US082-ZSSC3230EVZ

This manual is a guide for calibrating the US082-ZSSC3230EVZ Pmod™ Board using the ZSSC3230EVB Evaluation Kit. The ZSSC3230EVB Evaluation Kit also supports IC calibration programming using the PQFN IC socket. For more details, refer to the *ZSSC3230 Evaluation Kit Manual*.

Contents

1. Setup and Configuration

1.1 Hardware Configuration

The following additional lab equipment is required for using the board (and is sold separately).

- ZSSC3230EVB Evaluation Kit
- USB micro-B cable (provided with evaluation board)
- US082-ZSSC3230EVZ Pmod Board
- US082-ZSCALINTRPEVZ Board (interposer board)
- PC running Windows 10 with at least one USB port
- Capacitive sensor or 1pF to 30pF through hole capacitor, 5% accuracy or better

1.2 Software Configuration

The latest version of ZSSC3230 Evaluation Software can be downloaded from the Renesas website.

Note: Install the ZSSC324x evaluation software and FTDI USB drivers.

1.3 Board Setup

1. Verify that the I^2C pull up jumper J11 and J12 are populated on ZSSC3230EVB board.

   Note: Use only one set of pull-up resistors on the I^2C bus line.
2. On the ZSSC3230EVB board, at the VDD Select J8 header, place a jumper across GUI contr.
3. Ensure that all the pins on the ZSSC3230EVB board are populated except for DIGTST on J1 header.
4. For the measurement mode setting, place a jumper on the C0 side of J9 and the Cc side of J10.
5. The position of SW2 switch is irrelevant in this calibration.
6. Plug the J1 connector on the US082-ZSCALINTRPEVZ board to the P3 connector of ZSSC3230EVB board.
7. Plug the J3 connector on the US082-ZSSC3230EVZ Pmod board to J2 of the US3230-INTERPEVZ board.
8. Connect the capacitor sensor or different values of capacitor on pins 1 and 2 of the connector J1 of US082-ZSSC3230EVZ Pmod board.
9. Connect the USB cable from the USB connector on the ZSSC3230EVB board to an available USB port on the computer.

   Note: See Figure 1 for the complete hardware setup.

