

Description

The modular ZSSC4151C SSC Evaluation Kit is designed for sensor module evaluation, laboratory setup, and module calibration development for the ZSSC4151C Sensor Signal Conditioner IC (SSC). The user's sensor module can be connected to the kit for development, evaluation, and calibration. Alternately, the kit provides a sensor replacement board that can be connected in place of an actual sensor module for basic evaluation purposes only.

The ZSSC4151C Evaluation Software required for the ZSSC4151C SSC Evaluation Kit (not included with the kit) is downloaded via a no-cost customer account from the ZSSC4151C product page or by contacting Renesas. (See the contact information on the last page.) It provides a graphical user interface (GUI) for communication, calibration, configuration, and evaluation.

Features

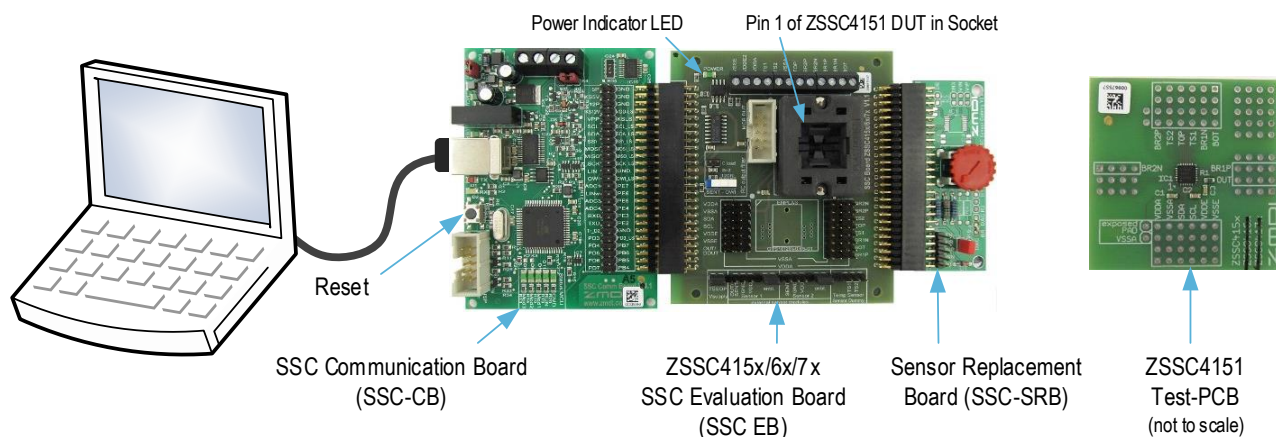
- Communication interface enables configuration, calibration, and performance evaluation for the ZSSC4151C
- Modular ZSSC415x/6x/7x SSC Evaluation Board also allows evaluation of the ZSSC416x and ZSSC417x IC families
- Demonstration of basic application circuit
- Advanced ZSSC415x Evaluation Software is available for download from the ZSSC4151C product page at www.renesas.com/ZSSC4151 with free customer login

Note: Refer to the ZSSC41xx *Evaluation Board Reference Guide* for a detailed description of the primary board for the kit, the ZSSC415x/6x/7x SSC Evaluation Board, including connector descriptions, board schematics, layout, and bills of materials.

Kit Contents

- ZSSC415x/6x/7x SSC Evaluation Board (SSC EB) V1.x
- SSC Communication Board (SSC-CB) V4.1
- SSC Sensor Replacement Board (SSC-SRB) V2.0
- 5 ZSSC4151C IC samples (24-QFN 4 × 4 mm)
- ZSSC4151C Test-PCB
- USB 2.0 cable
- Tweezer (provided for safe handling of IC samples)

ZSSC4151C SSC Evaluation Kit



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1. Basic Setup

Note: There is a “dummy” IC in the socket on the ZSSC415x/6x/7x SSC Evaluation Board that should be replaced with an actual ZSSC4151C device under test (DUT). See the figure on page 1 for the location of pin 1 for proper IC orientation.

1.1 Optional User Equipment

The kit can be powered via the on-board KS5V supply, which can be controlled by the GUI.

1.2 User Computer Requirements and Setup

1.2.1 Computer Requirements

A Windows®-based computer is required for interfacing with the kit and configuring the part. The user must have administrative rights on the computer to download and install the ZSSC4151C Evaluation Software for the kit.

