

## Important Notes

### Restrictions in Use

IDT's ZSC31050 SSC Evaluation Kit, consisting of the SSC Communication Board (SSC CB), the ZSC31050 Evaluation Board (ZSC31050 SSC EB), and the calibration software, is designed for sensor module evaluation, laboratory setup, and module calibration development only.

IDT's Evaluation Kit hardware and software must not be used for module production and production test setups.

### Disclaimer

IDT shall not be liable for any damages arising out of defects resulting from

- (i) delivered hardware or software
- (ii) non-observance of instructions contained in this manual and in any other documentation provided to user, or
- (iii) misuse, abuse, use under abnormal conditions or alteration by anyone other than IDT.

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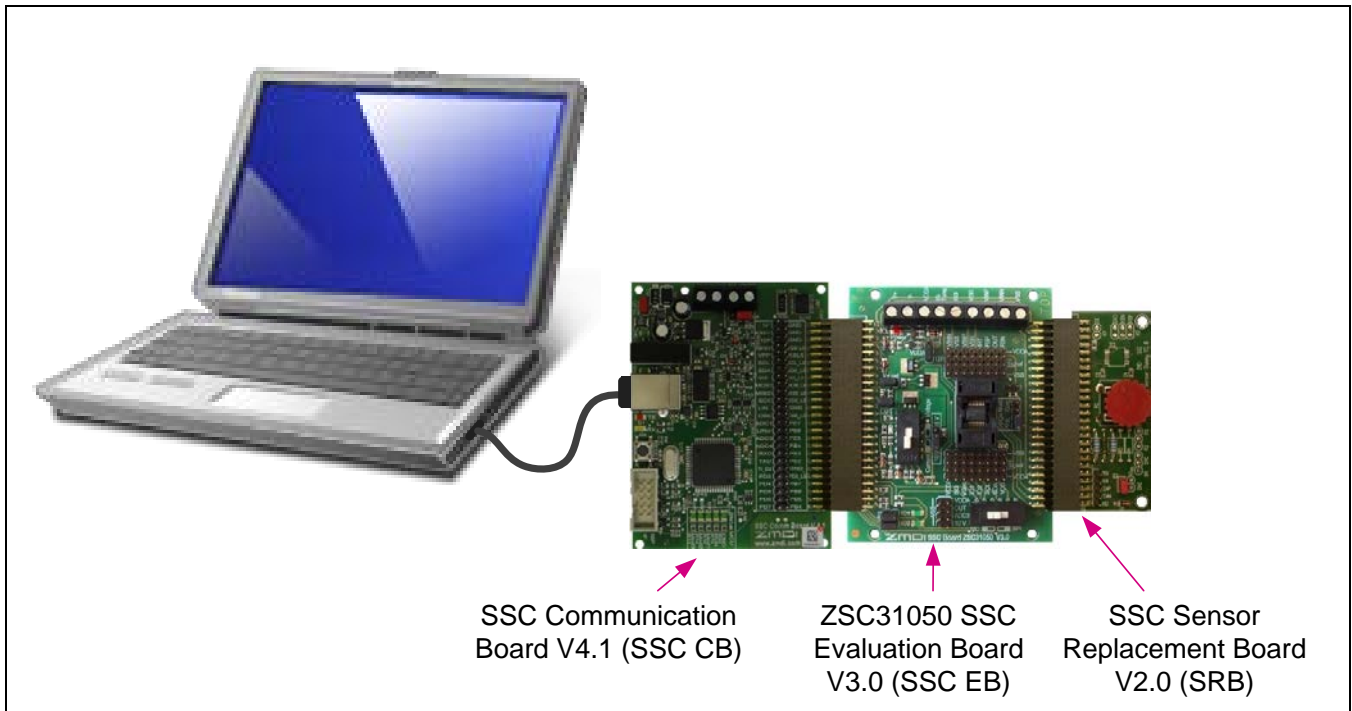
# 1 Kit Contents

The ZSC31050 Evaluation Kit consists of the following parts:

- SSC Communication Board (SSC CB) V4.1 (including USB cable) \*
- ZSC31050 SSC Evaluation Board (SSC EB) V3.0
- SSC Sensor Replacement Board (SRB) V2.0
- 5 samples of the ZSC31050 (SSOP16 5.3mm)

Note: The ZSSC31050 Evaluation Kit Software is available on IDT's website at <http://www.IDT.com/ZSC31050> as described in section 3.

**Figure 1.1 ZSC31050 Evaluation Kit**



The SSC Evaluation Kit contains the hardware needed for communication and calibration of ZSC31050 sensor signal conditioning ICs. A PC can communicate with the ZSC31050 via the Communication Board (SSC CB) through a USB connection. The Sensor Replacement Board (SRB) provides a replacement for an actual sensor and can be used for the first step of calibration or a dry-run calibration as described in section 4. On the SRB, the sensor replacement signal is controlled by a potentiometer (see Figure 1.1).

The software will run under Windows® 98/ME/XP/NT/Vista/Windows® 7/ Windows® 8 operating systems.

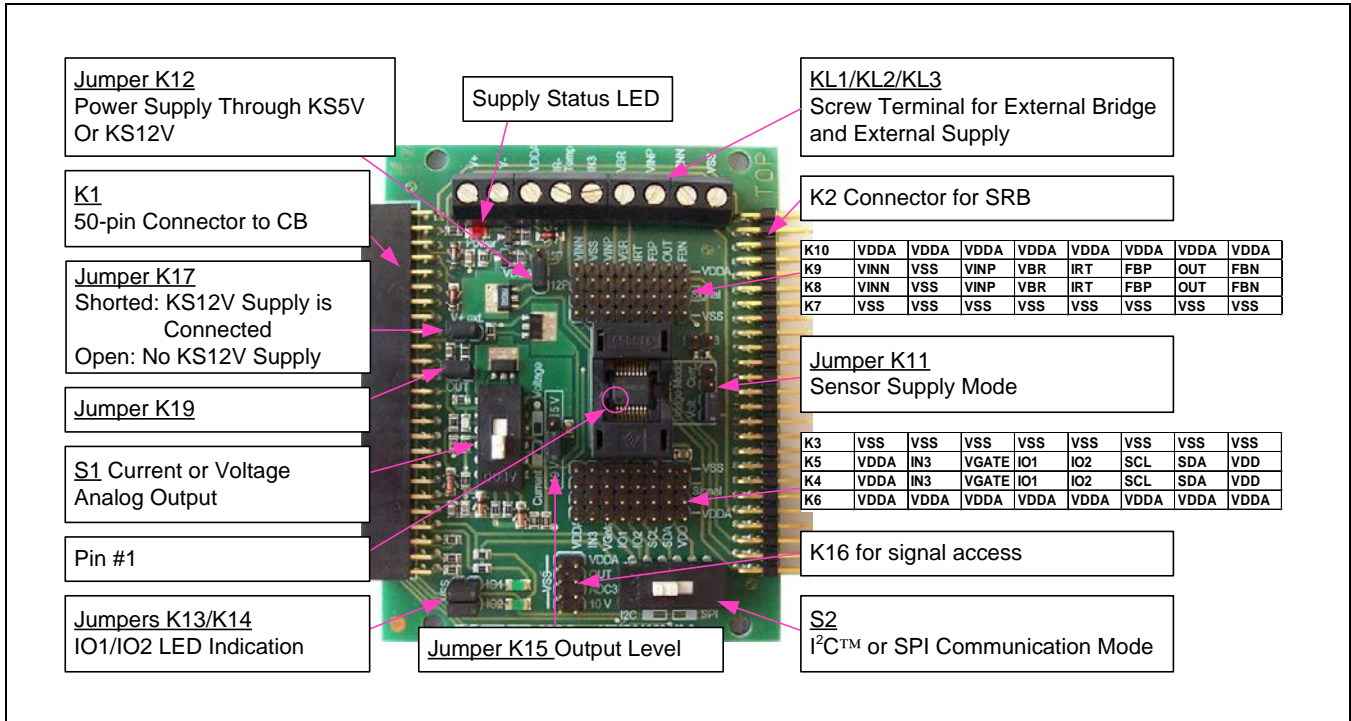
Note: The ZSC31050 Software refers to the sensor signal as the “pressure” measurement; however, the ZSC31050 can function with any bridge sensor type (e.g., piezo-resistive, ceramic-thickfilm, or steel membrane-based).

\* For detailed information about SSC Communication Board, please refer to the *SSC Communication Board Data Sheet* (see section 6).

