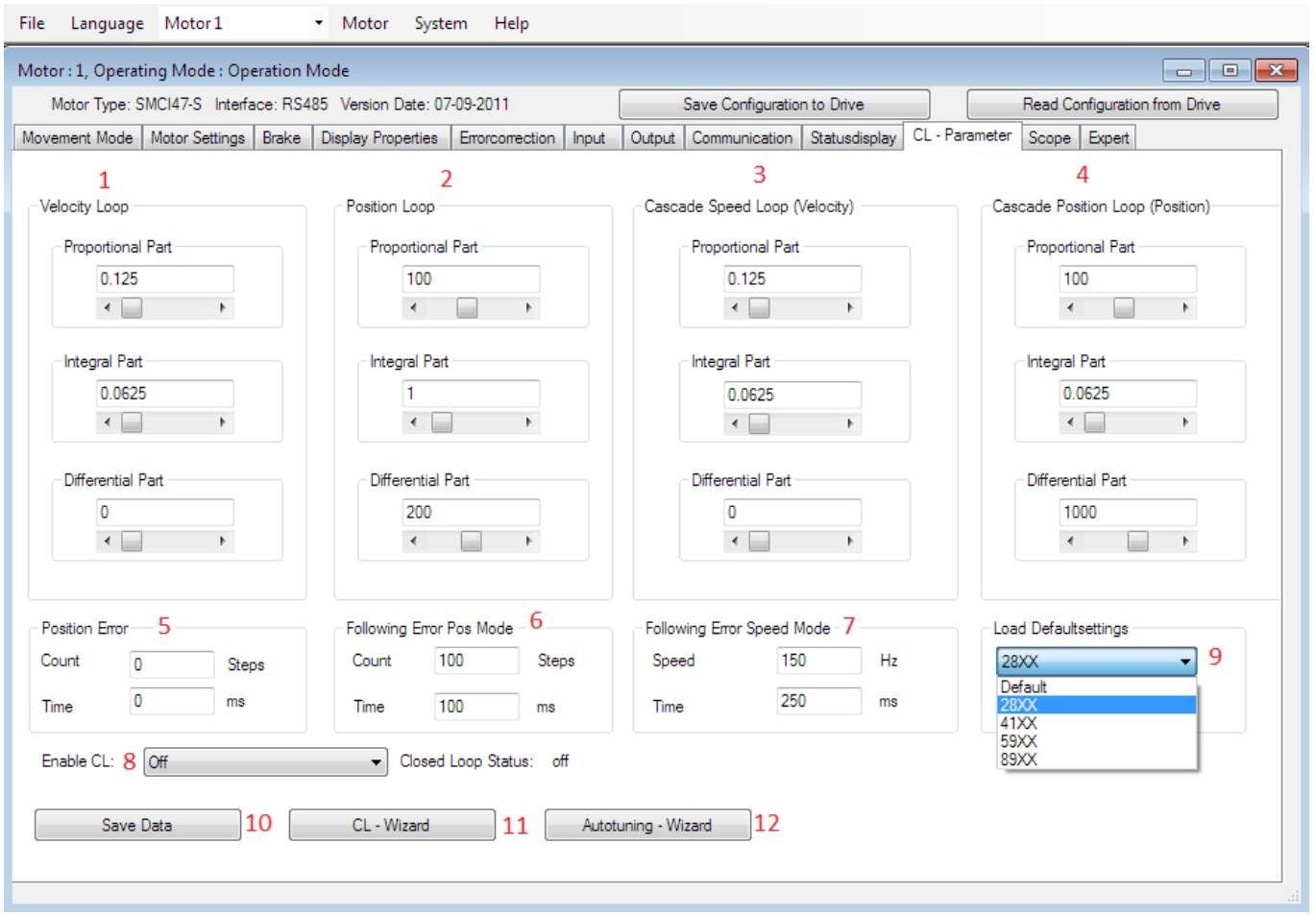
CL-Parameter



- Set the motor to the closed loop mode
- Change the tolerances for the following errors
- Tune the PID parameters of the loop

Testing and changing the values here should best be done if the motor is not attached to the application, and can run freely. If you tune the application, take care that “motors running wild” cannot hurt the application or the operator. Changing the PID beyond the default values needs some experience!

