

BME280

Desktop Development 2.1 User Manual



BME280 User Manual

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1 About user manual

This manual describes the installation and usage of the Development Desktop 2.1 User Interface (DD2.1 UI); a Windows based PC software application and related embedded firmware/software developed by **Bosch Sensortec** for demonstration and evaluation of sensors.

1.1 Who should read this manual

This information is intended to users who wish to use the BME280 sensor alongside DD2.1 UI to graphically display the Indoor Air Quality (IAQ), relative humidity, altitude, and associated components.

1.2 DD2.1 UI Overview

DD2.1 UI is a PC based software used to read, capture, and display sensor data. To display the sensor data of BME280 on DD2.1 UI, mount the sensor on the **Bosch Sensortec** application board. This is a universal demonstration environment for **Bosch Sensortec** sensor products.

Bosch Sensortec sensors are mounted on sensor specific shuttle boards. All sensors shuttle boards have an identical footprint and can be plugged into the application board's shuttle board socket. DD2.1 UI automatically detects the sensor that has been plugged in and starts the corresponding software application.

1.3 Sensor Communication:

DD2.1 UI software supports both SPI and I²C to communicate with the sensor.

1.4 Graphical display:

DD2.1 UI displays the sensor data and interrupts in different graphical formats.

1.5 Data logging:

DD2.1 UI offers data logging of the sensor data.

2 About the BME280

The typical applications that use BME280 are:

- Context awareness, e.g. skin detection, room change detection
- Fitness monitoring / well-being
- Warning regarding dryness or high temperatures
- Measurement of volume and air flow
- Home automation control
- control heating, venting, air conditioning (HVAC)
- Internet of things
- GPS enhancement (e.g. time-to-first-fix improvement, dead reckoning, slope detection)
- Indoor navigation (change of floor detection, elevator detection)
- Outdoor navigation, leisure and sports applications
- Weather forecast
- Vertical velocity indication (rise/sink speed)

The targeted devices that use BME280 are:

- Handsets such as mobile phones, tablet PCs, GPS devices
- Navigation systems
- Gaming, e.g. flying toys
- Camera (DSC, video)
- Home weather stations
- Flying toys
- Watches

Table 1 : The technical specifications of the BME280 sensor

Parameter	Technical Data
Package Dimensions	8-Pin LGA with metal 2.5 x 2.5 x 0.93 mm ³
Operation Range (full accuracy)	Pressure: 300...1100 hPa Temperature: -40...85°C
Supply Voltage V _{DDIO}	1.2 ... 3.6 V
Supply Voltage V _{DD}	1.71 ... 3.6 V
Interface	I ² C and SPI
Average current consumption (1 Hz data refresh rate)	1.8 µA @ 1 Hz (H, T) 2.8 µA @ 1 Hz (P, T) 3.6 µA @ 1 Hz (H, P, T) T = temperature
Average current consumption in sleep mode	0.1 µA
Pressure sensor RMS Noise Sensitivity Error Temperature coefficient offset	0.2Pa (equiv. to 1.7cm) ±0.25% (equiv. to 1m at 400m height change) ±1.5Pa/K (equiv. to ±12.6cm at 1 °C temperature change)
Humidity sensor: Response time (τ63%) Accuracy tolerance Hysteresis	1 s ±3% relative humidity ≤2% relative humidity

3 Getting Started

The below sections highlight the procedure to set up connections between BME280, DD2.1 UI , and the PC.

3.1 Setting Up the board-PC connection

The procedure to connect sensor to PC via USB is as below:

- ▶ Install DD2.1 UI
- ▶ Insert the shuttle board and application board.

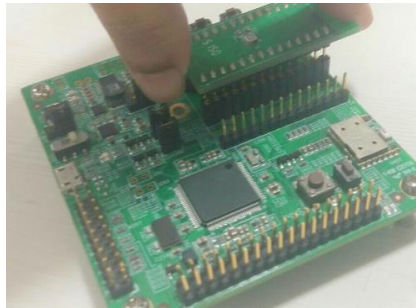


Figure 1 : Insert sensor for APP2.0



Figure 2 : Insert sensor for APP3.0

- ▶ Connect the board and PC using a USB cable/Bluetooth.



Figure 3 : Connect board and PC for APP2.0

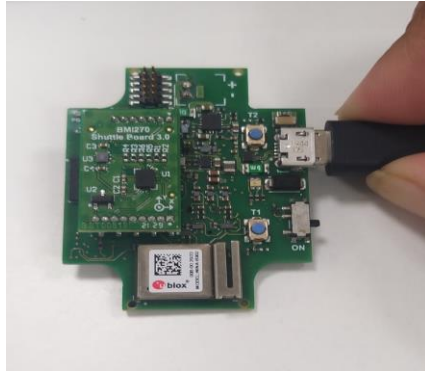


Figure 4 : Connect board and PC for APP3.0

- Turn the on/off switch **ON**. The LED glows.