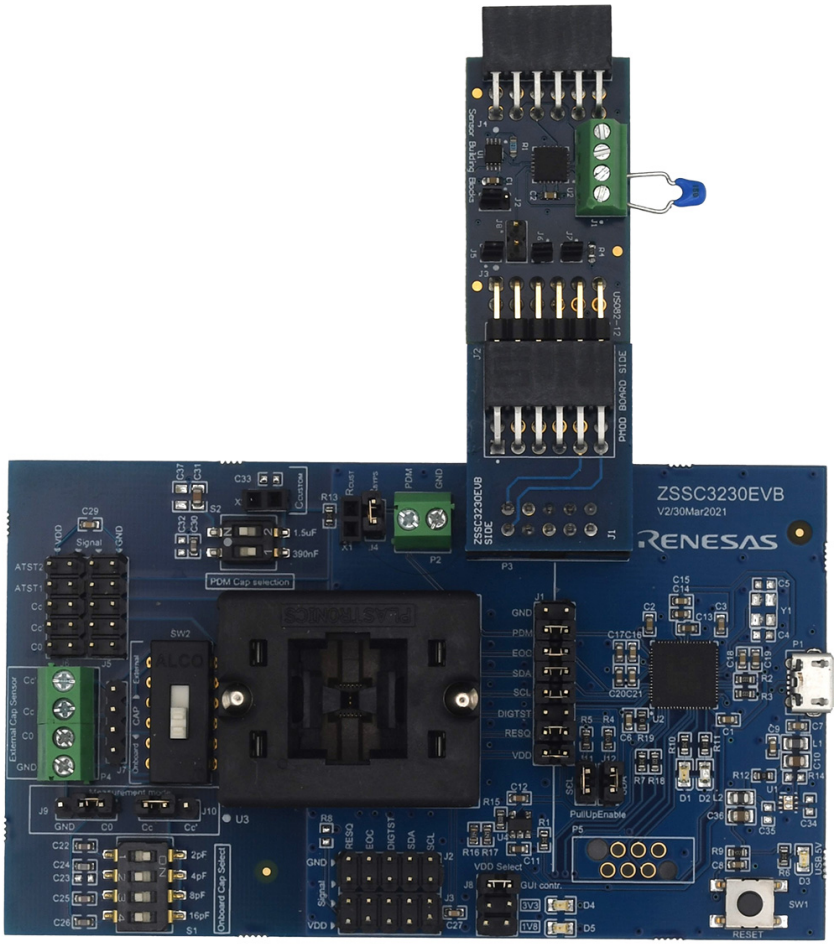

Figure 1. Board Connections

2. Calibration Procedure

1. From the PC Start menu, select the **Renesas** folder to locate and start the ZSSC323x evaluation software.
2. Ensure that the ZSSC3230EVB board appears as an active board device by clicking on the **Refresh** button.
3. In the left sidebar, find the CONNECTION section, and from the VDD dropdown menu, select **VDD: 3.3V**.
4. From the menu bar, select **SETTINGS** > **I²C ADDRESS** to set the I²C slave address and speed to 0x48.

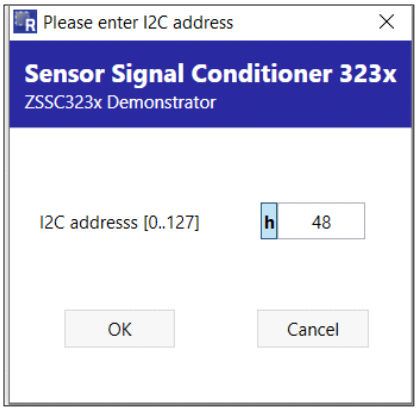

Figure 2. I²C Address Dialog

5. Click the **Connect** button to connect to the US082-ZSSC3230EVZ board. For the IC STATUS in the left sidebar, the status indicators for **Powered** and **Normal Mode** appear yellow.

