HDC1010EVM User’s Guide

User's Guide

Literature Number: SNAU199
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HDC1010EVM User's Guide

1 Introduction

The Texas Instruments HDC1010EVM evaluation module (EVM) enables designers to evaluate the operation and performance of the HDC1010 Relative Humidity and Temperature sensor.

The EVM contains one HDC1010 (See Table 1).

Table 1. Device and Package Configurations

DEVICE	IC	PACKAGE
U1	HDC1010YPAR	DSBGA - 8 pin (YPA0008)

The EVM hosts an MSP430F5528 microcontroller (µC) as well as the HDC1010. The µC is used to control the HDC1010 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, setup and use the HDC1010EVM.

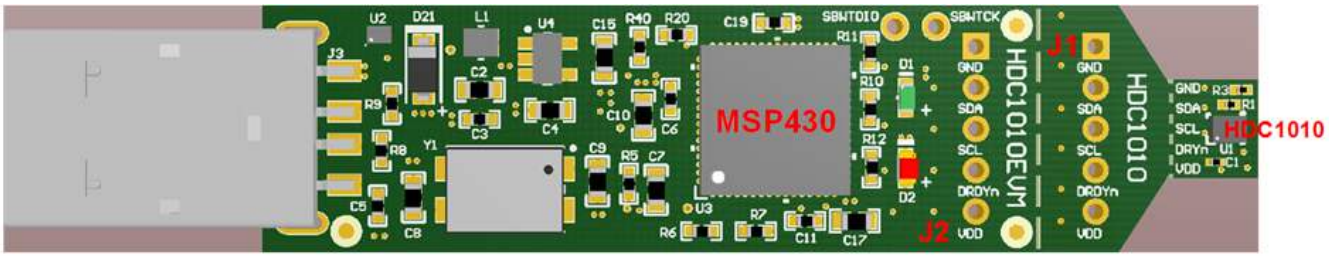


Figure 1. HDC1010EVM

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 5-wire cable

J1.1	GND
J1.2	SDA
J1.3	SCL
J1.4	DRDYn
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.

J2.1	GND
J2.2	SDA
J2.3	SCL
J2.4	DRDYn
J2.5	VDD

2.1.3 USB Type A Connector

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

2.2 Hardware Setup

The HDC1010EVM power is supplied via the USB connector. The LDO (U4) converts the 5V from the USB to 3.3V used by the HDC1010 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 HDC1010 is set at EVM level at 1000000xb on the EVM. The I2C address has been set mounting the 0 Ω resistors R3 and R1 (refer to Figure 2).

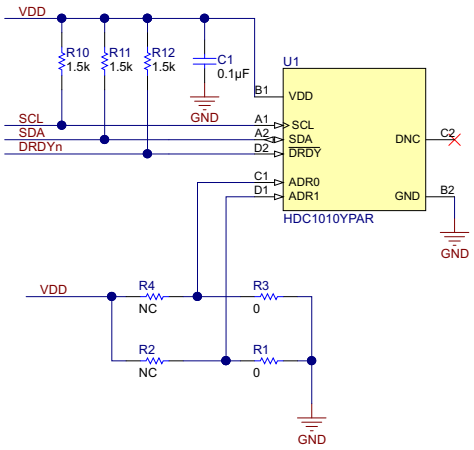


Figure 2. HDC1010EVM : Sensor module

In order to change the I2C address, remove the resistors R1 and R3 and populate the R2 and R4 with 0 Ω resistors (refer to Figure 3 and Figure 4)

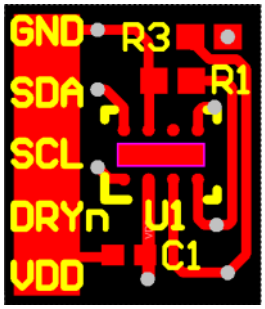


Figure 3. HDC1010EVM: Layout Resistors for I2C Address Setting - Top

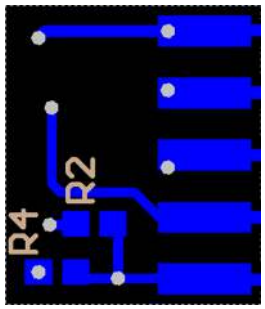


Figure 4. HDC1010EVM: Layout Resistors for I2C Address Setting - Bottom

Table 2. I2C Address

ADR1	ADR0	R1	R2	R3	R4	HDC1010 ADDRESS
0	**0**	**Short**	**Open**	**Short**	**Open**	**1000000**
0	1	Open	Short	Short	Open	1000001
1	0	Short	Open	Open	Short	1000010
1	1	Open	Short	Open	Short	1000011

In the table above, the EVM default configuration is in **bold**.

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

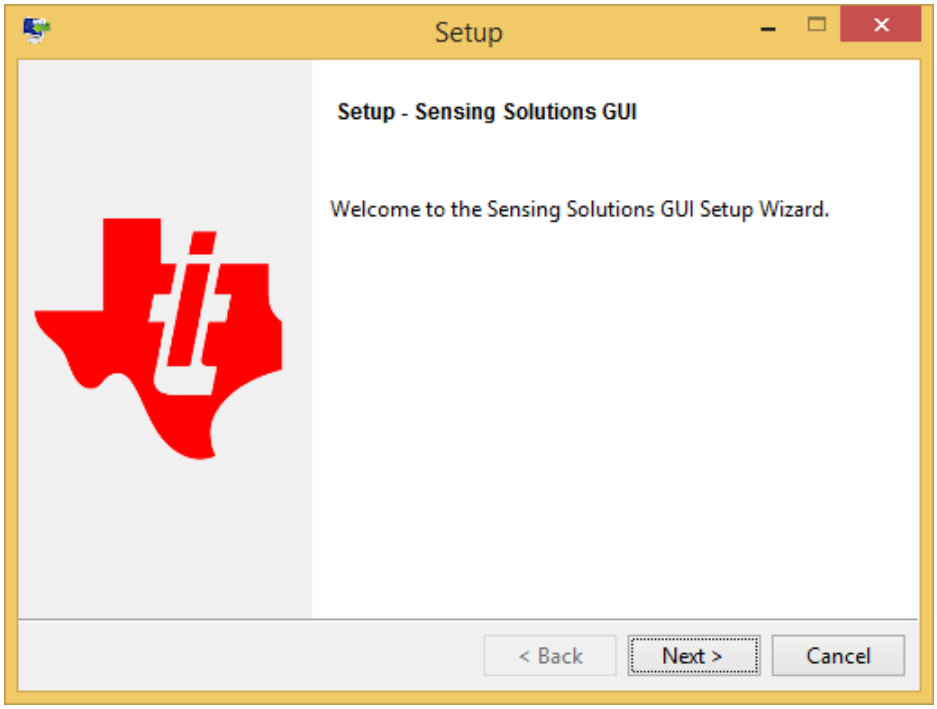


Figure 5. GUI Installer Welcome Page

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

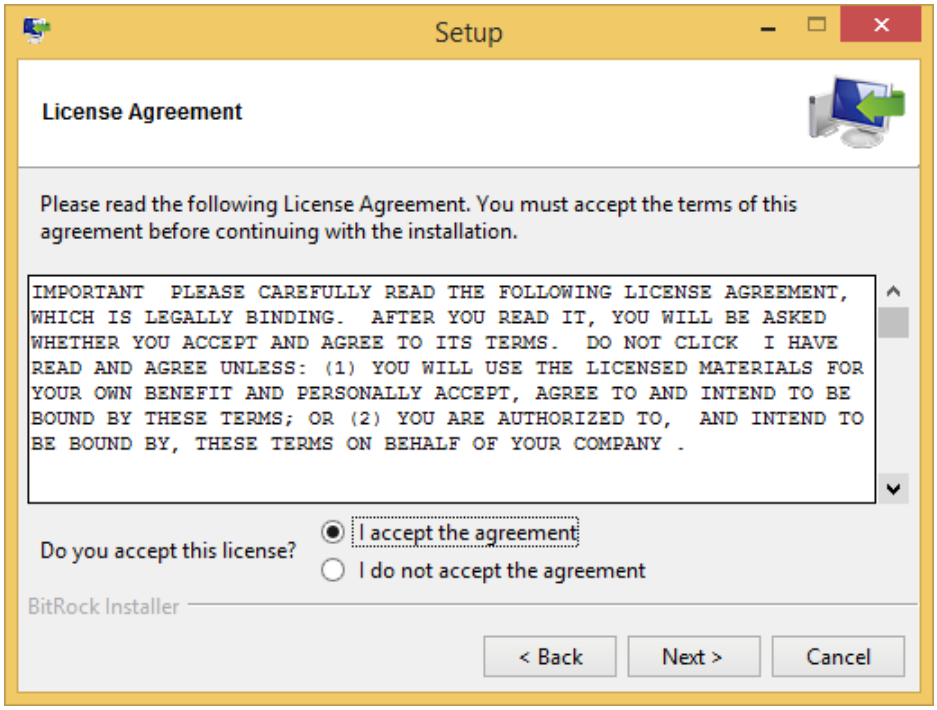


Figure 6. GUI Installer License Agreement

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.

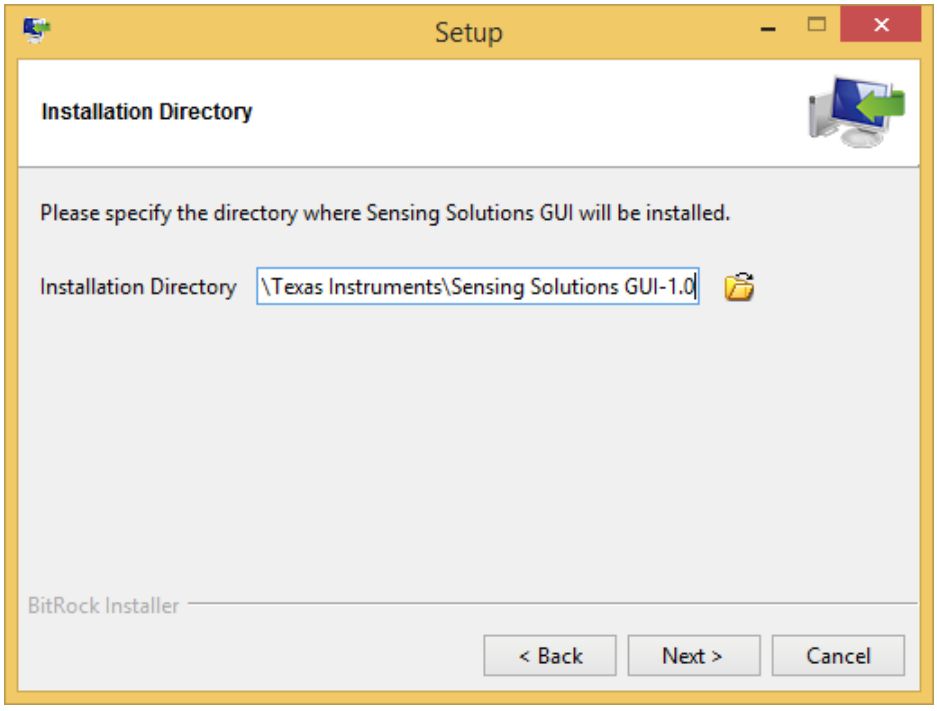


Figure 7. GUI Installer Installation Directory

7. Wait for all files to install

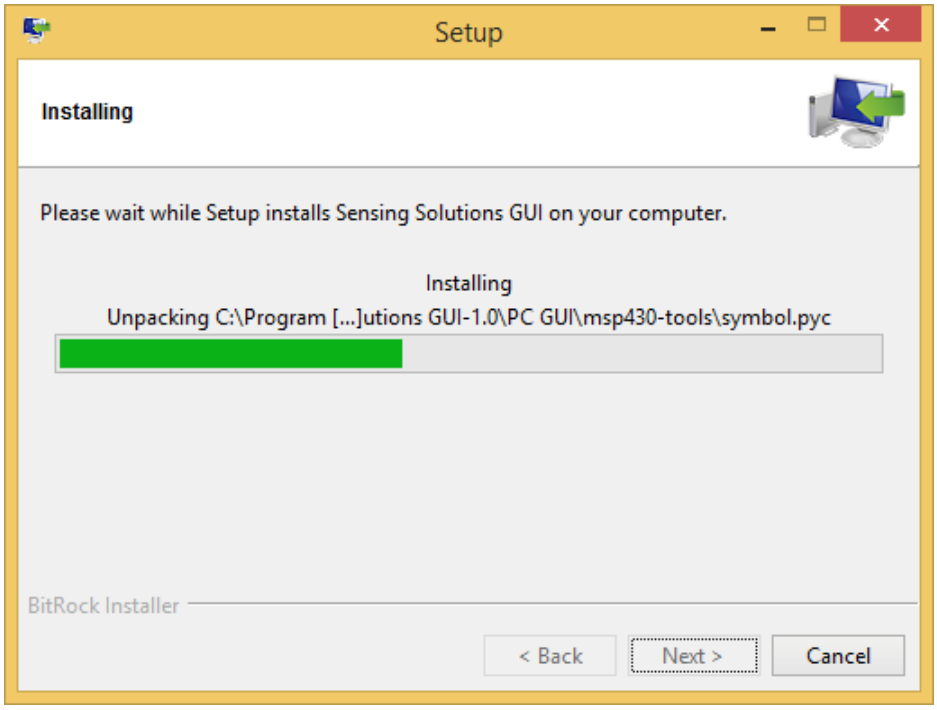


Figure 8. GUI Installer Copying Files

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.

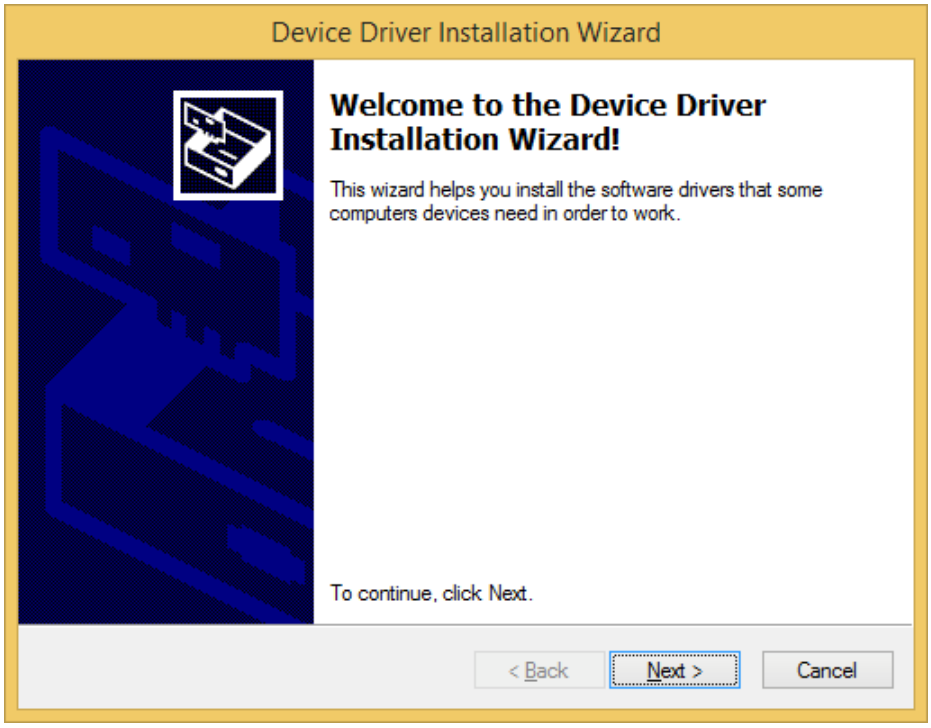


Figure 9. EVM Driver Installer Welcome Page

9. Wait for the driver to install

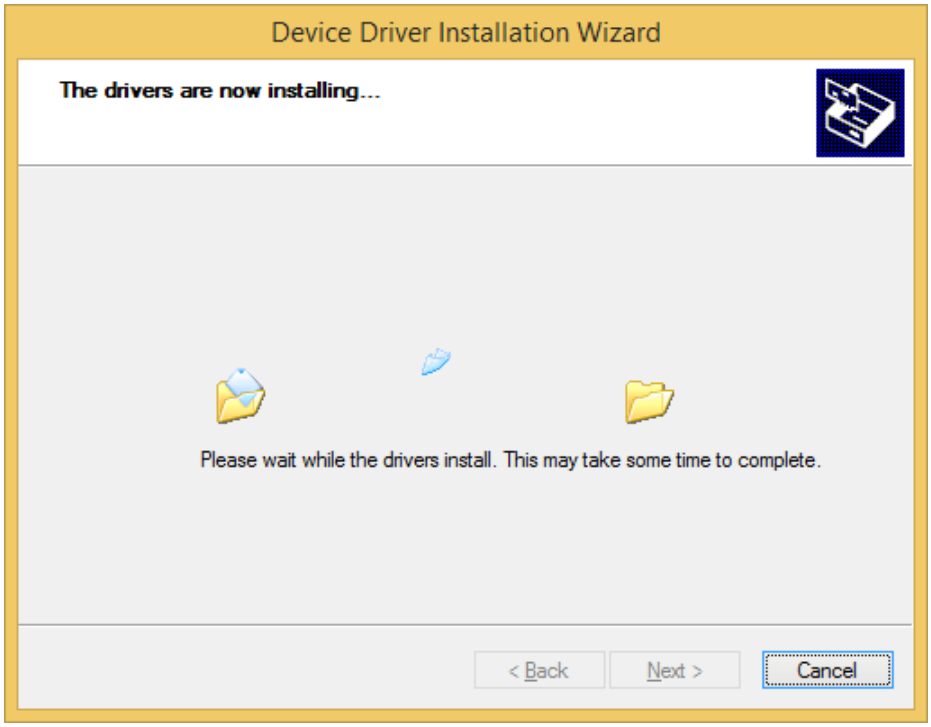


Figure 10. EVM Driver Installer In Progress

10. Click “Finish” after the driver has been installed

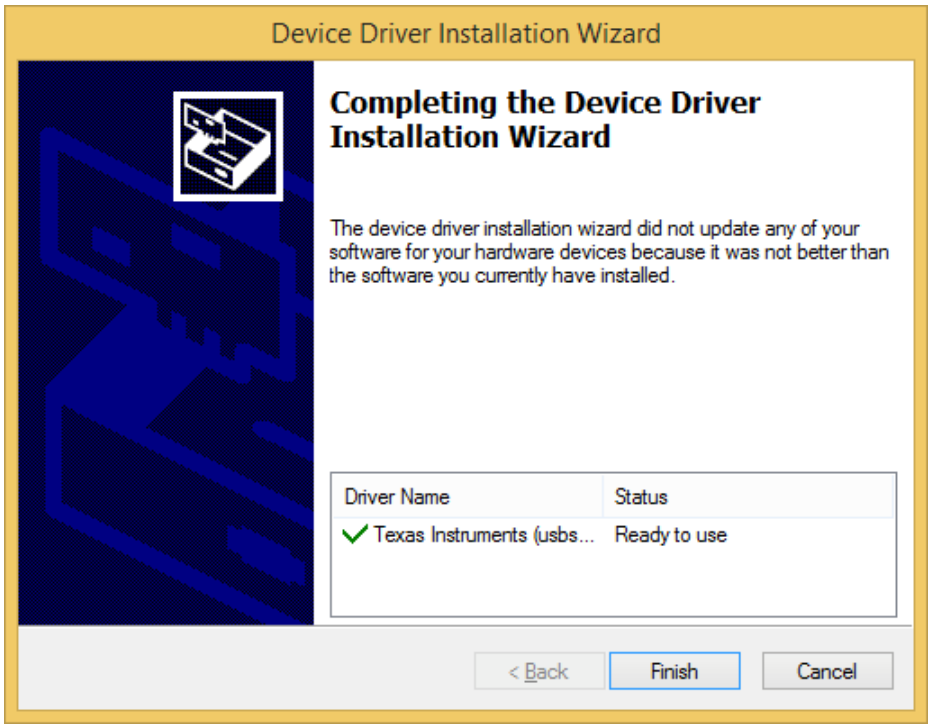


Figure 11. EVM Driver Installer Complete

11. Click “Finish” to complete the software installation

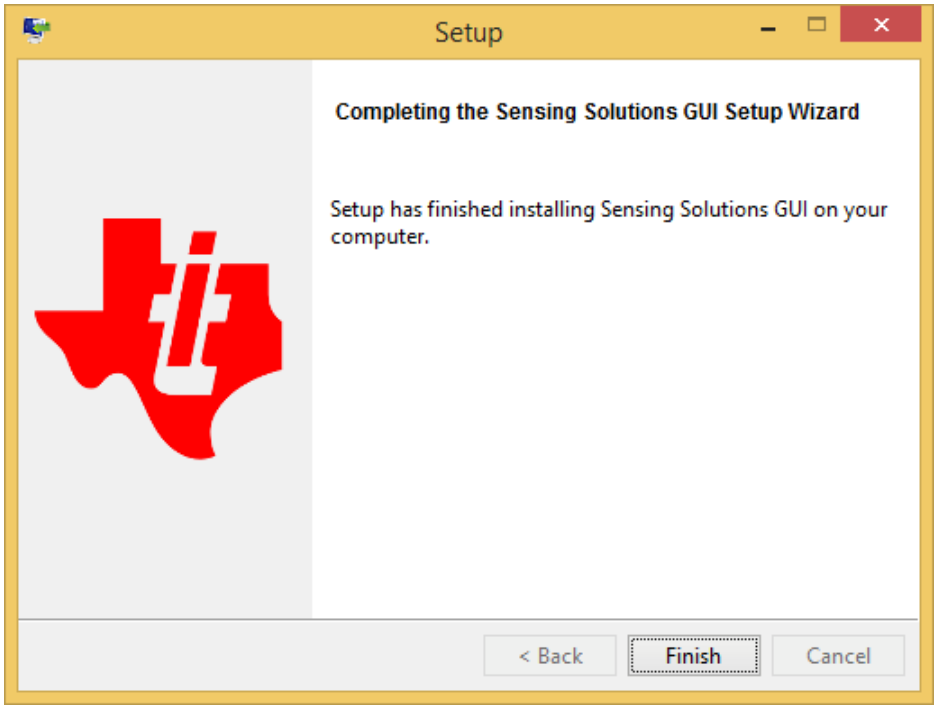


Figure 12. GUI Installer Complete

2.4 Operation

When the EVM is connected the host computer, the latter should automatically detect the device as an HDC1080EVM/HDC1000EVM.

