XENSIV™ TLE4978 current sensor evaluation boards

User guide

About this document

Scope and purpose

This evaluation board user guide describes the hardware and software functionalities of XENSIV™ TLE4978 current sensor Evalkits.

Intended audience

This document is intended for design engineers, technicians, and developers of electronic systems involved in the evaluation of the XENSIV™ TLE4978 current sensor.

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.

Safety precautions

Note: *Please note the following warnings regarding the hazards associated with development systems*

Table 1 Safety precautions

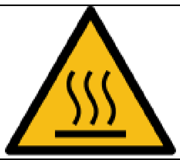
	**Warning:** *The sensor device on the sensor board provides only functional isolation, the user has to take care for proper voltage isolation between high voltage and low voltage domain to be protected against injury or death. The customer assumes all responsibility and liability for its correct handling and/or use of the evaluation board and undertakes to indemnify and hold Infineon Technologies harmless from any third party claim in connection with or arising out of the use and/or handling of the evaluation board by the customer.*
	**Warning:** *It has to be considered that an additional isolation has to be added to the evaluation board by the operator to protect the user against hazards caused by high voltage. Infineon do not provide any isolation to protect human lives against high voltage on this sensor board. The responsibility is up to the user to install a proper isolation between the sensor board and the user interface. Failure to comply may result in personal injury or death.*
	**Caution:** *The sensor on the evaluation board may become hot during sensing operation. Hence, necessary precautions are required while handling the board. Failure to comply may cause injury and / or equipment damage.*
	**Caution:** *The design operates with unprotected high voltages. Therefore, only personnel familiar with power electronics high voltage applications and associated machinery should plan or implement the installation, startup and subsequence maintenance of the senor board in a high voltage environment. Failure to comply may result in personal injury and/or equipment damage.*
	**Caution:** *The sensing board using TLE4978 contains parts and assemblies sensitive to electrostatic discharge (ESD). Electrostatic control precautions are required when installing, testing, servicing or repairing the assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with electrostatic control procedures, refer to the applicable ESD protection handbooks and guidelines.*
	**Caution:** *A drive or load that is incorrectly applied or installed can lead to component damage or reduction in product lifetime. Wiring or application errors such as undersizing the motor, supplying an incorrect or inadequate AC supply, or excessive ambient temperatures may result in system malfunction.*

Table of contents

1 Getting started

The XENSIV™ TLE4978 is a high-bandwidth, high-precision, automotive, coreless current sensor with analog output, over-current detection (OCD) and zero crossing detection (ZCD) features.

The following sections describe the different parts of the TLE4978 Current Sensor Evaluation kit, hardware connection, software installation and clarifies how to use the graphical user interface (GUI) in order to perform the first evaluation of the sensor in a particular application. The TLE4978 Evaluation kit shall be used at low voltages, as instructed in the safety precautions section. The current sensor provides galvanic isolation. Please consider the safety precautions for high voltage applications as described in the enclosed disclaimer document provided with the delivered sensor kit.

1.1 Evaluation kit hardware

This section describes the required hardware and the installation of the software components of an Evaluation Kit package.

1.1.1 Content

This evaluation kit package consists of the following components:

- TLE4978 evaluation board (TLE4978 EVAL 40A, TLE4978 EVAL 50A or TLE4978 EVAL 60A)
- Current Sensor Programmer Shield
- XMC1100 Bootkit (KIT_XMC11_BOOT_001)
- Ribbon cable

Figure 1 depicts the content of the TLE4978 evaluation kit (EVK). Please note that this picture is generic and the latest variant may suffer modifications.

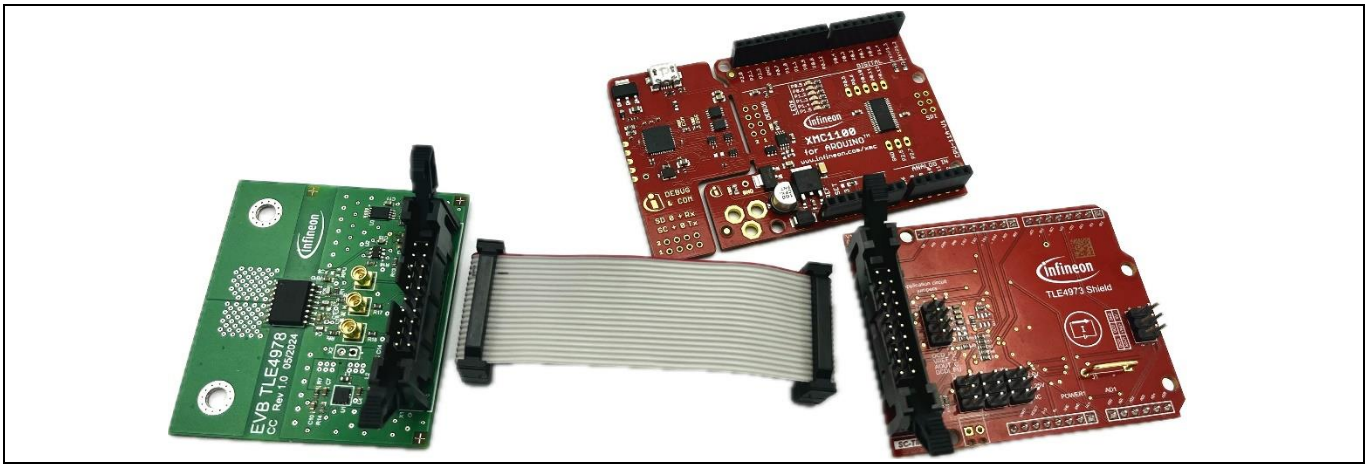


Figure 1 TLE4978 EvalKit components

1.1.2 Connection guide

The software supports connecting a sensor located in a custom setup. A setup that uses either one or three TLE4978 sensors can be detected by the software. In either of the two cases, please make sure to also add the components from the application circuit:

- 220 pF capacitor on AOUT,
- 220 nF capacitor on VDD,
- 4.7 kΩ pull-up resistor on DCDI or populate DCDI_PU jumper on shield.

Pin number	Description
1-4	IP+
5-8	IP-
9	ZCD
10	VDD
11	GND
12	RES
13	AOUT
14	OCD
15	DCDI/ OCD_THR
16	NC

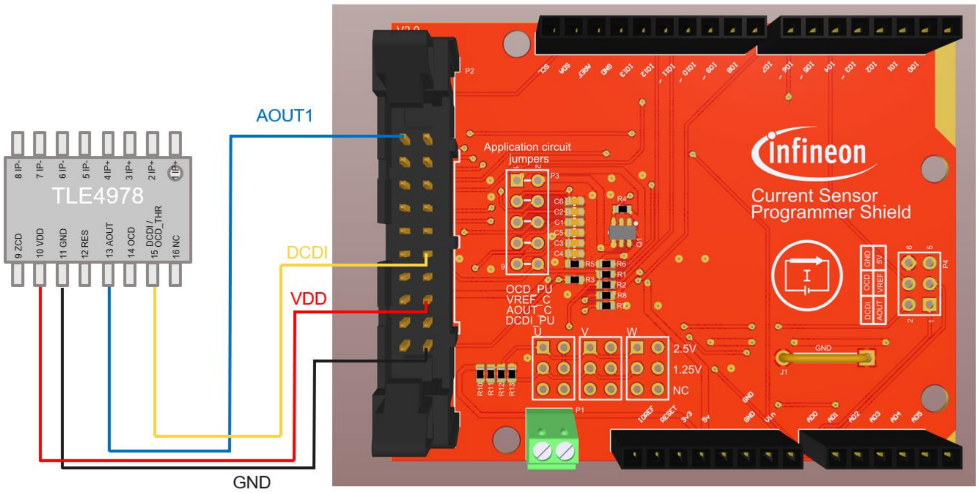


Figure 2 One TLE4978 sensor connection

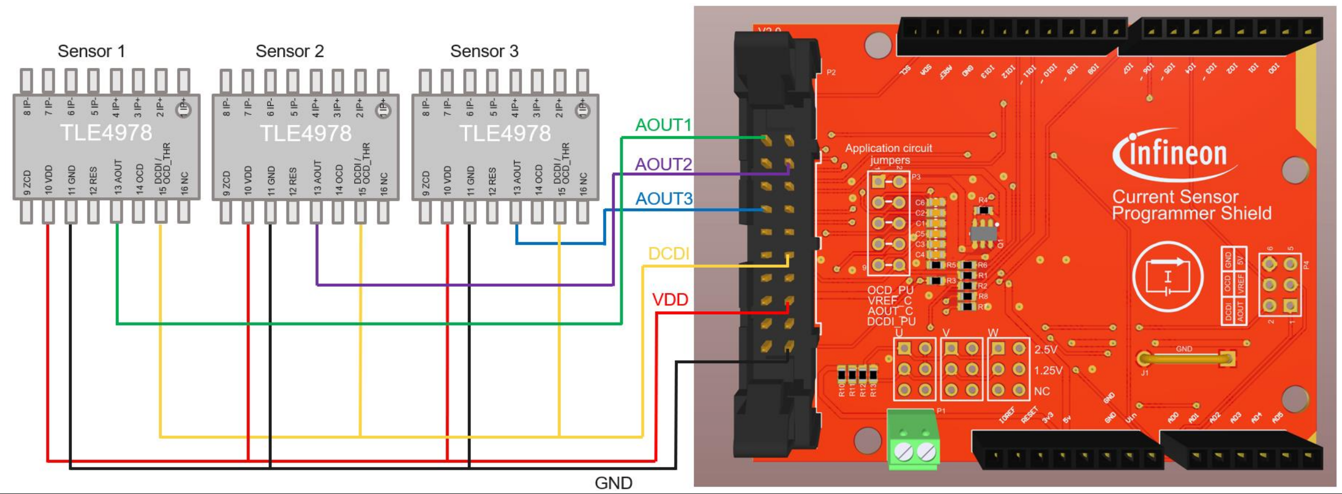


Figure 3 Three TLE4978 sensors connection

Note: For custom setups, please make sure to use "TLE4978 Three-Phase" in the initialization wizard, since the default "TLE4978 One-Phase" mode expects an LDO, analog multiplexer and feedback voltage. The Three-Phase mode doesn't require any additional components except the ones from the application circuit. It works with one, two or three sensors.