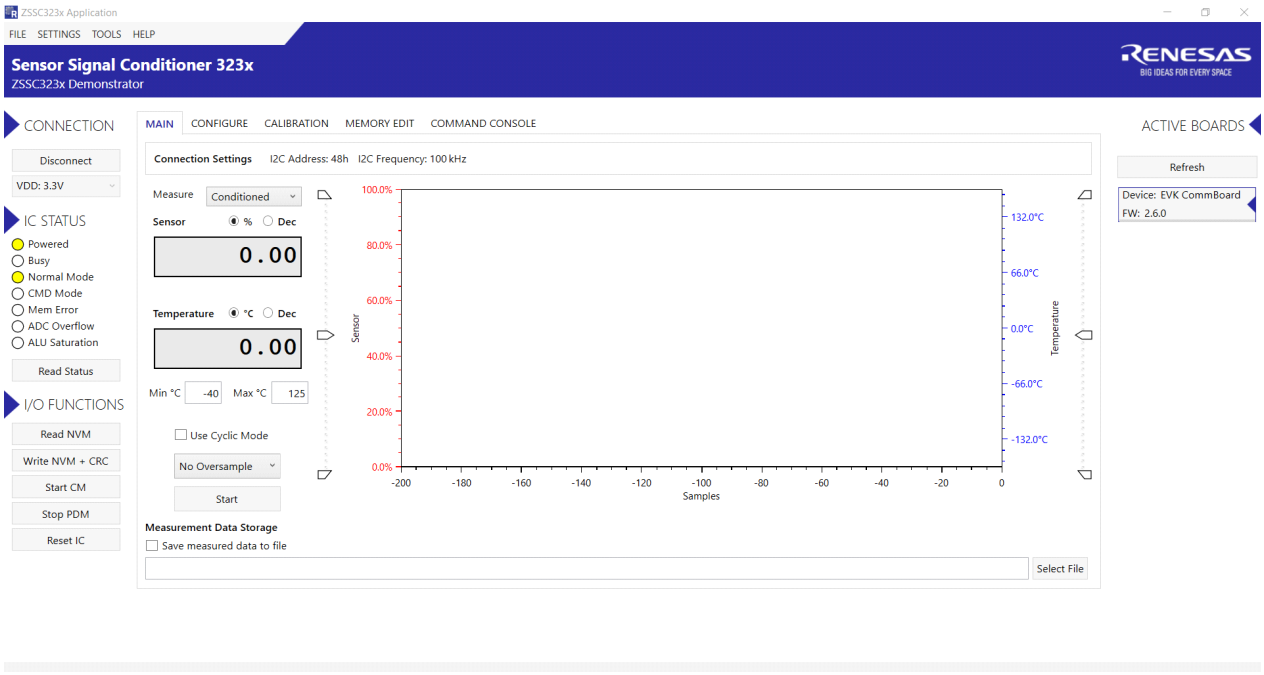

Figure 3. Connect to Board

6. In the MAIN application tab, click the **Start** button. The measurement graph displays the uncalibrated sensor response while the stimulus signal is applied. Press the **Stop** button.

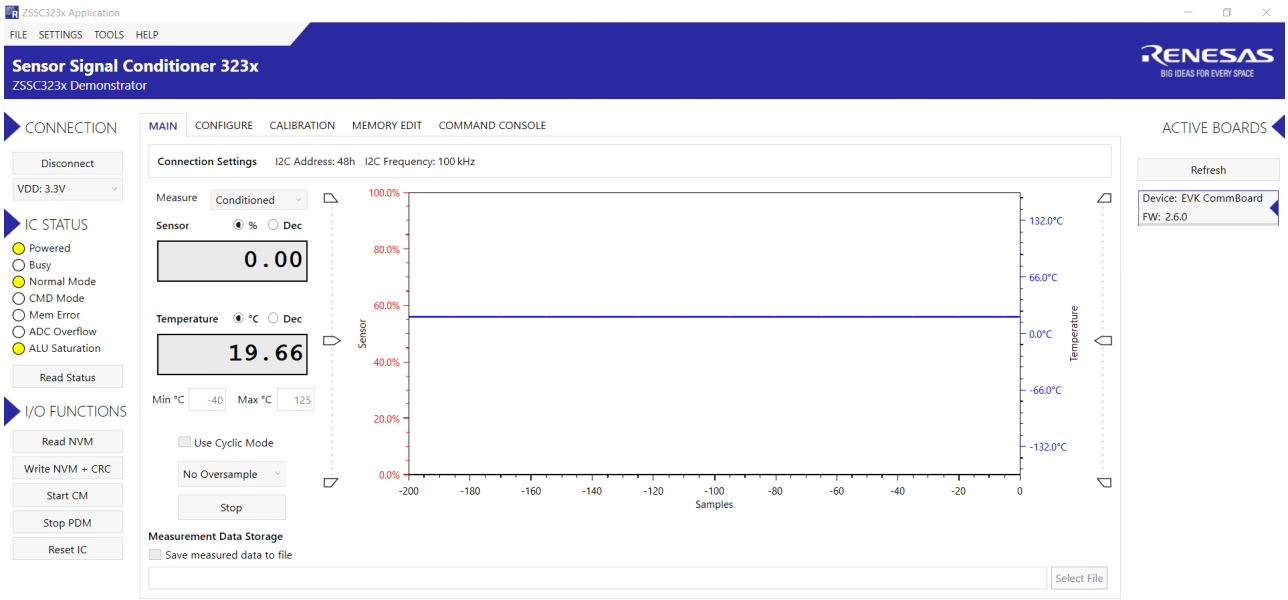

Figure 4. Start Measurement

Note: Before useful raw data can be collected from the IC, it must be initialized. The initialization step involves setting the Analog Front End (AFE) configuration bits for the end application.

7. Click the **CONFIGURE** application tab. The CONFIGURE settings appear. Next, click on the **SIGNAL** CONDITIONING tab.
   a. Write down the value in **Temp. gain (Gain_T)**. For this case, it is 2097152.
   b. The **Temp. gain (Gain_T)** value is used in step 20.