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

2.5 Reducing the SensorThermal Mass

The HDC1010EVM can be broken into 2 sections to isolate the thermal mass of the µC from the HDC1010. Figure 13 shows the board perforations that allow the two sections to be broken apart.

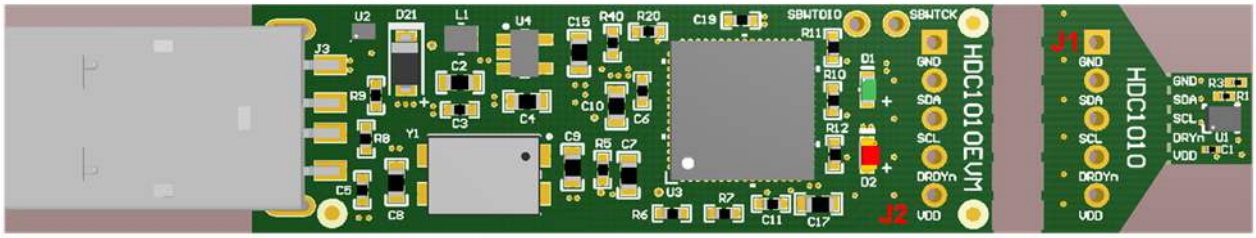


Figure 13. HDC1010EVM : PC Interface and Sensor Module

The communication between the two modules is ensured through the connector J1 and J2 and a 5-wire cable. In this configuration the thermal mass of the EVM is dramatically reduced, improving the temperature measurements performances of the HDC1010. 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 inFigure 14. The PCB segment that hosts the HDC1010 is 5.5mm x 5mm.

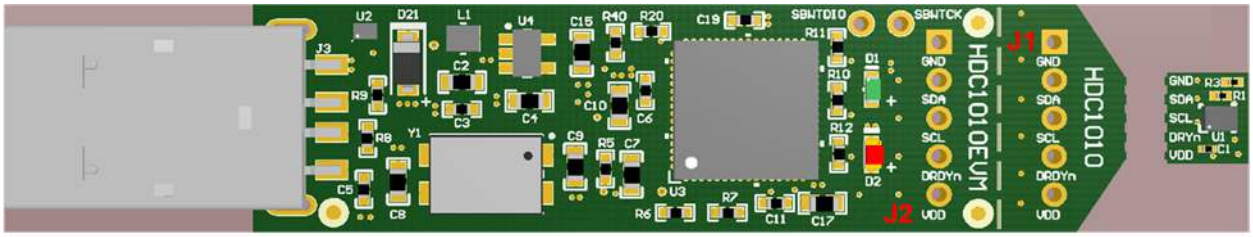


Figure 14. HDC1010EVM : PC Interface and Smaller Sensor Module

Also in the case where the EVM is broken in 2 sections it is still possible to use the GUI (ensuring the connections between the modules) or alternatively it is possible to connect the sensor module to a custom micro-controller. (Refer to Figure 15).

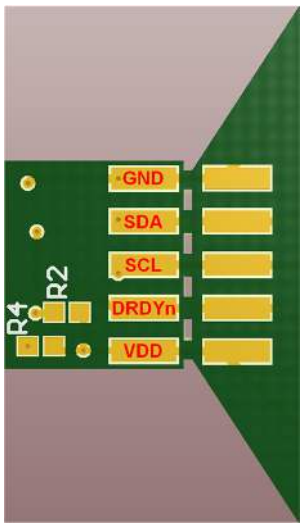


Figure 15. HDC1010EVM : Pads for I2C and Supply of the Smaller Sensor Module

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

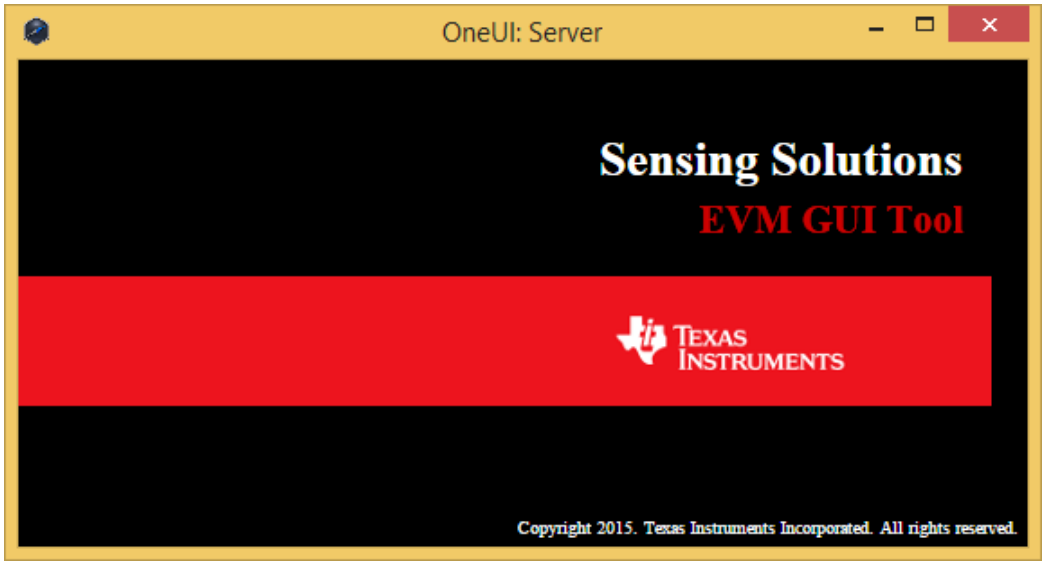


Figure 16. GUI Splash Screen

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!

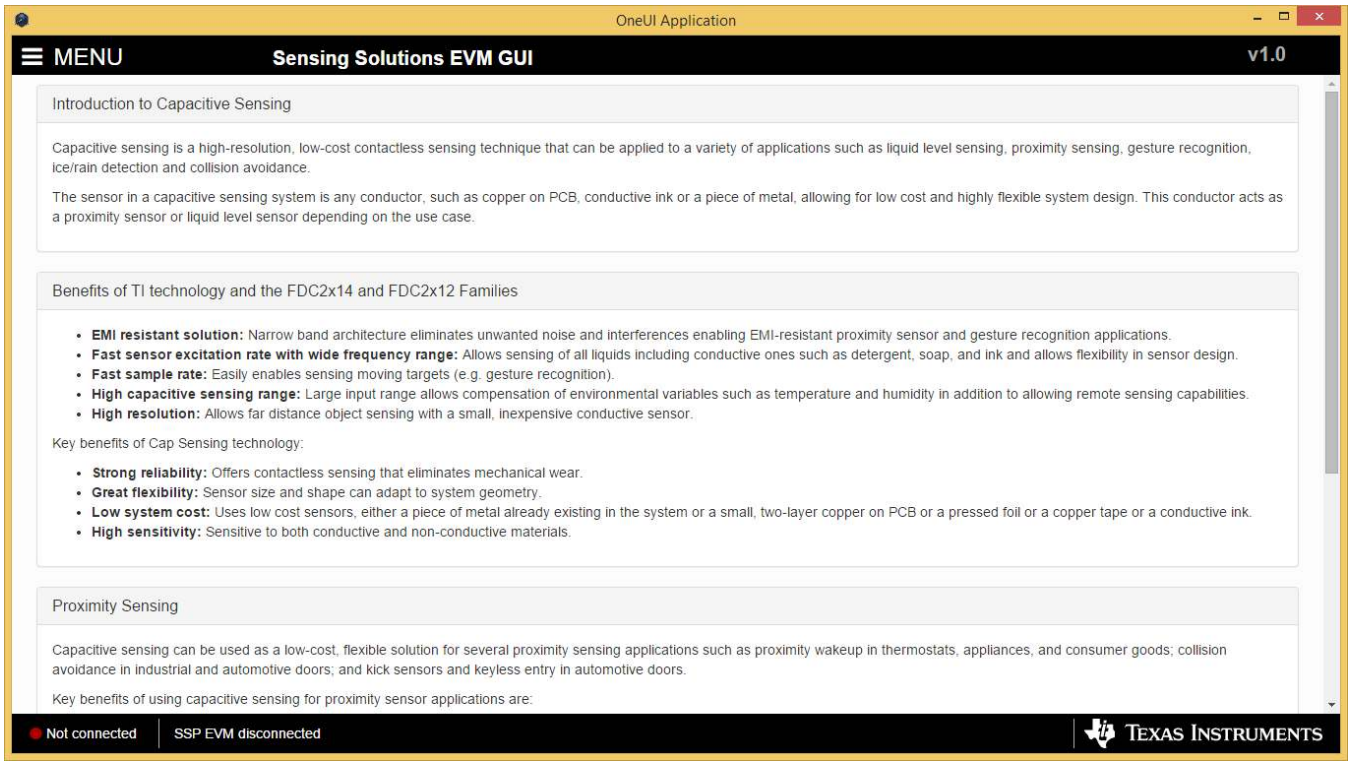


Figure 17. GUI Introduction Page

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.