## 2 ZSC31050 Evaluation Board

### 2.1. Overview

Figure 2.1 ZSC31050 SSC Evaluation Board – Overview



The main purpose of the SSC Evaluation Kit is communication between the PC and the ZSC31050. The PC sends commands and data via its USB port (configured as a virtual COM port) to the SSC CB. The microcontroller on the SSC CB interprets these commands and relays them to the ZSC31050 in the SPI, I<sup>2</sup>C™<sup>†</sup>, or OWI (One-Wire Interface) communication mode. The microcontroller will also forward any data bytes from the ZSC31050 back to the PC via the USB connection. These bytes can be sensor and temperature readings to be displayed by the PC software, raw ADC data used during calibration, or EEPROM data. The SSC CB microcontroller controls the power signals required for entering the Command Mode.

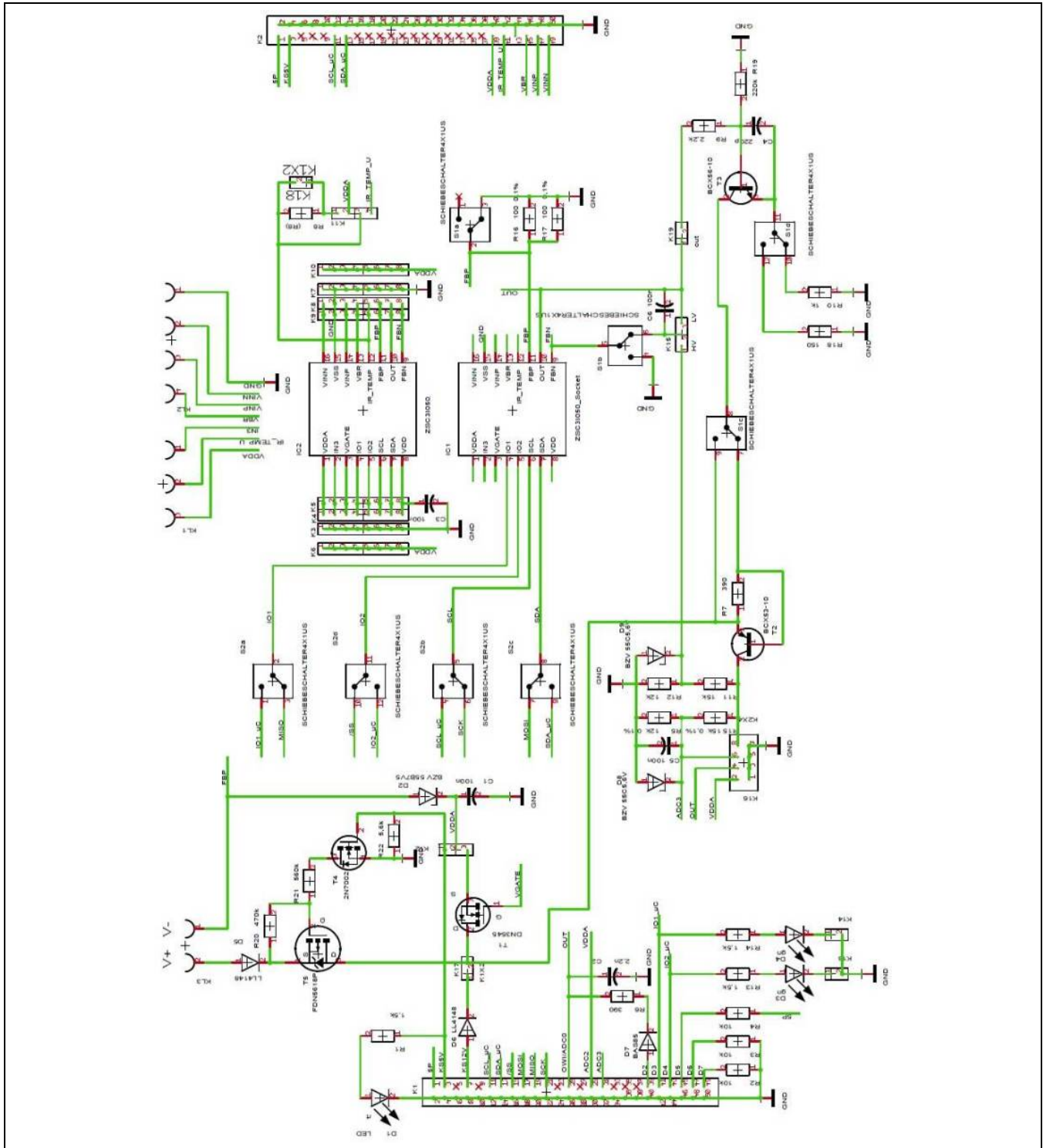
### 2.2. Schematic

Figure 2.2 shows the schematic of the ZSC31050 SSC Evaluation Board (SSC EB). The SSC EB is powered by the KS5V or KS12V supply controlled by the microcontroller on the SSC CB and the position of jumpers K12 and K17. The red LED displays the status of the supply. Its forward current is not included in the measured supply current.

Jumper K17 can be used to manually remove the KS12V power supply for the ZSC31050 or for a simple measurement of the supply current.

<sup>†</sup> I<sup>2</sup>C™ is a trademark of NXP.

Figure 2.2 SSC Evaluation Board Schematic



The SSC EB board type is hard-coded by three resistors on K1 connector pins D7 (low), D6 (low), and D5 (high). The SSC EB is connected to the SSC CB via a 50-pin female connector. On-board there are several pin-header strips for simple access to all IC signals (K3, K4, K5, K6, K7, K8, K9, K10, and K16).

The SRB can be connected to the SSC EB via its 50-pin male connector. Alternatively, an external bridge sensor element, external supply, and an external temperature sensor can be connected using the on-board screw terminal KL1/KL2.

### **2.3. Connections to the ZSC31050**

The SSC EB has an SSOP-16 socket for inserting the SSOP-16 ZSC31050. Note the pin orientation shown in Figure 2.1.

The connectors K3 through K10 on the SSC EB can be used to connect directly to the ZSC31050 for in-circuit programming. NOTE: Only one ZSC31050 connection option can be used at a time (i.e., either through the SSC CB or via individual connections).

### **2.4. Reset Switch**

Use the push button on the SSC CB to reset communications if needed. See Figure 4.1 for the location of the reset button.

## **3 ZSC31050 Software**

### **3.1. Overview**

The ZSC31050 Software is intended for demonstration purposes and calibration of single units. This section gives a short overview of the variety of ways to use this evaluation software. For a calibration example using the complete SSC Evaluation Kit, refer to section 4. IDT can provide users with algorithms and assistance in developing their full production calibration software.

The ZSC31050 Evaluation Kit does not include the software, which must be downloaded from the IDT website ([www.IDT.com](http://www.IDT.com)) to ensure receiving the latest release. To download the software, navigate to the product page at <http://www.IDT.com/ZSC31050>.

On the product page, click on the link titled “ZSC31050 Evaluation Software Rev. X.xxx” (where X.xxx is the current revision) and follow the dialog instructions as needed to download the zip file for the software.

Open the zip file and extract the executable file *ZSC31050\_Evaluation\_Software\_rev.X.xxx.exe*.

To install the software on the user's PC hard drive, double-click on the downloaded *extracted* file. Respond to the dialog box to select the installation directory, and the software will complete the installation, which results in a program shortcut on the desktop of the PC.

The default software installation folder is *C:\[program files]\ZMDI\ZSC31050*. The software logs various data and commands into log files as described in section 3.3. The software has a main window and five submenus that are intended for the following functions:

- Main Window: IC setup, configuration, and communication via check boxes, entry fields, and pull-down menus
- RAM/EEPROM Dialog: Direct access to RAM/EEPROM registers (consecutively numbered)
- Calibration Dialog: Acquisition of raw values from sensor and calculation of coefficients
- Calibration Register Dialog: Direct access to RAM/EEPROM registers (sorted by categories)
- Get Raw Values Dialog: Special Dx commands for the ZSC31050 ‡
- Send Command Dialog: Low-level write/read communication with SSC CB §

### 3.2. USB Driver Installation

USB driver installation is not applicable to the current version ZSC31050 Evaluation Kit since it includes the current version of the SSC CB (rev. 4.1). The USB driver installation is only required if the CB revision is rev.3.3 or earlier. To install the USB drivers on the earlier boards, refer to the *SSC Communication Board Driver Installation Application Note* (see section 6).

### 3.3. User Files

User files are saved in *[Program Files]\ZMDI\ZSC31050* and consist of log files and EEPROM files.

- *ZSC31050\_COMx.log* This is a communication log file created when connection with the SSC CB and the ZSC31050 is established (via OWI or I<sup>2</sup>C™\*\* interface). This file is a log of the communication to the ZSC31050 during the software session and can be saved after closing the software by renaming the file. Otherwise, it is overwritten the next time the software is opened.
- *save\_[date]\_[time].31050* This is a log file containing IC settings and acquired RAW data. This file can be used to load/save EEPROM contents.
- *save\_[date]\_[time].31050\_txt* This is a log file in text format containing ZSC31050 settings and acquired RAW data. This file can be used to view the EEPROM contents.

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‡ For details of the Dx commands, refer to the *ZSC31050 Functional Description*.

