SensorXplorer™ Installation Guide

By Samy Ahmed

OVERVIEW

The SensorXplorer™ is a demonstration kit designed to help evaluate Vishay's digital sensors featured on Vishay's sensor boards. These boards, along with their respective software modules, can be used to demonstrate and test each sensor's functionalities, allowing the user to quickly understand how various settings affect the sensor's results. The SensorXplorer board includes a USB to I^2C interface chip, a 3.3 V regulator, several indication LEDs, as well as multiple GPIOs to control the functionality of each board and allow data to be read and displayed on a PC. To get an overview of available sensor boards, as well as to download the software modules and board design files, please visit: www.vishay.com/optoelectronics/SensorXplorer.

Here you will also find a link next to each board showing its availability at each of our distributors.

The following document covers what you get in the box and how to use the kit to explore our sensor products.

KIT CONTENTS

The SensorXplorer includes the following:

- A micro USB cable to connect the SensorXplorer board to a Windows PC



- A SensorXplorer board that acts as a USB-I^2C interface between the software on the PC and the Vishay sensor boards



APPLICATION NOTE

For technical questions, contact: sensorstechsupport@vishay.com

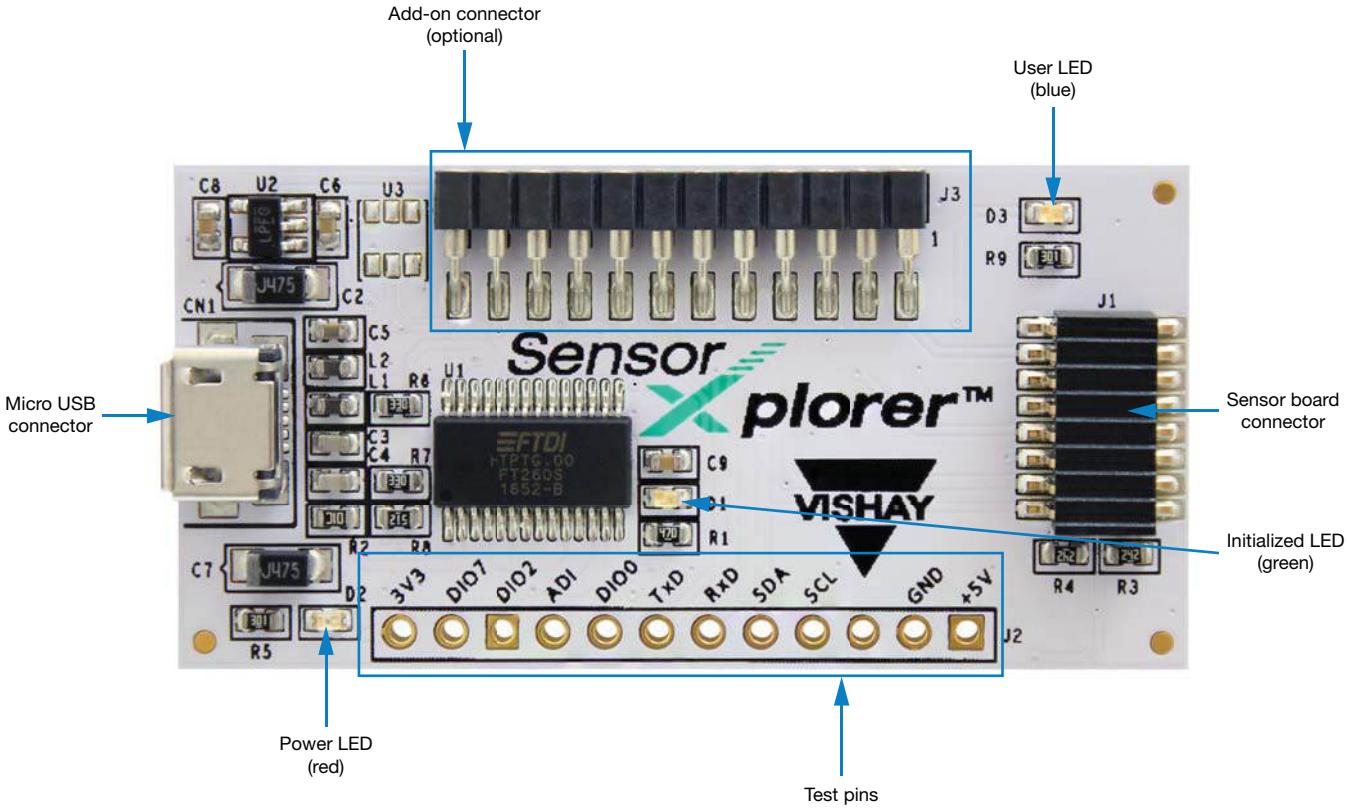
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HARDWARE DESCRIPTION

The SensorXplorer can be connected to a PC via the micro USB cable provided. As the USB-I²C interface chip is a standard HID device, the board should enumerate and driver installation should be automatic, as described in “Installing the Driver and SensorXplorer Installer”. Once connected, the power LED will indicate that the board is powered and that 3.3 V are being provided by the on-board voltage regulator. Vishay sensor boards can then be connected to the standardized sensor board connector, as shown in “Sensor Board Connector (J1)”. The add-on connector allows future control boards to be connected to the SensorXplorer; however, these are currently not supported. When a sensor board is connected and its respective software is started, the “Initialized” LED will light up to indicate that the SensorXplorer is ready to communicate with the board. The “User” LED is only used for specific applications. A further description of its use can be found in the respective sensor’s application note.

An overview of the board and its components can be found in the image below:



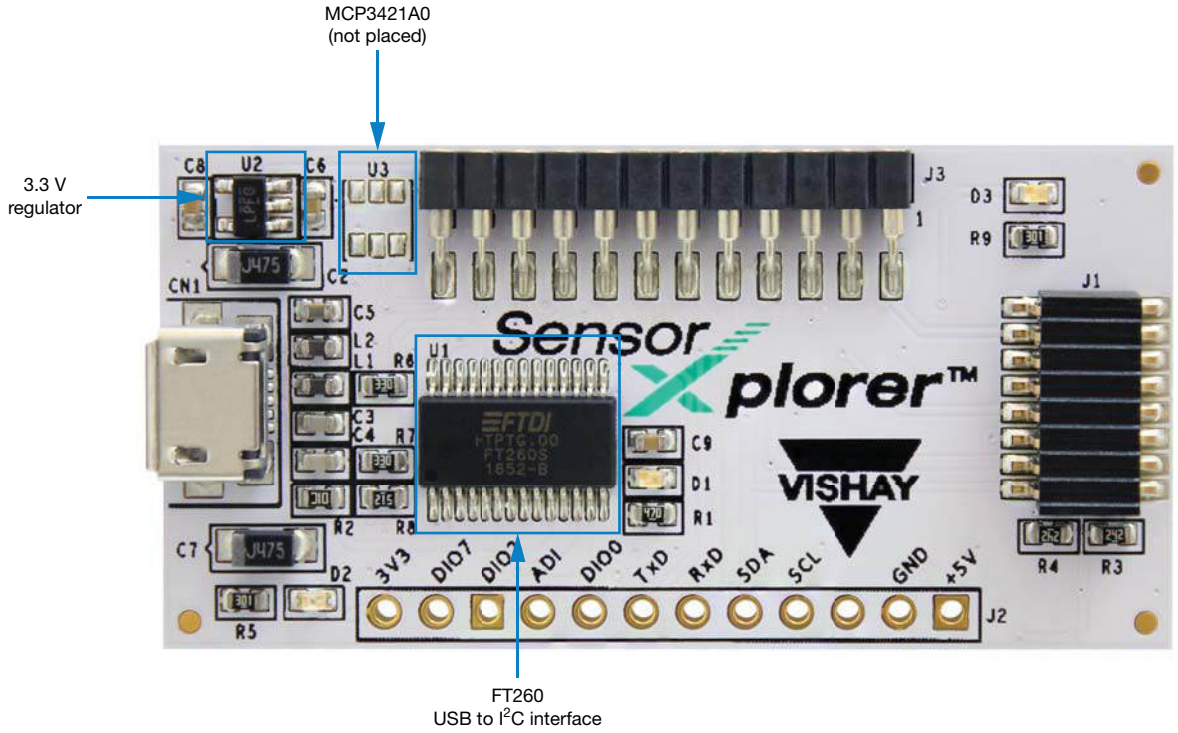
- **Micro USB connector** to connect the SensorXplorer to a windows PC
- **Add-on connector** to support future add-on boards
- **User LED** used in application-specific instances. The LED will usually be off. If used, its description can be found in the sensor’s application note
- **Sensor board connector** (2 x 8 pins) for Vishay sensor boards. Pinning descriptions can be found below
- **Initialized LED** (D2) to indicate that the SensorXplorer has been initialized by the respective software module
- **Test pins** (11 pins) to allow external equipment (e.g. an oscilloscope) to be connected

