

Description

The ZSSC3018 SSC Evaluation Kit is designed for sensor module evaluation, laboratory setup, and module calibration development for the ZSSC3018 Sensor Signal Conditioners (SSC).

The main purpose of the ZSSC3018 Evaluation Kit is communication between the user's computer and the ZSSC3018. The computer sends commands and data via its USB port (configured as a virtual COM port) to the SSC Communication Board (SSC CB). The microcontroller on the SSC CB interprets these commands and relays them to the ZSSC3018 located on the ZSSC3018 SSC Evaluation Board using the I²C or SPI communication mode.

The microcontroller will also forward any data bytes from the ZSSC3018 back to the computer via the USB connection. These bytes can be sensor readings to be displayed on the computer by the software, raw analog-to-digital converter (ADC) data used during calibration, or EEPROM data.

Note: This document also covers software usage for ZSSC3018 Mass Calibration Systems (MCS). See section 4 for details.

Kit Contents

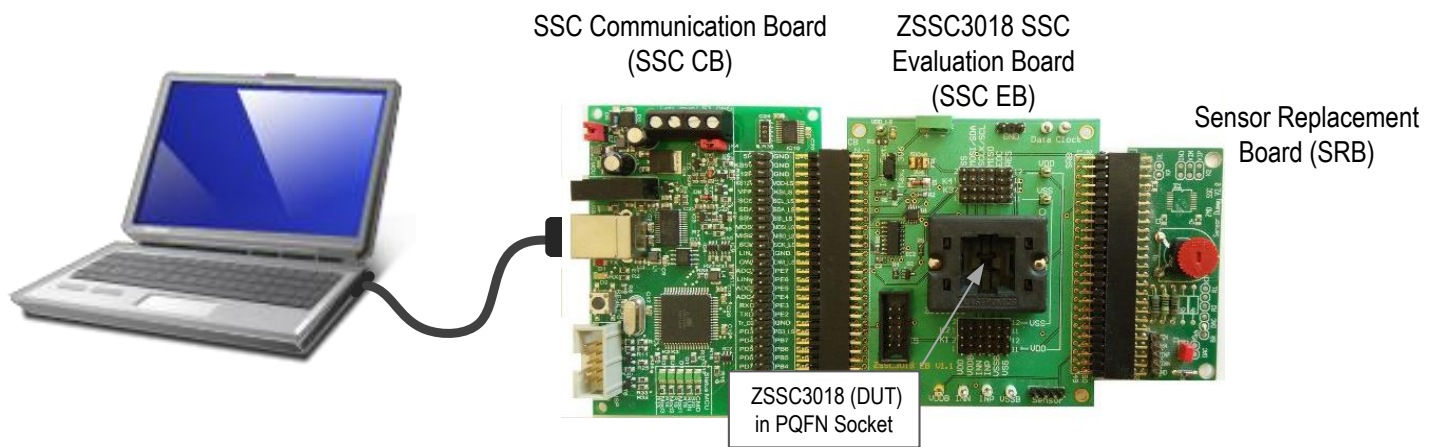
- ZSSC3018 SSC Evaluation Board (SSC EB) V1.2
- SSC Communication Board (SSC CB) V4.1 *
- SSC Sensor Replacement Board (SRB) V2.0
- 5 samples of the ZSSC3018 (24-PQFN 4 x 4 mm)
- USB cable
- Vacuum suction pen (for safe handling of samples)

Features

- I²C or SPI communication interface enables quick and easy configuration and calibration of the ZSSC3018 using the user's computer.
- Connections are provided on the ZSSC3018 SSC Evaluation Board for user's sensor module, which can be used instead of the SSC Sensor Replacement Board.
- A potentiometer on the SSC Sensor Replacement Board controls a voltage that simulates a sensor signal ranging from 2mV to 110mV, which can be input to the analog front-end of the ZSSC3018 (INP and INN pins) for evaluation of basic features or for demonstrating a "dry-run" calibration.
- Modular design allows reuse of kit components for evaluation of select ZSSCxxxx products.
- Clamshell 24-PQFN socket for ZSSC3018 device under test (DUT) facilitates testing multiple DUTs without soldering.
- Software is available for download from the IDT web site www.IDT.com/ZSSC3018.

* Note: The SSC Communication Board must have the current V4.12 firmware in order to recognize the ZSSC3018. If using an older Communication Board, contact IDT regarding firmware update procedures. For more detailed information about the SSC Communication Board, refer to the *SSC Communication Board Data Sheet* available at www.IDT.com/SSC-COMM-BD.

ZSSC3018 SSC Evaluation Kit



Important Notes

Restrictions in Use

IDT’s ZSSC3018 SSC Evaluation Kit, consisting of the SSC Communication Board (SSC CB), ZSSC3018 Evaluation Board (SSC EB), SSC Sensor Replacement Board (SSC RB), and ZSSC3018 Software, is designed for sensor module evaluation, laboratory setup, and module calibration development only. IDT’s SSC Evaluation Kit hardware and software must not be used for module production or production test setups.

The SSC Mass Calibration System is designed only for development, evaluation, and laboratory setup of sensor modules with IDT Sensor Signal Conditioner ICs. The IDT Mass Calibration System 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.

To the extent permitted by law, IDT hereby expressly disclaims and user expressly waives any and all warranties, whether express, implied, or statutory, including, without limitation, implied warranties of merchantability and of fitness for a particular purpose, statutory warranty of non-infringement, and any other warranty that may arise by reason of usage of trade, custom, or course of dealing.

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1. Setup

1.1 User Equipment

- A Windows®-based computer is required for interfacing with the kit and configuring the ZSSC3018.
- Optional: The ZSSC3018 power (VDD) can be supplied by the user's external power supply. See section 1.3.2 for connection details.

1.2 User Computer Requirements and Setup

1.2.1 Computer Requirements

Note: The user must have administrative rights on the computer to download and install the ZSSC3018 Evaluation Software for the kit.

The computer must meet the following requirements:

- Windows® XP SP3, Vista SP1 or later, 7 (including SP1), 8, 8.1, 10
- Supported architecture: x86 and x64
- Available USB port
- Internet access

1.2.2 ZSSC3018 Evaluation Software Installation and Setup

The ZSSC3018 Evaluation Software required for the kit is not included with the kit. To ensure use of the latest version of the software, it is available for download in zip file format from the IDT web site at www.IDT.com/ZSSC3018.

Note: FTDI USB drivers are needed for communication. If these drivers are not already installed on the user's computer, the software automatically installs the correct drivers after user confirmation.

Follow these procedures to install the Evaluation Kit Software on the user's computer:

1. After downloading the zip file to the user's computer, extract the contents of the zip file.
2. Double click on the extracted *setup.exe* file.
3. Follow the resulting standard installation instructions displayed on the screen, entering the installation path if needed. If the default path settings have been used, the software automatically completes the installation and creates an access link on the user's computer under *Start > All Programs > IDT > ZSSC3018 Evaluation*. The installation dialog offers the option to create a desktop short-cut icon for the software if selected.
4. Connect the kit hardware as described in section 1.3 before starting the software program for the first time. See section 1.4 for additional software setup and usage.

1.3 Hardware Setup

1.3.1 Overview of Hardware Connections

The ZSSC3018 Evaluation Kit contains the hardware needed for communication and a demonstration calibration of the ZSSC3018 sensor signal conditioning ICs. The user can use the software to communicate with the ZSSC3018 DUT installed on the ZSSC3018 SSC Evaluation Board (SSC EB) via the SSC Communication Board (SSC CB) connected to the user's computer through a USB cable.

The SSC Sensor Replacement Board (SRB) can be connected to the SSC EB as a replacement for an actual sensor and can be used for the first step of a calibration demonstration or a dry-run calibration. Alternatively, the user's sensor module can be connected to the SSC EB for configuration, calibration, and evaluation as an aid to module development.

Important: Do not connect the SRB to the SSC EB if the user's sensor module is used.

The ZSSC3018 power (VDD) can be supplied from the SSC CB's VDD_LS power supply or from an externally connected supply; for example, a low-noise laboratory power supply or battery that is used to achieve better performance or accuracy.

Important: The maximum voltage for an external supply is 3.6V.

Important: Upon delivery, there is a dummy IC in the socket on the ZSSC3018 SSC Evaluation Board that must be replaced with an actual ZSSC3018 device under test (DUT) as described in the next section.

See section 4 regarding the K5 Mass Calibration Board (MCB) DUT connector on the SSC EB shown in Figure 2.

Important: If using the ZSSC3018 Mass Calibration System, do not connect the SSC EB to the SSC CB. Instead, follow the instructions in section 4.

1.3.2 Kit Hardware Connections and Power-up

Important: If using an external power supply, do not apply the power connection until instructed.