1.1.3 Hardware design

This section offers a detailed description of the hardware design Rev1.2 of the TLE4978 evaluation board (EVB).

The hardware is composed of the following main blocks:

- **Application circuit:** consisting of the following components:
  - The TLE4978 sensor – powered by a Buck-Boost converter.
  - TS5A3159QDBVRQ1 analog multiplexer, used to switch the OCD_THR pin's function between OCD Threshold Voltage and DCDI communication pin.
  - Low-Pass filter on the AOUT line.
- **Power supply:** the TPS63002 Buck-Boost converter is used for supplying a steady 5V to the sensor. The input voltage comes directly from the USB.
- **External EEPROM:** the M24C02-WDW6TP I²C EEPROM is used on the EvalBoard to store sensor information like name, package and range.
- **Current Sensor Programmer Shield:** used to connect the TLE4978 EVB to the XMC1100 Bootkit. Also contains jumpers that can be used to connect the sensor without the other components present on the EvalBoard. An additional PMOS transistor can also be used to control sensor power when the Buck-Boost converter isn't present.
- **Target microcontroller:** the main microcontroller is an XMC1100, TSSOP38 package, 64 kB of flash. This device handles the communication with the sensor and data forwarding to USB via the debugger.
- **On-board debugger:** the XMC1100 Bootkit board features a debugger implemented via an XMC4200 microcontroller. This auxiliary microcontroller features a debug probe firmware delivered by SEGGER – Jlink. This debugger is used for flashing the target microcontroller and for establishing a serial communication via USB.

1.1.4 Schematics

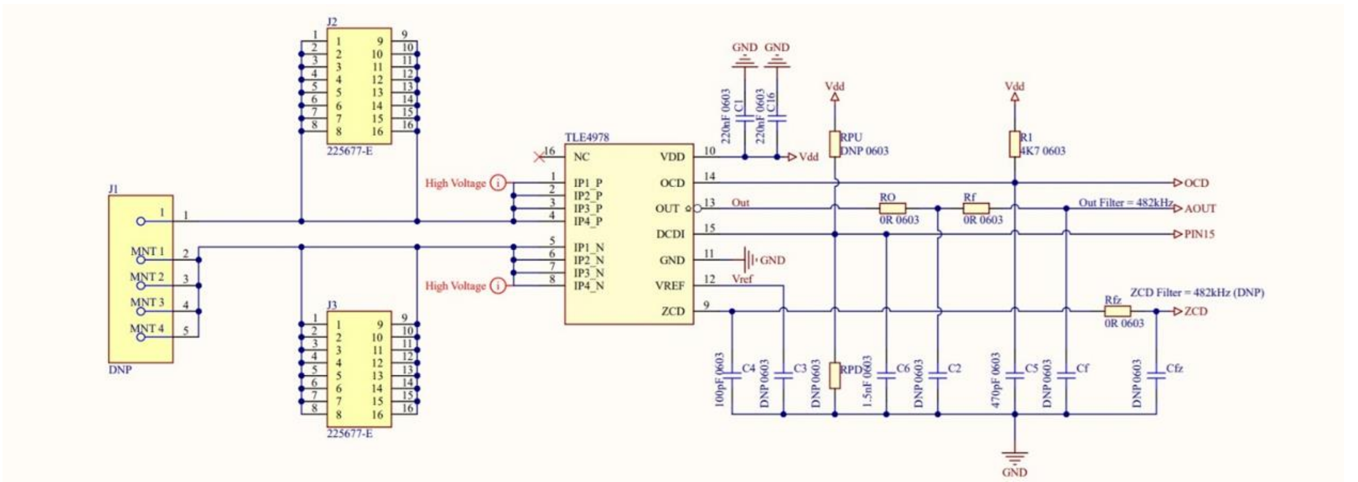


Figure 4 Application circiuit

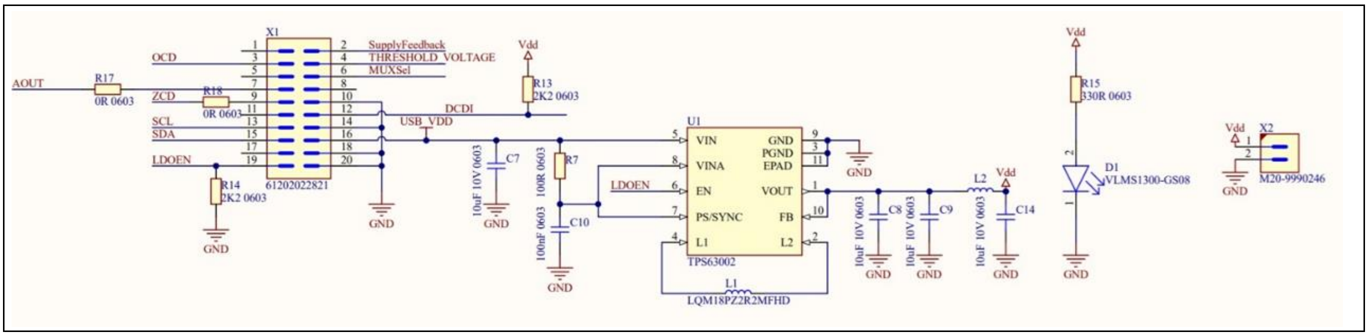


Figure 5 Connector and LDO

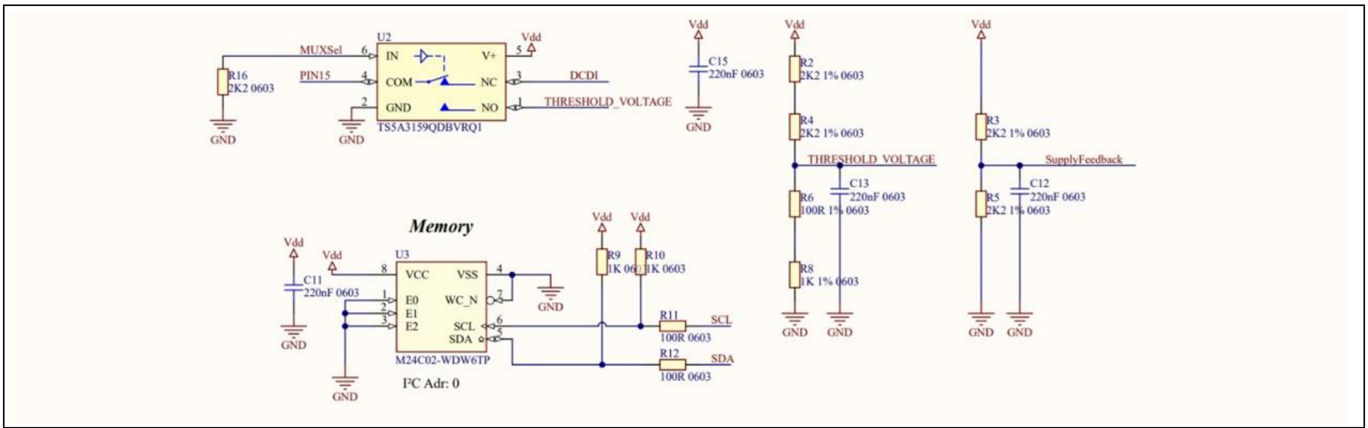


Figure 6 Analog multiplexer and external EEPROM

The connector X1 is described below (Figure 7) and may be used for debugging, probing or connecting additional hardware.