CL-Parameter



1. Velocity Loop: PID parameters for the velocity loop. (Speed as controlled value)

2. Position Loop: PID parameters for the position loop. (Position as controlled value)

3. Cascade Speed Loop: Only for special applications.

4. Cascade Position Loop: Only for special applications.

5. Position Error: Sets the allowed end position error in steps and the time the controller has to get this position at the end of the profile.

6. Following Error Position Mode: Allowed number of steps beside the demand position and the time to get back into range.

7. Following Error Speed Mode: Allowed frequency beside the target speed and time to get back into range.

8. Enable CL: Choose between Closed Loop off, activation directly by appearance of the index signal or at the end of the profile, where the index signal appeared.

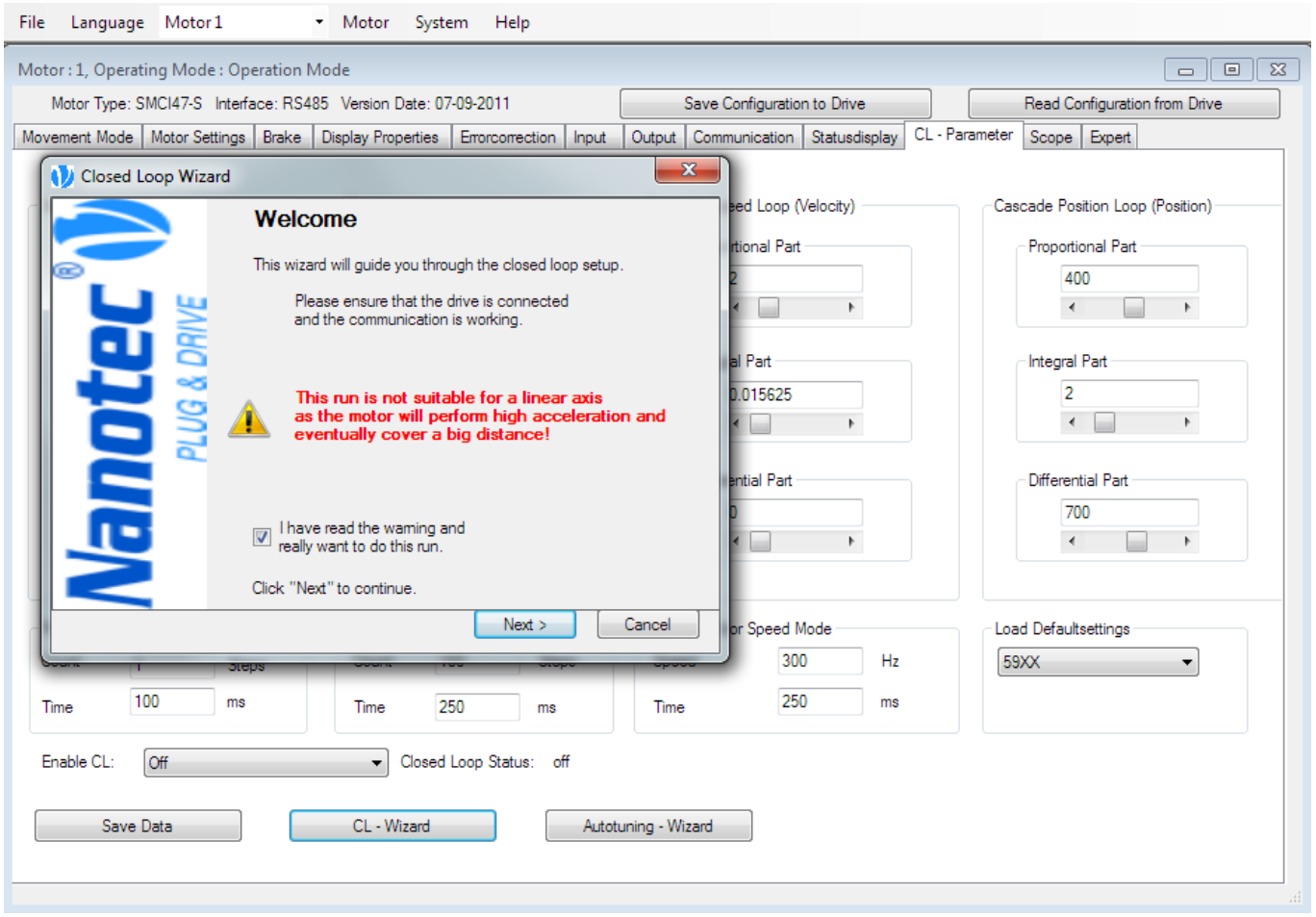
9. Load Default setting:
You can load PID parameters which approximately fit to the motor.