Follow these procedures to set up the kit hardware:

1. Install the ZSSC3018 DUT in the PQFN socket on the ZSSC3018 SSC Evaluation Board (SSC EB) taking care to orient pin 1 properly as shown in Figure 1. Note: If the DUT is completely unconfigured, see "Memory Error" in Table 2.
2. If using the SSC CB's VDD_LS power supply, place a jumper shunt across the "Int." position on the "Int./Ext." connector header on the SSC EB (see Figure 2).
Or
If using an external power supply, apply the shunt in the "Ext." position on the "Int./Ext." header.
3. Connect the SSC CB and SSC EB as shown in Figure 1. Refer to Table 4 for the pin assignments for this connection.
4. If using the SRB, connect it to the SSC EB. See Table 5 for the pin assignments for this connection.
Or
If using the customer's sensor module, connect the module to the "Sensor" connector shown in Figure 2. For alternative connections, see Figure 23 for the ZSSC3018 Evaluation Board schematic.
5. Connect the USB cable from the USB connector on the SSC CB to an available USB port on the user's computer.
Note: If the computer is on and the SSC CB's VDD_LS power supply was selected in step 2 above, then the kit is now powered up as indicated by the VDD_LS supply status LED turning on (see Figure 2).
6. Alternative: If an externally connected supply is to be used as selected in step 2 above instead of the internal supply, then before connecting it to the kit, adjust the external power supply to the proper voltage and current levels (1.68V to 3.6V). Connect the power supply positive voltage to the "+" pin of the two-pin header for the external power supply on the SSC EB (see Figure 2) and connect the power supply ground to the "-" pin.

Figure 1. ZSSC3018 SSC Evaluation Kit Hardware Connections with Internal Supply

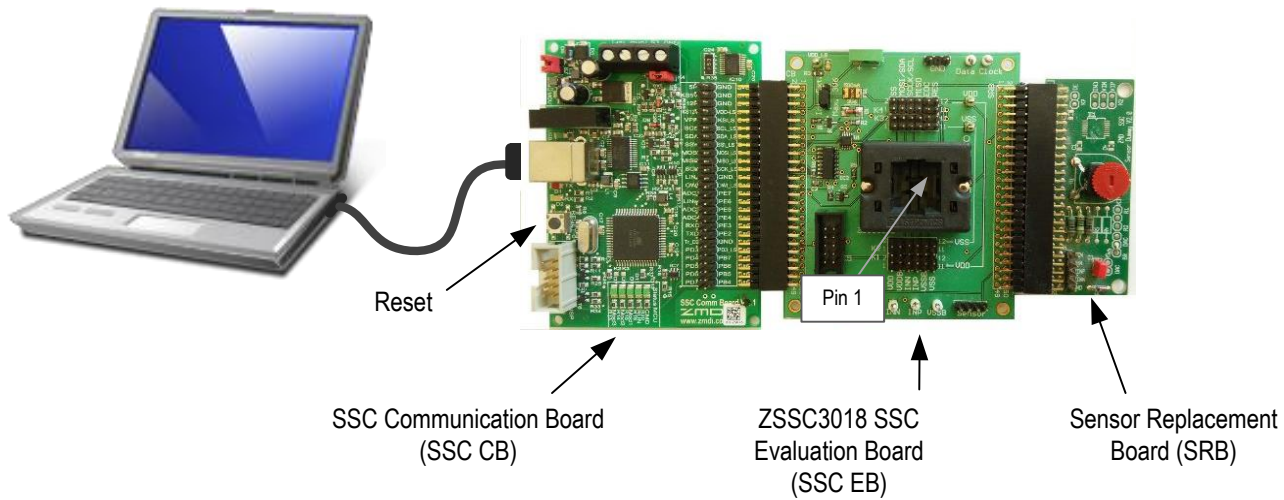


Figure 2. ZSSC3018 SSC Evaluation Board – Overview

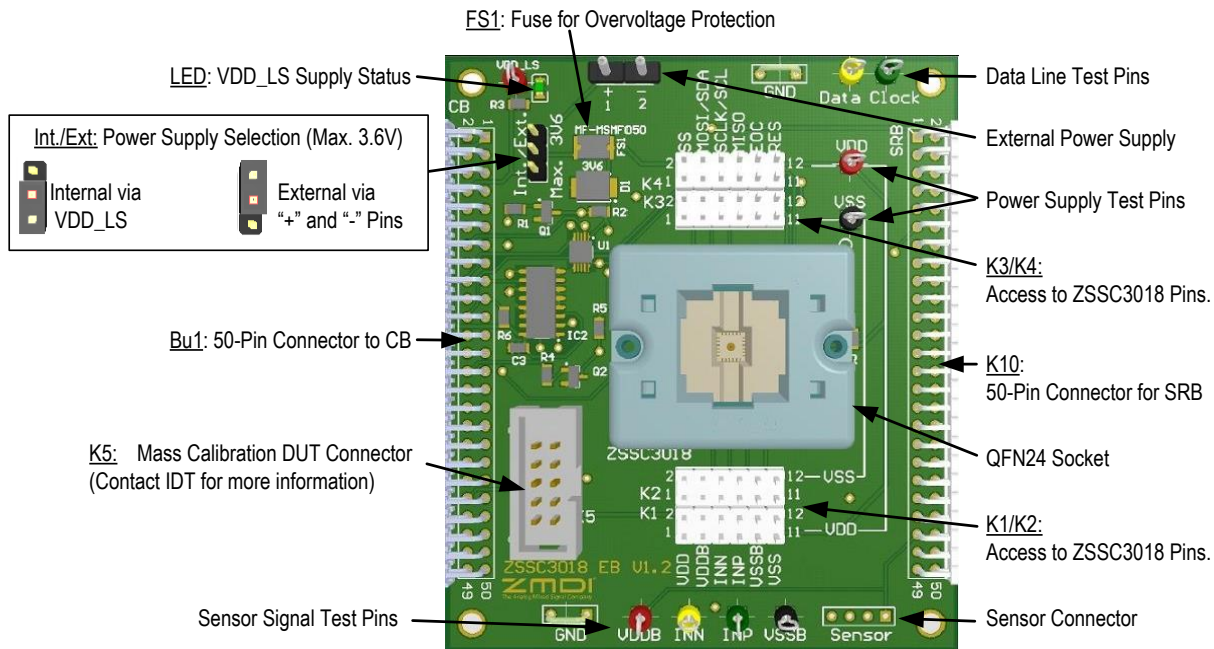


Table 1. ZSSC3018 Evaluation Board Connectors, Switches, and LEDs

Name	Description
VDD_LS	Status LED for the VDD_LS supply.
Bu1	50-pin female connector connected to the SSC CB. See Table 4 for descriptions of the signals on Bu1.
K10	50-pin male connector to the SRB. See Table 5 for descriptions of the signals on K10.
Int./Ext.	Selection between SSC CB power supply (VDD_LS) or "+ -" external power supply.

Name	Description
+ 1	External power supply connector.
- 2	
K1, K2, K3, K4	Header strips for access to all ZSSC3018 signals. Each connector also provides access to VDD or VSS on one of the sides.
Sensor	Headers for connections for external sensor.
FS1	Fuse for protection against overvoltage.
ZSSC3018	Socket for inserting the 24-PQFN 4 x 4 mm ZSSC3018 DUT.
K5	Mass Calibration Board (MCB) DUT connector. Contact IDT for further information.
Data	Test pin for the data line (interface selectable by the CB's PE6 pin level; see Table 4).
Clock	Test pin for the interface clock (interface selectable by the CB's PE6 pin level; see Table 4).
GND	Ground connection to VSS.