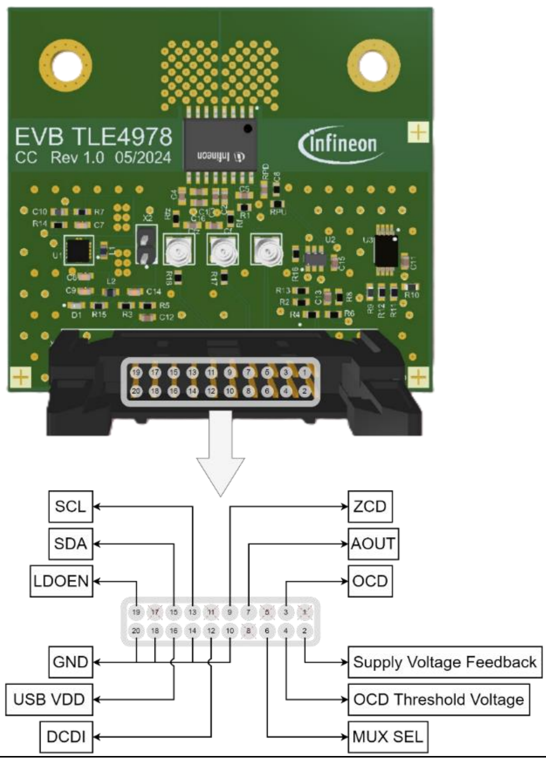


Figure 7 TLE4978 evaluation board connector pinout

The external EEPROM uses the '**SCL**' and '**SDA**' pins. '**LDOEN**' is used by the Buck-boost converter that takes the USB voltage from '**USB VDD**' and regulates it at 5 V. '**AOUT**', '**OCD**', '**ZCD**' and '**DCDI**' are used directly by the sensor. '**MUX SEL**' is used by the analog multiplexer to switch the sensor's DCDI pin between OCD threshold and DCDI communication pin, depending on the sensor's operating mode. The OCD threshold voltage comes out of a voltage divider (~1 V) and is also on the connector, so it can be measured and displayed in software. '**Supply Voltage Feedback**' is the output voltage of the Buck-boost converter, which is also measured and displayed in software.

1.1.5 PCB layout considerations

The design described in Section 0 is physically implemented in PCB technology using a standard process with following characteristics:

- PCB material: FR4
- PCB thickness: 1.6 mm ±10%
- Copper: 2 layers Top/Bottom, 35 µm thickness

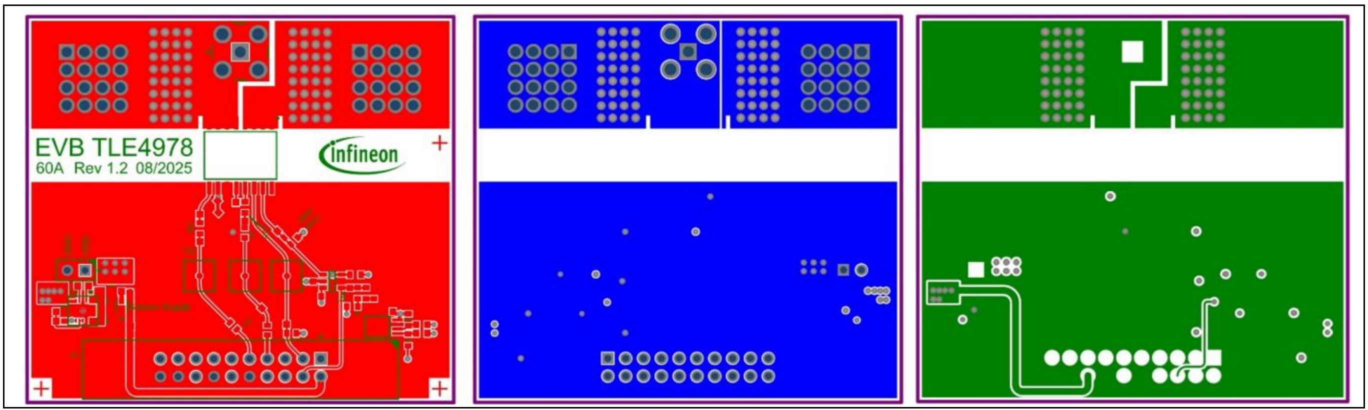


Figure 8 TLE4978 evaluation board PCB layout details

1.1.6 Bill of materials

The complete bill of material (BOM) is available on the download section of the Infineon homepage. A log-in is required to download this material.

Table 2 BOM of the most important/critical parts of the evaluation board

Qty.	Ref Designator	Description	Footprint	Populated
6	C1, C11, C12, C13, C15, C16	220nF 0603	GCM188R71H104KA57J, CAPC1608X90N-3	Yes
6	C2, C3, Cf, Cfz, RPD, RPU	DNP0603	CAPC1608X90N-4, CAPC1608X90N, RESC1609X50N	No
1	C4	100pF0603	CAPC1608X90N	Yes
1	C5	470pF0603	CAPC1608X90N	Yes
1	C6	1.5nF0603	CAPC1608X90N	Yes
4	C7, C8, C9, C14	10uF10V0603	CAPC1608X120N	Yes
1	C10	100nF0603	CAPC1608X87N	Yes
1	D1	VLMS1300-GS08	FP-6_541-5092_01-4-MFG	Yes

Qty.	Ref Designator	Description	Footprint	Populated
1	J1	DNP	FP-142-0701-201-MFG	No
2	J2, J3	225677-E	225677E	Yes
2	L1, L2	LQM18PZ2R2MFHD	INDC1608X95N_LQM18P_FR	Yes
3	MMCX_OCD, MMCX_Out_Flt, MMCX_ZCD	734152061	CON-SMA-734152061	Yes
1	R1	4K7 0603	RESC1609X50N	Yes
4	R2, R3, R4, R5	2K2 1% 0603	RESC1608X55N-1	Yes
1	R6	100R 1% 0603	RESC1608X55N-1	Yes
3	R7, R11, R12	100R 0603	RESC1608X55N-2	Yes
1	R8	1K 1% 0603	RESC1608X55N-1	Yes
2	R9, R10	1K 0603	RESC1608X55N-6	Yes
3	R13, R14, R16	2K2 0603	RESC1608X55N-1	Yes
1	R15	330R0603	RESC1608X55N-2	Yes
5	R17, R18, Rf, Rfz, RO	0R0603	RESC1609X50N, 1608[0603], RESC1608X55N-1	Yes
1	TLE4978	TLE4978	SOIC127P1030X265-16N-4	Yes
1	U1	TPS63002	SON50P300X300X100-11N-1-V	Yes
1	U2	TS5A3159QDBVRQ1	SOT95P280X145-6N-6	Yes
1	U3	M24C02-WDW6TP	SOP65P640X120-8N-1	Yes
1	X1	61202022821	CON-M-THT-61202022821	Yes
1	X2	M20-9990246	CON-M-THT-M20-9990246	Yes

1.2 Software installation

1.2.1 Requirements

The TLE4978 Evaluation Software was developed and tested on the following PC configuration:

- Operating system: Windows 10 64-bit / Windows 11 64-bit (also supports Windows 7)
- RAM: 8 GB (maximum RAM usage estimated at around 150 MB when data logging is on)
- Storage: 512 GB (minimum required for installation: 250 MB, including dependencies)
- CPU: 3.00 GHz, 4 cores (lower performance CPUs may suffer from performance issues)

1.2.2 Software download

The graphical user interface software is offered free-of-charge on our website, via the the Infineon Developer Center online platform, section tools, or from the Infineon Developer Center Launcher. The user may filter the tool list by inserting the text “Current Sensor” or “TLE4978” and the following record shall appear: **XENSIV™ TLE4978 Current Sensor Evaluation App.**

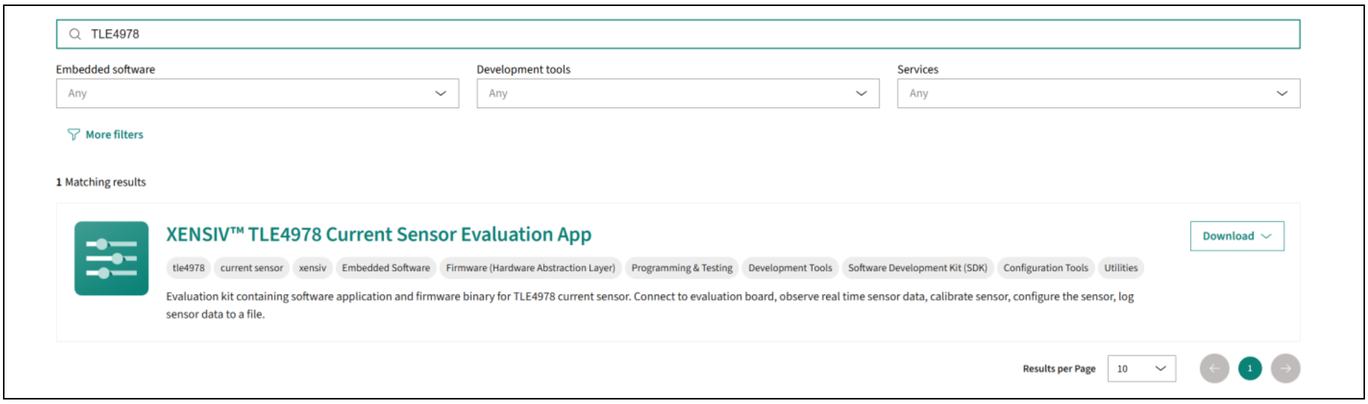


Figure 9 Infineon Developer Center: Download software

It is highly advised to install the Infineon Developer Center Launcher application prior to installing the above mentioned app.