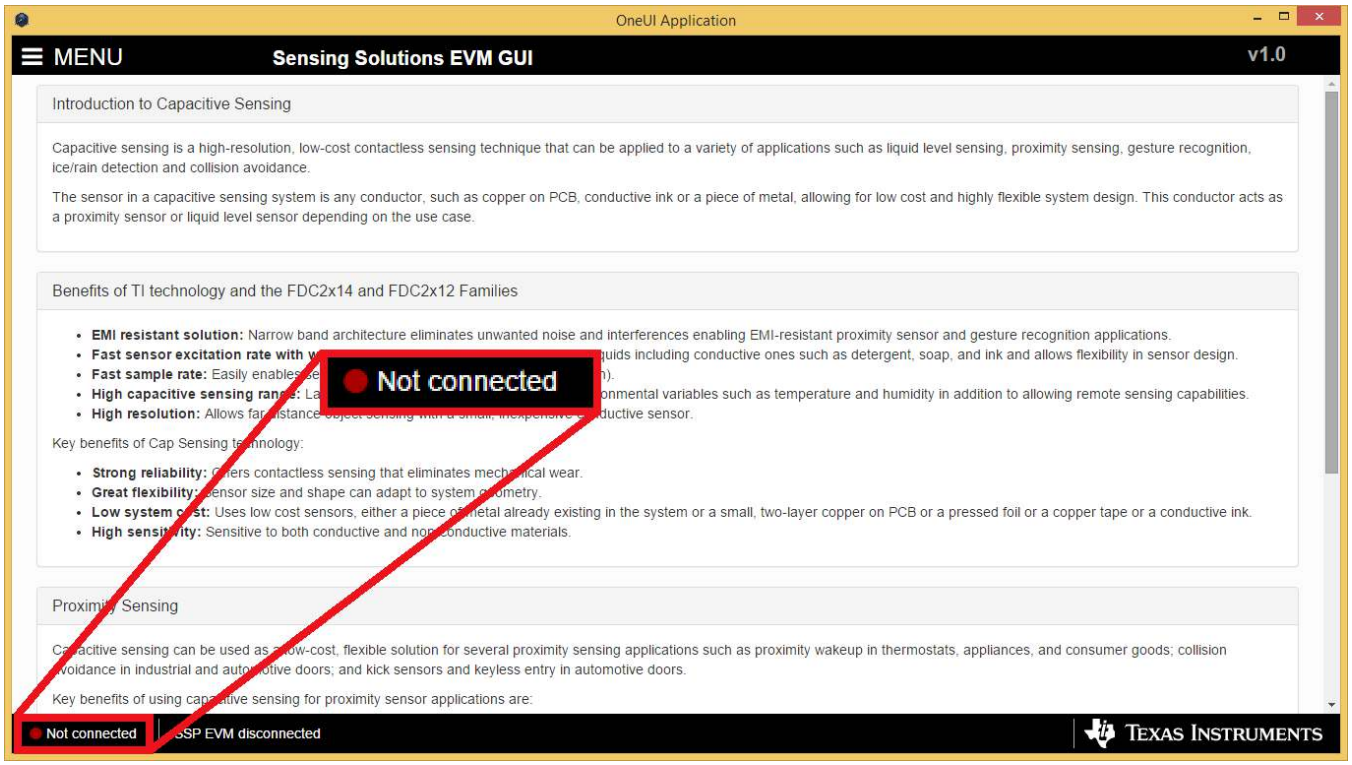


Figure 18. GUI Disconnected From EVM

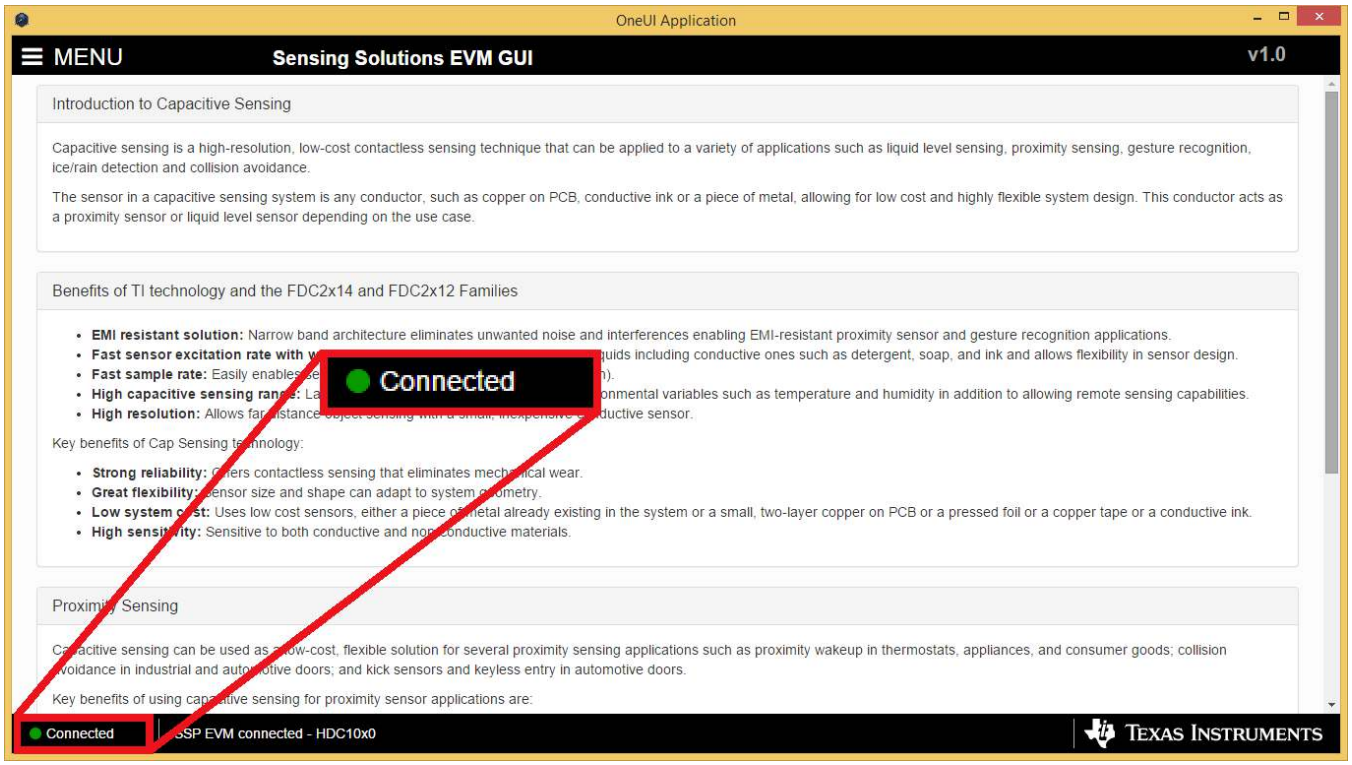


Figure 19. GUI Connected from EVM

3.3 Navigating the GUI

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

1. Click “Menu” in the upper left corner

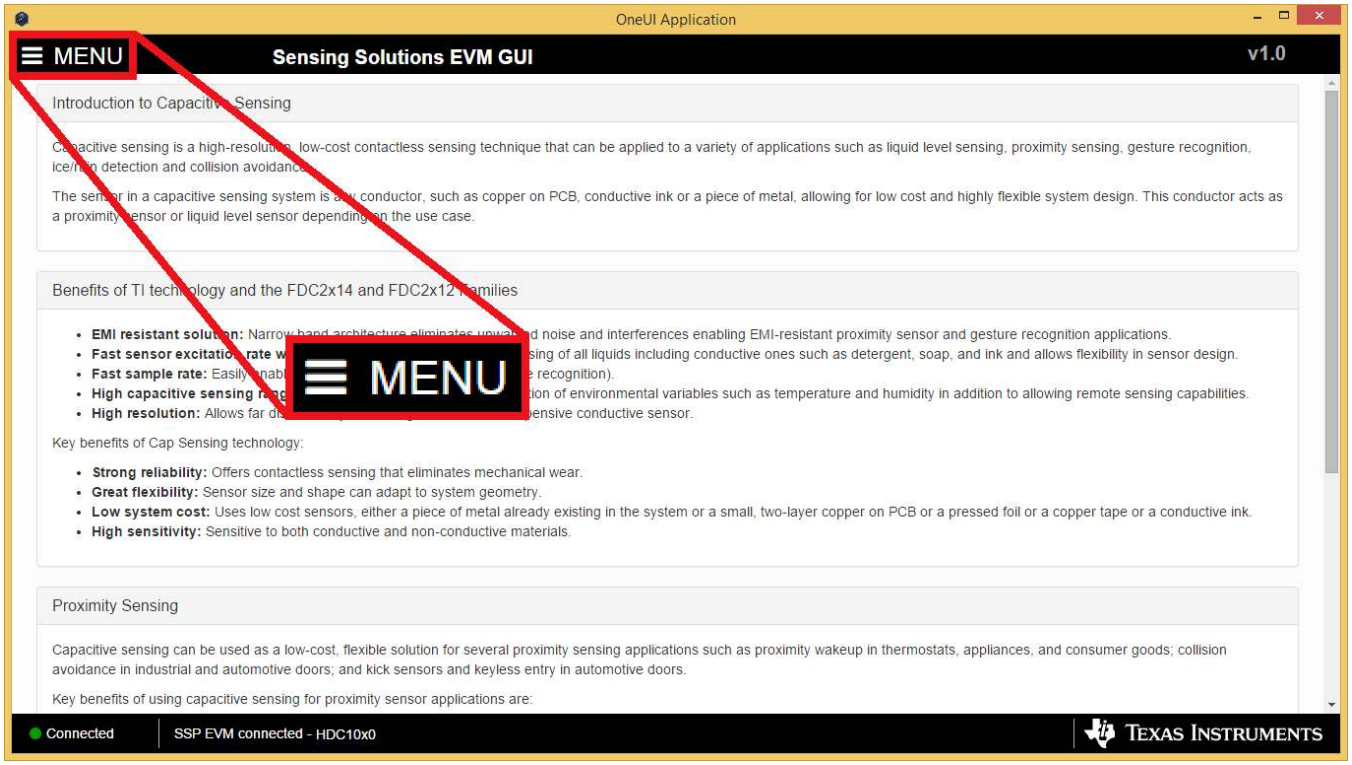


Figure 20. GUI Menu Button

2. Select the desired page from the menu shown on the left

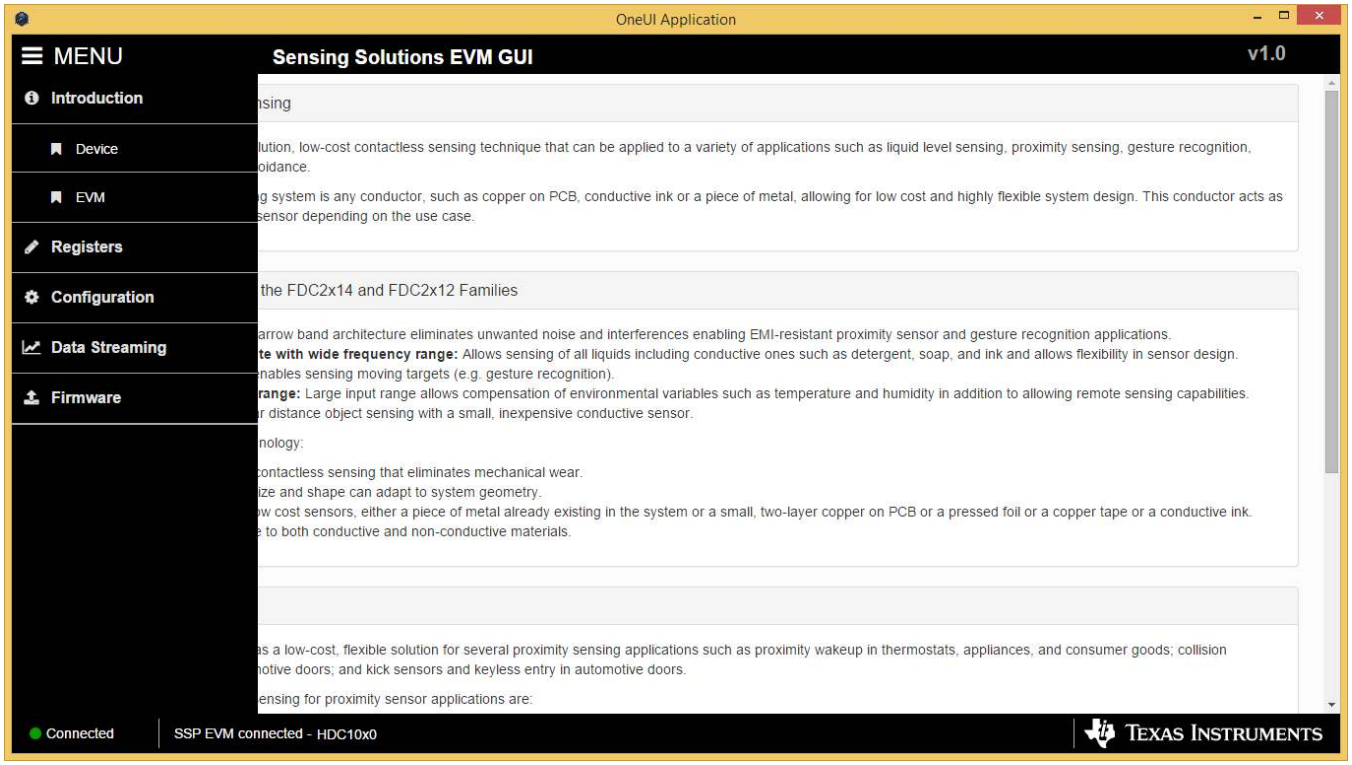


Figure 21. GUI Navigation Menu

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.