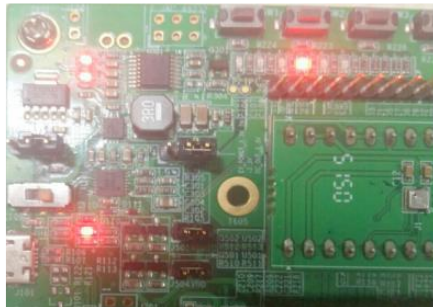


Figure 5 : Connection complete for APP2.0

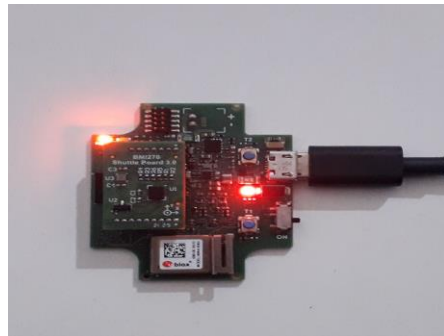


Figure 6 : Connection complete for APP3.0

To start the DD2.1 UI software:

- Click Start -> Programs -> Development Desktop 2.1.
- Or
- Double click the DD2.1 UI software icon on the desktop.

The Graphical User Interface (GUI) of the software is as seen below:

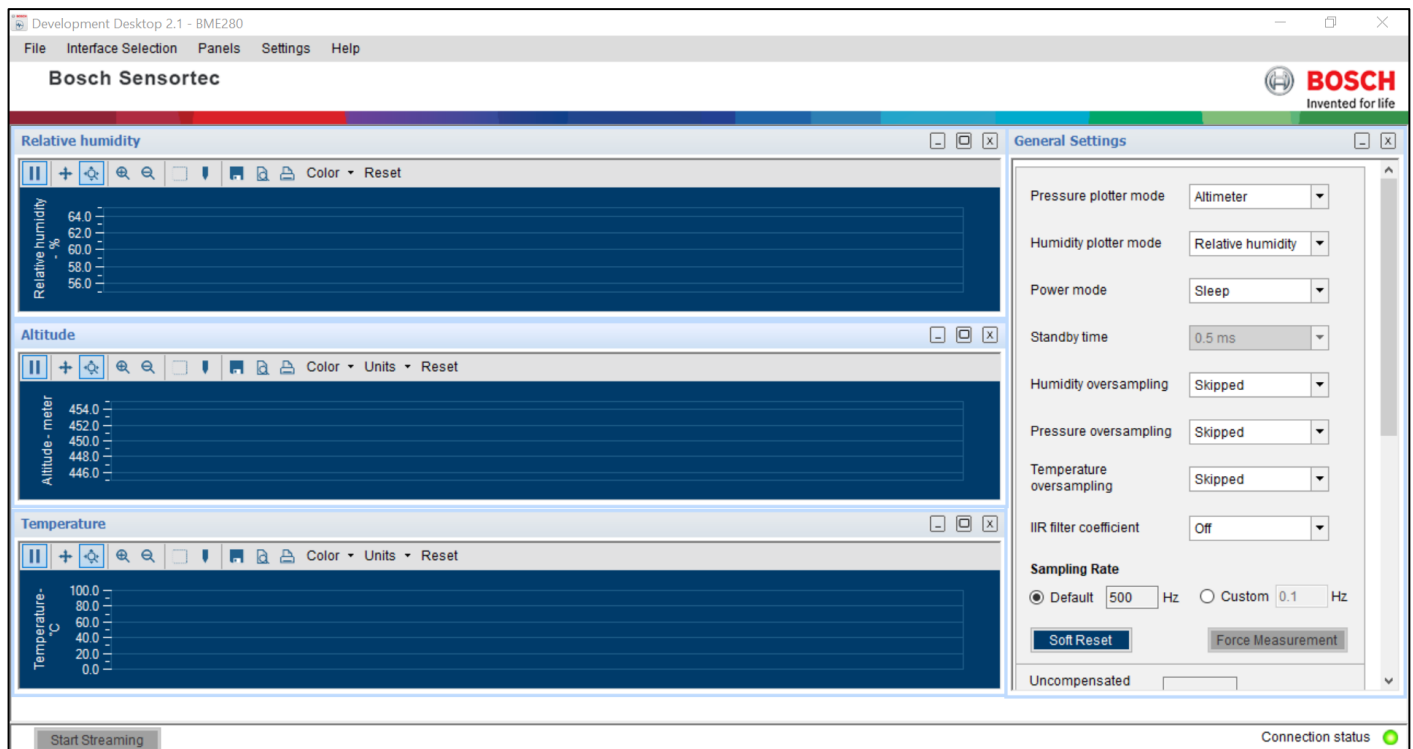


Figure 7 :: DD2.1 UI Startup View

When the PC and board are connected, the Communication Status glows green as shown below:

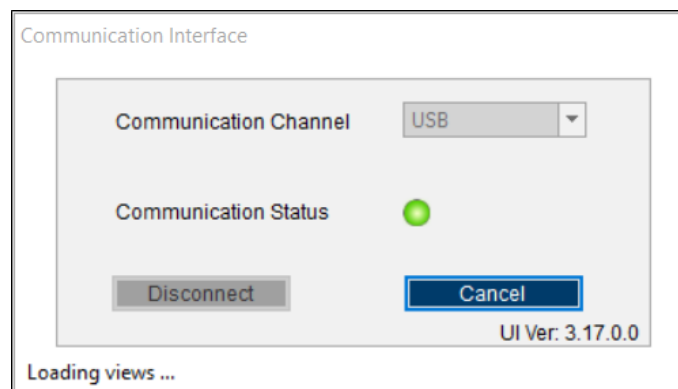



Figure 8 : Communication Status

- The communication status is also indicated at the bottom right of the GUI at all times:

Connection status 

- Other menu options include:
 - File
 - Interface Selection
 - Panels
 - Settings
 - Help

These menu options are explained in detail in the following sections.