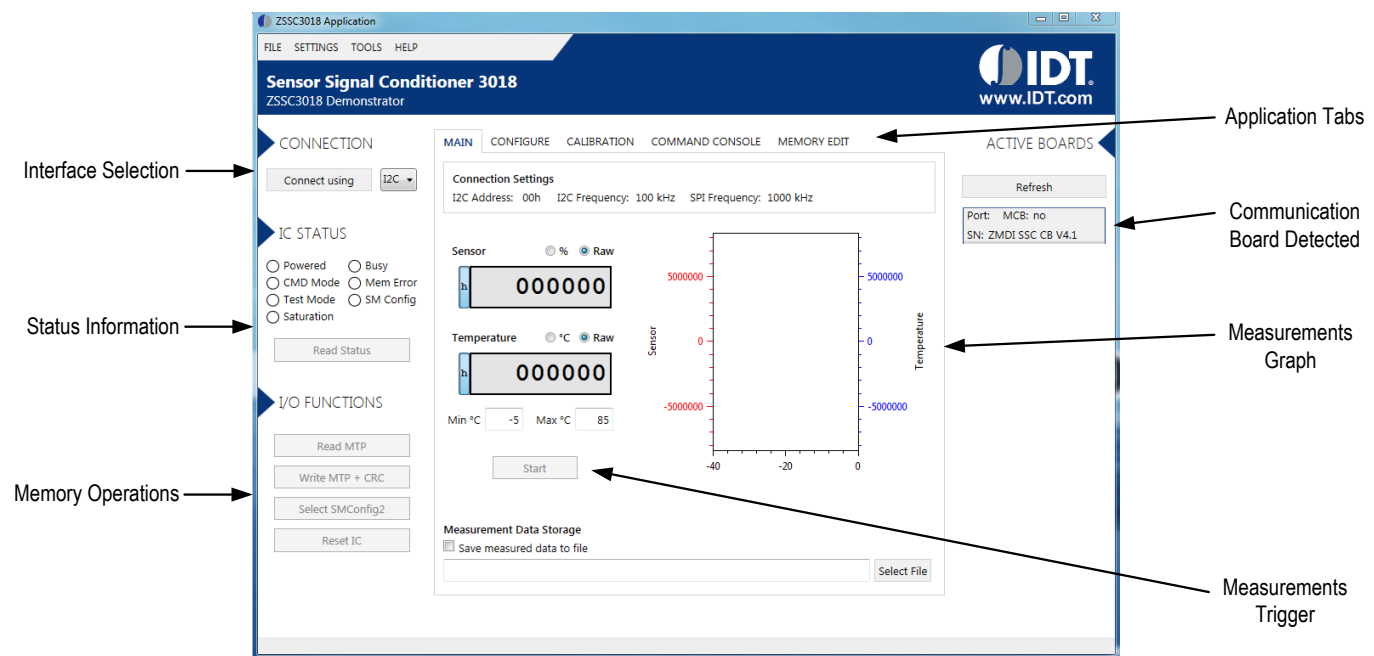
1.4 Communication Setup

When the Evaluation Kit is powered, start the ZSSC3018 Evaluation Software. The window opens with the “Main” application tab displayed (see Figure 3). On the right panel under “ACTIVE BOARDS,” there is a list of the active, correctly connected devices, which will include the SSC Communication Board (“IDT SSC CB V4.1”). Multiple devices can be connected to the user’s computer.

Follow these steps to set up communication with the kit:

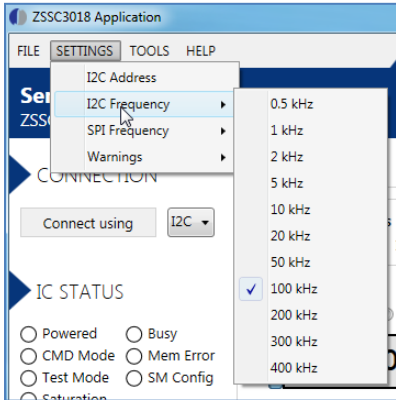
1. If multiple devices are listed under “ACTIVE BOARDS,” select the desired device from the list by clicking on it. Refresh the list after changing any connections by clicking the “Refresh” button.

Figure 3. Initial Display



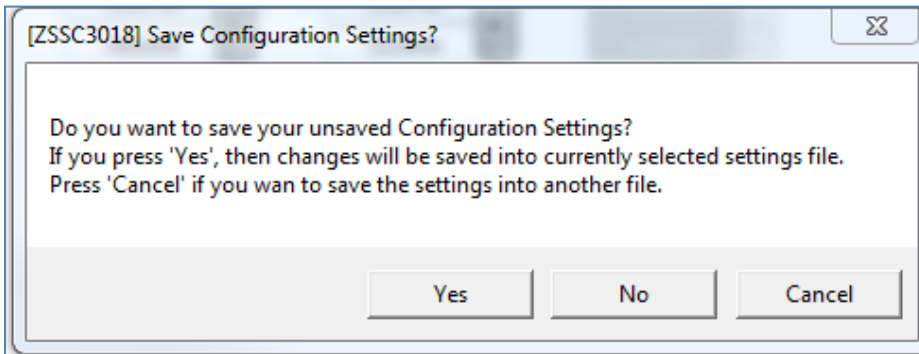
2. Select a communication protocol (I²C or SPI) in the dropdown menu under “CONNECTION” in the left panel. See Figure 3.
3. If necessary, select additional parameters for the I²C/SPI communications and specific settings, such as speed and the slave address, via the “SETTINGS” dropdown menu on the top banner shown in Figure 4. The new settings will be applied the next time that a connection is re-established with the ZSSC3018.
Note: The I²C address must be set correctly in order to establish successful I²C communication.
4. Click the “Connect using” button to establish communication with the ZSSC3018. When communication is correctly established, the “Connect using” button changes to “Disconnect.” The software generates the corresponding data frame structure with values by default.

Figure 4. Settings Menu



Note: When the Evaluation Software is closed, the user will be prompted to save the current configuration of the GUI in a *.cfg file. The next time the software is opened, this configuration will be loaded automatically with the saved settings. This will only save configuration settings of the software, such as I²C, SPI, and COM port settings.

Figure 5. Save Configuration Dialog Window



2. Usage Guide

The ZSSC3018 Evaluation Software is intended for demonstration purposes and calibration of single units. Upon request, IDT will provide the user with algorithms and assistance in developing their full production calibration software.

Note: The reset button on the SSC CB (see Figure 1) initializes the CB controller to its initial state. Note that any port settings will be overwritten.

2.1 “IC STATUS” Section

In the left panel under “IC STATUS,” the status of the device is indicated via the color of the virtual LEDs (see Figure 3). The colors are defined in Table 2. The current status can be read by clicking the “Read status” button. A yellow virtual LED indicates that the status is active; white indicates inactive.

Table 2. IC Status Indicators

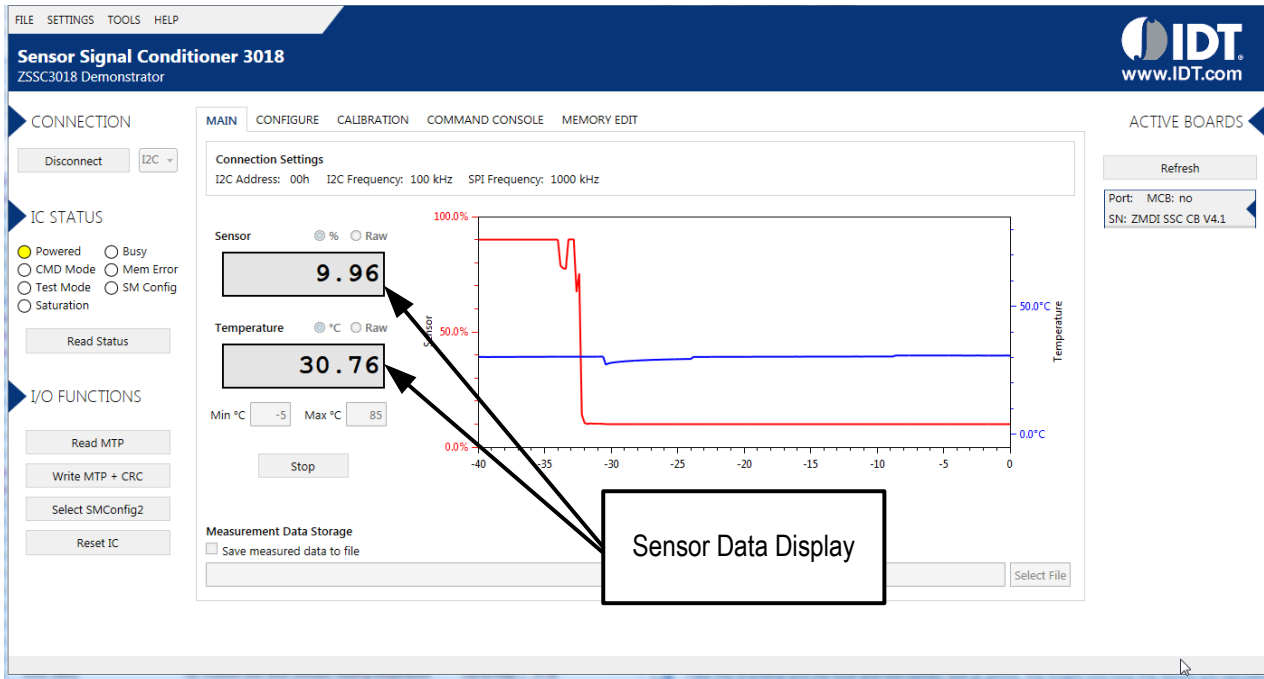
Control	Virtual LED Indication
● Powered	The ZSSC3018 is powered correctly.
● CMD Mode	The ZSSC3018 is in Command Mode and remains active and ready to receive dedicated commands.
● Test Mode	The ZSSC3018 is in Test Mode (not intended for users).
● Saturation	An error has occurred due saturation of the internal ALU (Arithmetic Logic Unit). Normally, the virtual LED blinks for every value out of range.
● Busy	The ZSSC3018 software is receiving data from the ZSSC3018.
● Memory Error	The CRC test has failed. Important note: Upon first use of an unconfigured ZSSC3018, this virtual LED should be yellow. To clear the initial error indicator, write data to memory (e.g., bridge configuration, coefficients) and generate the signature of the memory contents via the “Write MTP + CRC” button in the left panel (see sections 2.3 and 2.5). The settings for this initial memory write operation can be random because these registers will be overwritten as part of the configuration and calibration procedures.
SM Config	○ <i>SM_Config1</i> is the selected configuration. ● <i>SM_Config2</i> is the selected configuration. Note: The configuration is selected by the “SM_CONFIG” sub-tab under the “CONFIGURE” tab (section 2.3).