Please note that the download of the *XENSIV™ TLE4978 Current Sensor Evaluation App* is only open for users registered with a MyInfineon account.

1.3 Software installation

Download the **XENSIV™ TLE4978 Current Sensor Evaluation App** from Infineon Website or from Infineon Developer Center Launcher. Install the Evaluation Kit software by double clicking on the installer file. Please notice that administrator rights are required.

The installer file contains the following elements:

- Binaries/compiled objects needed for running the gpahical user interface
- SEGGER JLink Driver for establishing a serial port communication with the on-board debugger
- .NET 4.8 online installer (needed only for older versions of Windows which do not have this already installed). Installation requires a stable internet connection.

Installation steps

1. License agreement. It is required that you agree with Infineon Terms and Conditions before continuing.

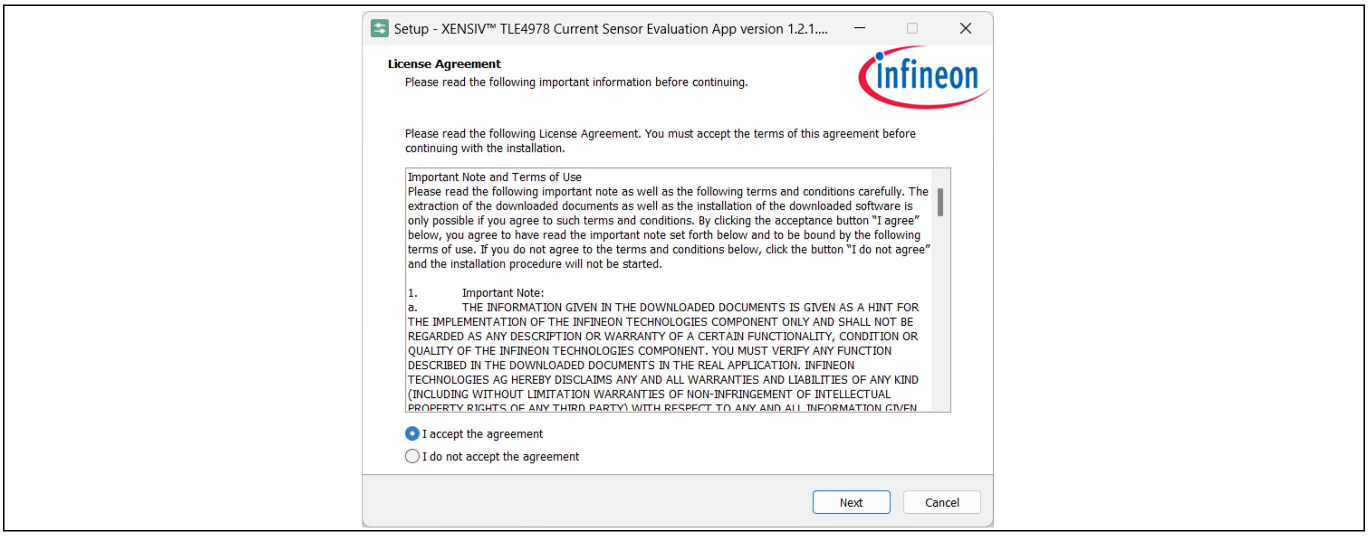


Figure 10 Software installation: License agreement

2. Installation type selection. We recommend using the Quick Installation type. After pressing “**Install**”, the installation process will begin.

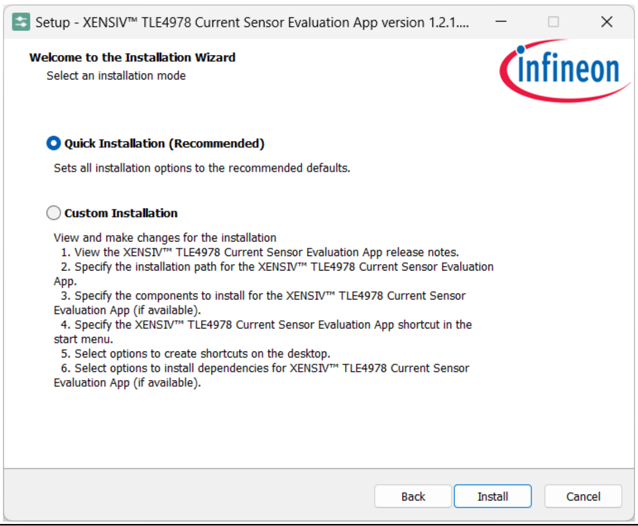


Figure 11 Software installation: Quick installation

3. After the binaries are copied to the installation folder, the user is prompted to install the SEGGER JLink Driver. If this is already installed, the user can opt out of installing it again. Please note that by not having this driver installed, the USB connection between the PC and the TLE4978 Evalkit board will not be possible.

Figure 12 Software installation: SEGGER J-Link driver

4. After the SEGGER JLink driver is installed, the user is prompted to install .NET Framework 4.8.

Note: Please note that this version of .NET Framework comes pre-installed on versions of Windows starting with Windows 10 build 1903 (released May 2019). If this is the case, the user will be informed that it’s already installed. Otherwise, the installation will proceed if there is an active internet connection.

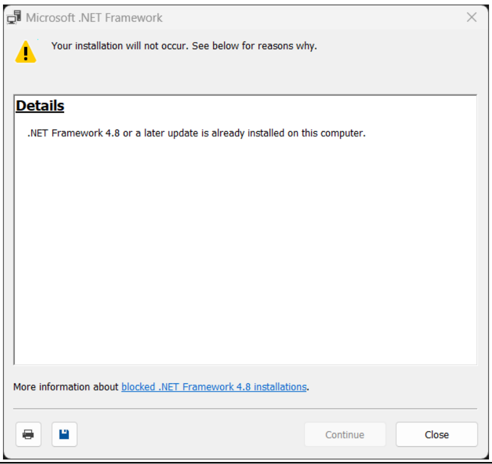


Figure 13 Software installation: .NET 4.8 installation

The user is notified upon completion of all installer processes and a shortcut is created on the Desktop by default. The user can choose to run the program after the installation.

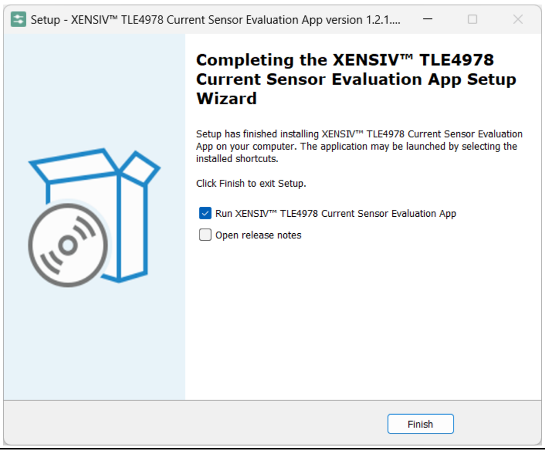


Figure 14 Software installation: Complete

1.4 Software uninstall

In order to uninstall the software package, go to '**Start**' → '**Add or remove programs**' and search for the *"XENSIV™ TLE4978 Current Sensor Evaluation App"*. Press '**Uninstall**' in order to delete the software from the PC.

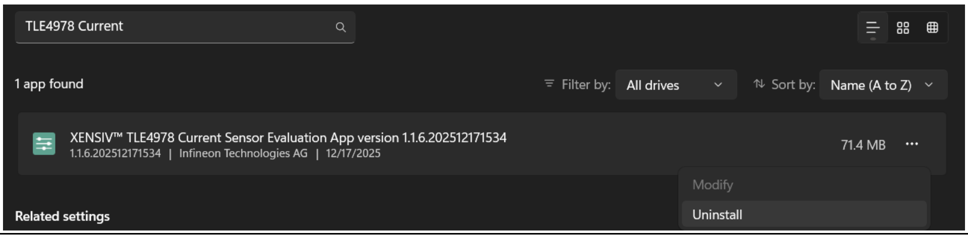


Figure 15 Software uninstall

All installation files are deleted from the system, except:

- SEGGER JLink driver, which can be uninstalled separately, if needed.
- .NET 4.8 dependencies, which are part of the operating system in most cases.

2 Using the evaluation software

This chapter describes all the features and their usage on the *XENSIV™ TLE4978 Current Sensor Evaluation App* in correlation with the TLE4978 EVB. Please make sure that the EvalBoard is attached to the Current Sensor Programmer Shield and XMC1100 Bootkit board via the ribbon cable.

2.1 Startup screen and connecting to the programmer

Figure 16 depicts the default screen of the *TLE4978 Current Sensor Evaluation App* after startup.

