HDC1050EVM User 's Guide

User's Guide

![TEXAS INSTRUMENTS]

![Texas Instruments logo]

HDC1050EVM User 's Guide

1 Introduction

The Texas Instruments HDC1050EVM evaluation module (EVM) enables designers to evaluate the operation and performance of the HDC1050 Relative Humidity and Temperature sensor.

The EVM contains one HDC1050 (See Table 1).

Table 1. Device and Package Configurations

DEVICE	IC	PACKAGE
U1	HDC1050	PWSON 6pin

The EVM hosts an MSP430F5528 microcontroller (µC) as well as the HDC1050. The µC is used to control the HDC1050 and communicate with a host PC through a USB port. The EVM is designed to be broken into two sections if desired. The sensor section can be separated from the µC section so that the user can remotely locate the sensor from the µC section.

2 Setup

This section describes the connectors on the EVM as well and how to properly connect, set up and use the HDC1050EVM.
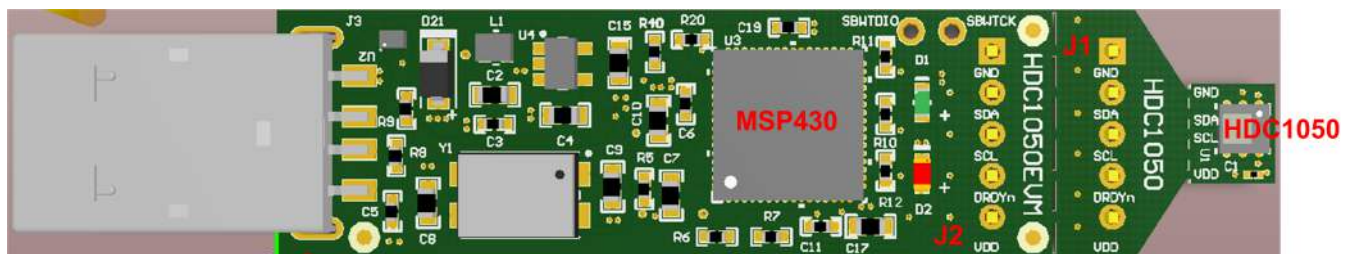

Figure 1. HDC1050EVM

2.1 Input/Output Connector Description

2.1.1 J1 – 5x1 Header

This header is not populated and can be installed if the EVM is broken in 2 sections: PC interface and Sensor. This connector with its counterpart J2 allows the communication of the two sections through a 4-wire cable.

Pin out:
- J1.1 GND
- J1.2 SDA
- J1.3 SCL
- J1.4 DRDYn **(NOTE: this signal is not supported by the HDC1050, and does not need to be connected to a host controller)**
- J1.5 VDD

2.1.2 J2 – 5x1 Header

This header is not populated and can be installed if the EVM is broken in 2 sections: PC interface and Sensor. This connector with its counterpart J1 allows the communication of the two sections through a 5-wire cable.

Pin out:
- J2.1 GND
- J2.2 SDA
- J2.3 SCL
- J2.4 DRDYn **(NOTE: this signal is not supported by the HDC1050n and does not need to be connected)**
- J2.5 VDD

2.1.3 J3 – USB Type A Connector

This connector is used for communications with the PC and provides power for the EVM.

2.2 Hardware Setup

The HDC1050EVM power is supplied via the USB connector. The LDO (U4) converts the 5V from the USB to 3.3V used by the HDC1050 and the MSP430. The EVM may be directly inserted into a USB port on a PC or laptop, or may be connected to the latter using the appropriate USB cable.

The I2C address of the HDC1050 is 1000000xb and is fixed by design.

The EVM features a Spy-by-Wire interface to the MSP430 that enables custom firmware development and debug using Code Composer Studio ©.

2.3 Software Setup

2.3.1 System Requirements

The Sensing Solutions GUI supports:
- 64-bit Windows 7
- 64-bit Windows XP

The current GUI does not support 32-bit Windows operating systems. The host machine is required for device configuration and data streaming. The following steps are necessary to prepare the EVM for the GUI:
- The GUI and EVM driver must be installed on the host.
- The EVM must be connected to a full speed USB port (USB 1.0 or above).

2.3.2 Sensing Solutions GUI and EVM Driver Installation

The Sensing Solutions GUI and EVM driver installer is packaged in a zip file. Follow these steps to install the software.

1. Download the software ZIP file from the EVM tool page
2. Extract the downloaded ZIP file
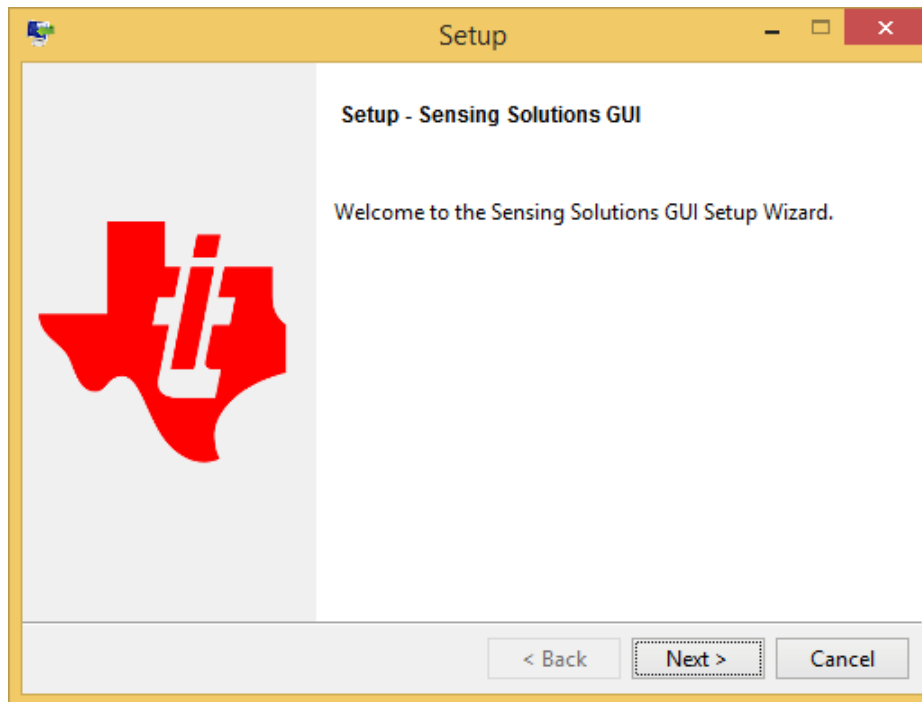3. Run the included executable
4. Follow all directions from the installer

Figure 2. GUI Installer Welcome Page

5. Read the license agreement and if you still wish to install the software, select "I accept the agreement" and click "Next" as shown in
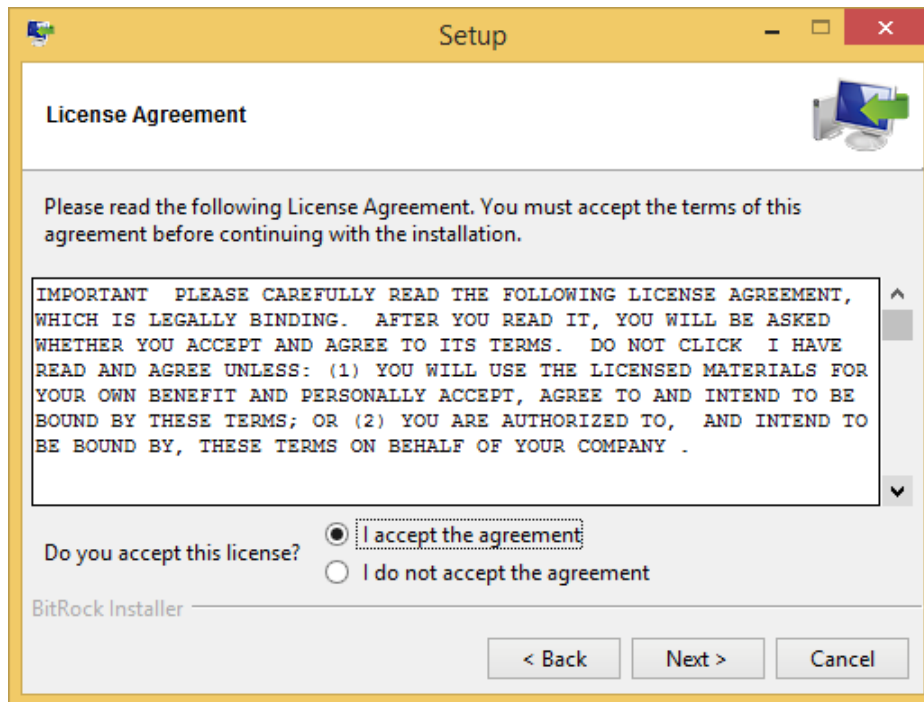
Figure 3. GUI Installer License Agreement

6. Select the installation directory. If the user installing the software is not a system administrator a directory not with "Program Files" should be chosen instead of the default.
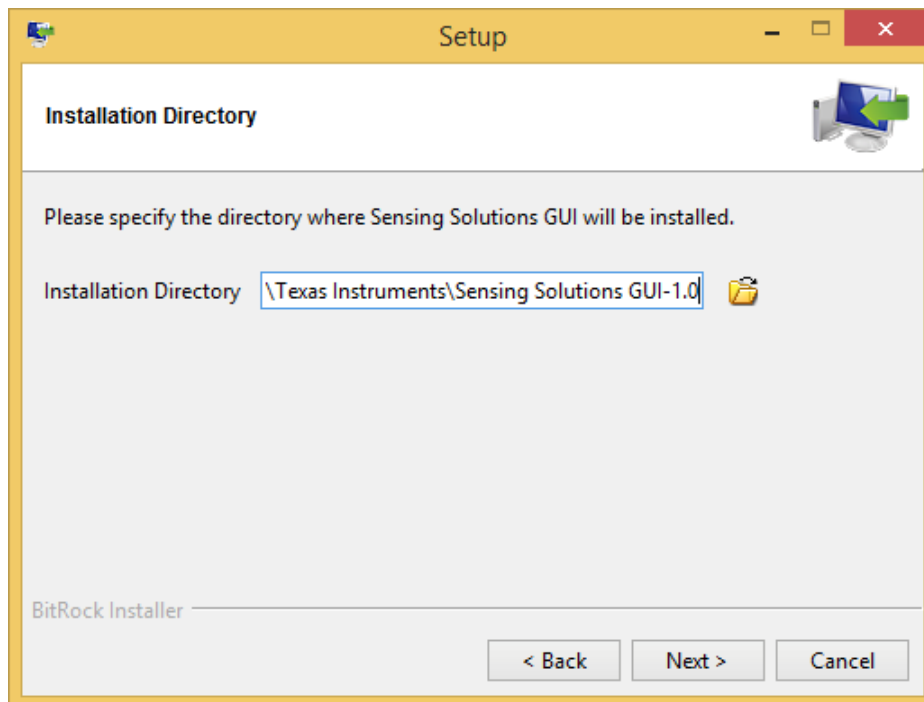

Figure 4. GUI Installer Installation Directory
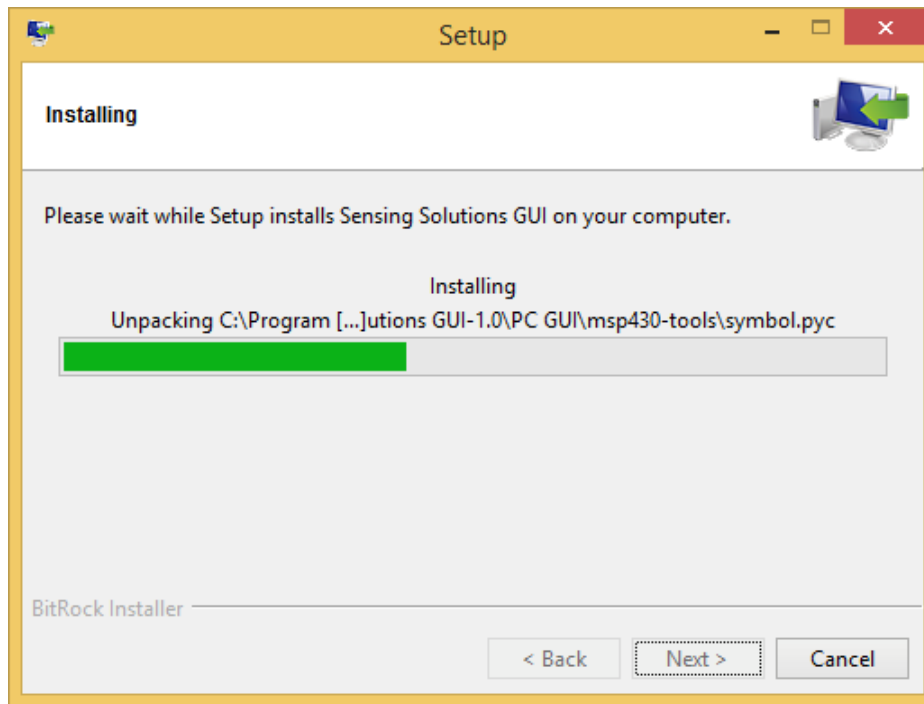
7. Wait for all files to install

Figure 5. GUI Installer Copying Files

8. After the files have copied a device driver installer will start. If prompted about an unsigned driver, choose to install the driver anyways. If running Windows 8 or 8.1, the PC must be started in a "Safe" mode to install the unsigned driver.
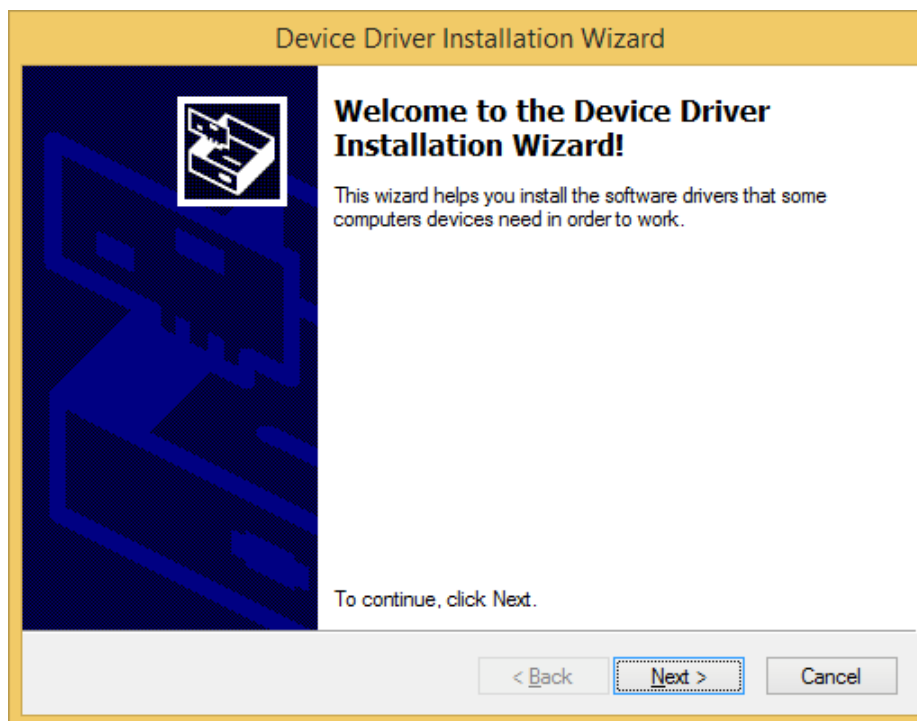

Figure 6. EVM Driver Installer Welcome Page

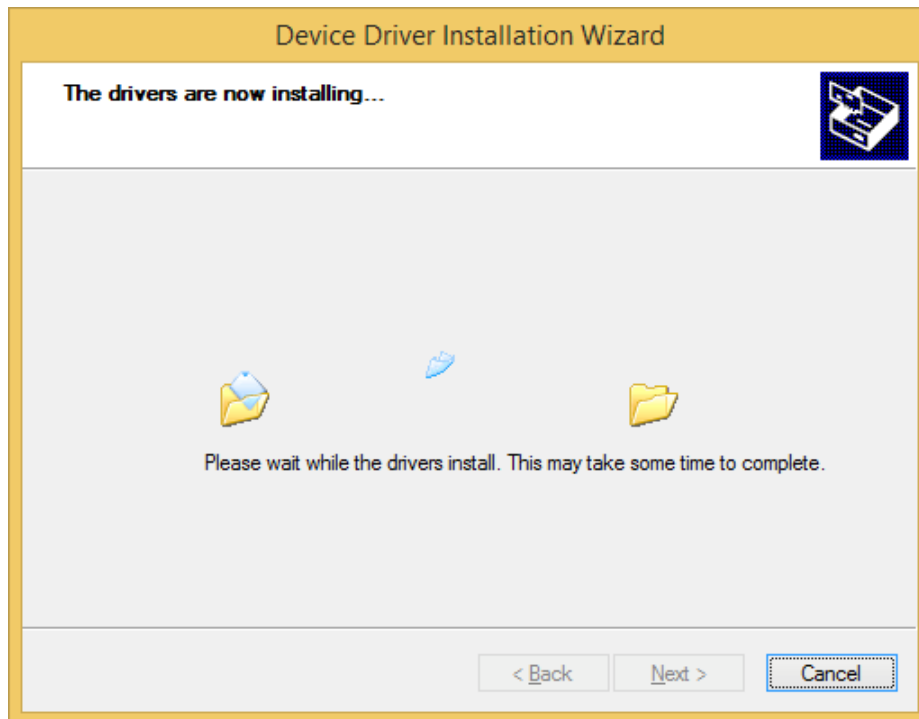9. Wait for the driver to install

Figure 7. EVM Driver Installer In Progress

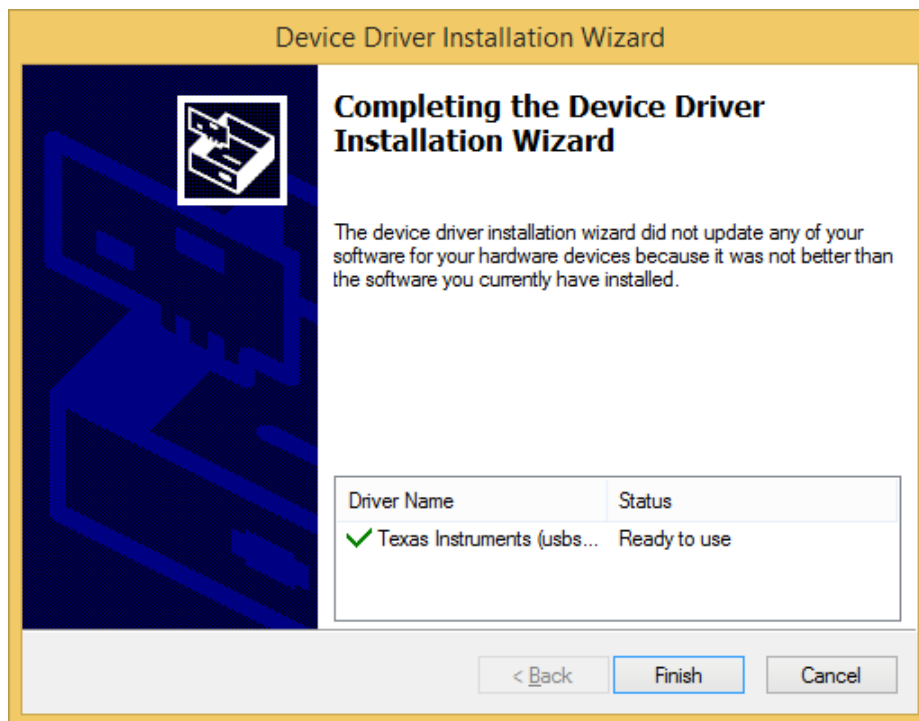10. Click "Finish" after the driver has been installed

Figure 8. EVM Driver Installer Complete
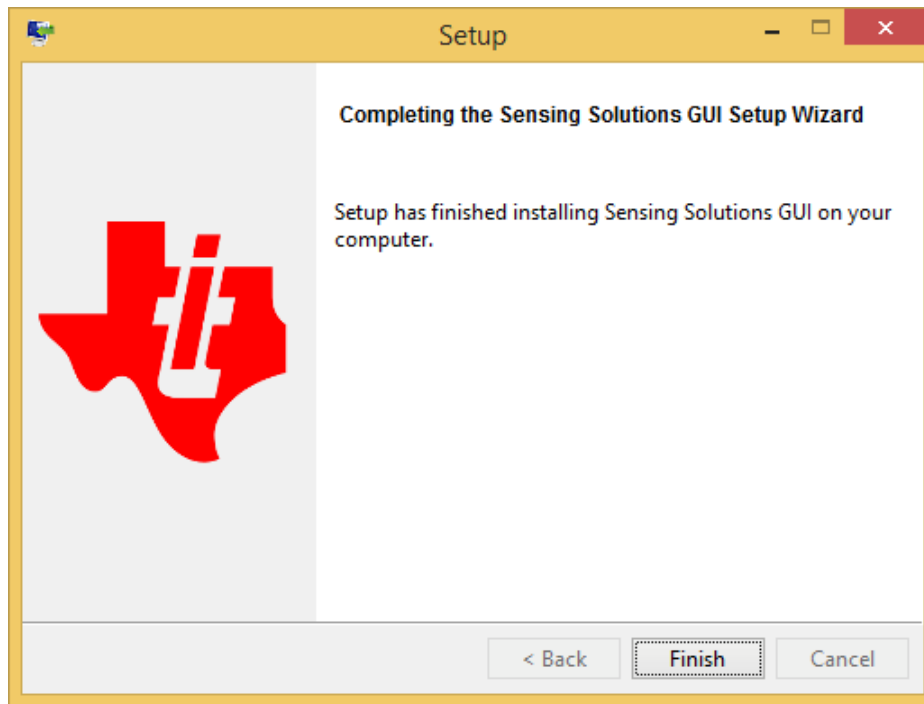
11. Click "Finish" to complete the software installation

Figure 9. GUI Installer Complete

2.4   Operation

When the EVM is connected the host computer, the latter should automatically detect the device as an HDC1050EVM/HDC1000EVM.