10. Save Date: Save your settings.

11. CL-Wizard: Determine the load angle and encoder index offset (has to be done before you can switch to CL)

12. Autotuning-Wizard: Helps you to find the best PID parameters under load. (Motor moves very far and with high speed)

CL-Parameter



Setting up Closed Loop

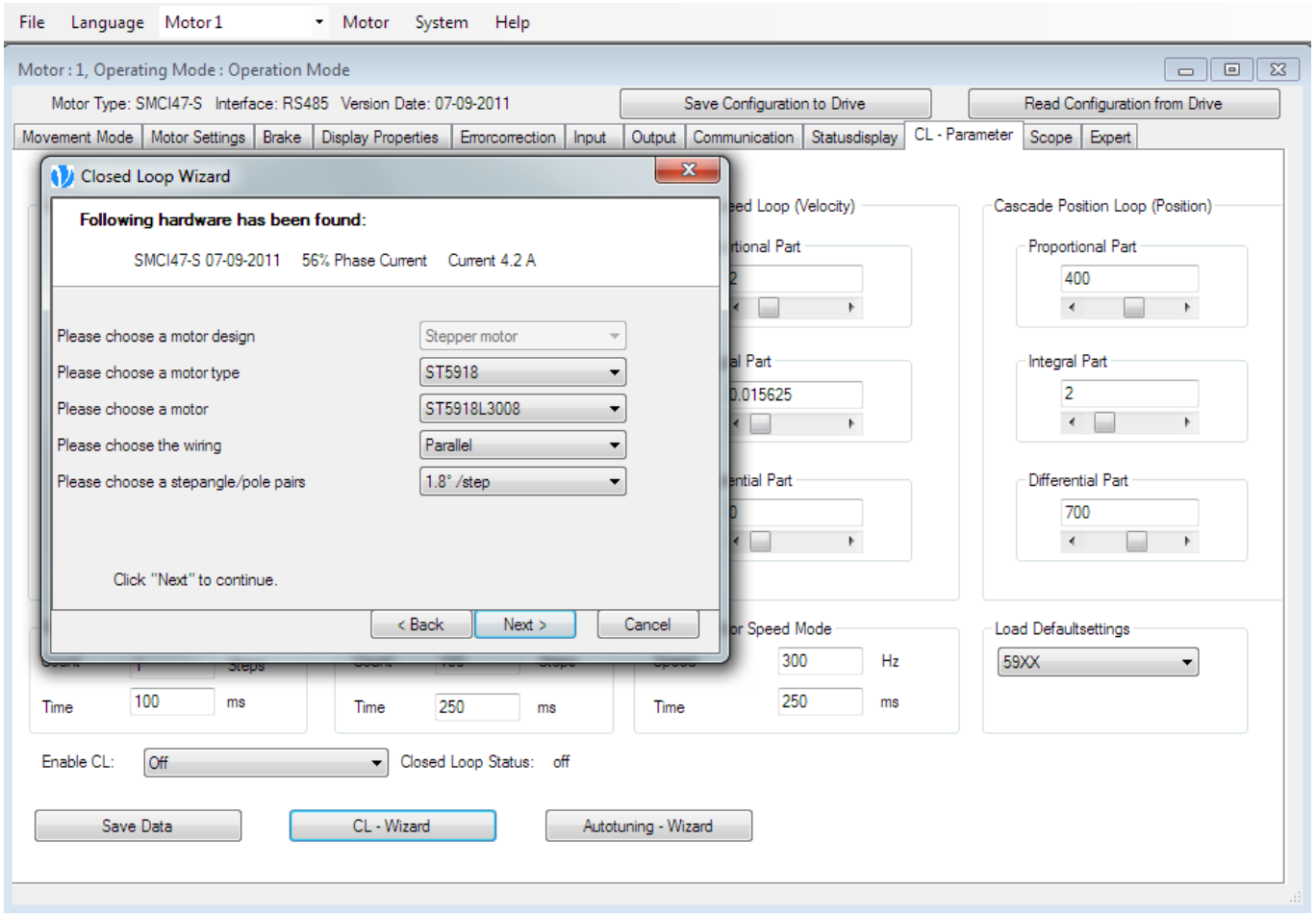
First, set the right configuration on the Motor Settings tab.

