

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*.

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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 I²C pull up jumper J11 and J12 are populated on ZSSC3230EVB board.

Note: Use only one set of pull-up resistors on the I²C 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.

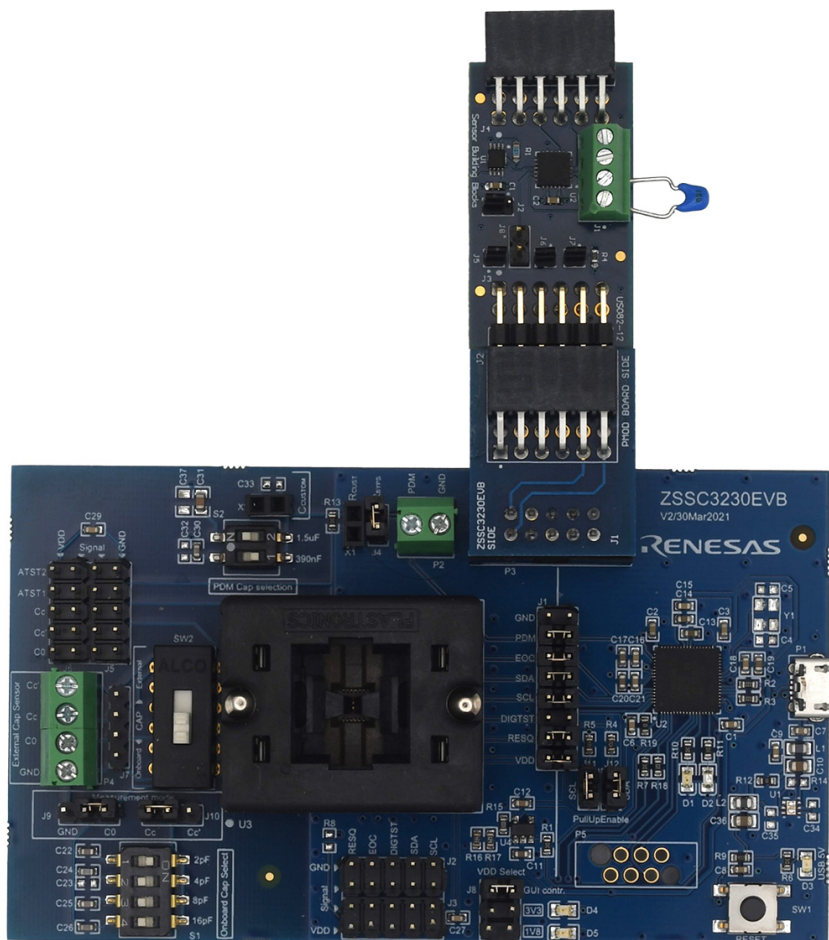


Figure 1. Board Connections

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 ZSSC3230EVZ 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.

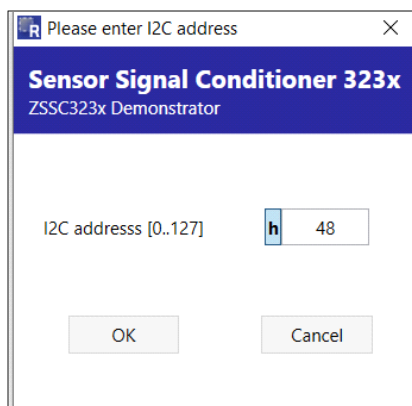


Figure 2. I²C Address Dialog

- 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.