Launch the GUI. A detailed description of the GUI operation is presented later in this document.

2.5   Reducing the Sensor Thermal Mass

The HDC1050EVM can be broken into 2 sections to isolate the thermal mass of the µC from the HDC1050. The yellow arrow in Figure 10 shows the board perforations that allow the two sections to be broken apart.
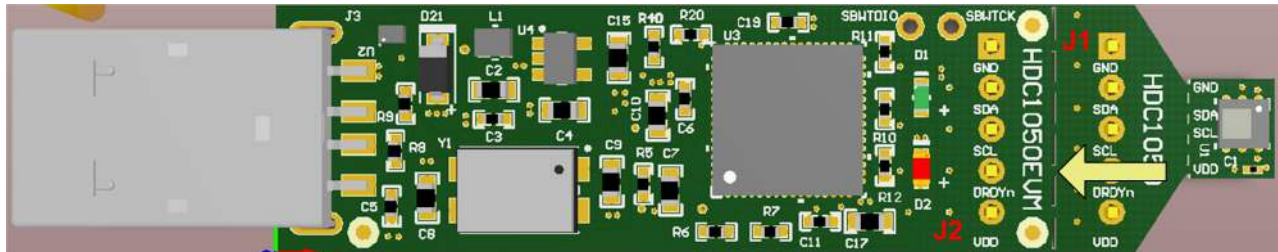

Figure 10. HDC1050EVM µC and Sensor Sections

The communication between the two modules is achieved through the connectors J1 and J2 and a 4-wire cable. In this configuration the thermal mass of the EVM is dramatically reduced, improving the temperature measurement performance of the HDC1050. The cable connecting J1 to J2 must conform to I2C cable length constraints. When used in this configuration, the GUI can still be used to communicate with the EVM and collect data.

If the thermal mass of the sensor section is still excessive, the sensor section can be reduced by breaking it at the perforation shown by the yellow arrow, indicated in Figure 11. The PCB segment that hosts the HDC1050 is 5.5mm x 5mm.
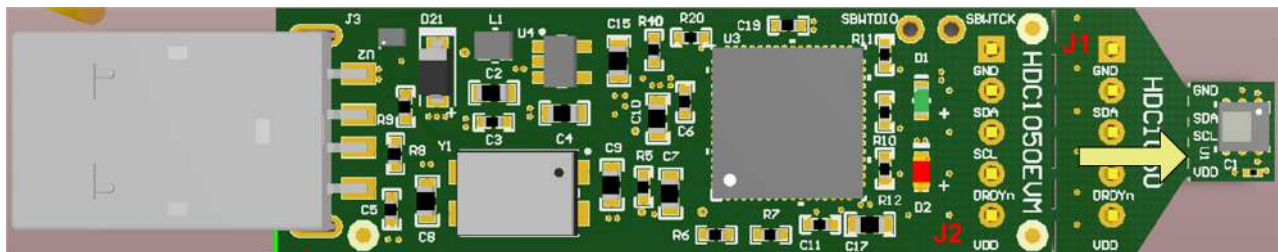
Figure 11. HDC1050EVM Small Sensor Section

The communications with the µC section is achieved through a 4-wire cable soldered at the pads accessible on the bottom layer of the PCB (Refer to Figure 12).
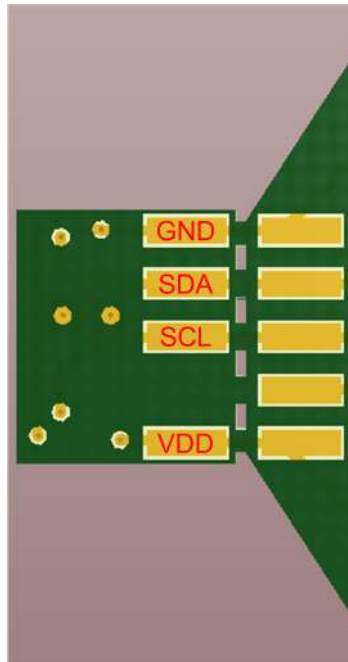
Figure 12. HDC1050EVM Pads for I2C and Supply of the Smaller Sensor Section

3 GUI Operation

The section describes how to use the GUI

3.1 Starting the GUI

Follow these steps to start the GUI:

1. Select the windows start menu
2. Select "All programs"
3. Select the "Texas Instruments" folder
4. Select the Sensing Solutions GUI
5. Click "Sensing Solutions GUI"
6. Splash screen will appear for at least two seconds.
   • Slower PC's may show a blank splash screen without any texts for up to 20 seconds
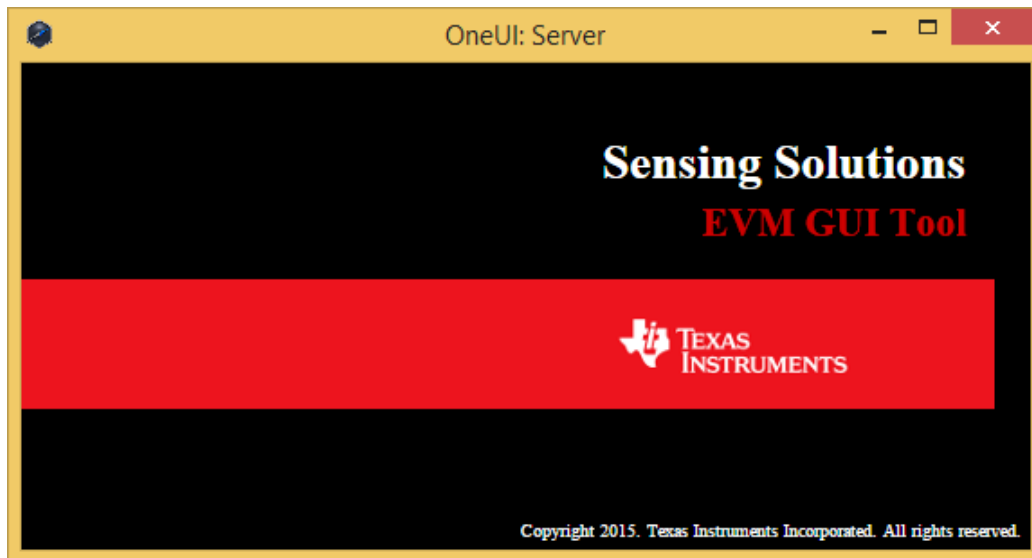
Figure 13. GUI Splash Screen

7. After the splash screen is displayed the main window will open. Note: Only one instance of the GUI may be open at a time!
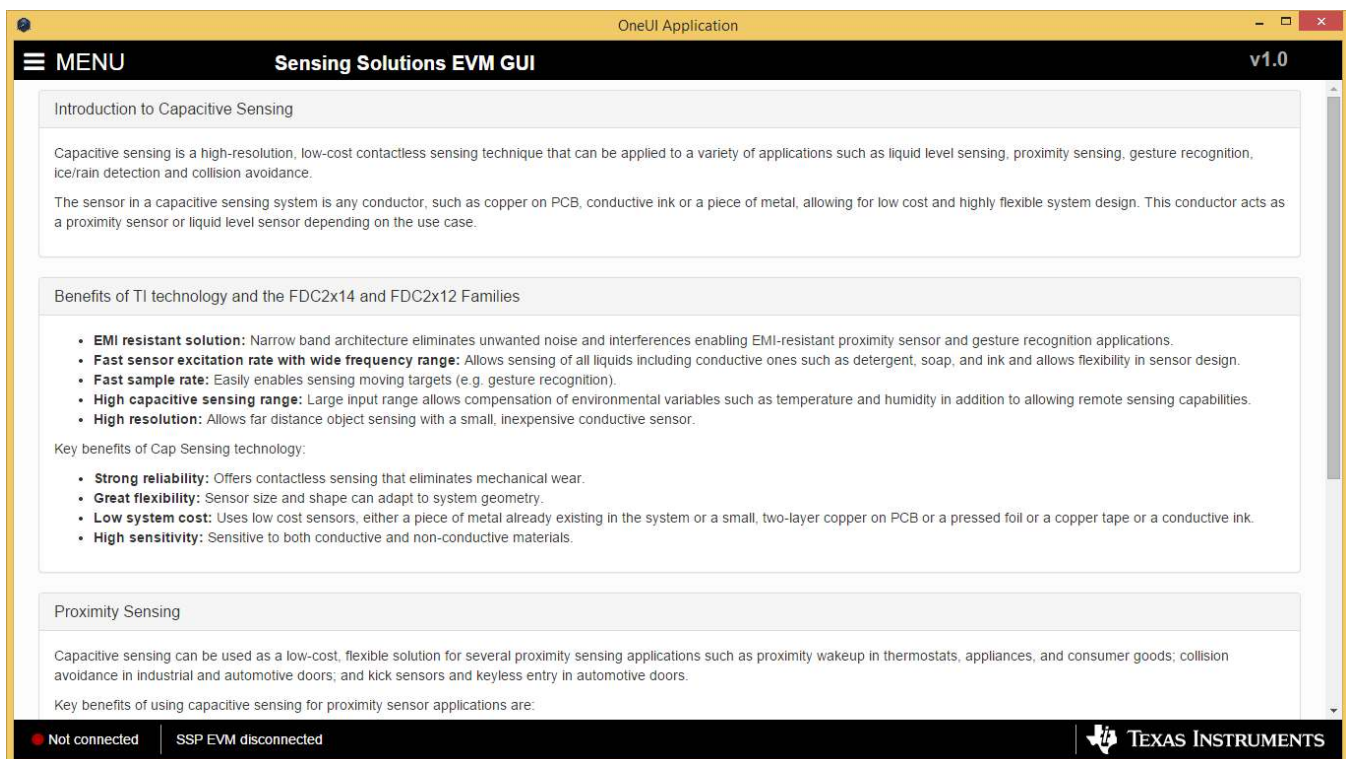
Figure 14. GUI Introduction Page

3.2 Connecting the EVM

Follow these steps to connect the EVM to the GUI:

1. Attach the EVM to the computer via the USB port.
2. The GUI always shows the connection status on the bottom left corner of the GUI

• The initial release of this GUI does not support multiple GUI instances or multiple devices. To control multiple EVMs, virtual machines may be used or multiple PC's are required. Future releases will support multiple EVMs from a single instance of the GUI.
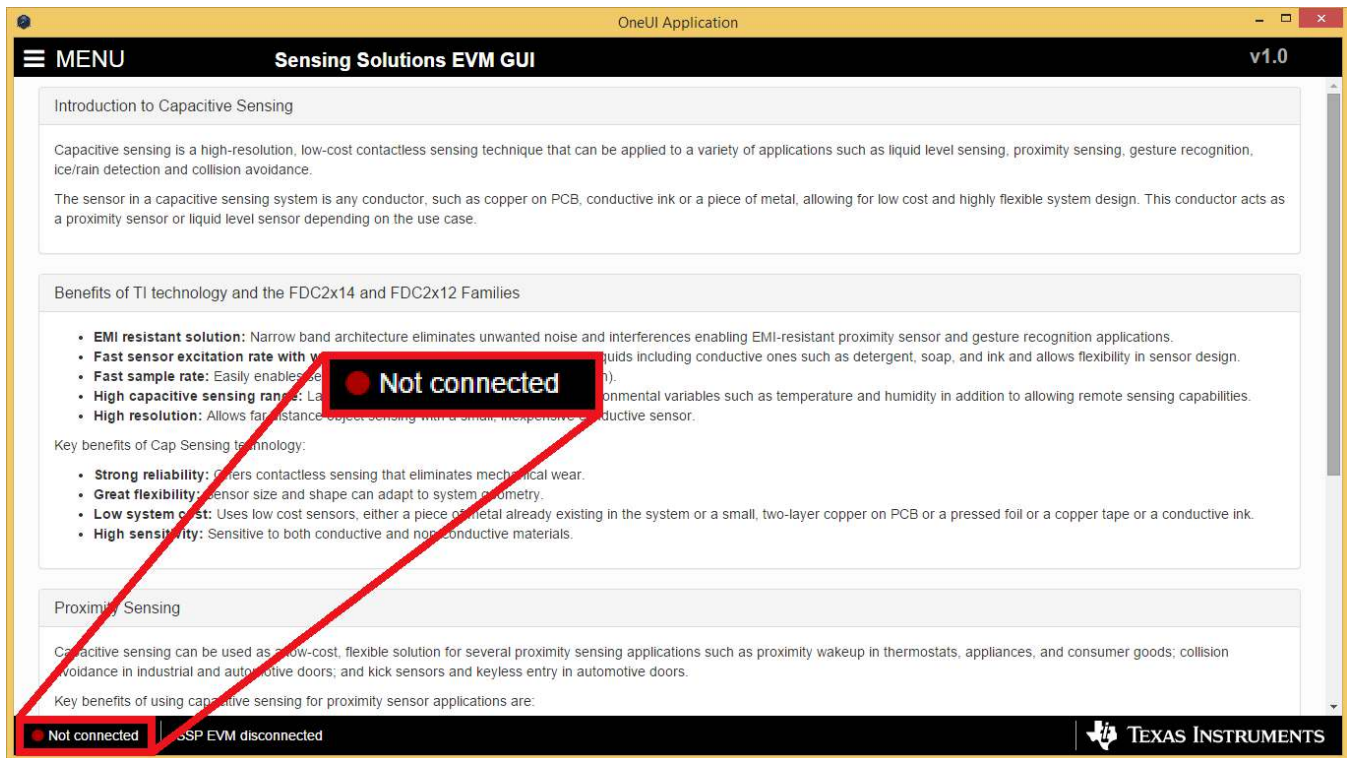
Figure 15. GUI Disconnected From EVM
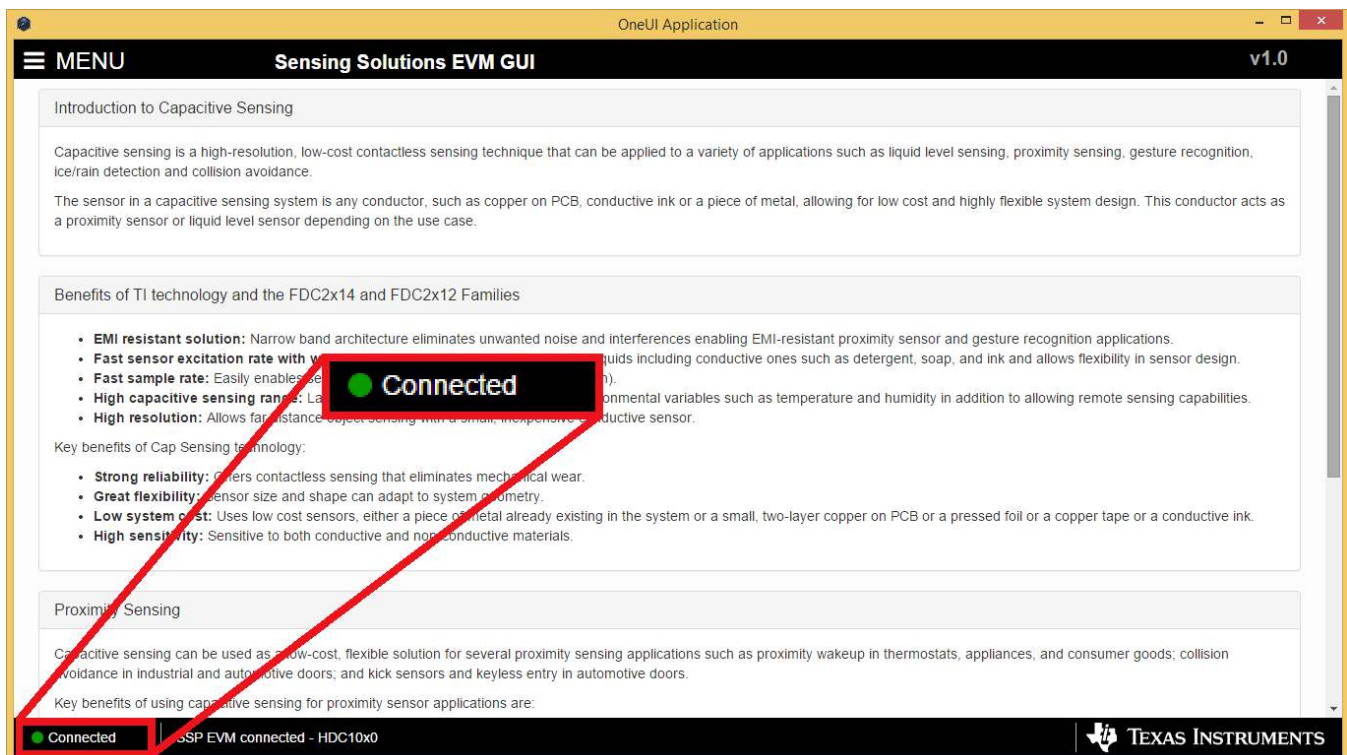
Figure 16. GUI Connected from EVM

3.3   Navigating the GUI

To navigate to different pages of the GUI follow these steps:

1. Click "Menu" in the upper left corner
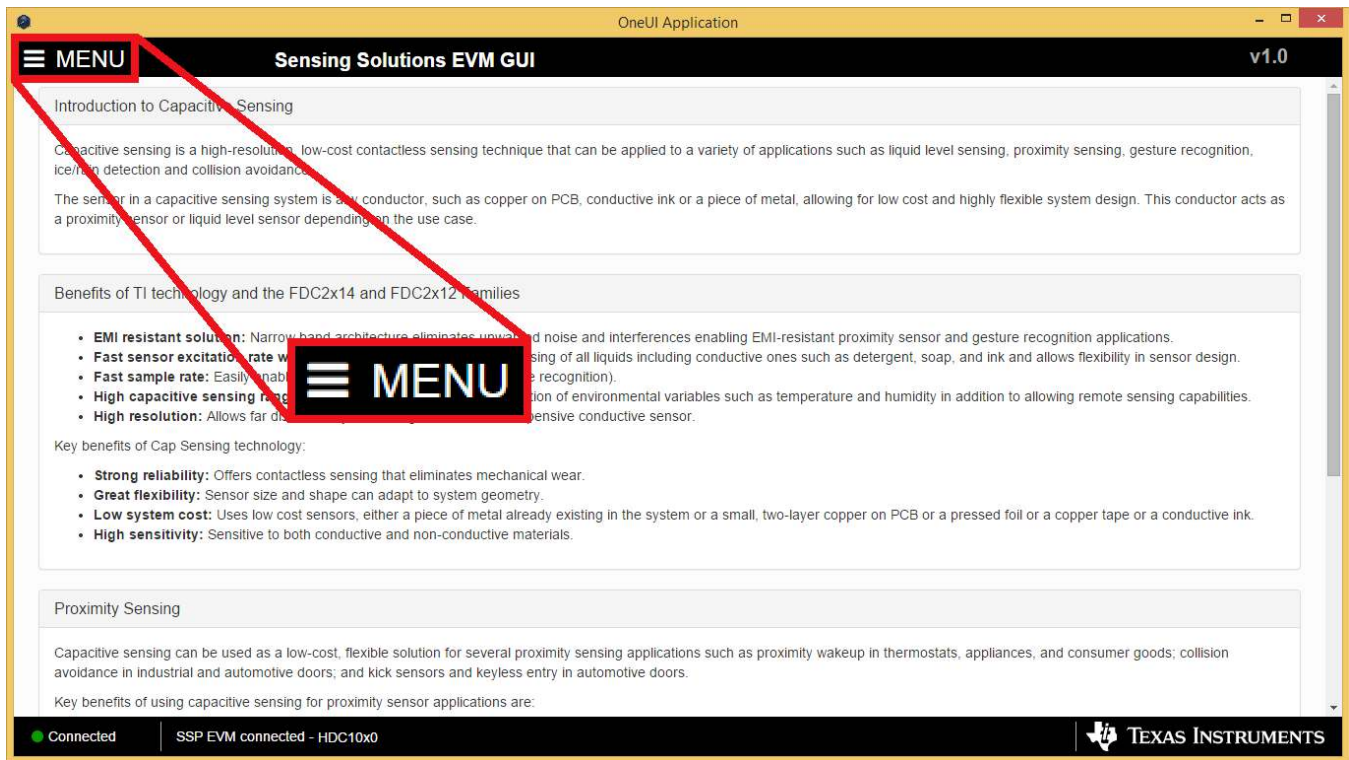
Figure 17. GUI Menu Button

2. Select the desired page from the menu shown on the left
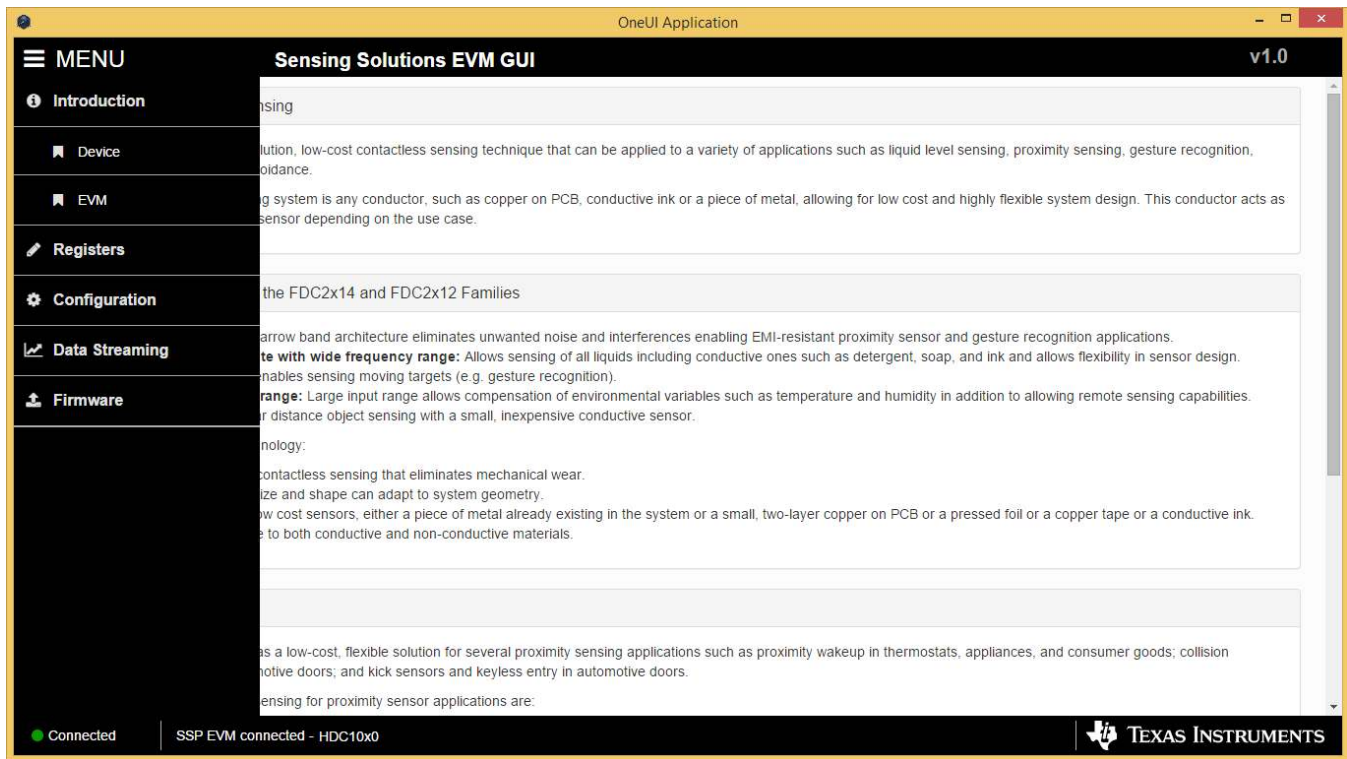
Figure 18. GUI Navigation Menu

3.4 Configuring the Device using Register Page

The register page allows users to control the device directly with the register values. The user may also use this page to read the currect register values on the device.

3.4.1 Automatically Updating GUI Register Values Using Auto-Read

Autoread will periodically request the register values on the device. Click the dropdown box next to "Auto Read" to select the update interval.
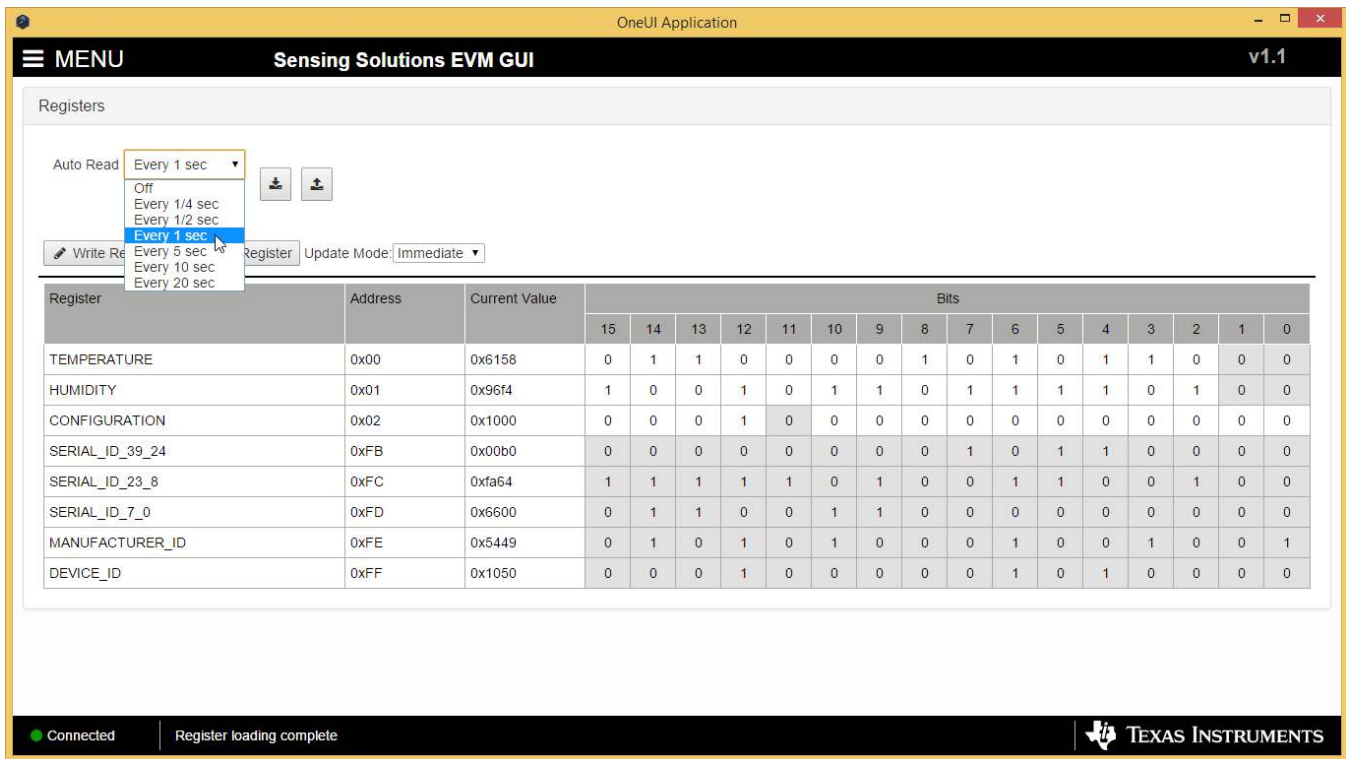
Figure 19. Selecting Auto-Read Interval on Register Page

3.4.2 Manually Updating Device Register Values

There are two methods to change register values: update the entire register value or change a single bit within the register. The recommended update mode is always "Immediate" and not "Deferred". To update register values, follow these steps.

1. Double-click the current value of the register that needs to be changed. The text will turn into an editable text box

Register	Address	Current Value	Bits															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
TEMPERATURE	0x00	0x61b0	0	1	1	0	0	0	0	1	1	0	1	1	0	0	0	0
HUMIDITY	0x01	0x9a68	1	0	0	1	1	0	1	0	0	1	1	0	1	0	0	0
CONFIGURATION	0x02	0x3000	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
SERIAL_ID_39_24	0xFB	0x00b0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0
SERIAL_ID_23_8	0xFC	0xfa64	1	1	1	1	1	0	1	0	0	1	1	0	0	1	0	0
SERIAL_ID_7_0	0xFD	0x6600	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0
MANUFACTURER_ID	0xFE	0x5449	0	1	0	1	0	1	0	0	0	1	0	0	1	0	0	1
DEVICE_ID	0xFF	0x1050	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0

Figure 20. Selecting a Register's Current Value for Editting on Register Page

2. Type the new value in hexadecimal into the box and click enter. The text box changes to normal text and the GUI will send a command to the EVM to update the device register

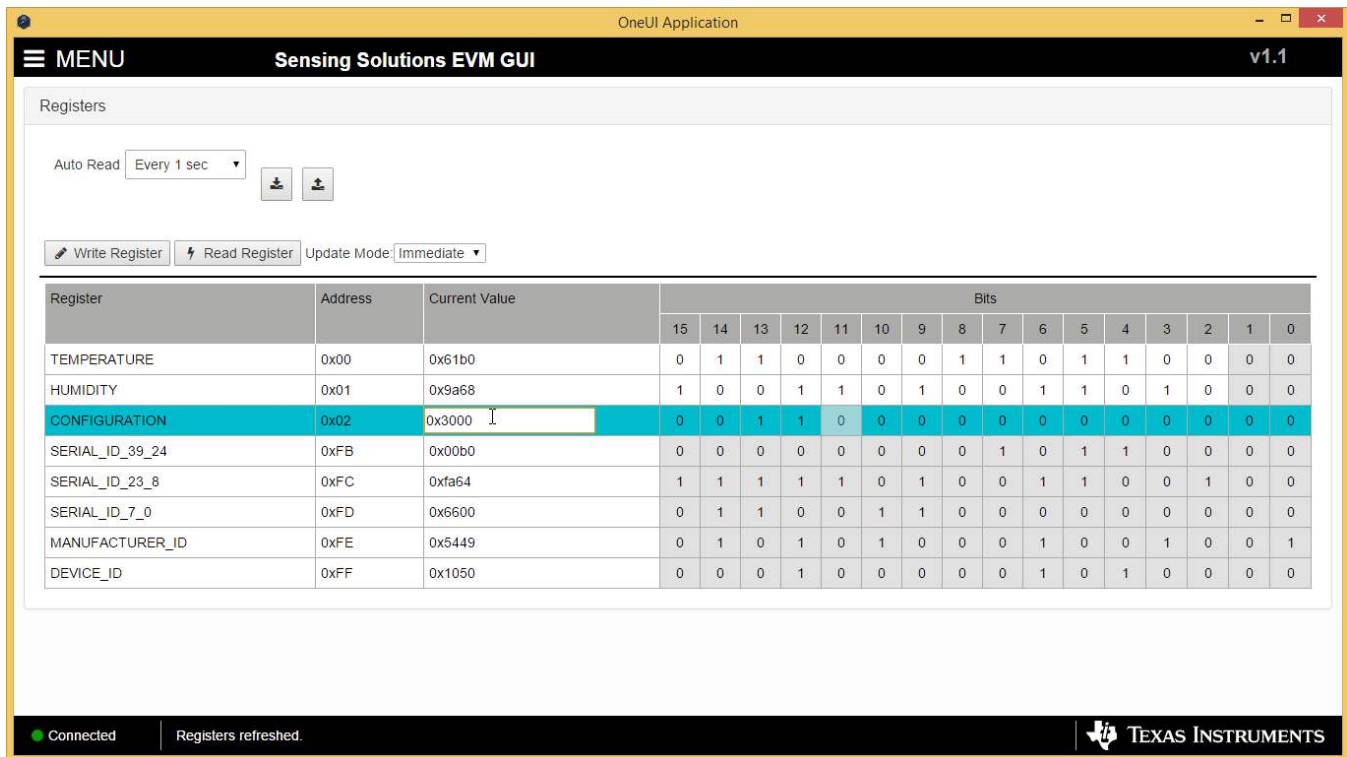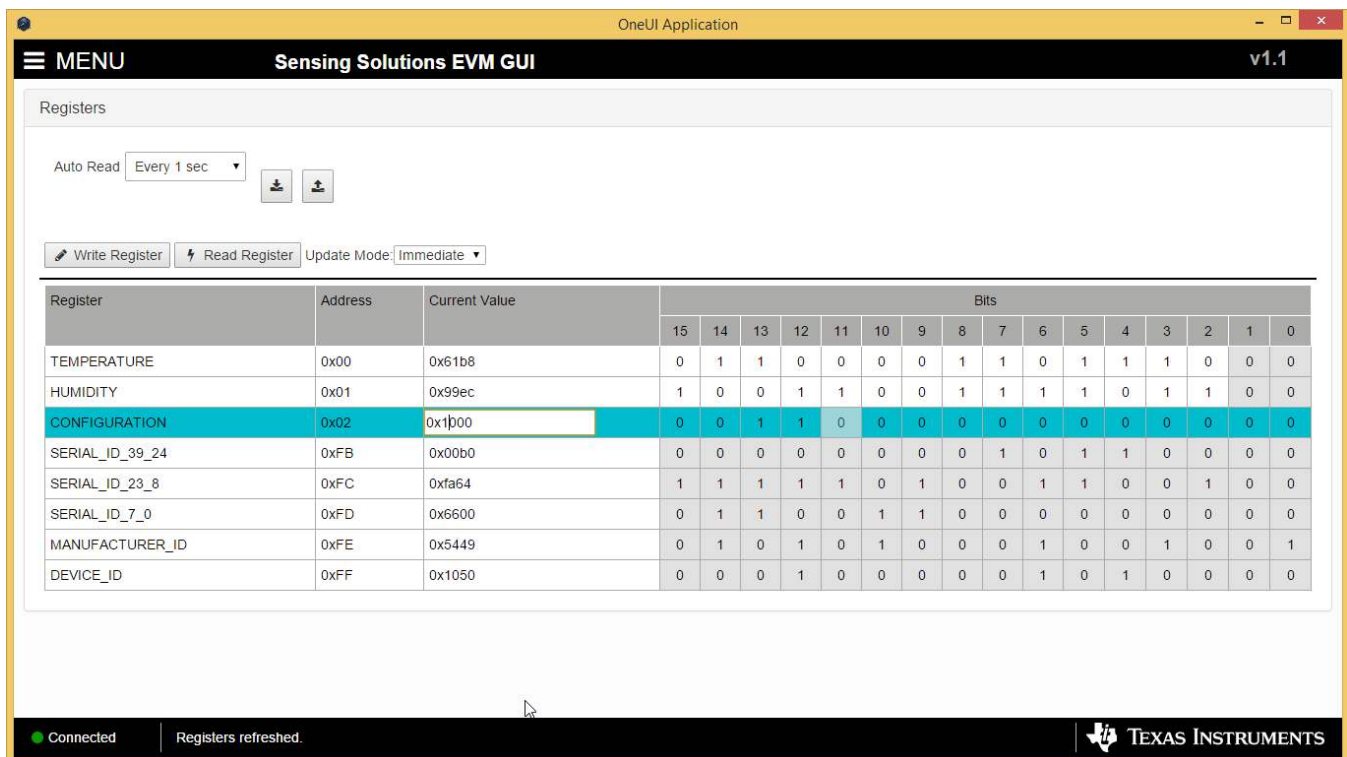| Register	Address	Current Value	Bits															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
TEMPERATURE	0x00	0x61b8	0	1	1	0	0	0	0	1	1	0	1	1	1	0	0	0
HUMIDITY	0x01	0x99ec	1	0	0	1	1	0	0	1	1	1	1	0	1	1	0	0
CONFIGURATION	0x02	0x1000	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
SERIAL_ID_39_24	0xFB	0x00b0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0
SERIAL_ID_23_8	0xFC	0xfa64	1	1	1	1	1	0	1	0	0	1	1	0	0	1	0	0
SERIAL_ID_7_0	0xFD	0x6600	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0
MANUFACTURER_ID	0xFE	0x5449	0	1	0	1	0	1	0	0	0	1	0	0	1	0	0	1
DEVICE_ID	0xFF	0x1050	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0

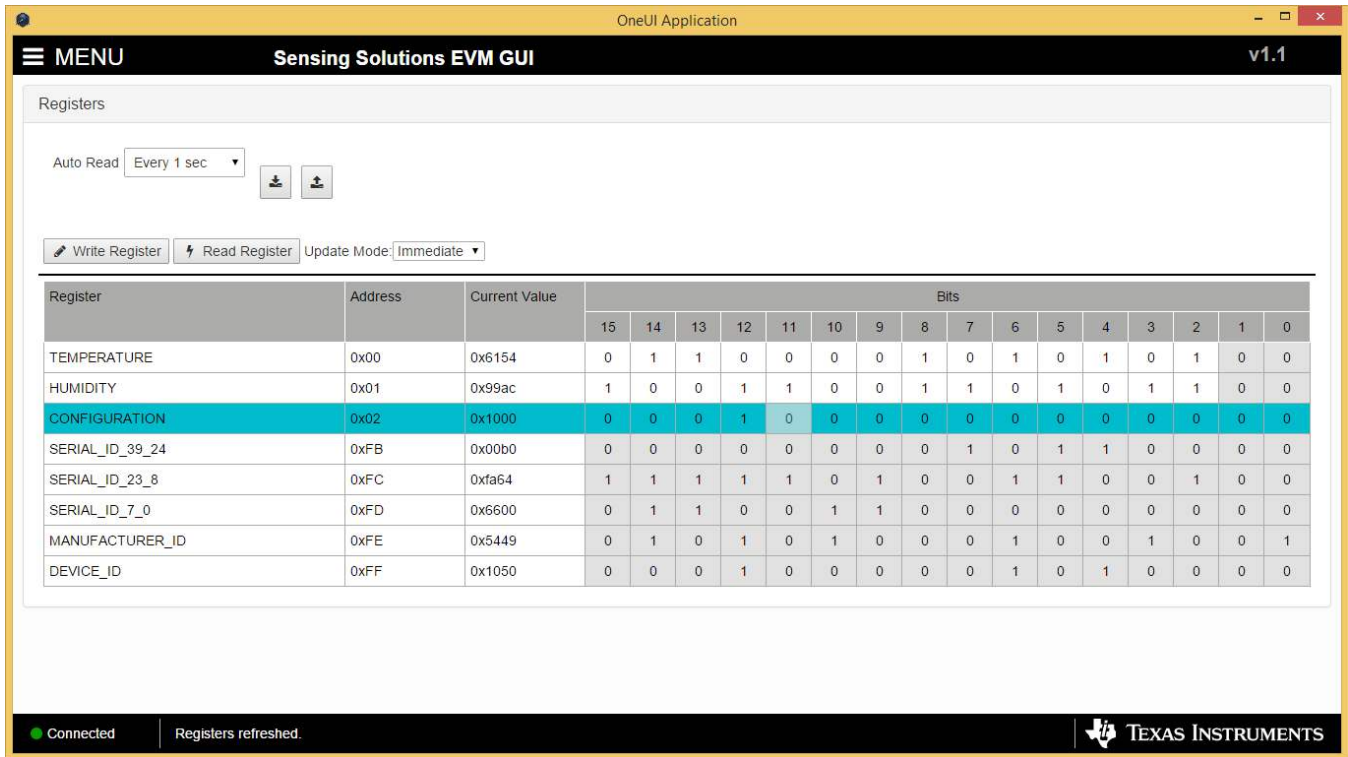**Figure 21. Entering New Value for Register on Register Page**

Figure 22. Register Value Updated After Changing Value on Register Page

To change individual bit values rather that entire register values follow these steps.