The Phase Current should be the rated current of the motor, (here 4.2A). The encoder resolution has to be at the right value. (here 500)

Then load the default settings for the 59XX.

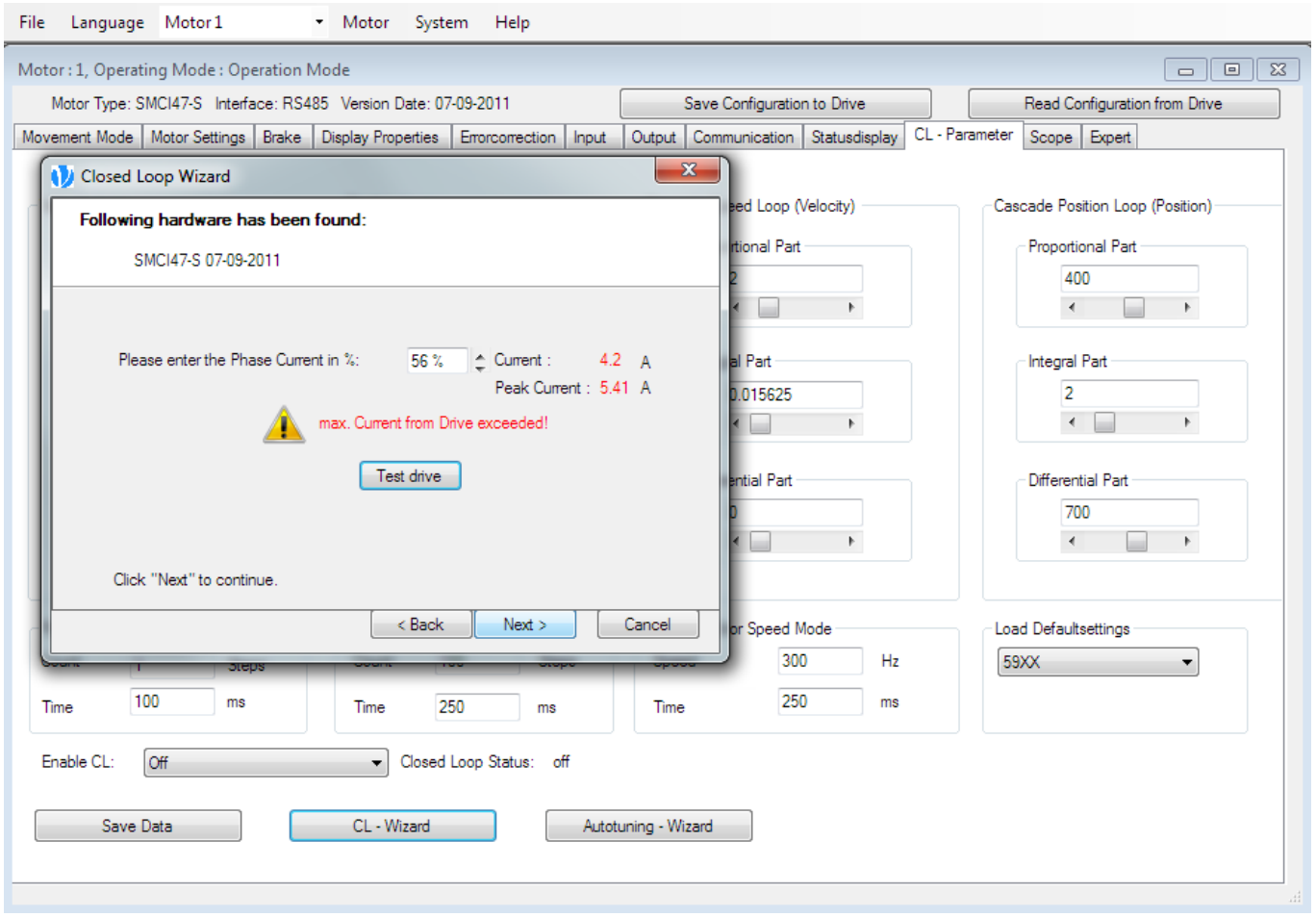
Start the CL-Wizard now.