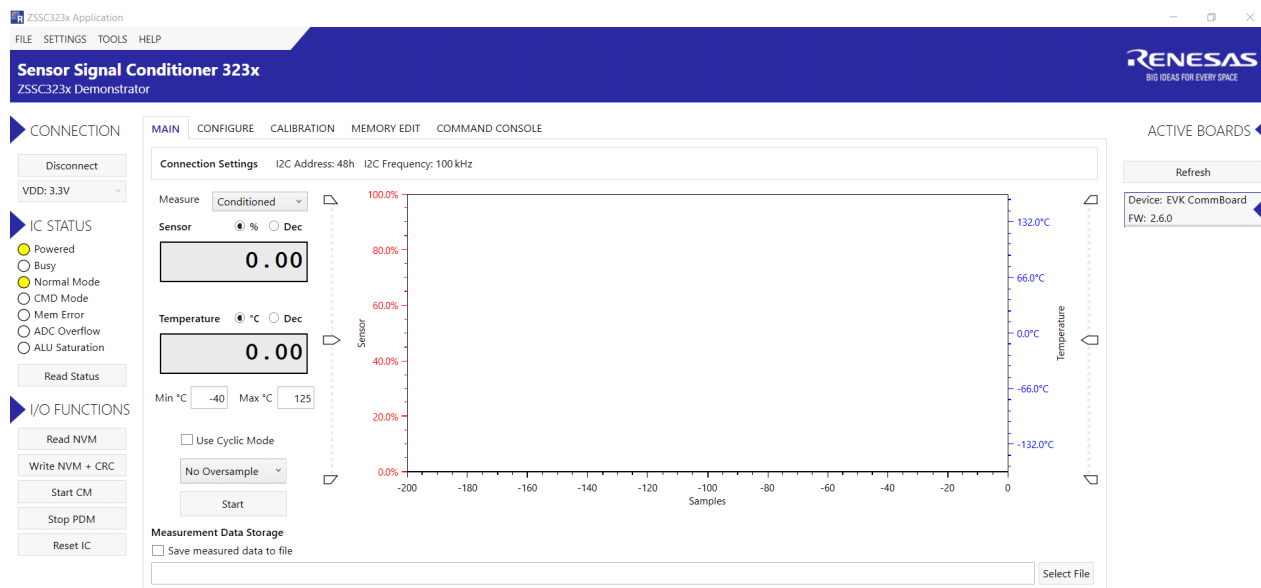


Figure 3. Connect to Board

- 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.

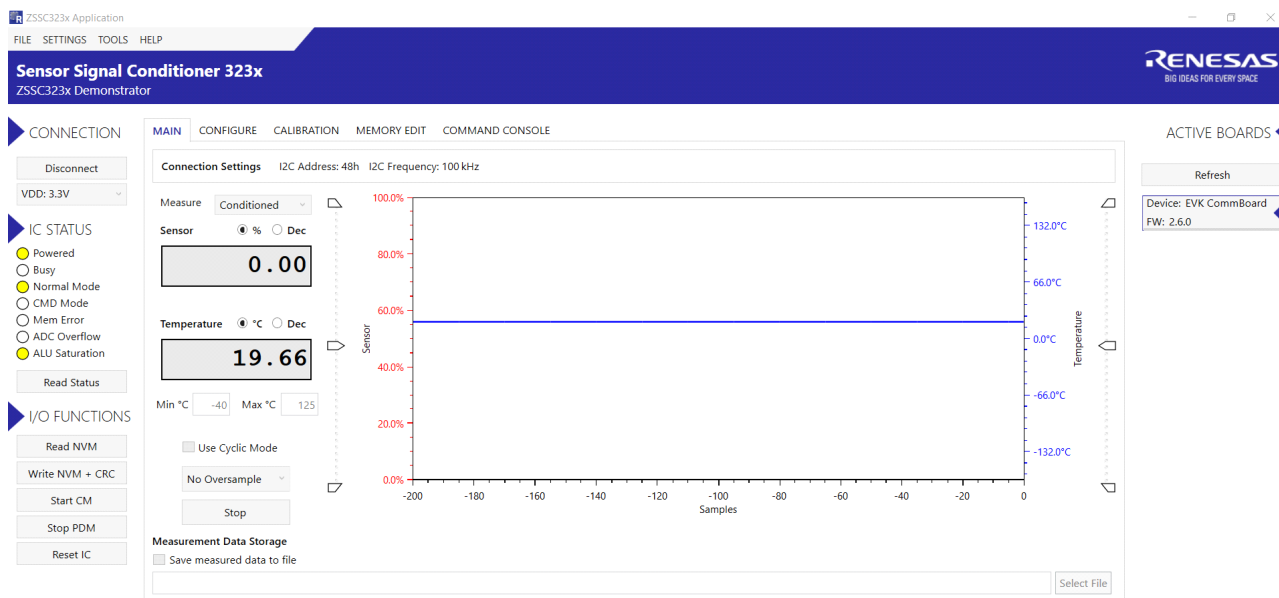


Figure 4. Start Measurement

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.
- Write down the value in **Temp. gain (Gain_T)**. For this case, it is 2097152.
 - The **Temp. gain (Gain_T)** value is used in step 20.

Signal conditioning parameters	Value (decimal)
Sensor gain (Gain_S)	2097152
Sensor offset (Offset_S)	0
Gain corr. (Tcg)	0
Offset corr. (Tco)	0
SOT Tcg	0
SOT Tco	0
SOT sensor	0
Temp. gain (Gain_T)	2097152
Temp. offset (Offset_T)	0
SOT temp	0
Sensor offset shift	0
Temp. offset shift	0
Second order curve	Parabolic

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

Measurement configuration	Value
Cap Range [Max C Signal Input Range]	16.0pF
Zero Shift Capacitance	no offset
ADC Conversion Bits	14
Noise Mode	"Humidity 14bit"
Sensor Leakage Compensation	disabled
Senscap Type	differential
Sensor Input Pin	CC
Dithering	enabled
Subtraction Mode	disabled
Active Shield Drive	disabled
High Current Mode	disabled

Figure 6. AFE Configuration

SIGNAL CONDITIONING AFE CONFIG APPLICATION

Application parameters	Value (decimal)
Customer ID0	0
Customer ID1	0
Interrupt threshold 1 (TRSH1)	0
Interrupt threshold 2 (TRSH2)	0
Update period in cyclic operation	no delay
EOC pin interrupt configuration	EoC signal
PDM Output	disabled
Signal Inversion	disabled
User Memory 0 (9bit)	300
User Memory 1	10741
User Memory 2	56683
I2C Slave Address	h 48

Figure 7. Application Configuration

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

I/O FUNCTIONS

Read NVM

Write NVM + CRC

Start CM

Stop PDM

Reset IC

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**.