The computer must meet the following requirements:

- Windows® 10, Windows® 7
- Microsoft® .NET 4.0
- Internet access

1.2.2 ZSSC4151C Evaluation Software Installation and Setup

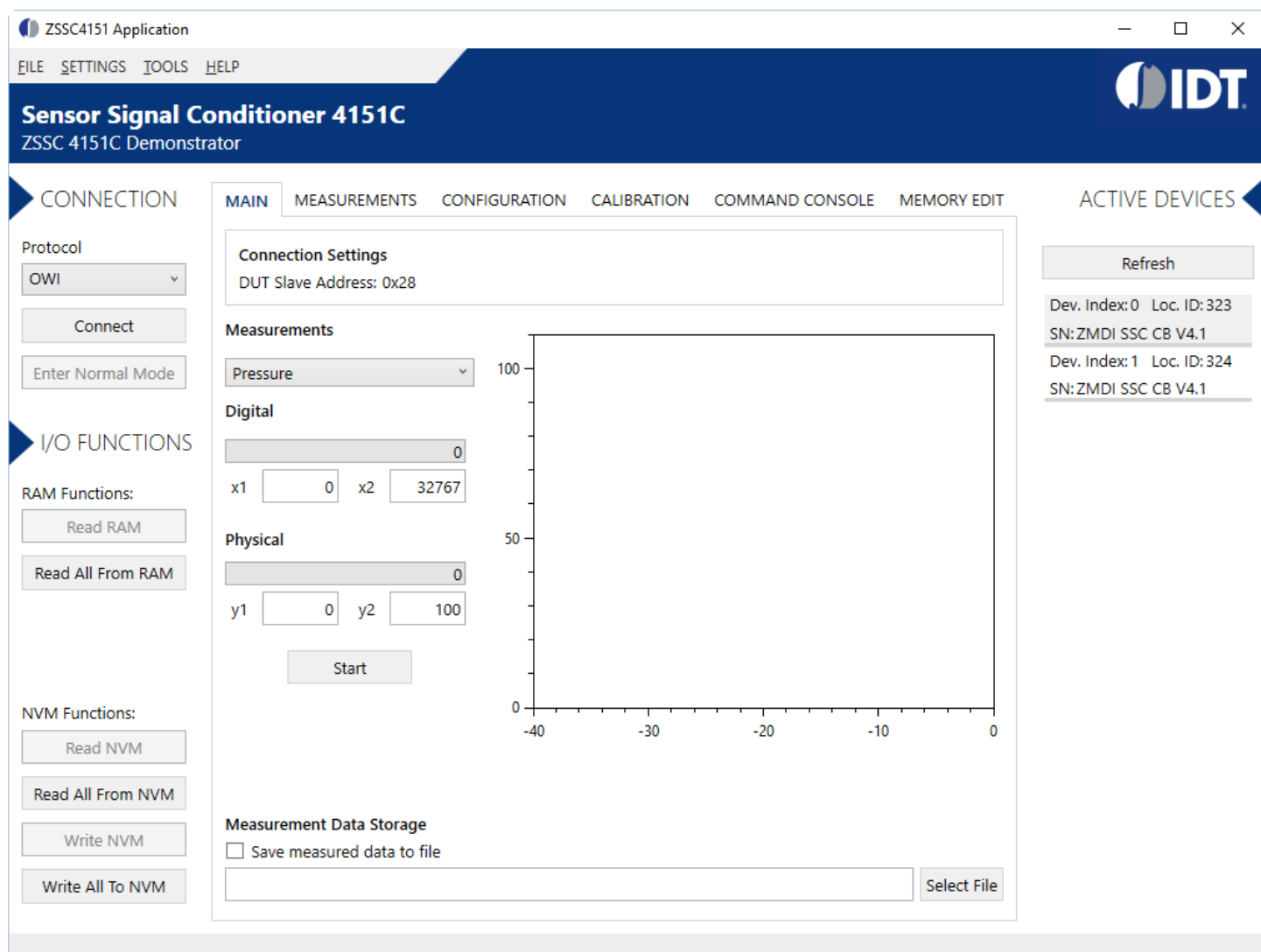
The *ZSSC4151C Evaluation Software* provides a user-friendly graphical user interface (GUI) for connecting to the ZSSC4151C SSC Evaluation Kit. To ensure use of the latest version, a zip files of the *ZSSC4151C Evaluation Kit Software Rev 1.x.x* and the *NVM Memory File* must be downloaded from the product page on the Renesas website (see section 5).

Follow these procedures to download and install the software:

1. Visit the ZSSC4151C product web page or kit web page and download the software and memory zip files. Extract the contents of the zip files to the user's computer.
2. Activate the extracted *ZSSC415xSetup.exe* file and follow the screen prompts to install the software.
3. Launch the *ZSSC415x* program from the Start Menu in Windows® or by clicking the desktop icon created by the installation program.
4. Connect the assembled kit to the user's computer and then continue the software setup as described in section 2.

Note: In some cases, the user's operating system detects the board type and automatically installs a driver the first time that the SSC Communication Board is connected. For this reason, the computer should be connected to the Internet during the first USB connection so that the operating system can download a driver. If a driver fails to install, contact Renesas for assistance. (See the last page for contact information.)