3.2 Upgrading Firmware

3.2.1 For App 2.0 Board:

To upgrade the firmware of DD2.1 UI to match the current version, follow the steps below:

- Click **Menu -> Settings-> Firmware Upgrade**. The following window appears:

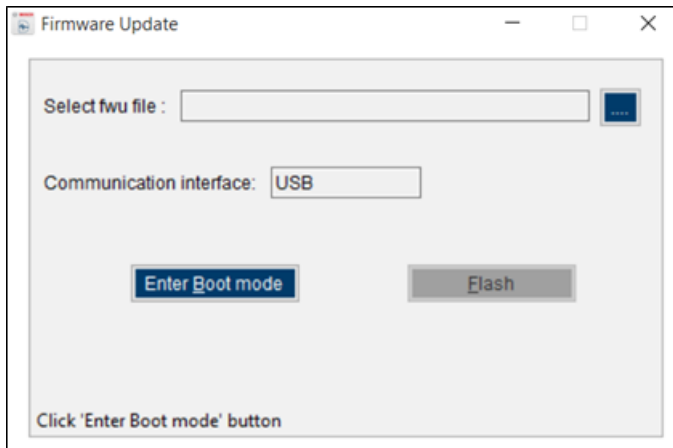


Figure 9 : Firmware upgrade window

- Click Enter Boot mode.

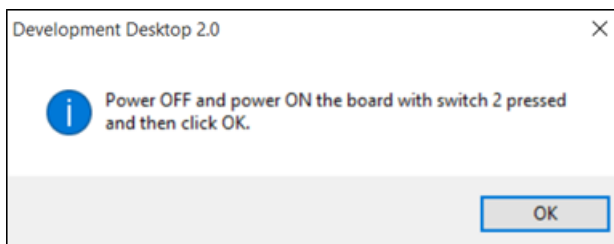


Figure 10 : Application Boot Loader

- Switch off board, and press **Switch 2**. In Application board, all four LEDs will glow simultaneously.
- Click **OK**.
- All four LEDs will glow simultaneously.
- Press **OK**.

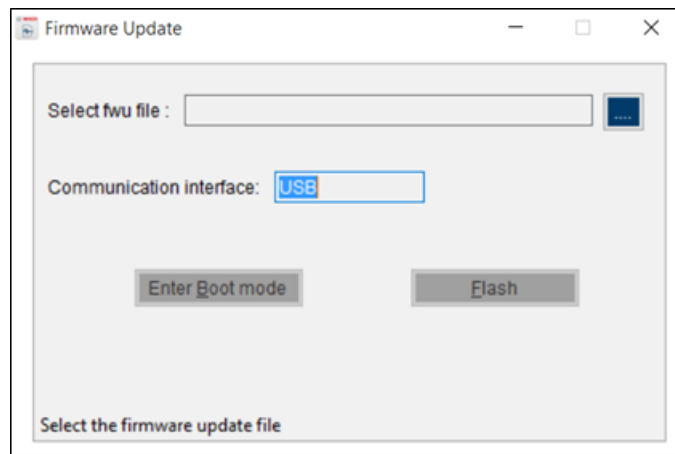


Figure 11 : Boot mode Detected

- Select the default firmware update file (*.fwu2) from the DD2.1 UI installation directory in the folder **Firmware**.
- Click **Flash**.

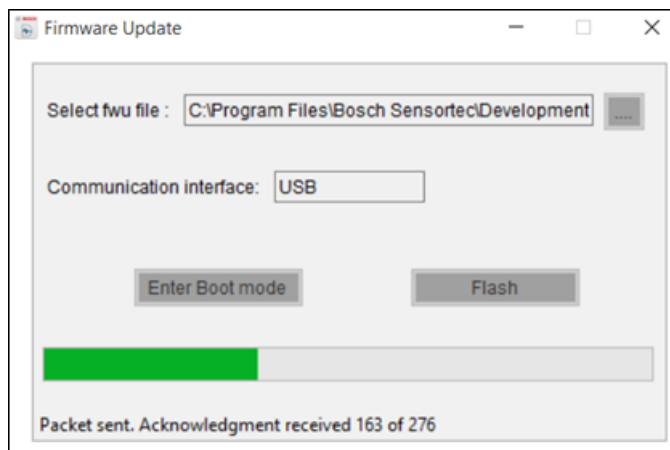


Figure 12 : Firmware upgrade completion

- Once firmware upgrade is complete, restart the application board, and DD2.1 UI.