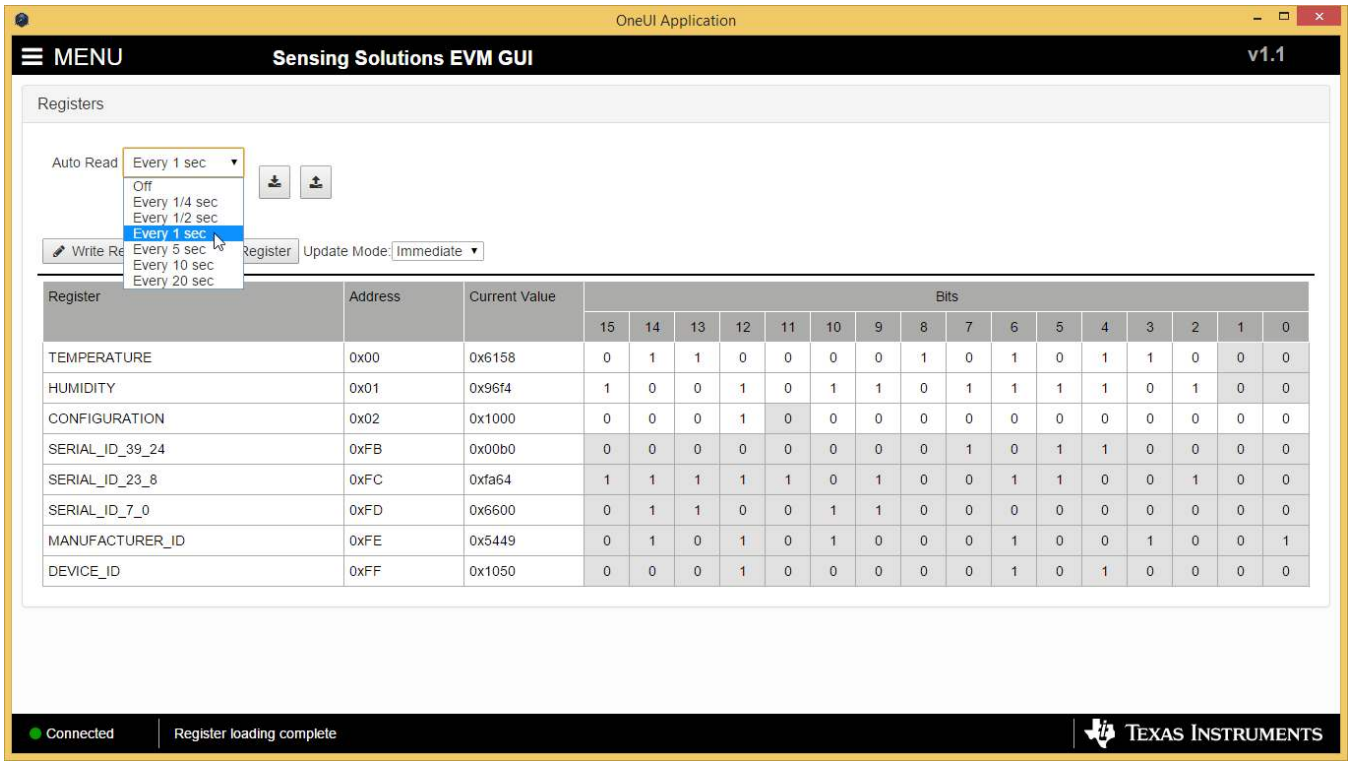


Figure 22. Selecting Auto-Read Interval on Register Page

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

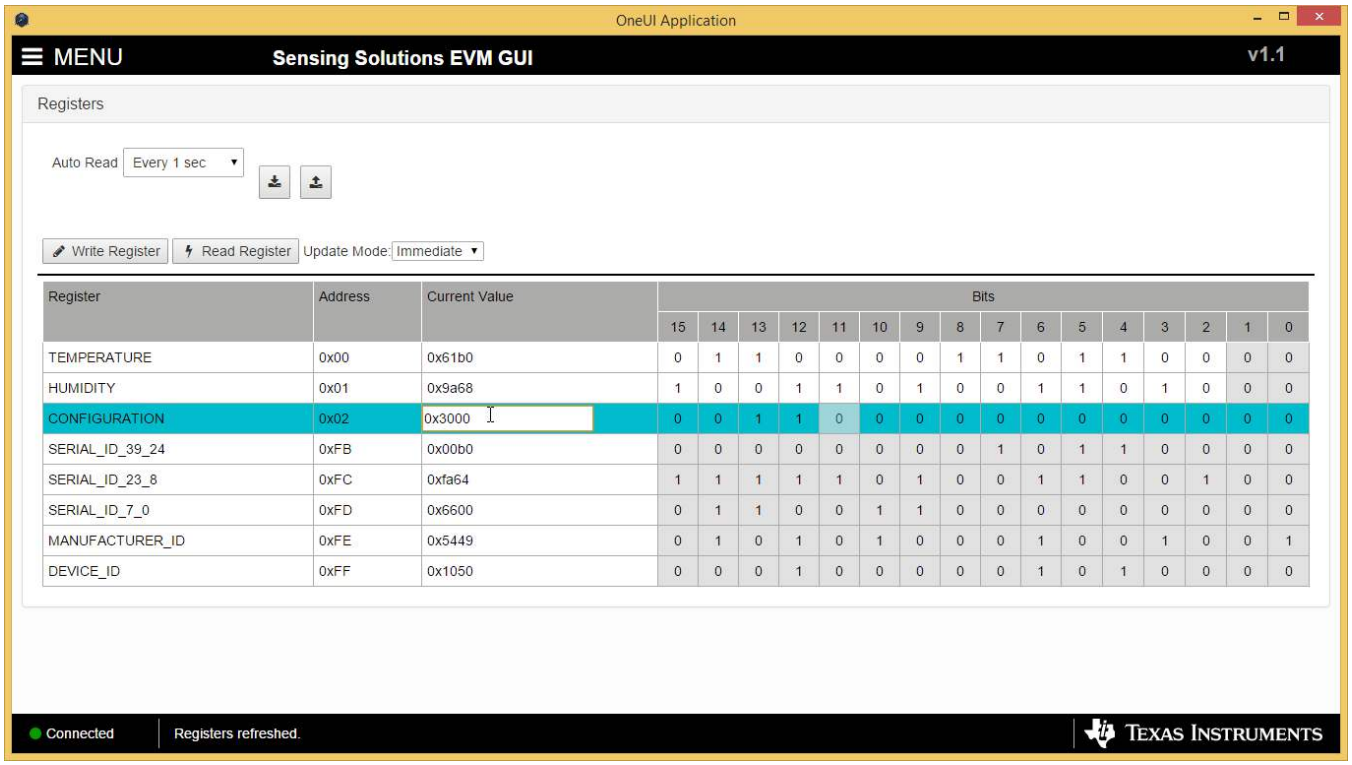


Figure 23. Selecting a Register's Current Value for Editting on Register Page

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

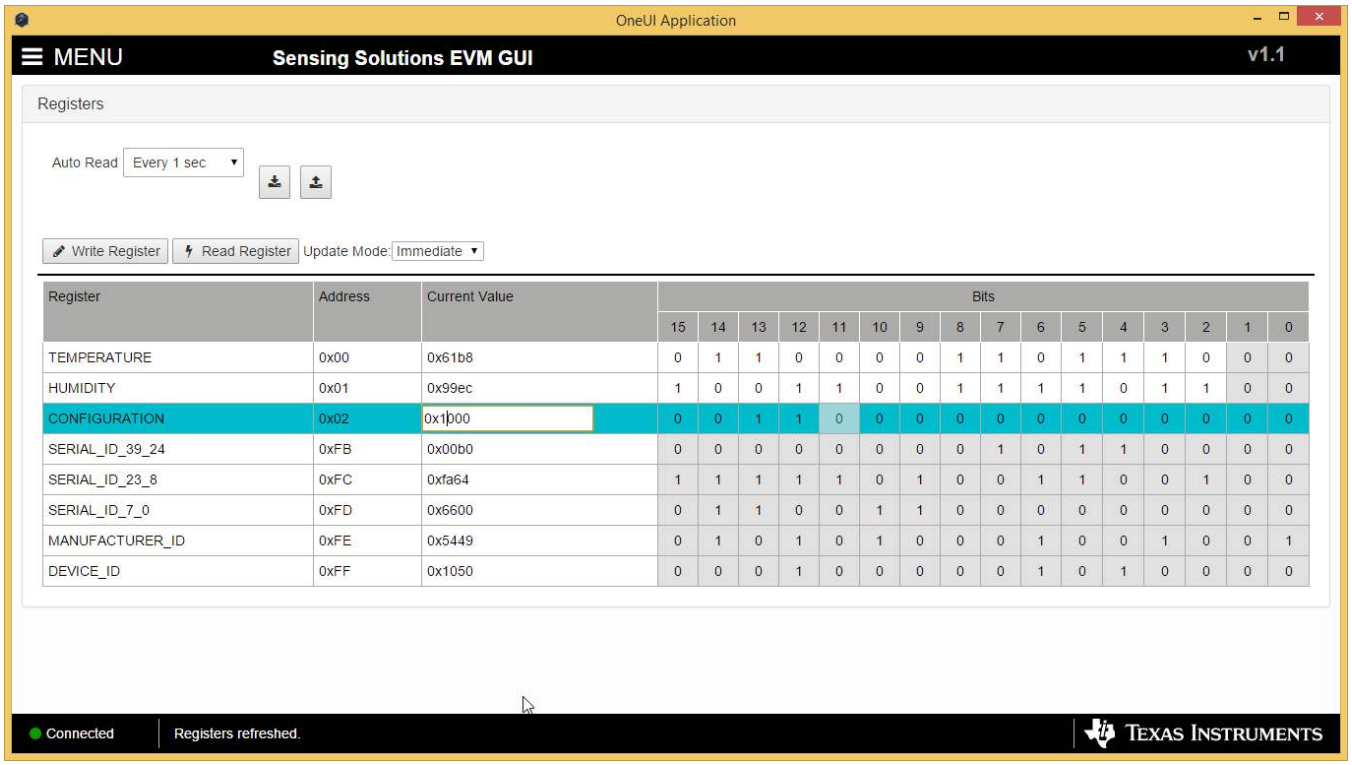


Figure 24. Entering New Value for Register on Register Page

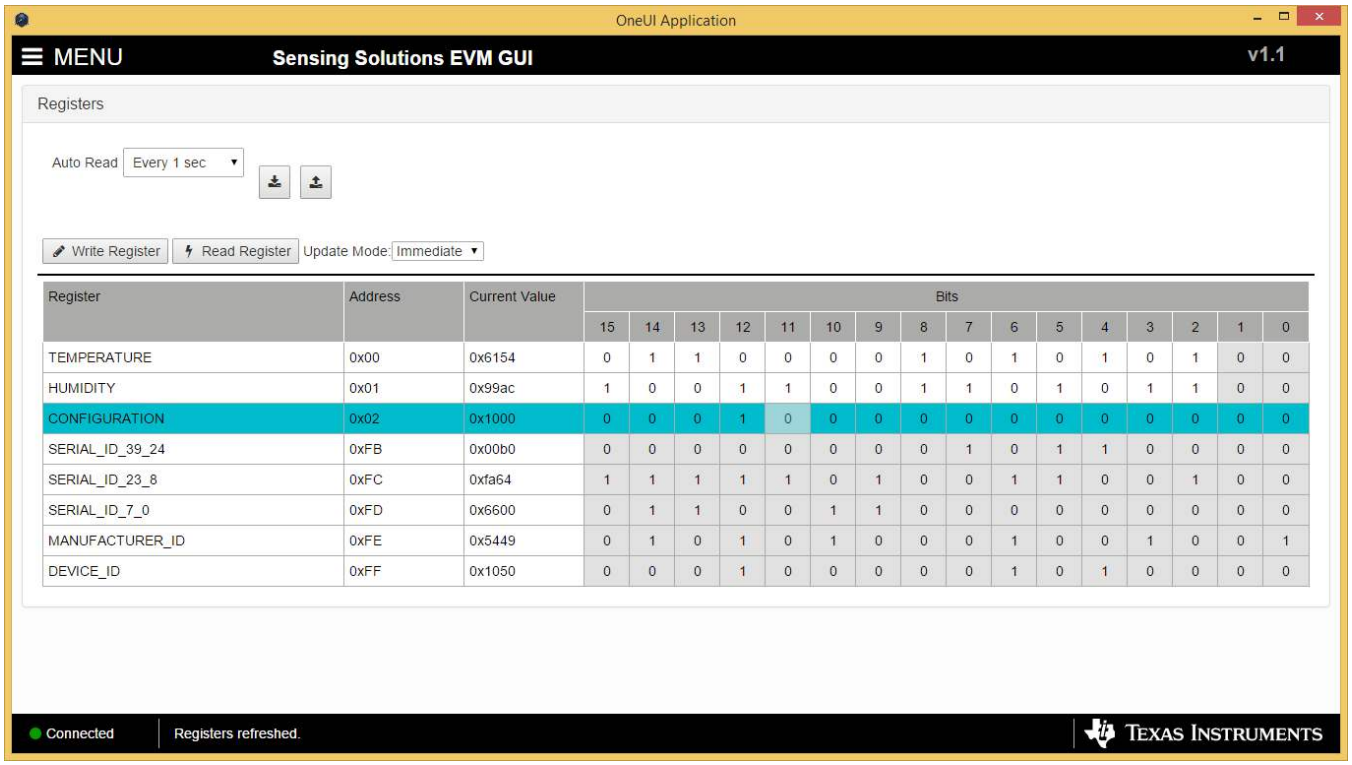


Figure 25. Register Value Updated After Changing Value on Register Page

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

1. Hover the mouse over the desired bit to change

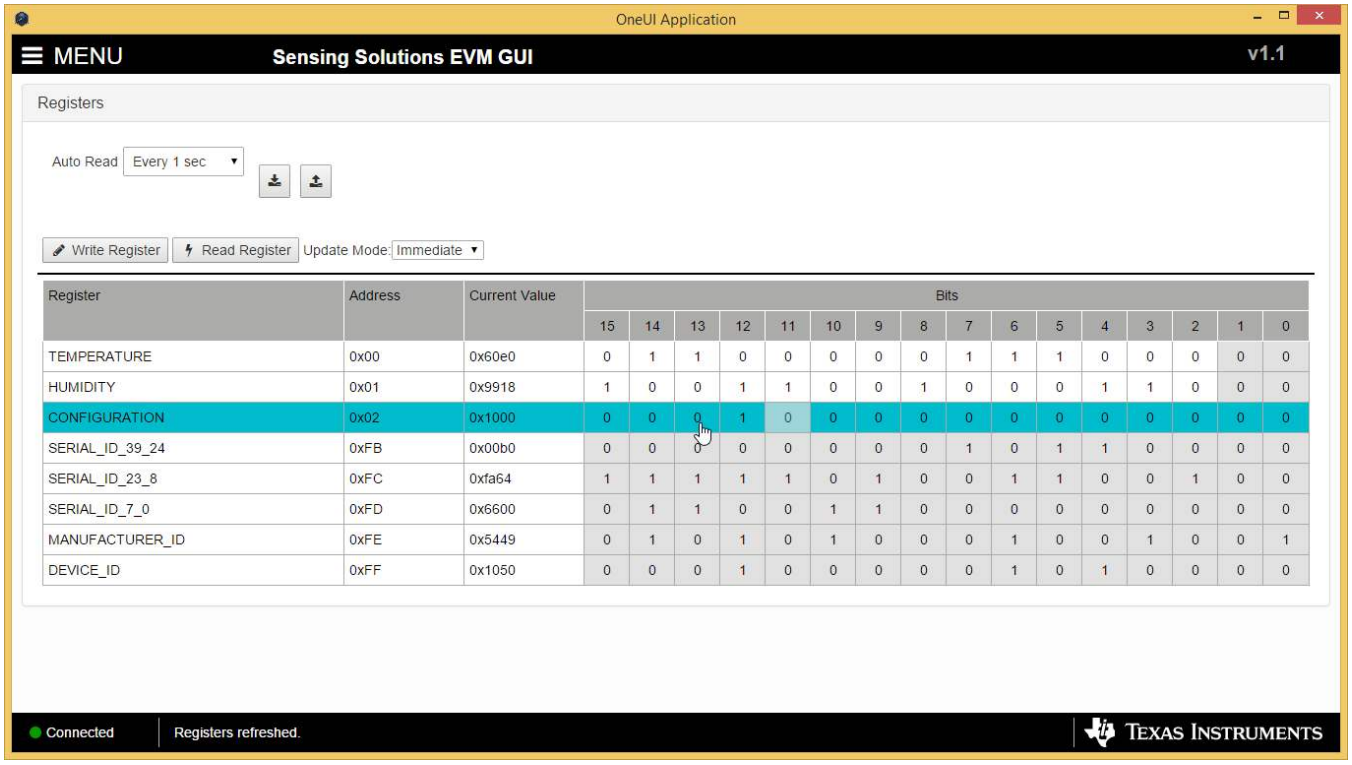


Figure 26. Hovering Mouse Over Register Bit Value on Register Page

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

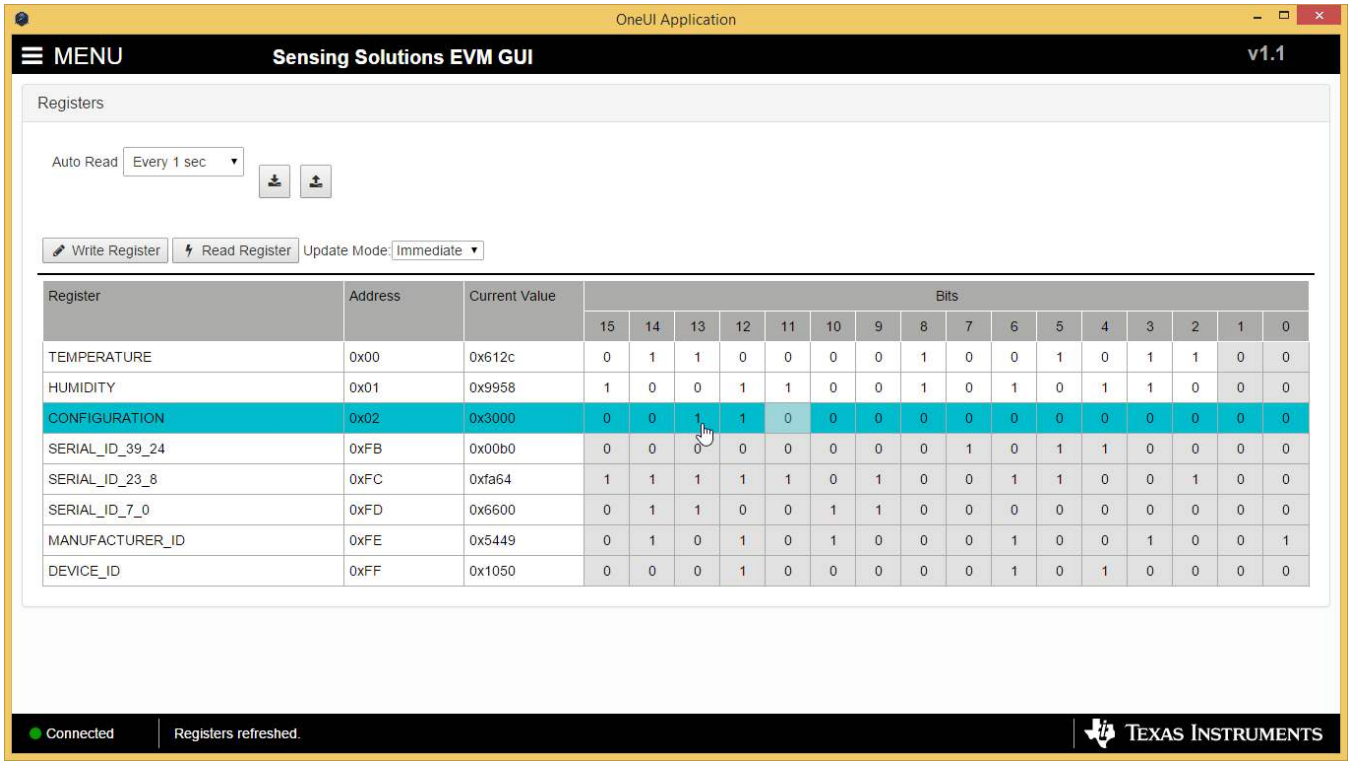


Figure 27. Toggling Register Bit Value on Register Page

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

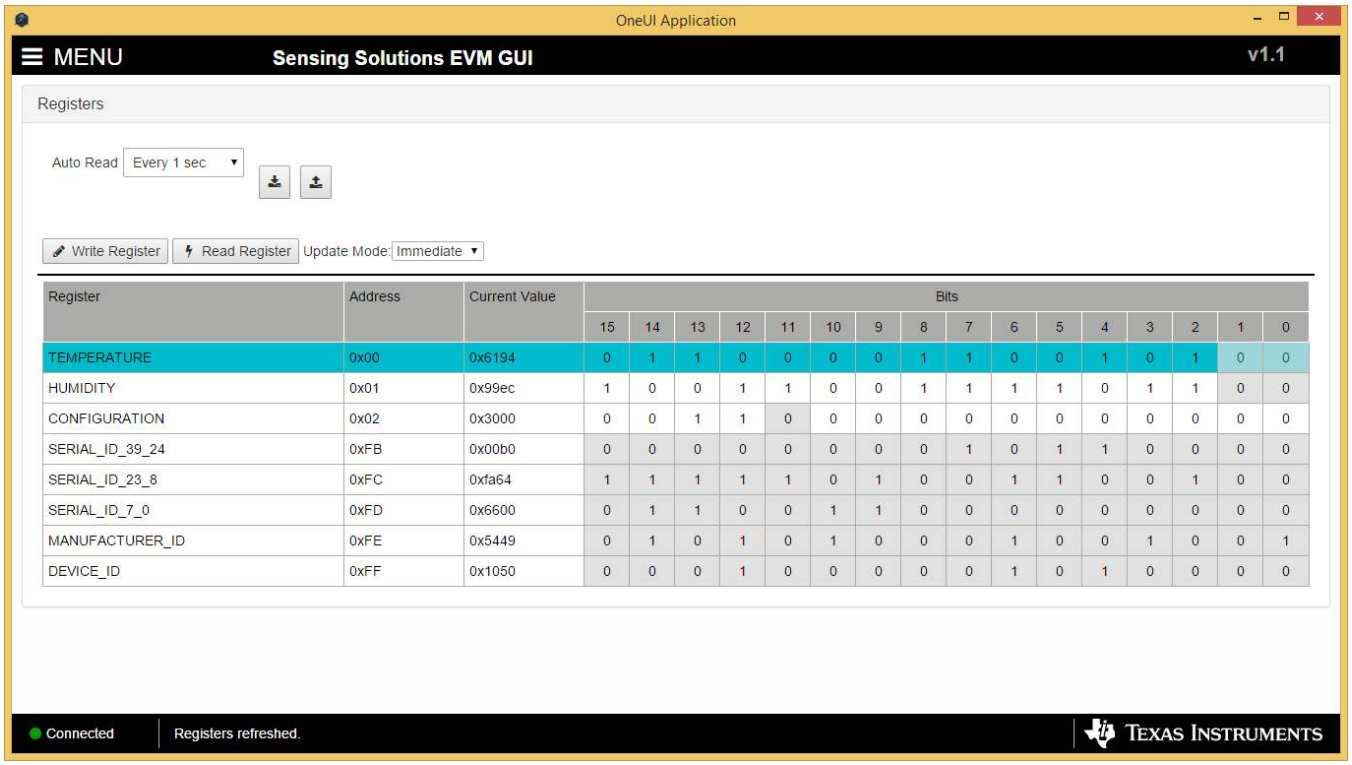


Figure 28. Selecting a Register on Register Page

2. Click the “Read Register” button to update the selected register’s current value and bit values in the table

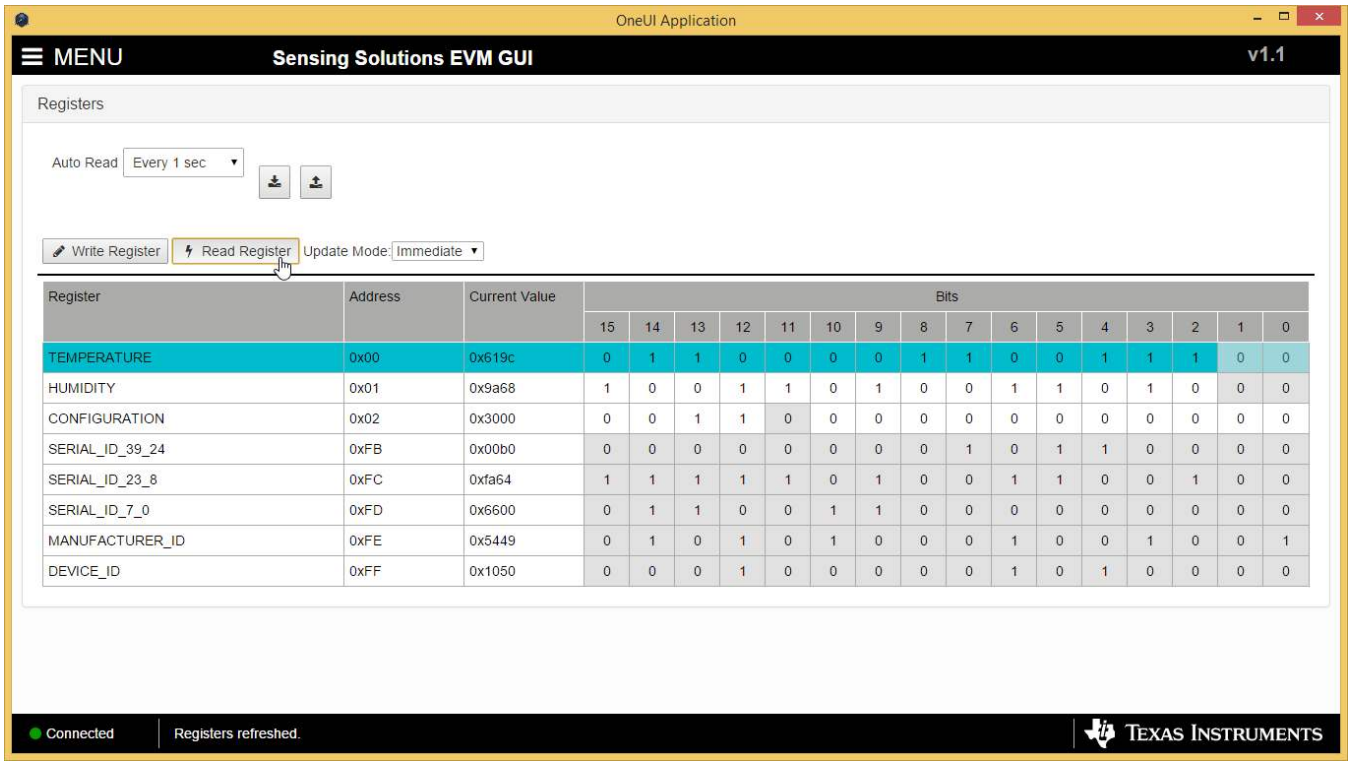
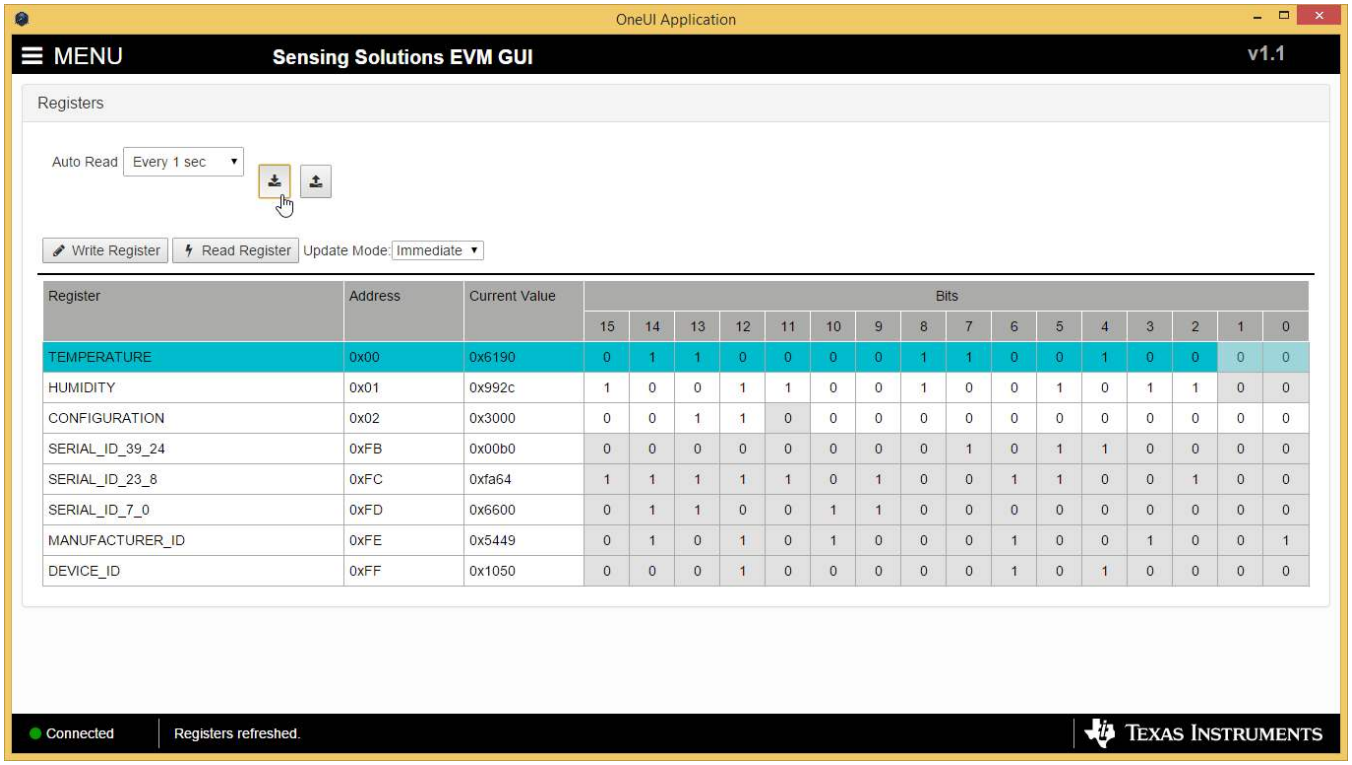


Figure 29. Reading the Current Device Register Value on Register Page

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



Register	Address	Current Value	Bits															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
TEMPERATURE	0x00	0x6190	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0
HUMIDITY	0x01	0x992c	1	0	0	1	1	0	0	1	0	0	1	0	1	1	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 30. Save Register Values to File on Register Page