1.	Hover the mouse over the desired bit to change
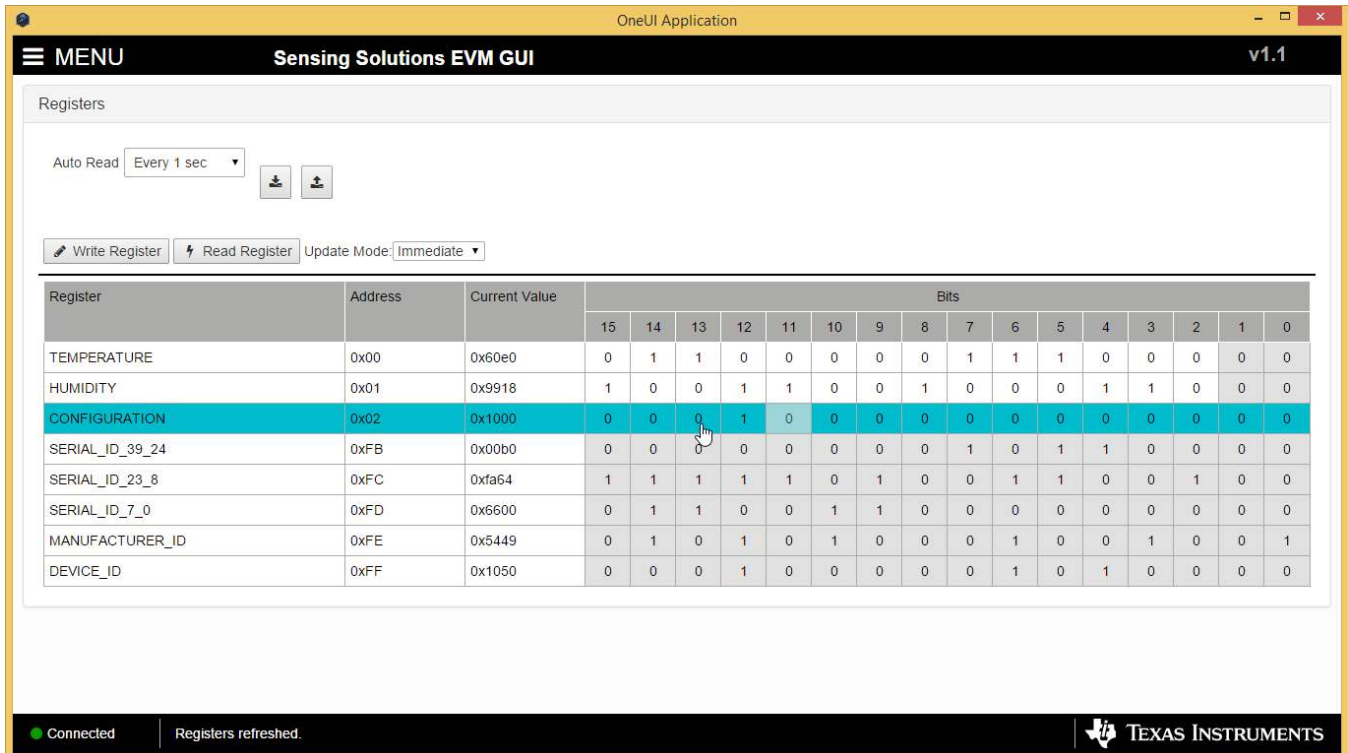

Figure 23. Hovering Mouse Over Register Bit Value on Register Page

2. Double-click the bit to toggle its value and the register's current value will update automatically

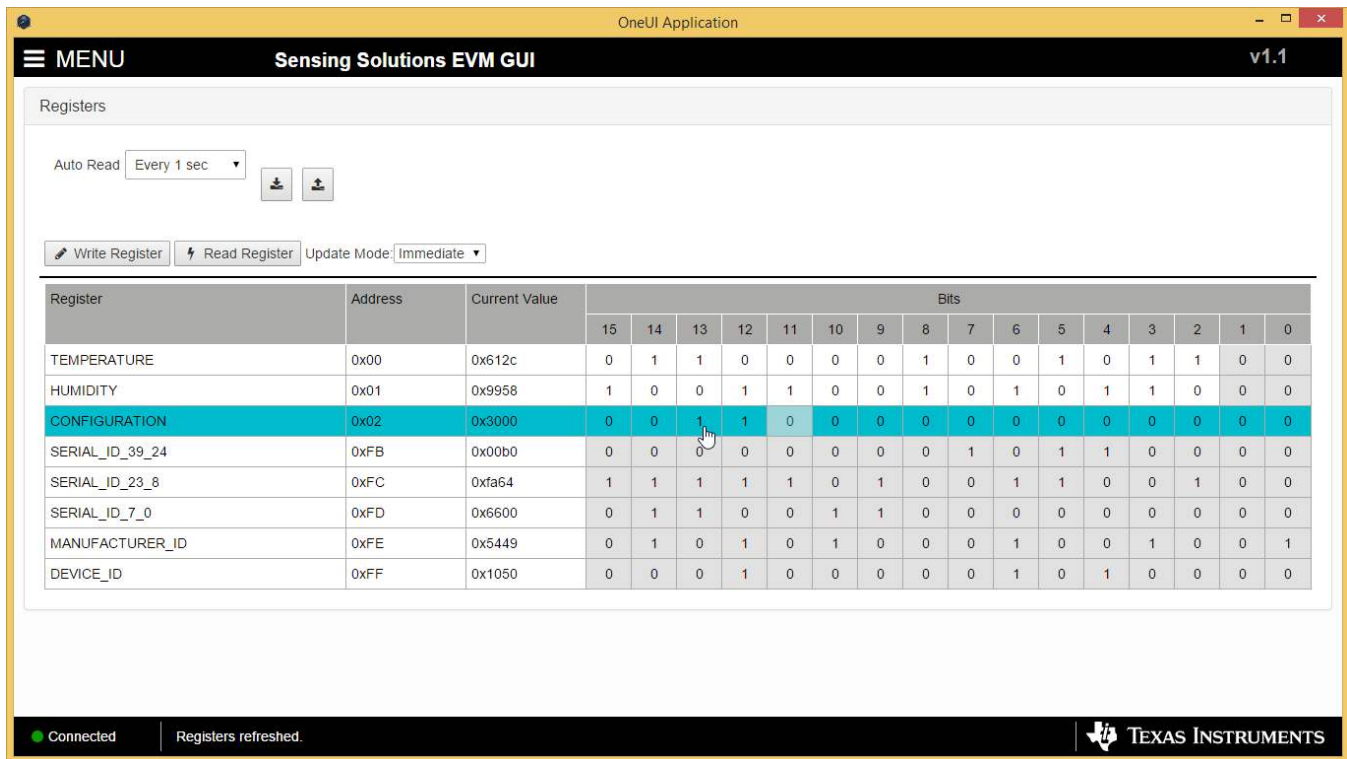**Figure 24. Toggling Register Bit Value on Register Page**

3.4.3 Reading Register Values without Auto-Read

To read register values follow these steps.

1. Select the register to update by clicking any column of the register row in the table
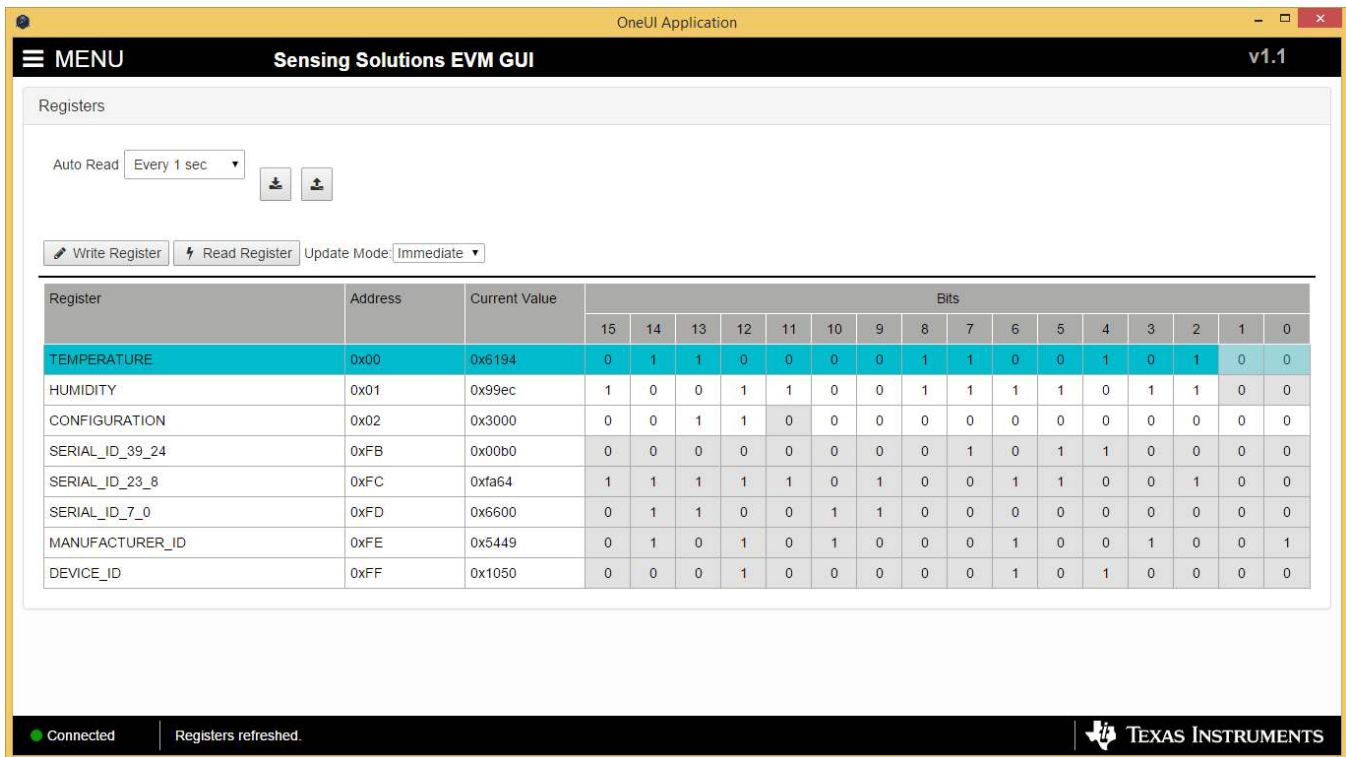
Figure 25. Selecting a Register on Register Page

2. Click the "Read Register" button to update the selected register's current value and bit values in the table
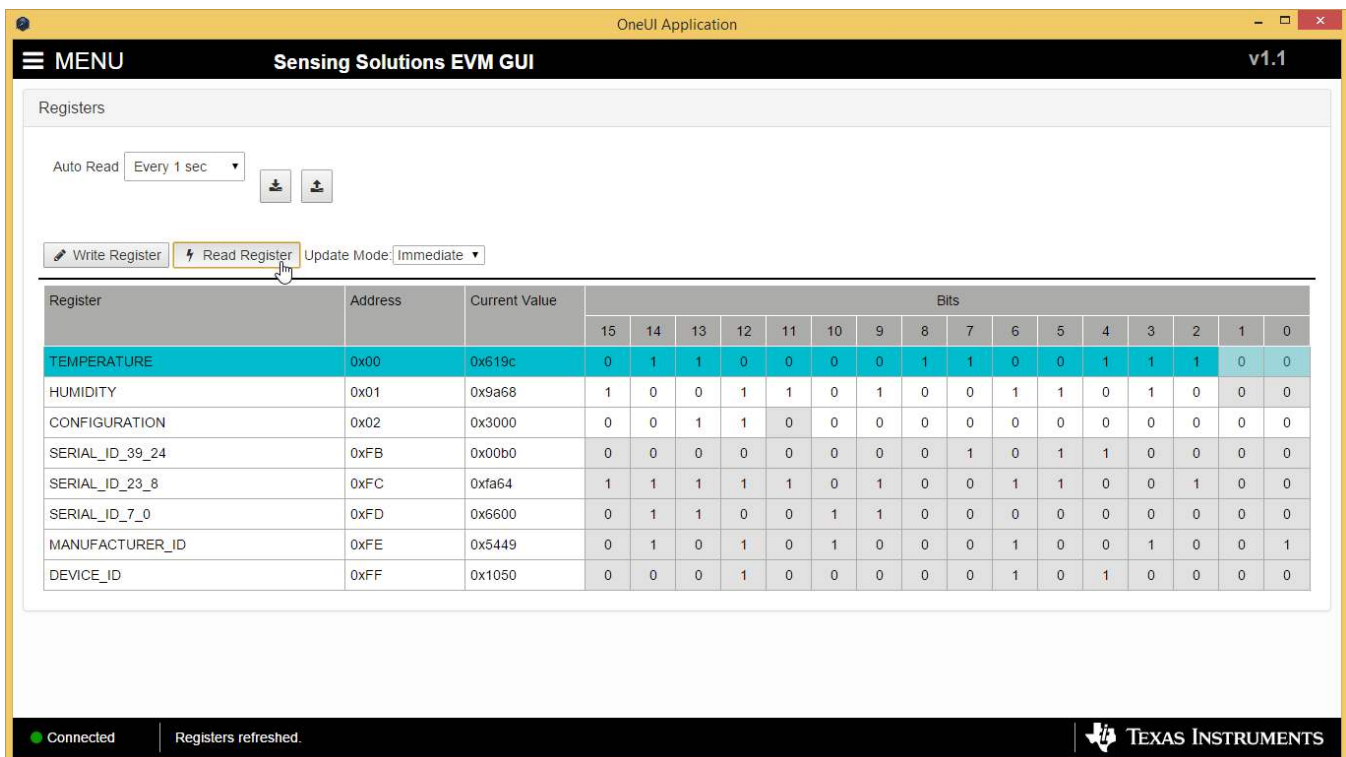
Figure 26. Reading the Current Device Register Value on Register Page

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3.4.4 Saving Device Configuration

To save the current register settings of the device follow these steps.

1. Click the button immediately right to the "Auto-Read" selection dropdown
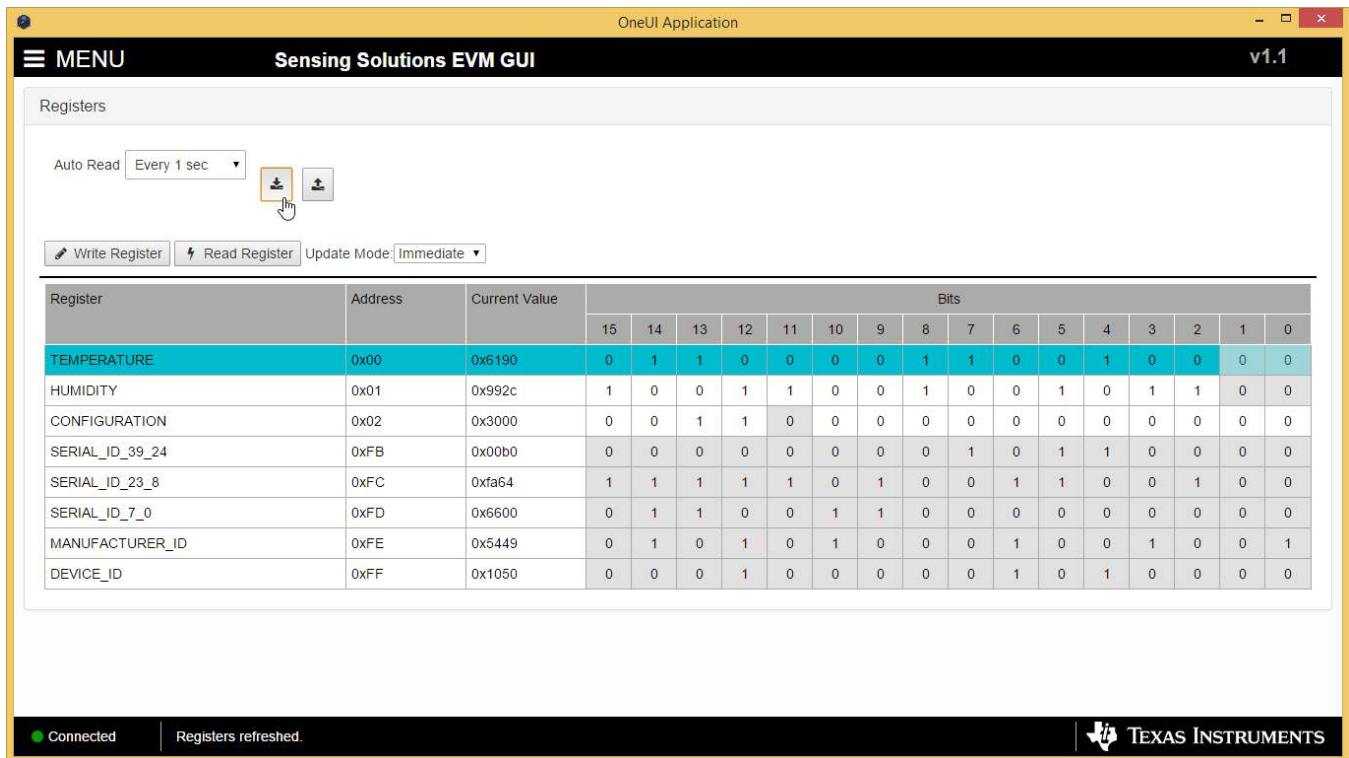
Figure 27. Save Register Values to File on Register Page

2. Choose a JSON file name and the directory to save it within. Then click "Save"
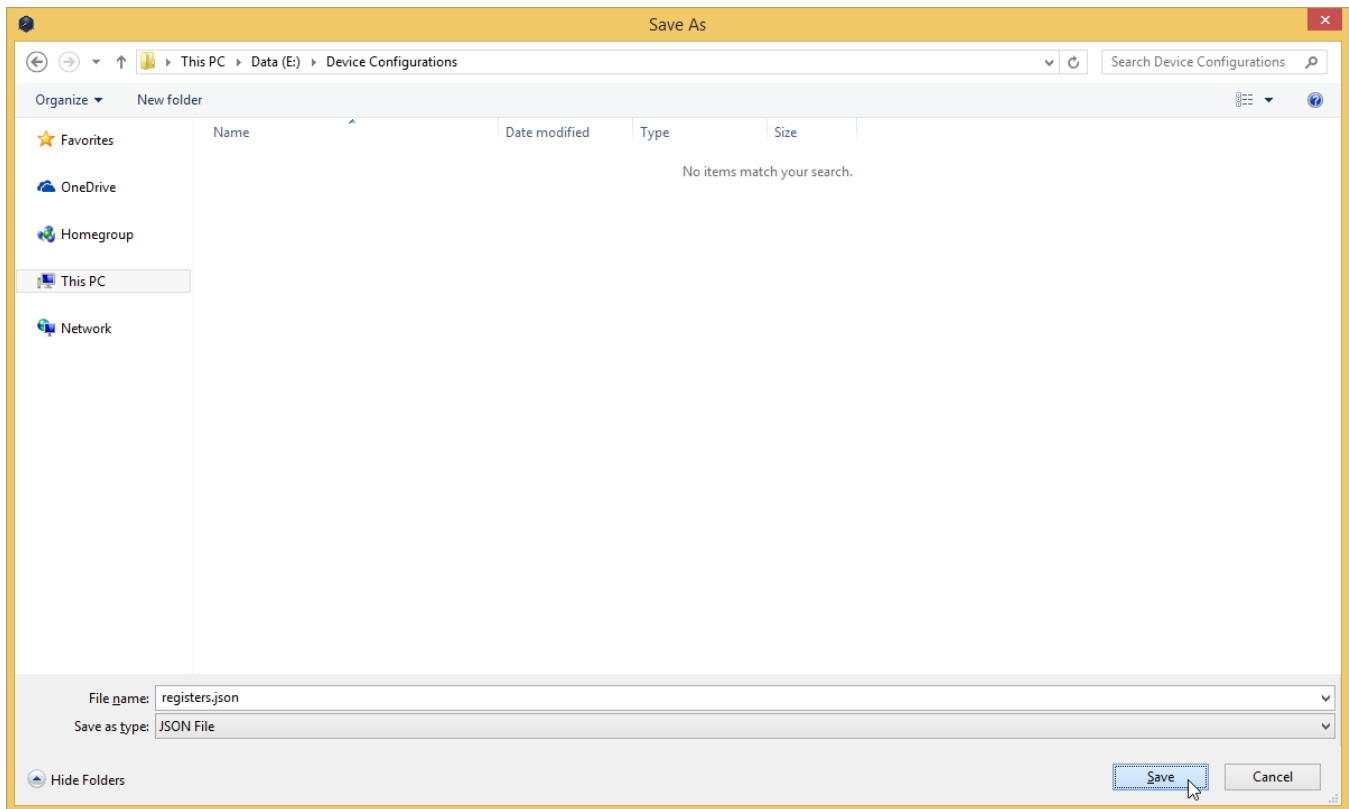
Figure 28. Choosing a JSON File Name to Save Register Values

3.4.5 Loading Previously Saved Device Configuration

To load previously saved register settings from a JSON file follow these steps.