3.2.2 For App 3.0 Board:

To upgrade the firmware of DD2.1 UI to match the current version, follow the steps below:

1. Click **Menu -> Settings-> Firmware Upgrade**. The following window appears:

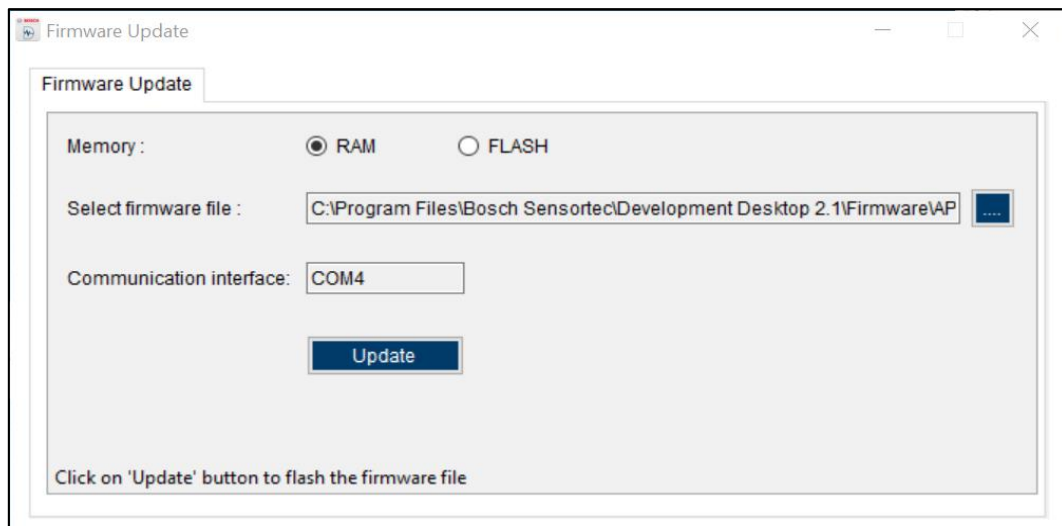


Figure 13 : Firmware upgrade window

Default firmware file (*.bin) will be automatically chosen from the DD2.1 UI installation directory in the folder **Firmware\App3.0**.

2. Choose RAM or Memory option to flash the latest recommended firmware file.
3. The file path will get automatically chosen/selected in the select firmware file path textbox. User can also select the firmware as required.
4. Click on **Flash**.
5. DD2.1 recommended firmware is COINES_bridge firmware for App3.0 shuttle board. If the user chose to flash DD firmware, a popup message will be shown. User can still choose the DD firmware and proceed.

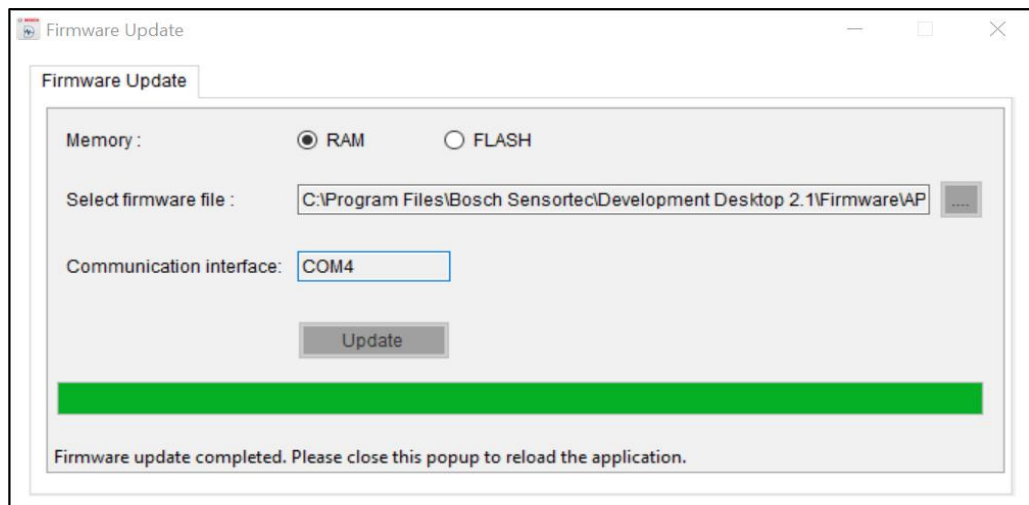


Figure 14 : Firmware upgrade completion

6. Once firmware update is completed, Please close the popup and DD 2.1 application will get automatically reloaded.

4 Working with DD2.1 UI

The functions of the BME280 sensor are discussed in details in the below sections.