2. Choose a JSON file name and the directory to save it within. Then click “Save”

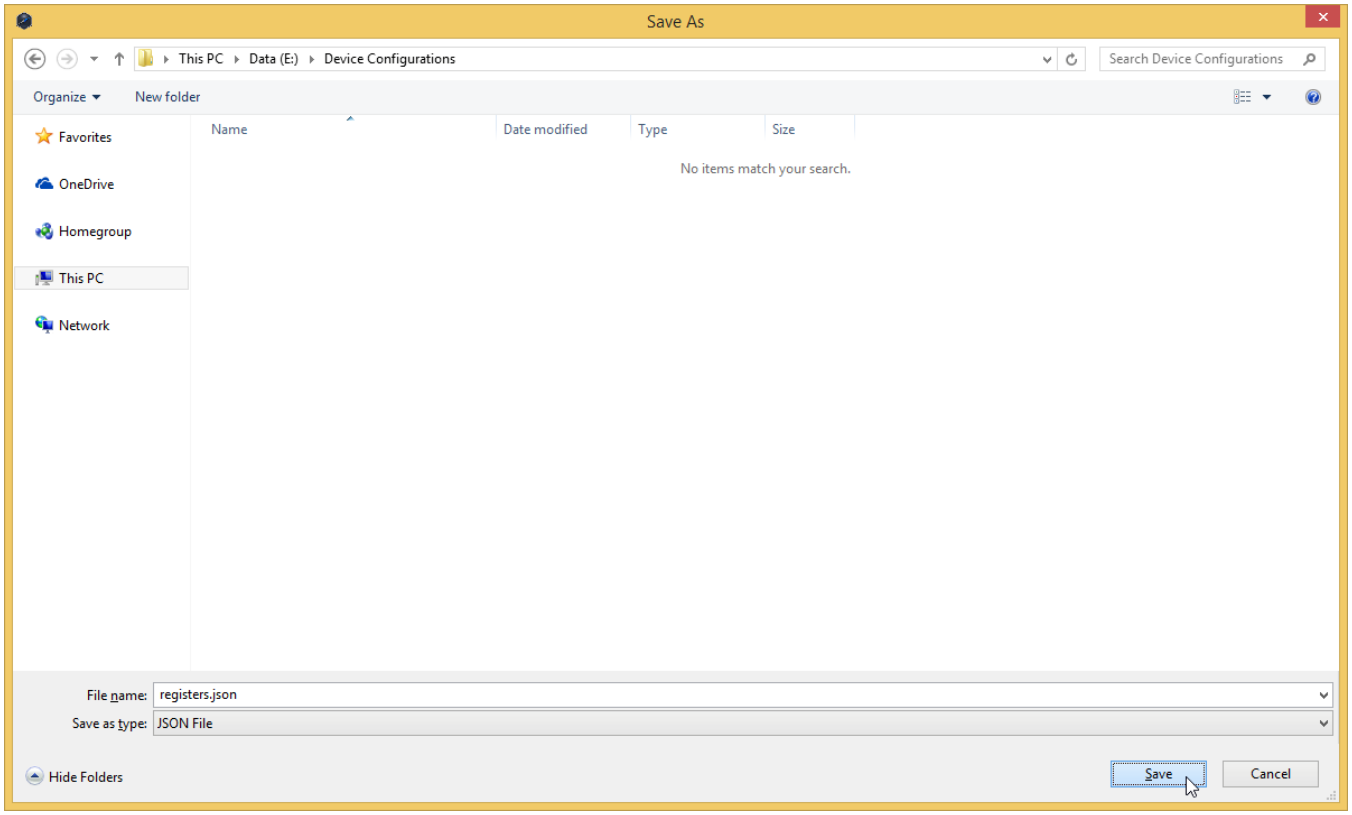


Figure 31. Choosing a JSON File Name to Save Register Values

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

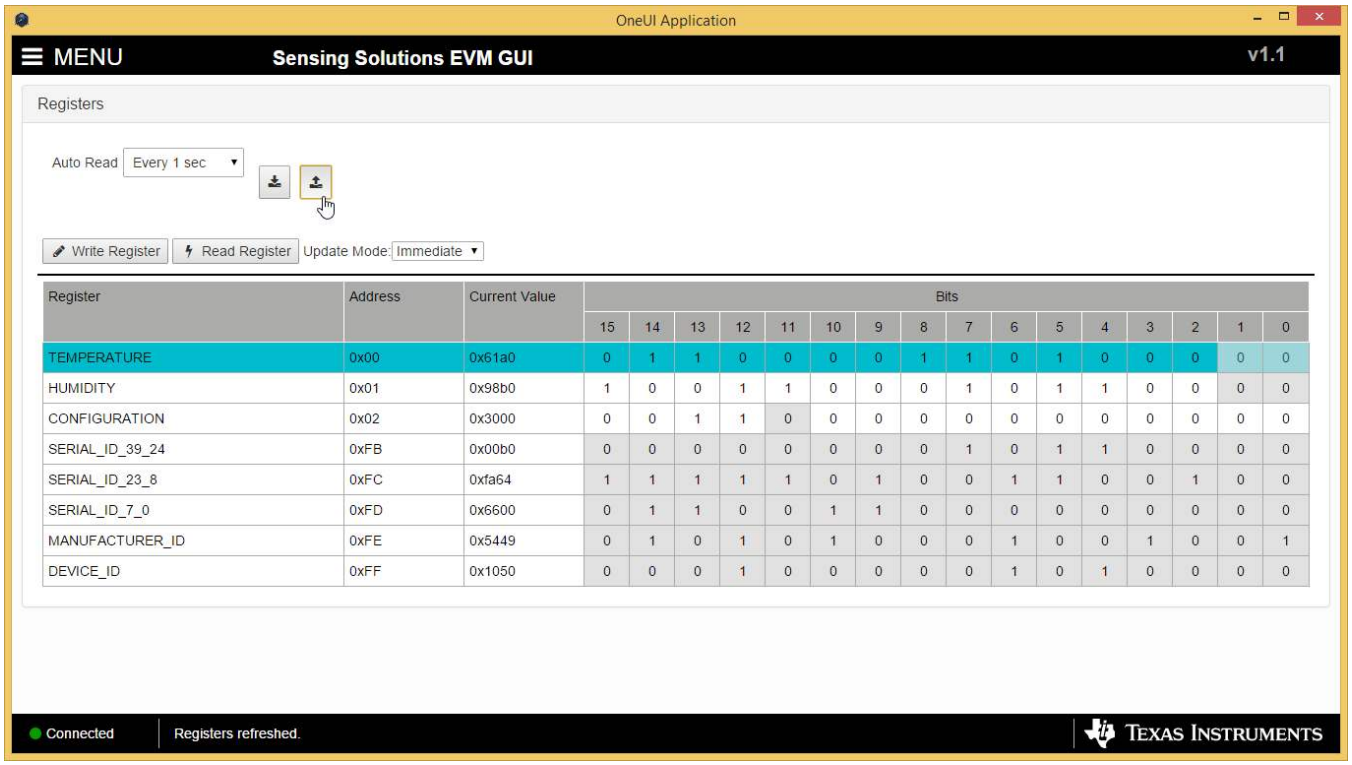


Figure 32. Loading Previously Saved Register Values from File on Register Page

2. Select the JSON file with the desired settings and click “Open”

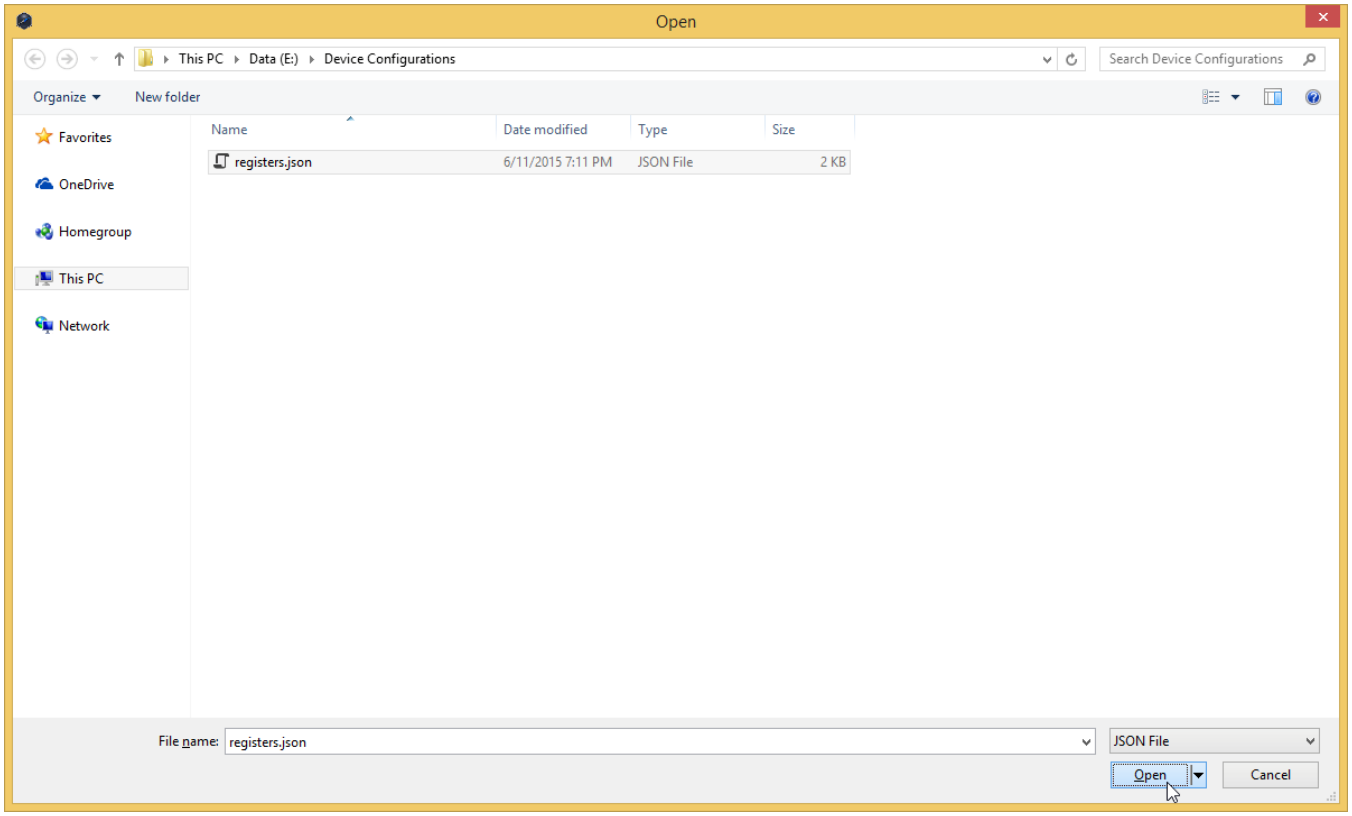


Figure 33. Selecting Previously Save Register Value JSON File

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 HDC1010 please reference the device datasheet.

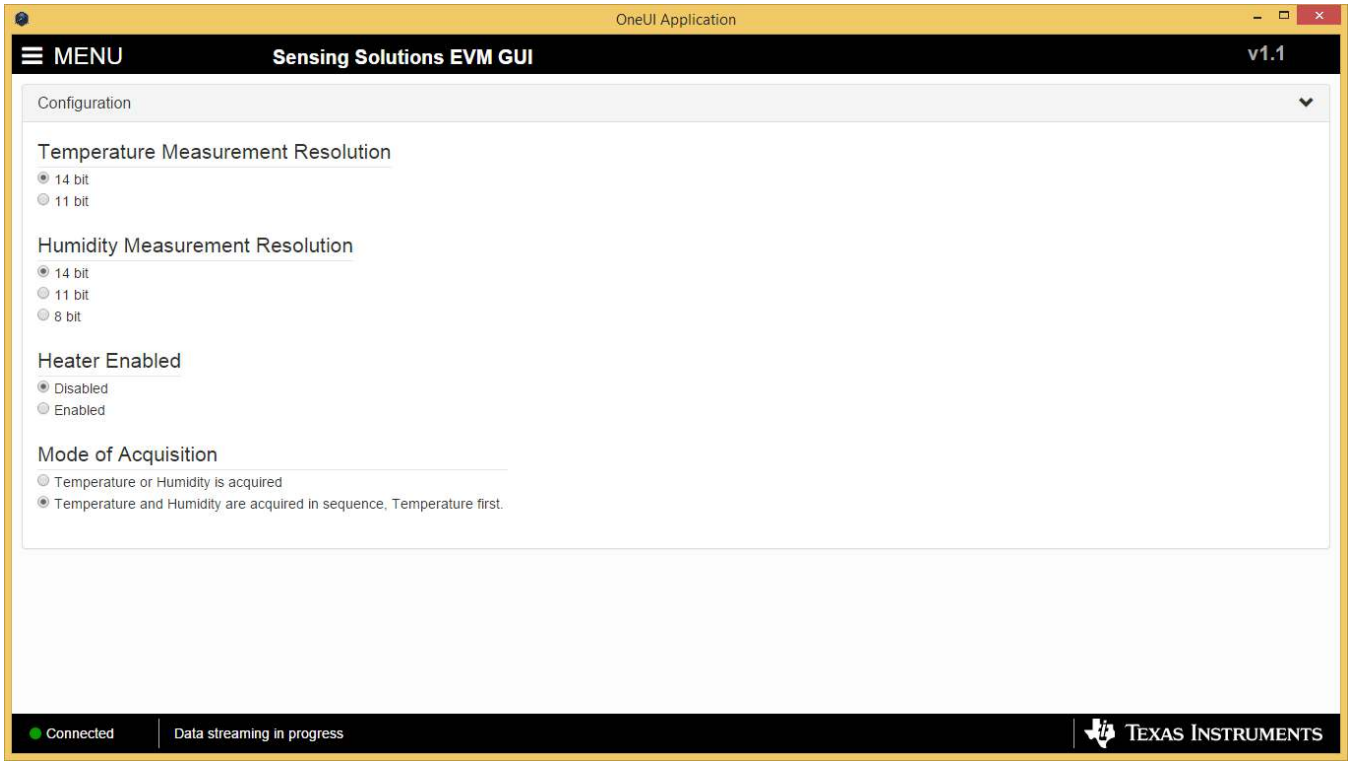


Figure 34. HDC1010 GUI Configuration Page

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 35. 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.

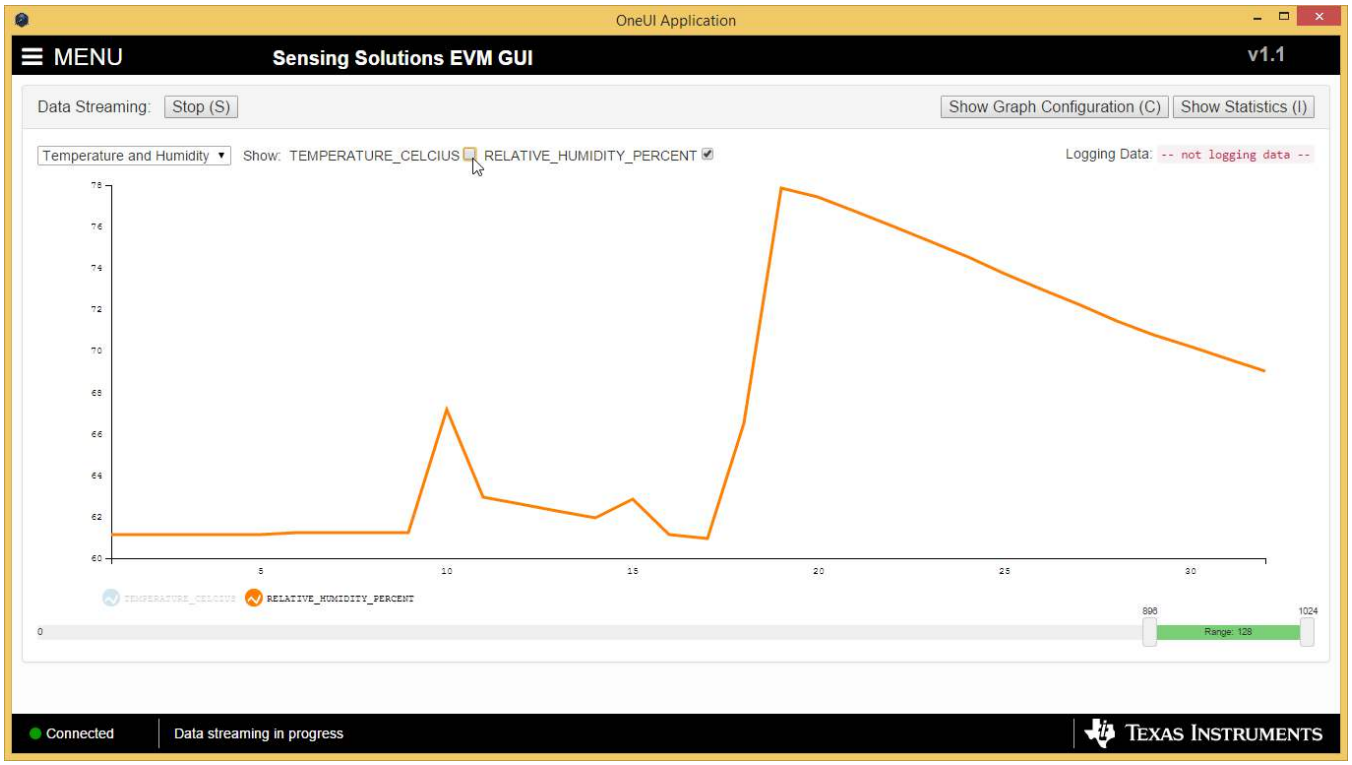


Figure 36. Data Streaming Graph Showing Only Relative Humidity Percent

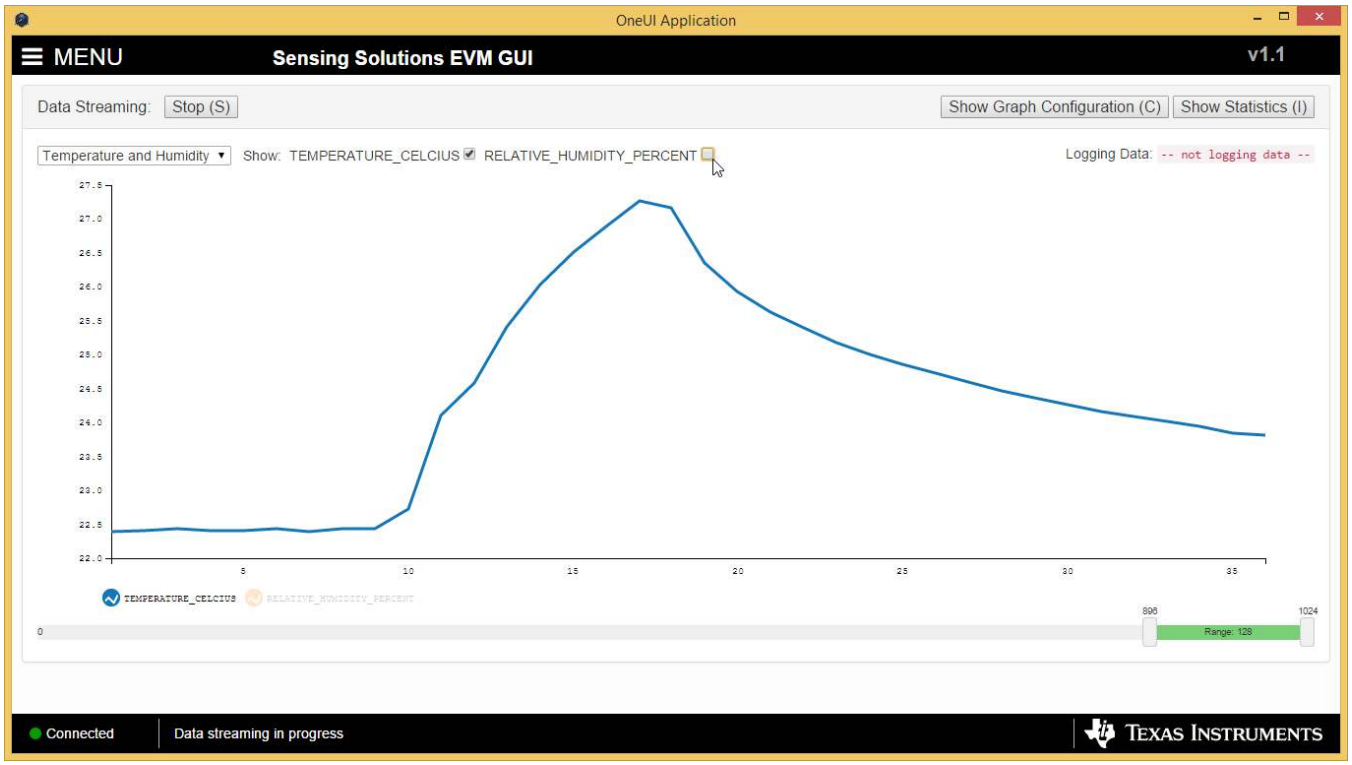


Figure 37. Data Streaming Graph Showing Only Temperature

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"