1. Click the button furthest right from the "Auto-Read" selection dropdown

Figure 29. Loading Previously Saved Register Values from File on Register Page

2. Select the JSON file with the desired settings and click "Open"
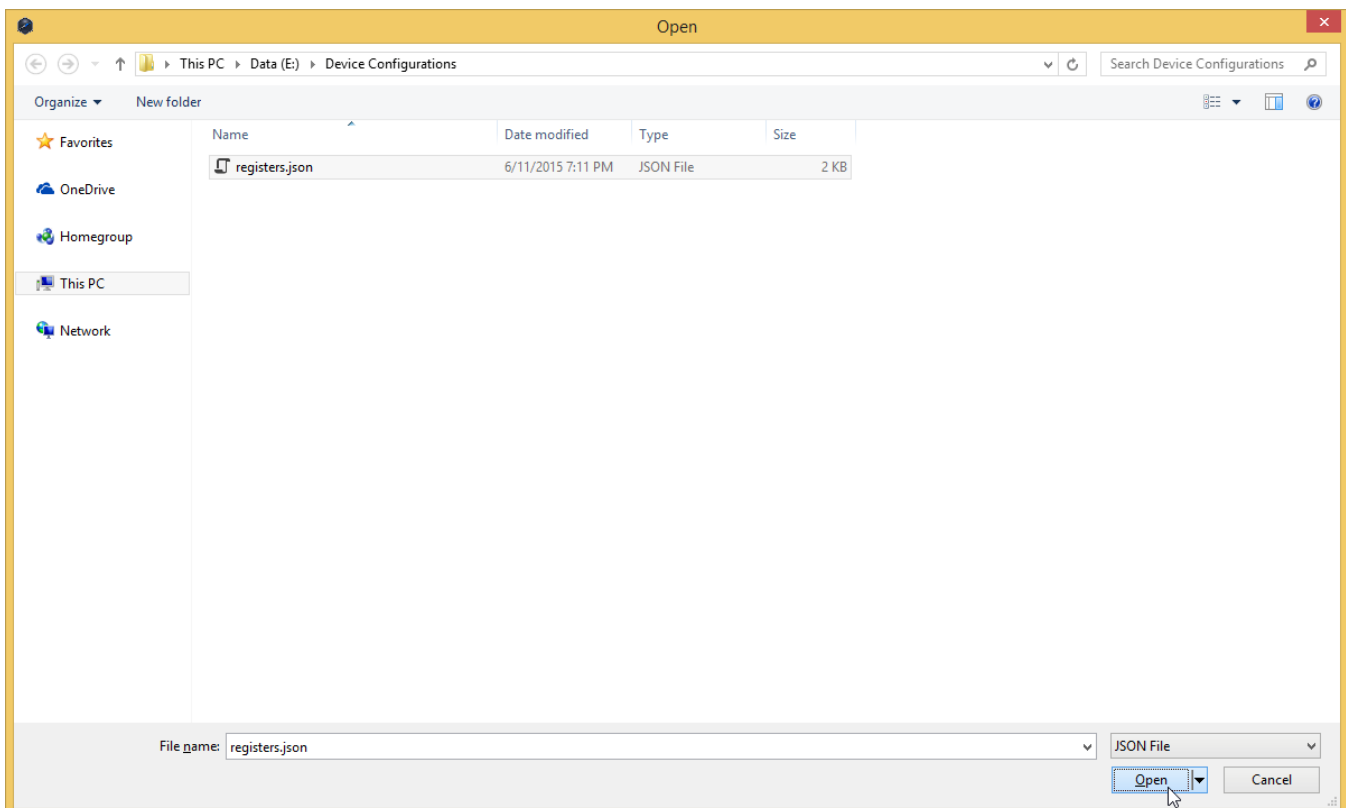
Figure 30. Selecting Previously Save Register Value JSON File

3.5 Configuring the Device using Configuration Page

The Sensing Solutions GUI is capable on configuring the device more intuitively than the direct register values. For more information about configuring the HDC1050 please reference the device datasheet.
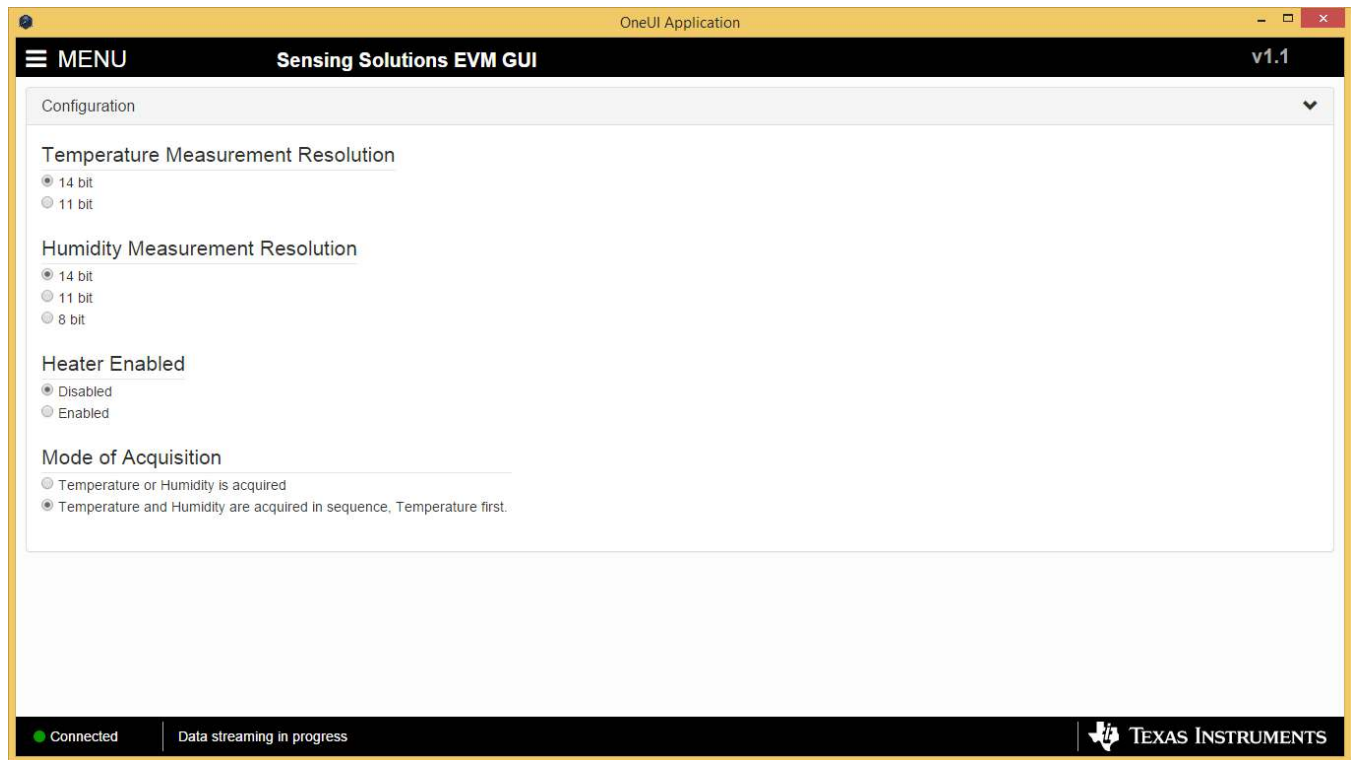
Figure 31. HDC1050 GUI Configuration Page

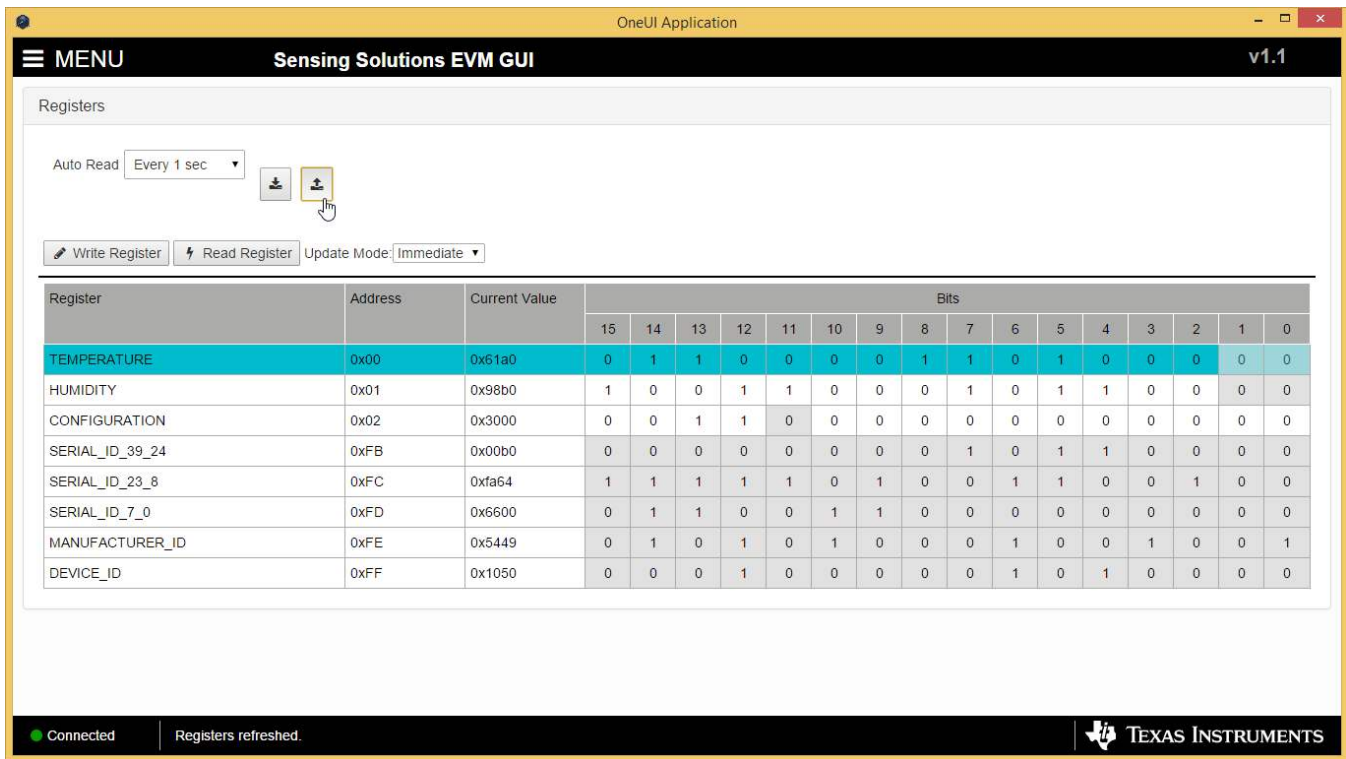## 3.6 Streaming Measurement Data

The Sensing Solutions GUI and EVM provide a tool to capture measurement data at rates up to 500Hz. The section describes how to use the data measurement tools from the "Data Streaming" page accessible from the GUI menu.

3.6.1 Choosing Graph Units and Visible Channels

Select the drop down menu on top of the y-axis to choose the units of the graph. Available options include: Temperature and Humidity, and Raw Code.
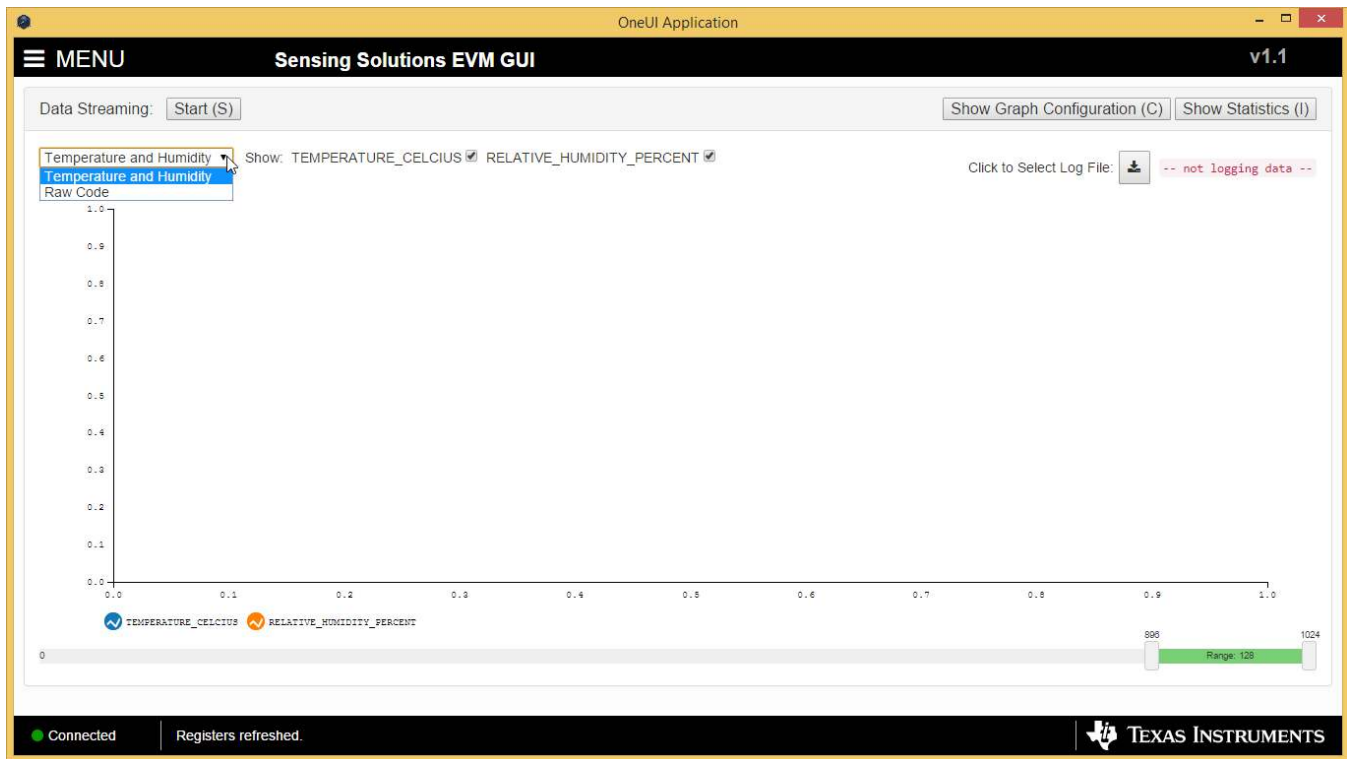
Figure 32. Selecting the Measurement Units for the Data Streaming Graph

To select which measurements are displayed in the graph, check or uncheck the temperature and relative humidity boxes shown next to the graph units. Selecting or not selecting the data types only affects the graph and not the data logged to a file. If a data type is not enabled in the Configuration page it will not appear on the Data Streaming page.

Figure 33. Data Streaming Graph Showing Only Relative Humidity Percent
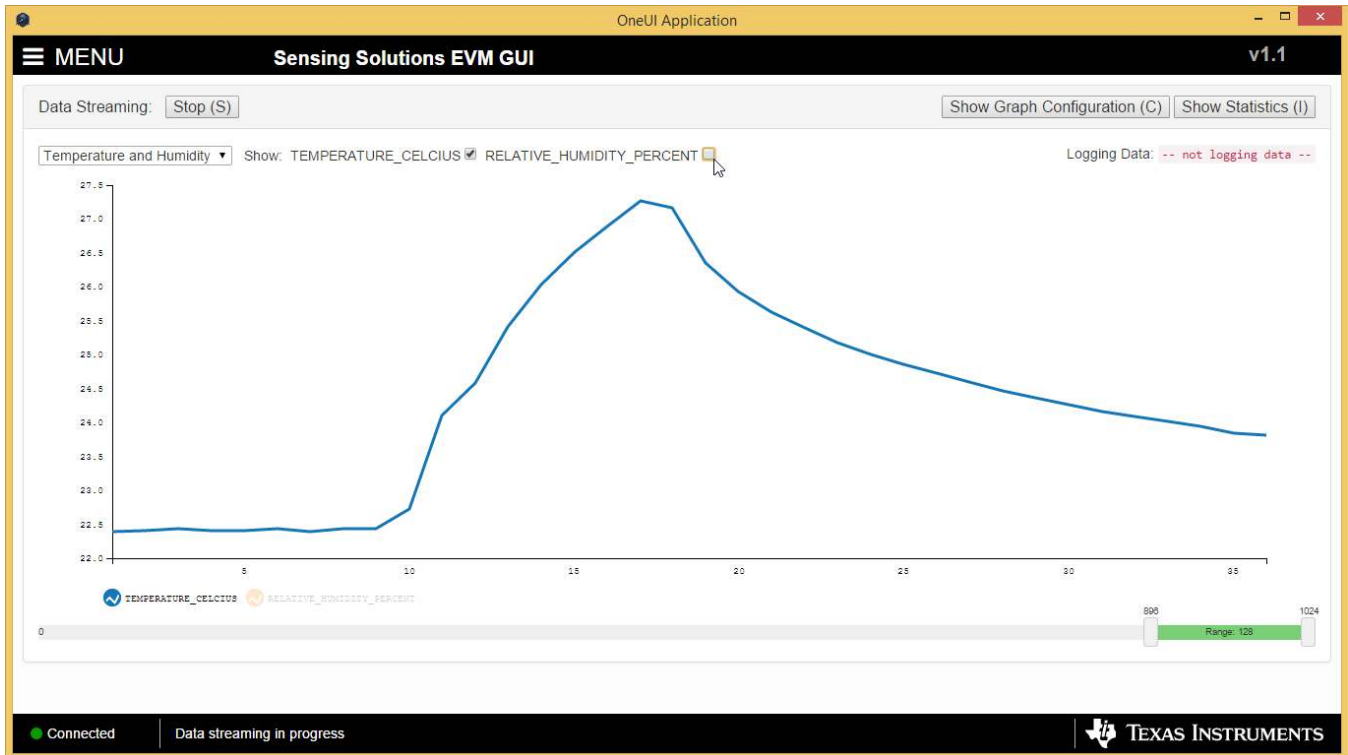
Figure 34. Data Streaming Graph Showing Only Temperature

3.6.2 Logging data to a file

Follow these steps to log measurement data to a file.