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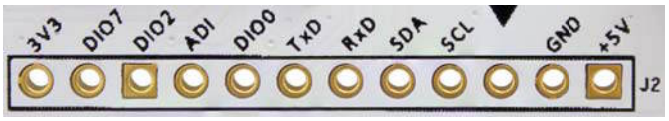
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- **FT260** full-speed HID USB to I²C interface chip (www.ftdichip.com/support/documents/datacheets/ICs/DS_FT260.pdf)
- **3.3 V regulator** to supply sensor boards (LP2985_3V3)
- **MCP3421A0** (not placed) can be placed in order to provide analog input

Test Pins (J2)

The featured test pins give access to the I²C, UART, and GPIO interfaces, as well as power and ground pins featured on the board. These pins aim to help hardware debugging while testing. As indicated by the silk screen, the pinning is as follows:



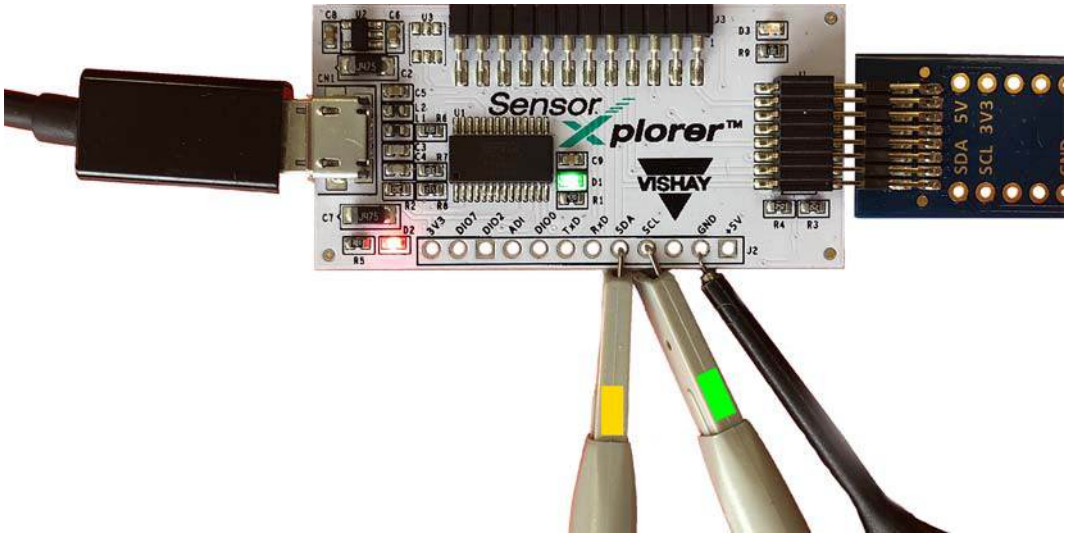
Pin 1 (+5 V)	5 V from USB port
Pin 2 (GND)	GND - ground
Pin 3	Not connected
Pin 4 (SCL)	I²C clock line
Pin 5 (SDA)	I²C data line
Pin 6 (RxD)	UART receiving line
Pin 7 (TxD)	UART transmitting line
Pin 8 (DIO0)	GPIO to control “Initialized” LED
Pin 9 (ADI)	Sensor board interrupt input / ADC input (if placed)
Pin 10 (DIO2)	GPIO connected to PA2 on sensor board connector
Pin 11 (DIO7)	GPIO connected to PA0 on sensor board connector
Pin 12 (3V3)	3.3 V supplied by on-board low dropout voltage regulator

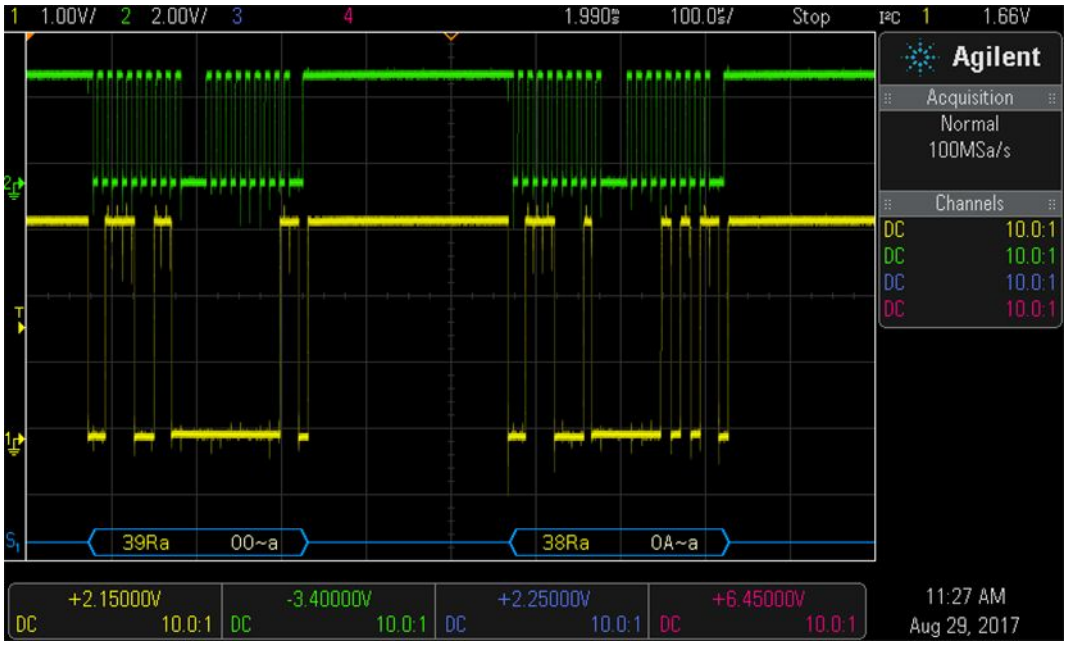
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The test pins can be either used to debug signals, e.g. to connect an oscilloscope to verify data that is being sent to the sensor or to monitor the power pins, or for prototyping on a breadboard by soldering pin headers into the test pins.