4.1 Sensor Data

4.1.1 Altitude

- To view altitude on the plotter, go to **Panels -> Altitude**, or click **Ctrl+P**.
- The altitude can be seen in either the altitude panel, or altimeter dial display.
- To see variations in the altitude data, move the sensor up and down vertically.
- Units of measurement include:
 - Meter
 - Feet
- The different plotter modes in altitude include:
 - Altimeter: Displays altitude in the plotter and dial
 - Barometer: Displays Sea level pressure in the plotter
 - Manometer: Displays absolute pressure in the plotter

4.1.2 Relative Humidity

- To view relative humidity data on the plotter, go to **Panels -> Relative Humidity**, or click **Ctrl+H**.
- To see variations in humidity data, introduce elements of different humidity/ moisture levels over the sensor.
- The different plotter modes in relative humidity include:
 - Relative Humidity
 - Absolute Humidity
 - Dew Point

4.1.3 Temperature

- To view temperature data on the plotter, go to **Panels -> Temperature**, or click **Ctrl+T**.
- To see variations in temperature data, introduce elements of different temperature levels over the sensor.
- DD2.1 UI is equipped to display temperature data in the following units of measurement:

- °C
- °F
- K

4.2 Default View

To reset the DD2.1 UI homepage to its default view, go to **Panels->Default View**, or click **Ctrl+V**.

4.3 Memory Map

- Memory map is used to launch the binary view of the sensor.
- This view contains information on all sensors and their respective addresses.
- To launch Memory Map, go to **Panels -> Memory Map**, or click **Ctrl+M**. The following window appears:
 - To configure sensor values, click **Write**.
 - To read the current register settings on the sensors, click **Read**.

Note: This option is disabled when the sensor is streaming data.

The Memory Map window displays the BME280 register map. It is divided into two main sections: Binary View and Trim Registers.

Binary View		Trim Registers	
FEh	00000000	dig_T1	28349
FDh	10000000	dig_T2	26663
FDh	00000000	dig_T3	50
FBh	00000000		
FAh	10000000	dig_P1	37260
F9h	00000000	dig_P2	-10586
F8h	00000000	dig_P3	3024
F7h	10000000	dig_P4	6531
F5h	00000000	dig_P5	-26
F4h	00000000	dig_P6	-7
F3h	00000000	dig_P7	9900
F2h	00000000	dig_P8	-10230
E0h	00000000	dig_P9	4285
D0h	01100000	Sensor Id	815569269

At the bottom of the window, there are two buttons: **Read** and **Write**.

Figure 15 : Memory Map

4.4 Sensor Mode

- BME280 offers three different power modes:
 - ▶ Sleep mode
 - No operation, all registers accessible, lowest power and Selected after startup
 - ▶ Forced mode
 - Perform one measurement, store results and return to sleep mode
 - ▶ Normal mode
 - Perpetual cycling of measurement and inactive periods

4.5 General Settings:

- To view the General Settings window, go to **Menu -> Panels -> General Settings**, or click **Ctrl+G**

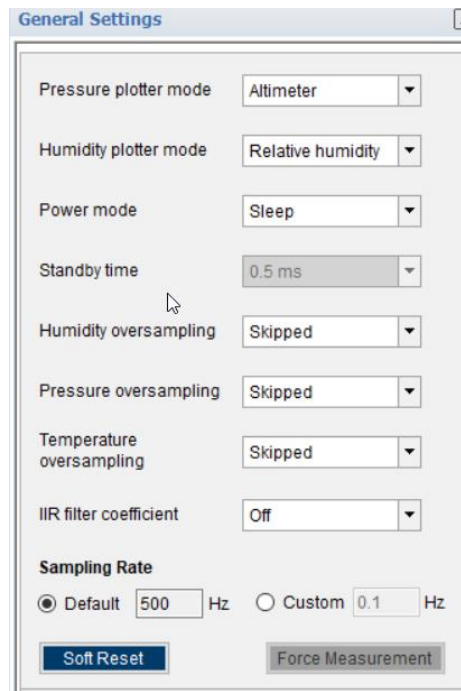


Figure 16 : Measurement Settings

- Altitude and Humidity plotter depends on the value selected in Pressure and Humidity plotter mode
- Pressure, temperature and humidity measurement depends on its corresponding oversampling selection.
- To skip measurement, set all three oversampling values to **Skipped**.
- To initiate measurement, set appropriate oversampling values from the drop down menu.
- **IIR filter coefficient** feature is used to suppress unwanted disturbances without causing additional interface traffic and process load. It effectively reduces the bandwidth of the output signals. To select **IIR filter coefficient**, choose appropriate option from the drop-down menu.
- The sampling rate is the rate at which the data will be read from the sensor.
- While streaming, data is sampled keeping the default sampling rate values as base (based on the sensor configuration settings).
- The following values are measured during streaming:
 - Uncompensated Humidity (UH)
 - Uncompensated pressure (UP)
 - Uncompensated temperature(UT)
 - Relative Humidity – in percentage (%)
 - Absolute Altitude – in meters (m)
 - Sea Level Pressure – in hectopascal (hPa)
 - Absolute Pressure – in hectopascal (hPa)
 - Absolute Temperature – in degree Celsius (°C)

Uncompensated humidity (UH)	<input type="text"/>
Uncompensated pressure (UP)	<input type="text"/>
Uncompensated temperature (UT)	<input type="text"/>
Relative humidity	<input type="text"/> %
Absolute altitude	<input type="text"/> meter
Sea level pressure	<input type="text"/> hPa
Absolute pressure	<input type="text"/> hPa
Absolute temperature	<input type="text"/> °C

