

TLE 4801/03 Evaluation board user guide

About this document

Scope and purpose

This document describes the evaluation board for the TLE4801/03 inductive torque and angle sensor. The purpose of this manual is to describe the software installation process and how to use the TLE4801/03 inductive torque and angle sensor Evaluation board. The sensor board coil design is designed to allow the torque and angle functionality but also the absolute angle measurement.

Intended audience

This document is intended for anyone who wants to use the TLE4801/03 inductive torque and angle sensor or inductive linear position sensor demonstrator kit.

Evaluation Board

This board is to be used during the design-in process for evaluating and measuring characteristic curves, and for checking datasheet specifications.

Note: PCB and auxiliary circuits are NOT optimized for final customer design.

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Important notice

Important notice

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Inductive sensor demonstrator boards

1 Inductive sensor demonstrator boards

Inductive position sensors offer high design flexibility for different position sensing applications. With the same sensor IC from the TLE4801/03 family angle, torque but also linear travel measurements can be realized with different sensing coil designs. Exemplary sensor reference designs are available using the TLE4801/03 product family.

1.1 Rotary position sensor

The torque and angle demonstrator is designed to demonstrate rotary sensing applications. The TLE4801 iTAS Evaluation board consists of:

- A coil PCB with the TLE4801 assembled,
- Two target PCBs,
- Mechanical components.

1.1.1 Mechanical setup

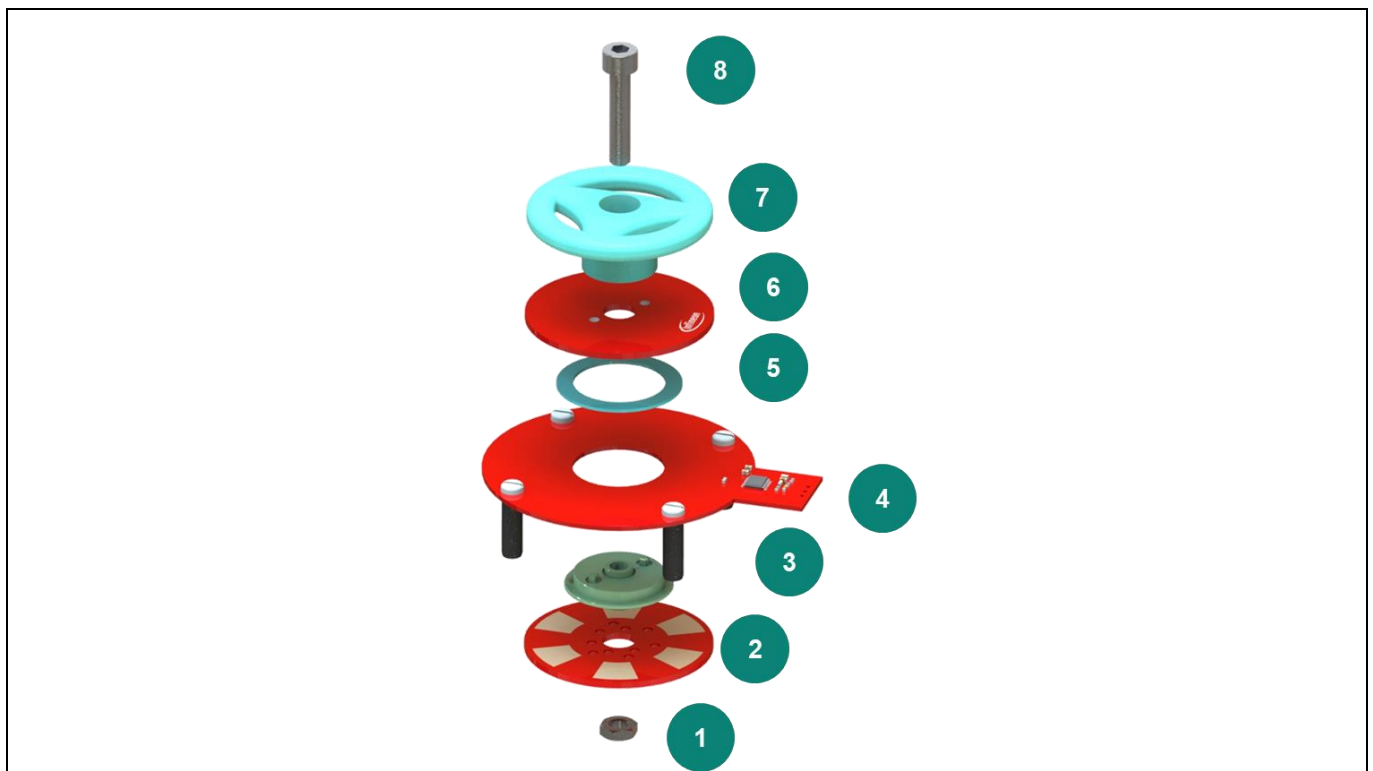


Figure 1 Explosion view of the TLE4801 Eval Kit

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Inductive sensor demonstrator boards

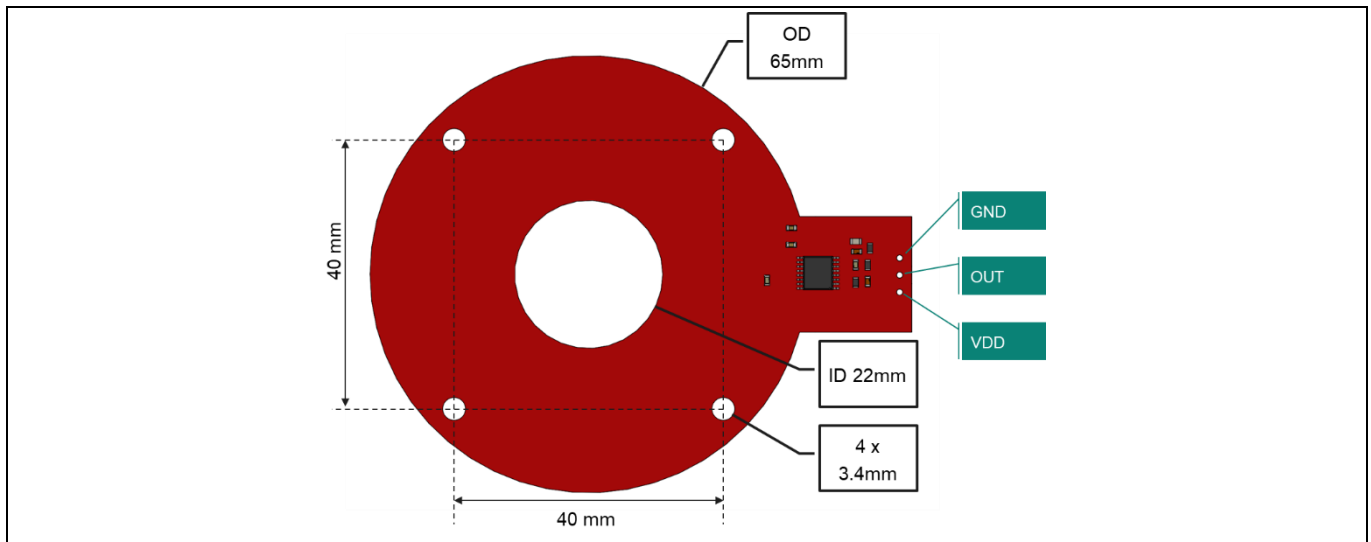


Figure 2 Coil PCB dimensions and pinout

With the through holes on the coil PCB, the sensor can be assembled to a test bench. 4xM3 screws can be used for fixation.

1.1.2 Output modes

The TLE4801/03 product family offers different output modes. The torque and angle demonstrator is designed with a period count of 5 and 6 periods over one mechanical rotation. The concept demonstrates 2 operation modes,

- Torque operation mode
- Absolute position operation mode

In angle mode, the mechanical angle is constructed from the partial angles for applications which need high resolution. In torque mode the difference angle is computed from the partial angles, typically this is used in torque sensors in electric power steering (EPS).

1.1.2.1 Torque mode

To operate the demonstrator in torque mode, the number of target wings needs to be set correctly. With the current design of 5 and 6 periods, the number of wings at angle1 needs to be set to 5 and the angle2 to 6. For details on the registers, please refer to the relevant user manual of the TLE4801/03 family.

To demonstrate the torque functionality the torque and angle demonstrator board features 5 different locator positions on the bottom target. To set the difference angle between the top and bottom target, the bottom target needs to be lifted and put into another position. 5 equiangular positions are available from -5° to 5° .

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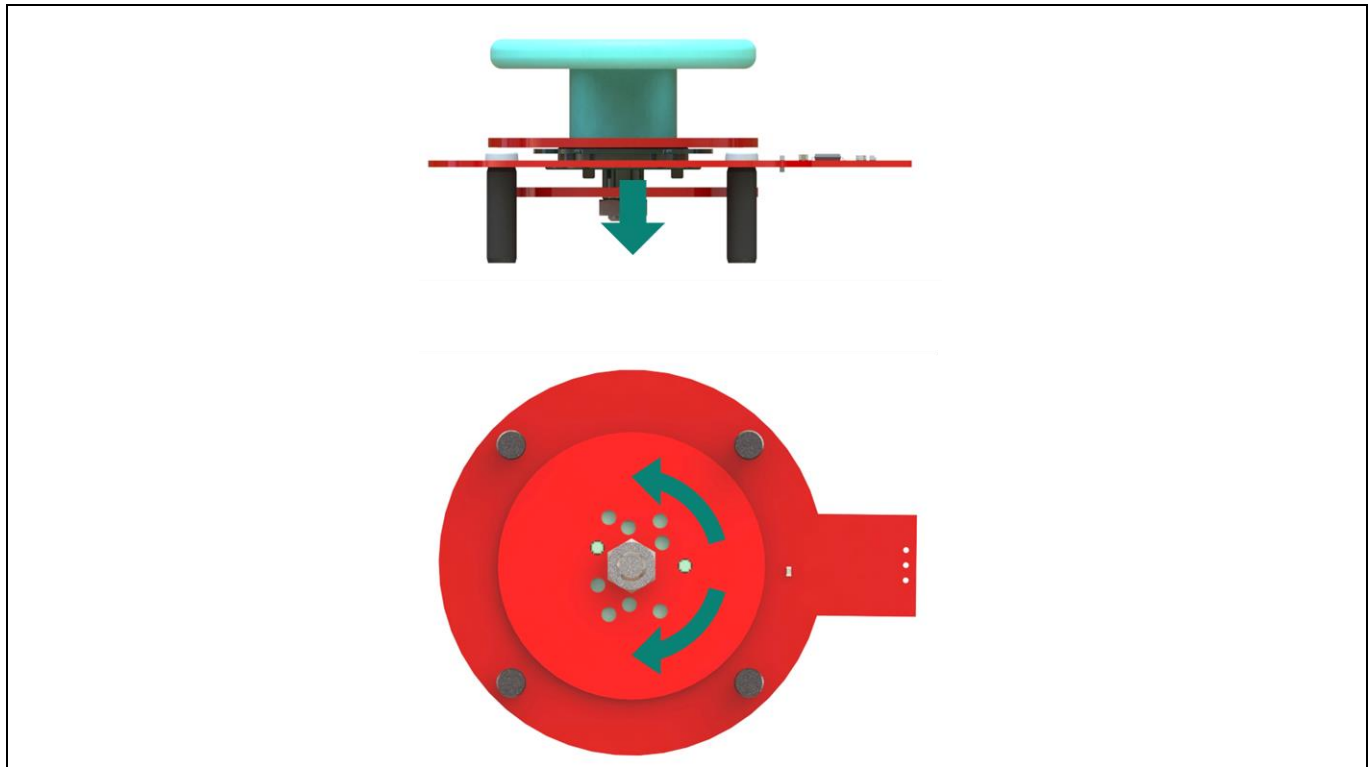