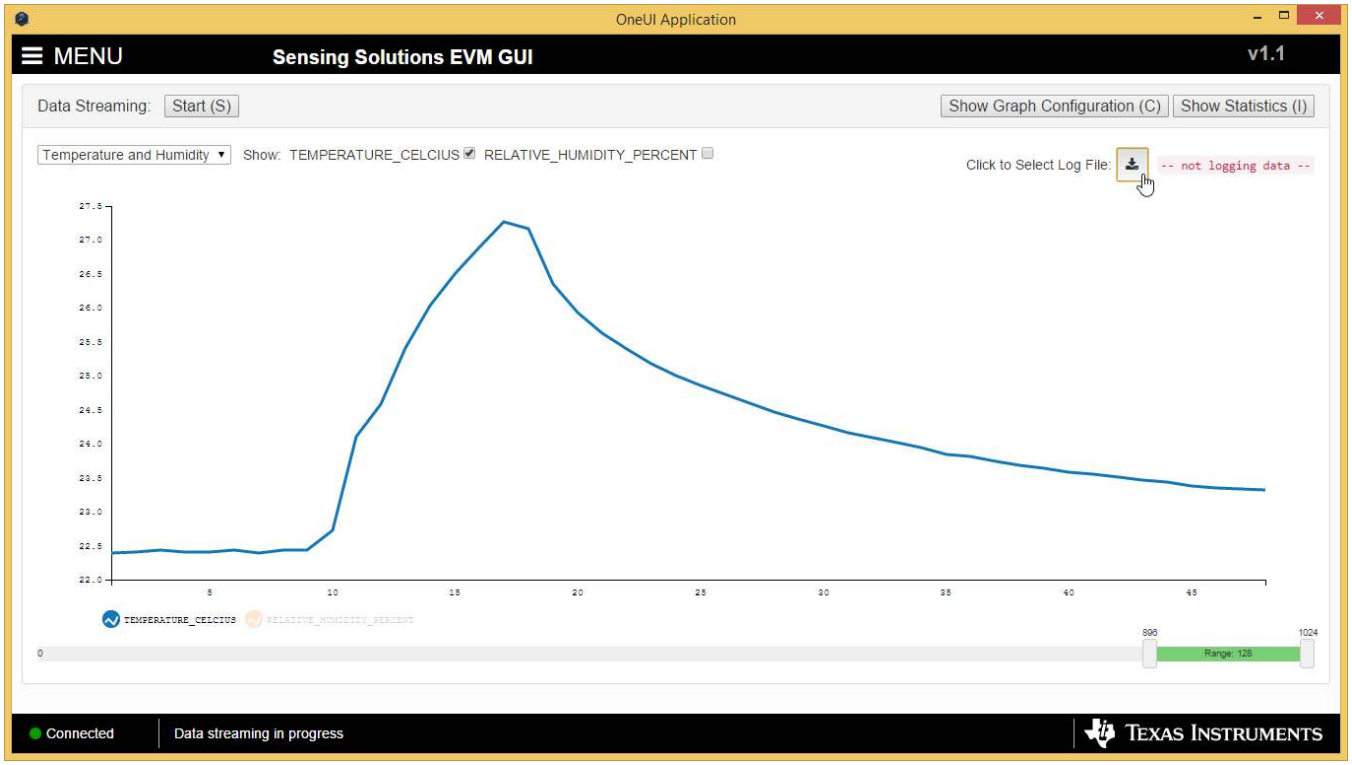


Figure 38. Select Log File Button on Data Streaming Page

2. Select a file name and directory to save the data to and then click the “Save” button

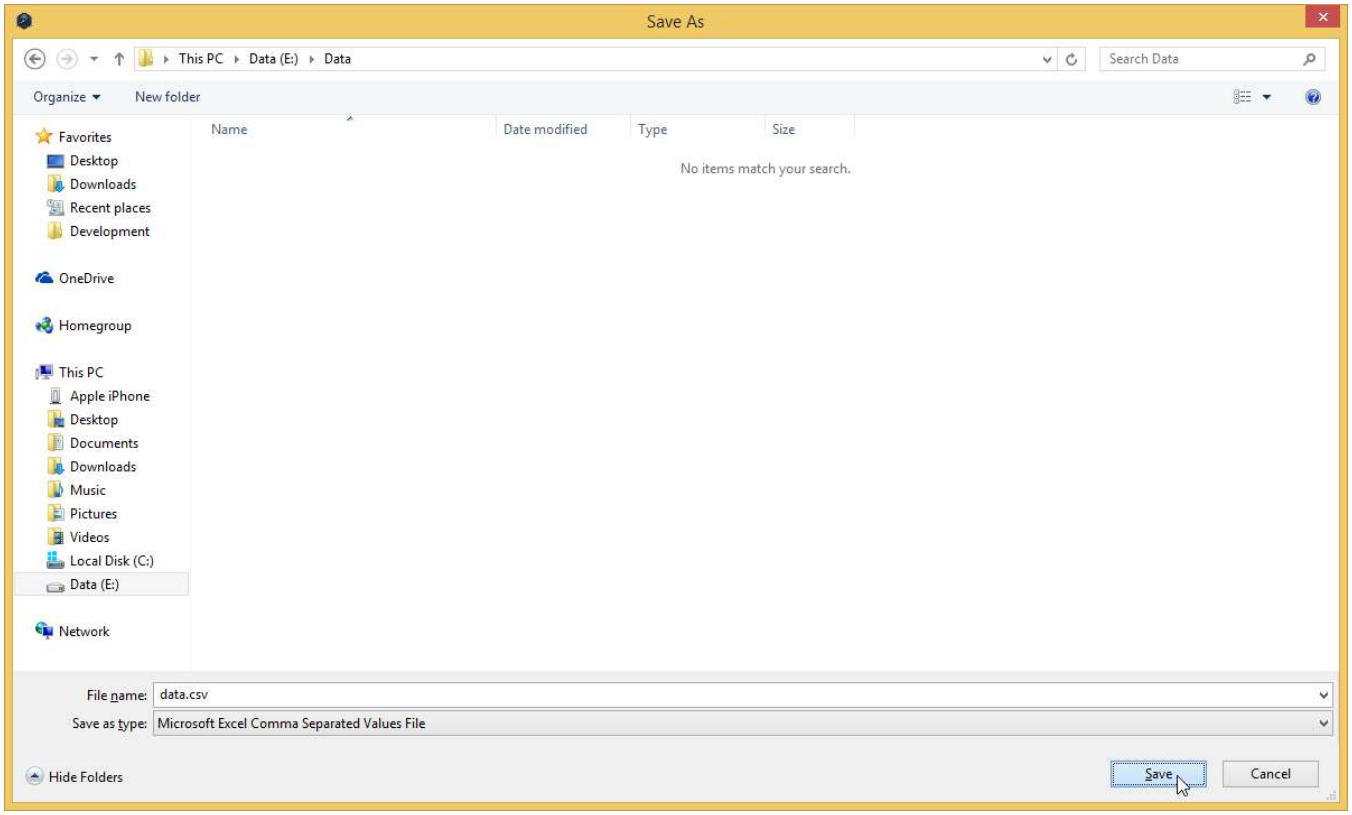


Figure 39. Selecting the Log File for Data Streaming

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

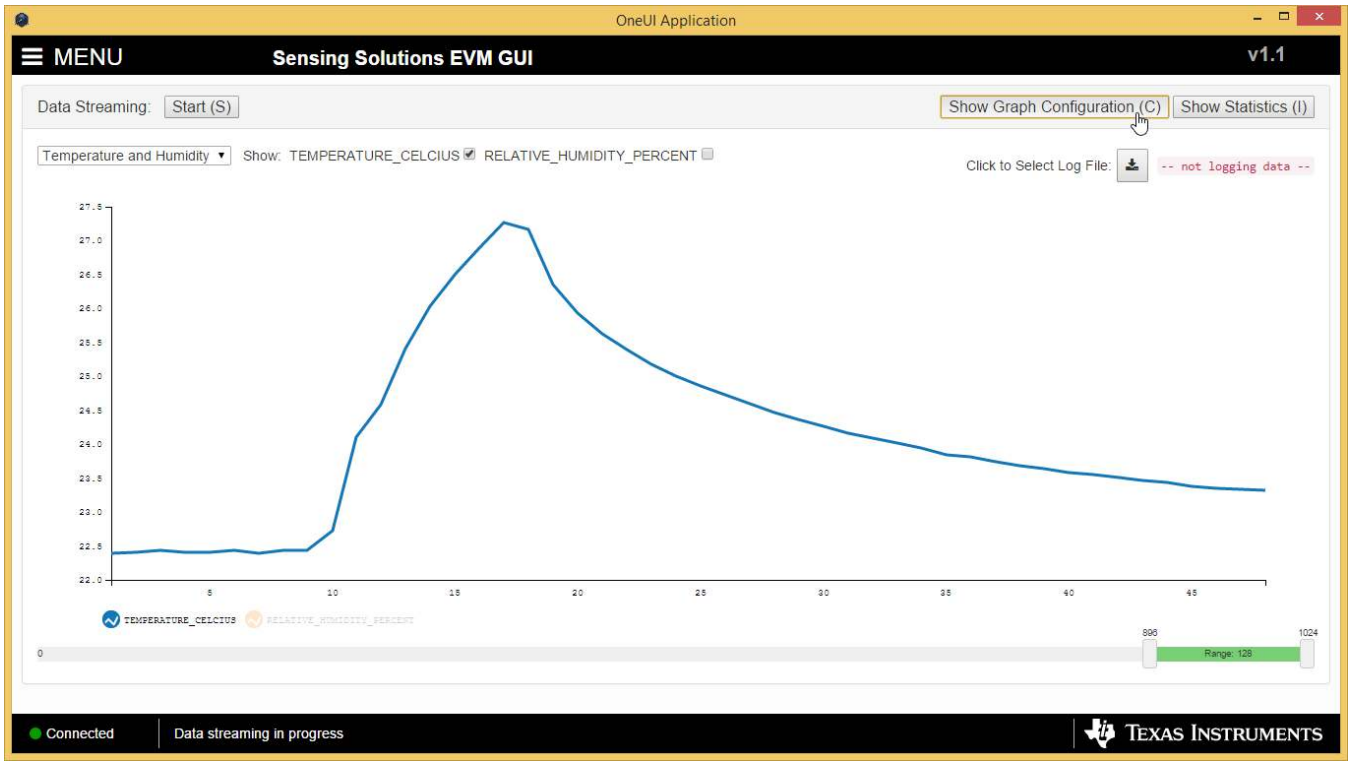


Figure 40. Show Graph Configuration Button on Data Streaming Page

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

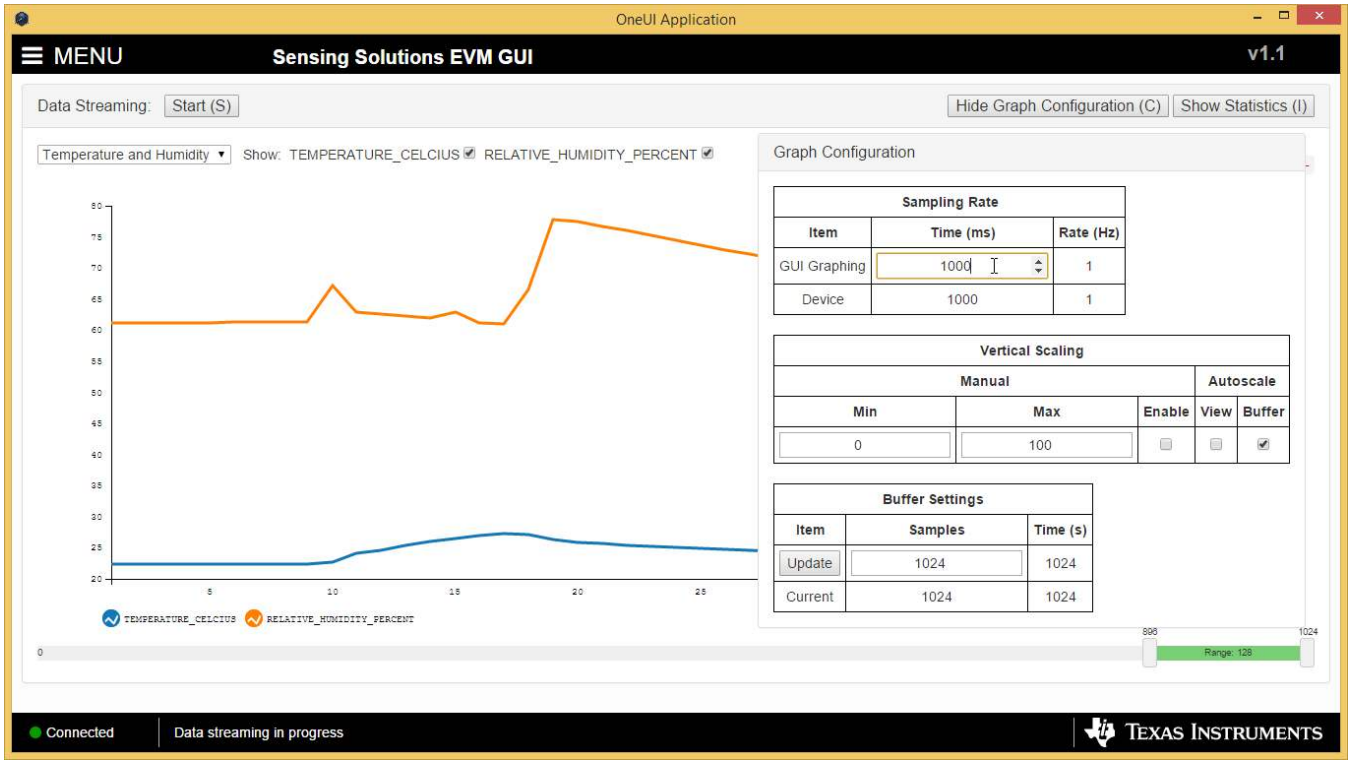


Figure 41. Setting the Data Streaming Sample Rate to 1 Second

3. The vertical scaling can be automatically updated or manually controlled by selecting either checkboxes in the “Vertical Scaling” table

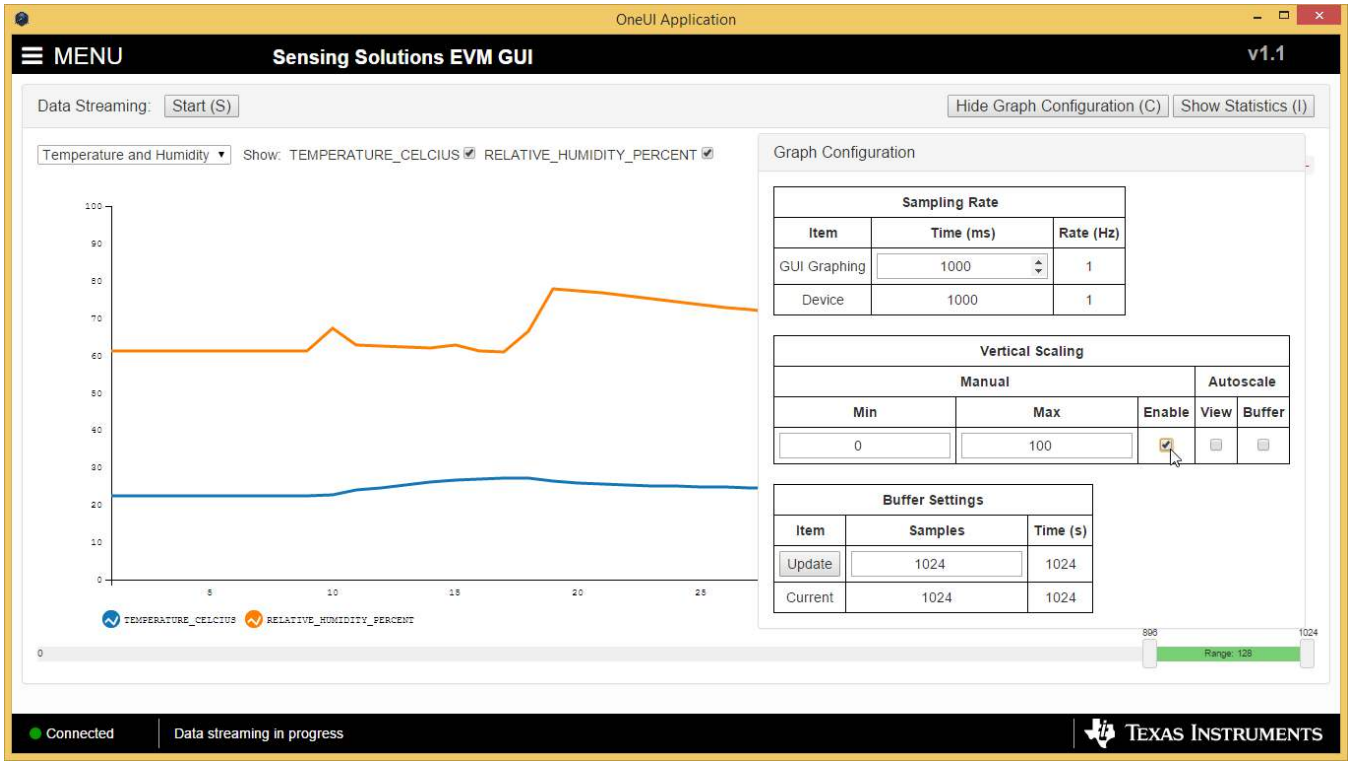


Figure 42. Manually Setting the Vertical Scale on Data Streaming Graph

3.6.4 Starting and Stopping Measurement Data Acquisition

To start data streaming click the “Start” button.

Figure 43. Starting Data Acquisition on Data Streaming Graph

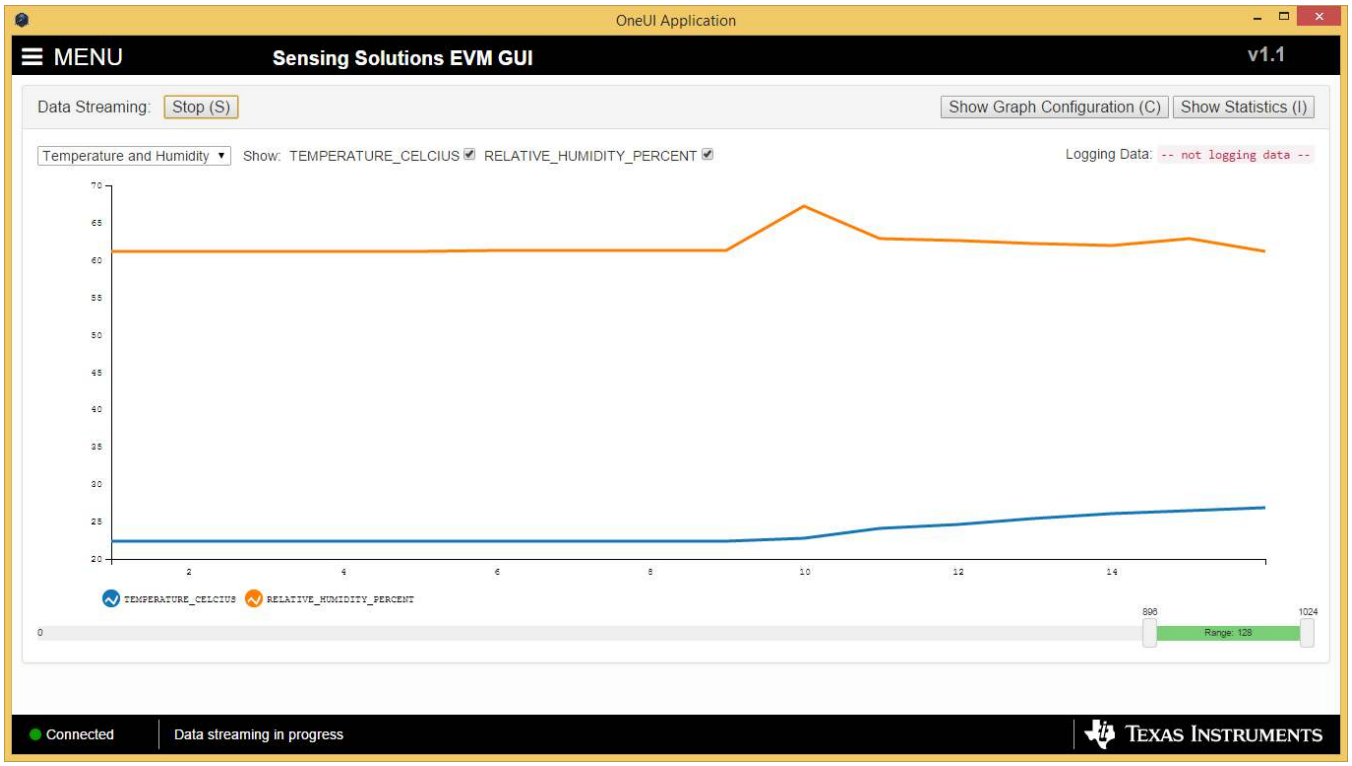


Figure 44. Data Acquisition In Progress on Data Streaming Page

To stop data streaming click the “Stop” button.