Figure 1. Initial Display after Installation and Activation of the Evaluation Software

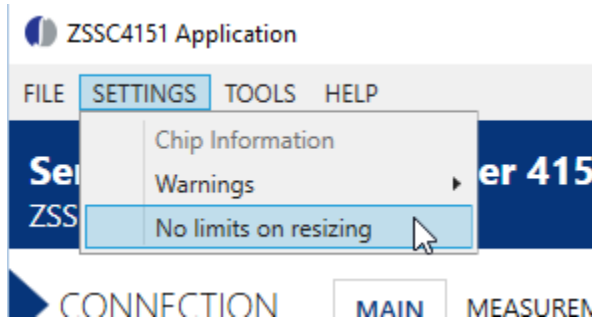


2. Usage Guide

2.1 Display Setup

To enable resizing the window, go to “SETTINGS” on the top menu and check the “No limits on resizing” as shown in Figure 2.

Figure 2. Enabling Resizing the Window



2.2 Activating the Hardware Connection

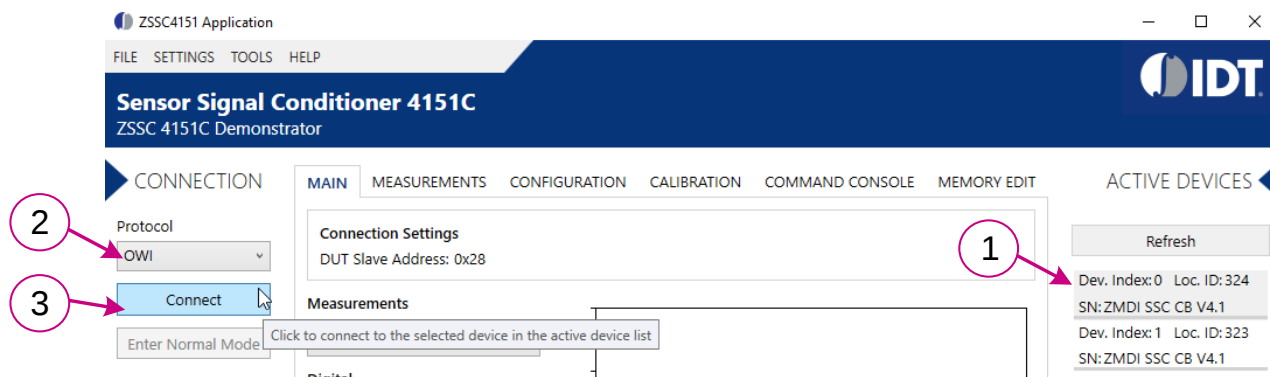
Software Connect enables power supply to EVK/DUT via the on-board KS5V supply or the power supply connected externally to VDDE2.

Note: do not use external power supply connected to VDDE that is not controlled by software. Power cycle or power-up timing is necessary for proper IC function.

Activate the hardware connection by the following steps:

1. Select device from the list of active devices.
2. Select I²C or OWI (One Wire Interface) from the drop-down menu below “Protocol” (see Figure 3).
3. Click the “Connect” button. On the Evaluation Board, verify that the green D1 LED power indicator turns on. The “ACTIVE DEVICES” list on the right side of the “Main” tab menu shows information about the board and device that are connected.

Figure 3. Connecting the Hardware via I²C or OWI



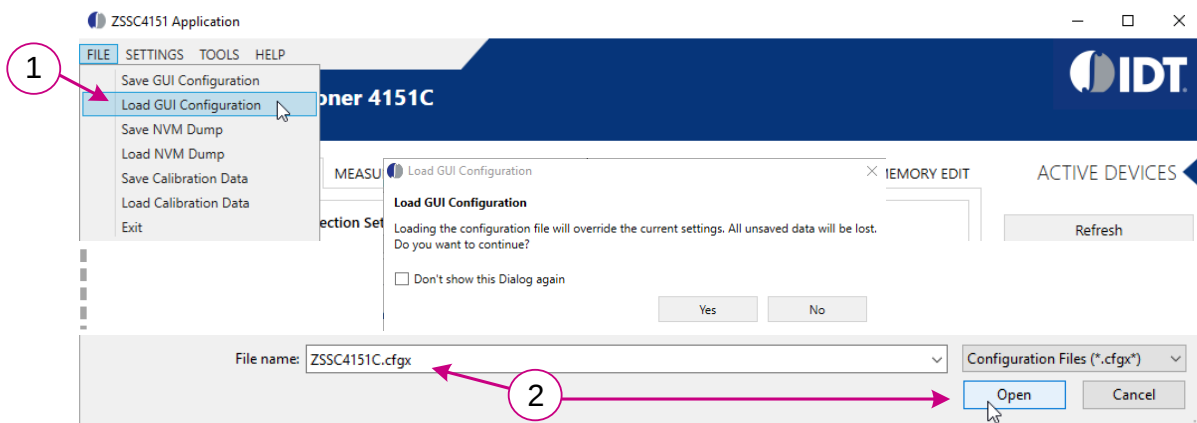
2.3 Creating a Customer Specific Configuration File

Loading default configuration file is not necessary, therefore it is not available for download. If there is a specific need to modify the GUI configuration, follow these steps:

1. On the top menu, select *FILE > Save GUI Configuration* to save the default configuration file (see Figure 4).
2. Open and modify the *ZSSC4151C.cfgx* file as needed.
3. On the top menu of the evaluation software, select *FILE > Load GUI Configuration* to browse to the file location and load the modified configuration file.
4. Click the “Open” button.
5. Click “Yes” to accept overwriting the current configuration settings in the “Load GUI Configuration” window.