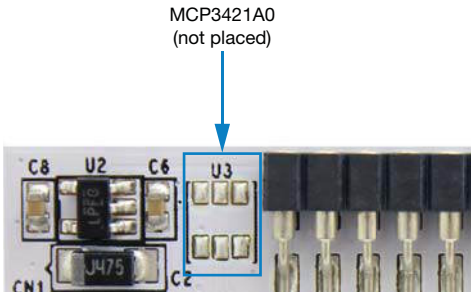


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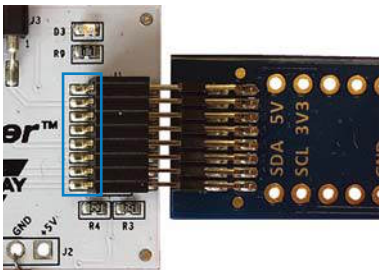
Analog to Digital Converter (optional)



As the USB to I²C chip (FT260) has no analog inputs, the PCB layout includes solder pads (U3) for a MCP3421 analog to digital converter. The SensorXplorer does not come populated with an MCP3421 device. Any Vishay sensor board that requires an analog input will have the required A/D converter populated directly on the board. If the A/D converter on the SensorXplorer is to be added manually, please be sure to choose the slave address version MCP3421A0 as documented in the schematic, resulting in a 7-bit slave address of 0x68, to avoid slave address conflicts with Vishay sensor boards. For a product overview of the MCP3421, please visit the following page: www.microchip.com/wwwproducts/en/en520011.

Sensor Board Connector (J1)

The sensor board connector is standardized for all Vishay sensor boards. Thus the SensorXplorer is compatible with all of Vishay's sensor boards. Vishay sensor boards should be connected as follows:

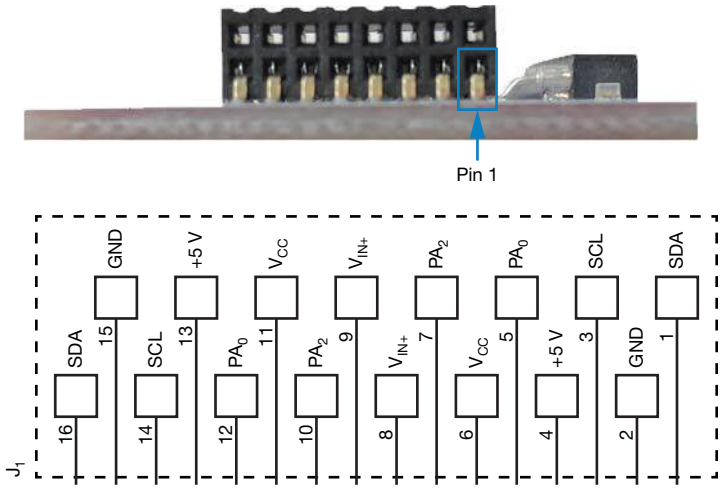


The pinning of the connector is mirrored on the SensorXplorer board, so there is an option of connecting the board the other way around; however, this is not recommended, as the connector has pins on the SensorXplorer board side of the connector, as indicated above. If the sensor board is connected the other way around, care must be taken not to push the sensor board all the way through, as this will lead to a short circuit.

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The pinout of this connector is shown below:



Pin 1, pin 16 (SDA)	I^2C data line
Pin 2, pin 15 (GND)	Ground
Pin 3, pin 14 (SCL)	I^2C clock line
Pin 4, pin 13 (+5 V)	5 V
Pin 5, pin 12 (PA_0)	DIO7
Pin 6, pin 11 (V_{CC})	3.3 V
Pin 7, pin 10 (PA_2)	DIO2
Pin 8, pin 9 (V_{IN+})	Sensor interrupt / ADC input (if placed)

Future Application Add-On Board Connector (J3) (currently not supported)

This connector does not have any function for the Vishay sensor boards. It is designed to allow for the connection of control boards in the future.



The pinout of this connector is as follows:

Pin 1	5 V
Pin 2	Ground
Pin 3	Not connected
Pin 4	I^2C clock line
Pin 5	I^2C data line
Pin 6	RxD UART receiving line
Pin 7	TxD UART transmitting line
Pin 8	DIO0
Pin 9	Sensor interrupt input / ADC input (if placed)
Pin 10	DIO2
Pin 11	DIO7
Pin 12	3.3 V

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Backwards Compatible With Vishay SensorStarterKit

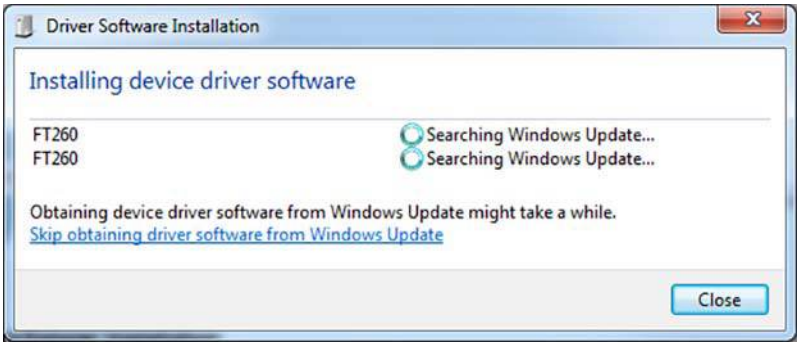
The SensorXplorer is fully backwards compatible with the USB dongle featured in the previous evaluation tool, the "SensorStarterKit". If you have already purchased such a kit in the past, all the sensor boards and respective software modules will continue to work. It is always recommended that you use the latest version of the software modules. If an upgrade is made to the SensorXplorer, be sure to run the SensorXplorer installer, documented below, in order to have all the necessary DLLs.

INSTALLING THE DRIVER AND SensorXplorer INSTALLER

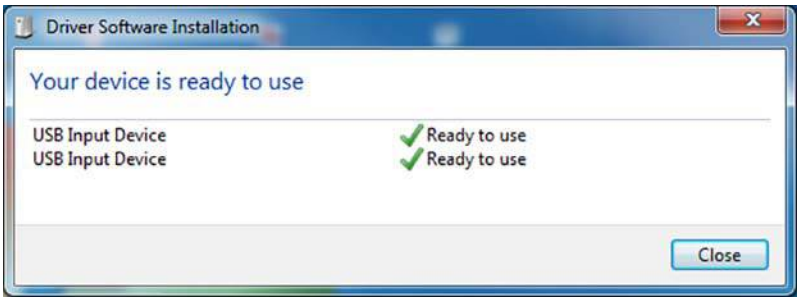
The SensorXplorer is a standard HID device and will be automatically recognized as such by the Windows OS. In order to be correctly installed, the PC should be connected to the internet when the board is first connected, so that Windows can automatically install the necessary drivers. The drivers installed are dependent on the version of Windows running on the PC. From Windows 8 and upwards, Microsoft includes a new HID miniport driver that allows direct communication with I^2C devices via HID. The FT260 featured on the SensorXplorer is compatible with this driver, so the SensorXplorer should function correctly out of the box.

USB HID Driver Installation

For devices running a Windows version prior to Windows 8, some additional drivers will need to be installed. Upon connecting the SensorXplorer to the PC, Windows will automatically start to look for these drivers. The installation can take several minutes and the status is shown in a separate pop-up window, which can be called from the task bar close to where the clock is located.



Windows will then download the generic HID driver from the internet. After successful installation, the status window will show the two green checks, as shown in the picture below.



Do not disconnect the SensorXplorer until driver installation has been completed.