The graphical user interface software will monitor all USB ports and check if any connected device matches the signature of the TLE4978 EvalKit. If a match is found, a new device will appear as depicted in Figure 16. By selecting the device, the software will connect and flash the correct firmware version to the target microcontroller if it is out of date. Otherwise, the connection will be established using the firmware version already present on the selected board.

Note: You can flash the firmware forcefully by going to 'Settings' (menu button in the top left corner) and checking "Always update firmware (irrespective of current version)"

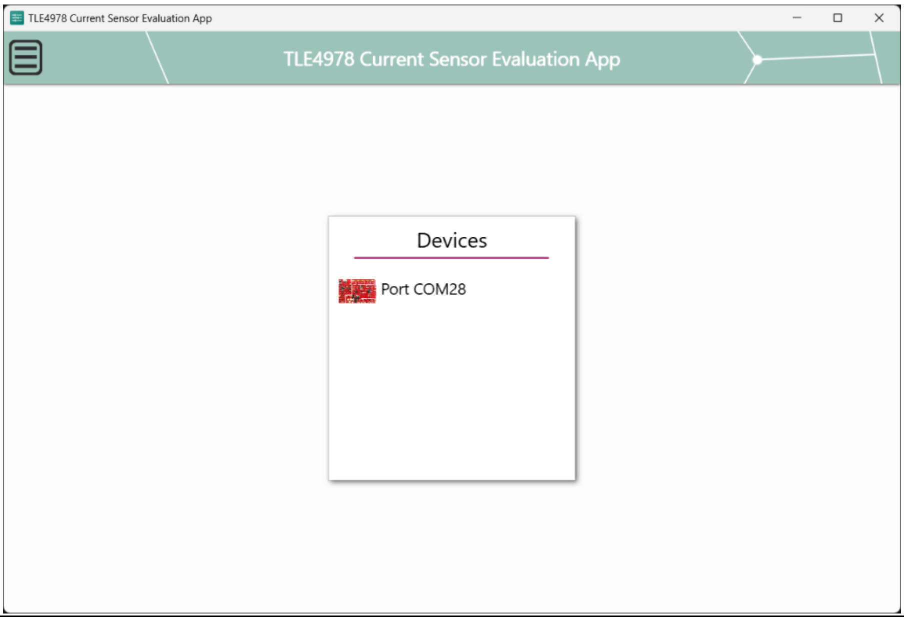


Figure 16 Software usage: Startup screen

Upon connecting to the board, the software will display the view described in chapter 2.2. The sensor range and sensitivity will be recognized automatically and the scaling in the "Current Readout" view (chapter 2.3.1) will be adjusted accordingly.

2.2 Initialization wizard

If the EvalBoard's external EEPROM has been previously burned with the correct configuration, the software will proceed to showing the main menu. Otherwise, an initialization wizard will pop up allowing the user to select from a predefined list of possible configurations, as depicted in Figure 17.

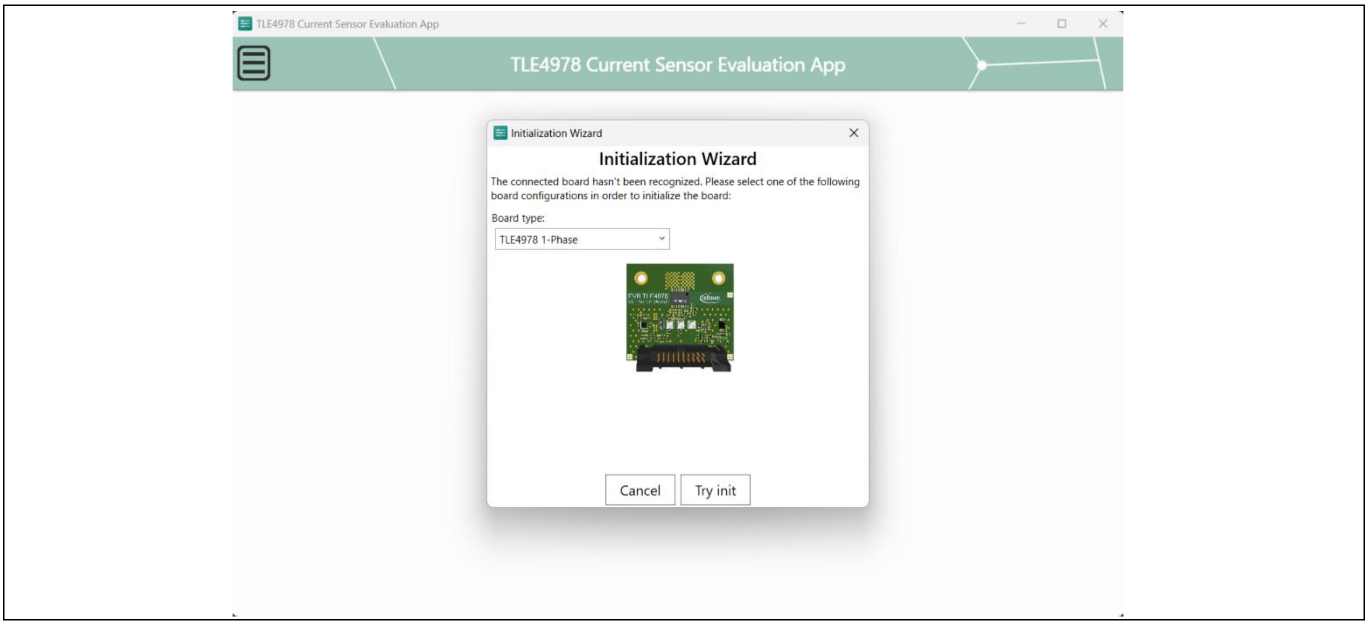


Figure 17 Initialization wizard

Clicking on the "***Board type***" dropdown will show the possible board configurations:

- TLE4978 1-Phase – the EvalKit used in this user guide
- TLE4978 3-Phase – custom setup with one, two or three sensors

Upon choosing a configuration, the software will also check if the connected board meets the required conditions. Some configurations require a DCDI pull-up jumper placed on the shield, and other boards require a transistor for toggling power. The software will inform the user if these conditions are not met. If no errors appear, the user may proceed with using the software.

2.3 Main window and scenarios

Once the board is connected, the graphical user interface changes and it is shown in Figure 18. The software GUI is split in two sections:

- **Sensor controls:** situated on the left panel. The user can disconnect from the board or control the sensor. If a scenario is entered, different buttons and controls will appear here.
- **Main section:** situated on the right panel. You can select different scenarios and interact with them or return to the main screen. This panel isn't meant to interact with the sensor directly.

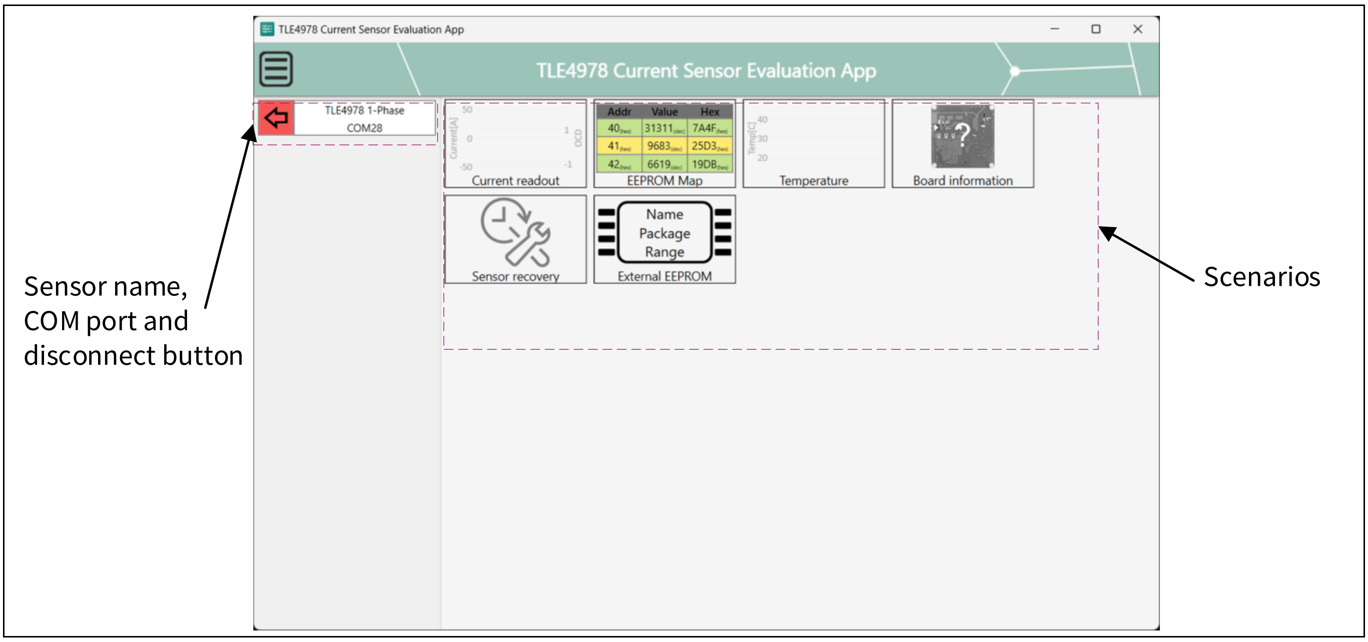


Figure 18 Software usage: Main screen

2.3.1 Current readout

The main function of the sensor is current readout. In the software, the value of the current is displayed on a chart, along with the status of OCD (over-current detection) and ZCD (zero cross detection) pins.