2.2 “MAIN” Application Tab

Click the “Start” button on the “MAIN” application tab (see Figure 3) to display the readings for “Sensor” and “Temperature” in the boxes on the left of the tab. Data can be displayed as a percentage of the range in decimal numbers or as a raw value (click the “Raw” radio button) in decimal or hexadecimal. In raw mode, the numerical format (hexadecimal or binary) is selected by clicking the small blue button on the left of the data display box (see Figure 3).

On the right of the “MAIN” tab is a graphical representation of the data received from the sensors that shows the variations of the read values: the data shown in red is for the bridge sensor and the data for the temperature is blue. The data scale for temperature output is on the right of the main graph; the scale for bridge sensor measurements is on the left. The x-axis represents the number of measurement points at a given value in a run. The axis is auto-scalable.

Figure 6. Sensor Readings on the “MAIN” Tab



2.3 “CONFIGURE” Application Tab

The “CONFIGURE” application tab has five sub-tabs for different settings as described in Table 3. Figure 7 is an example showing the “SM_CONFIG” sub-tab. See the ZSSC3018 Data Sheet for further details about the settings.

Figure 7. The “CONFIGURE” Tab

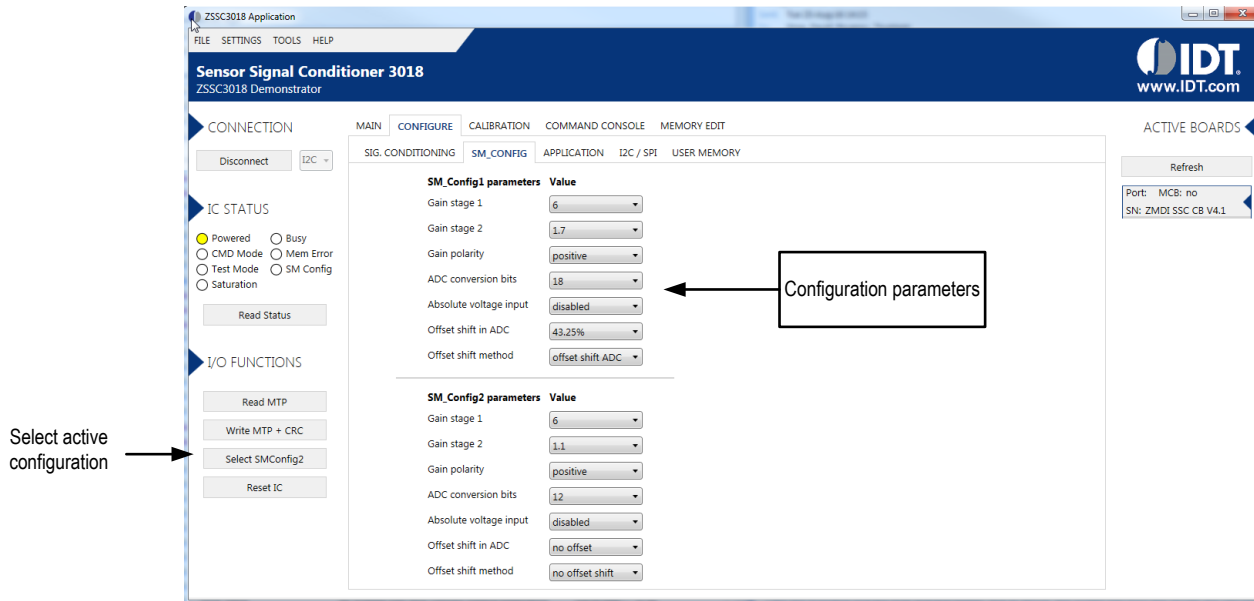


Table 3. Sub-tabs under the “CONFIGURATION” Tab

Sub-tab	Description
SIG. CONDITIONING	This tab provides settings for signal conditioning parameters in decimal values.
SM_CONFIG	This tab provides settings for parameters for the measurement configuration registers (<i>SM_config1</i> and <i>SM_config2</i>). Select one of the configurations to be used for calibration.
APPLICATION	On this tab, the “CustomerID0” and “CustomerID1” entry fields allow assigning a unique identification to the ZSSC3018 This identification is programmed in the MTP memory. There are also entry fields for the TRSH1 and TRSH2 thresholds. See the ZSSC3018 Data Sheet for details.
I2C/SPI	This tab provides settings for the communication interface including the I2C address, SPI polarity, and CKP_CKE for polarity and phase.
USER MEMORY	This tab allows editing the user memory. Note: These changes are not automatically written. Changes that have not been written to memory yet are shown in red on the “MEMORY EDIT” tab (see section 2.5).

In the “SIG. CONDITIONING” sub-tab, all necessary coefficients for signal processing are stored; e.g. gain, offset, and temperature compensation. Initial values are 0; the calibration procedure must be performed in order to set these parameters. See Figure 8.

Figure 8. “SIG. CONDITIONING” Sub-tab

SIG. CONDITIONING		SM_CONFIG	APPLICATION	I2C / SPI	USER MEMORY
Signal conditioning parameters		Value (decimal)			
Sensor gain (Gain_S)	<input type="text" value="0"/>				
Sensor offset (Offset_S)	<input type="text" value="0"/>				
Gain corr. (Tcg)	<input type="text" value="0"/>				
Offset corr. (Tco)	<input type="text" value="0"/>				
SOT Tcg	<input type="text" value="0"/>				
SOT Tco	<input type="text" value="0"/>				
SOT sensor	<input type="text" value="0"/>				
Temp. gain (Gain_T)	<input type="text" value="0"/>				
Temp. offset (Offset_T)	<input type="text" value="0"/>				
SOT temp	<input type="text" value="0"/>				
Sensor offset shift	<input type="text" value="0"/>				
Temp. offset shift	<input type="text" value="0"/>				
Second order curve	Parabolic ▾				

The “SM_CONFIG” sub-tab sets different parameters of the analog front-end (AFE) of the ZSSC3018; e.g., gain, signal polarity, and ADC resolution. See Figure 9. Two sets of configuration parameters can be saved: *SM_Config1* and *SM_Config2*. By default, *SM_Config1* is used; in this case, settings for *SM_Config2* are not mandatory. The *SM_Config2* settings are very useful in cases where there are two different applications for one sensor. To switch to the alternative signal measurements configuration, a command must be sent. The selected configuration stays active until there is a reset or a configuration selection command changes the other signal measurements configuration register. The active configuration can be selected via the buttons under “I/O Functions.”

Figure 9. “SM_CONFIG” Sub-tab

SIG. CONDITIONING		SM_CONFIG	APPLICATION	I2C / SPI	USER MEMORY
SM_Config1 parameters		Value			
Gain stage 1	6 ▾				
Gain stage 2	1.1 ▾				
Gain polarity	positive ▾				
ADC conversion bits	12 ▾				
Absolute voltage input	disabled ▾				
Offset shift in ADC	no offset ▾				
Offset shift method	no offset shift ▾				
SM_Config2 parameters		Value			
Gain stage 1	20 ▾				
Gain stage 2	1.1 ▾				
Gain polarity	positive ▾				
ADC conversion bits	12 ▾				
Absolute voltage input	disabled ▾				
Offset shift in ADC	no offset ▾				
Offset shift method	no offset shift ▾				

The “APPLICATION” sub-tab under the “CONFIGURATION” application tab allows setting two 16-bit customer ID values, the sensor threshold limits (24-bit), and the cycle update period. See Figure 10.

Figure 10. “APPLICATION” Sub-tab

Application parameters		Value (decimal)
Customer ID0	<input type="text"/>	0
Customer ID1	<input type="text"/>	0
Interrupt threshold 1 (TRSH1)	<input type="text"/>	0
Interrupt threshold 2 (TRSH2)	<input type="text"/>	0
Update period in cyclic operation	<input type="text" value="n/a"/>	
EOC pin interrupt configuration	<input type="text" value="EoC signal"/>	

The “I2C/SPI” sub-tab configures the I²C slave address and SPI protocol interface parameters. See Figure 11.

Figure 11. “I2C/SPI” Sub-tab

I2C Settings	
I2C slave parameters	
Address	<input type="text" value="h 00"/>

SPI Settings	
Spi slave parameters	
SS Polarity	<input type="text" value="Low"/>
CKP_CKE	<input type="text" value="CPHA = 0; CPOL = 0"/>

The “USER MEMORY” sub-tab under the “CONFIGURATION” tab allows the user to access ZSSC3018 memory registers from 1A_{HEX} to 32_{HEX}. These registers do not affect the ZSSC3018 configuration. See the *ZSSC31018 Data Sheet* for details on these registers.