Windows installs two separate drivers for the SensorXplorer, as the USB interface chip featured on the board is configured for and gives access to two separate interfaces:

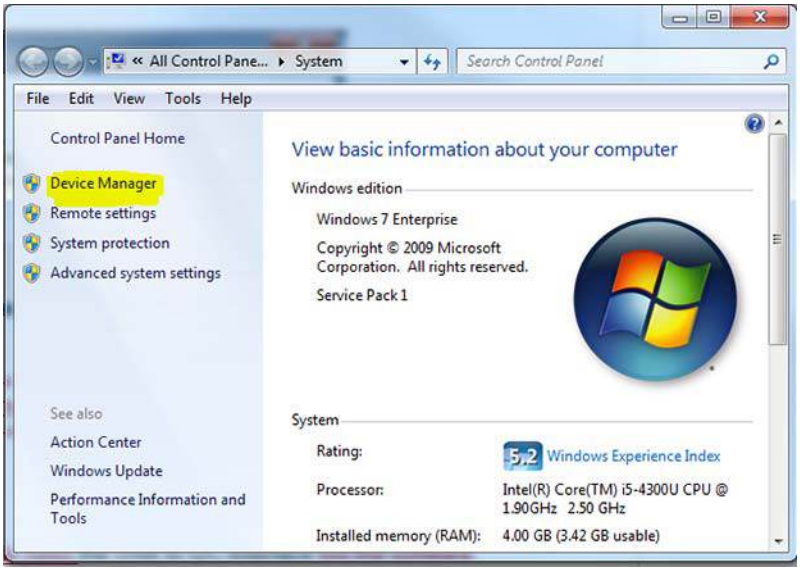
- USB to I^2C
- USB to UART

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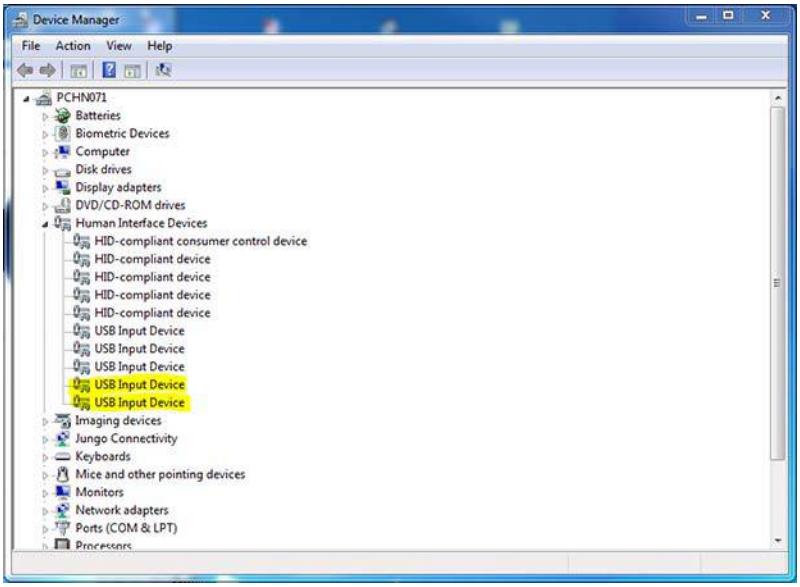
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Vishay sensor boards only make use of the USB to I²C interface, as all the digital sensors offered by Vishay feature an I²C interface. The UART interface can be used for debugging in future applications; however, it has no function in the standard Vishay software modules.

The successful installation of the drivers can be verified in the device manager. To access the device manager, right click on the “My Computer” symbol and choose “Properties”. A new window will pop up, as shown in the picture below. The device manager can then be opened from the pane on the left-hand side:



Next, expand the list of the “Human Interface Devices”, as shown below. Count the amount of USB input devices listed. When the SensorXplorer board is disconnected, the number of USB input devices should be reduced by two (one for each of the interfaces listed above).



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SensorXplorer Installer

In order to use the software modules for each of the respective sensor boards, the SensorXplorer installer should first be run, as this installs the required LabView 2013 runtime engine, as well as the license files for the drivers. The SensorXplorer installer can be downloaded from the SensorXplorer website: www.vishay.com/optoelectronics/SensorXplorer. Once downloaded, unzip the file and start the “setup.exe” file from within the unzipped folder. You will be presented with the following screen:



Follow the instructions in the installation wizard to install the runtime engine and license files. The installation may require administrative privileges.



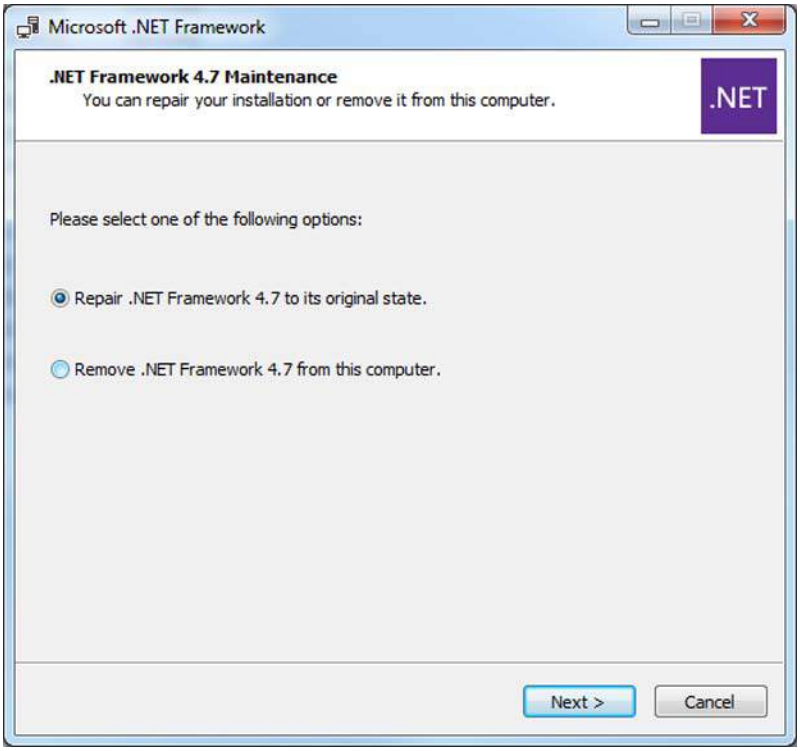
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The SensorXplorer installer will prompt you to choose an installation directory. The SensorXporer directory should be kept unchanged, as the DLLs necessary for the sensor board software modules to work are copied into this directory and are referenced as absolute paths. Thus these files must reside in this directory. The “National Instrument products” in the above image refer to the installation of the LabView 2013 runtime engine. You may choose the installation path; however, it is recommended that the standard directory is used.

After the SensorXplorer installation is complete, the .Net 4.7 installer is automatically launched. .Net 4.7 is required for the DLLs that communicate with the HID interface to work. Follow the instructions given in the wizard to complete the installation. If the PC already has .Net 4.7 installed, then the installer will offer to repair or remove the installation, as shown in the screenshot below. There is no need to repair the installation, so the installer can be closed / canceled.



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Installing the Driver when using the SensorStarterKit Dongle (predecessor of the SensorXplorer)



As mentioned above, the SensorXplorer sofware and respective sensor board software modules are fully backwards compatible with the previous SensorStarterKit. In order to use these modules with the SensorStarterKit USB dongle (pictured above), the respective driver must be installed. As this is an unsigned driver, this must be installed manually. After running the SensorXplorer installer (version 1.05 and above), the driver files will be placed in the following directory:

C:\Program Files (x86)\Vishay SensorXplorer\

Please follow the instruction below to install the driver:

Click on Start

Right click on Computer

Click on Manage

Click on Device Manager

Right click on “Unknown device”

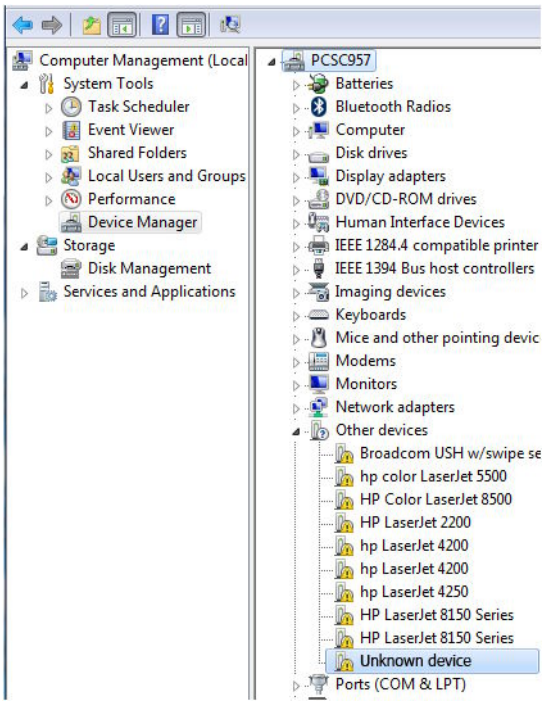
Select “Properties”