Figure 3 Bottom target offset angle adjustment

With this setting the nonius calculation done inside the TLE4801 generates the difference angle between the top and bottom target. Please note, that the output is dependent on the output protocol selected for the TLE4801. For details and the possible options, please refer to the respective datasheet.

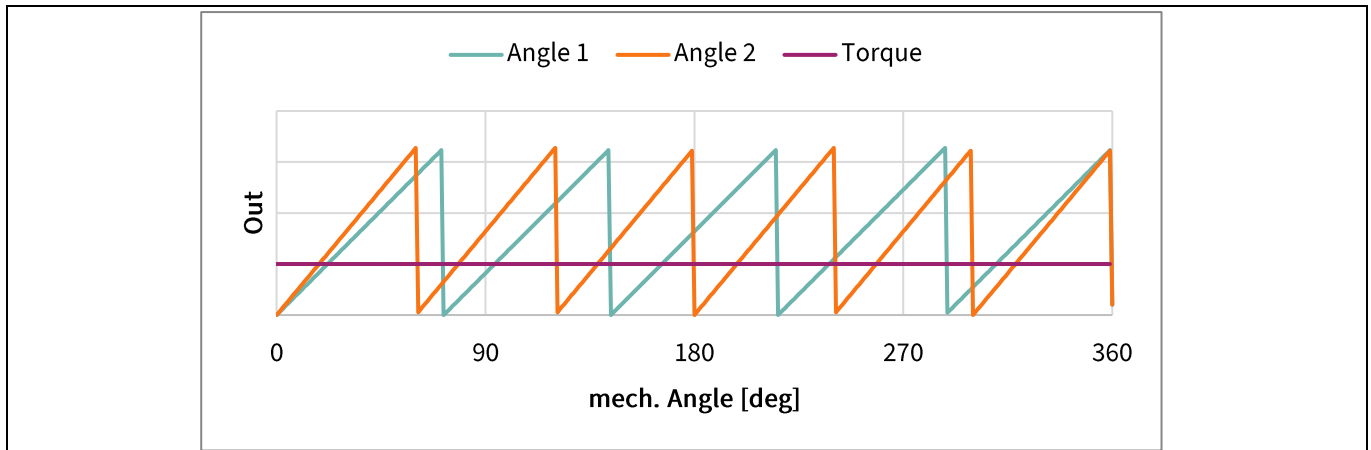


Figure 4 Ideal outputs in torque operation mode

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Inductive sensor demonstrator boards

1.1.2.2 Absolute angle mode

To operate the demonstrator in absolute position mode, the number of target wings needs to be set correctly. With the current design of 5 and 6 periods, the number of wings at angle1 and angle2 need to be both set to 1. For details on the registers, please refer to the relevant user manual of the TLE4801/03 family.

With this setting the nonius calculation done inside the TLE4801 generates the absolute mechanical position from the 2 individual partial angles. Please note, that the output is dependent on the output protocol selected for the TLE4801. For details and the possible options, please refer to the respective datasheet.

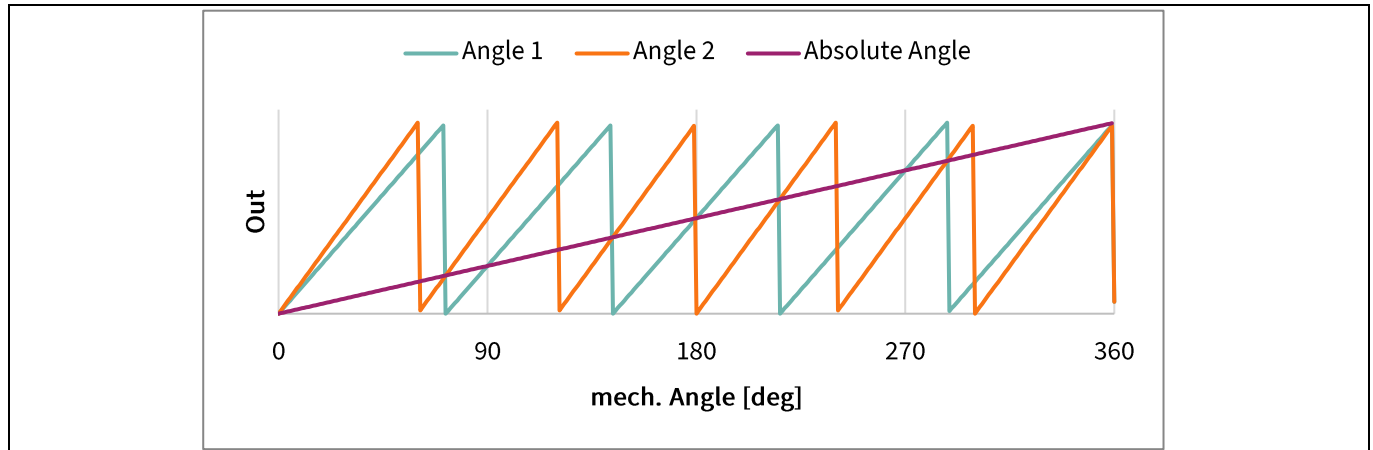


Figure 5 Ideal outputs in angle operation mode

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1.2 Linear position sensor

The TLE4803 linear position sensors are available in 2 versions with 200mm and 300mm of measurement range. Both variants contain:

- A coil PCB with the TLE4803 assembled,
- One target PCB,
- Mechanical components.

1.2.1 Mechanical setup

Two versions of linear demonstrator are available with two different measurement ranges and receiving coil configurations. To demonstrate the potential in design flexibility the linear position sensors were designed with the following variants.

- The 200mm demo features an absolute track combined with a high-resolution track with 5 periods,
- The 300mm demo features a nonius concept with 4 respectively 5 periods over the uniqueness range.

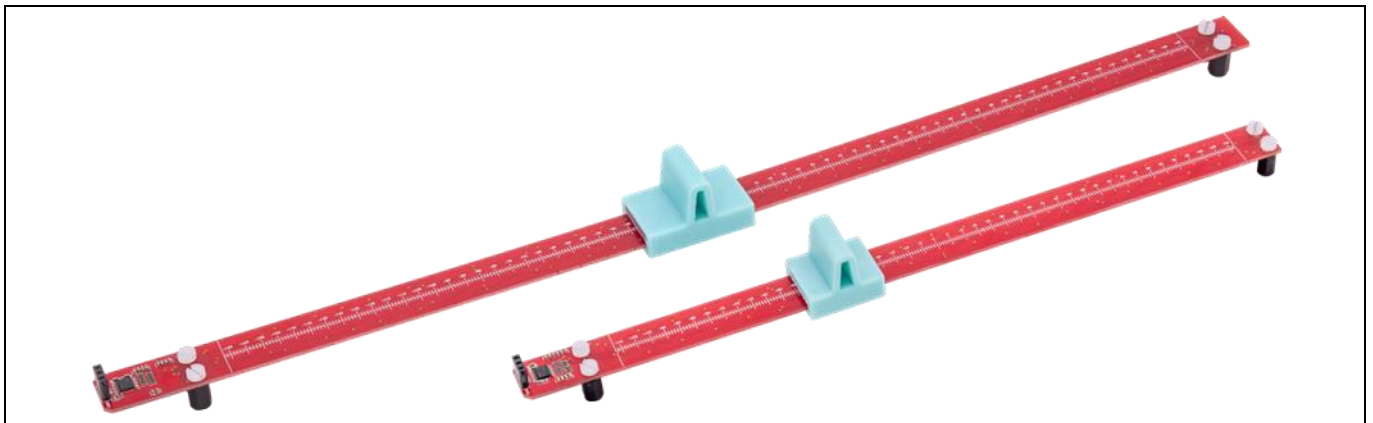


Figure 6 Inductive linear position sensor boards

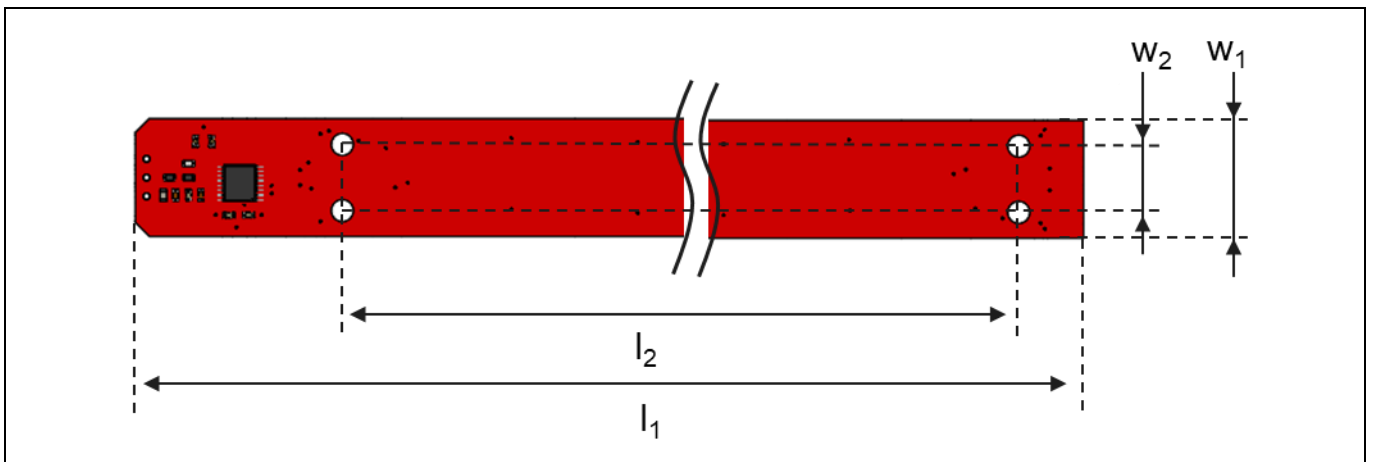


Figure 7 Coil PCB dimensions

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Inductive sensor demonstrator boards