A customer specific configuration file can also be requested from Renesas and can be loaded by following steps from 3 to 5.

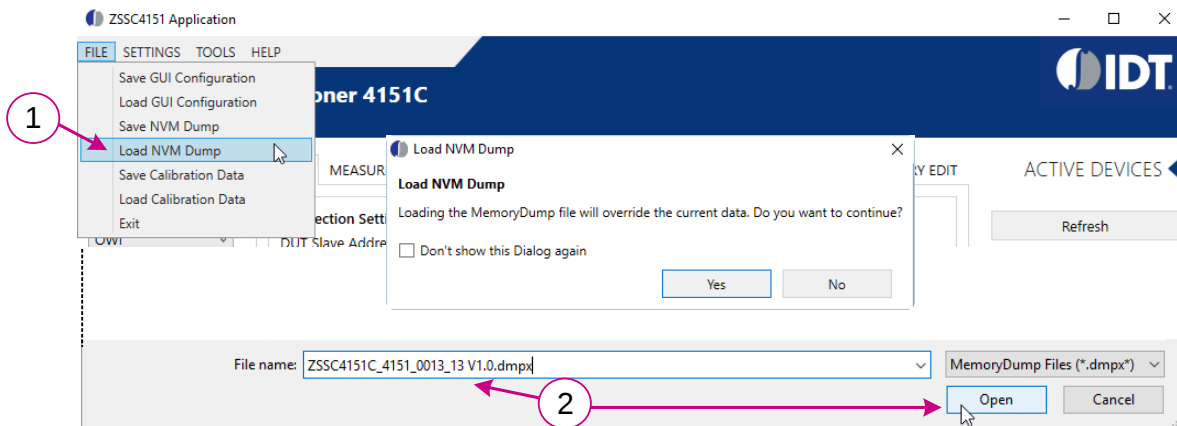
Figure 4. Loading the GUI Configuration File



2.4 Loading the NVM Dump File

1. On the top menu, select **FILE > Load NVM Dump** to load a file containing the non-volatile memory (NVM) data (see Figure 5).
2. A default NVM file, `ZSSC4151C_4151_0013_13 V1.0.dmpx`, is provided with the configuration and memory files as shown in the "File name" field in Figure 5. Browse to the file location, and click the "Open" button.
3. In the resulting "Load RAM Dump" window, click the "Yes" button to accept overwriting current data.