1. Click the button in the upper right under next to "Click to Select Log File"
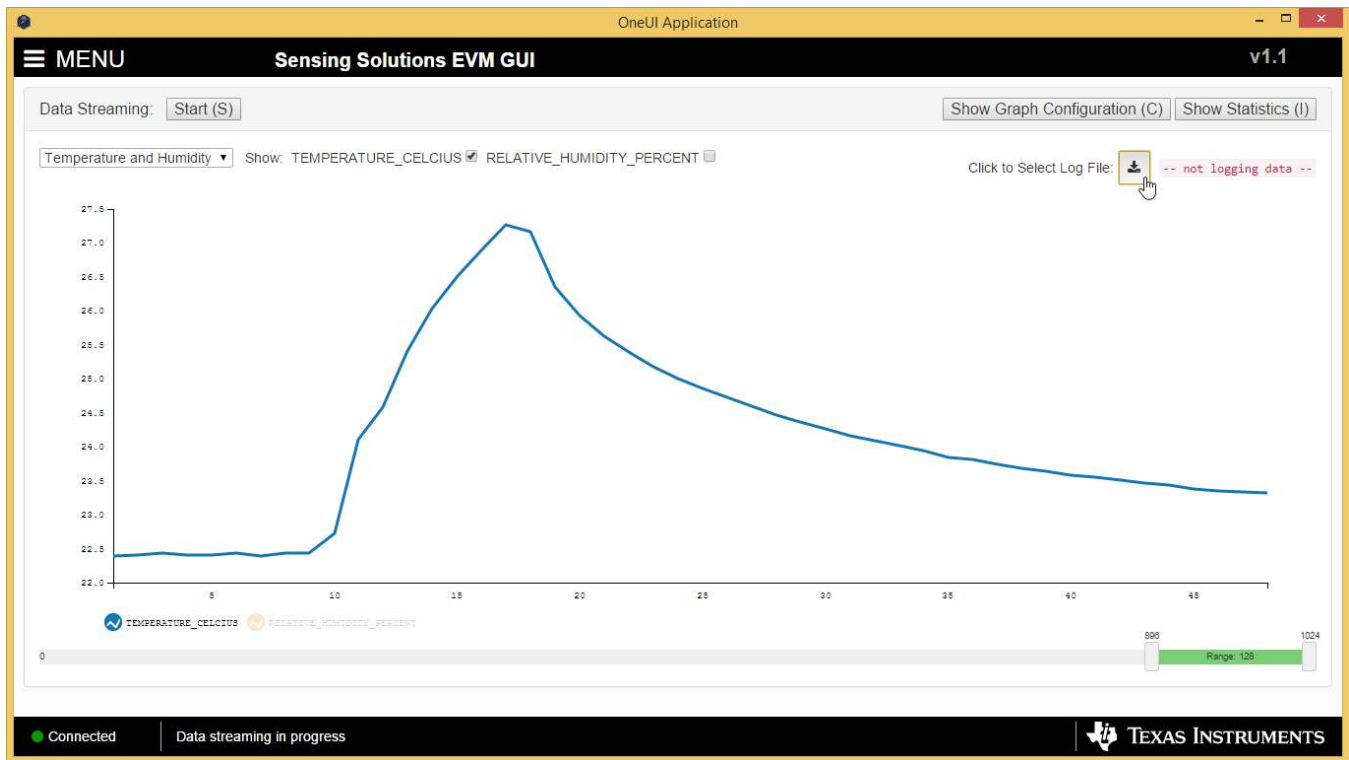
Figure 35. Select Log File Button on Data Streaming Page

2. Select a file name and directory to save the data to and then click the "Save" button
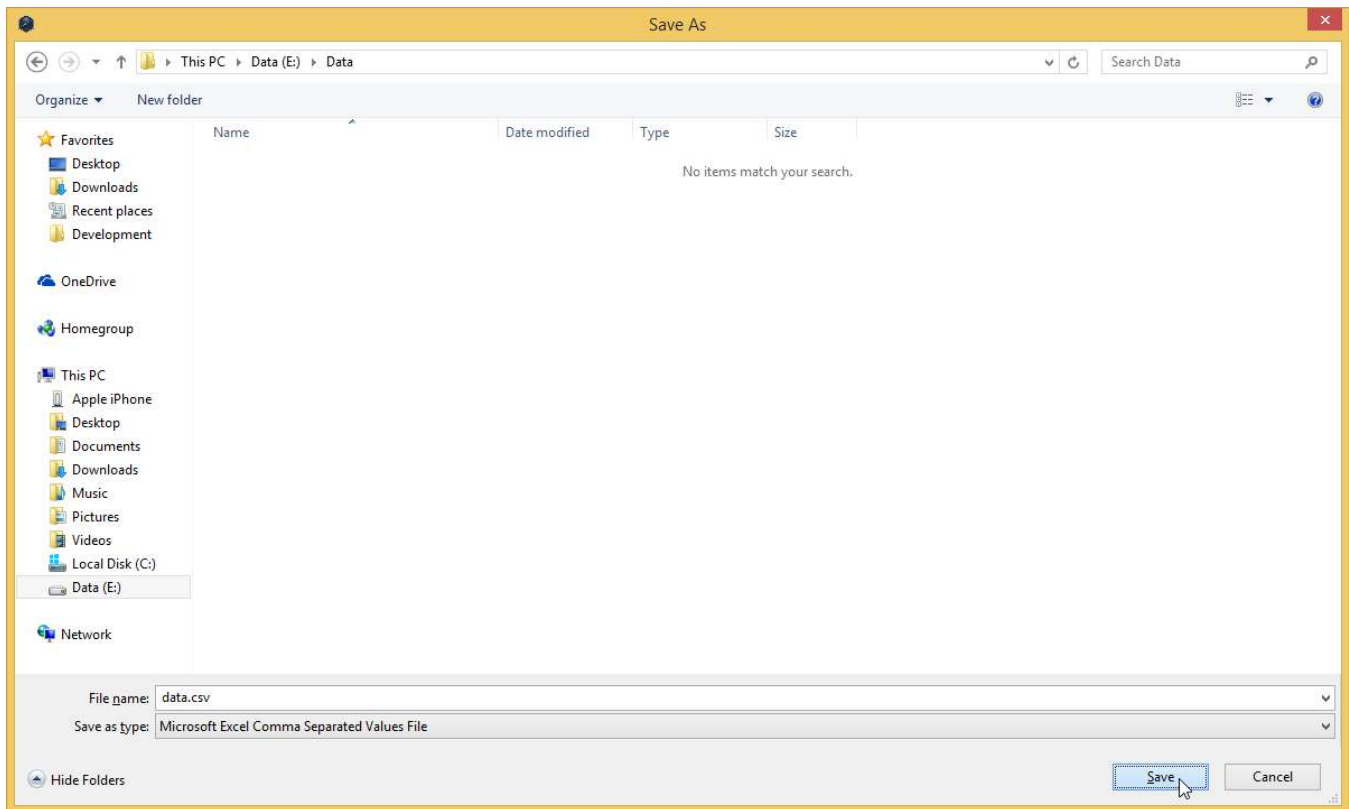
Figure 36. Selecting the Log File for Data Streaming

3.6.3   Setting the vertical axis scale and sampling rate

To set the vertical axis scale or change the sampling rate follow these steps.

1. Click the "Show Graph Configuration" button
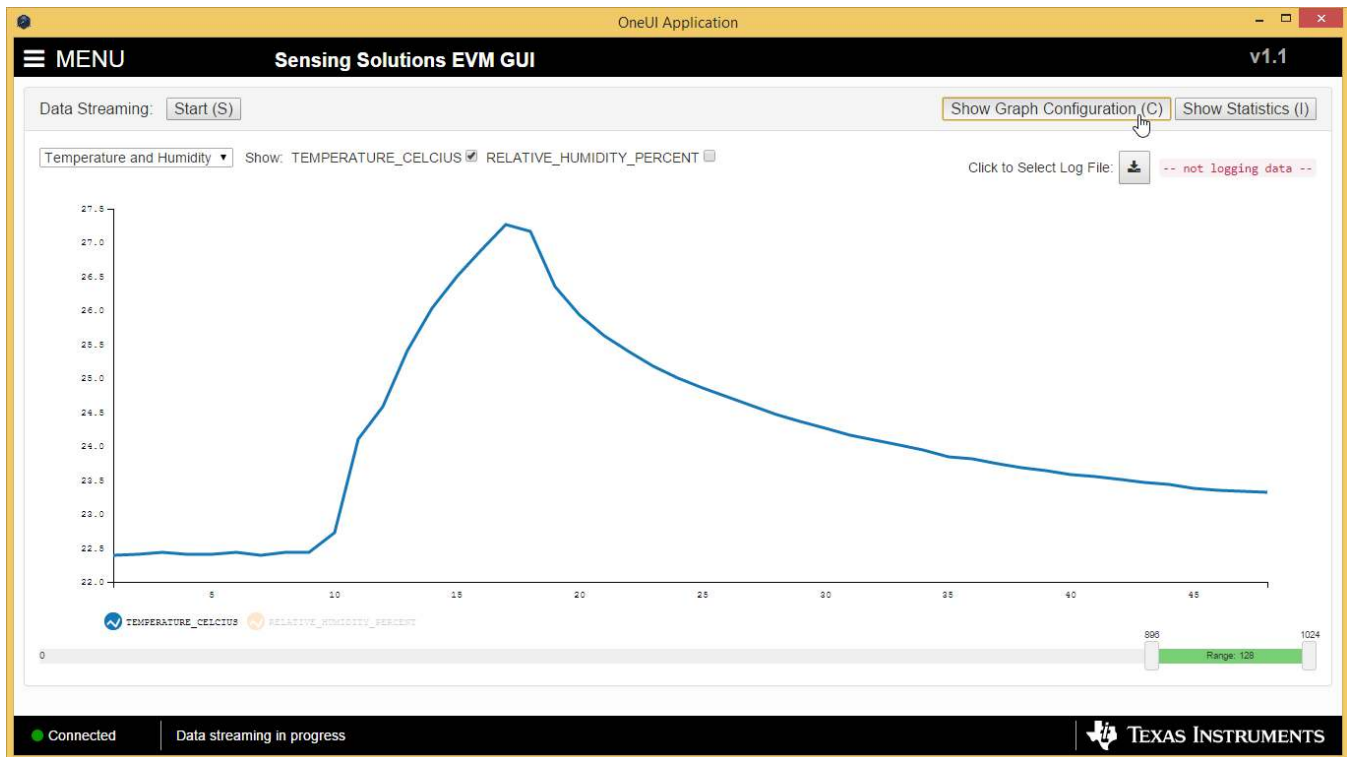
Figure 37. Show Graph Configuration Button on Data Streaming Page

2. The sampling rate can be adjusted in the "Sampling Rate" table.
   • Note that the GUI sampling rate affects only the graph and logging rate but not the actual device sampling rate
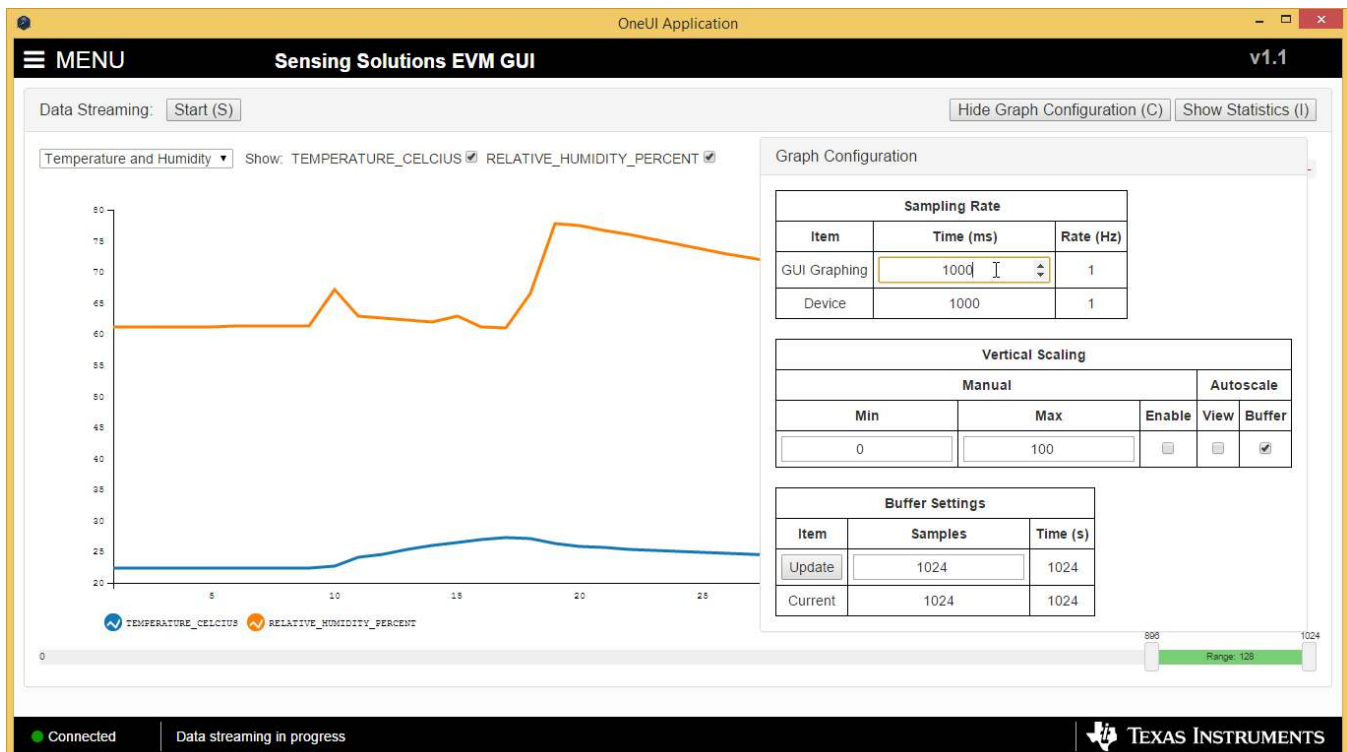
Figure 38. Setting the Data Streaming Sample Rate to 1 Second

3. The vertical scaling can be automatically updated or manually controlled by selecting either checkboxes in the "Vertical Scaling" table
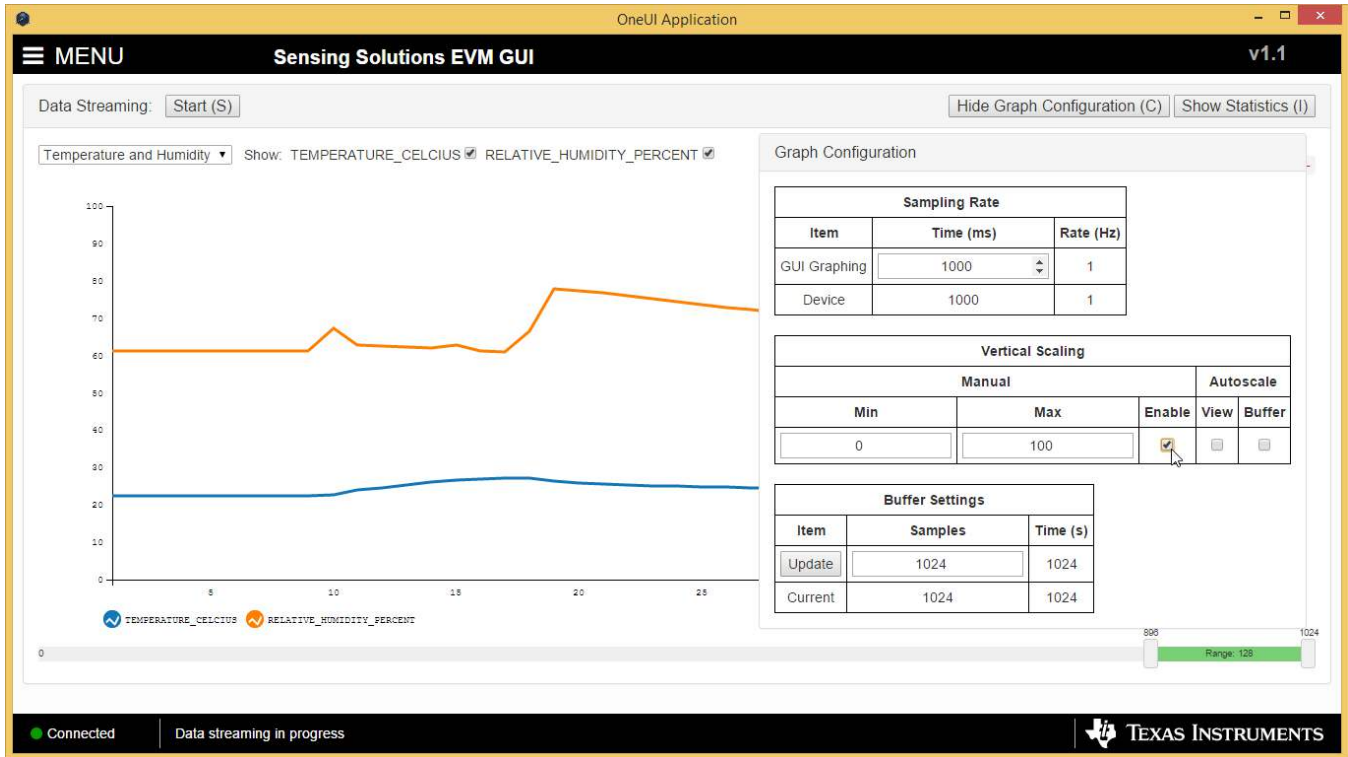
Figure 39. Manually Setting the Vertical Scale on Data Streaming Graph

3.6.4   Starting and Stopping Measurement Data Acquisition

To start data streaming click the "Start" button.

Figure 40. Starting Data Acquisition on Data Streaming Graph
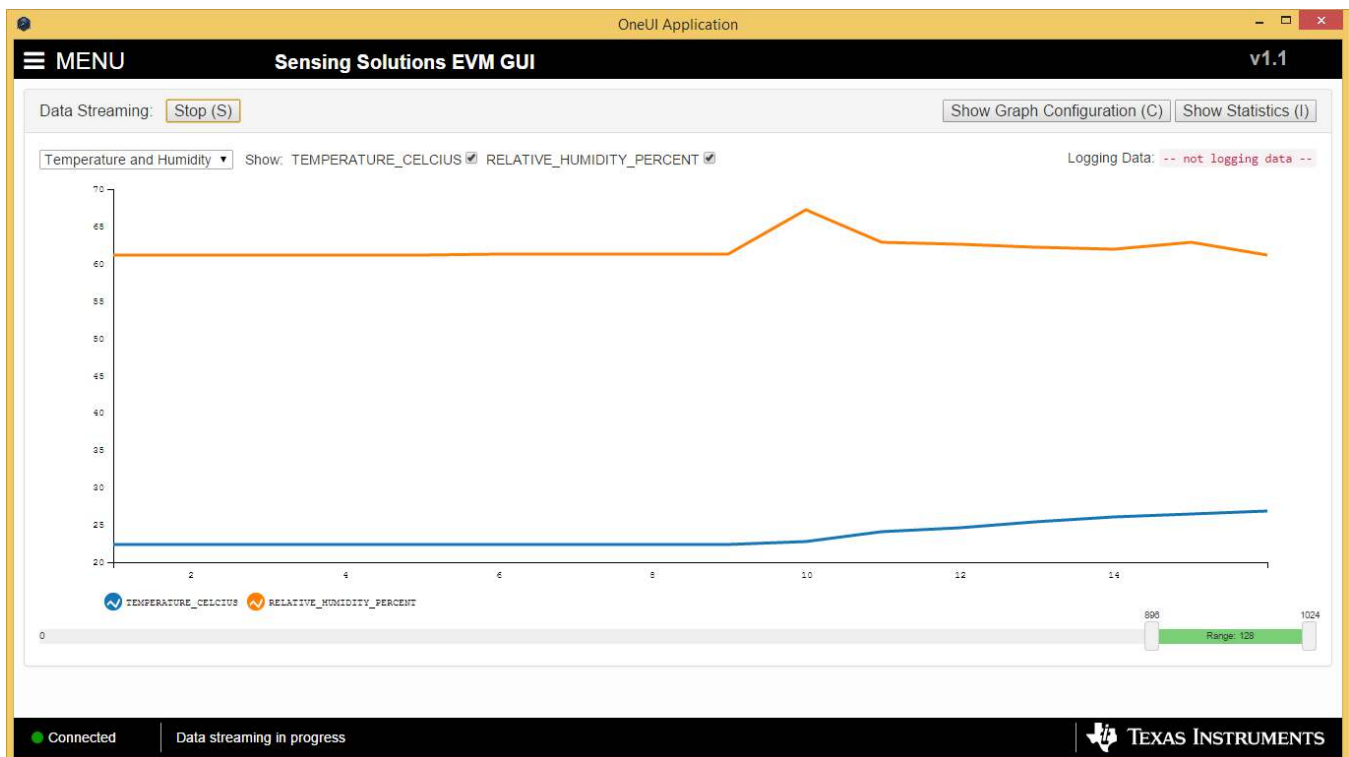
Figure 41. Data Acquisition In Progress on Data Streaming Page