Table 1 Coil PCB dimensions parameters

Parameter	200mm demo	300mm demo	Unit
l_1	270.5	391	mm
l_2	245	354	mm
w_1	16	16	mm
w_2	9	9	mm
\varnothing	3	3	mm

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Inductive sensor demonstrator boards

1.2.2 Output modes

The output modes for the 200 mm and 300 mm demonstrator board are different by means of the angle 1 and angle 2 information generated during measurement. The graph below shows the output information generated over the 200 mm measurement range with the demonstrator board. Angle 1 gives the full travel range with one period, angle 2 gives a sawtooth signal with 5 periods over the travel range. This configuration allows the direct true-power-on position detection combined with a high resolution of the 5 periods.

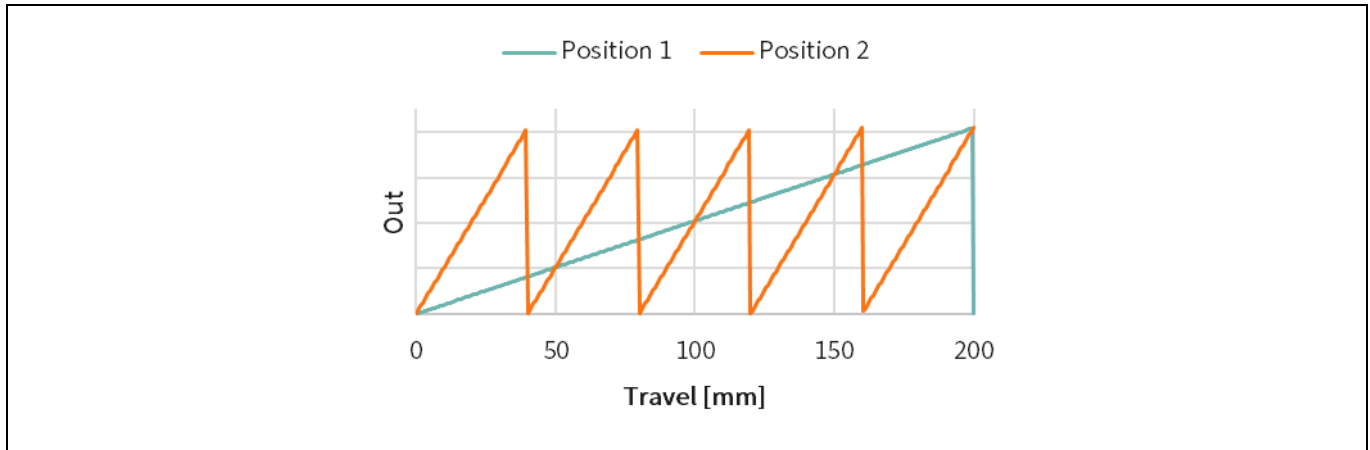


Figure 8 200 mm linear demonstrator output

The 300 mm demonstrator board generates 4 periods on angle 1 and 5 periods on angle 2 along the 300 mm measurement range. With this configuration the true-power-on position detection can be obtained from both outputs, exemplary through a nonius calculation. The figure below shows the exemplary output generated.

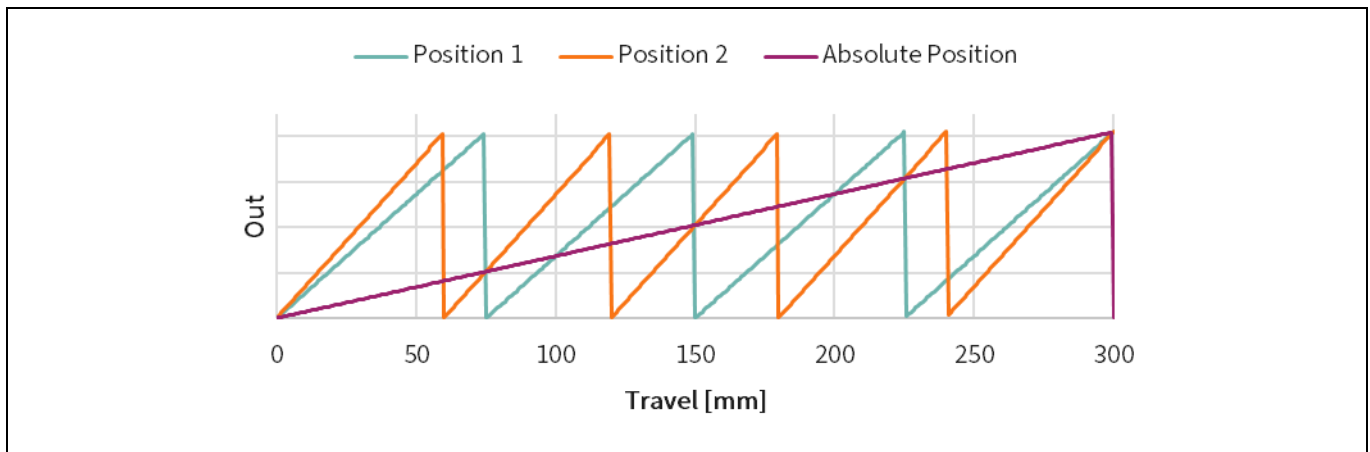


Figure 9 300 mm linear demonstrator output

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Programming interface MSS Readout Tool

2 Programming interface MSS Readout Tool

The inductive sensor demonstrators can be programmed with the MSS Readout tool. The programmer is based POSIF board (position sensor interface board) - featuring an XMC4700 microcontroller and the SSRT (Speed Sensor Readout Tool) frontend board

The evaluation board package consists of the following components:

- Position Sensors Interface board.
- Speed Sensors Readout Tool board. Both boards are already stacked together via headers.
- 24V power supply (and power plug adapters when available at supplier)
- Micro USB cable

For more details on the MSS READOUT TOOL, please refer to the XENSIV™ Speed Sensors Readout Tool User guide

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Evaluation software and system setup

3 Evaluation software and system setup

3.1 Getting started

Before working with the demonstrator, the software needs to be downloaded at:

<https://softwaretools.infineon.com/tools/com.ifx.tb.tool.xensivtle480xangletorquesensorevaluationsoftware>

The following installation steps for the software need to be executed:

- Install the Evaluation board software by double clicking on the installer file
- Administrator rights are required for installing the software and the required dependencies
- User must accept the License Agreement to continue with the installation process
- Quick installation is preferred, but any option can be chosen
- Dependencies installation can be skipped by unchecking them in “Custom Installation” or simply by cancelling the corresponding dialog window when it is prompted
- After software installation is finished, dependencies installation is prompted
- If the required dependencies are already installed on the computer (.NET 4.8 or above and FTDI driver version 2.12.28 or above), installation can be cancelled/skipped
- When the installation finished successfully, the user can choose to run the software and to view the release notes
- A desktop icon is created automatically

Please be aware that in case the FTDI driver is installed for the first time on the computer, the POSIF board must be connected before starting the software.

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Evaluation software and system setup

3.2 Hardware connection

The demonstrator board and the MSS Readout Tool needs to be connected like below:

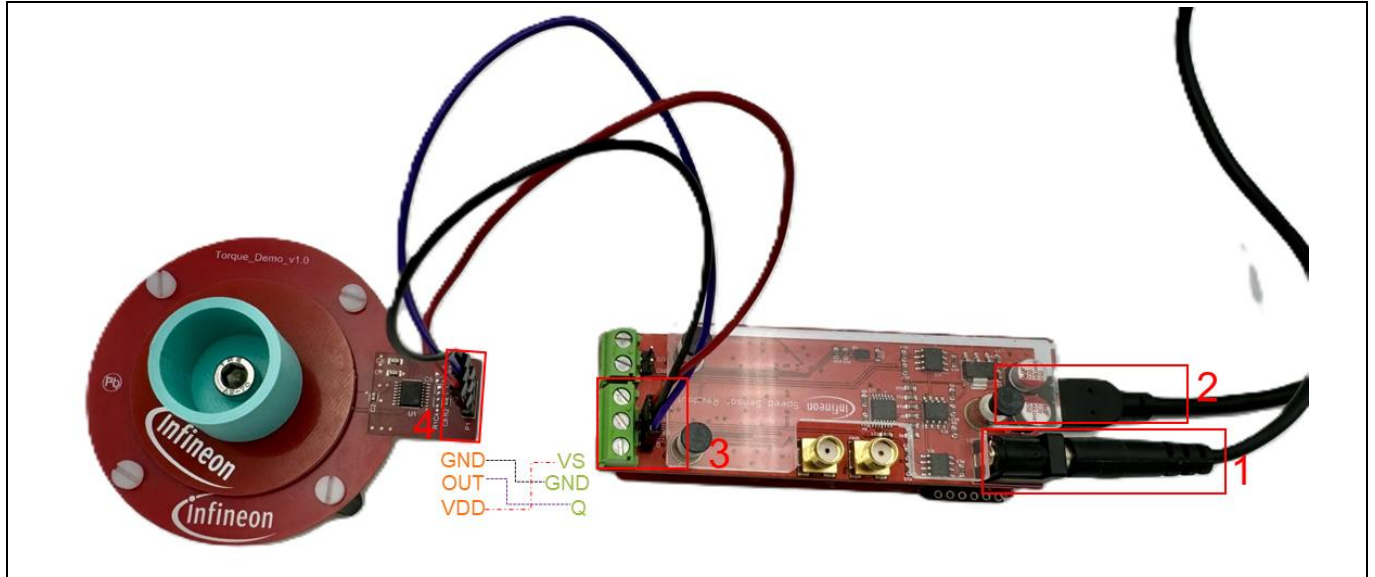


Figure 10 Connection of demonstrator board and MSS Readout Tool

Once correctly connected and started the software, the software will monitor all USB ports and check if any connected device matches the signature of the evaluation board. A new device will appear as “Port X”. By selecting the device, the software will connect and flash the correct firmware for the target microcontroller.