The panel on the left allows the user to start or stop the readout. This only enables or disables continuous readout between the PC and the microcontroller, as the sensor is always sending data on AOUT. OCD and ZCD status is also displayed in the panel on the left:

- If the circle is green: the pin is inactive, meaning that it is at its default status (HIGH for OCD and LOW for ZCD)
- If the circle is red: the pin is active (OCD goes LOW and ZCD sends a HIGH pulse)
- If the circle has no color: readout is off.

The controls panel (left) allows the user to start or stop readout, change readout frequency or average and observe OCD and ZCD status. The XMC's ADC is sampled at 20kHz. The user can choose how many samples to make an average on before sending it to the software. Then, the user can also pick the maximum frequency.

Example

250 Hz and 64 average points. The averaging window is 64 samples wide, so a value is sent to the software at a frequency of 20000 / 64 = 312.5 samples per second (ADC sample rate is 20kHz). The user also selected 250 Hz max frequency, so the actual readout rate will be 250 samples per second.

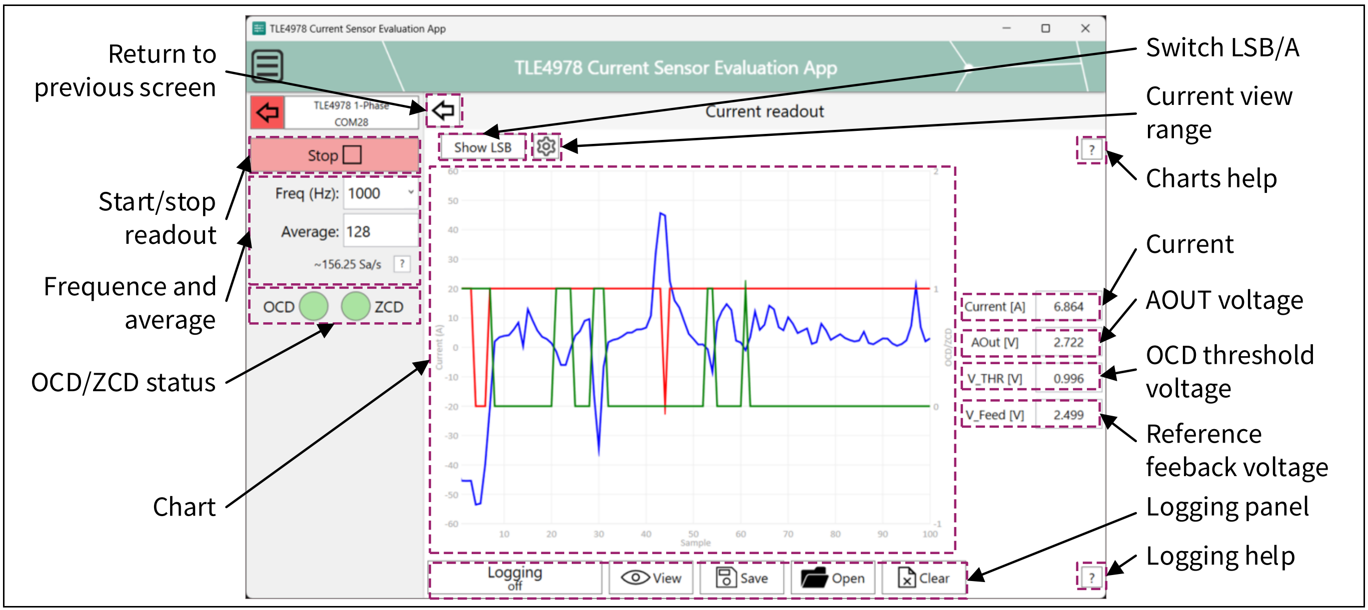


Figure 19 Software usage: Current readout

- The user can switch current units between LSB and A (Amperes). This changes the unit for the chart, but also for the values on the right:
- **AOut:** voltage of AOUT, either in LSB or V (Volts).
- **VRef:** LDO reference voltage, used to calculate the current in A.
- **Current value:** always in A. The value of the current in LSB will be the same as AOut in LSB.
- **VThr:** OCD threshold voltage → the voltage at which the OCD pin goes LOW.

The chart shows the value of the current in the selected unit of measurement, along with the status of OCD and ZCD pins. The chart automatically scales to higher current values. The settings button allows changing the chart limits to custom ones. Sensor readings are enabled by default when the user enters the scenario.

2.3.2 Sensor data logging

The logging feature is useful when capturing an event is needed, along with some samples before and after the event. Logging is enabled by clicking the first button labeled '**Logging**'. Doing this changes the small text underneath from 'off' to 'on' and the color of the button to red. Clicking the button again disables logging.

Other buttons in the logging panel:

- **View:** open a new window where the logged points are displayed.
- **Save:** save the logged points to disk.
- **Open:** show the logged points from a previously saved file.
- **Clear:** empty the logged points list.

Data logging is supported in the current readout and temperature readout scenarios. Each scenario has its own logging file format. The user can press the '**Open**' button in either of the two scenarios and choose any logging file type (current or temperature).

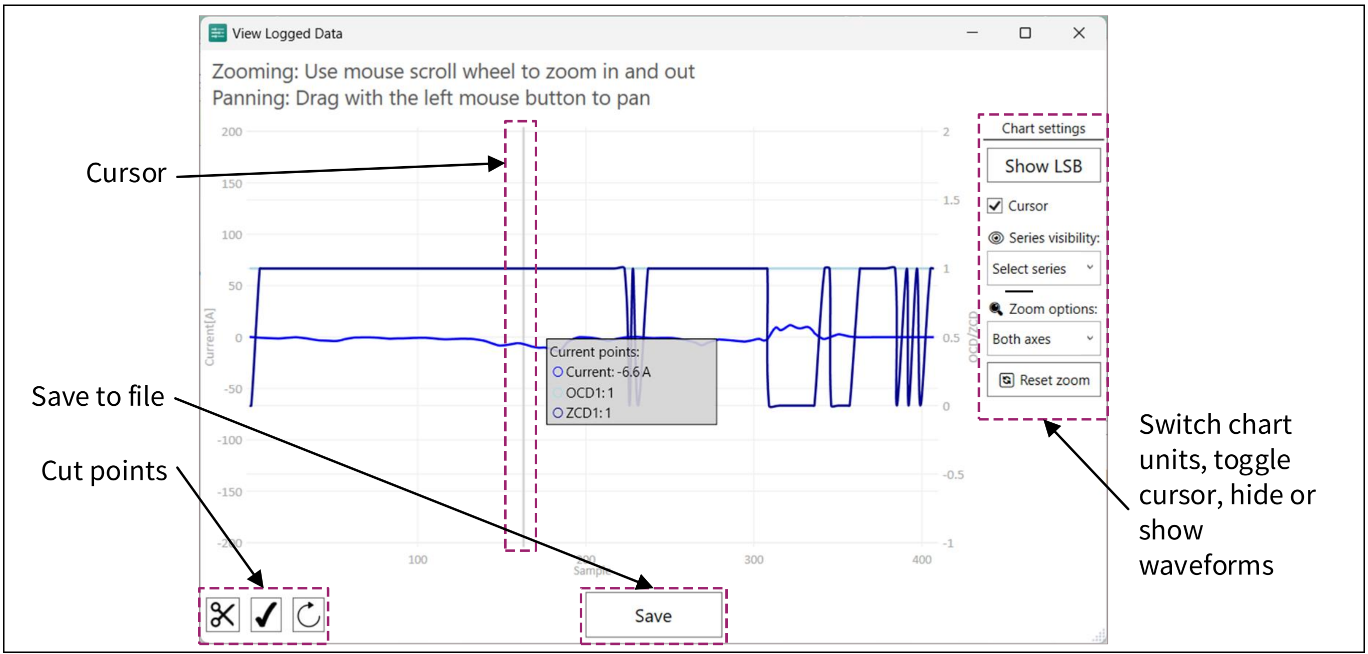


Figure 20 Software usage: Logging window

The logging file contains values for current (Amperes and LSB), OCD and ZCD. The files are saved in *.csv* form. There is no limit on how many points can be logged. Data logging takes place in a temporary file initially, so there won't be any memory increase when logging is in progress.

Figure 20 shows a screenshot of the logging window inside which the user can see and manipulate logged points. The buttons on the bottom right allow the user to cut a certain part of the chart, accept the modifications temporarily or reload the previously saved dataset. To commit to the changes, the user shall click the '**Save**' button.