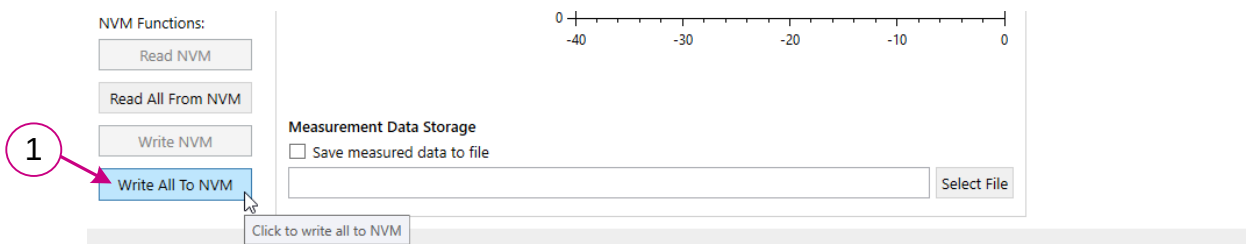
Figure 5. Load the NVM Data into GUI



2.5 Writing the Memory Contents to Nonvolatile Memory (NVM)

1. Click the "Write All To NVM" button to download the NVM data into the ZSSC4151C (see Figure 6).

Figure 6. Writing the Configuration into the ZSSC4151C NVM

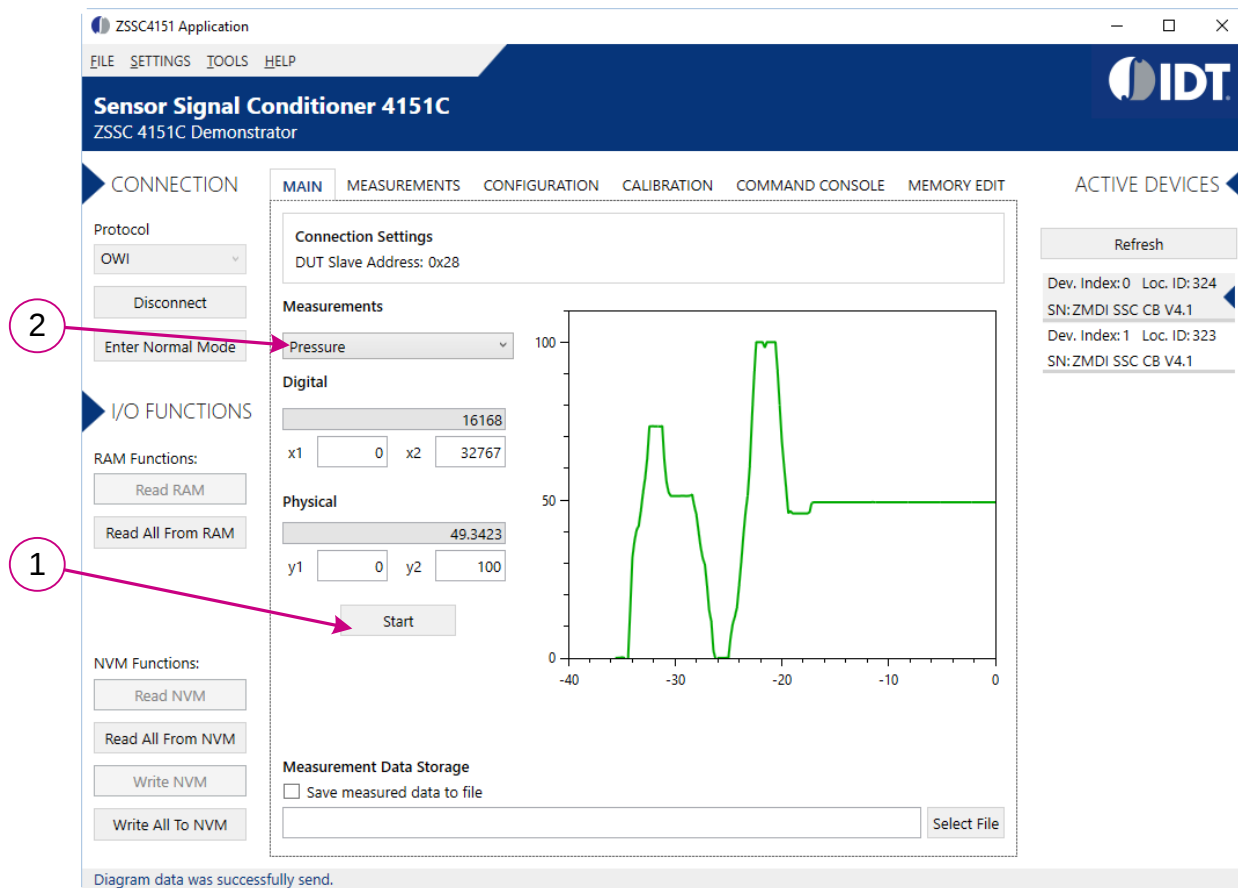


2.6 Taking Measurements

Note: The GUI refers to the bridge sensor measurand as “Pressure,” but this can be any type of resistive sensor signal. The ZSSC4151C is designed for almost all types of resistive full and half bridge sensors.

1. Click the “Start” button to begin acquiring and recording measurements (see Figure 7). The “Start” button becomes the “Stop” button when it is clicked.
2. With “Pressure” selected in the “Measurements” pulldown, turn the red knob on the Sensor Replacement. The “Pressure” (Green) waveform plot should move up and down with the knob rotation. The “Temperature” and “Pressure Raw” waveforms can also be displayed using the “Measurements” pulldown selector, but only one waveform at a time will be displayed.
3. Click the “Stop” button to discontinue measurements.