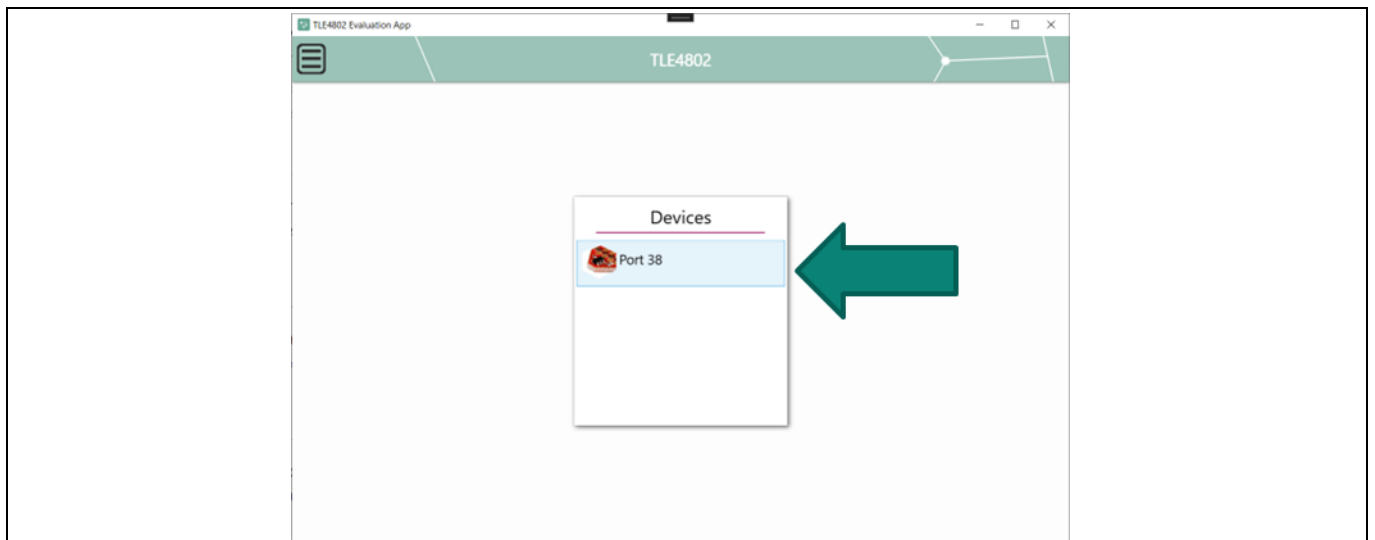


Figure 11 Device selection in the evaluation software

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Evaluation software and system setup

3.3 Readout mode

The user can now enter the readout mode through selecting the panel “Readout mode”.

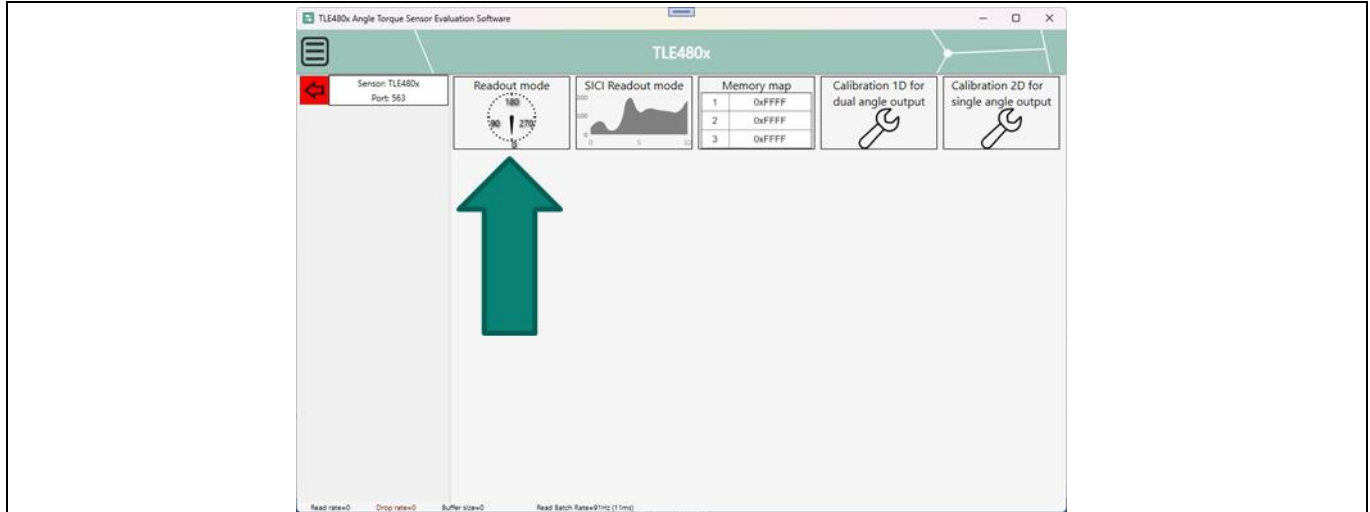


Figure 12 Selection of the readout mode

Readout mode panel plots on charts the sensor’s output. It has 3 charts:

- Angular Gauge for Angle 1 (and its projection in cartesian) (1)
- Angular Gauge for Angle 2 (and its projection in cartesian) (2)
- Cartesian chart for Torque (3)

The opened view contains inside other views and features:

- Acquisition settings (4)
- Chart settings (5)
- Logging (6)
- Error Indication (7)

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Evaluation software and system setup

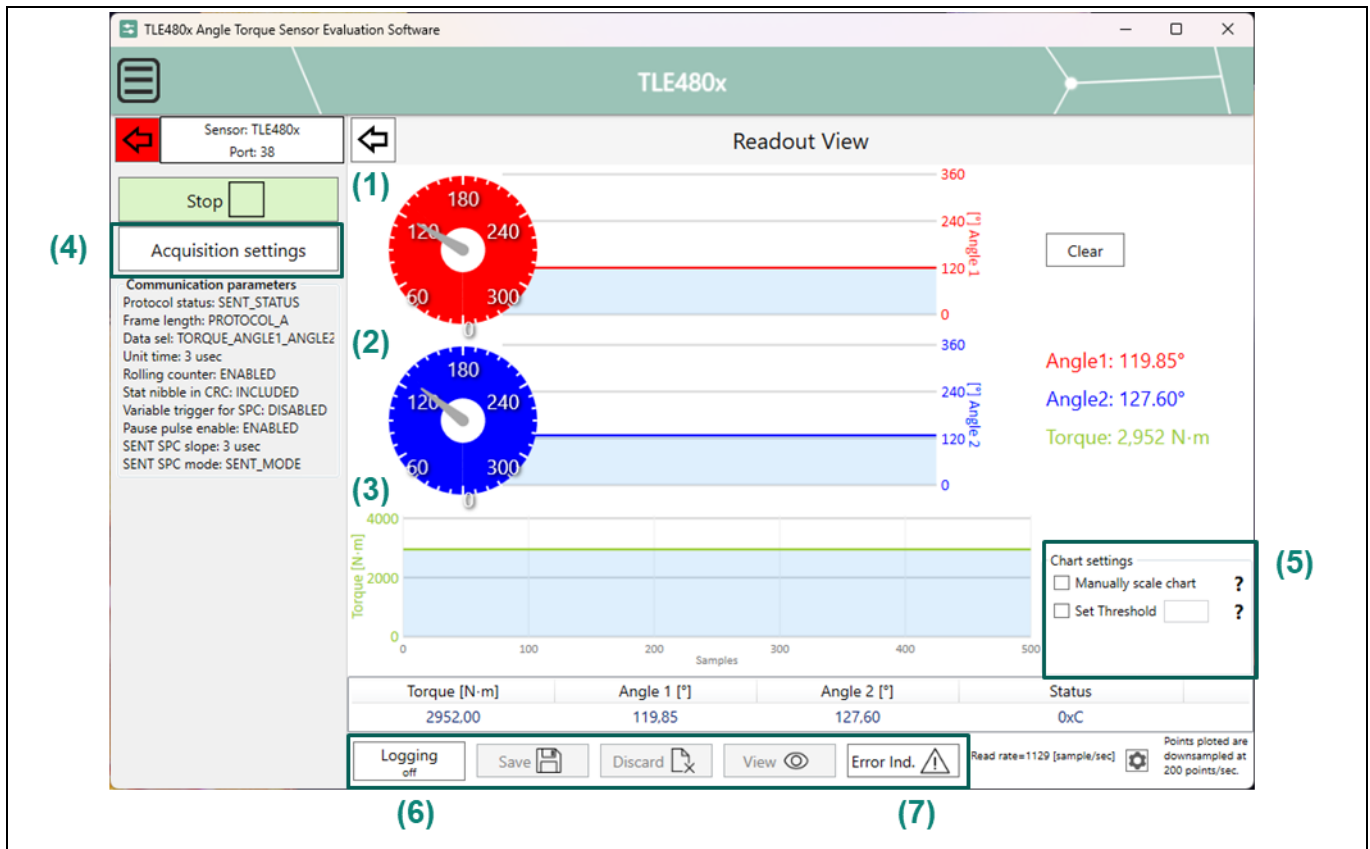


Figure 13 Readout mode panel

The readout view content is automatically configured based on the CMTP configuration, based on the data selection of the SPC/SENT protocol written in the CMTP. All received data can be logged in csv format. This contains raw and processed data, device status, CRC and any error indication captured on the communication pin during a SPC/SENT communication. Please refer to the datasheet and user manual for details.

3.3.1 The readout view – logging window

The readout view – logging window is a feature useful to view logged points, without needing to reconstruct a chart from the saved points in the csv file.