CL-Parameter



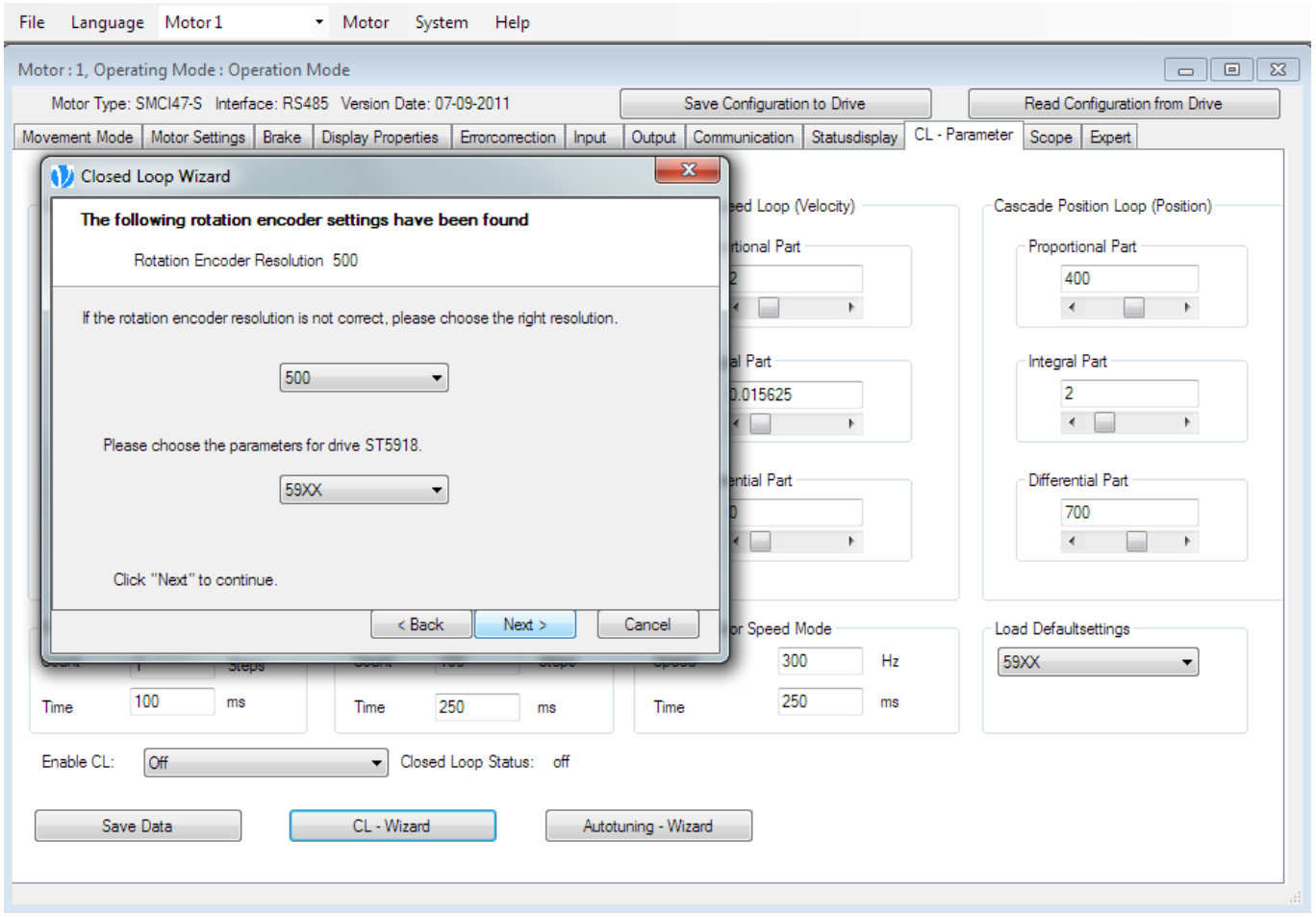
The Closed Loop Wizard shows the configuration with the important data.