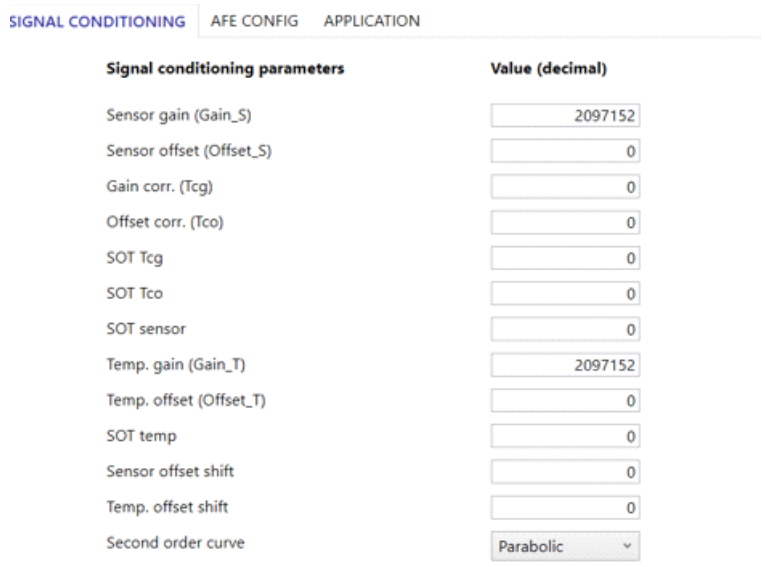

Figure 5. Temperature Gain Value

8. Next, click on the **AFE CONFIG** tab, and set the parameters as follows.
   - Cap Range (Max C Signal Input Range): 16.0pF
   - Zero Shift Capacitance: no offset
   - ADC Conversion Bits: 14
   - Sensor Input Pin: CC