The panel on the right allows the user to change the following parameters of the chart:

- **Show LSB/Show A:** Switch between LSB and Amperes.
- **Cursor checkbox:** Enable or disable the chart cursor. Disabling the cursor also hides the current points popup.
- **Series visibility:** show or hide certain waveforms.
- **Zoom options:** possibility to zoom only on the vertical or horizontal axes.
- **Reset chart:** zoom to fit the whole chart and pan to the center.

After clicking the "**Save**" button, the user may enter a comment that will be added to the header of the file. The logged points are saved in CSV format (comma separated values), with the following structure:

- **Header section:** contains the timestamp, sensor name, logging mode (current or temperature) and the user comment.
- **Data section:** each logged line consists of a data bunde containing the index, computed current, OCD and ZCD status, current in LSB format.

2.3.3 EEPROM Map

The EEPROM Map scenario allows the user to view or change various parameter of the sensor, like its DCDI address, baudrate, OCD/ZCD threshold, ZCD hold time and OCD deglitch. The user can change any of the parameters without worrying about CRC, which is automatically calculated and displayed in the GUI after every change of the EEPROM.

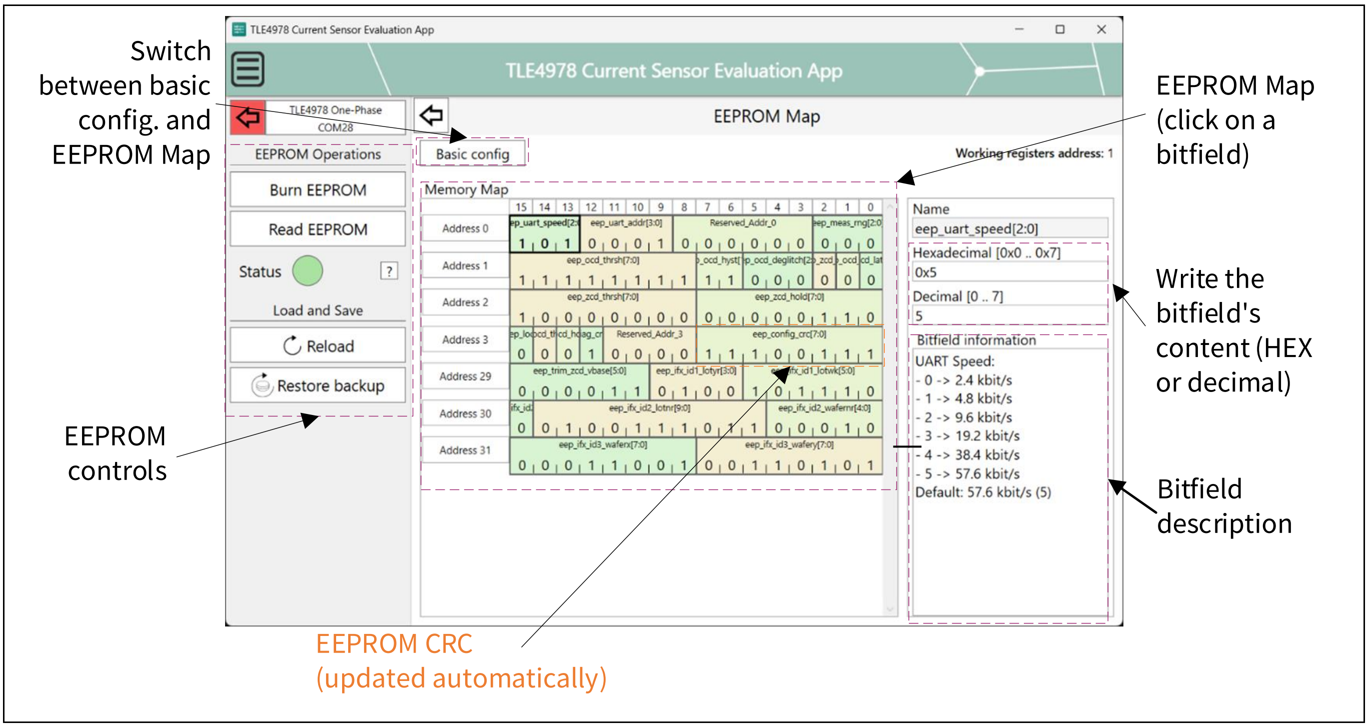


Figure 21 Software usage: EEPROM Map

The scenario will start with a loading screen where the sensor EEPROM is being read. Only the user accessible area of the EEPROM can be changed, while the reserved area will be hidden. The software needs to read the whole register map in order to compute the correct CRC. There are currently two views in this scenario:

- **EEPROM Map:** the memory map is displayed, with all the user-accessible rows and bitfields. Clicking on a bitfield will update the description on the right. The user can write either in decimal or hexadecimal format. Refer to Figure 22Figure 21.
- **Basic configuration:** a simpler view which displays only the fields the user can modify. The content of the bitfields can be entered only in decimal format. Each field comes with a description tooltip that appears when the cursor is on top of the question mark button. Refer to Figure 22.

The user can switch between the two views by clicking the button near the top left of the view: '**Basic configuration**' or '**EEPROM Map**'. Both views have the same effect and are updated in real time, so if the user changes something in one view, it will be reflected in the other view as well.

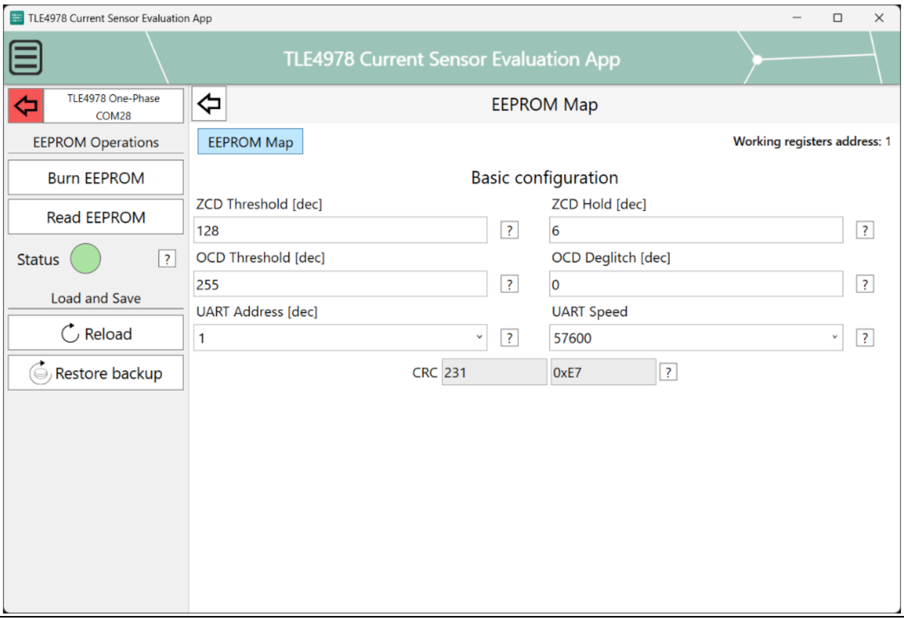


Figure 22 Software usage: EEPROM basic configuration

When writing to the bitfields, the sensor's EEPROM doesn't change. If the user wants to commit the changes, the '**Burn EEPROM**' button on the left must be pressed. This operation will take some time, and the user **must not** disconnect the sensor or close the program, which may result in permanent sensor damage.

Each bitfield content is verified and can not be wrong. For example, if a bitfield is 3 bits wide, the content can be in the range [0, 7] and the user can not write a value outside that range. The user can not write to the CRC register as it's automatically calculated. The contents of the reserved registers are also locked and the user can not modify them.

The panel on the left contains buttons for EEPROM burn and read, which are the only two operations that require the sensor. The status light indicates when the EEPROM is busy or if an error occoured during the last EEPROM operation. The '**Reload**' button is used for reloading the EEPROM to the last known state without reading it again from the sensor.

The software will automatically save the first EEPROM content detected for each sensor (based on the ID fields) and will store that content to disk. The user can click the '**Restore backup**' button to reload the first configuration to the sensor. This backup only contains the EEPROM configuration that was first detected by the software on the current PC.

2.3.4 Temperature readout

The temperature readout scenario displayed in Figure 23 is used to display the sensor's temperature in Celsius or LSB. The temperature is read digitally from a DCDI register, therefore the sensor will be in test mode in this scenario. The same features from the current readout scenario are also available here: start/stop readout, frequency, data logging and switching between LSB and C. The temperature readout frequency depends on the DCDI baudrate: a lower DCDI baudrate will result in a longer readout frame width.