CL-Parameter



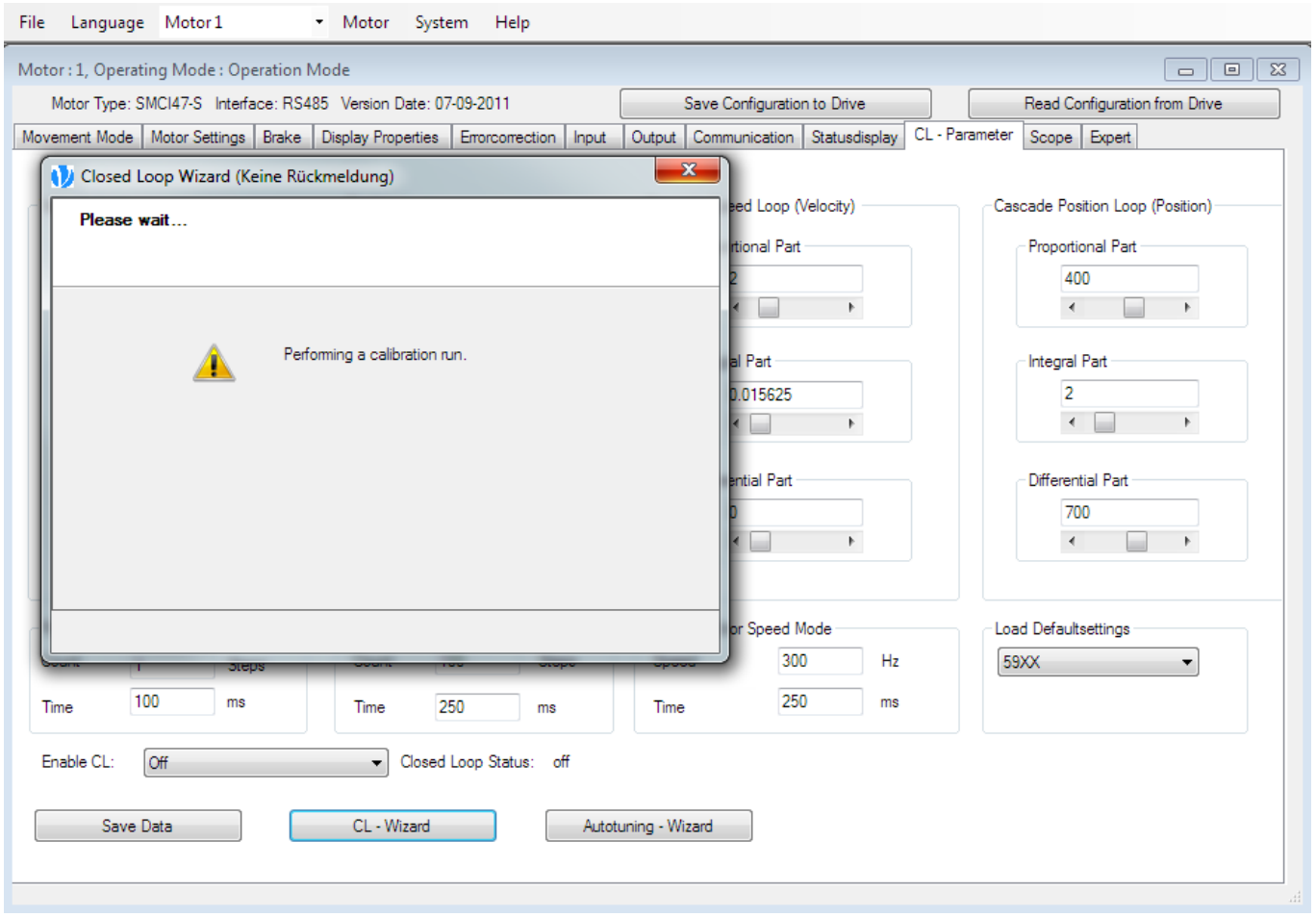
The Closed Loop Wizard shows the configuration with the important data.

CL-Parameter



The Closed Loop Wizard shows the configuration with the important data.