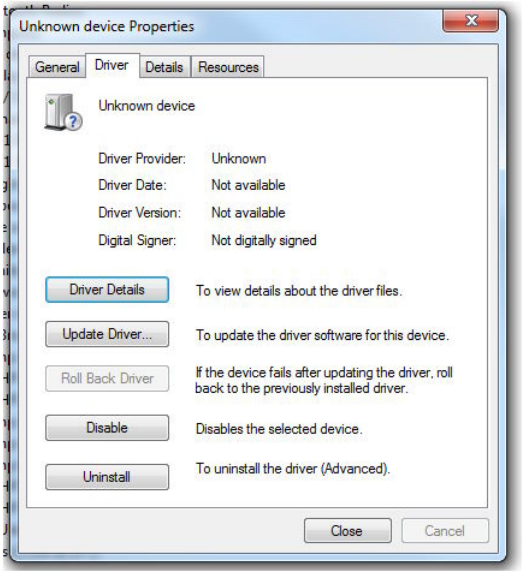
Select Driver tab

Click on Update Driver

Click on Browse

Navigate to:
C:\Program Files (x86)\Vishay SensorXplorer\USB Drive





Restart computer

The respective sensor board software modules should now function as intended when used with the SensorStarterKit USB dongle.

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INSTALLING THE SensorStarterKit UNSIGNED DRIVER ON WINDOWS 10

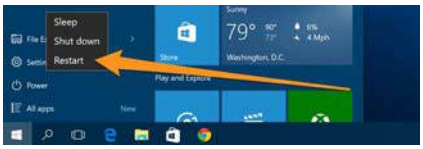
In order to install the above mentioned unsinged driver on a windows 10 machine, some additional steps must be taken as the driver signature verification must be disabled.

The following explains how to go about this process:

Source:
http://www.howtogeek.com/167723/how-to-disable-driver-signature-verification-on-64-bit-windows-8.1-so-that-you-can-install-unsigned-drivers/

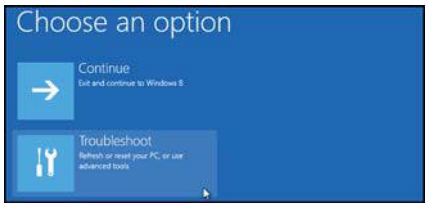
To disable driver signature verification, we are going to need to get into the troubleshooting options from the boot manager. The easiest way to bring this screen up is to select restart from the power options menu (on Windows 8 that is under charms or on the login screen, and in Windows 10 it is on the start menu).

Hold down the SHIFT key while you click restart.

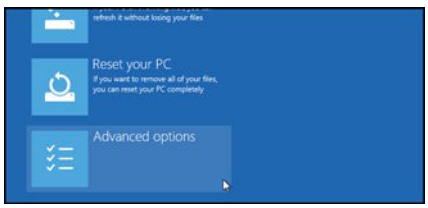


(Again, you can use this trick on any of the power menus in Windows 8 or 10, whether on the login screen, charms bar, start menu, or start screen)

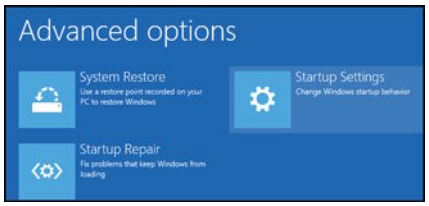
Once your computer has rebooted you will be able to choose the troubleshoot option.



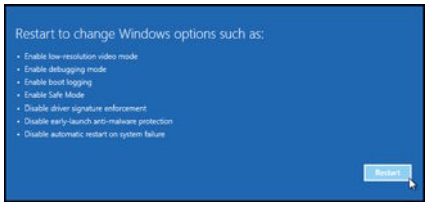
Then head into advanced options.



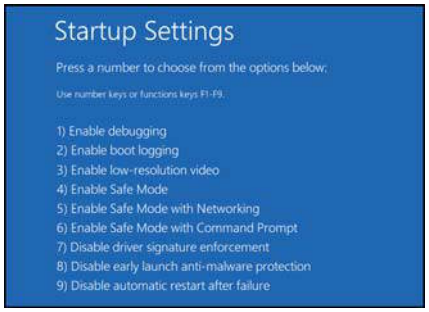
Then startup settings.



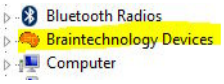
Since we are modifying boot time configuration settings, you will need to restart your computer one last time.



Finally, you will be given a list of startup settings that you can change. The one we are looking for is “Disable driver signature enforcement”. To choose the setting, you will need to press the F7 key.



That is all there is to it. Your PC will then reboot and you will be able to install unsigned drivers without any error message. After the driver has been correctly installed an orange logo should appear in the device manager when the USB dongle is plugged into the PC:



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SENSOR BOARDS AND SOFTWARE MODULES

Most digital sensors offered by the Vishay Optoelectronics group have an associated sensor board that can be used to test the sensor's features, as well as give an indication of its performance. Each of these boards has an associated demo software module to get you up and running with testing quickly. The software modules map each of the sensor's registers, the function of which is documented in the sensor's application note, to a control, so that its influence on the sensor's results can be tested. The demo software modules for each sensor board can be downloaded from the SensorXplorer website (www.vishay.com/Opticalsensors/SensorXplorer). Once downloaded, the software modules do not need to be installed but simply unzipped, after which the "exe" should be started from within the unzipped folder.

Vishay Sensor Boards

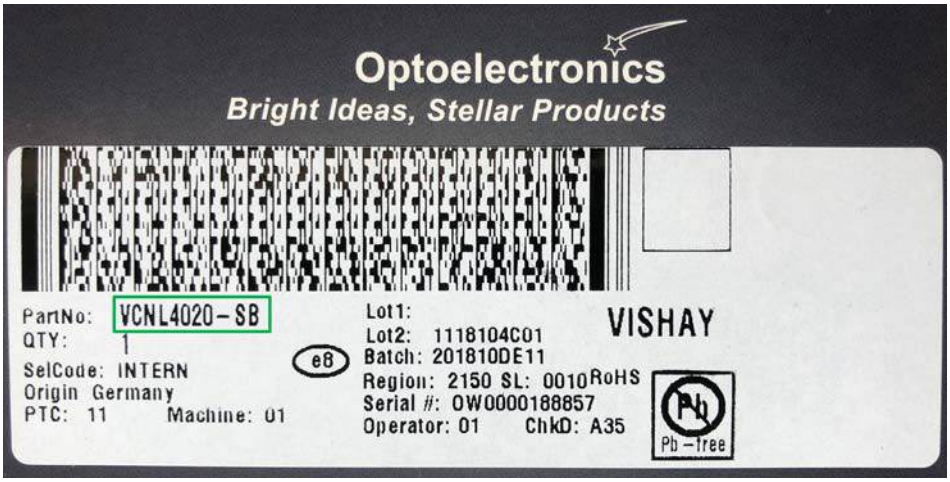
Vishay sensor boards can be ordered through one of our many distributors. For an overview of availability for each of the boards, please visit the SensorXplorer website and click the shopping cart icon located next to each board.