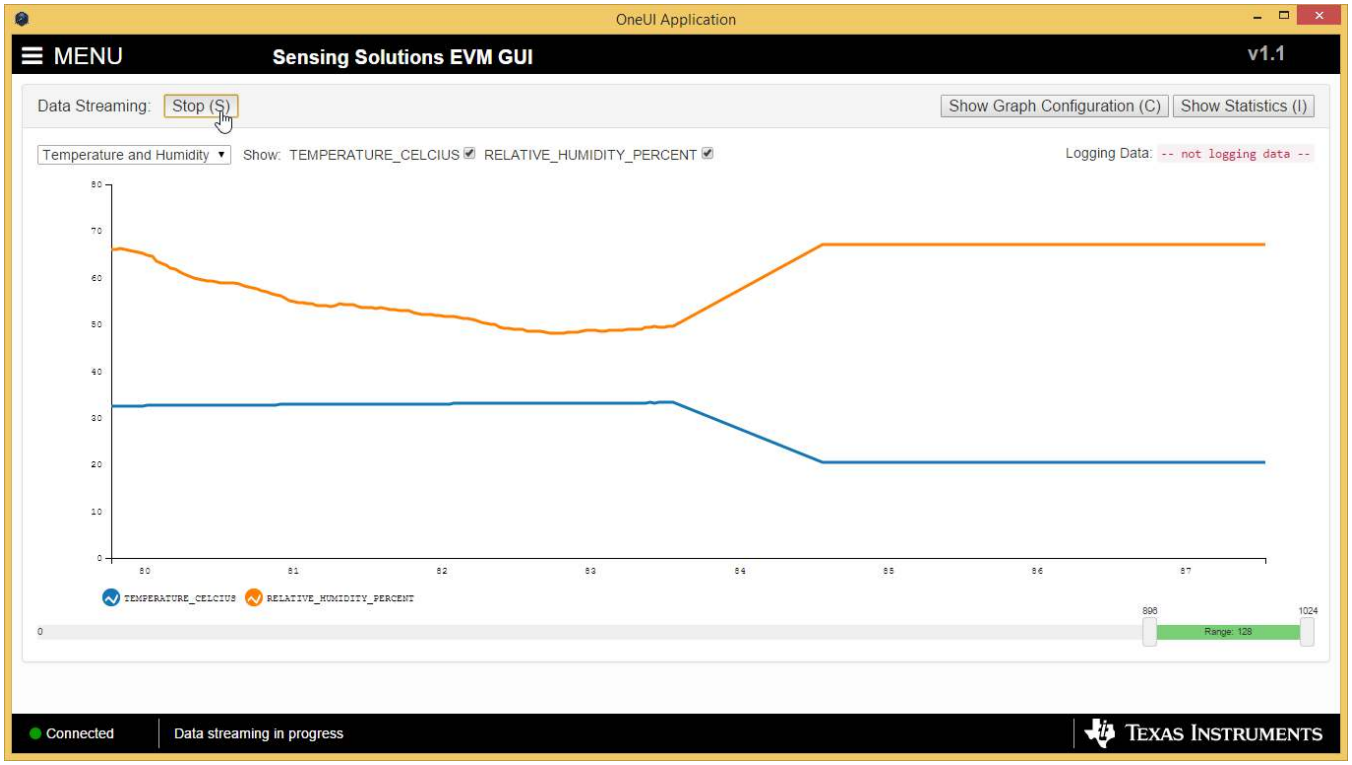


Figure 45. Stopping Data Acquisition on Data Streaming Graph

3.6.5 Displaying Measurement Data Statistics

Click the “Show Statistics” button to view the measurement statistics.

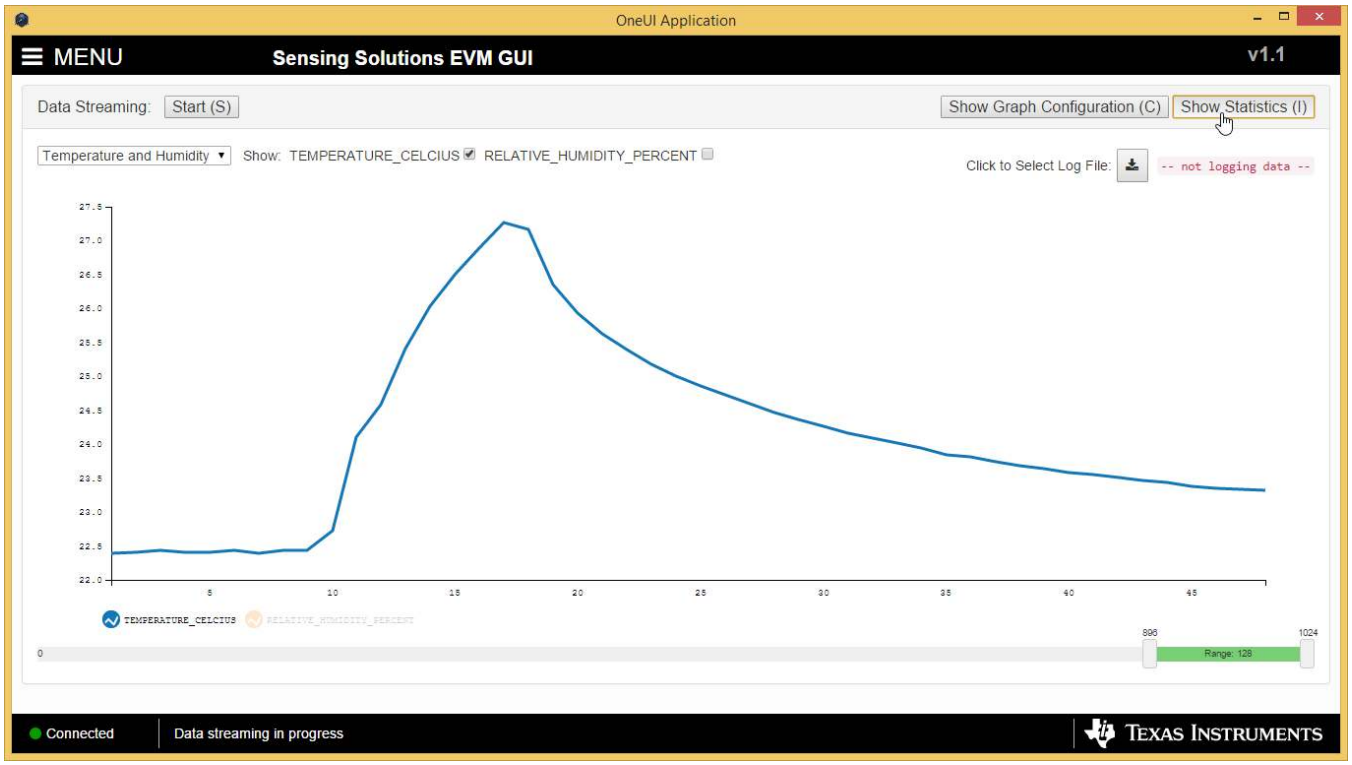


Figure 46. Show Statistics Button on Data Streaming Graph

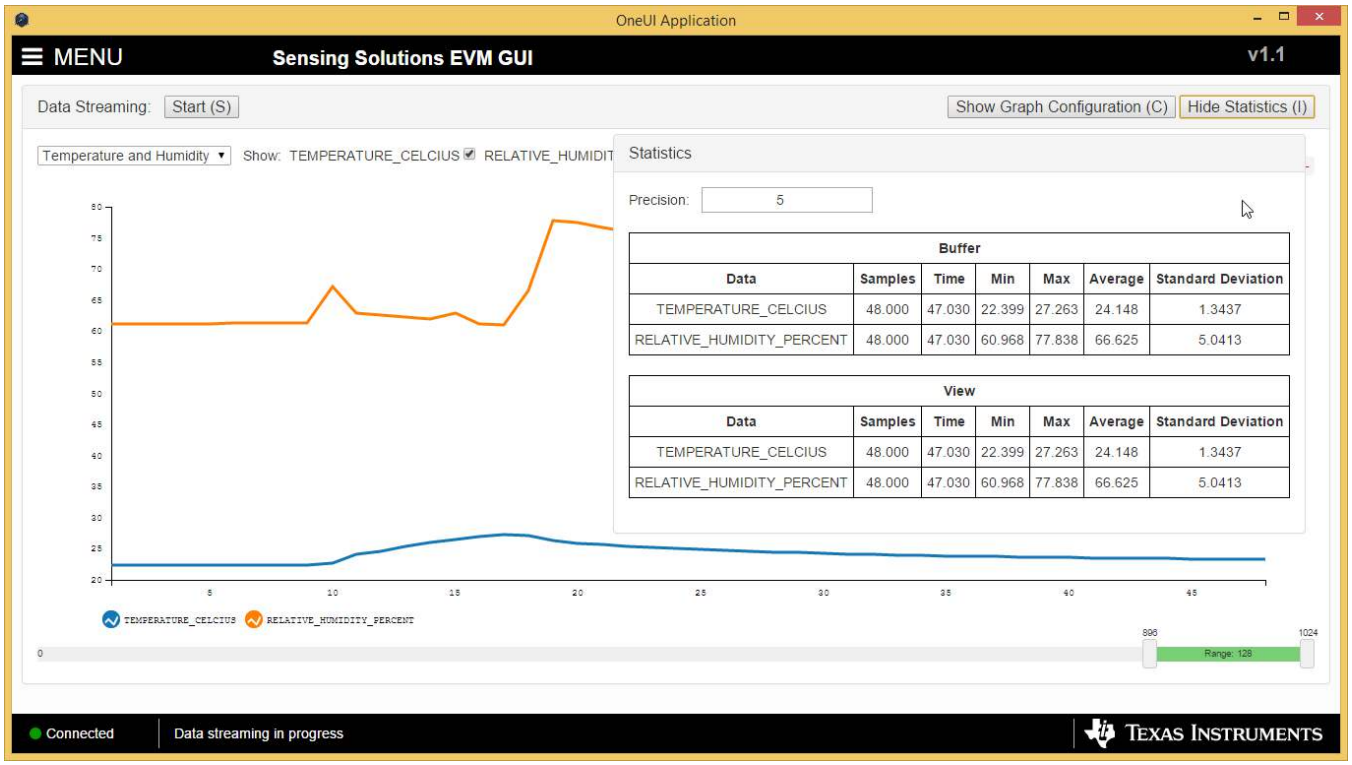


Figure 47. Data Statistics on Data Streaming Graph

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.

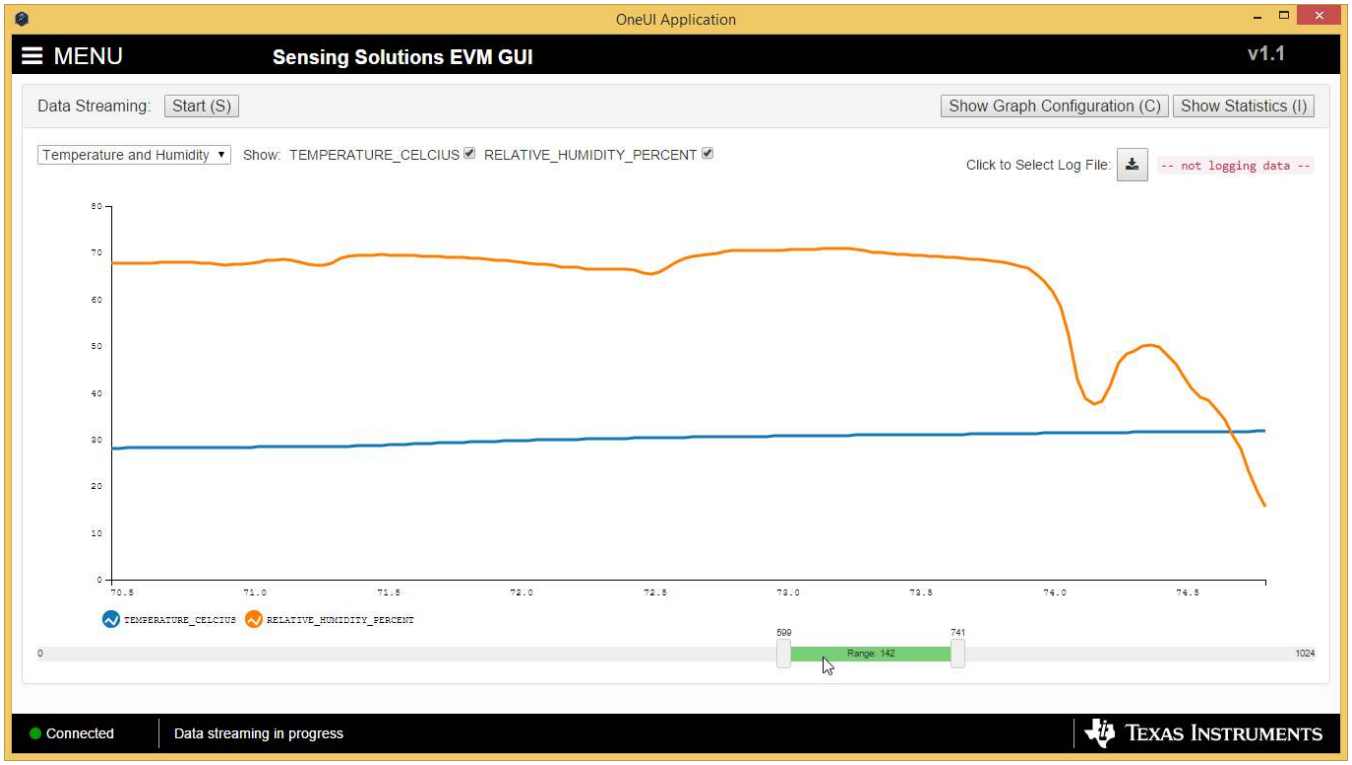


Figure 48. Moving the Data Graph Sample View

Figure 49. 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

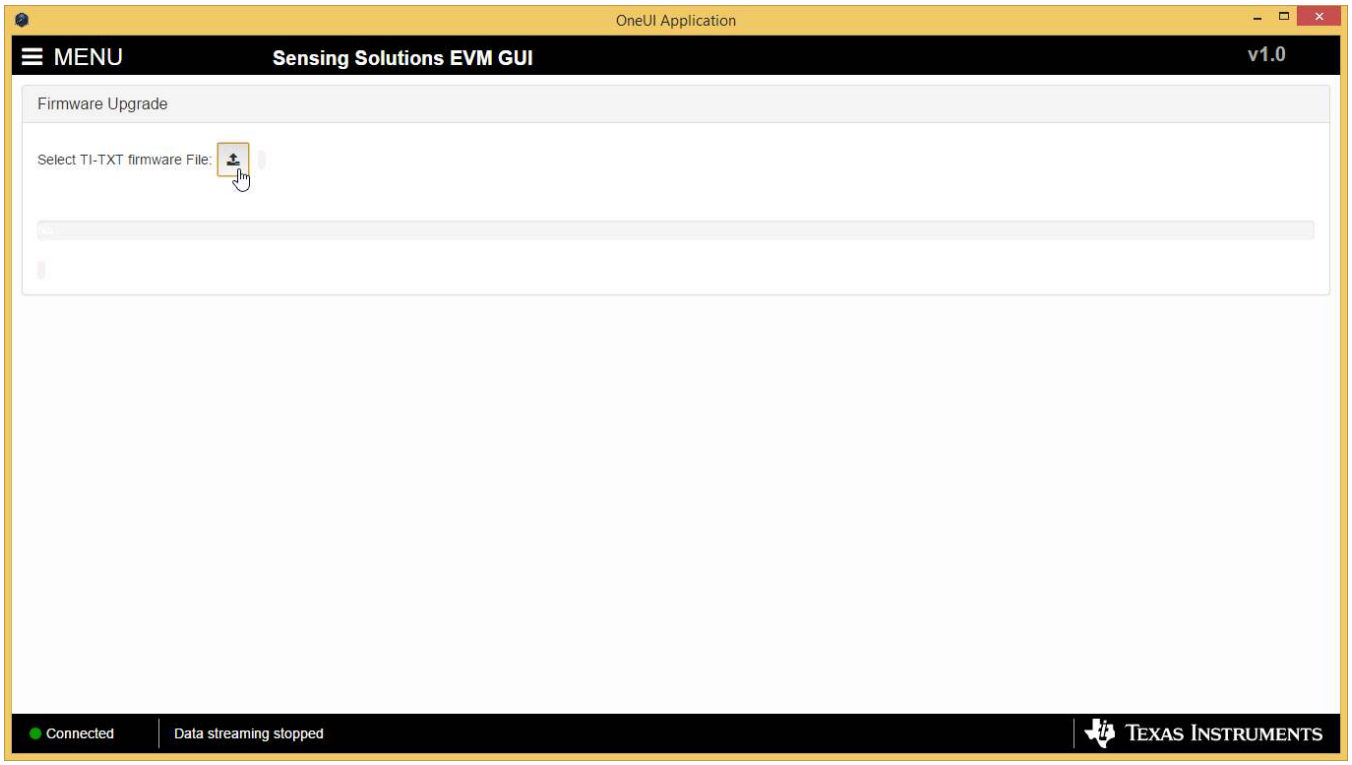


Figure 50. Select TI-TXT File Button on Firmware Upload Page

2. Select the firmware file and click “Open”

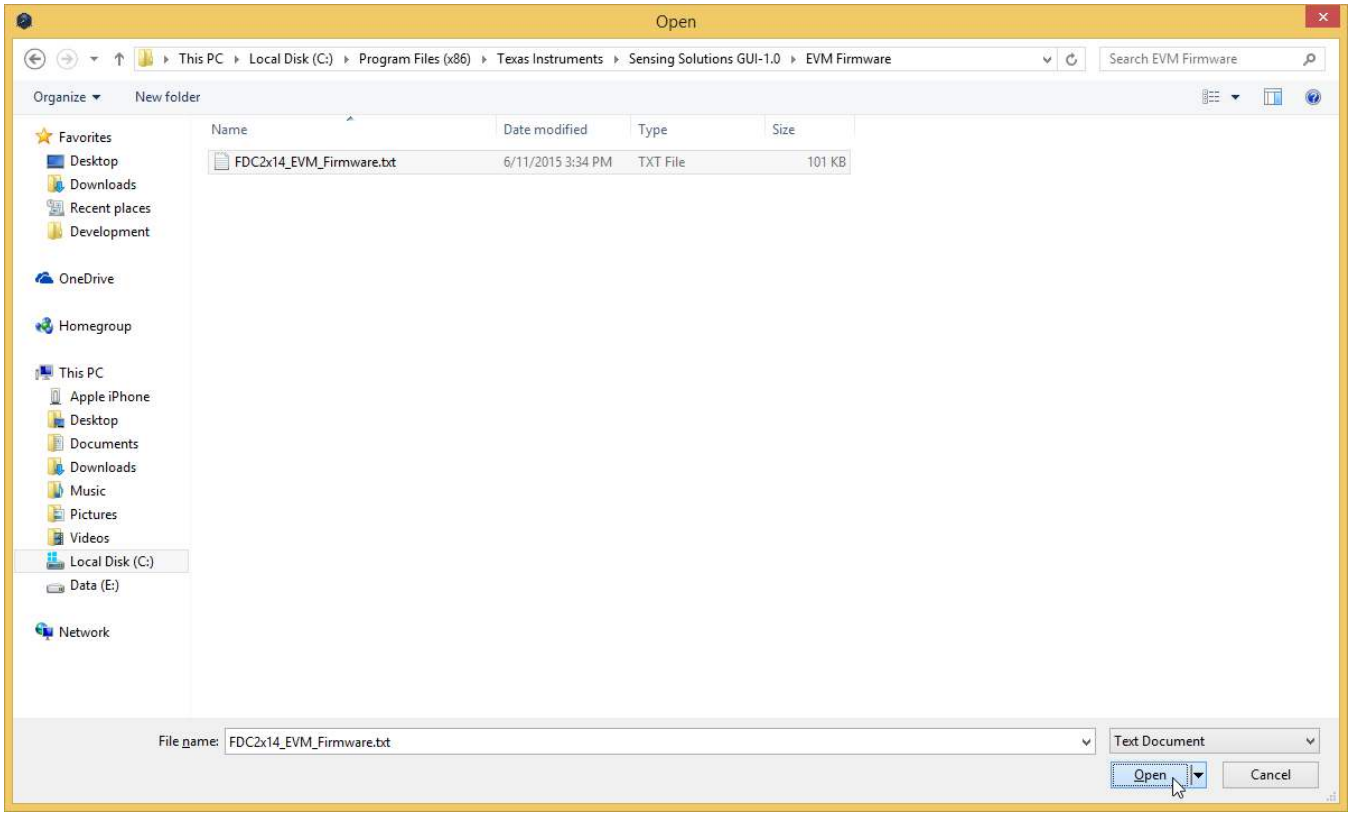


Figure 51. Selecting TI-TXT Firmware File for Upload to EVM

3. Click the “Upload Firmware” button

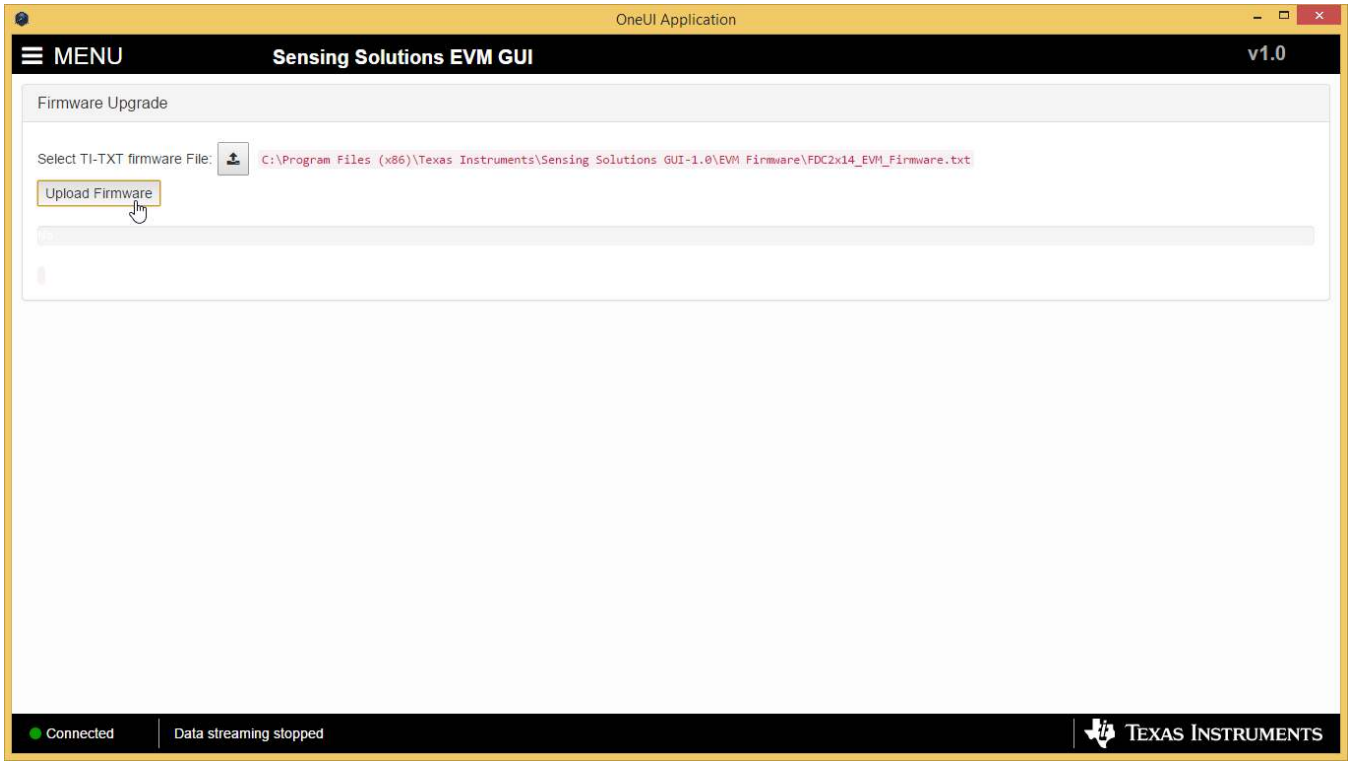


Figure 52. Upload Firmware Button on Firmware Upload Page

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.