Temperature range Acquisition Settings

Min °C

Skip the first samples

Max °C

Average samples

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.

Calibration Type Settings

Temperature range

Acquisition Settings

Type

3 Points: S(O+G+SOT)

Min

-40

°C

Skip the first

0

samples

Curve

Parabolic

Max

125

°C

Average

1

samples

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, and 12.5% 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.

Calibration Type Settings

Temperature range

Acquisition Settings

Type

3 Points: S(O+G+SOT)

Min

-40

°C

Skip the first

0

samples

Curve

Parabolic

Max

125

°C

Average

1

samples

Calibration points

S2	37.5	Get	3282	Get	Get
S3	94	Get	7288	Get	Get
S1	12.5	Get	1531	Get	Get

Sensor Targets [%]

Temp [°C]

T2

T1

T3

Calculate coefficients

Write coefficients to NVM

Write coefficients to IC

Save CSV

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.

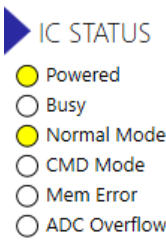


Figure 12. IC Status

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.

Calibration Type Settings

Temperature range

Acquisition Settings

Type

3 Points: S(O+G+SOT)

Min

-40

°C

Skip the first

0

samples

Curve

Parabolic

Max

125

°C

Average

1

samples

Calibration points

S2

37.5

Get

3282

Get

Get

S3

94

Get

7288

Get

Get

S1

12.5

Get

1531

Get

Get

Temp [°C]

T2

T1

T3

Calculate coefficients

Write coefficients to NVM

Write coefficients to IC

Save CSV

Coefficient result

RESULT	Offset S	Gain S	Tcg	Tco	SOT Tco	SOT Tcg	SOT S	Offset T	Gain T	SOT T
SUCCESS	-1058986	4941938					-15294			

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.

SIGNAL CONDITIONING		AFE CONFIG	APPLICATION
Signal conditioning parameters		Value (decimal)	
Sensor gain (Gain_S)		4941938	
Sensor offset (Offset_S)		-1058986	
Gain corr. (Tcg)		0	
Offset corr. (Tco)		0	
SOT Tcg		0	
SOT Tco		0	
SOT sensor		-15294	
Temp. gain (Gain_T)		2097152	
Temp. offset (Offset_T)		0	
SOT temp		0	
Sensor offset shift		0	
Temp. offset shift		0	
Second order curve		Parabolic	

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.

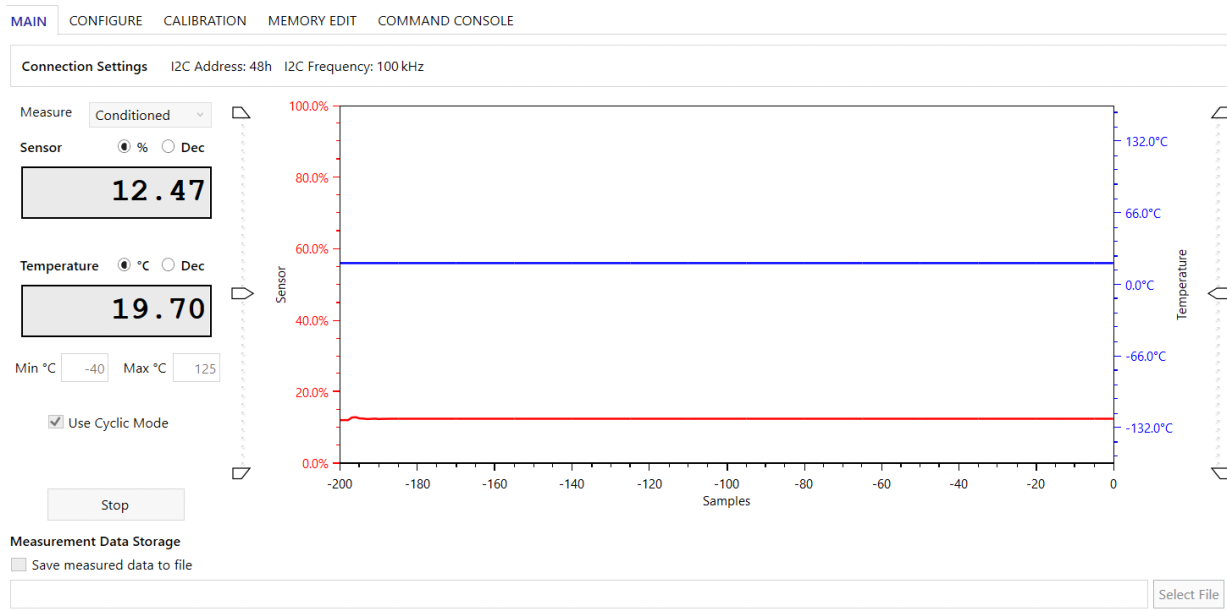


Figure 15. Measurement Result after Calibration

4. Revision History

Revision	Date	Description
1.00	Jun 26, 2024	Initial release.

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