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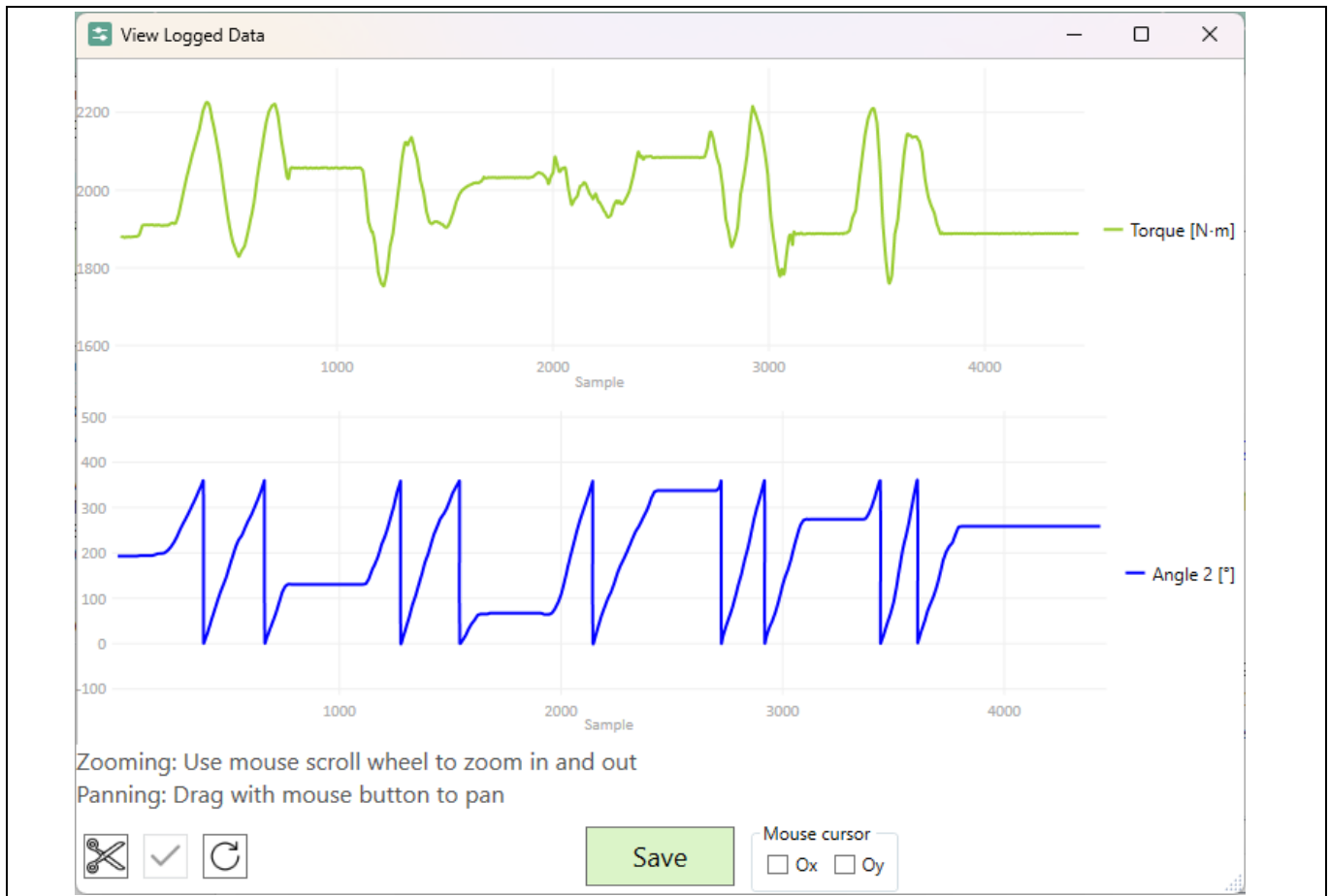


Figure 14 Readout view – logging window

3.3.2 The readout view – error indication window

The readout view – error indications window displays all the captured error indications in the SENT/SPC communication. The list is updated every second. The error indication is included in the default logging capabilities. The window is closed automatically when exiting the readout mode.

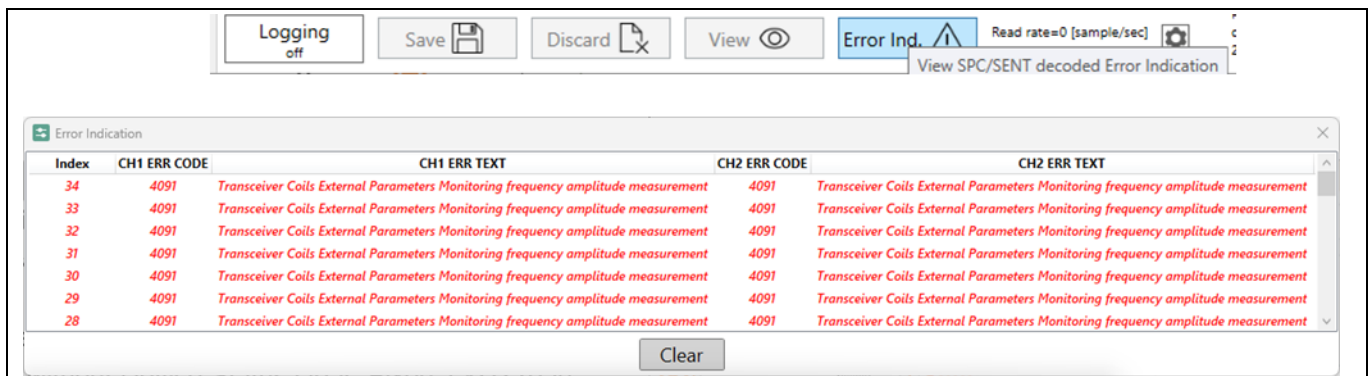


Figure 15 Readout view – error indication window

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Evaluation software and system setup

3.4 SICI Readout mode

After successful software startup, the user can now enter the SICI Readout mode through selecting the panel “SICI Readout mode”. Here the sensor can be programmed via SICI and the normal 5 V voltage level is applied. This way it is possible to fine tune values in the “READ_IN_REGISTERS” and to read via SICI the raw values or angular digital values through the working registers afterwards.

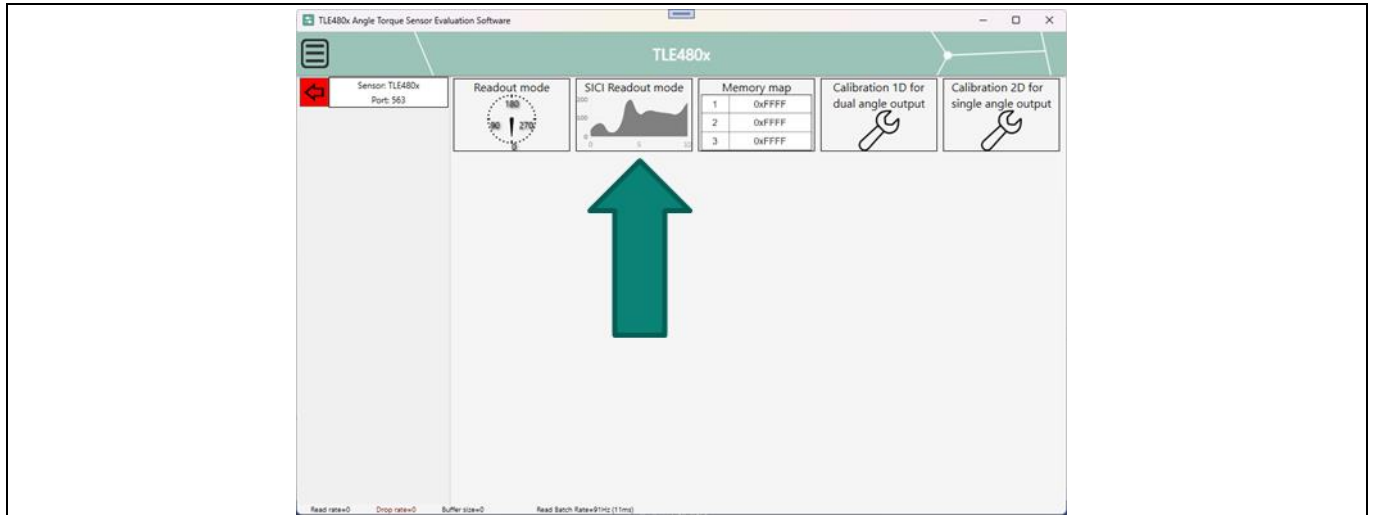


Figure 16 Selection of SICI Readout mode

SICI Readout mode displays, plots and logs the sensor’s registers content at a fixed 100 Hz sample frequency. It has 4 selectable views:

- Angle 1/2 & Torque (angle1/2_dsp_int_reg, torque_dsp_int_reg)
- Vector Length 1/2 & ADC Range 1/2 (vector_len_dsp_adc1/2_int_reg, osc_amp_reg)
- ADC1/2 Raw (adc1/2_x_reg, adc1/2_y_reg)
- ADC1/2 Compensated (x1/2_o_dsp_int_reg and y1/2_f_dsp_int_reg)