To stop data streaming click the "Stop" button.
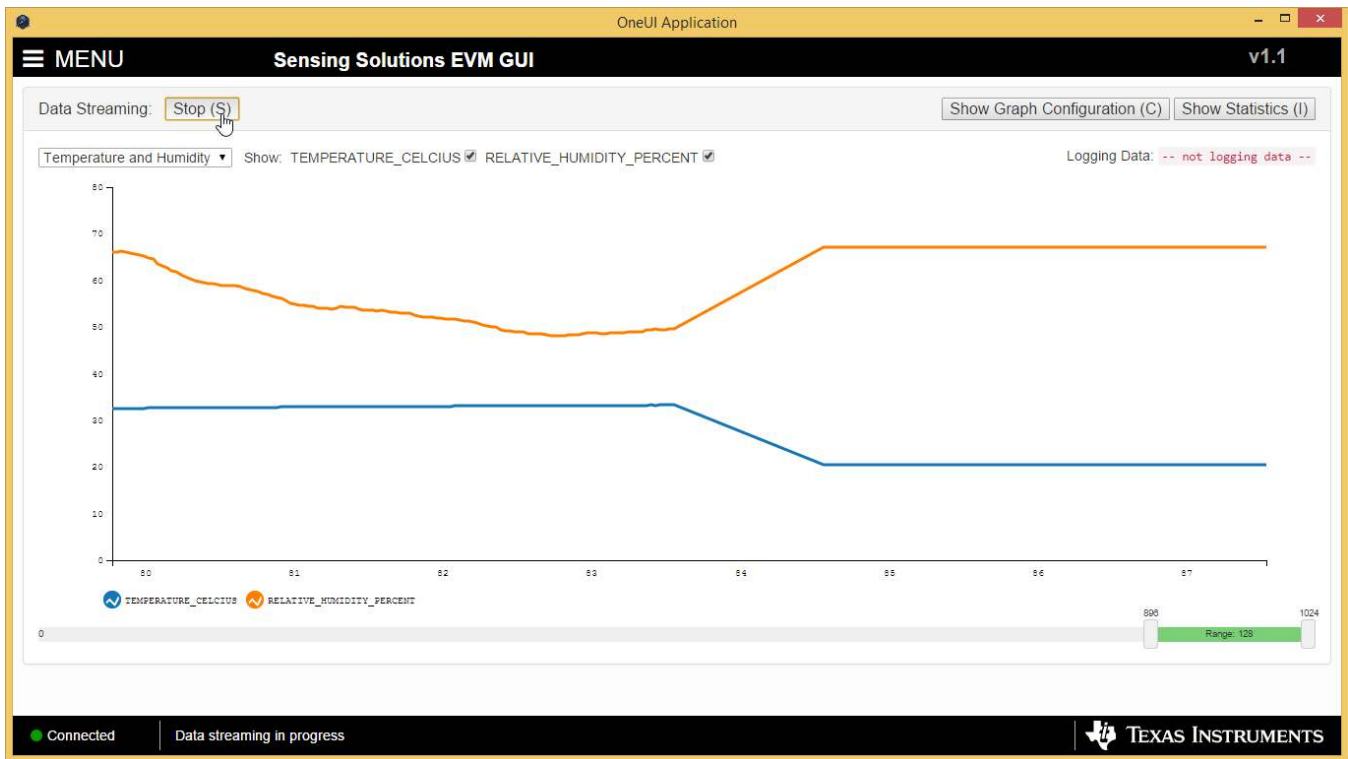
Figure 42. Stopping Data Acquisition on Data Streaming Graph

3.6.5 Displaying Measurement Data Statistics

Click the "Show Statistics" button to view the measurement statistics.
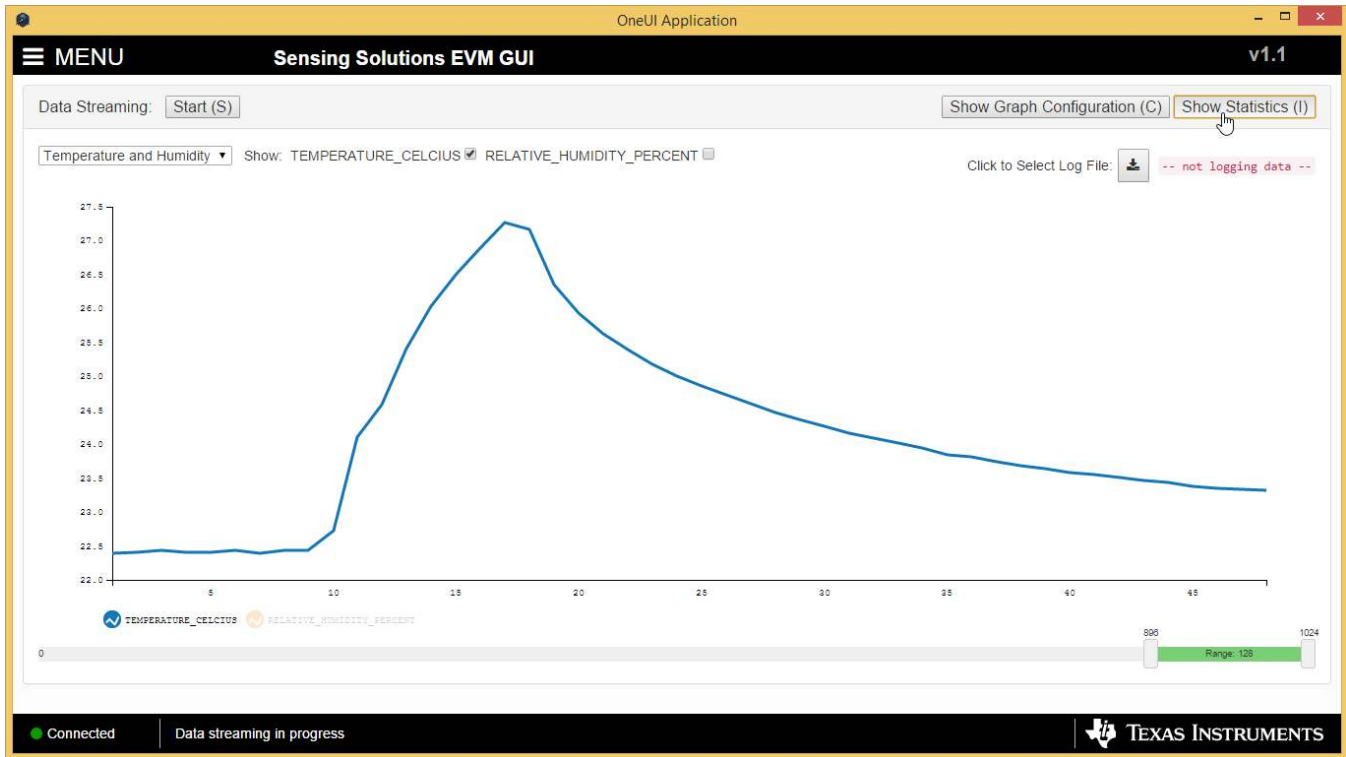
Figure 43. Show Statistics Button on Data Streaming Graph
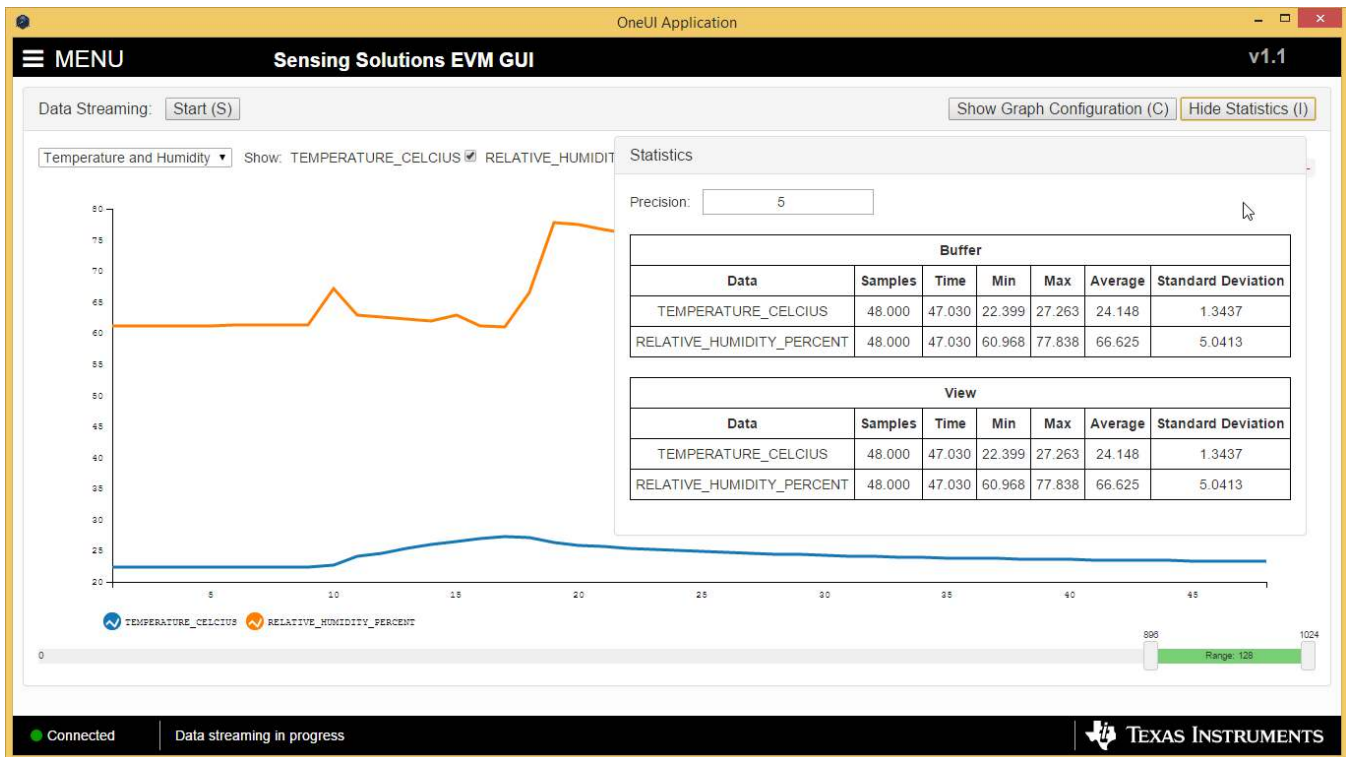
Figure 44. Data Statistics on Data Streaming Graph

3.6.6 Navigating the GUI's Data Buffer

After stopping the data stream, the number of data samples displayed can be selected by moving the dual slider under the graph.

Figure 45. Moving the Data Graph Sample View
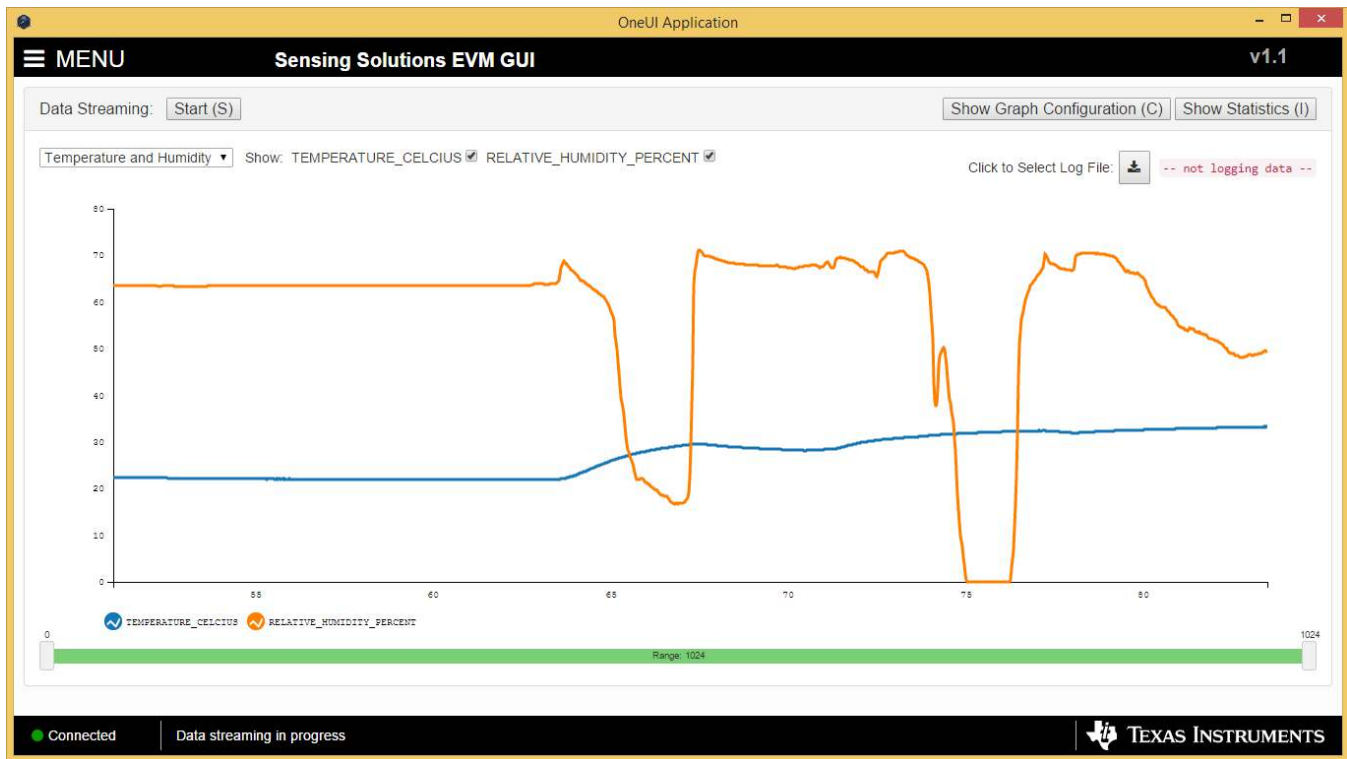
Figure 46. Viewing the Entire Buffer on Data Graph

3.7 Updating the EVM Firmware

To upload new firmware to the EVM, navigate to the "Firmware" page from the GUI menu and follow these steps.

1. Click the button to select a TI-TXT firmware file
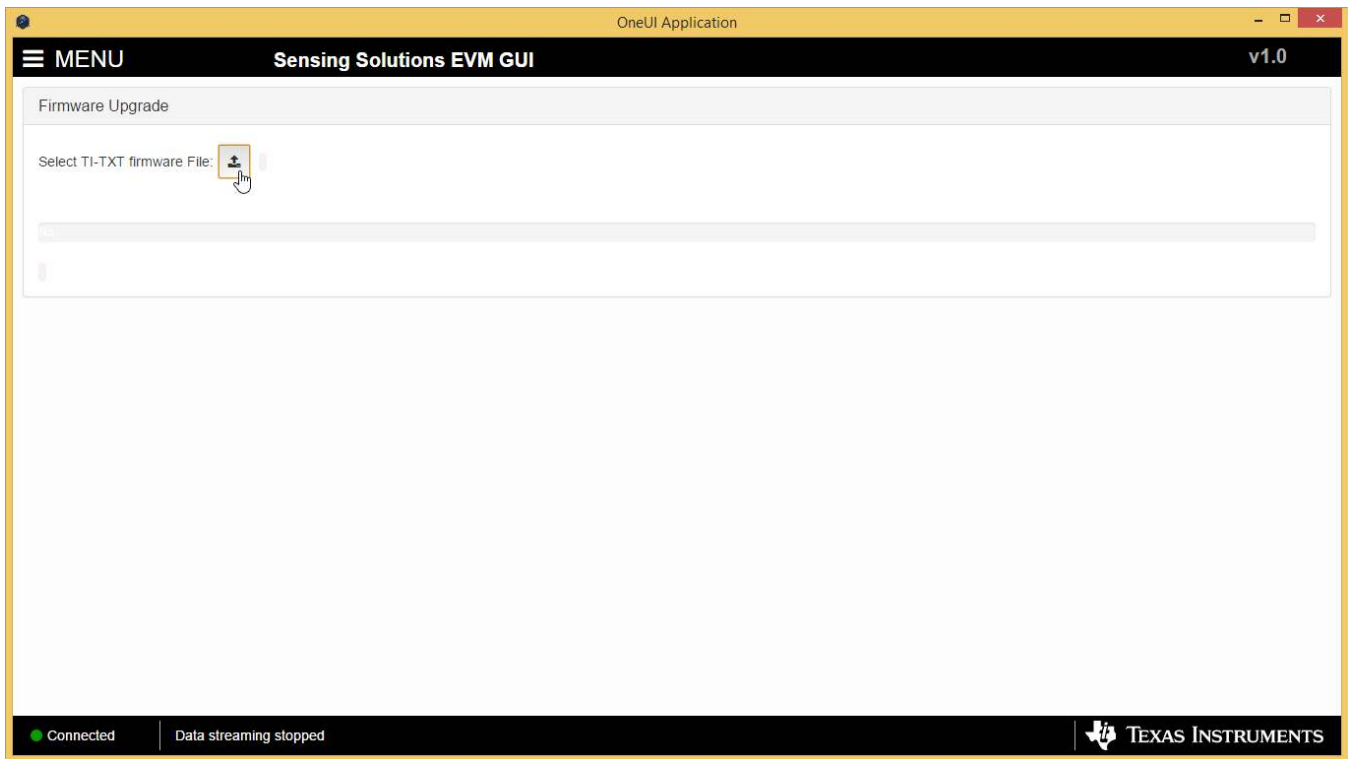
Figure 47. Select TI-TXT File Button on Firmware Upload Page

2. Select the firmware file and click "Open"
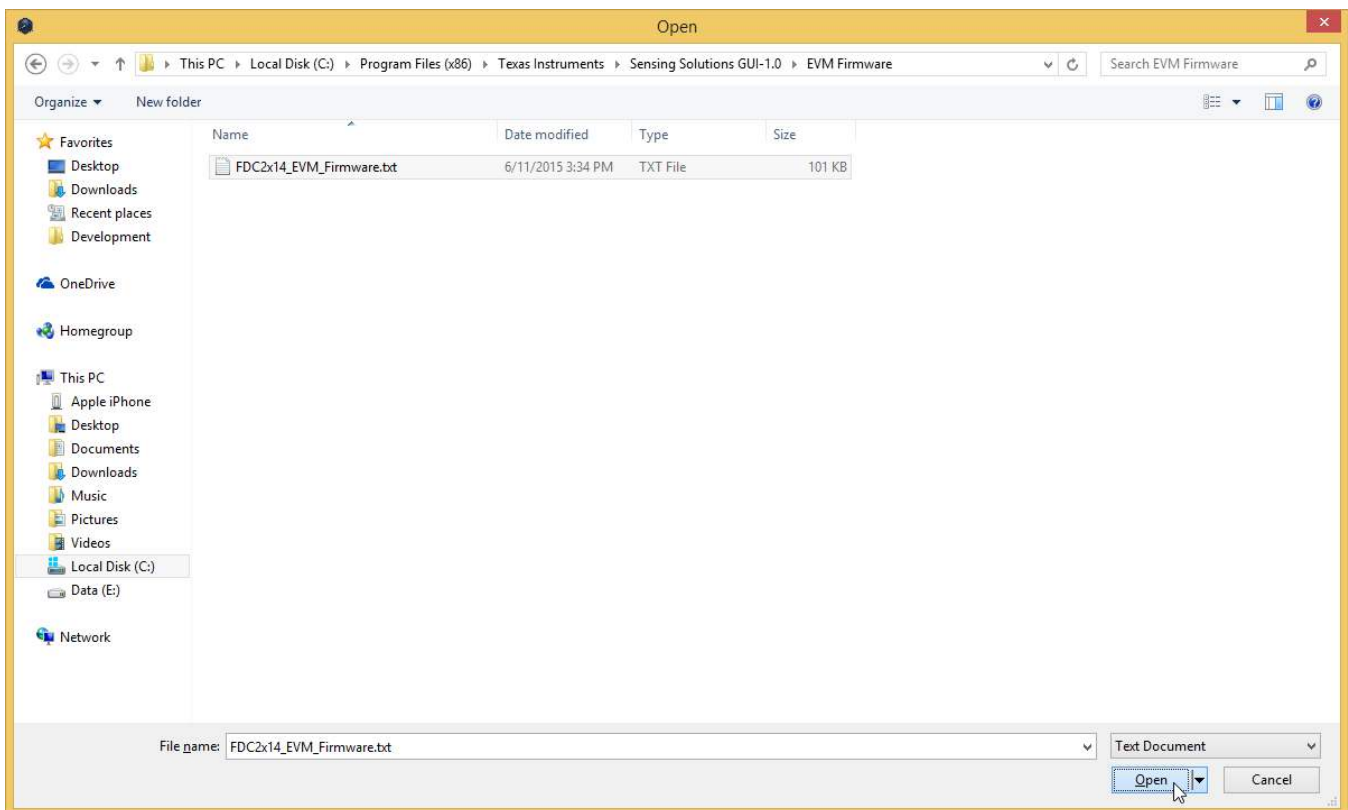
Figure 48. Selecting TI-TXT Firmware File for Upload to EVM