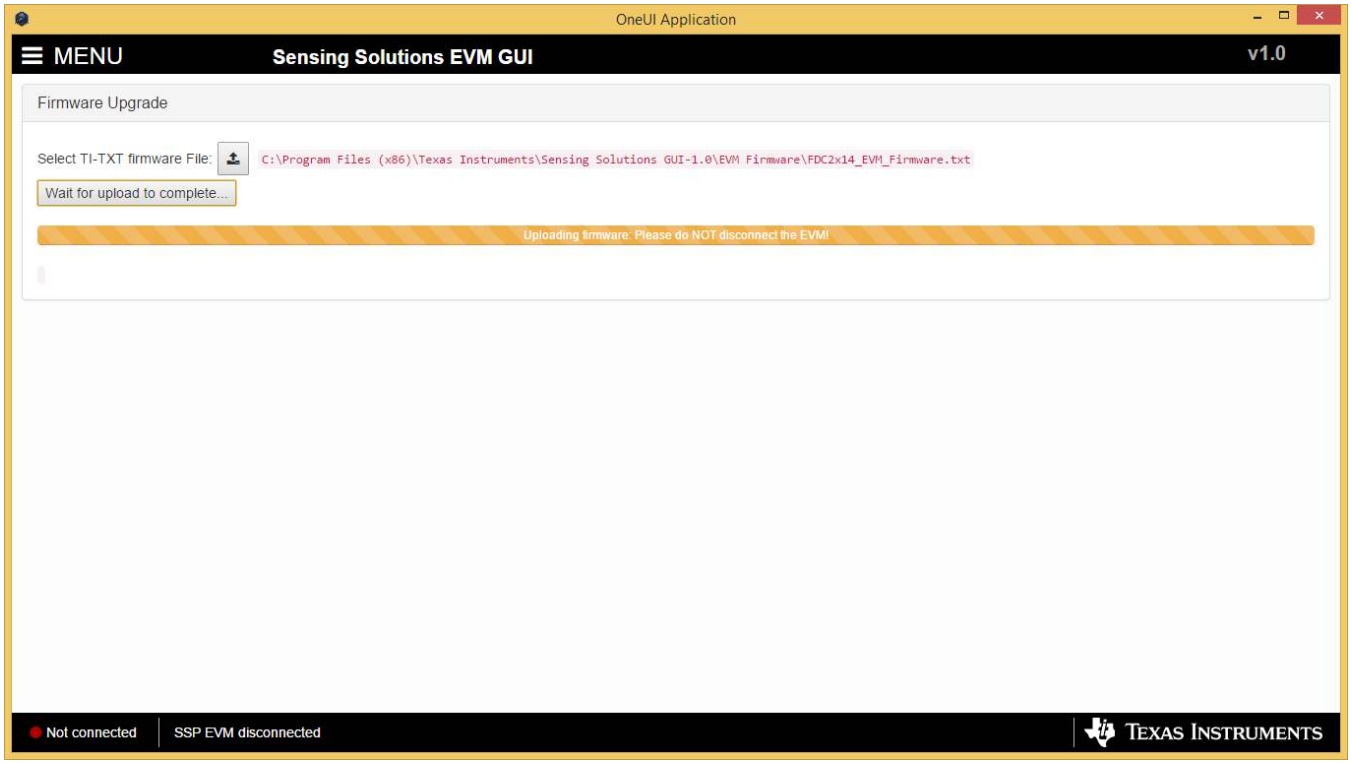


Figure 53. Firmware Upload in Progress

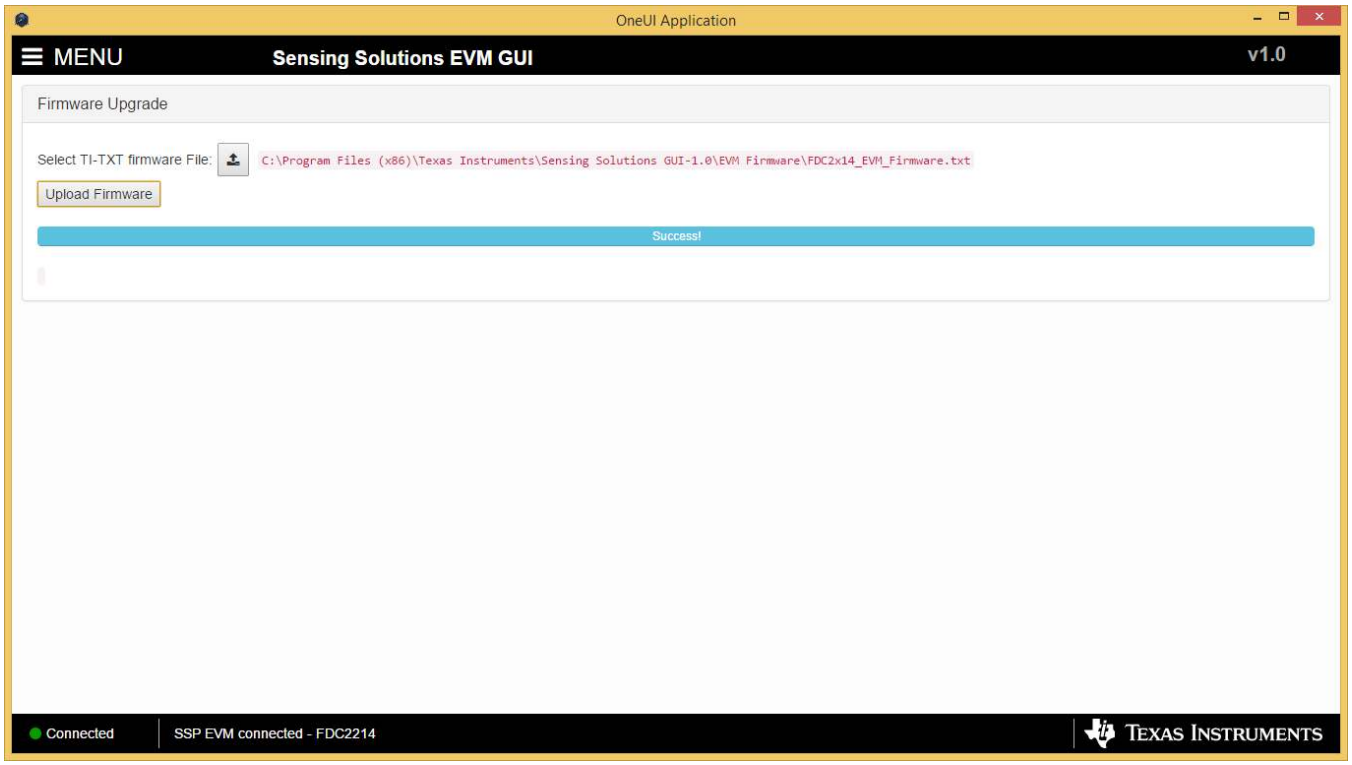


Figure 54. Firmware Upload Success

4 Board Layout

Figure 55 and Figure 56 show the board layout for the HDC1010EVM.

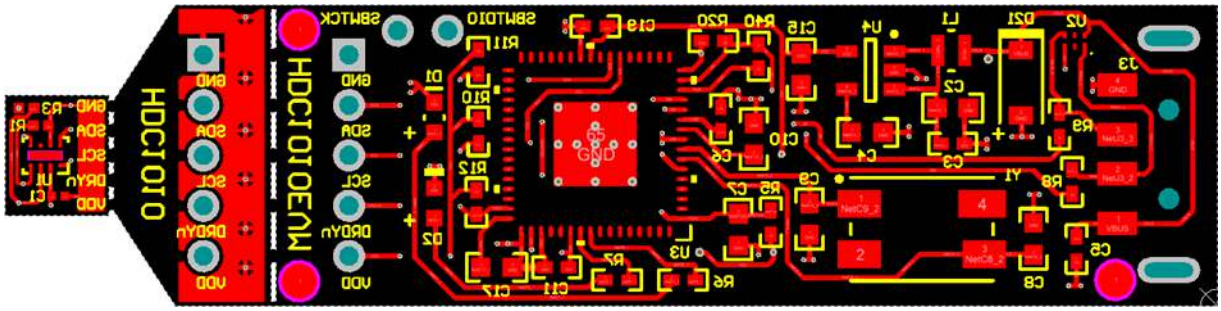


Figure 55. Top Layer Routing

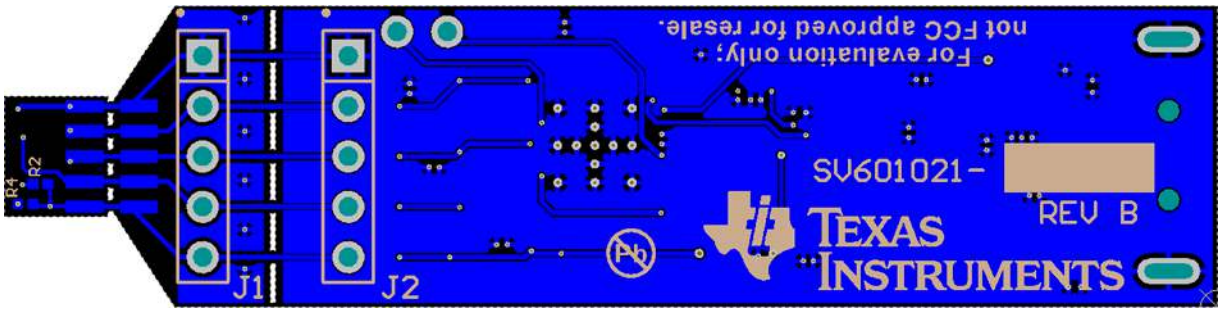


Figure 56. Bottom Layer Routing

5 Schematic

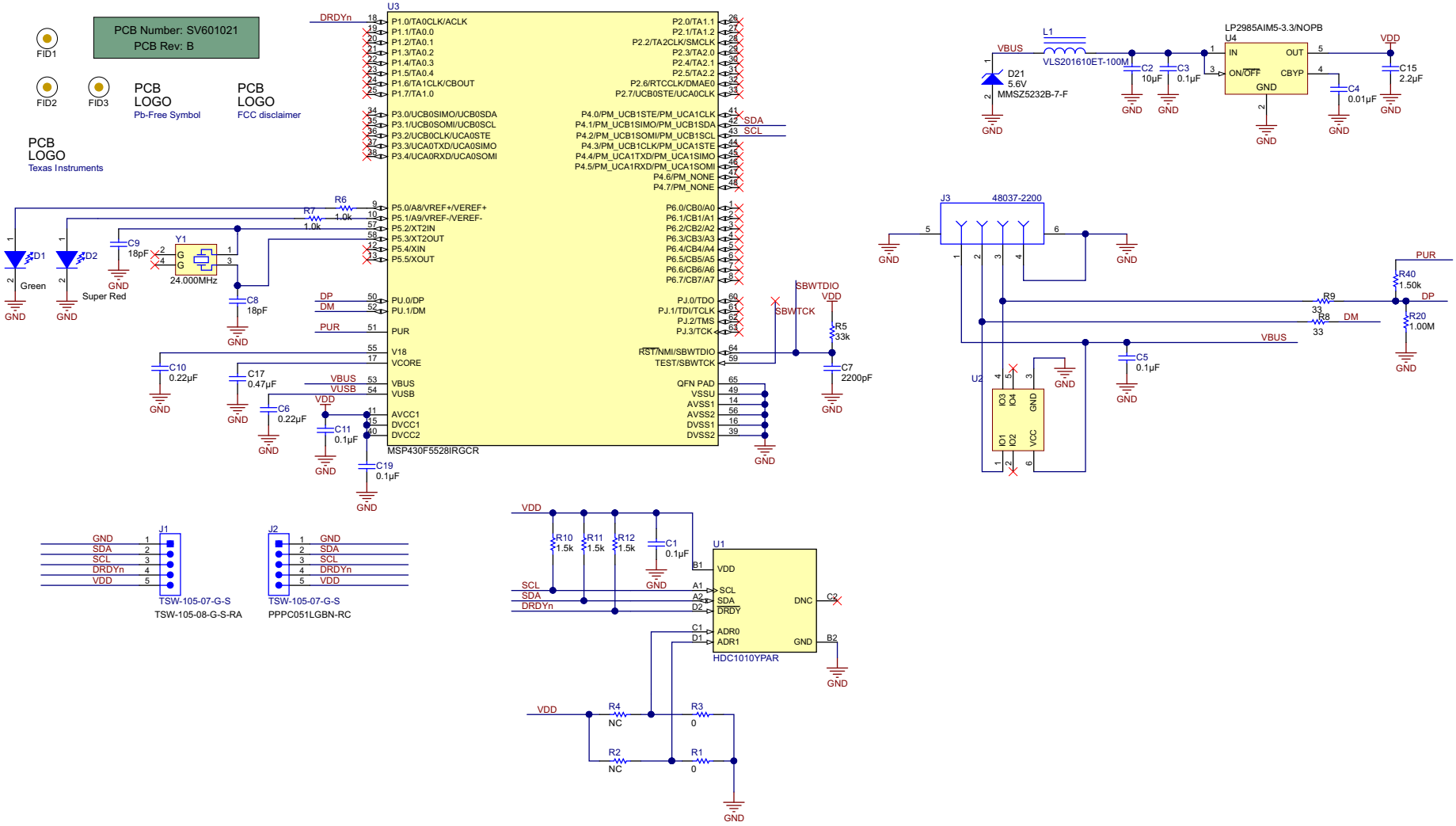


Figure 57. HDC1010EVM Schematic

6 HDC1010EVM Bill of Materials

COUNT	REF DES	DESCRIPTION	FOOTPRINT	PART NUMBER
1	C1	CAP, CERM, 0.1µF, 10V, ±10%, X5R, 0201	0201	CL03A104KP3NNNC
1	C2	CAP, CERM, 10µF, 10V. ±20%, X5R, 0603	0603	C1608X5R1A106M080AC
4	C3, C5, C11, C19	CAP, CERM, 0.1µF, 16V, ±5%, X7R, 0402	0402	GRM155R71C104JA88D
1	C4	CAP, CERM, 0.01µF, 50V, ±5%, C0G/NP0, 0603	0603	CGA3E2C0G1H103J080AA
1	C6	CAP, CERM, 0.22uF, 16V, ±10%, X7R, 0402	0402	GRM155R71C224KA12D
1	C7	CAP, CERM, 2200pF, 50V, ±10%, X7R, 0603	0603	C0603X222K5RACTU
2	C8, C9	CAP, CERM, 18pF, 100V, ±5%, C0G/NP0, 0603	0603	GRM1885C2A180JA01D
1	C10	CAP, CERM, 0.22µF, 25V, ±10%, X5R, 0603	0603	06033D224KAT2A
1	C15	CAP, CERM, 2.2µF, 10V, ±10%, X5R, 0603	0603	C0603C225K8PACTU
1	C17	CAP, CERM, 0.47µF, 10V, ±10%, X7R, 0603	0603	C0603C474K8RACTU
1	D1	GREEN LED, 1.7x0.65x0.8mm	0603	LG L29K-G2J1-24-Z
1	D2	SUPER RED LED, 1.6x0.60x0.8mm	0603	SML-LX0603SRW-TR
1	D21	Diode, Zener, 5.6V, 500mW, SOD-123	SOD-123	MMSZ5232B-7-F
2	J1, J2	Header, TH, 100mil, 5x1, Gold plated, 230 mil above insulator	-	TSW-105-07-G-S
1	J3	Connector, USB Type A, 4POS R/A, SMD	-	48037-2200
1	L1	INDUCTOR POWER 10µH .45A SMD	VLS201610	VLS201610ET-100M
2	R1, R3	RES, 0Ω, 5%, 0.05W, 0201	0201M	ERJ-1GE0R00C
2	R2, R4	RES, 0Ω, 5%, 0.05W, 0201	0201M	ERJ-1GE0R00C
1	R5	RES, 33kΩ, 5%, 0.063W, 0402	0402	CRCW040233K0JNED
2	R6, R7	RES, 1kΩ, 5%, 0.063W, 0402	0402	CRCW04021K00JNED
2	R8, R9	RES, 33Ω, 5%, 0.063W, 0402	0402	CRCW040233R0JNED
3	R10, R11, R12	RES, 1.5kΩ, 5%, 0.063W, 0402	0402	CRCW04021K50JNED
1	R20	RES, 1MΩ 5%, 0.063W, 0402	0402	RC0402FR-071ML
1	R40	RES, 1.50kΩ, 1%, 0.063W, 0402	0402	CRCW04021K50FKED
1	U1	HDC1010 – Low Power, High Accuracy Digital Humidity Sensor with Temperature Sensor	YPA0008	HDC1010
1	U2	4-Channels ESD-Protection Array for High-Speed Data Interfaces	DRY0006A	TPD4E004DRY
1	U3	MSP430F5528 Mixed Signal micro-controller	RGC0064B	MSP430F5528IRGC
1	U4	Micropower 150 mA Low-Noise Ultra Low-Dropout Regulator, 5-pin SOT-23, Pb-Free	MF05A	LP2985AIM5-3.3/NOPB
1	Y1	CRYSTAL 24.000MHZ, 18pF, SMD	ABMM	ABMM-24.000MHZ-B2-T

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