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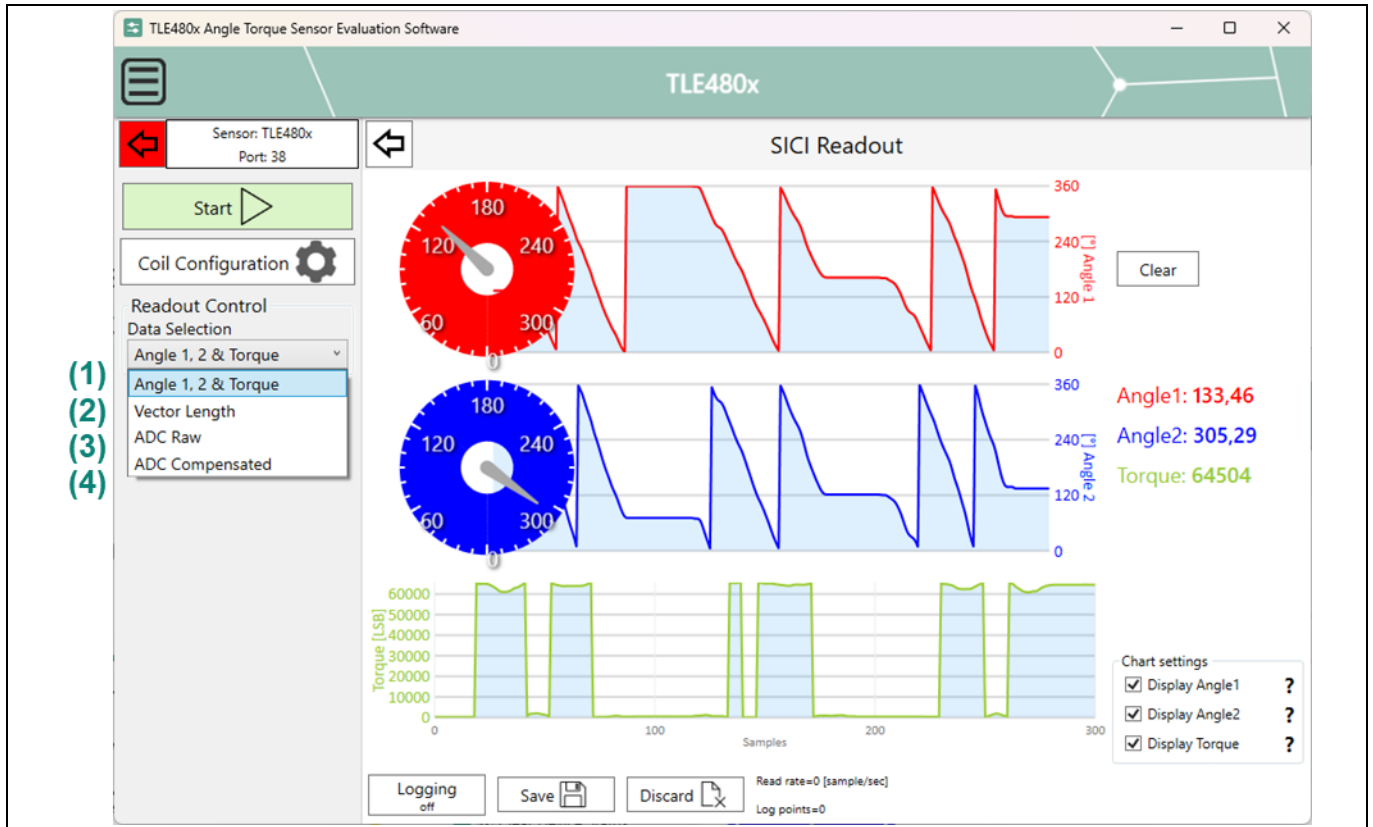


Figure 17 SICI Readout view

All received data can be logged in csv format. This contains raw and processed data. The software logs a maximum of 1 million frames. Logging data is kept between switching views. Sensor is put in test/programming mode upon selecting one of the configuration views (“SICI Readout Mode” or “Memory Map”). Test Mode is checked before issuing a reset command as to keep any volatile settings in case of configuration view change. The opened view contains the feature coil configuration for easy access of basic coil design settings.

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3.4.1 SICI Readout view – Angle 1/2 & Torque

This view displays, plots and logs the sensor's Angle1/2 & Torque DSP registers content:

- 2 angular gauges for Angle1/2 (and their cartesian projections). The displayed angle values are processed from raw register values in degrees, 360° range (1, 2)
- 1 cartesian chart for torque value. Value is displayed raw in [LSB] (3)
- Labels for displaying numeric values (4)
- The user can opt to disable any plot (this will not be displayed, but still logged in case this feature is enabled) (5)
- Plotted data can be cleared by pressing the “Clear” button (6)
- Data can be logged by enabling the toggle “Logging” button. This view logs in csv format all raw data for each register read and processed data (calculated angles) (7)

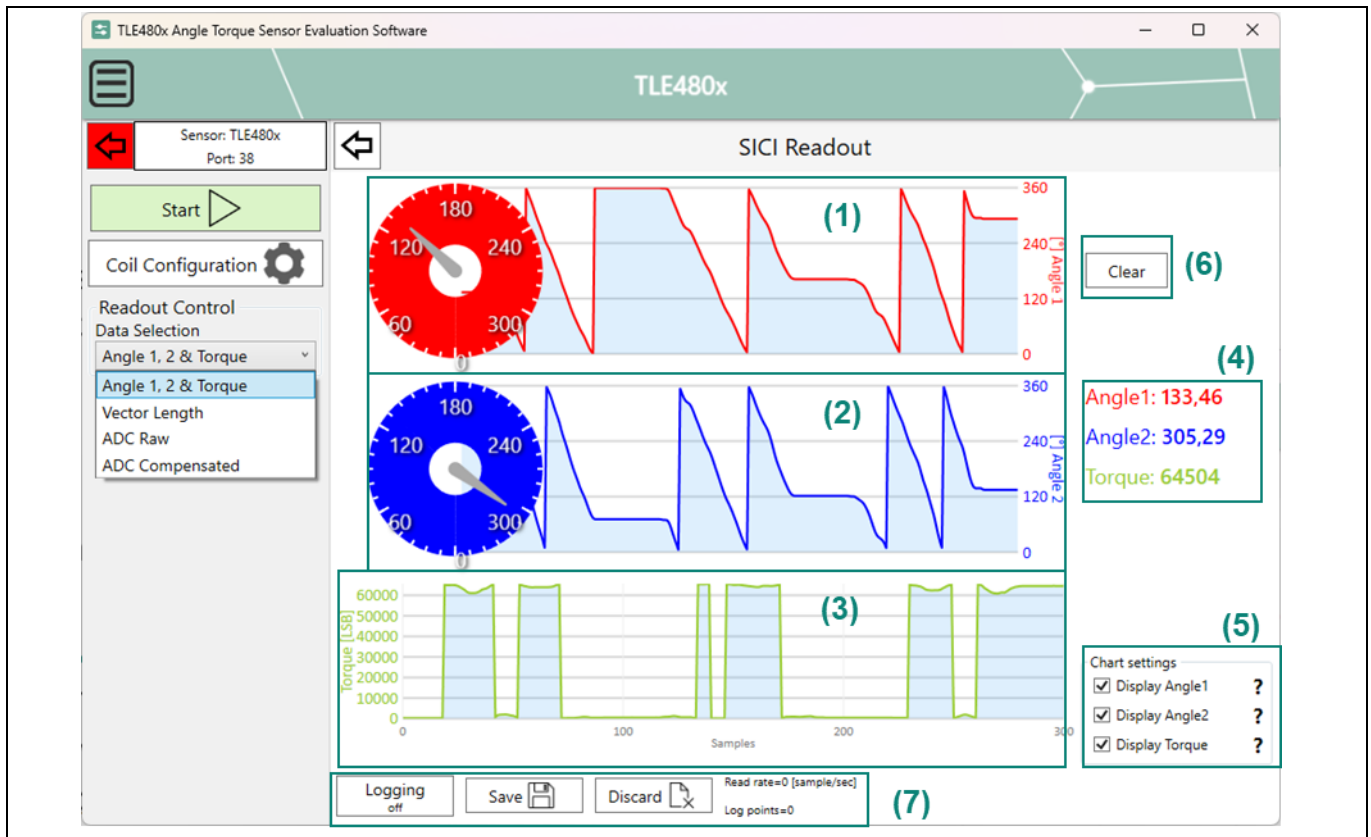


Figure 18 SICI Readout view, displays, plots and logs

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Evaluation software and system setup

3.4.2 SICI Readout view – Vector Length

This view displays, plots and logs the sensor's Vector Length1/2 & ADC1/2 Range registers content:

- 2 cartesian charts for ADC1/2 Vector Length + Range data pairs with different Y axis. Vector Length is displayed in [mV] and ADC Range in [LSB] + text decoding (1,2)
- Labels for displaying numeric and text values (3)
- Plotted data can be cleared by pressing the “Clear” button (4)
- Data can be logged by enabling the toggle “Logging” button. This view logs in CSV format all raw data for each register read and processed data (5)

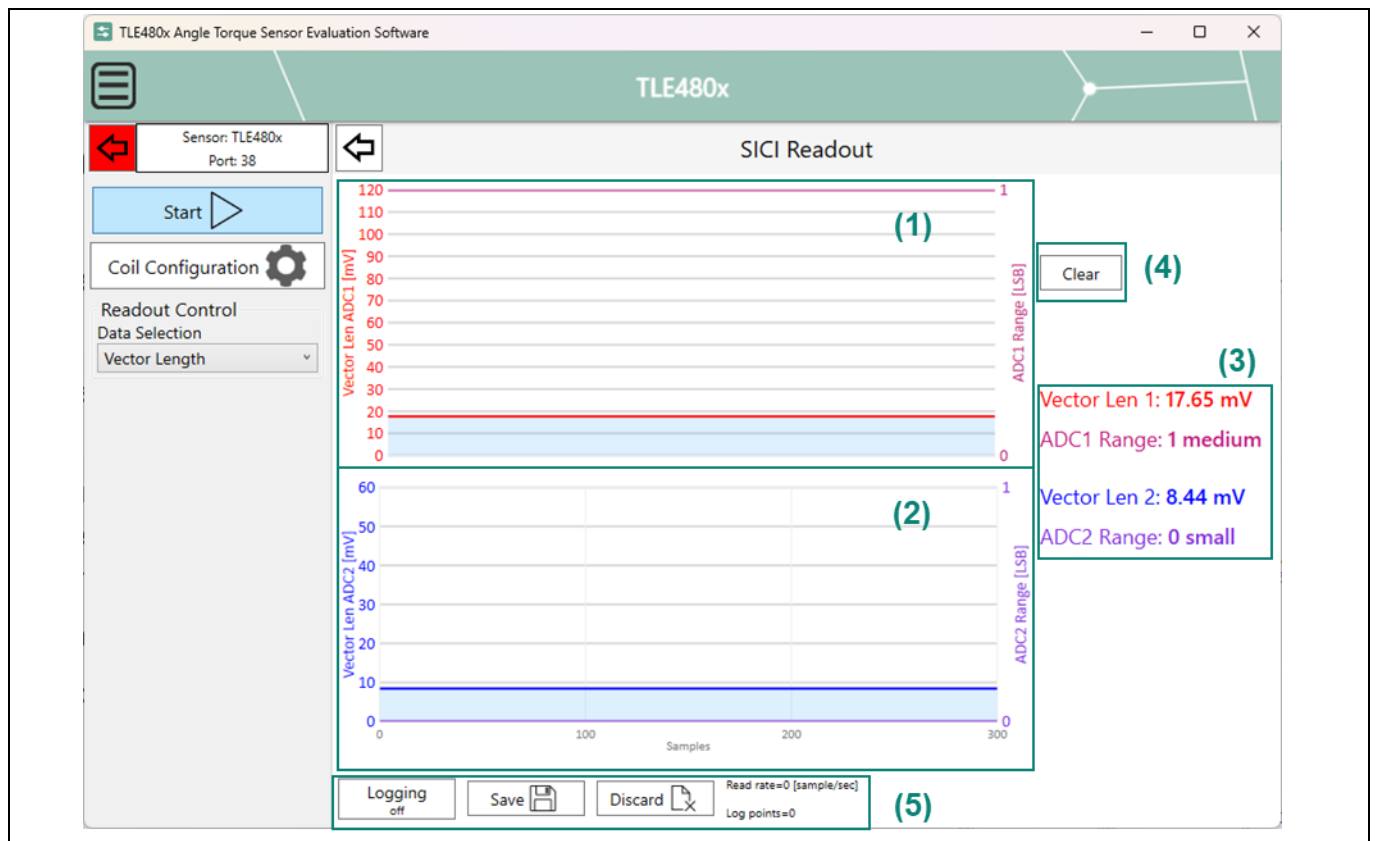


Figure 19 SICI Readout view, vector length

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Evaluation software and system setup