§ For details about SSC CB command structure, refer to the *SSC Communication Board Data Sheet* and *SSC Command Syntax*.

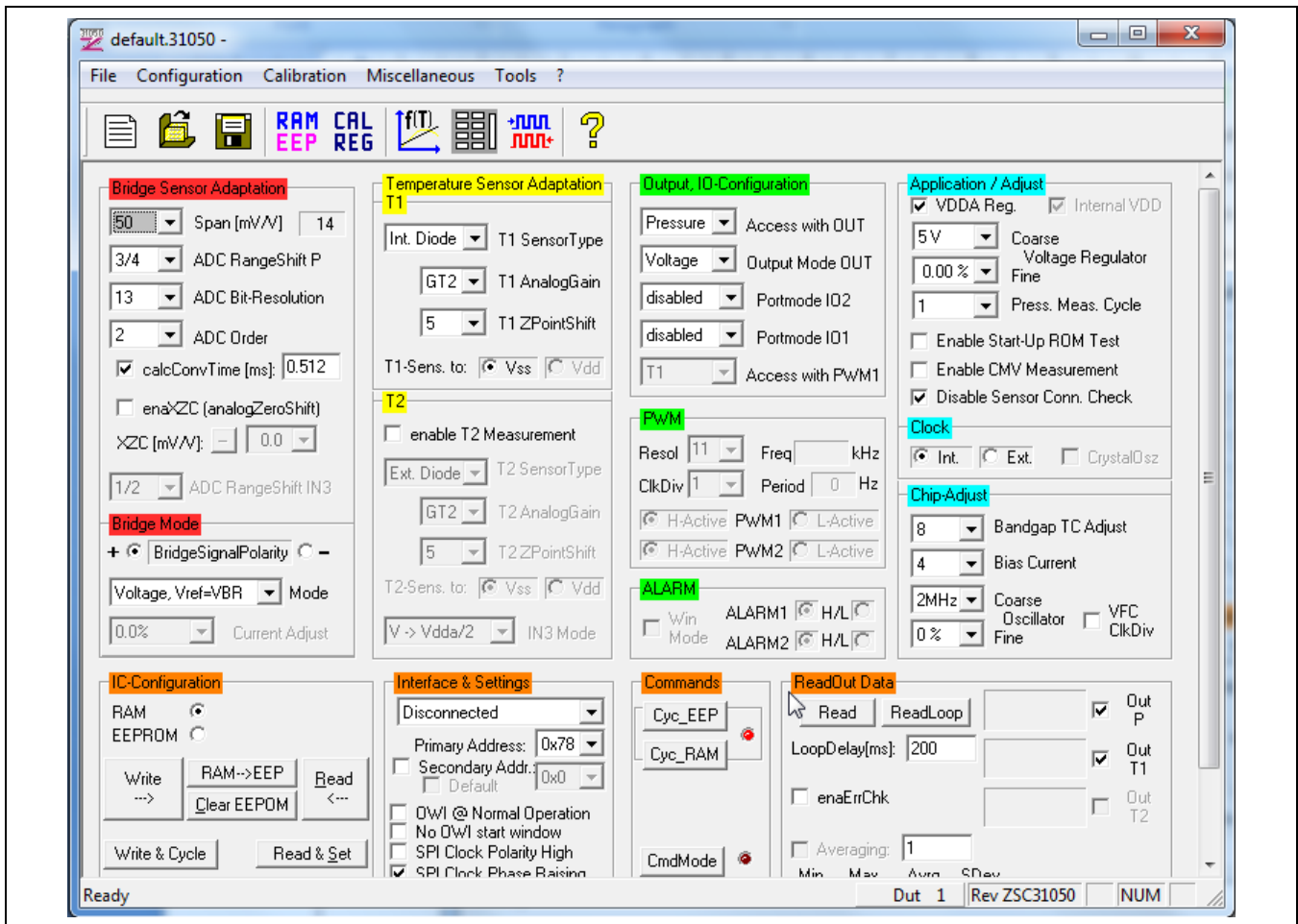
\*\* I<sup>2</sup>C™ is a registered trademark of NXP.

### 3.4. General Setup of the Software

Install the software as described in section 3.1.

Because of the large number of different functionalities of the ZSC31050, the user interface is divided into different segments for associated functionalities. Several submenus allow access to sub-functionalities. After the ZSC31050 Software is started, the main window is displayed (Figure 3.1). When communication is established with a ZSC31050 inserted in the socket on the SSC Evaluation Board, the software can be adapted to the ZSC31050's configuration by clicking on the **Read&Set** button on the main window in the "IC-Configuration" section.

Figure 3.1 Main Window of the Evaluation Software



The main window includes all the settings for configuration of the ZSC31050 in a clear structure that hides the corresponding HEX commands behind buttons and pull-down menus. For a detailed description of the commands, refer to the *ZSC31050 Functional Description*. An information box that explains functionality appears when the cursor is placed over most buttons, drop down menus, and check boxes.

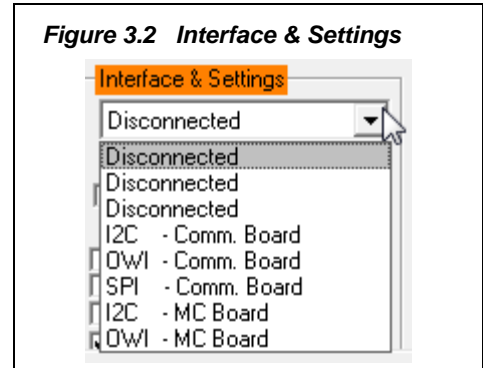


### 3.4.1. Interface Selection

The ZSC31050 supports three interfaces: SPI, OWI and I<sup>2</sup>C™.

After starting the software, select the interface for the application in the “Interface & Settings” section.

Below the drop down menu for the interface, there is a menu for selecting the I<sup>2</sup>C™ addresses to be used. Enter the general address using the menu. There is also an option to use an additional address. Refer to the *ZSC31050 Functional Description* for more details.



The one-wire digital interface (also called OWI) combines a simple and easy protocol adaptation with a cost-saving pin sharing (A<sub>OUT</sub>). The communication principle is derived from the I<sup>2</sup>C™ protocol. An advantage of OWI output signal capability is that it enables “end of line” calibration. It is designed mainly for calibration, but it may also be used to digitally read the calibrated sensor signal continuously.

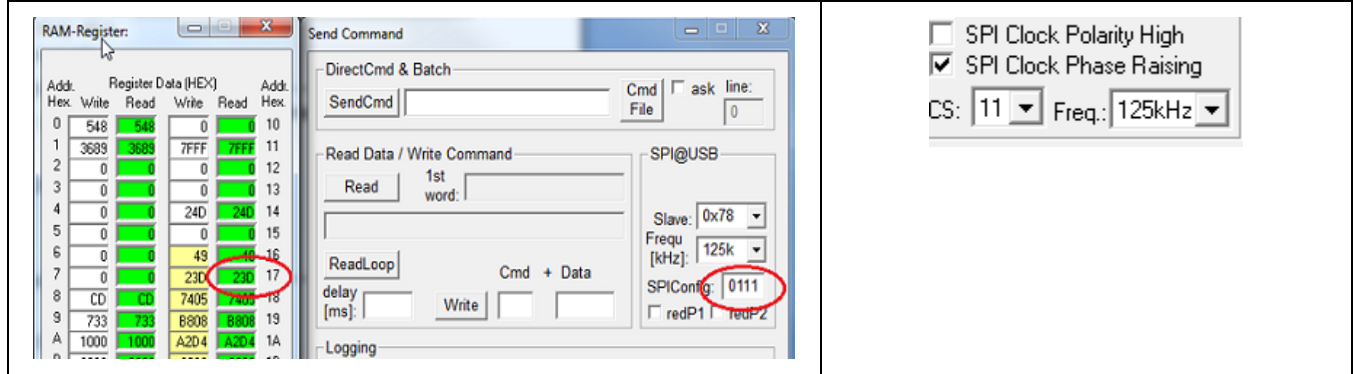
To use SPI communication instead of I<sup>2</sup>C™ or OWI, use the following procedure to enable SPI communication:

1. Using either the I<sup>2</sup>C™ or OWI interface, set bit [0] of register 17<sub>HEX</sub> to 1 to enable SPI (see section 3.8 for instructions for changing bits in registers).
2. Select the clock edge (bit [2], SPICKE) and clock polarity (bit [1], SPICKP) in register 17<sub>HEX</sub> as needed to configure the SPI. (See the *ZSC31050 Functional Description* for details on SPI clock phase and polarity.)
3. Write the registers to the EEPROM as described in section 3.8.
4. Adjust the Evaluation Software SPI configuration from the main Window or the Send Command Window (see section 3.10) by sending the following bits for the “SPIconfig” field as shown in Figure 3.3:
  - o Bit [0] & Bit [1] for Chip Select (CS) to 11 (CS on, idle = high)
  - o Bit [2] to SPICKE
  - o Bit [3] to SPICKP
5. Select the “Disconnected” interface in the “Interface & Settings” section and slide switch S2 to SPI on the SSC Evaluation Board.
6. Select the “SPI – Comm. Board” interface from the drop down menu.