CL-Parameter

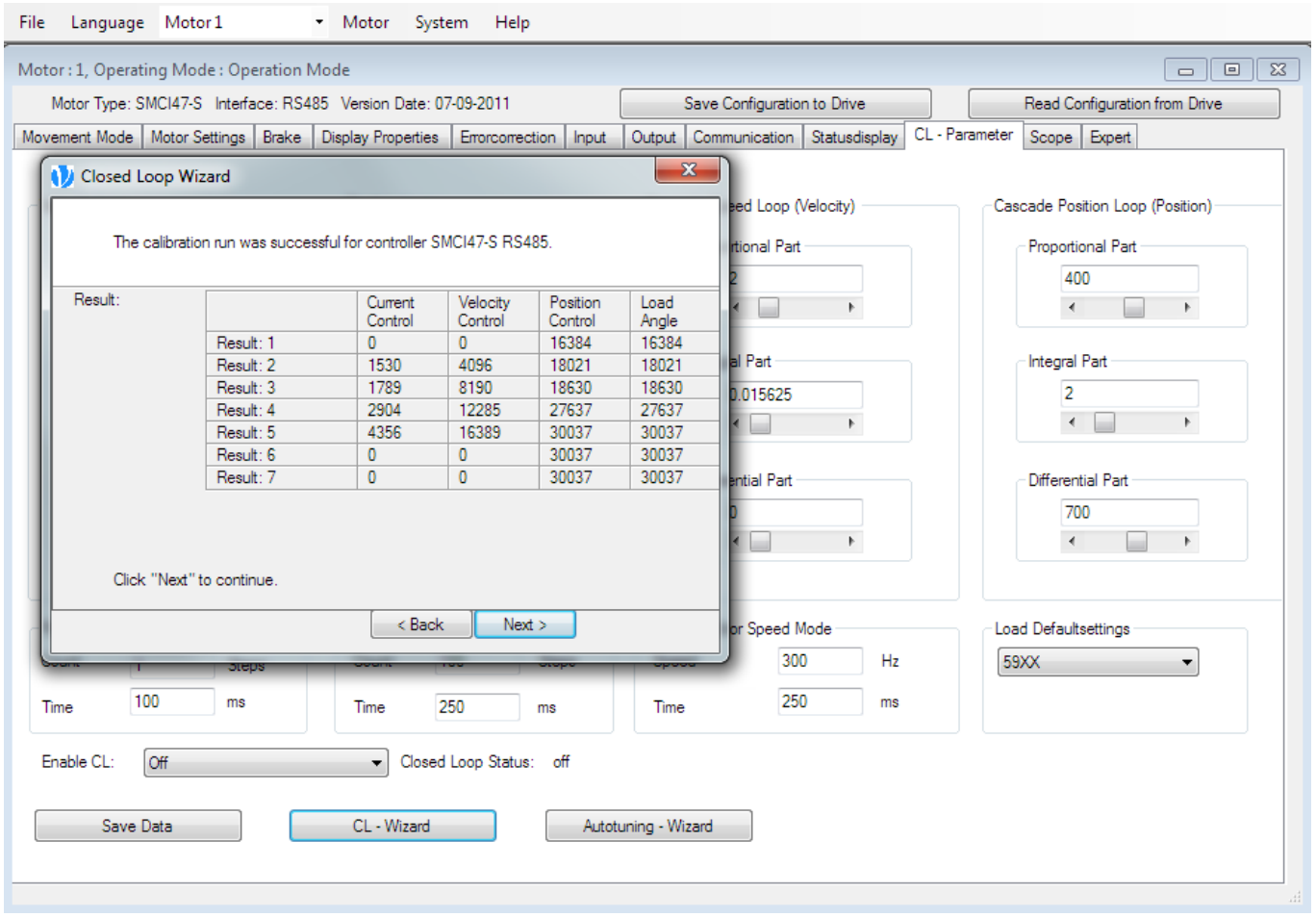


Now the motor will run in both directions at a different speed.

The calibration run will take about 1-2 minutes.