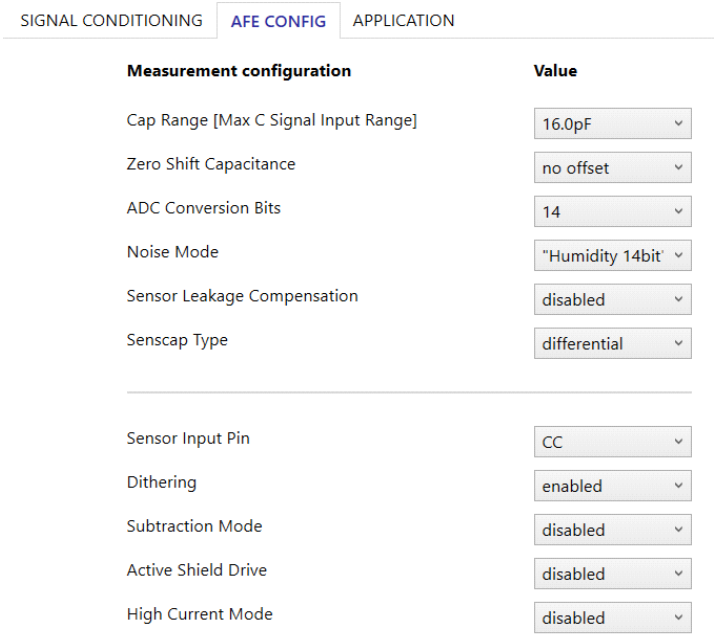

Figure 6. AFE Configuration

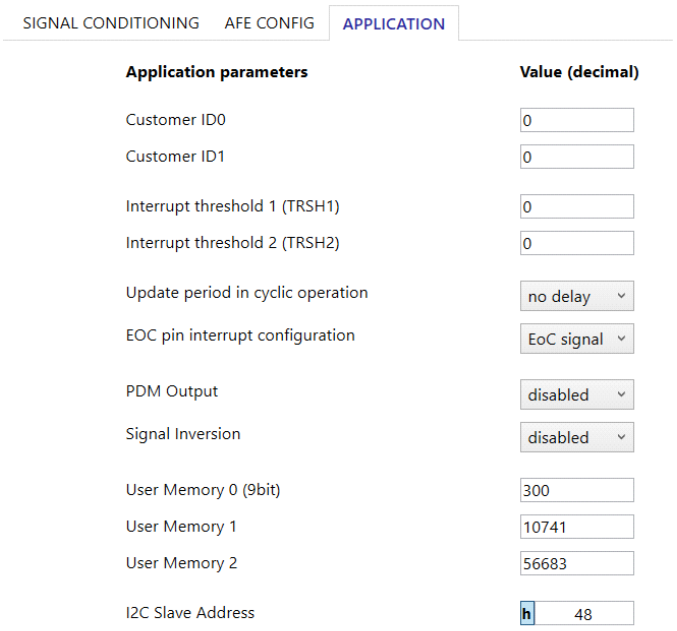

Figure 7. Application Configuration

9. From the I/O FUNCTIONS menu in the left sidebar, click the **Write NVM + CRC** button.

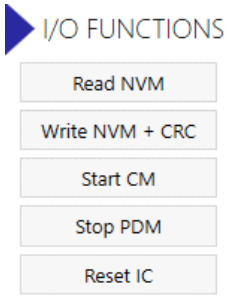

Figure 8. Write NVM+CRC

10. Next, from the I/O FUNCTIONS menu, click the **Reset IC** button.
11. Click on the **CALIBRATION** application tab, and set the **Acquisition Settings**.

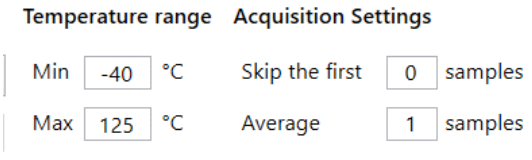

Figure 9. Acquisition Settings

12. In the **CALIBRATION** application tab, choose between one of the seven different types of possible calibrations scenarios in the **Calibration Type Setting**.

    The **3 Points: S(O+G+SOT)** calibration type is chosen.

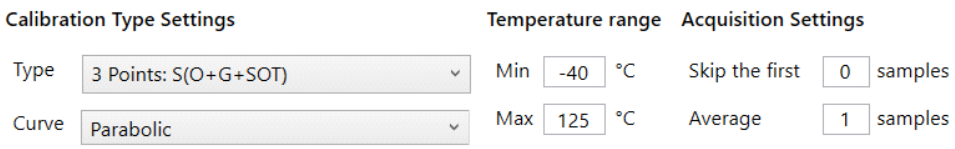

Figure 10. Calibration Type Selection

13. By choosing the 3 Points: S(O+G+SOT) option, it enables the S1, S2, S3 data fields under the **Sensor Targets [%]**. This is the target range of the ADC as a percentage of full scale.

    Set the value for each data field. For example, 94% for S3, 37.5% for S2, and12.5% for S1.

    a. Example, target application range: 0 to 16pF

    b. Capacitive calibration reference points: 2pF, 6pF, and 15pF

    c. The defined reference points have the following assignment, with added buffers for parasitic impact.

        i. 2pF → 12.5% of the range

        ii. 6pF → 37.5% of the range

        iii. 15pF → 94% of the range

14. For the S3 data field, click the **Get** button while the stimulus signal is applied to the sensor to measure the value within a 94% target range.

15. Repeat the process for S1 and S2, by clicking the **Get** button and applying a stimulus to the sensor and measuring it within the set target range.