The search function of the following screen can then be used to check the worldwide availability of the board.



When the board arrives, the name featured on the barcode on the back indicates the board type. Below is an example of the VCNL4020 sensor board:



All sensor boards come with the same connector pinout, making them all compatible with the SensorXplorer board. This pinning includes the I^2C communication pins and the GPIOs necessary for the demo application, as described in the "Hardware Description" section above.

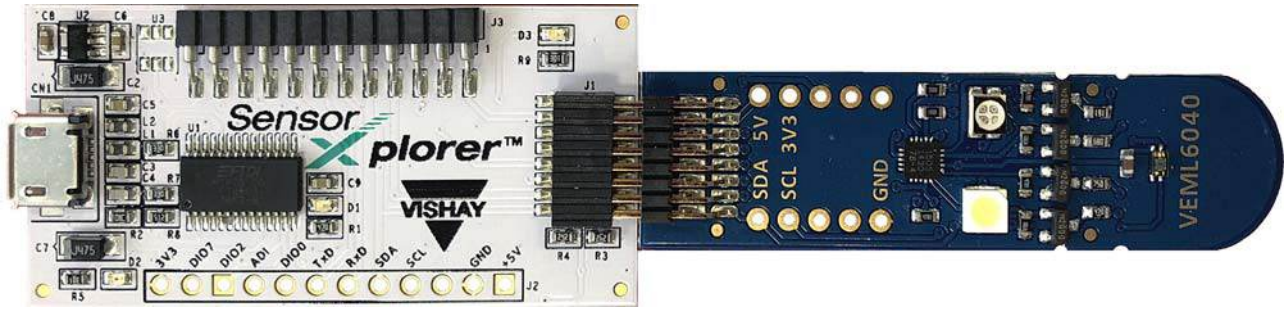
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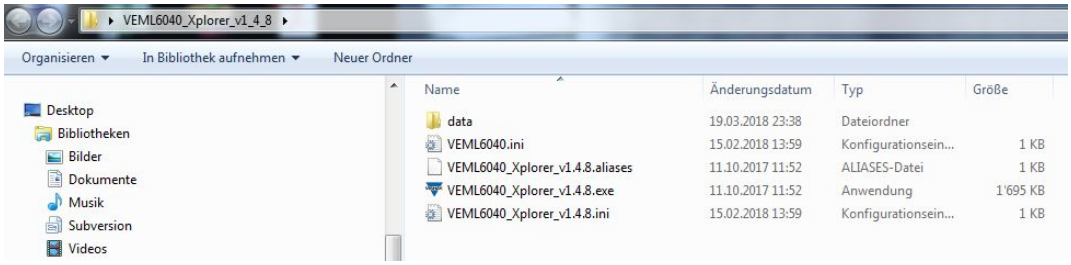
SensorXplorer™ Installation Guide

Using the Sensor Boards With the SensorXplorer

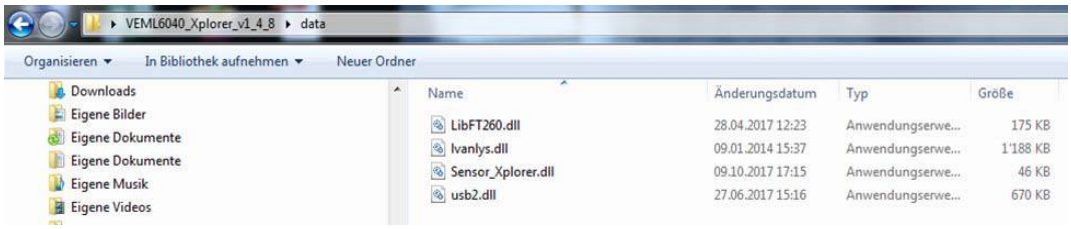
To use the SensorXplorer with a sensor board and the respective software module, the SensorXplorer board should be connected to the sensor board as shown in the picture below. The VEML6040 board will be used as an example, but the steps are valid for any board.



After having connected the sensor board to the SensorXplorer and the SensorXplorer to the PC, unzip the respective demo software. Open the unzipped folder and start the executable from within the folder:



The data folder contains the required DLLs for the executable to run and for the hardware communication to function. This folder should not be moved or deleted, as the executable references it as a relative path.

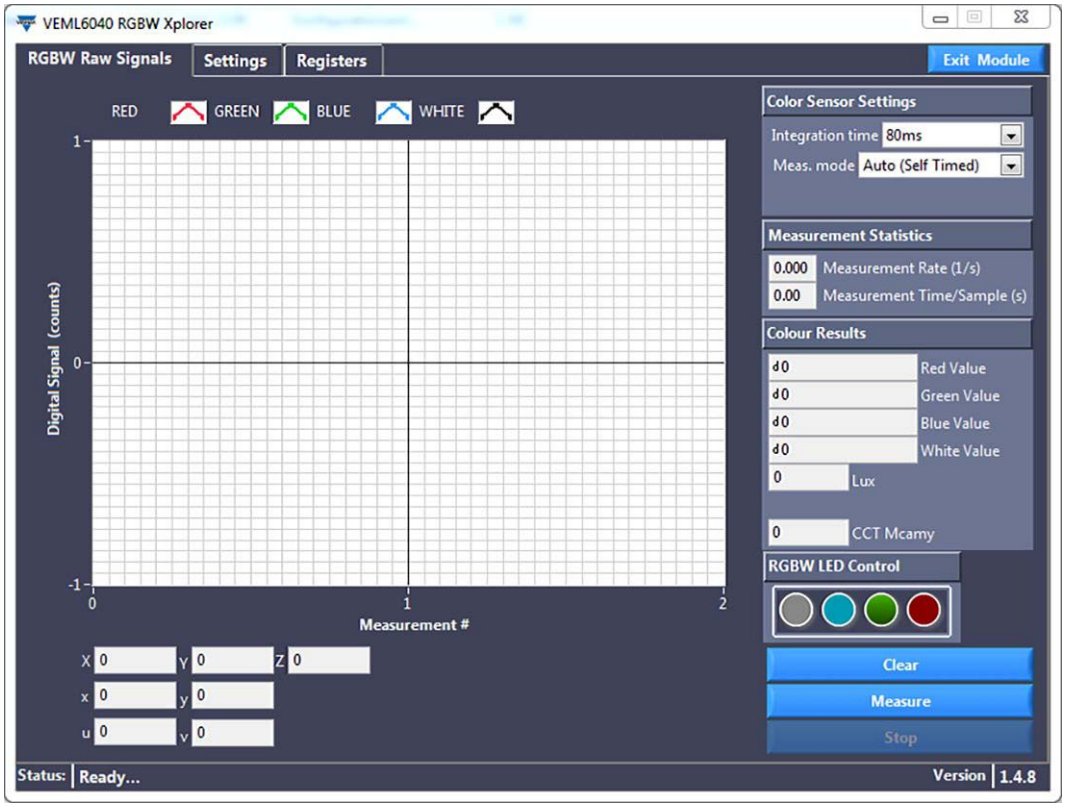


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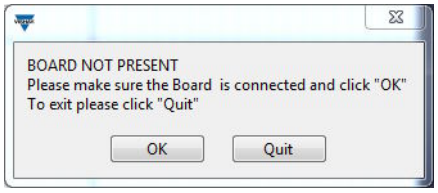
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Start the application.exe file that has the same name as the sensor to be tested. The demo software GUI opens and will look similar to the example below.

The green SensorXplorer “Initialized” LED will light up to indicate that the communication to the hardware is functioning correctly. The following user interface will open and the board is ready to be used:



If the sensor board is not connected properly and fails, the following pop-up window will appear. Either connect the board and click “OK” to begin the initialization process again, or click “Quit” to close the software.