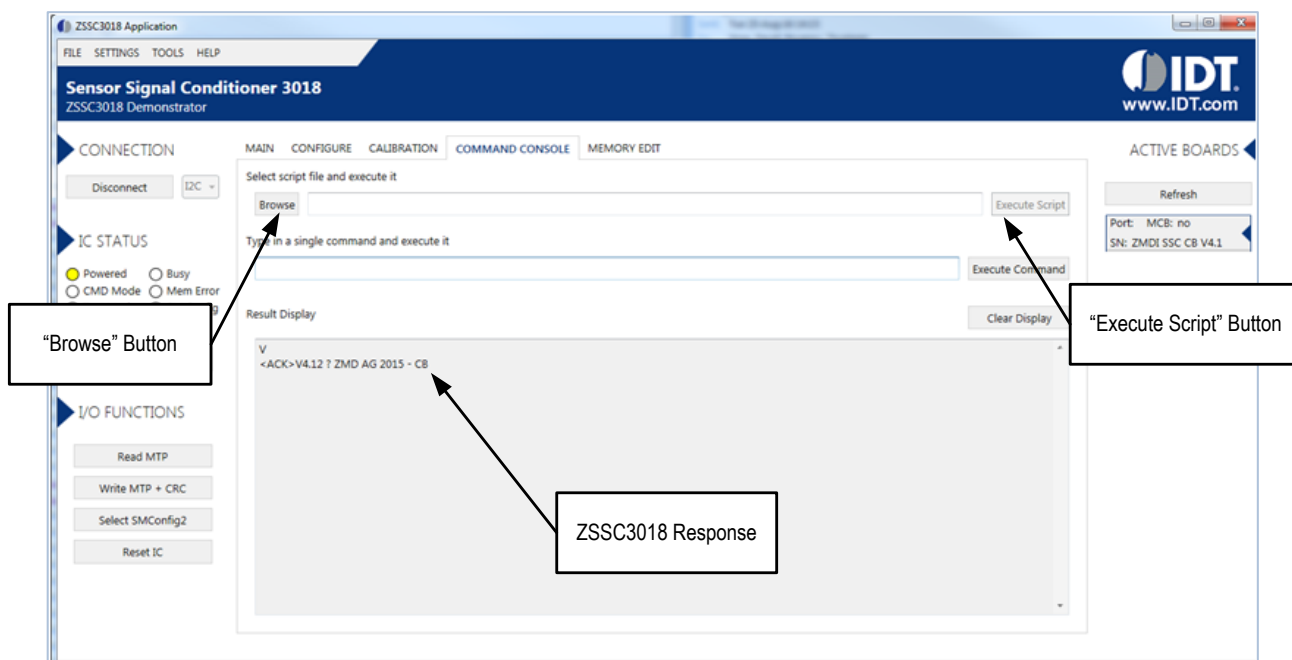
Figure 12. “USER MEMORY” Tab

	0	1	2	3	4	5	6	7
1Ah	0000	0000	0000	0000	0000	0000	0000	0000
22h	0000	0000	0000	0000	0000	0000	0000	0000
2Ah	0000	0000	0000	0000	0000	0000	0000	0000
32h	0000	0000	0000	0000	0000	0000	0000	

2.4 “COMMAND CONSOLE” Application Tab

On the “COMMAND CONSOLE” tab, the user can write commands directly to the ZSSC3018 and see the response in the output window. A previously edited script file can be loaded and executed directly as a command sequence by clicking the “Browse” button, selecting a file, and clicking the “Execute Script” button shown in Figure 13. The script file must be a text file with valid commands according to the *SSC Command Syntax for V4.x Communication Boards* spreadsheet, which is available at <http://www.idt.com/products/sensor-products/sensor-signal-conditioners/ssc-cb-ssc-communication-board>. The output data from the ZSSC3018 can be copied and saved for further analysis by right-clicking on the results in the display.

Figure 13. “COMMAND CONSOLE” Tab

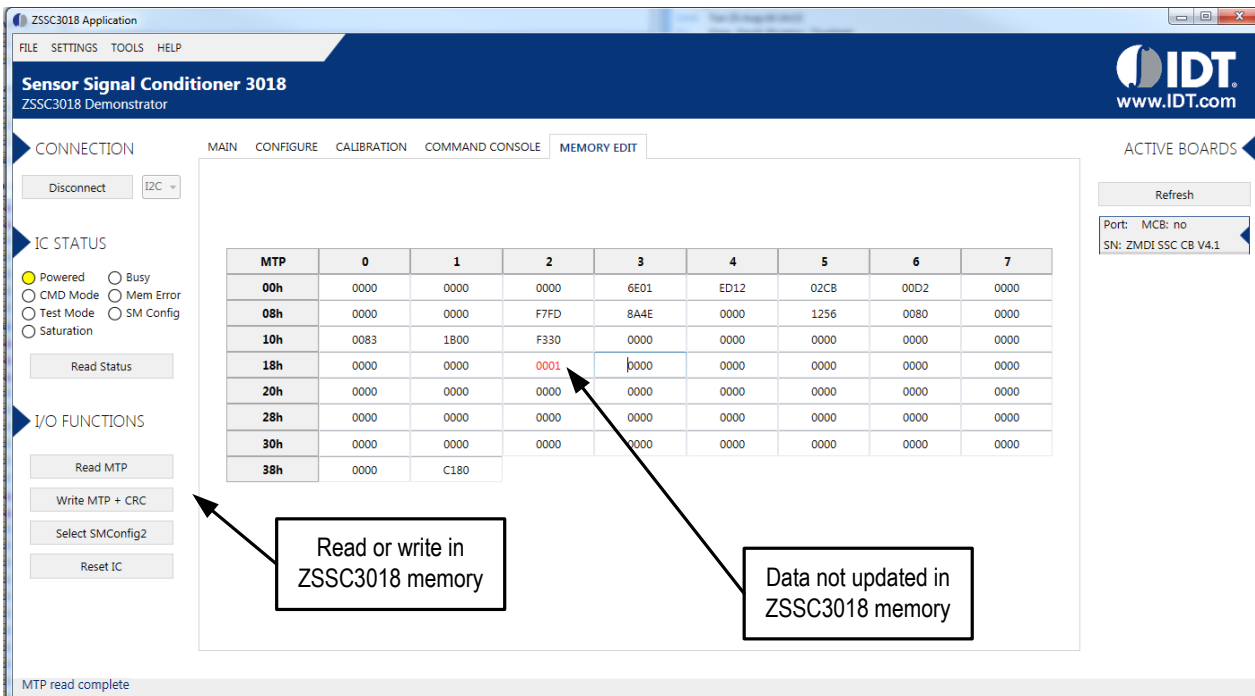


2.5 “MEMORY EDIT” Application Tab

The “MEMORY EDIT” tab shows the current state of the ZSSC3018 memory. It allows the user to edit and write memory contents with an automatically generated CRC and to choose between two different stored configurations for the ZSSC3018. Writing new values directly to the memory can be done in the grid box in the correct address for the new value. After the data is entered, the new content must be updated in the ZSSC3018 via the “Write” command or by clicking the “Write MTP + CRC” button. The display grid updates automatically when the configuration changes in the “Configuration” and “Calibration” application tabs; the values that are not yet written in the ZSSC3018 memory are shown in red. These values are NOT written automatically in the ZSSC3018—to complete this, click the “Write MTP + CRC” button.

The data is displayed as four hexadecimal digits for each of the first 20_{HEX} (32_{DEC}) addresses in the MTP. The final register 39_{HEX} (57_{DEC}) contains the checksum of the entire memory contents. To display the ZSSC3018 memory contents in the table, read the complete memory by clicking on the “Read MTP” button. The resulting message in the lower left corner of the window should be “MTP read complete.”

Figure 14. “MEMORY EDIT” Tab



2.6 “CALIBRATION” Application Tab

The “CALIBRATION” tab is used for acquiring raw data and calculating the coefficients needed for signal linearization and temperature compensation.

Note: If the user displays the ZSSC3018 Evaluation Software in a smaller window, the settings section becomes a scrolling window and the area of settings that is displayed is controlled by the scroll bar below the settings section.

The first step in using the “CALIBRATION” tab is to select the type of calibration to be performed. This defines the number of measurement points for the sensor signal at various temperatures (if temperature compensation is selected).

The output signal targets define the actual output data in percentage of the ADC range that the ZSSC3018 will output for the measured sensor value after signal conditioning. For the example below, at a bridge sensor reading of -7301920 counts with 24-bit resolution, the ZSSC3018 will read 10% of 2^{24} after calibration.

Figure 15. Sensor Calibration using the “CALIBRATION” Tab

The screenshot shows the 'CALIBRATION' tab of the ZSSC3018 Application software. The interface is divided into several sections:

- Calibration Type Settings:** Includes 'Type' (S:Linear, T:Linear) and 'Curve' (Parabolic) dropdowns.
- Temperature range:** Shows 'Min' (-40 °C) and 'Max' (125 °C) input fields.
- Acquisition Settings:** Includes 'Skip the first' (0 samples) and 'Average' (1 samples) settings.
- Calibration points:** A table with columns for 'Sensor Targets [%]', 'S2', 'S3', and 'S1'. Each point has associated gain and offset values.
- SM Config for calibration:** Includes 'Gain stage 1', 'Gain stage 2', 'Polarity', 'Conversion bits', 'Absolute voltage input', 'Offset shift in ADC', and 'Offset shift method' settings.
- Buttons:** 'Calculate coefficients', 'Write coefficients to MTP', and 'Write coefficients to IC' are visible.
- Coefficient result table:**

RESULT	Offset S	Gain S	Tcg	Tco	SOT Tco	SOT Tcg	SOT S	Offset T	Gain T	SOT T
SUCCESS	1207809	5696786	715	-210				-260093	1804878	

3. Example of Configuration and Calibration Procedures

This calibration example uses the Sensor Replacement Board to simulate a sensor signal. A typical calibration flow includes the five basic steps described in the following sections: setup and initialization; data collection; coefficient calculation; memory programming; and verification. Figure 16 shows the details for the configuration and calibration steps.