Figure 17 : Sensor Metrics

4.6 Reset Sensor

- Resetting the sensor is possible by cycling VDD level or by writing soft reset command

4.6.1 PO Reset

- Power-On Reset option resets the logic part and register values after both VDD and VDDIO reach their minimum levels
- Once PO Reset button clicked, sensor reset to default values and UI reflect the default values

4.6.2 Soft Reset

- Soft Reset option is used to erase the possible old settings
- Once Soft Reset button clicked, the default values would be updated in UI

4.7 Data Export/ Log

- To save the output values plotted by DD2.1 UI , go to **Panels -> Data Export**, or click **Alt+D**.
- By default, the data values are logged into a text (.txt) file in the destination folder of DD2.1 UI.
- The steps to follow data logging are as seen:

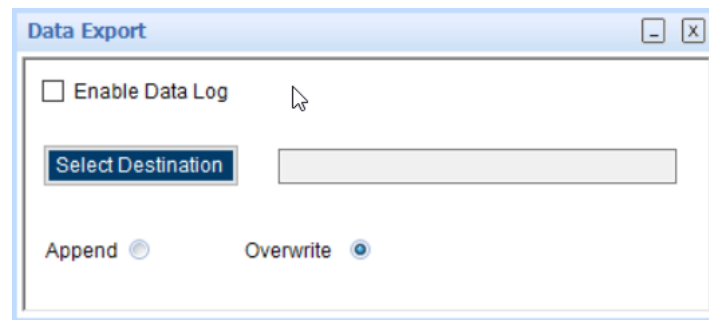


Figure 18 : Data Export

1. Go to **Panels-> Data Export**, or click **ALT + D**.
2. Click **Select Destination**, and select required destination folder.
3. To log new data into the selected file, click **Append**.
Or
To erase old data from the selected file and log new data in its place, click **Overwrite**.
4. Check **Enable Data log**.
5. Click **Start streaming** button to plot the sensor data in the plotter.
6. Click **Stop streaming** to end the plotting of the sensor data. The output of the sensor data is saved in the desired destination path.

4.8 Register Access

- To go to Register Access, go to **Menu -> Panels -> Register Access**, or click **Ctrl+R**. The following window appears:

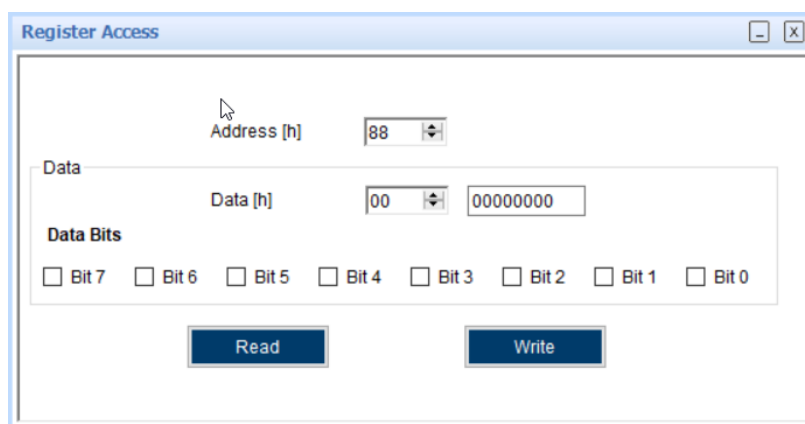


Figure 19 : Register Access

- Register Access is used to read or write values into a register. To implement this, follow the below steps:
 - Enter the register address in Address [h].
 - Enter the data you wish to read/ write in Data [h].
 - Select the data bits into which data has to be written or read from.
 - As per requirement, click Read/Write.

4.9 Calibration

- Calibration sea level pressure done by entering the reference sea level pressure.
- The reference altitude displayed

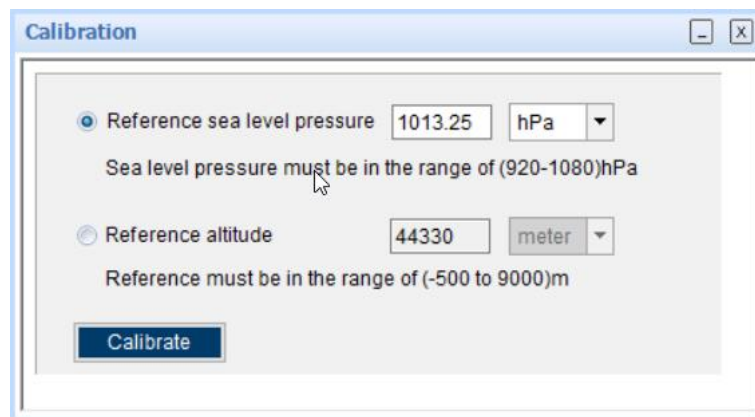


Figure 20 : Calibration window

- DD2.1 offers the functionality to display the altitude data in the following units:
 - m: meter
 - ft.: feet
- DD2.1 offers the functionality to display the pressure data in the following units:
 - hPa : hecto Pascal
 - mmHg : mm of mercury
 - PSI: Pounds per square inch.