Figure 7. Starting and Monitoring the Measurement Sequence



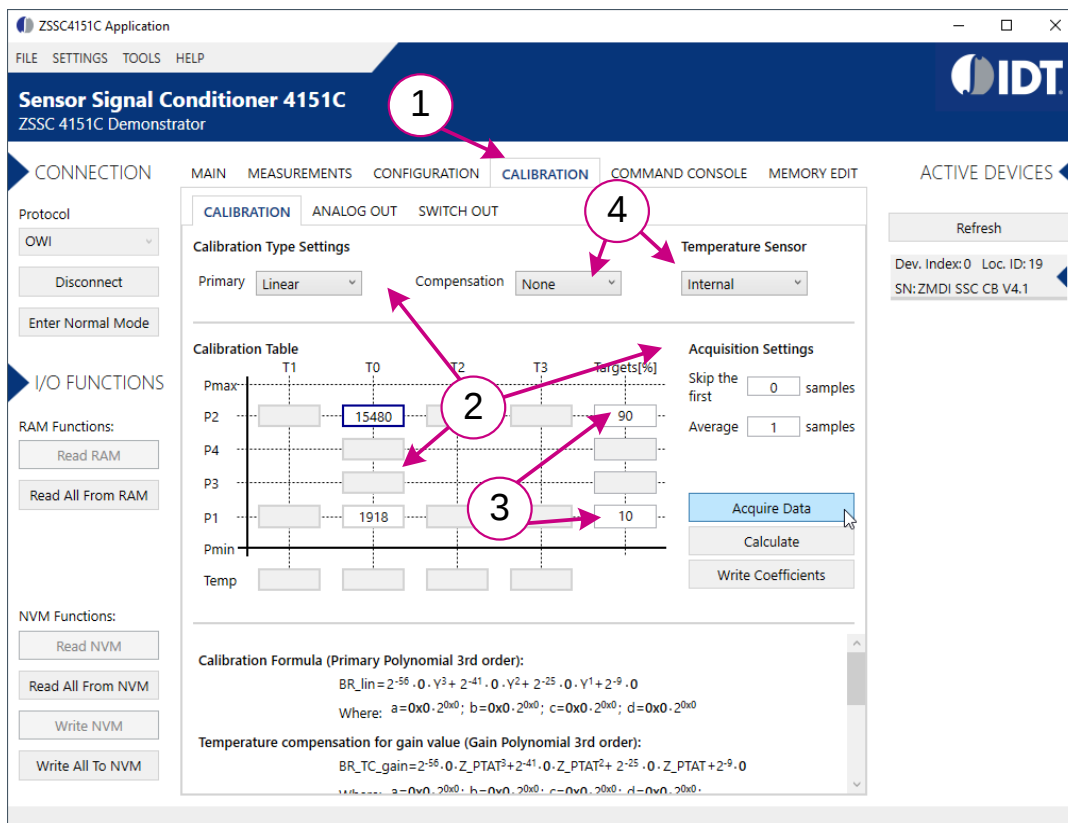
3. Performing a Simple “Dry Run” Calibration

This section describes the basic operations to perform a simple, two-point linear calibration at a single temperature. Higher order calibrations are performed similarly, but with additional points taken over the bridge measurand and temperature.

3.1 Setting up the Calibration and Acquiring Data

1. Select the “Calibration” tab to display the “Calibration” window (see Figure 8).
2. Ensure that the “Calibration Type Settings” and “Acquisition Settings” are set as shown in Figure 8. The “Calibration Table” shows that there are only two points required to complete the calibration in this case.
3. Set the upper and lower “Target” limits to 90% and 10% respectively.
4. Select the “Temperature Sensor” used for compensation. Select “Internal” if there is no external temperature sensor or the “Compensation” field is set to “None”.

Figure 8. Using the Calibration Window Tab to Set Upper and Lower Target Limits



- Turn the red knob on the Sensor Replacement Board fully counterclockwise. Select the "P1" field and click the "Acquire Data" button (see Figure 9).
- Turn the red knob on the Sensor Replacement Board fully clockwise. Select the "P2" field and click the "Acquire Data" button.
- Click the Calculate button. The coefficients for the calibration will be calculated and updated in the calibration formula textbox at the bottom of the window. HINT: Scroll to the bottom of the textbox so that the "Output" button appears. Move the cursor over the "Output" button. A popup window will appear showing the complete set of calibration coefficients.
- Click the "Write Coefficients To NVM" button. This will download the updated coefficients to the NVM of the ZSSC4151C.

Figure 9. Using the Calibration Window Tab to Acquire Data and Calculate Coefficients

The screenshot shows the ZSSC4151C Application GUI. The CALIBRATION tab is selected, displaying the Calibration Type Settings (Primary: Linear, Compensation: None, Temperature Sensor: Internal), a Calibration Table with points P1, P2, and Temp, and the Calibration Formula (Primary Polynomial 3rd order). A popup window on the right shows the results of the calibration, including a table of data points and the calculated polynomial coefficients.

	T1	T0	T2	T3	Target[P]
P2	0.472412	15480			0.9
P1	0.0585327	1918			0.1

bitNorm=15 PrimaryOrder: Linear Comp.Order: None
 Primary.minCbits= 7 Comp.Gain.minCbits= 7 Comp.Offset.minCbits= 7
 PTgtMin= 0.000000 PTgtMax= 1.000000 P in [-1,1] T in [0,1]

applyPolyFit:
 yA= 1.93293, yB= -0.0131397, tg= 0.258675, to= -0.00679779
 n3= 0, n2= 0, n1= 1, n0=-1.73472e-017

SUCCESS: all coefficients computed.
 USING the (computed) Lagrange-polynomial fit.

Successful calculation of the polynomial coefficients and weights for "Compensated" calibration:

Primary Polynomial	Comp.Gain Polynomial	Comp.Off. Polynomial
C0 = 0x0000, W0 = 0	C0 = 0x4239, W0 = 8	C0 = 0x90A0, W0 = 2
C1 = 0x4000, W1 = 11	C1 = 0x0000, W1 = 0	C1 = 0x0000, W1 = 0
C2 = 0x0000, W2 = 0	C2 = 0x0000, W2 = 0	C2 = 0x0000, W2 = 0
C3 = 0x0000, W3 = 0	C3 = 0x0000, W3 = 0	C3 = 0x0000, W3 = 0

3.1.1 Checking the Calibration

The calibration can be checked in the "Main" tab (see Figure 7).