3.1 Setup and Initialization

After the GUI is started, ensure that the Evaluation Kit's SSC Communication Board appears as an active device. Then select a communication interface (SPI or I²C), and if needed, set the slave address and speed. Then click the "Connect using" button to connect to the ZSSC3018. Once the correct communication is established, read the simulated data from the Sensor Replacement Board by clicking the "Start" button on the "MAIN" application tab (note that the simulated sensor data is not calibrated).

The next step is setting the analog front-end (AFE) configuration, which can be done directly on the "CALIBRATION" tab (e.g., set the gain of the first and the second stage, number of ADC bits resolution, and offset). See Figure 16. These parameters are described in detail in the ZSSC3018 Data Sheet. (If the "SM_Config for calibration" section is not displayed, see section 2.6.)

The "Acquisition Settings" section has two adjustment fields: "Skip the first" and "Average." Use the "Skip the first" entry field to select the number of measurements to be discarded at the beginning of the measurement to avoid collecting invalid data. Use the "Average" entry field to indicate the number of samples to use to calculate average values to get more coherent data. (If the "Acquisitions Settings" section is not displayed, see section 2.6.)

Figure 16. Calibration Steps

The screenshot shows the 'CALIBRATION' tab of the ZSSC3018 Demonstrator GUI. The interface includes sections for Calibration Type Settings, Temperature range, Acquisition Settings, Calibration points, SM Config for calibration, and Coefficient result. 14 numbered callouts point to specific steps in the process:

1. Select calibration type
2. Select temperature range
3. Set values for sampling
4. Copy AFE configuration
5. Adjust AFE if needed
6. Set target limits S1 and S2
7. Set acquisition temperatures
8. Acquire the data for the active calibration points
9. Calculate coefficients
10. Copy AFE settings to IC
11. Write calculated coefficients
12. Write to IC
13. Verify register contents
14. Reset the ZSSC3018

RESULT	Offset S	Gain S	Tcg	Tco	SOT Tco	SOT Tcg	SOT S	Offset T	Gain T	SOT T
SUCCESS	1207835	5696545								

3.2 Data Collection

The ZSSC3018 provides digital compensation of individual sensor offset, 1st and 2nd order sensor gain, and 1st and 2nd order temperature gain and offset drift. On the “CALIBRATION” tab, choose between one of the seven different types of possible calibration scenarios from the drop-down menu under “Calibration Type Settings.” See Figure 16. For this example, use the two-point calibration without temperature compensation to obtain the gain and offset calibration for the simulated sensor signal from the Sensor Replacement Board (SRB). Choose the “B:Linear” option from the drop-down menu under “Calibration Type Settings,” which enables the “S1” and “S2” data fields in the “Sensor Targets” section. This is the target range of the ADC as a percentage of full scale; for this example; a recommended value will be within the range of 10% and 90%.

Next, in the “Calibration points” section (for which there are only two active fields in this case), click the “Get” buttons to acquire data for the first and the second points as follows. For point S2, adjust the potentiometer for the lowest measurable value for the dummy sensor by turning the SRB potentiometer counter-clockwise. For the next value, turn the potentiometer clockwise and click the “Get” button for the S1 point to obtain the second value in the calibration curve. For more details on possible calibration types, refer to the *ZSSC3018 Data Sheet*.

3.3 Coefficient Calculation

The coefficient calculation is done by the Dynamic Link Library (DLL) provided by IDT. This DLL is accessible by any software and is provided to the customer as means for calibration on a large scale and integration with the customer’s existing workflow. Once the data is gathered and the user has clicked the “Calculate coefficients” button, the “SUCCESS” message is displayed in the “Coefficient result” table if a possible solution has been found. If the “FAILED” message is displayed, adjustments must be made to the first and second stages to achieve the optimal resolution without saturation of the ADC.

3.4 Memory Programming

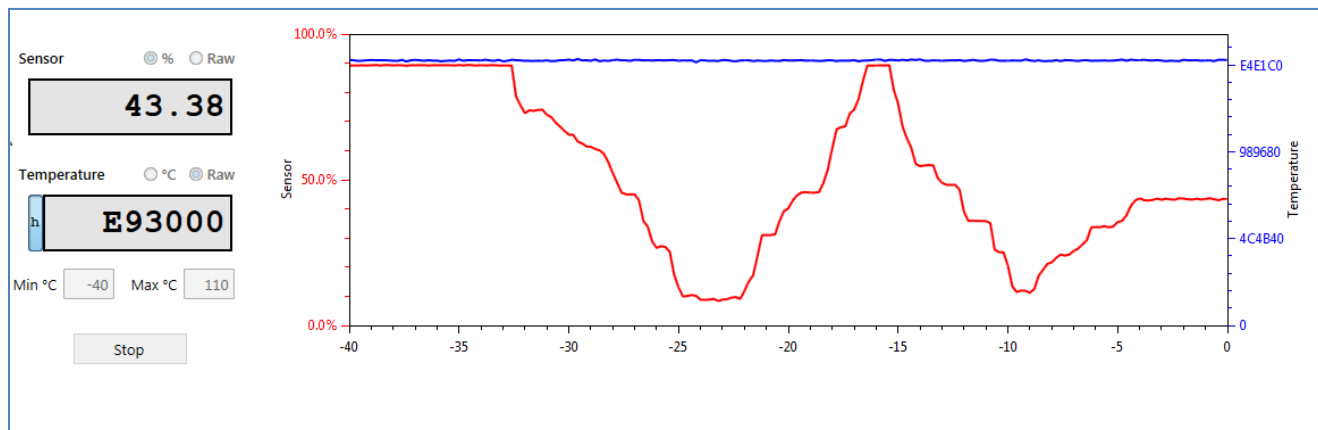
After the coefficients have been successfully calculated using the DLL, they must be written to the MTP memory. This is done either directly by clicking the “Write coefficients to IC” button or by clicking the “Write coefficients to MTP” button and then changing to the “MEMORY EDIT” application tab and clicking the “Write MTP+ CRC” button.

3.5 Verification

After a successful coefficient calculation and memory programming is performed, a recommended practice is to read the memory contents and verify in the “MAIN” application tab that correct data is read from the sensor.

Measurement data values should be between the target points set during calibration (10% and 90%) as shown in Figure 17.

Figure 17. Calibrated Sensor Measurement



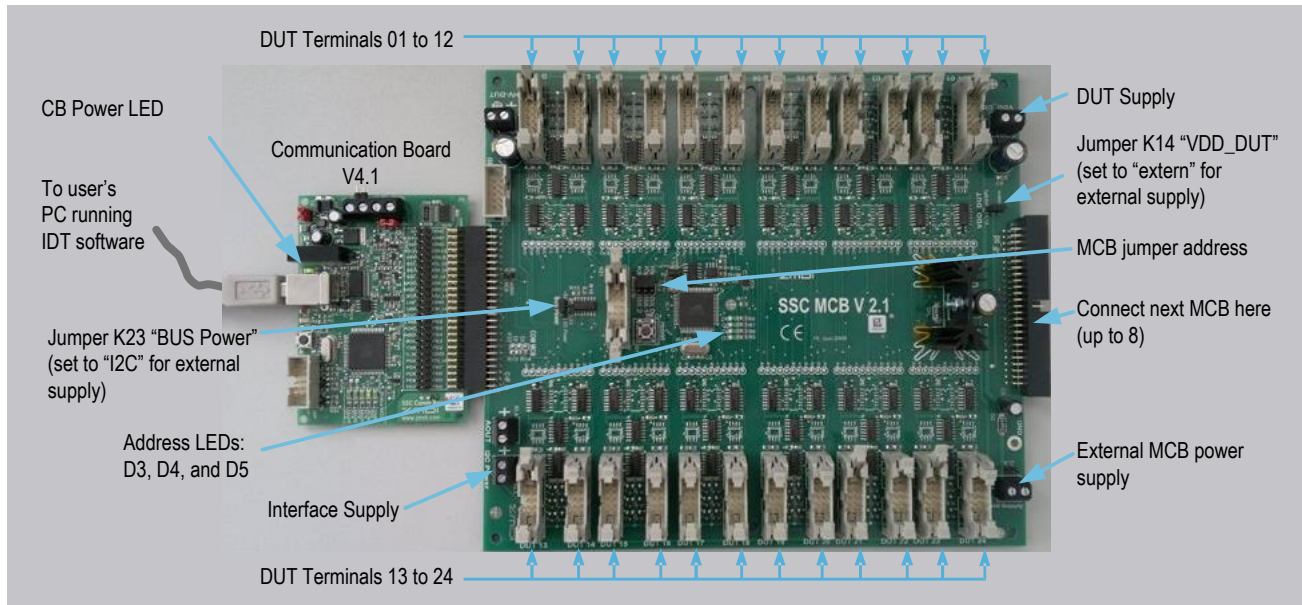
4. SSC Mass Calibration System (MCS)

The ZSSC3018 software supports using the SSC Mass Calibration System (MCS) shown in Figure 18 to perform calibration, configuration, and evaluation for multiple ZSSC3018 DUTs connected to the Mass Calibration Board (MCB). When using the MCS, the MCB is used in place of the SSC EB at the Bu1 connection to the SSC Communication Board (SSC CB). Refer to the *SSC Mass Calibration Board Data Sheet* for full details of MCS contents and operation.