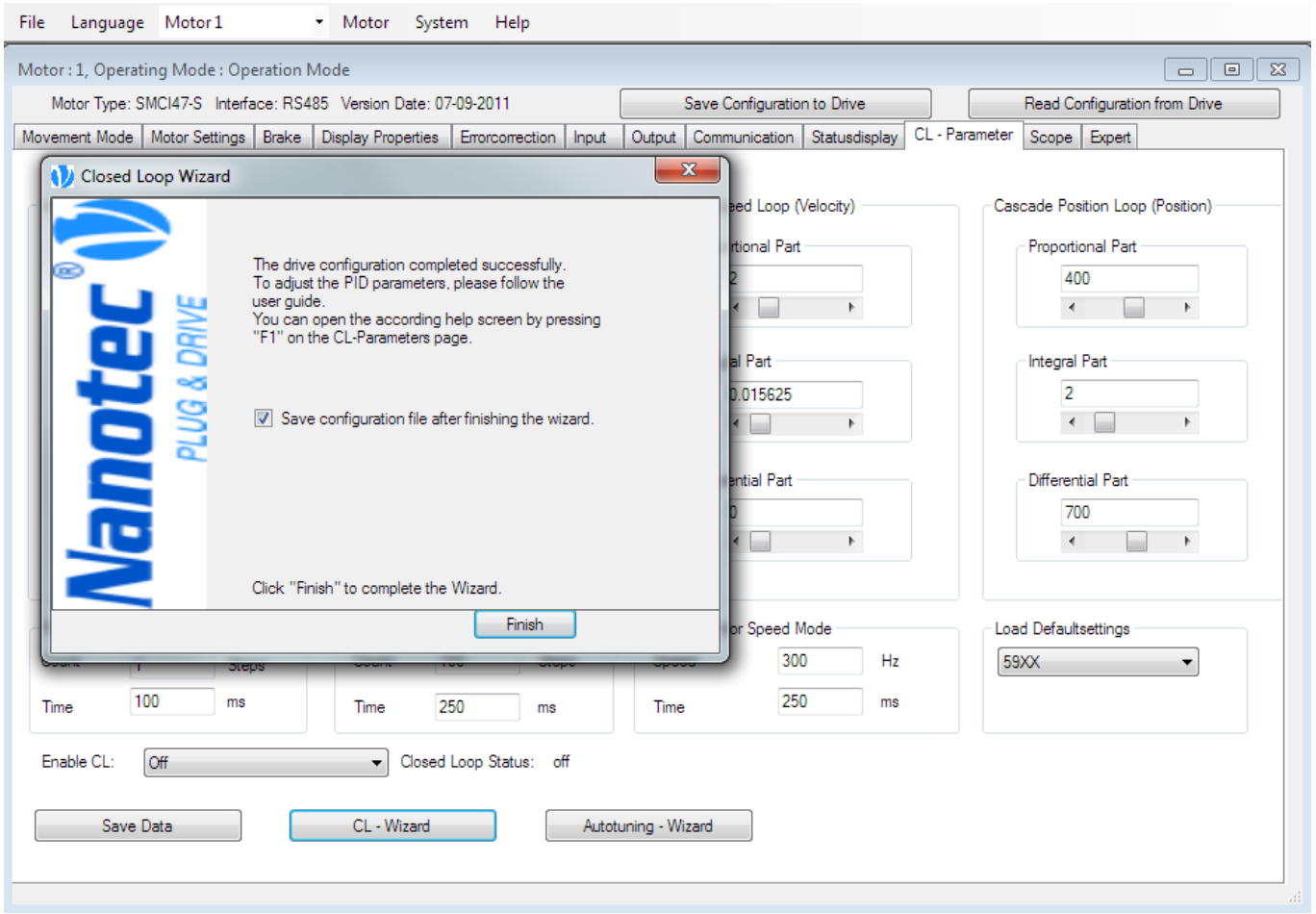
Do not disturb the motor during this period as this would cause a bad calibration.

CL-Parameter



If the calibration is successful, a table with the measured values appears.

CL-Parameter



Your system is in closed loop mode now!

Exercise:

Test a few different operating modes to see the benefit of the closed loop mode.
Try out the functionality of the torque mode, which is enabled now.

Typical problems

Here are some typical problems you may face at the customer site:

?	There is no reaction on the inputs.
!	The Signal GND (COM) might not be connected.
?	If I want to start a profile I always get into an error loop.
!	The “Release” function might be chosen for an input but it is low. (typical at SMCI35)
?	I do not get any communication.
!	The correct driver might not be installed.
?	My outputs are not working; there is no signal.
!	The outputs are open collector outputs; they switch to GND potential.

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Thanks for your attention!

Nanotec Electronic GmbH & Co. KG
Kapellenstr. 6
D-8522 Feldkirchen b. München

Tel.: +49 (0) 89 - 900 686 - 0
Fax: +49 (0) 89 - 900 686 -50
info@nanotec.de

www.nanotec.com