3. Click the "Upload Firmware" button
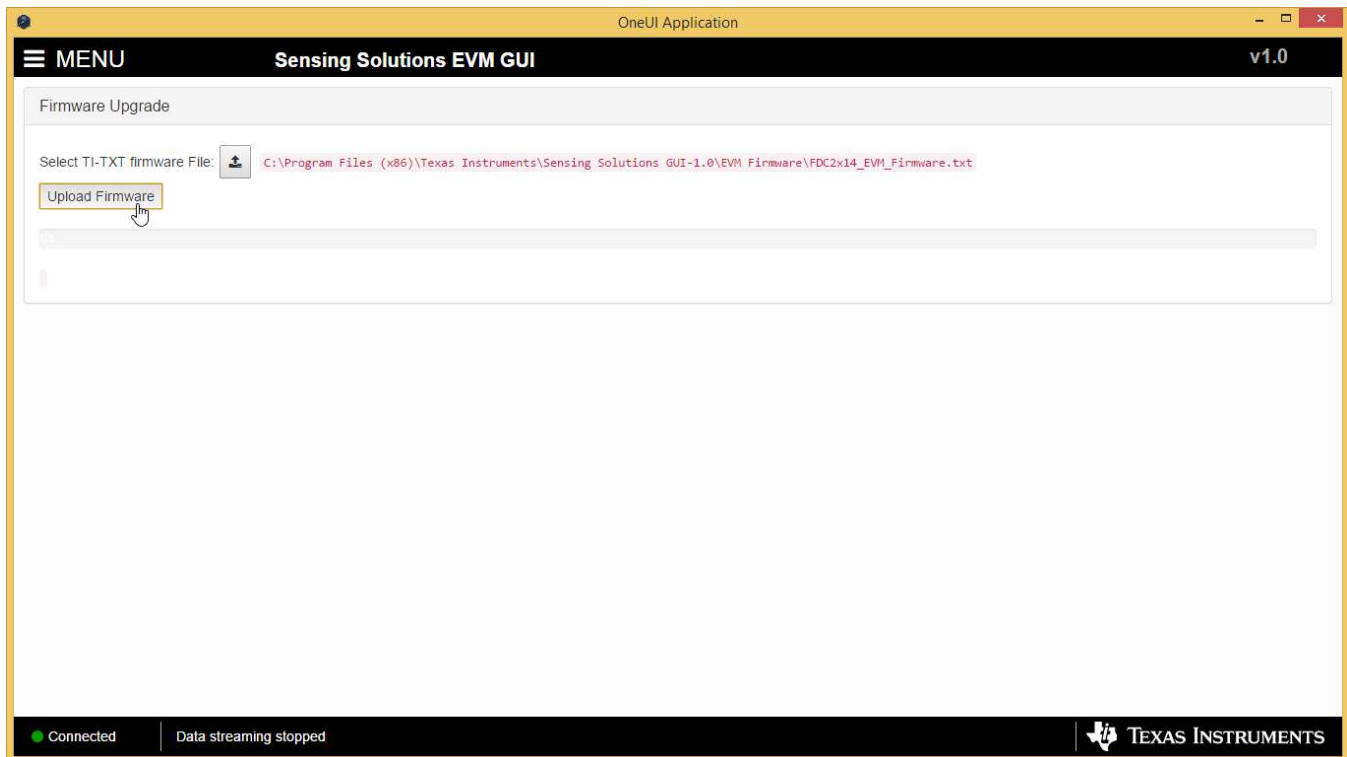
Figure 49. Upload Firmware Button on Firmware Upload Page

4. Wait for the firmware to upload. Do NOT disconnect the EVM from the PC at this time! Also note that the GUI will disconnect from the EVM. The upload process should not take more than one minute.
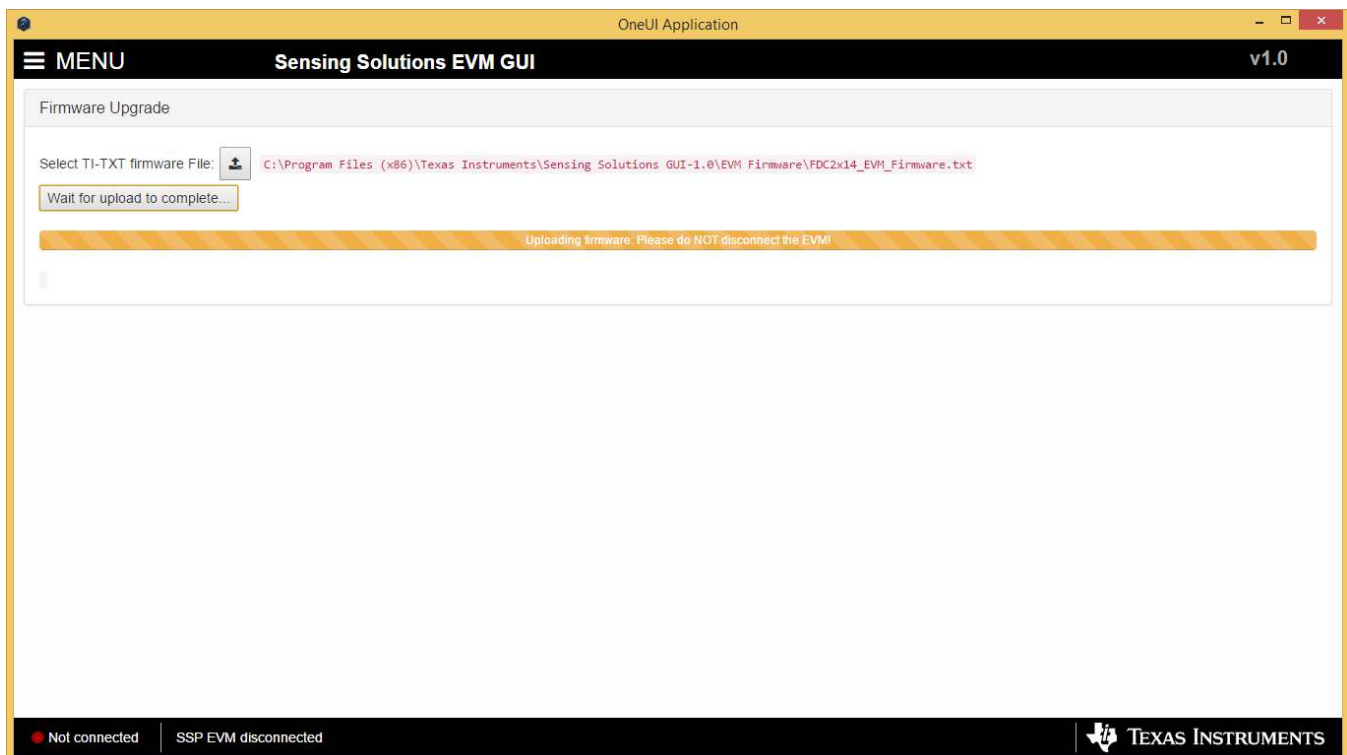
Figure 50. Firmware Upload in Progress
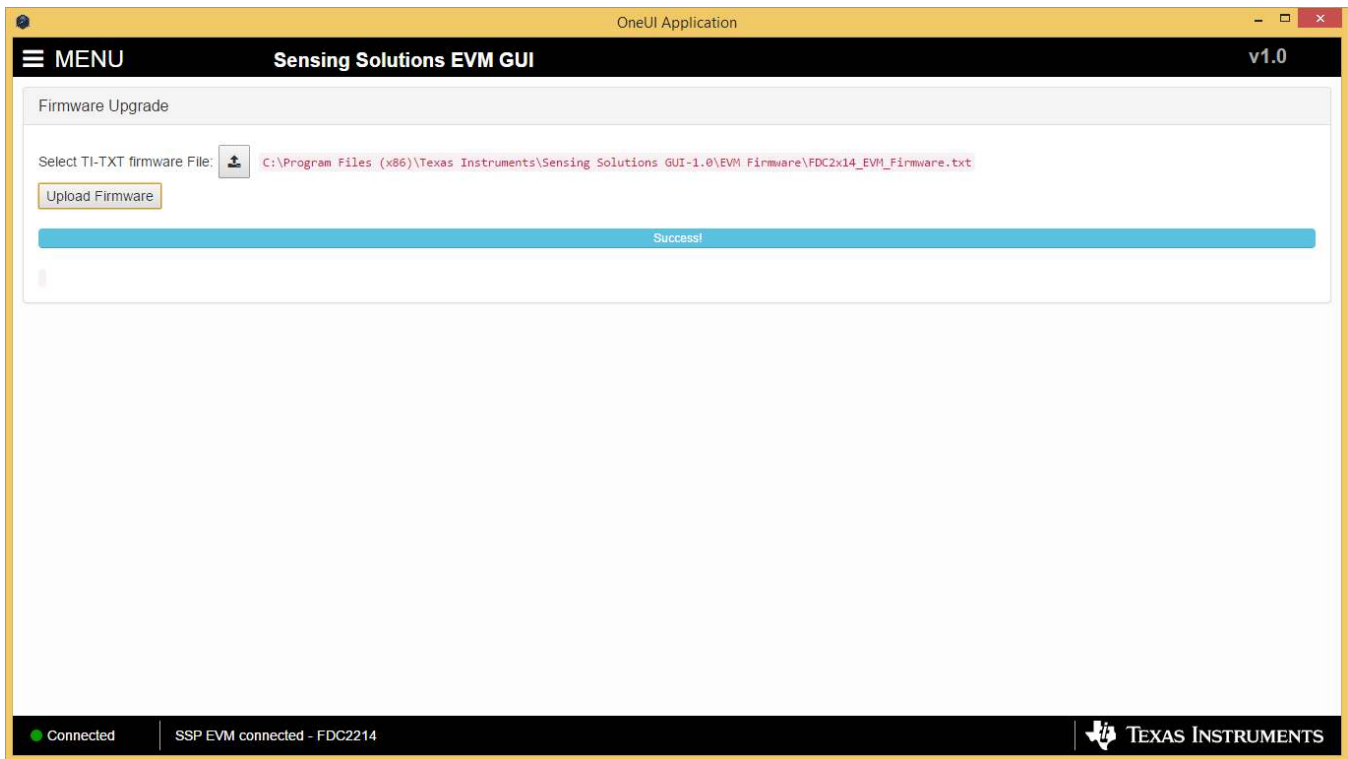
Figure 51. Firmware Upload Success

4   Board Layout

Figure 52 and Figure 53 show the board layout for the HDC1050EVM. Note that the DAP pad on the HDC1050 is grounded on the EVM, but in most system designs, should be left floating (not contacted with GND) to reduce the influence of the PCB thermals on the temperature measurement.
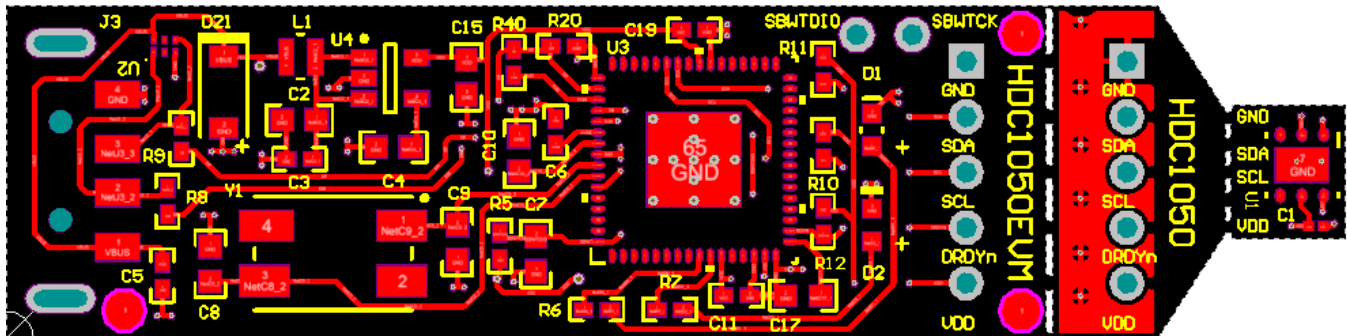
Figure 52. Top Layer Routing
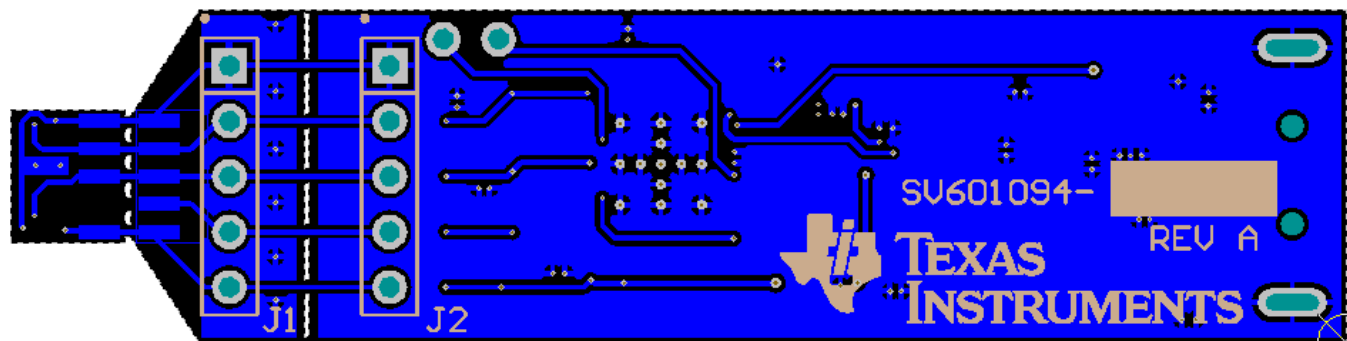
Figure 53. Bottom Layer Routing

5   Schematic
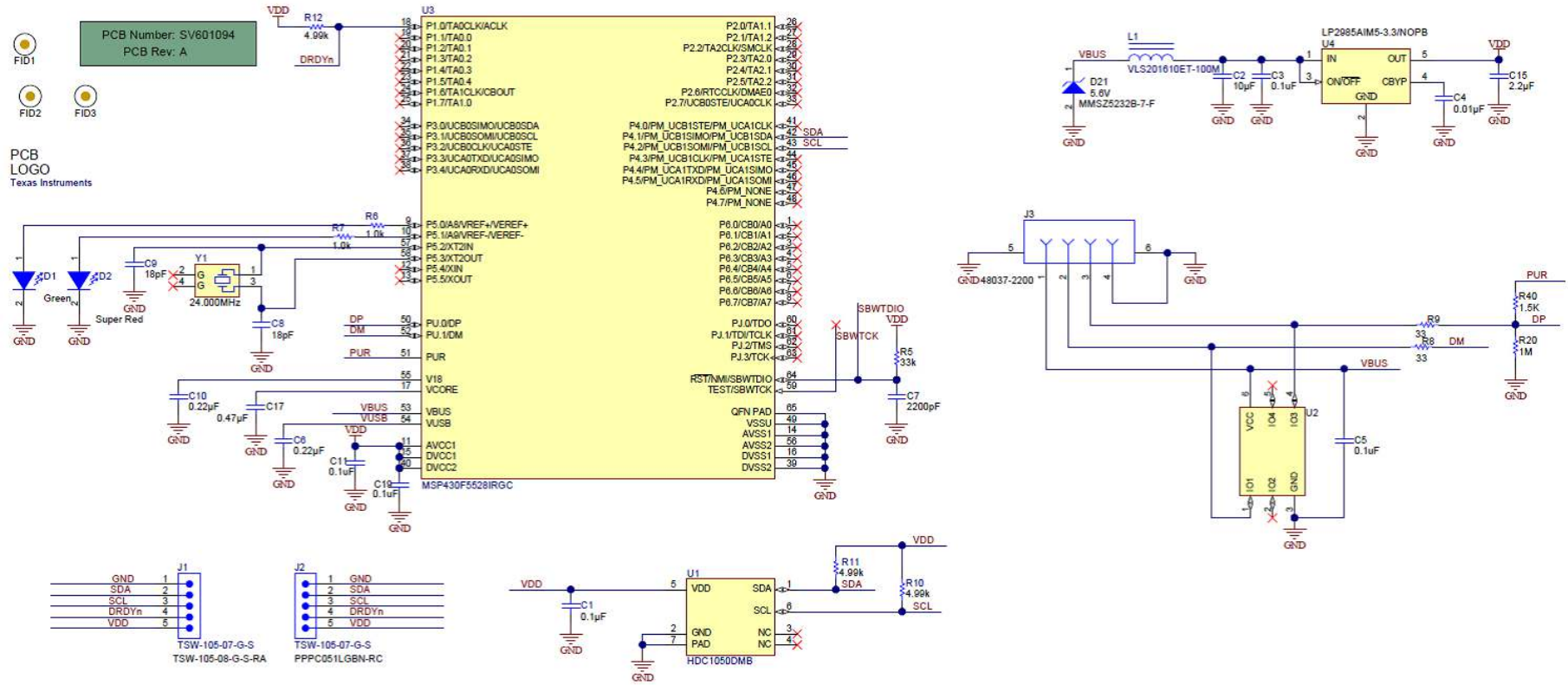
Figure 54. HDC1050EVM Schematic

6   HDC1050EVM Bill of Materials

Part Number	Description	Designator	Footprint	Quantity
CL03A104KP3NNNC	CAP, CERM, 0.1uF, 10V, +/-10%, X5R, 0201	C1	0201	1
C1608X5R1A106M	CAP, CERM, 10uF, 10V, +/-20%, X5R, 0603	C2	0603	1
GRM155R71C104JA88D	CAP CER 0.1UF 16V 5% X7R 0402	C3, C5, C11, C19	0402	4
C1608C0G1E103J	CAP, CERM, 0.01uF, 25V, +/-5%, C0G/NP0, 0603	C4	0603	1
GRM155R71C224KA12D	CAP, CERM, 0.22uF, 16V, +/-10%, X7R, 0402	C6	0402	1
C0603X222K5RACTU	CAP, CERM, 2200pF, 50V, +/-10%, X7R, 0603	C7	0603	1
GRM1885C2A180JA01D	CAP, CERM, 18pF, 100V, +/-5%, C0G/NP0, 0603	C8, C9	0603	2
06033D224KAT2A	CAP, CERM, 0.22uF, 25V, +/-10%, X5R, 0603	C10	0603	1
C0603C225K8PACTU	CAP, CERM, 2.2uF, 10V, +/-10%, X5R, 0603	C15	0603	1
C0603C474K8RACTU	CAP, CERM, 0.47uF, 10V, +/-10%, X7R, 0603	C17	0603	1
LG L29K-G2J1-24-Z	LED, Green, SMD	D1	LG L29K_GREEN	1
SML-LX0603SRW-TR	LED, Super Red, SMD	D2	SML-LX0603SRW_SuperRed	1
MMSZ5232B-7-F	Diode, Zener, 5.6V, 500mW, SOD-123	D21	SOD-123	1
Fiducial	Fiducial mark. There is nothing to buy or mount.	FID1, FID2, FID3	Fiducial10-20	3
TSW-105-07-G-S	Header, TH, 100mil, 5x1, Gold plated, 230 mil above insulator	J1, J2	TSW-105-07-G-S	2
48037-2200	Connector, USB Type A, 4POS R/A, SMD	J3	CONN_USB_0480372200	1
VLS201610ET-100M	Inductor, Shielded, Ferrite, 10uH, 0.4A, 1.38 ohm, SMD	L1	VLS201610	1
CRCW040233K0JNED	RES, 33k ohm, 5%, 0.063W, 0402	R5	0402	1
CRCW04021K00JNED	RES, 1.0k ohm, 5%, 0.063W, 0402	R6, R7	0402	2
CRCW040233R0JNED	RES, 33 ohm, 5%, 0.063W, 0402	R8, R9	0402	2
CRCW04024K99FKED	RES, 4.99k ohm, 1%, 0.063W, 0402	R10, R11, R12	0402	3
RC0402JR-071ML	RES,1M ohm, 5%, 0.063W, 0402	R20	0402	1
CRCW04021K50JNED	RES 1.5K OHM 1/16W 5% 0402 SMD	R40	0402	1
HDC1050DMB	Humidity Sensor, DMB0006A	U1	DMB0006A_NV	1
TPD4E004DRY	4-CHANNEL ESD-PROTECTION ARRAY FOR HIGH-SPEED DATA INTERFACES, DRY006A	U2	DRY0006A	1
MSP430F5528IRGC	Mixed Signal MicroController, RGC0064B	U3	RGC0064B	1
LP2985AIM5-3.3/NOPB	Micropower 150 mA Low-Noise Ultra Low-Dropout Regulator, 5-pin SOT-23, Pb-Free	U4	MF05A_N	1
ABMM-24.000MHZ-B2-T	Crystal, 24.000MHz, 18pF, SMD	Y1	Abracon_ABMM	1

Revision History

Changes from Original (June 2015) to A Revision   **Page**

• Added content on new GUI operation.   10

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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        3.1.1 *Notice applicable to EVMs not FCC-Approved:*

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        3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

        CAUTION

        This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

        Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

        FCC Interference Statement for Class A EVM devices

        NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

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Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

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http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or

3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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