- Click the "Start" button in this window and observe the reading to verify readings. If the red knob of the Sensor Replacement Board has been left in the fully clockwise position as in step 6 in section 3.1, the calibration at the "P2" calibration point can be verified by checking that the output for "Pressure" is 90%.
- Similarly, if the red knob is turned fully counterclockwise, the reading should be 10%.

3.2 Saving the NVM Data and GUI Configuration Settings

The GUI settings and NVM contents for this example can be saved to new configuration and NVM dump files. Select **FILE > Save GUI Configuration** from the top menu and save the configuration under a new name. Similarly, the NVM dump file can be saved using **FILE > Save NVM Dump** and creating a new name.

4. Setting the Output modes

This section describes the basic operations to setup the output modes. The ZSSC4151C supports the ratiometric analog output or the switch output on the output pin.

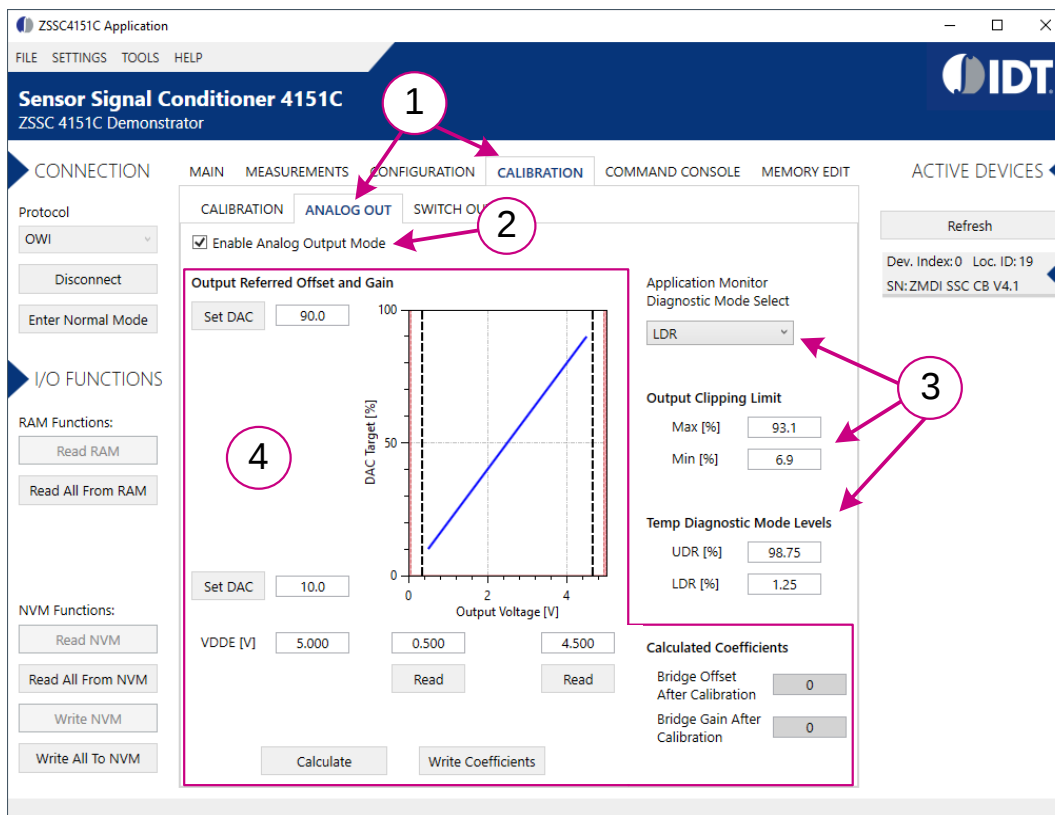
4.1 Setting the Analog Output

Before setting up the Analog Output, ensure that the calibration of the device was properly executed (see section 3).

1. Select "Calibration" > "Analog Out" tabs to display the "Analog Out" window (see Figure 10).
2. Select "Enable Analog Output Mode", which disables the Switch Out mode automatically.
3. Set the required "Application Monitor Diagnostic Mode Select" option, the "Output Clipping Limit" fields, and the "Temp Diagnostic Mode Levels" fields.

The Analog Output can be adjusted with respect to gain and offset. This can be used to compensate for possible resistances due to ferrite beads or resistors in the Analog Output line. Details about the concept can be found in the *ZSSC4151C Functional Description* document.