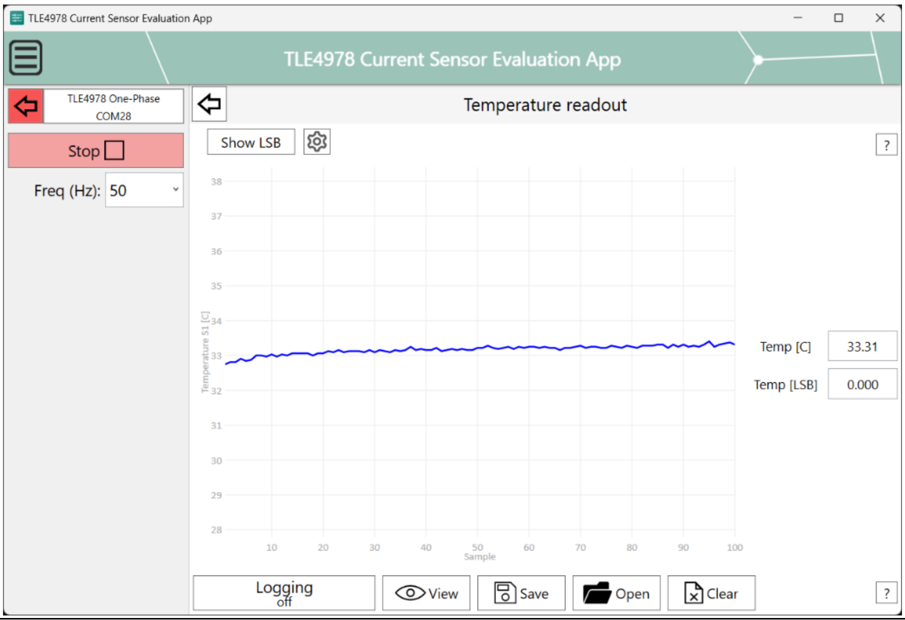


Figure 23 Software usage: Temperature readout

Data logging in temperature readout mode works in the same way as current readout. This functionality is explained in Section 2.3.2.

2.3.5 Board information

The software supports multiple sensors and multiple board configurations. In this view, the software will show all the information about the currently selected board:

- The number and type of the sensors on the board;
- Baudrate (must be the same for all sensors);
- Whether or not DCDI is always enabled on the sensors;
- Other features: OCD threshold measurement, analog multiplexer, feedback voltage measurement, LDO.

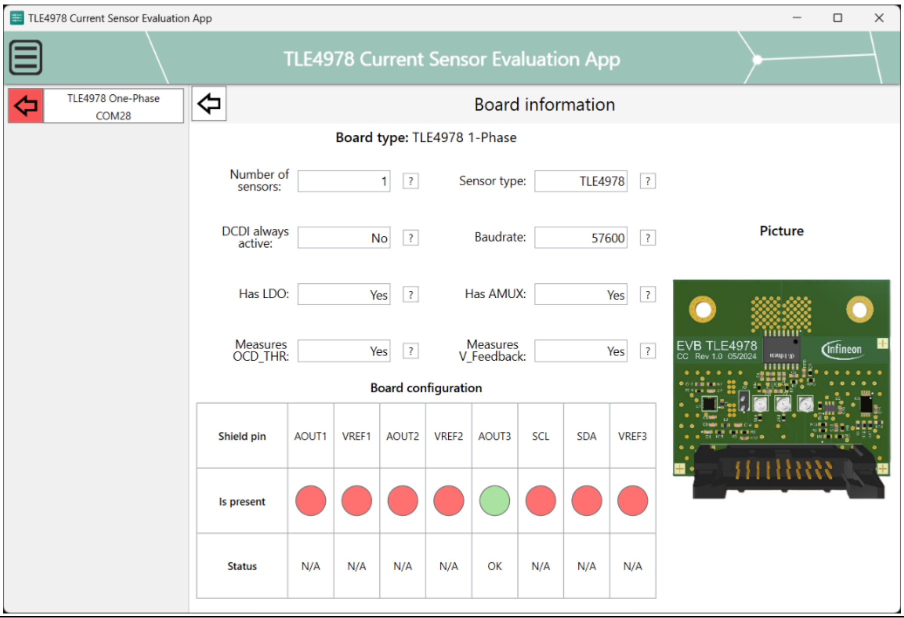


Figure 24 Board information

2.3.6 Sensor recovery

In some cases, the sensor's EEPROM might be compromised. If the sensor detectes a wrong CRC in the EEPROM, the shadow registers will be set to their default values, which means that the sensor will be stuck at a baudrate of 57600 bps and DCDI will require a special sequence to be activated. The analog output of the sensor will also be wrong.

If the software doesn't detect a sensor, the user can still use the software and they can enter the "*Sensor recovery*" view in order to restore the sensor's EEPROM to a working condition.

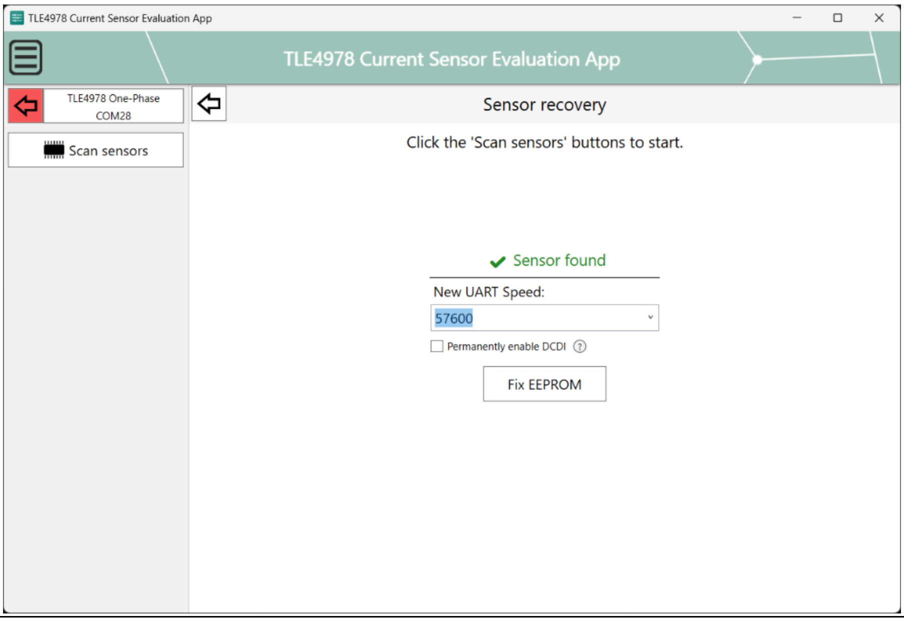


Figure 25 Sensor recovery

After clicking the '**Scan sensors**' button on the left, the software will begin scanning for sensors at all known baudrates. If a sensor is detected, the user will be informed and it can be revived.

The user can choose a UART speed for the sensor and whether or not to permanently enable DCDI. For TLE4978 sensors this is not required since the DCDI sequence is always used. Keep in mind that by always enabling DCDI, the sensor will ignore any voltage on the OCD_THR pin and rely on the value stored in the EEPROM, in the '*eep_ocd_thrsh*' field.

Clicking the '**Fix EEPROM**' button will set the sensor's address to '1'. A message will be shown informing the user about the operation's result. After restoring the sensor's EEPROM, all the other views can be used again.

2.3.7 External EEPROM

The TLE4978 EVB also contains an external I²C EEPROM used for writing sensor name, range, package and the date and time of programming (Figure 26). If no external EEPROM is present, this scenario won't appear. The scenario doesn't have any controls in the left panel. The external EEPROM is read-only, therefore it can't be modified by the user.

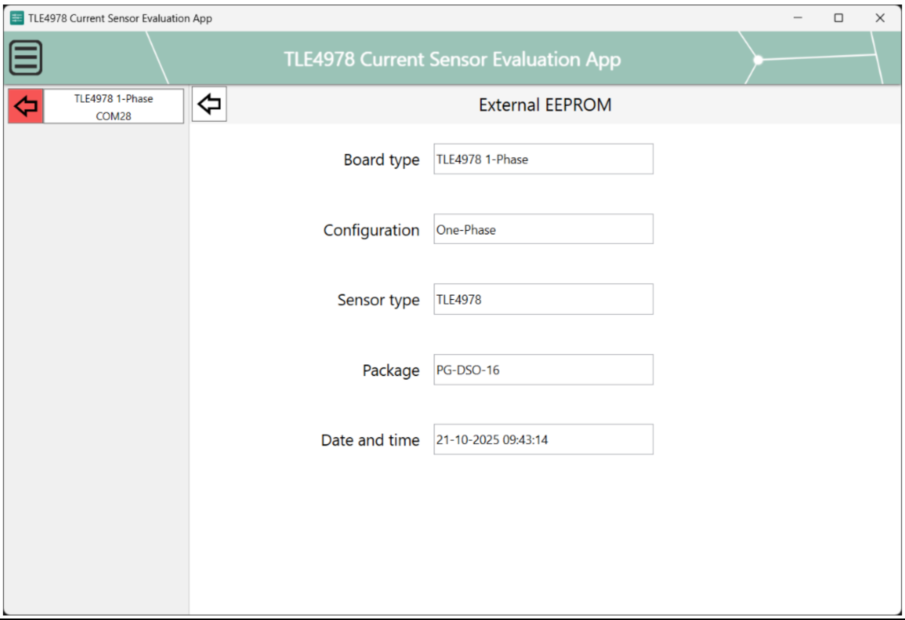


Figure 26 External EEPROM

Revision history

Document revision	Date	Description of changes
1.00	2026-03-13	Initial release

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