3.4.3 SICI Readout view – ADC Raw

This view displays, plots and logs the sensor’s raw uncompensated ADC1/2 X/Y registers content:

- 2 cartesian charts for ADC1/2 X + Y combined values (2 line series sharing the same axes). ADC X/Y are displayed in signed values [DEC] (1,2)
- Labels for displaying numeric values (3)
- Plotted data can be cleared by pressing the “Clear” button (4)
- Data can be logged by enabling the toggle “Logging” button. This view logs in CSV format all signed register values (5)



Figure 20 SICI Readout view, ADC Raw

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3.4.4 SICI Readout view – ADC Compensated

This view displays, plots and logs the sensor's offset and gain compensated ADC1/2 X/Y registers content:

- 2 cartesian charts for ADC1/2 X + Y combined values (2 line series sharing the same axes). ADC X/Y are displayed in signed values [DEC] (1,2)
- Labels for displaying numeric values (3)
- Plotted data can be cleared by pressing the “Clear” button (4)
- Data can be logged by enabling the toggle “Logging” button. This view logs in CSV format all signed register values (5)

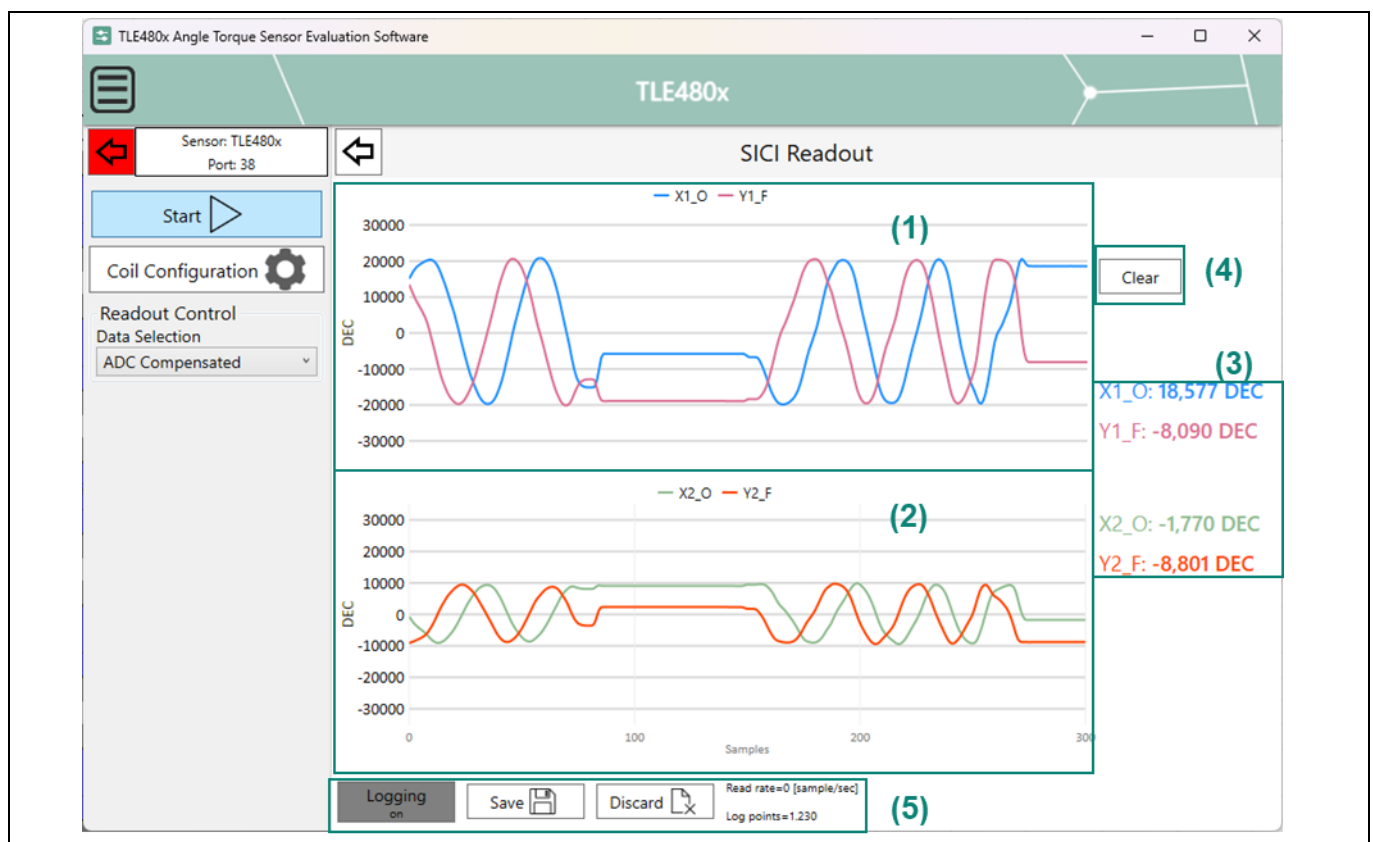


Figure 21 SICI Readout view, ADC compensated

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3.4.5 SICI Readout view – Coil Configuration Window

This window is accessible by pressing the corresponding button in the control panel (1). This window offers ease of access to the “Coil Configuration” parameters:

- Number of poles for ADC1/2 (2)
- Inversion of mechanical angle (3)
- Direction change of angle1/2 value (4)
- Security feature disable (!*Valid only for TLE4802) (5)

To activate the settings or read the settings from CMTP, the buttons for Read, Write, Power-On Reset (6) are available:

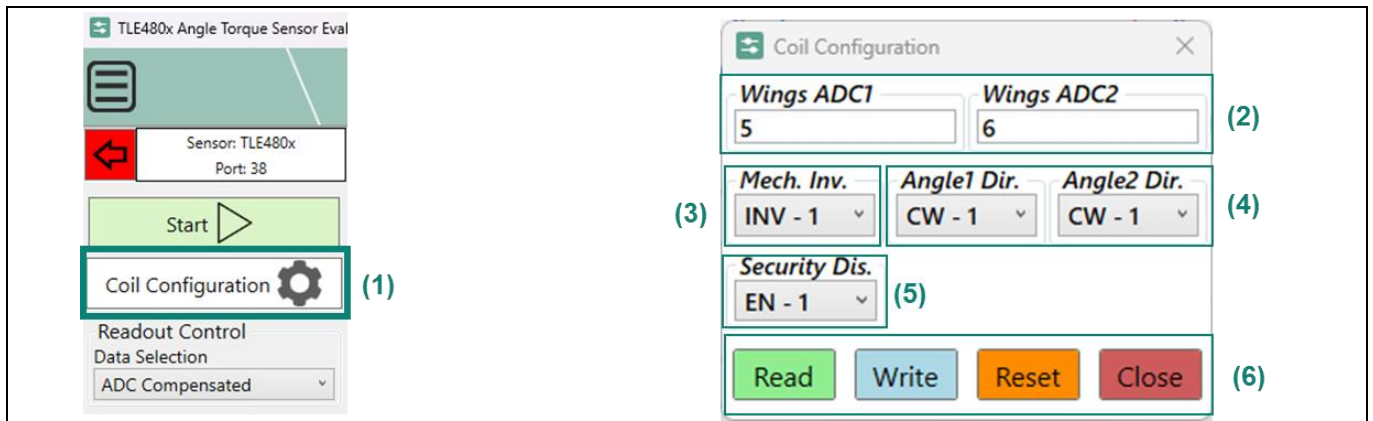


Figure 22 SICI Readout view, coil configuration window access and features

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3.5 Memory Map View

3.5.1 CMTMP memory map

The application in the memory map view can read CMTMP memory and internal registers. The CMTMP memory contains addresses [256 ... 316] including IFX exclusive addresses. The user may write only in the addresses [273 ... 307]. As the CMTMP is limited in writing cycles, the remaining writing cycles are displayed in the CMTMP memory map view. For details please refer to the user manual.