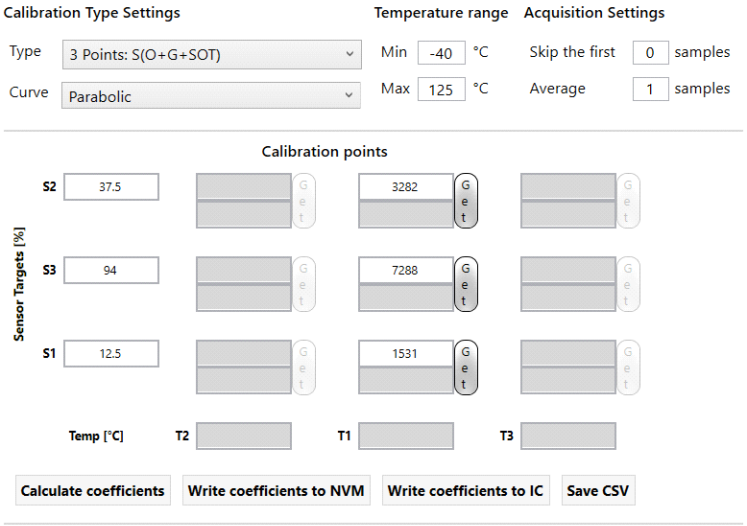

Figure 11. Calibration Setup

16. For the IC STATUS in the left sidebar, verify that the **ADC Overflow** status indicator is not yellow. If the **ADC Overflow** is yellow, return to the **CONFIGURATION** application tab to adjust the AFE settings.

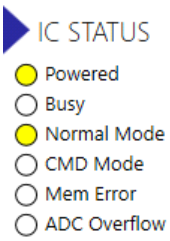

Figure 12. IC Status

17. When the data is collected, click the **Calculate coefficients** button. A SUCCESS message is displayed in the **Coefficient result** table if a possible solution is found.

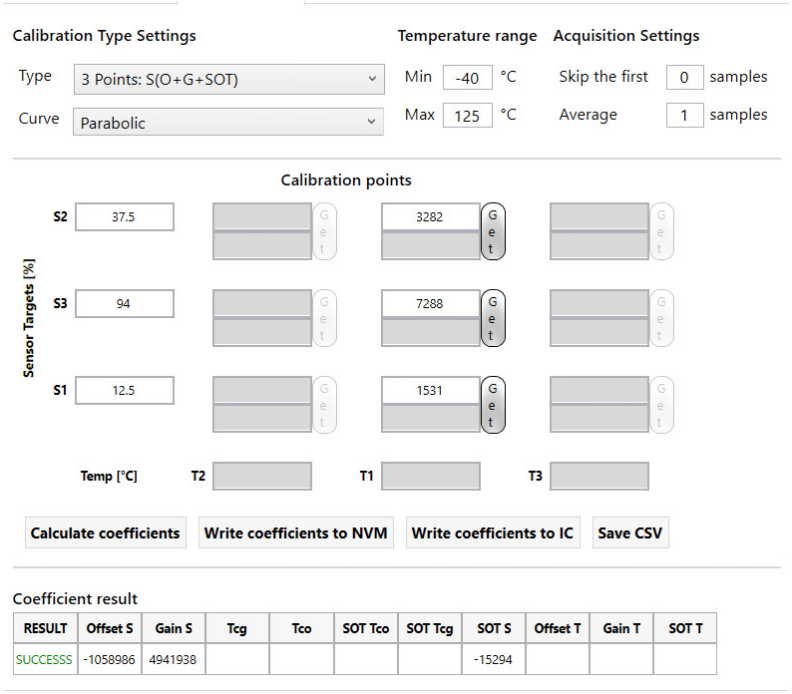

Figure 13. Calculate Coefficients

18. If the FAILED message is displayed, an adjustment must be made to the AFE settings to achieve the optimal resolution without saturation of the calibration coefficients or ADC.
19. The coefficients must be written to the IC memory. Click on **Write coefficients to IC** button.
20. Click on **CONFIGURE** tab. Enter the value from step 7 (2097152) in the **Temp. gain(Gain_T)** field.