Note: After enabling the SPI communication, no OWI or I<sup>2</sup>C™ communication is possible.

For the example in Figure 3.3, register 17<sub>HEX</sub> contains ...D<sub>HEX</sub> (...1101<sub>BIN</sub>), which enables SPI communication with SPICKE=1 and SPICKP=0; therefore SPIConfig should be configured as 0111<sub>BIN</sub> for proper communication.

**Figure 3.3 SPI Interface Adjust**

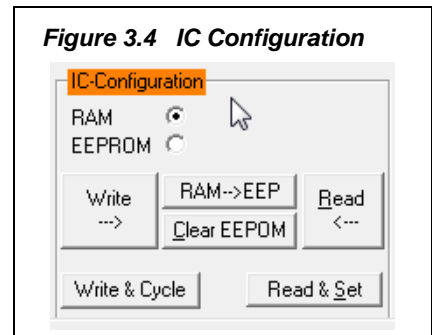


### 3.4.2. ZSC31050 Configuration

Because the ZSC31050 has 32 RAM and EEPROM registers, there is a radio button in the “IC-Configuration” (ZSC31050 configuration) section to switch the displayed information between these two memory types. Depending on the RAM or EEPROM selection, the buttons’ content will change.

This section also includes the following buttons:

- **Clear EEPROM**: Clears the EEPROM contents.
- **Write & Cycle**: Copies the current software settings into the RAM of the ZSC31050 and starts the measurement cycle using the current RAM settings (command: 02<sub>HEX</sub><sup>††</sup>).
- **RAM-->EEP**: Copies the RAM contents into EEPROM. The free-user-memory registers (1E<sub>HEX</sub> and 1F<sub>HEX</sub>) will also be copied using the contents of the IDT software registers<sup>††</sup>.
- **Read & Set**: Reads the complete RAM contents and updates all of the ZSC31050 software.
- **Read**: Reads the complete RAM or EEPROM contents and updates the “RAM\_Register” menu. (see section 3.8)
- **Write**: Copies the current software settings into the RAM/EEPROM of the ZSC31050.



The “updated” simulated LED displays the software configuration status compared with the ZSC31050’s register content. If the content is identical, the LED is green (On).

<sup>††</sup> For details about ZSC31050 commands, refer to the *ZSC31050 Functional Description*.

<sup>††</sup> The contents of the “RAM\_Register” dialog will be used for free-user-memory registers.

### 3.4.3. Analog Front End (AFE) Adjustment

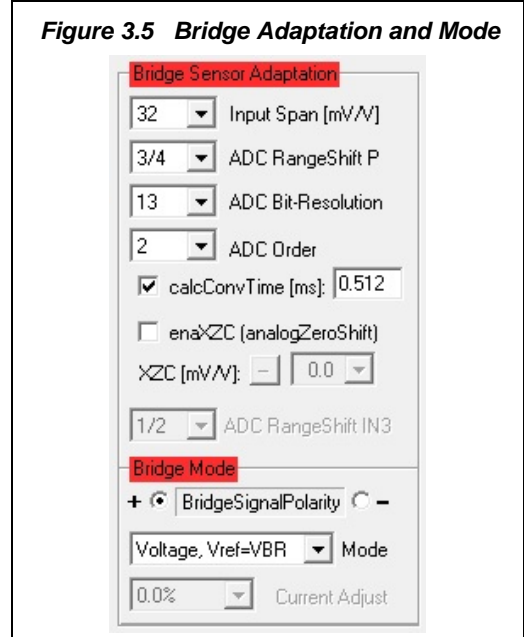
The ZSC31050 has different options to adapt the analog front end (AFE) to the specific sensing element. The “Bridge Sensor Adaptation” and “Bridge Mode” sections (see Figure 3.5) configure the programmable gain amplifier (PGA) and the extended zero compensation (XZC).

Refer to the *ZSC31050 Data Sheet* for details about PGA and XZC settings.

The next stage of the AFE is the ADC. The signal path within the AFE is fully differential, so it is necessary to provide an input signal within the common mode range. Otherwise, the ADC will provide a signal that is equal to 0000<sub>HEX</sub> (underflow) or 2<sup>ADC\_Resolution</sup> (overflow) in the “Sensor – Calibration” menu during calibration.

Refer to the *ZSC31050 Data Sheet* for details about ADC settings.

If the analog input voltage does not fit the ADC range and an underflow or overflow occurs, the “ADC Range Shift P” option can be used for fine-tuning. A lower “Span” setting in the “Sensor Adaptation” section can also be useful for fitting the ADC range.



Polarity of the sensor signal can be selected by the radio button and can be changed if using a user sensor module and the PCB layout requires swapped input pins. The drop-down menu can select the sensor operation mode, which can be voltage or current.

### 3.4.4. Temperature Sensor Selection

The last stage in the AFE is the multiplexer that selects the input signal for measuring temperature. The digital raw value for the sensor signal is processed with a correction formula to remove the temperature dependency based on the result of this measurement.

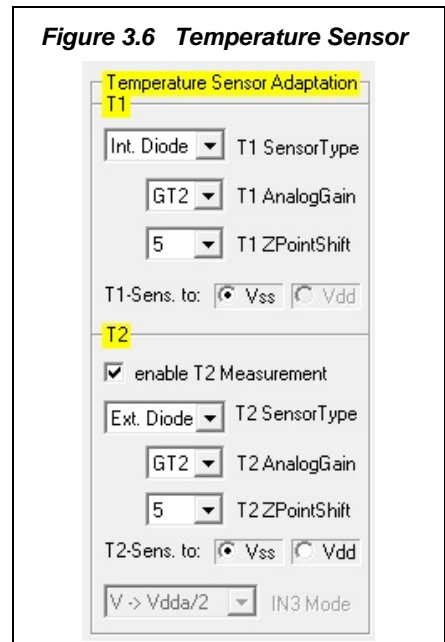
The temperature signal source can be the bridge voltage drop, thermistor, internal diode, and/or external diode (pn-junction).

The ZSC31050 can use different temperature channels:

- T1 (internal or external temperature sensor): used for calibration calculation, temperature correction, and an optional temperature output signal during Normal Operating Mode (NOM).
- T2 (optional): the external voltage mode can also provide a radiometric signal measurement of a half bridge or a voltage source referenced to an internal voltage divider or source.

For example, T2 can be used for measurement of the ambient temperature during NOM.

Note: The temperature measure source T1 sensor type for the temperature correction is required (only T1 can be used for correction).



### 3.4.5. Application Settings

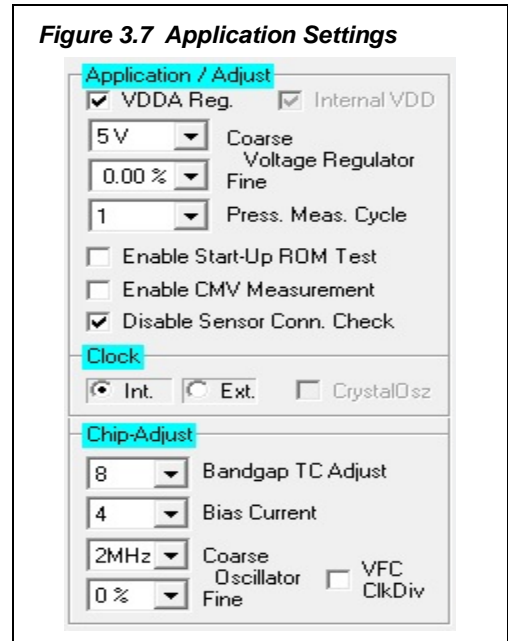
The internal microcontroller of the ZSC31050 can detect various errors and perform different types of measurement cycles. It controls multiple protection options that can be configured by the ZSC31050 Evaluation Software. Figure 3.7 illustrates the application options for the ZSC31050, which can be enabled/disabled via checkboxes and drop-down menus. For more details about the related options, refer to the *ZSC31050 Functional Description*.

- **VDDA Reg.** enables the coarse voltage regulator. When it is checked, the rough setting of VDDA in regulated VDDA mode (3-6V) can be set to one of four discrete steps from the **Course Voltage Regulator** drop-down menu. An accurate adjustment can be chosen by adjusting the **Fine** value.
- **Press. Meas.Cyle** increases the average sampling rate of the different inputs (the number of main sensor readings between two special readings).
- **Enable Start-Up ROM Test** enables the ROM check after power-on. If enabled, the start-up time will be increased by approximately 10ms. If a ROM error occurs, the ZSC31050 will change to the Diagnostic Mode (DM).
- **Enable CMV Measurement** enables the Common Mode Voltage (aging) test.
- **Disable Sensor Conn. Check** disables the Sensor Connection Check.