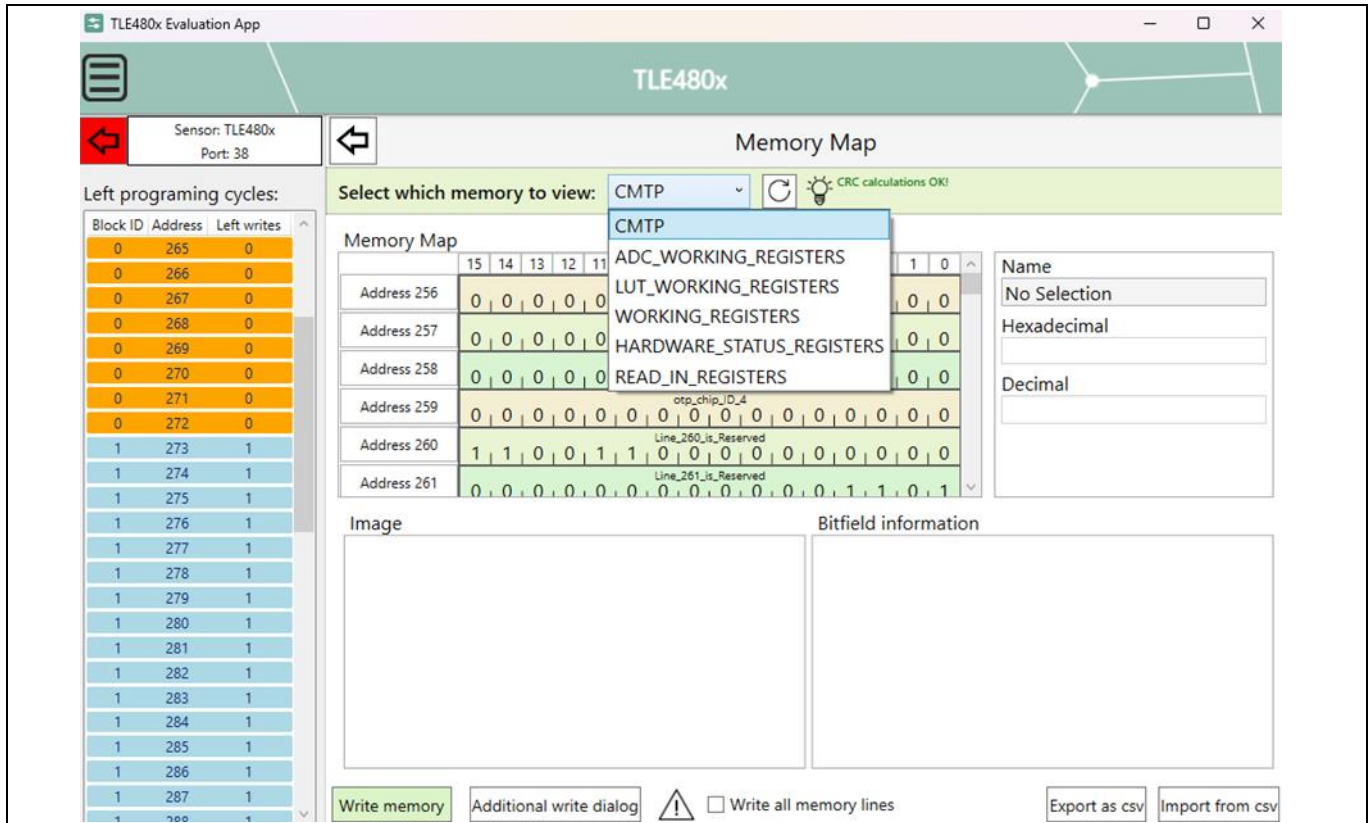


Figure 23 Memory map view, CMTMP

To write the address of interest, the user needs to select a bit field (1) in the address of interest and writes the content in either hexadecimal or decimal (2). After filling the desired addresses, “Write memory” needs to be clicked (3). To allow entering the Readout mode, the software checks if the CMTMP was written at least once. If this is true, only changed lines will be written. If not, all lines will be written. The user has the option overwrite this option using the checkbox.

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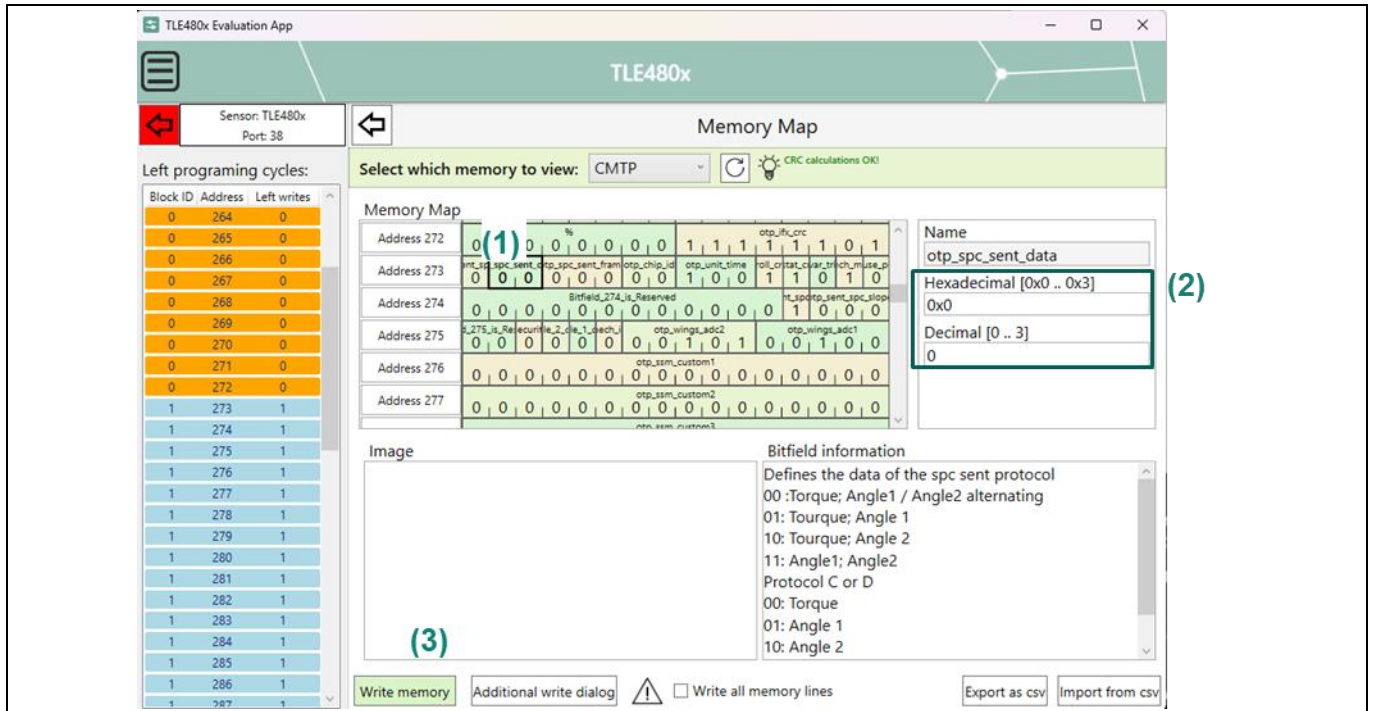


Figure 24 Memory map view, CMTTP writing procedure

The current memory configuration (as seen in the map view) can also be exported as a csv file by clicking “Export as csv”. Further a corresponding memory configuration file (csv format) can be imported for writable Memory Maps by clicking “Import from csv”. This is useful for writing full configurations of the sensor.

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3.5.2 Internal registers

The software can read the internal registers, which are grouped by category like shown in the figure below.

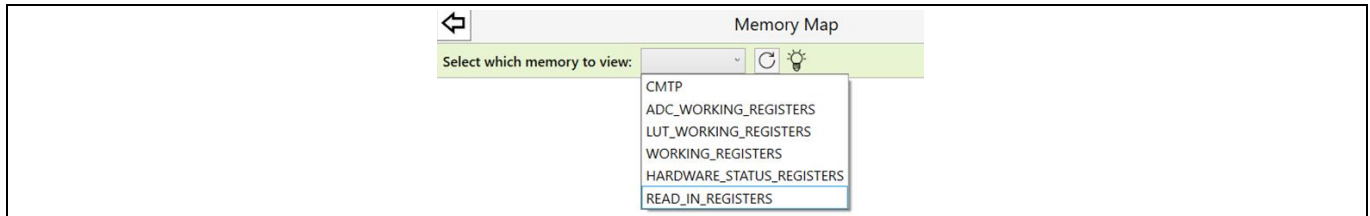


Figure 25 Memory map view, internal register grouping

All registers are implemented as read-only except the “READ_IN_REGISTERS”. These can be programmed via SICI and only the normal 5 V voltage level is applied. This way it is possible to fine tune values and to read via SICI the raw values or angular digital values through the working registers afterwards. After reset, in contrast to the CMTMP section, the values programmed here through SICI are again filled with the CMTMP values.

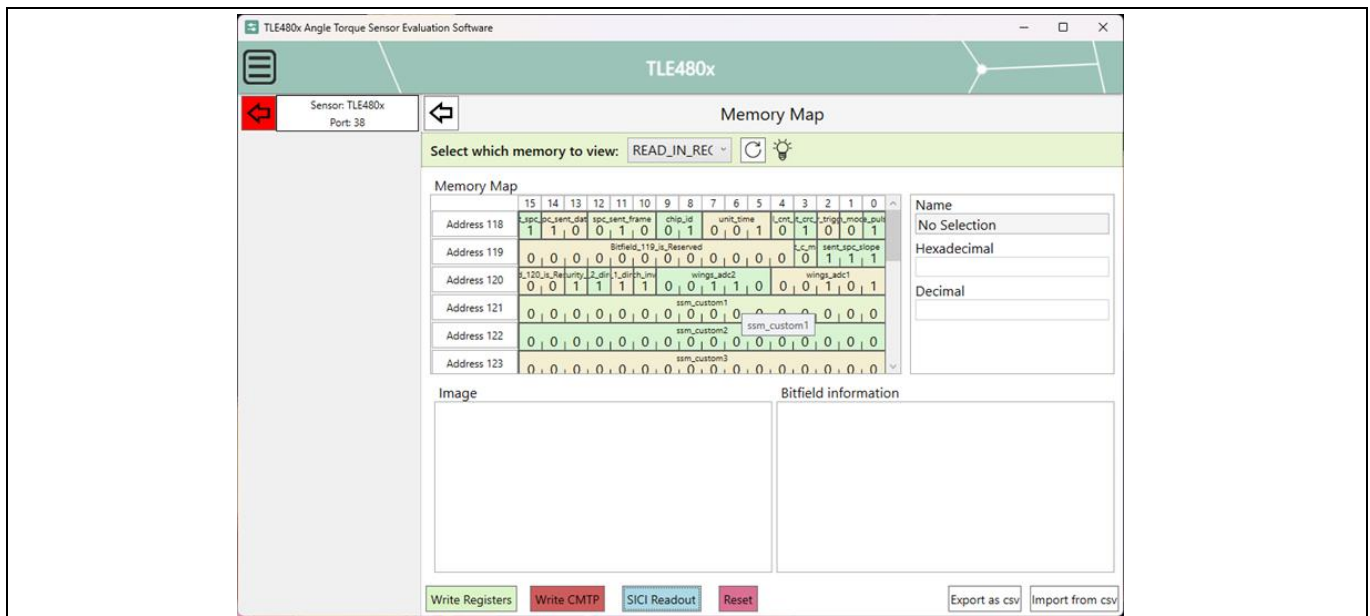


Figure 26 Memory map view, READ-IN-REGISTERS

In the Read In Registers view the user can fine tune the values and:

- Write the Read In Registers with the new values
- Write the CMTMP with the Read In Registers configuration (Only the changed lines will be written)
- Start a continuous readout of Working Registers for calibration purposes
- Reset the Read In Registers with the CMTMP values
- Export as csv. Here the user must select two options:
 - Read In Registers CSV format
 - Read In Registers converted to CMTMP CSV format

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Revision history

Revision history

Document revision	Date	Description of changes
1.0	2025-07-15	Initial release

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