To connect the ZSSC3018 DUTs to the Mass Calibration Board (MCB), there are several options, which can be combined as needed. User-provided sensor modules and/or the ZSSC3018 SSC Evaluation Board (SSC EB) can be connected to the DUT terminals using the ribbon cable provided with the MCS. When using the SSC EB, connect the ribbon cable from the DUT terminals on the MCB to the K5 connector on the SSC EB.

Important note: The voltage level provided from the CB to the MCB is 5V, which is not compliant with ZSSC3018 power supply requirements. Therefore, the “DUT Supply” and “Interface Supply” terminal blocks must be powered externally with a 1.68V to 3.6V supply. Set jumper K23 to “I2C” and K14 to “extern” to select the external supplies.

Figure 18. SSC Mass Calibration System



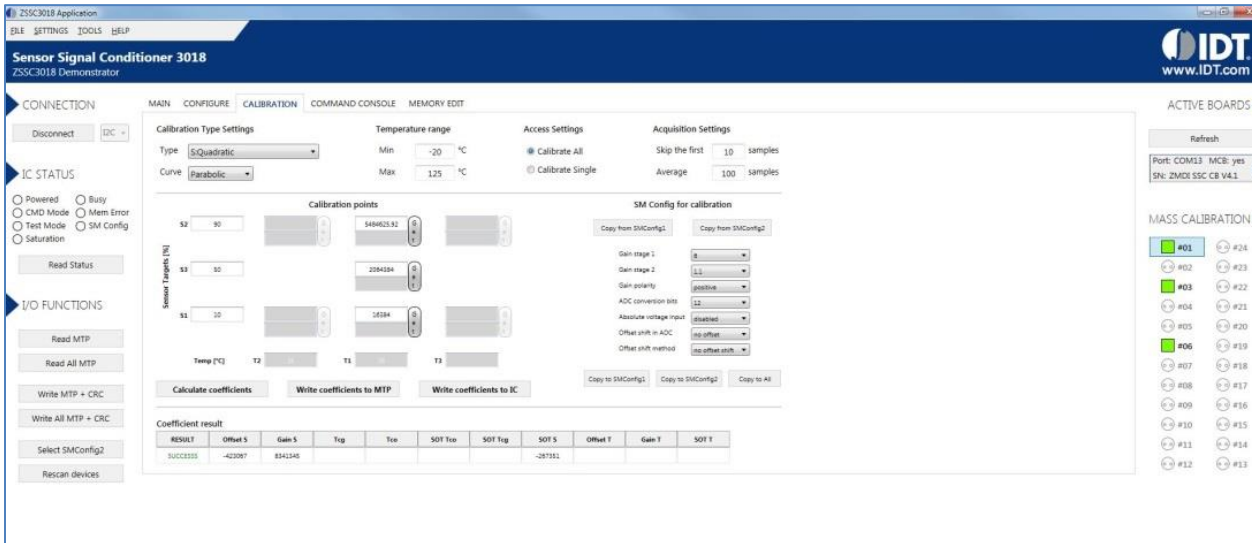
When the MCB is connected and the ZSSC3018 Evaluation Software has been activated, active DUTs are listed with a yellow checkbox in the right panel of the display as shown in Figure 19.

Figure 19. ZSSC3018 Evaluation Software with MCS and Uncalibrated DUTs



The calibration procedure for the MCS is the same as when using the ZSSC3018 SSC Evaluation Board and single DUT. After calibration, color of the checkboxes for the active DUTs changes to green in the right side panel.

Figure 20. ZSSC3018 Evaluation Software with MCS and Calibrated DUTs



In the “MEMORY EDIT” and “CONFIGURE” application tabs, the register contents and settings are displayed for the selected DUT.

Figure 21. “MEMORY EDIT” Tab for Selected ZSSC3018 DUT Connected to the MCS

MTP	0	1	2	3	4	5	6	7
00h	0000	0000	0000	7498	4761	0000	0000	0000
08h	0000	1457	0000	0000	0000	867F	0000	0000
10h	8400	0000	0002	0000	0000	0000	0000	0000
18h	0000	0000	0000	0000	0000	0000	0000	0000
20h	0000	0000	0000	0000	0000	0000	0000	0000
28h	0000	0000	0000	0000	0000	0000	0000	0000
30h	0000	0000	0000	0000	0000	0000	0000	0000
38h	0000	8F2A						

Figure 22. “CONFIGURE” Tab for Selected ZSSC3018 DUT Connected to the MCS

Signal conditioning parameters	Value (decimal)
Sensor gain (Gain_S)	8341345
Sensor offset (Offset_S)	-423067
Gain corr. (Tcg)	0
Offset corr. (Tco)	0
SOT Tcg	0
SOT Tco	0
SOT sensor	-267351
Temp. gain (Gain_T)	0
Temp. offset (Offset_T)	0
SOT temp	0
Sensor offset shift	0
Temp. offset shift	0
Second order curve	Parabolic

5. Schematics and Signal Connections between Boards

Note: For schematics for the SSC Mass Calibration Board, refer to the *SSC Mass Calibration Board V2.1 Datasheet* available on the IDT website at <http://www.idt.com/document/dst/ssc-mass-calibration-board-v21-datasheet>.

Figure 23. ZSSC3018 Evaluation Board Schematic

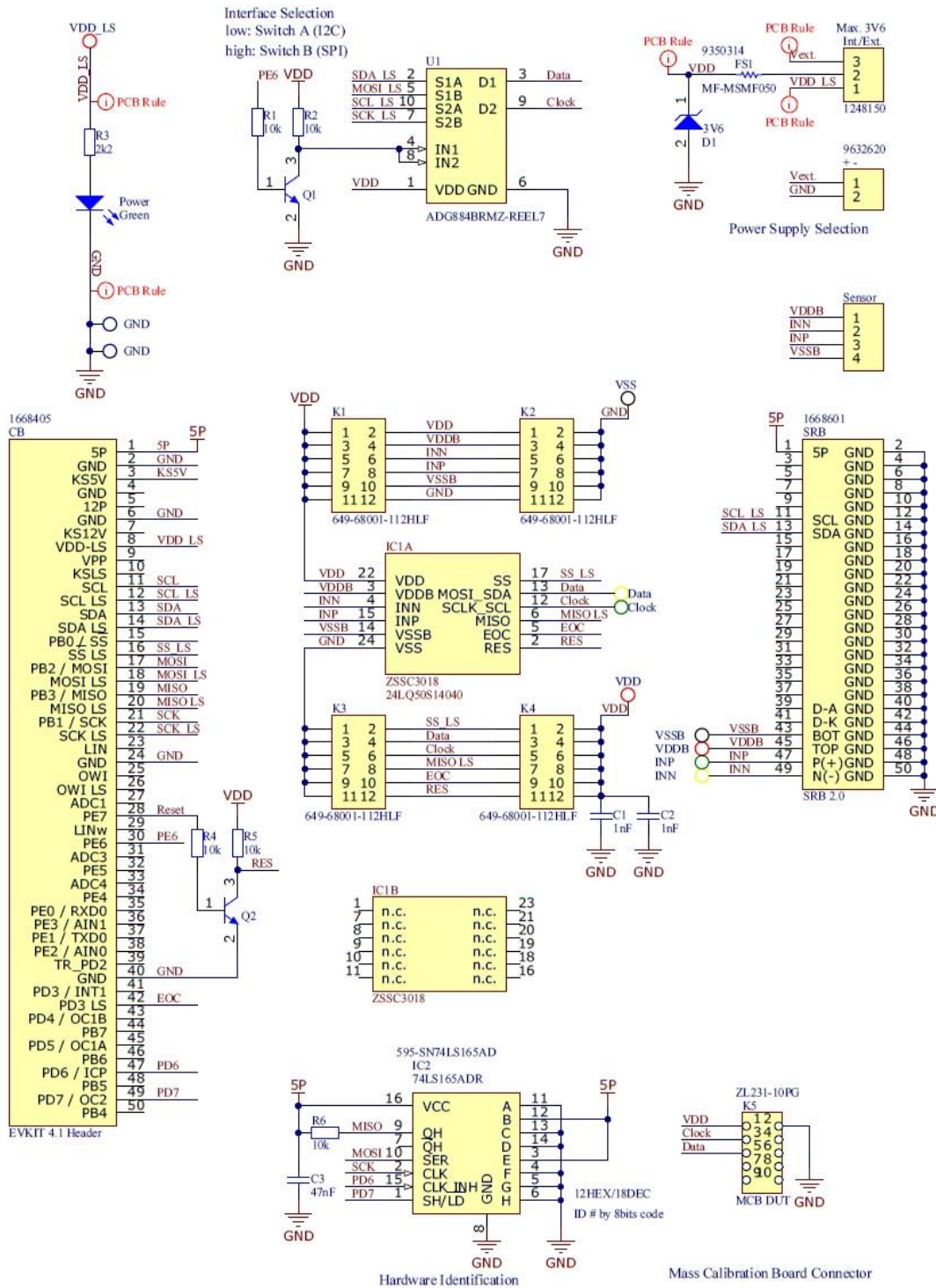


Table 4. Bu1 Signal Connections: SSC Communication Board and ZSSC3018 Evaluation Board or MCB