Figure 10. Using the Calibration Window Tab to Set the Analog Output



4.2 Setting the Switch Output

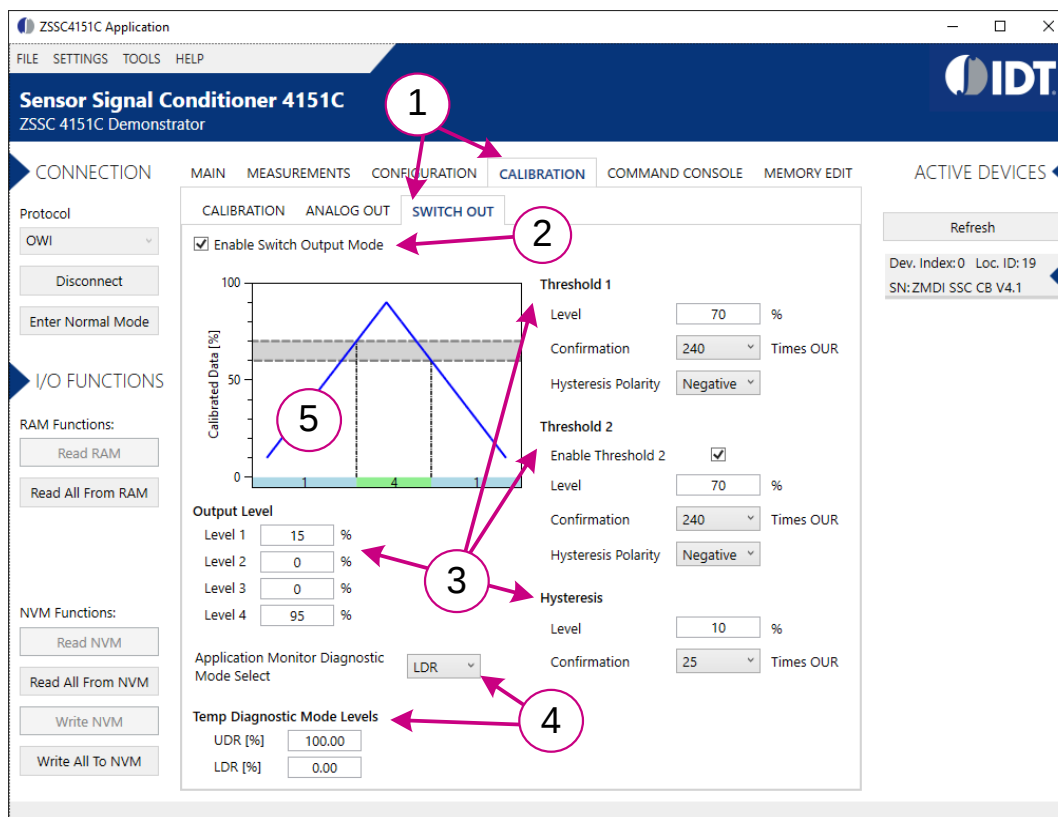
Before setting up the Switch Output, ensure that the calibration of the device was properly executed (see section 3).

1. Select “Calibration” > “Switch Out” tabs to display the “Switch Out” window (see Figure 11).
2. Select “Enable Switch Output Mode”, which disables the Analog Out mode automatically.
3. Set the required “Output Level”, “Threshold 1”, Threshold 2”, and “Hysteresis” fields.
4. Set the required “Application Monitor Diagnostic Mode Select” option and the “Temp Diagnostic Mode Levels” fields.

The graph is updated according to the parameters set.

Detailed description of the Switch Output is available in the *ZSSC4151C Functional Description* document.

Figure 11 Using the Calibration Window Tab to Set the Analog Output



5. Related Documents and Software Locations

Visit the following product pages on Renesas' website <https://www.renesas.com> to download the latest version of the ZSSC4151C Evaluation Software, related documents, and the latest version of this document, or contact Renesas via the contact information on the last page.

- Product page: <https://www.renesas.com/ZSSC4151>
- Kit product page: <https://www.renesas.com/zssc415xkit>
- SSC Communication Board: <https://www.renesas.com/ssc-cb>
- Sensor Replacement Board: <https://www.renesas.com/ssc-srb>

6. Glossary

Term	Description
DUT	Device Under Test
GUI	Graphical User Interface
NVM	Nonvolatile Memory
OWI	One-Wire Interface
SSC	Sensor Signal Conditioner
USB	Universal Serial Bus

7. Ordering Information

Note: Refer to the websites given in section 5 for the order codes for ordering additional individual SSC Communication Boards and SSC Sensor Replacement Boards, which can be ordered separately after purchasing an SSC Evaluation Kit.

Orderable Part Number	Description
ZSSC415XEVKV1P6	ZSSC4151C SSC Evaluation Kit: Communication Board, ZSSC415x/6x/7x Evaluation Board, Sensor Replacement Board, USB Cable, ZSSC415x Test PCB, Tweezer, 5 Samples.

8. Revision History

Revision Date	Description of Change
March 25, 2021	Section 4 added to explain the setup of the ZSSC4151C output modes using the GUI.
October 11, 2019	Initial release.

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