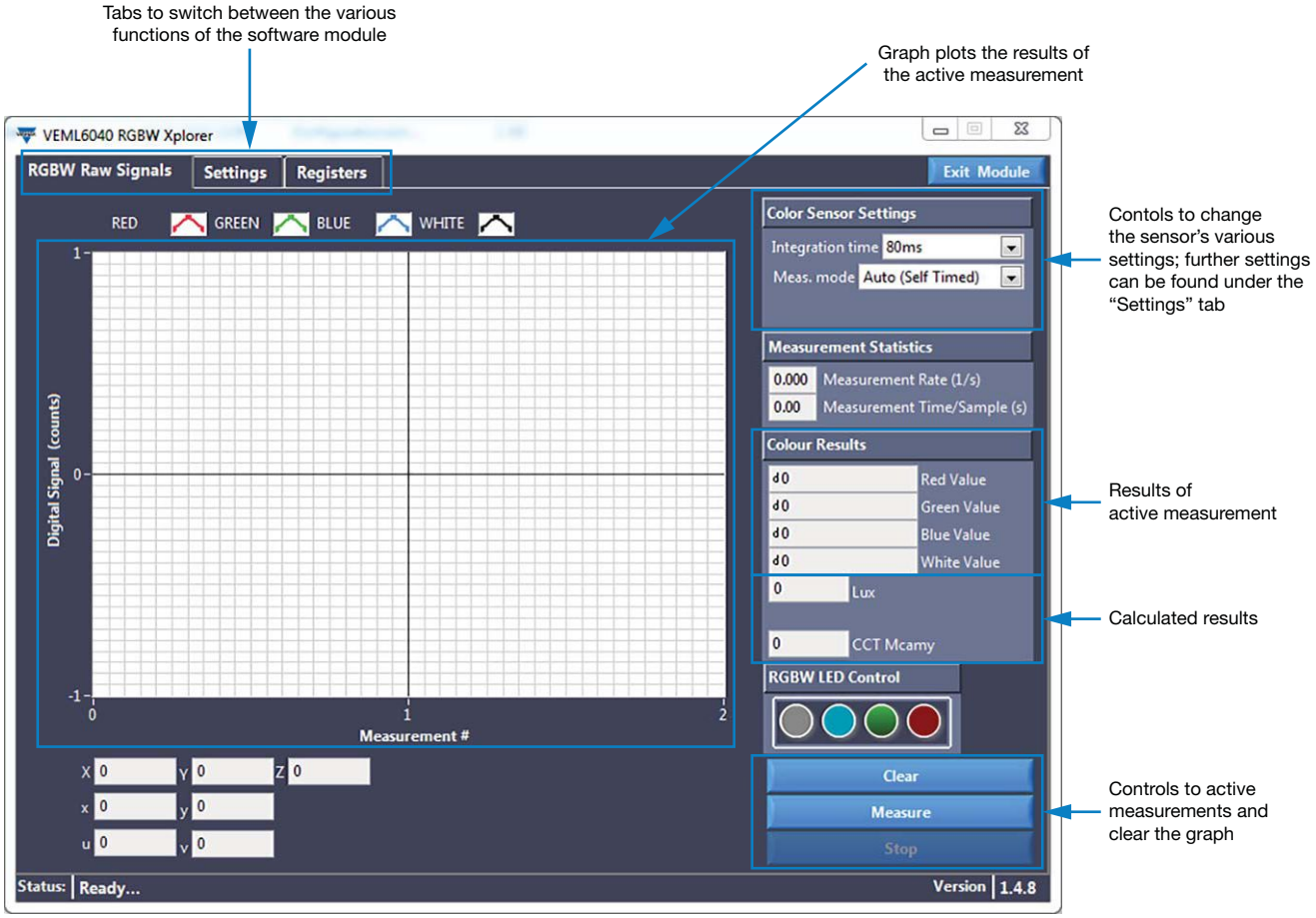


APPLICATION NOTE

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Depending on the component being tested, different sensing capabilities will be displayed on the horizontal tabs (e.g. ALS, proximity, RGB measurements). Measurements can be started and stopped with the controls on the bottom right-hand side of the UI. An overview of a typical software module layout can be found below:



BOARD DESIGN FILES

If you want to know exactly what is going on with your purchased SensorXplorer or sensor board, the deign files are freely accessible. These files can be downloaded on the SensorXplorer website: www.vishay.com/Opticalsensors/SensorXplorer.

Within each downloaded zip file you will find the schematic, assembly plan, and well as the BOM for every board.

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TROUBLESHOOTING

The SensorXplorer Board is not Recognized by the Windows PC

The generic HID driver required by the FT260 chip should install automatically after connecting the SensorXplorer. Make sure that you are connected to the internet when connecting the SensorXplorer to a PC for the first time, so that any necessary drivers can be installed by Windows automatically. Double check if the red power LED (D2) is “on” to indicate that the board has the correct power supply. Also make sure that the “data USB” cable, such as the one provided, is used, as a USB cable that only supplies power will not work with the SensorXplorer. Lastly, double check that the SensorXplorer is listed as a generic HID device, as explained in the “Driver Installation” section above. If it does not get listed, try to connect to a different USB port.

Error Code “Device Closed Failed”

This indicates that the DLL used to communicate with the SensorXplorer is in a non-defined state. This can either be a result of a faulty driver installation, e.g. the SensorXplorer board was disconnected during the driver installation process, or a software crash led to an undefined state of the DLL. Please connect the SensorXplorer board to a different USB port and restart the desired application software.

Board not Found

This error indicates that the slave address of the sensor under evaluation was not acknowledged and there has been a communication error.

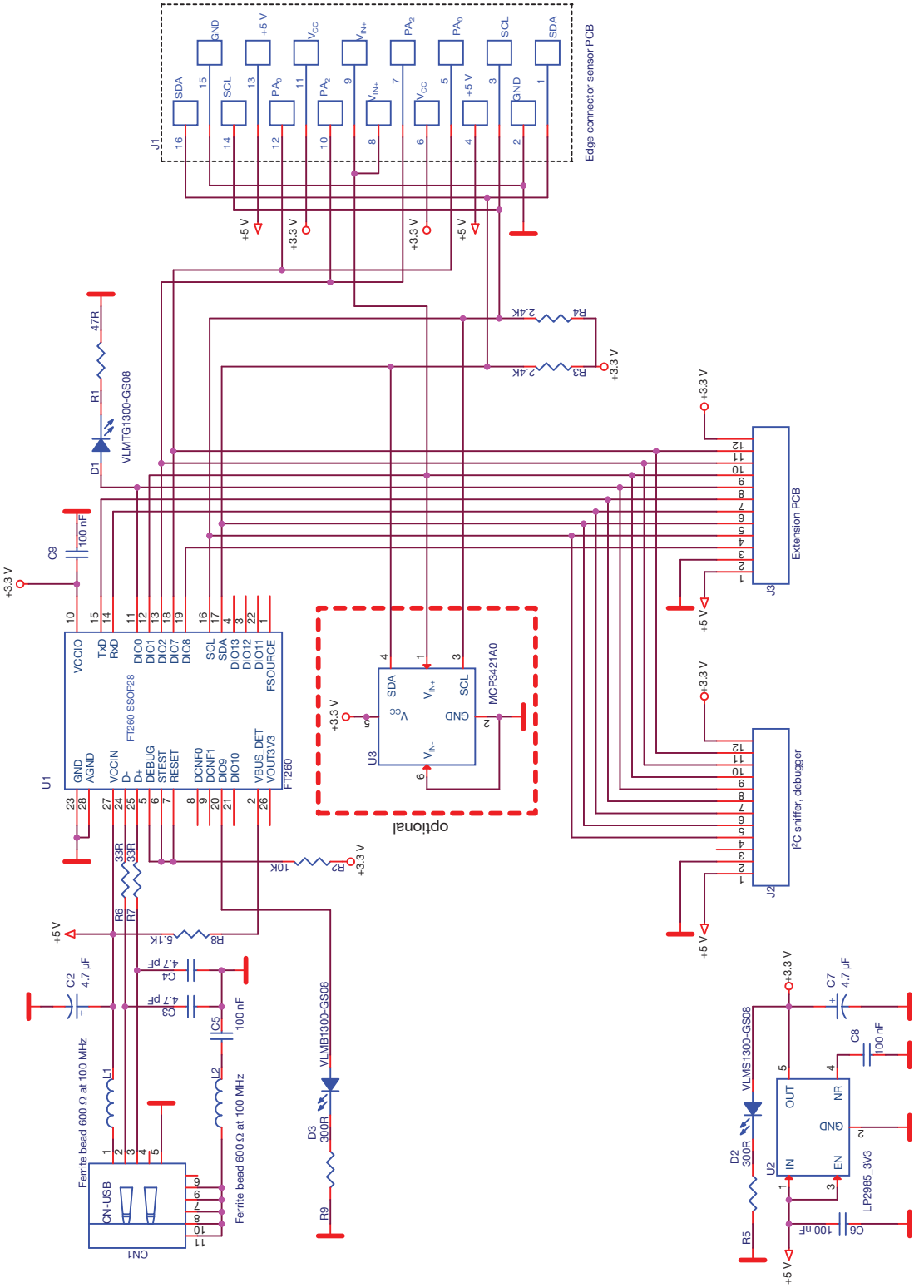
Make sure that you are using the software module that is intended for the connected board. Double check that the sensor board is connected firmly to the SensorXplorer and that the sensor board is connected.