The next segment selects the clock source. If the external clock is selected, the chip will halt if no clock is connected. The external clock is useful for a synchronized mode or a precise PWM frequency.

- **Bandgap TC Adjust** is used to adjust the temperature behavior of the regulated analog supply voltage.
- **Bias Current** is adjustable for moving the total current consumption of the ZSC31050 into a required range. Current consumption can be decreased or increased by this value, but this may cause worse or better analog performance.
- **Coarse Oscillator** and **Fine** adjust the setting for the system clock and influence the conversion time and PWM frequency.
- **VFC ClkDiv** enables an additional clock divider for the clock frequency of ADC. This will increase the accuracy of conversion result, but doubles the conversion time.

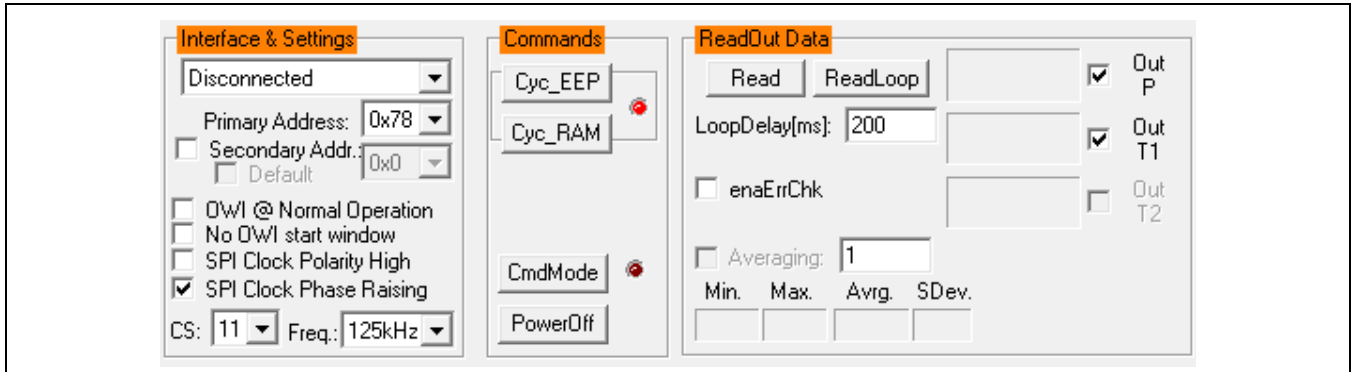
**Figure 3.7 Application Settings**



### 3.5. Operation Section

The operation section controls the collection of data and configuration of the ZSC31050.

Figure 3.8 Operation Section



#### 3.5.1. Operation Modes

- **Additional Addr.** enables an additional I<sup>2</sup>C™ slave address. See the *ZSC3150 Data Sheet* for details.
- **Enable OWI@NOM** starts NOM using the EEPROM configuration with digital output only; i.e., the OWI Interface Mode (conditioning result can be read via the digital interface).
- **Cyc\_EEP** starts NOM using the EEPROM contents. If the EEPROM signature is wrong, the DM is activated.
- **Cyc\_RAM** starts NOM using the RAM contents. When NOM is activated, the adjacent virtual LED turns green.
- **CmdMode** enters the Command Mode (CM) and sets communication protocol. The full set of commands is available during CM. When CM is activated, the adjacent virtual LED turns green.
- **PowerOff** powers off the ZSC31050. Click the **CmdMode** button or the selected interface to re-establish communication.

#### 3.5.2. Data Read-Out

**Read** & **ReadLoop**: To start a read-out of sensor data, click on one of these buttons. If a loop is started, the button text changes to “Stop.” Click the button again to stop the loop. In loop mode, some statistics can be monitored, such as minimum, maximum, standard deviation, and average.

#### 3.5.3. Enable Error Check

**enaErrChk** enables error checking according to the application settings described in section 3.4.5. An error code will be output if any of the errors selected occur.

#### 3.5.4. Average Count and Statistics

**Average Cnt:** 10 enables averaging and statistics calculation. It is only active if the measurement is in loop mode. Resulting data will be displayed after the specified cycles in the field are passed. The “Loop Delay” sets the frequency of data read-outs in milliseconds.

### 3.5.5. Output Temperature

<input checked="" type="checkbox"/>	OUT T1
<input checked="" type="checkbox"/>	OUT T2

enables the readout of the temperatures T1 or/and T2.

### 3.6. Output Configuration

The ZSC31050 provides analog and digital output options. Depending on the setting selected, different data, modes, and formats can be output on the pins:

- **Access with OUT** selects the output option for the OUT pin: Pressure (main sensor signal), T1, or T2 data.
- **Output Mode OUT** selects the mode for the OUT pin: Voltage (ratiometric analog voltage: 5% to 95% of VDD), Current (4 to 20mA output), or PWM2 signal. It can also be used to disable the output.
- **Portmode IO2** selects the output option for the IO2 pin: ALARM2 or disabled.
- **Portmode IO1** selects the output option for the IO1 pin: ALARM1, PWM1, or disabled.
- **Access with PWM1** selects the output option for the PWM1 pin: Pressure (main sensor signal), T1, or T2 data.

Note: When using the SPI interface, it is not possible to use the IO1 and IO2 outputs with PWM.

Settings for the PWM signal and ALARM:

- **Resol**: PWM output resolution.
- **Freq**: Calculated oscillator frequency
- **Period**: Calculated PWM frequency from the PWM period
- **ClkDiv**: PWM clock divider.
- **H-Active**: Active high signal for PWM1 or PWM2.
- **L-Active**: Active low signal for PWM1 or PWM2.
- **WinMode**: Alarm windows mode.
- **H/L**: Active high or active low level of the ALARM1 or ALARM2 signal.

For detailed PWM information, refer to the *ZSC31050 Functional Description*.

The source for the configuration for the OUT pin is affected by the **Enable OWI@NOM** checkbox in the “Interface & Settings” section (see section 3.5).

Figure 3.9 Output Configuration

The screenshot shows a software configuration window titled "Output, IO-Configuration". It contains several sections:

- Output, IO-Configuration**: A list of dropdown menus with their corresponding labels: Pressure (Access with OUT), Voltage (Output Mode OUT), ALARM2 (Portmode IO2), PWM1 (Portmode IO1), and T1 (Access with PWM1).
- PWM**: Settings for the PWM signal, including Resol (11), Freq (1998.8 kHz), ClkDiv (1), and Period (976 Hz). It also has radio buttons for H-Active and L-Active for both PWM1 and PWM2.
- ALARM**: Settings for the alarm signals, including Win Mode and radio buttons for H/L for both ALARM1 and ALARM2.