5 General Troubleshooting

Follow below guidelines while working with DD2.1 UI:

- Ensure that the shuttle board (with a valid sensor) is seated properly in the application board.
- Ensure that the PC-board connection is properly established.
- When switching on/ off DD2.1 UI, close and restart DD2.1 UI .
- Ensure that at least one channel is selected.

Follow these steps to check the USB connection:

1. Click **My Computer -> Manage -> Computer Management**.
2. Go to **System Tools -> Device Manager**.
3. Click on BST board and check for the USB connection.

Sometimes, data transfer between PC and application board does not work despite the USB device being properly enumerated in the Device Manager.

This could be because the application board is older or that the USB PID and VID have been used with that computer before. In this case, Windows is unable to install the required drivers automatically.

Follow these steps to check the USB connection:

1. Right-click on the USB-device corresponding to your application board (if you are not sure which device corresponds to your application Board, unplug all other USB devices like keyboard and mouse temporarily).

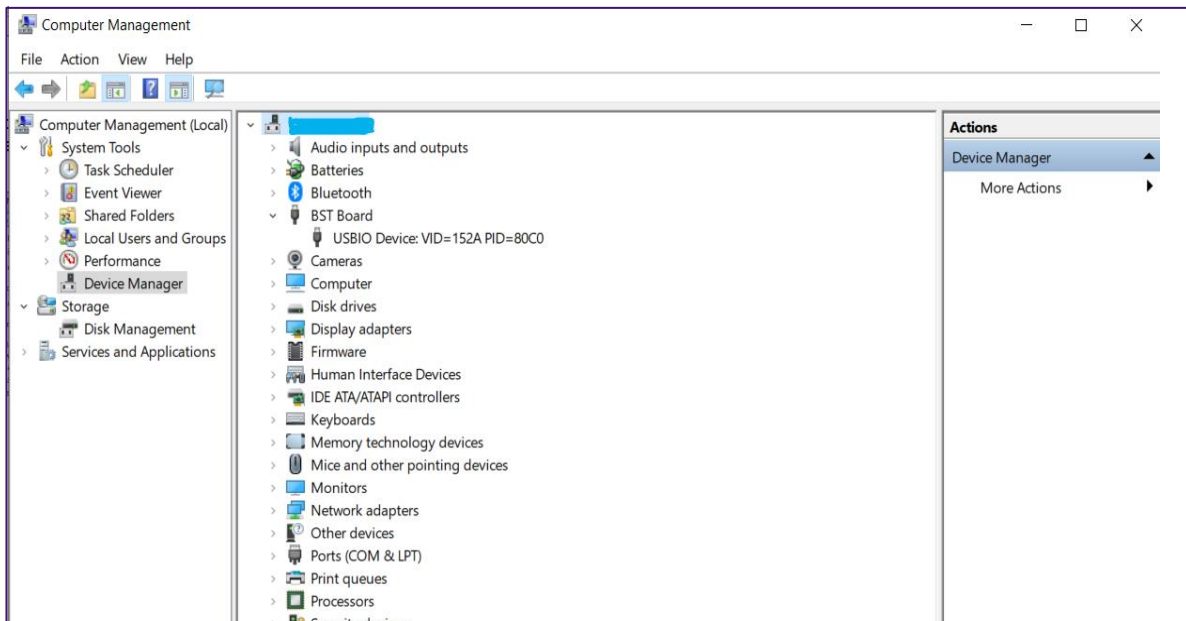


Figure 21 : Selecting USB device corresponding to application board

2. Click **Action -> Scan for hardware changes**. The new USB driver is installed automatically. Thereafter, the device communication will function properly.