Name	Description
5P	5V constant power supply.
GND	Ground connection.
VDD_LS	Adjustable Power Supply
SCL_LS, SDA_LS	I ² C interface, logic level defined by the VDD_LS.
SS_LS, MOSI_LS, MISO_LS, SCK_LS	SPI interface to the ZSSC3018, logic level defined by the VDD_LS.
MISO, MOSI, SCK	SPI interface, 5V logic (used for SSC EB identification by I ² C).
PE6	ZSSC3018 interface selection: low (I ² C), high (low-side SPI interface)
PE7	Bi-directional I/O port with internal pull-up resistors used to reset the ZSSC3018.
PD3	Control signal to the EOC pin of the ZSSC3018; logic level defined by the VDD_LS.
PD4	Bi-directional I/O port with internal pull-up resistors.
PD6, PD7	IC2 8-bit serial shift registers settings; set by the ZSSC3018 Evaluation Software.

Table 5. K10 Signal Connections: ZSSC3018 Evaluation Board and the Sensor Replacement Board

Name	Pin #	Description
SCL_LS	11	I ² C clock, logic level defined by the VDD_LS
SDA_LS	13	I ² C data, logic level defined by the VDD_LS
VSSB	43	Bridge negative supply voltage
VDDB	45	Bridge positive supply voltage
INP	47	Bridge positive signal
INN	49	Bridge negative signal

6. Bill of Materials (BOM)

Table 6. ZSSC3018 Evaluation Bill of Materials

Designator	Value/Part	Description	Footprint	Ref	Qty
+ -	+ -	Header, 2-Pin	HDR 1x2 5mm	Header 2	1
C1, C2	1nF	Capacitor	6-0805_N	Cap	2
C3	47nF	47nF 100V X7R+-10% SMD	6-0805_N	Cap	1
CB	EVKIT 4.1 Header	Header, 25-Pin, Dual Row, Right Angle	HDR2X25H 3d – off board	EVKIT 4.1 Header	1
Clock, INP	TPx1_grn	Test Point Single	TP Green	TPx1_grn	2
D1	3V6	3W Zener Voltage Regulator, 2-Pin SMB, Pb-Free, Tape and Reel	ONSC-SMB-2-403A03_H_V	CMP-1060-00194-1	1
Data, INN	TPx1_yel	Test Point Single	TP Yellow	TPx1_yel	2
FS1	MF-MSMF050	MF-MSMF Series – PTC Resettable Fuse, 15 V Max, 0.15Ω Min -40 to 85 °C, RoHS, Reel	BOUR-MF-MSMF050-2_V	CMP-0280-00002-1	1
GND1, GND2	GND	Test Point	GND_Con2 - 1.2mm	TP x2	2
IC1	ZSSC3018	Socket for ZSSC3218 Sensor Signal Conditioner	24LQ50S14040_Plastronic	ZSSC3218_QFN24_Socket_1	1
IC2	SN74LS165AD	Parallel-Load 8-Bit Shift Registers	SOIC-SL16_L	SN74LS165AD	1
Int./Ext.	Max. 3V6	Header, 3-Pin	HDR1x3_2.54	Header 3	1
K1, K2, K3, K4	Header 6X2	Header 6X2	HDR2X6 pin 3D	Header 6X2	4
K5	MCB DUT	Header 2x5	HDR2X5 3D Dir	HDR Str 10way 2.54 Dir	1
Power	Green	Typical infrared GaAs LED	LED0805 G 3D	LED0	1
Q1, Q2	MMBT2222LT1G	NPN, 0.6A , 3-SOT23, RoHS, TR	ONSC-SOT-23-3-318-08_M	CMP-0722-00001-1	2
R1, R2, R4, R5, R6	10k	Resistor	6-0805_N	Res2	5
R3	2k2	Resistor	6-0805_N	Res2	1
SRB	SRB 2.0	Header 2x25pin Male Right Angle	HDR2X25H 3D Male Off Board	SRB 2.0	1
U1	ADG884BRMZ-REEL7	0.5Ω CMOS, Dual 2:1 MUX / SPDT Audio Switches, -40 to 85 °C, 10-SOP (RM-10), Reel	ADI-RM-10_L	CMP-0790-00118-1	1
VDD, VDD_LS, VDDB	TPx1_red	Test Point Single	TP Red	TPx1_red	3
VSS, VSSB	TPx1_blk	Test Point Single	TP Black	TPx1_blk	2

7. Board Layout

Figure 24. ZSSC3018 Evaluation Board – Assembly Drawing

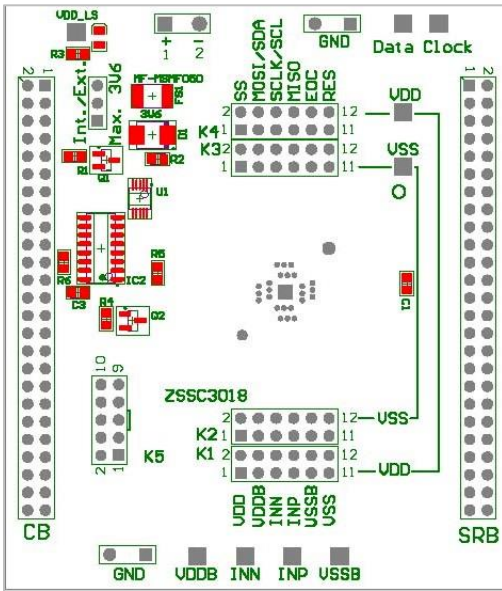
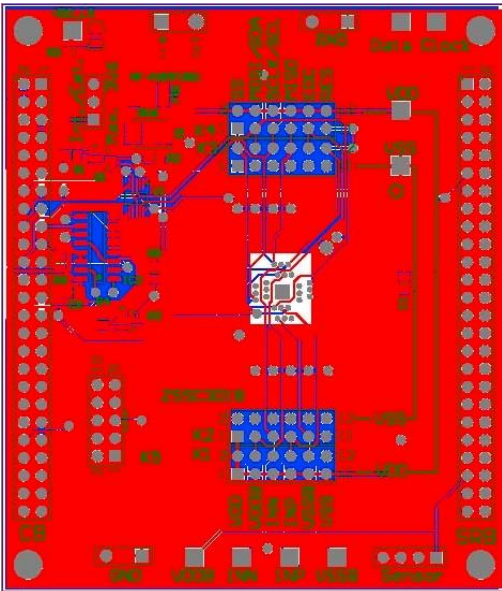


Figure 25. ZSSC3018 Evaluation Board – Layout



8. Ordering Information

Orderable Part Number	Description
ZSSC3018KITV1P0	Modular ZSSC3018 SSC Evaluation Kit including ZSSC3018 Evaluation Board, SSC Communication Board, SSC Replacement Board, five ZSSC3018 PQFN24 samples, and cable. Software is available for download on www.IDT.com/ZSSC3018 .
SSCCOMMBOARDV4P1C	SSC Communication Board
SSCSENSORREPBVDV2P0	SSC Replacement Board

Contact IDT for order information for the SSC Mass Calibration System.

9. Related Documents

Visit the following product pages under www.IDT.com for related documents and software tools:

<http://www.idt.com/zssc3018>

<http://www.idt.com/products/sensor-products/sensor-signal-conditioners/zssc3018kit-evaluation-kit-zssc3018>

<http://www.idt.com/products/sensor-products/sensor-signal-conditioners/ssc-cb-ssc-communication-board>

<http://www.idt.com/products/sensor-products/sensor-signal-conditioners/ssc-srb-ssc-replacement-board>

10. Revision History

Revision Date	Description of Change
October 14, 2016	<ul style="list-style-type: none">▪ Update for new software release.▪ Addition of MCS information▪ Addition of BOM and layout information▪ Application of new document layout and formatting.▪ Addition of order codes▪ Minor edits for clarity
April 26, 2016	Changed to IDT branding. The revision number is now the release date.
December 16, 2015 (Revision 1.0)	First release

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