### 3.7. Calibration Window


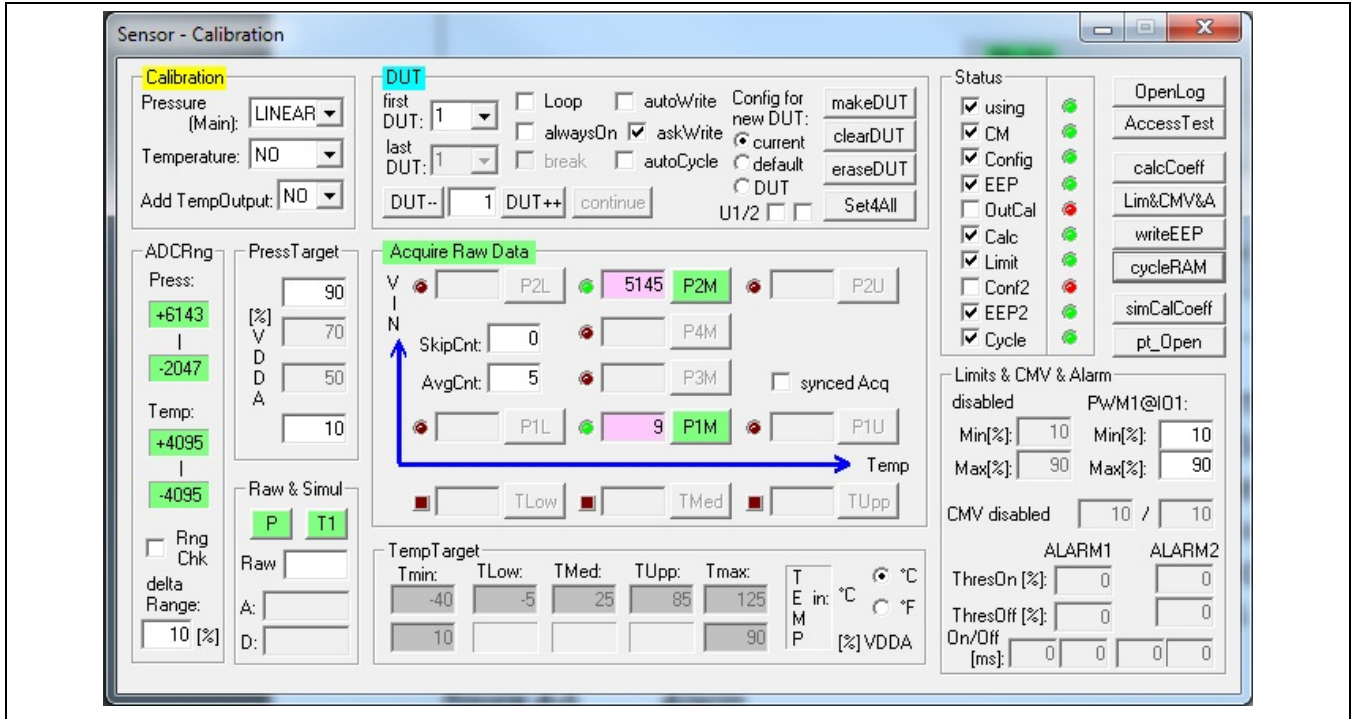

The “Sensor - Calibration” dialog is accessible from the main window by clicking on the  icon or by selecting “Calibration” on the top menu and then “Calibration” from the drop-down menu. It is used to perform a calibration of the ZSC31050 with either the SRB or the user’s sensor module. Section 4 gives an example calibration using the commands on this screen.

Figure 3.10 “Sensor – Calibration” Dialog



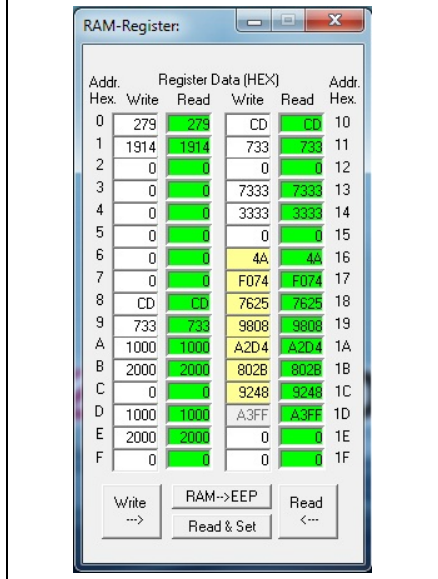
### 3.8. “RAM-Register” and “EEPROM-Register” Dialog Windows

The “RAM-Register” dialog or “EEPROM-Register” is accessible by clicking the  icon on the main menu after selecting either RAM or EEPROM respectively via the radio button in the “IC-Configuration” section. The dialog can also be accessed by selecting “Configuration” on the top menu and then “RAM/EEPROM.”

This dialog is used to read and write register contents into the ZSC31050 memories and has the same functionality as the “IC-Configuration” section in the main window. The **Write** and **Read** buttons store or read all register contents into and from the EEPROM/RAM (depending on which memory type is selected in the main window) of the ZSC31050. Register indexing corresponds to the ZSC31050 memory addresses. Refer to the *ZSC31050 Functional Description* for a full description of the registers. The configuration of the ZSC31050 is stored in 32 EEPROM 16-bit words as follows:

- Calibration coefficients for conditioning the main sensor signal via conditioning calculations and output limits are stored in eight registers (registers 0<sub>HEX</sub> to 7<sub>HEX</sub>).
- Calibration coefficients for conditioning the temperature sensor signal via conditioning calculations and output limits are stored in six registers (registers A<sub>HEX</sub> to F<sub>HEX</sub>).
- There are seven words for the configuration of the ZSC31050, which can be entered via fields in the main window (registers 16<sub>HEX</sub> to 1C<sub>HEX</sub>, with yellow background).
- Eight registers for storing limits and different types of settings (registers 8<sub>HEX</sub>, 9<sub>HEX</sub>, and 10<sub>HEX</sub> to 15<sub>HEX</sub>).
- One register is used for storing the EEPROM signature, which is used in NOM to check the validity of the EEPROM contents after power-on, (register 1D<sub>HEX</sub>).
- Two additional 16-bit registers are available for optional user data (registers 1E<sub>HEX</sub> and 1F<sub>HEX</sub>).

Figure 3.11 RAM-EEP Register – Example Showing RAM Contents




The “Write” columns show the PC data in hex format, which can be modified manually or by reading in a \*.31050 file. The “Read” columns show the data that was read last in hex format.

For more information regarding the registers, refer to the *ZSC31050 Functional Description*.

If current settings differ from the memory contents, registers that do not correspond to memory will have a red background after the “Read” operation.

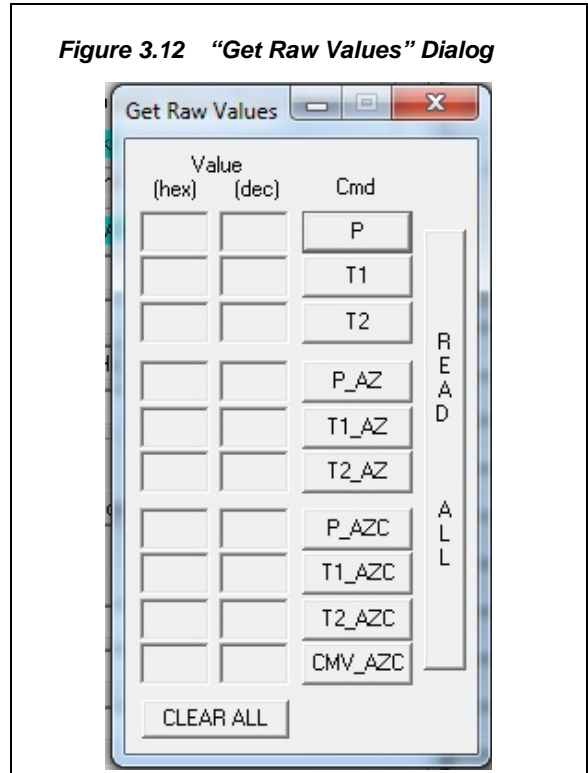


### 3.9. Get Raw Values Dialog


The “Get Raw Values” dialog is accessible from the main window by clicking on the  icon or by selecting “Calibration” on the top menu and then “Get Raw Values” from the drop-down menu. It is used to acquire the RAW values of the measurements for the following values.

- P**: Sensor Signal Raw Data (main channel).
- T1**: Temperature T1 Signal Raw Data.
- T2**: Temperature T2 Signal Raw Data.
- P\_AZ**: Sensor Signal Auto-Zero Raw Data.
- T1\_AZ**: Temperature T1 Signal Auto-Zero Raw Data.
- T2\_AZ**: Temperature T2 Signal Auto-Zero Raw Data.
- P\_AZC**: Sensor Signal Main Channel Raw Data including Auto-Zero Compensation.
- T1\_AZC**: Temperature T1 Signal Raw Data including Auto-Zero Compensation.
- T2\_AZC**: Temperature T2 Signal Raw Data including Auto-Zero Compensation.
- CMV\_AZC**: Common Mode Voltage Raw Data including Auto-Zero Compensation.
- READ ALL**: Reads all fields.
- CLEAR ALL**: Clears all fields.

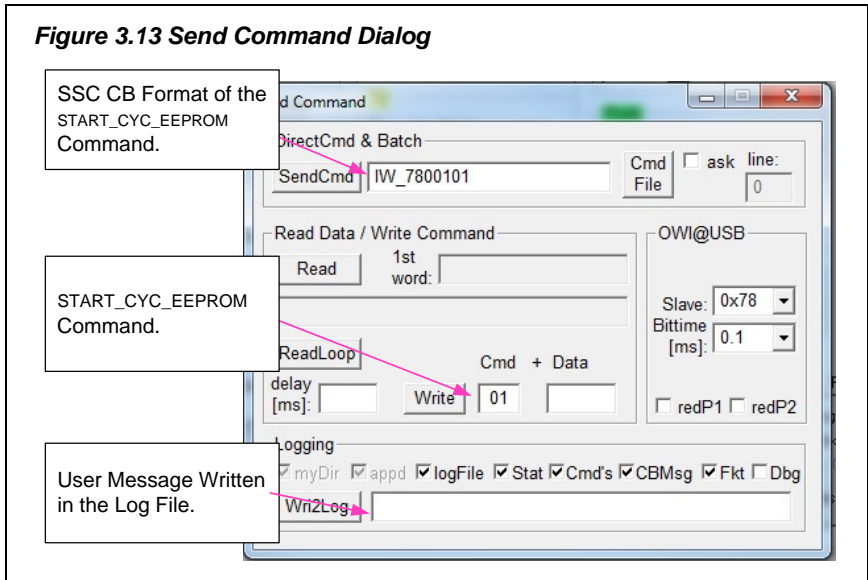
Figure 3.12 “Get Raw Values” Dialog



### 3.10. Send Command

The “Send Command” dialog is accessible from the main window by clicking on the  icon or by selecting “Calibration” on the top menu and then “Send Command” from the drop-down menu. This dialog is used for transferring commands from the PC to the microcontroller on the SSC CB and reading the result of the commands. A full summary and detailed command description of the applicable controller commands are given in *ZSC31050 Functional Description*. Note: The interface configuration section varies with the interface settings.