If you experience further issues, please contact us via the alias support email: sensorstechsupport@vishay.com.

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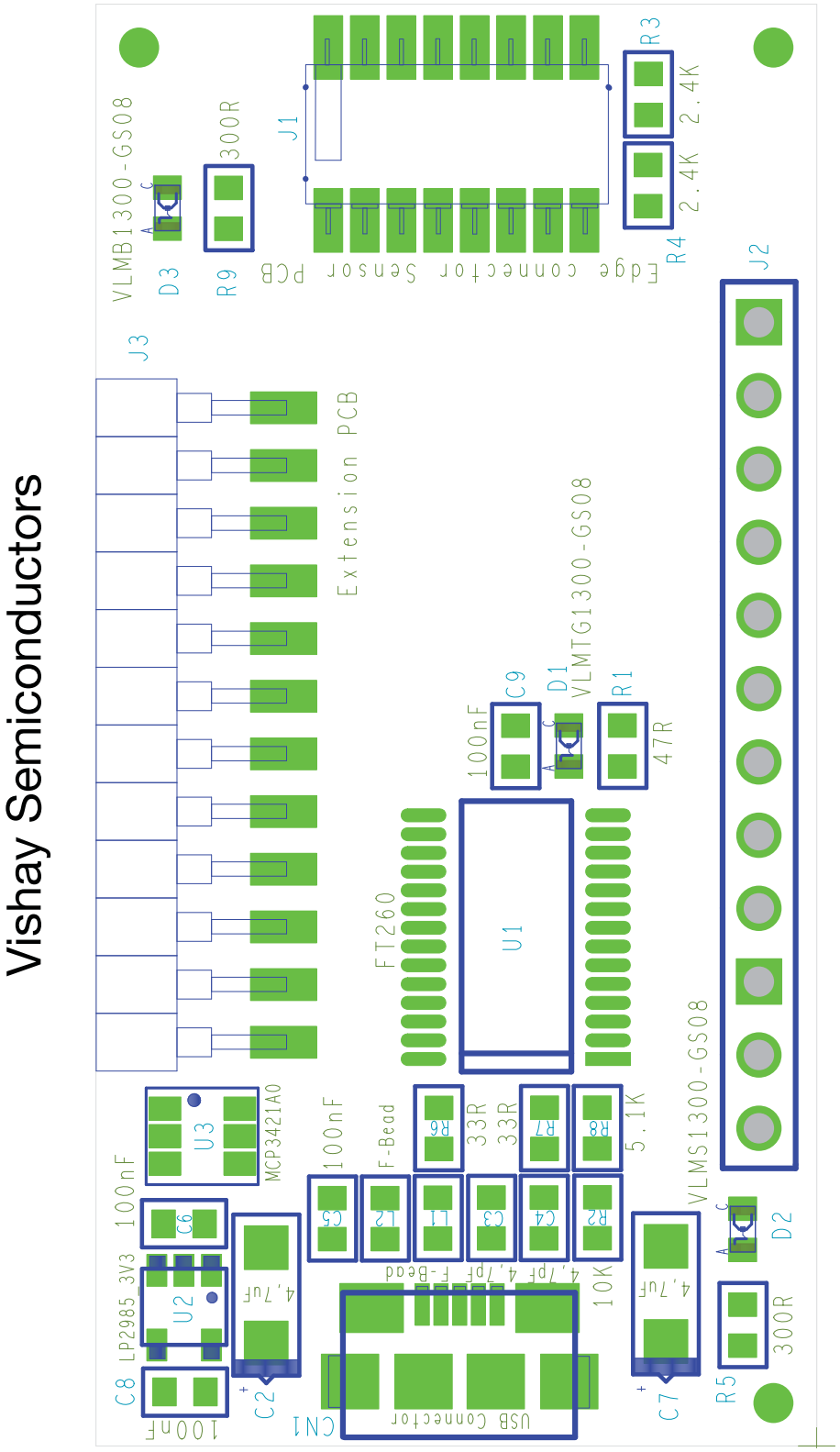
APPENDIX



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BILL OF MATERIALS					
ITEM	QUANTITY	REFERENCE	COMPONENT CLASS	VALUE	PACKAGE
1	1	C2	Capacitor	4.7 µF	SMC1206POL
2	1	C3	Capacitor	4.7 pF	SMC0603
3	1	C4	Capacitor	4.7 pF	SMC0603
4	1	C5	Capacitor	100 nF	SMC0603
5	1	C6	Capacitor	100 nF	SMC0603
6	1	C7	Capacitor	4.7 µF	SMC1206POL
7	1	C8	Capacitor	100 nF	SMC0603
8	1	C9	Capacitor	100 nF	SMC0603
9	1	R1	Resistor	47 Ω	SMR0603
10	1	R2	Resistor	10 kΩ	SMR0603
11	1	R3	Resistor	2.4 kΩ	SMR0603
12	1	R4	Resistor	2.4 kΩ	SMR0603
13	1	R5	Resistor	300 Ω	SMR0603
14	1	R6	Resistor	33 Ω	SMR0603
15	1	R7	Resistor	33 Ω	SMR0603
16	1	R8	Resistor	5.1 kΩ	SMR0603
17	1	R9	Resistor	300 Ω	SMR0603
18	1	L1	Inductor	Ferrite bead 600 Ω at 100 MHz	SMD0603
19	1	L2	Inductor	Ferrite bead 600 Ω at 100 MHz	SMD0603
20	1	D1	LED	Green (VLMTG1300)	SMD0603
21	1	D2	LED	Red (VLMS1300)	SMD0603
22	1	D3	LED	Blue (VLMB1300)	SMD0603
23	1	U1	IC	FT260	TSSOP28
24	1	U2	LDO	LP2985 3V3	SOT23/5
25	1	CN1	Connector	USB connector micro	USB SMD micro
26	1	J1	Connector	Edge connector sensor PCB	SMD receptacle 2 x 8
27	1	J3	Connector	Extension PCB	SMD Header Strip 12

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