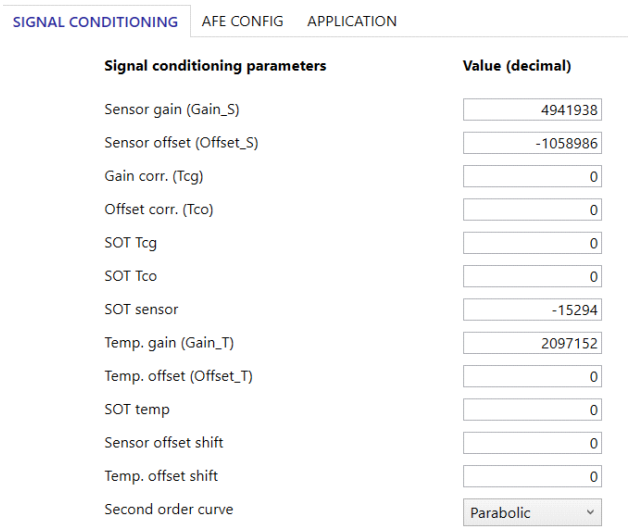

Figure 14. Configure Temp Gain Coefficients Manually

21. Click the **Write NVM + CRC** button. Next, click the **Reset IC** button.
22. After a successful coefficient calculation and memory programming is performed, read the memory contents by clicking on the **Read NVM** button.

3. Verify Calibration

To confirm a successful calibration, connect different values of capacitor on pins 1 and 2 of the J1 connector on the US082-ZSSC3230EVZ, or confirm by applying stimulus signal on a capacitive sensor and observing the waveform on the graph.

1. On the MAIN application tab, click the **Start** button.
2. The measurement data values should be the input capacitance.

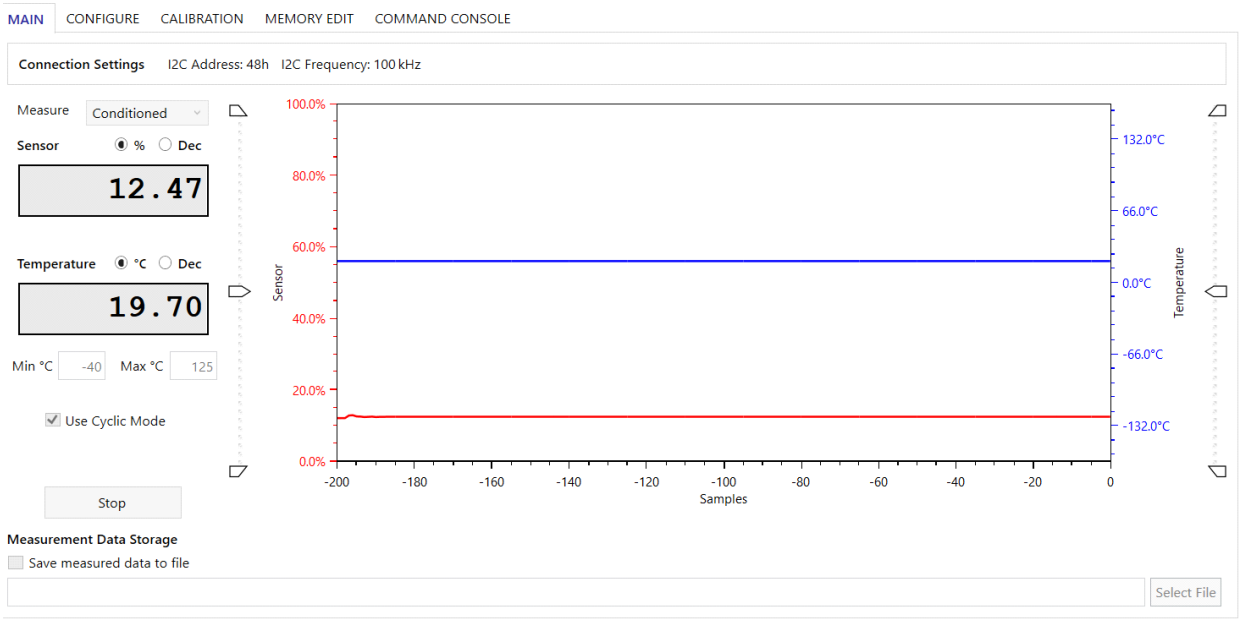

Figure 15. Measurement Result after Calibration

4. Revision History

Revision	Date	Description
1.00	Jun 26, 2024	Initial release.

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