Note: For additional functionality, the IDT SSC Terminal Software (which can be downloaded from the IDT website at [www.IDT.com/SSC-COMM-BD](http://www.IDT.com/SSC-COMM-BD)) can be used as an alternative to the ZSC31050 Software. This is the lowest level of communication for transferring commands from the PC to the microcontroller on the SSC CB. A full summary and detailed command description of the applicable controller commands are given in *SSC Command Syntax* document included in the download zip file. The “Send Command” dialog includes the following buttons:



**SendCmd**

Sends a command to the CB. Alternatively, a \*.31050\_cmd command file can be loaded where the starting line of the file can be specified by the “line:” field. The “ask” field enables confirmation after each command.

**Read**

Reads the output data buffer of the ZSC31050 and displays it in the adjacent field. A loop delay can also be added between the readings.

**Write**

Performs the same function as the “SendCmd” command except that the command field and the data field are separated. The ZSC31050 software generates the actual instruction to be sent to the SSC CB.

**Wri2Log**

Writes text entered in adjacent field to the log file. The checkboxes can be used to write various data into the log file, such as status, commands, messages, etc. The  logFile checkbox enables and disables the logging.

For the communication between the SSC CB and the ZSC31050, the ZSC31050’s slave address and the bit time (OWI selected) or frequency (SPI selected) can be selected from the drop-down menus on the right. The **redP1** and **redP2** check boxes are not applicable to the ZSC31050 Evaluation Board.

## 4 Calibration Examples

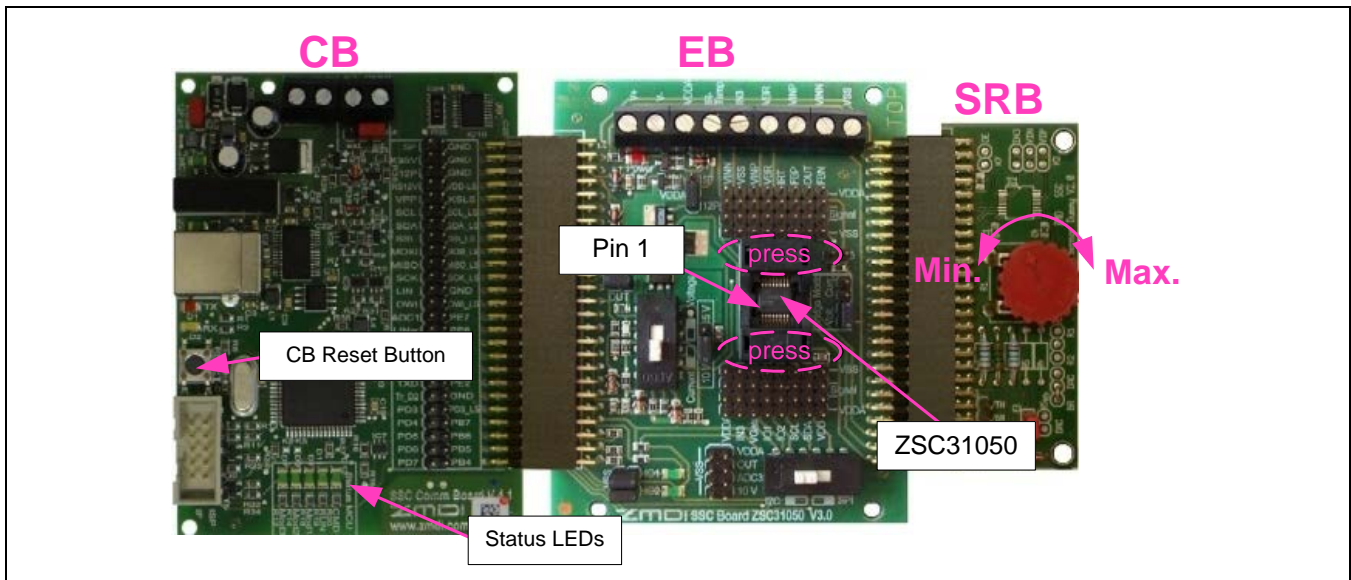


The following directions perform an example of a simple calibration using the sensor replacement board (SRB). The calibrated output will be displayed as a calibration result by the software.

### 4.1. Hardware Setup

- Connect the SSC CB, SSC EB, and SRB as shown in Figure 4.1.
- Press down on top of the socket on the SSC EB to open it and insert a ZSC31050 (note pin 1 orientation in Figure 4.1).
- Connect a USB cable from the USB connector on the SSC CB to an available USB port on the PC. Verify that the green PWR LED is lit on the SSC CB.

Figure 4.1 Hardware Setup for Calibration Example



### 4.2. Software Startup




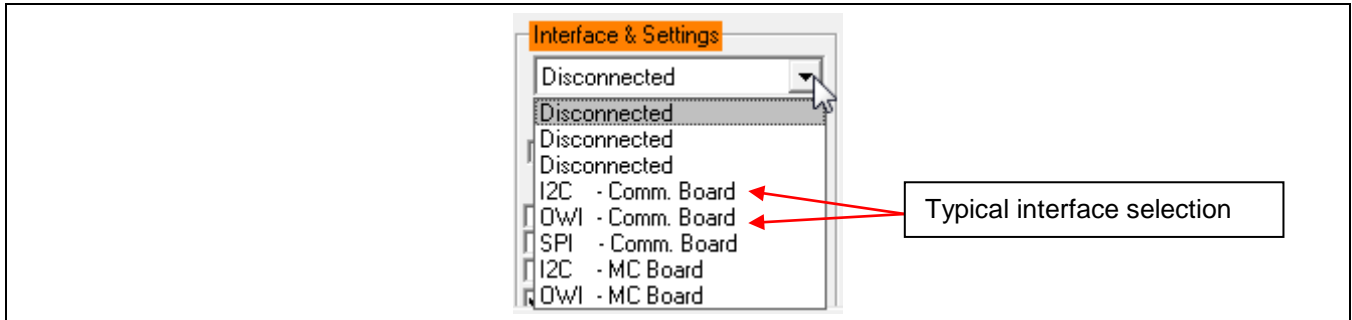
- Start the ZSC31050 Software by clicking on the  desktop icon or activate it from the Windows® Start Menu folder: `###\ZMDI\ZSC31050\ZSC31050.EXE`.
- Select "I2C - CB (USBPort-Kit)" or "OWI - CB (USBPort-Kit)" interface from the drop down menu in the "Interface & Settings" section of the main window as shown in Figure 4.2.

Figure 4.2 Select Interface

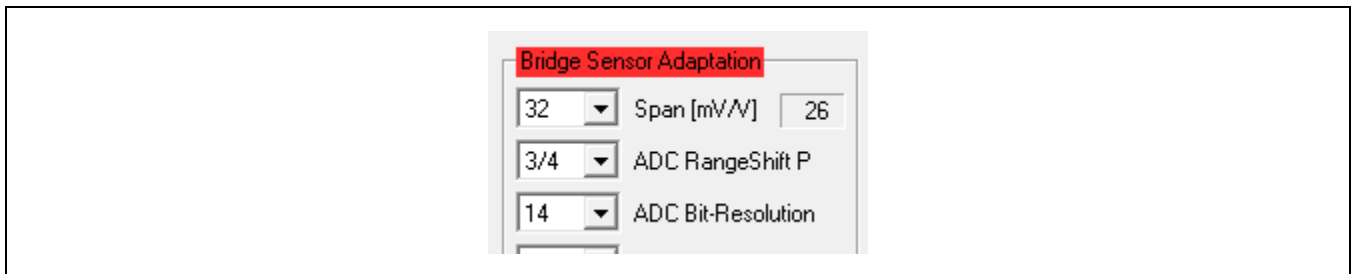


c) Select the following settings as shown in Figure 4.3:


- In the “Bridge Sensor Adaptation” section, set the “Span [mV/V]” (sensor sensitivity) menu to **32mV/V**, which is the typical span when using the SRB. With the 5V supply, this equals a total span of 160mV.
- In the “Bridge Sensor Adaptation” section, set the “ADC Bit-Resolution” menu to **14 bits** (equivalent to 16384 steps of the ADC).
- In the “Bridge Sensor Adaptation” section, set the “ADC Range Shift” menu to  $\frac{3}{4}$ , which fits the input signal range to the ADC output value (“analog zero”). For example for a range shift of  $\frac{3}{4}$  and 14 bits resolution, the read-out values would be between -4096 and +12287.