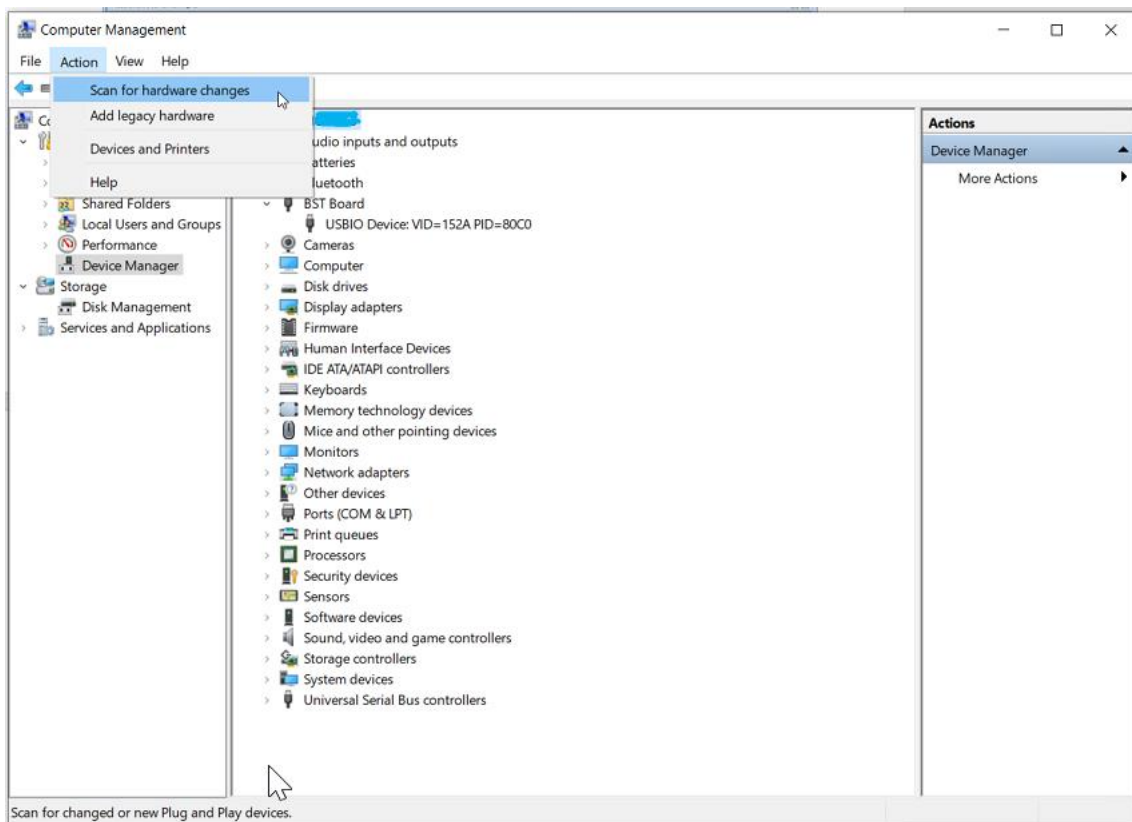


Figure 22 : USB driver installation

The following table lists some of the possible faults that you might encounter and the troubleshooting method.

Table 2 : General TroubeShoot

Condition	Possible cause	Solution
If Communication Status remains grey red after checking the Start Button .	Application Board is turned off.	Power on the application Board and restart the DD2.1 UI application. If the board is powered by rechargeable battery, ensure that the battery is charged.
Unable to locate the data logged file.	Destination path not properly defined.	Locate the file in the setup path of Development Desktop.
Error message Please connect application Board is displayed.	Application Board is not connected properly.	Ensure that the PC is connected with the application Board properly. If the board is powered by rechargeable battery, ensure that the battery is charged.
Error message Please connect Shuttle Board is displayed.	Shuttle Board is not fixed properly.	Ensure that the Shuttle Board is correctly fixed in the Development Board.
Error message Please select a path or file for logging is displayed.	Destination path for saving the logged data is not defined.	Select the Data Export option in the file menu and specify the destination path.
Error message Please select File from File Menu → Data Export option to proceed is displayed.	Destination path not selected.	In the file menu, select the Data Export option and select the destination path.
Error message Please Connect Valid Sensor is displayed.	Wrong sensor fixed on the application Board.	Ensure that correct sensor is fixed on the application Board.
Graph for x, y, z channel not plotted.	Channel x, y, z not checked.	Ensure that x, y, z channels are checked.

6 Legal disclaimer

i. Engineering samples

Engineering Samples are marked with an asterisk (*) or (e). Samples may vary from the valid technical specifications of the product series contained in this data sheet. They are therefore not intended or fit for resale to third parties or for use in end products. Their sole purpose is internal client testing. The testing of an engineering sample may in no way replace the testing of a product series. Bosch Sensortec assumes no liability for the use of engineering samples. The Purchaser shall indemnify Bosch Sensortec from all claims arising from the use of engineering samples.

ii. Product use

Bosch Sensortec products are developed for the consumer goods industry. They may only be used within the parameters of this product data sheet. They are not fit for use in life-sustaining or safety-critical systems. Safety-critical systems are those for which a malfunction is expected to lead to bodily harm, death or severe property damage. In addition, they shall not be used directly or indirectly for military purposes (including but not limited to nuclear, chemical or biological proliferation of weapons or development of missile technology), nuclear power, deep sea or space applications (including but not limited to satellite technology).

The resale and/or use of Bosch Sensortec products are at the purchaser's own risk and his own responsibility. The examination of fitness for the intended use is the sole responsibility of the purchaser.

The purchaser shall indemnify Bosch Sensortec from all third party claims arising from any product use not covered by the parameters of this product data sheet or not approved by Bosch Sensortec and reimburse Bosch Sensortec for all costs in connection with such claims.

The purchaser accepts the responsibility to monitor the market for the purchased products, particularly with regard to product safety, and to inform Bosch Sensortec without delay of all safety-critical incidents.

iii. Application examples and hints

With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Bosch Sensortec hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights or copyrights of any third party. The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. They are provided for illustrative purposes only and no evaluation regarding infringement of intellectual property rights or copyrights or regarding functionality, performance or error has been made.

7 Document history and modification

Rev. No	Chapter	Description of modification/changes	Date
1.0	BME280 User Manual	Initial release	March 2023

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