Note: Write the configuration into the RAM by pressing on the **Write** button in the “IC-Configuration” section.

Figure 4.3 Select Span, Resolution, and Range Shift



### 4.3. Calibration Data Acquisition

- a) Click on the  icon or select “Calibration” on the top menu and then “Calibration” from the drop-down menu. The “Sensor – Calibration” window appears as shown in Figure 4.4. Select the calibration mode from the drop down menu.

For this example, the recommended mode is

- ✓ **LINEAR** (two points only) for the sensor
- ✓ **NO** calibration for the temperature (temperature calibration requires a chamber with a controlled environment)

- b) Type the desired sensor target corresponding in percent to the VDDA supply. It is recommended that the output targets for the sensor points be in between 10% and 90%.

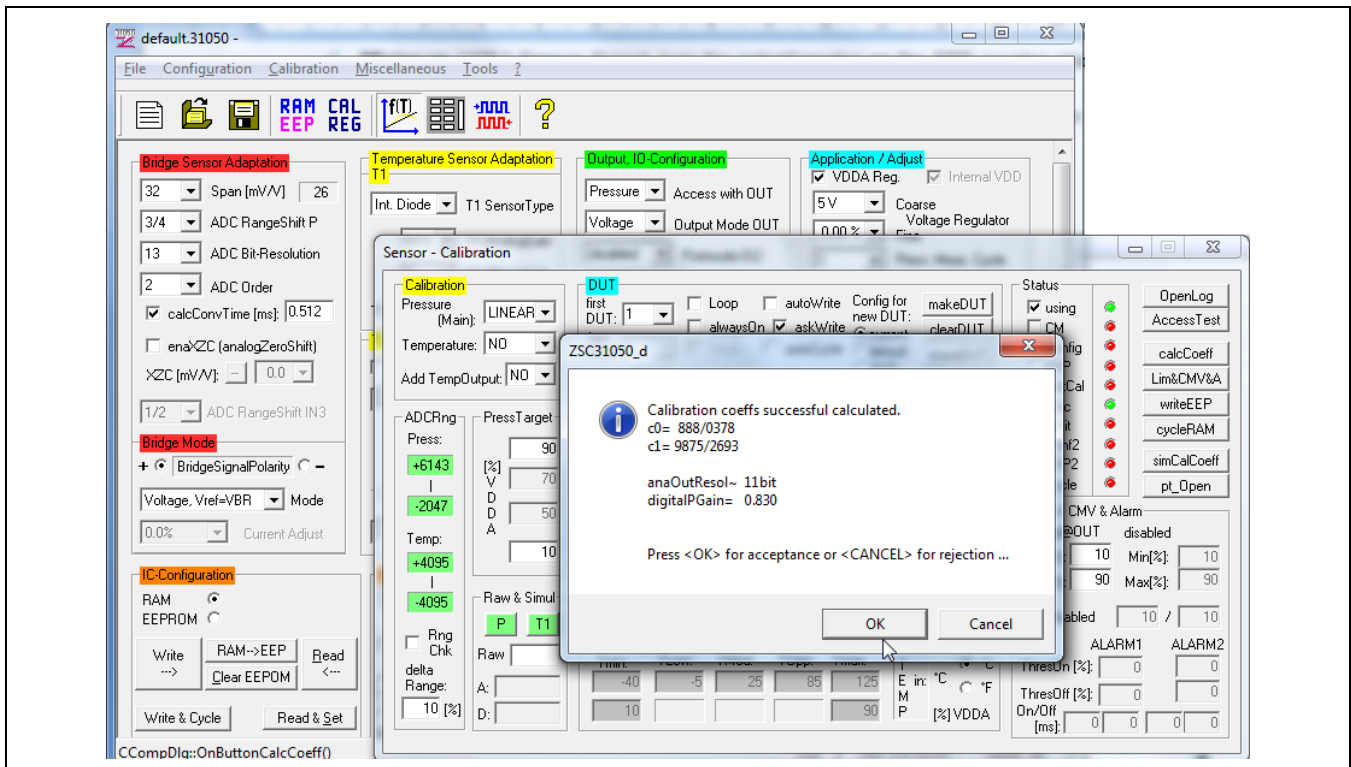
- c) Next start data collection. Normally this would be done with a real sensor attached on a remote board in a controlled chamber. Instead, this calibration example run uses the SRB as the input as follows:

- ✓ **Minimum [10%]** Sensor Signal: turn the potentiometer on the SRB counter-clockwise (CCW) to the end and click the **P1M** button.
- ✓ **Maximum [90%]** Sensor Signal: turn the potentiometer on the SRB clockwise (CW) to the end and click the **P2M** button.

Acquired data will be displayed in the text boxes next to the buttons.

Note: only active buttons corresponding to the calibration mode are green.

**Figure 4.4** Displaying the Result of the Coefficient Calculation



#### 4.4. Calculation of the Coefficients and Limits

- a) The `calcCoeff` button at the right of the “Sensor – Calibration” screen calculates the calibration coefficients. The result of the calculation (if successful) is displayed on the screen (see Figure 4.4). The calibration microcontroller (CMC) removes the offset and temperature dependency so that the measuring output result is within the target values (%VDDA or in this case between 10% and 90%).

Note: The number of calibration points is equal to the number of coefficients to be calculated.

- b) The `Lim&CMV&A` button calculates sensor aging (CMV) and oscillator limits.
- c) Click on `writeEEP` to make these calculations effective and written in the EEPROM. Option: starting a measuring cycle can be triggered by pressing the `cycleRAM` button.

Close the calibration window and trigger a measurement in the main window (see Figure 3.1) by clicking on either the `Read` or `ReadLoop` button in the Main Window. The ZSC31050 is already running in Normal Operation Mode (NOM) if the `cycleRAM` button was pressed in the calibration window. Measurement results can also be displayed in % by opening the “Tools -> Measure Output” window and selecting the output format in the checkbox.

## 5 Ordering Information

Product Sales Code	Description
ZSC31050KITV3.0	ZSC31050 Evaluation Kit, version 3.0
SSC Comm. Board V4.1	SSC Communication Board (SSC CB) V4.1 (including USB cable) *
SSC Board ZSC31050 V3.0	ZSC31050 SSC Evaluation Board (SSC EB) V3.0 *
SSC Sensor Replacement Board V2.0	SSC Sensor Replacement Board (SRB) V2.0 *
SSC Test Board V1.0	SSC Test Board V1.0

\* Can be ordered separately after ordering the ZSC31050 Evaluation Kit.

## 6 Related Documents

Document
ZSC31050 Data Sheet
ZSC31050 Functional Description
SSC Communication Board V4.1 Data Sheet *
SSC Sensor Replacement Board Data Sheet *
SSC Communication Board Application Note – USB Driver Installation *
SSC Command Syntax Spreadsheet for SSC CB V4.x *
SSC Command Syntax Spreadsheet for SSC CB V3.x *

Visit the ZSC31050 product page ([www.IDT.com/ZSC31050](http://www.IDT.com/ZSC31050)) or contact your nearest sales office for the latest version of these documents.

\* Documents marked with an asterisk (\*) are available at [www.IDT.com/SSC-COMM-BD](http://www.IDT.com/SSC-COMM-BD).

## 7 Glossary

Term	Description
ADC	Analog-to-Digital Converter
AFE	Analog Front End
CB	Communication Board
CMC	Calibration Microcontroller
CMV	Common Mode Voltage
OWI	One-Wire Interface
PCB	Printed Circuit Board
PGA	Programmable Gain Amplifier
SRB	Sensor Replacement Board
SSC	Sensor Signal Conditioner <i>or</i> Sensor Short Check <i>depending on context</i>
μC	Microcontroller

## 8 Document Revision History

Revision	Date	Description
1.00	April 2, 2012	First release
2.00	June 1, 2014	<p>Updates for new version of the SSC Communication Board 4.1, including revision of text regarding USB drives to indicate that USB driver installation is no longer applicable.</p> <p>SPI interface enabling procedure added.</p> <p>Updates for "Related Documents" section.</p> <p>Updates for contact information.</p>
2.01	November 19, 2014	<p>Updates for new version of ZSC31050 Evaluation Kit software:</p> <ul style="list-style-type: none"> <li>• Updates for section 3.4.1 and Figure 3.1.</li> <li>• Update for Figure 3.3.</li> <li>• Update for Figure 4.2</li> <li>• Update for Figure 4.4.</li> <li>• Related text edits.</li> </ul>
2.02	November 3, 2015	<p>Updates for new version Evaluation Software.</p> <p>Related updates for Figure 3.1, Figure 3.2, Figure 3.4, Figure 4.2, and Figure 4.4.</p> <p>Updates for button names in section 3.4.2</p> <p>Update for contact information.</p> <p>Minor edits for clarity.</p>
	April 26, 2016	Changed to IDT branding.