BMPxxx
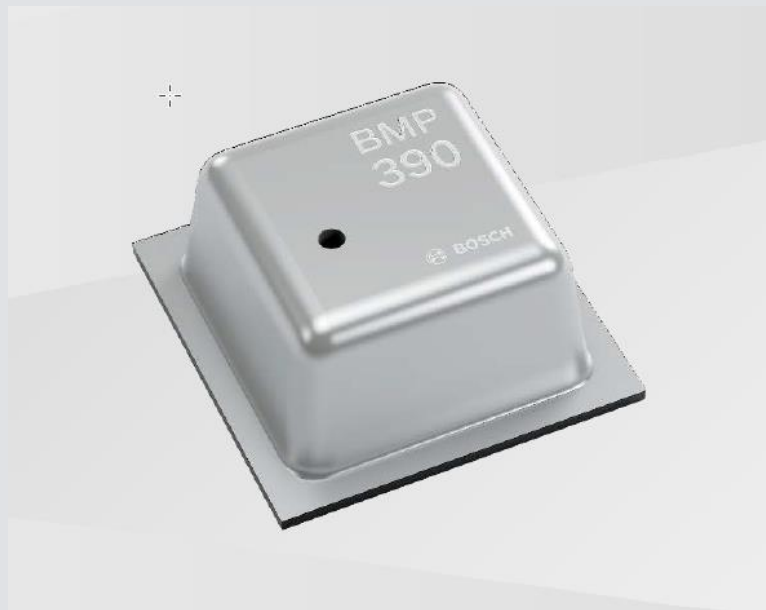# Desktop Development 2.1 User Manual

BMPxxx User Manual

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Notes	Data and descriptions in this document are subject to change without notice. Product photos and pictures are for illustration purposes only and may differ from the real product appearance.

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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 DD2.1 UI to demonstrate the BMPxxx sensor.

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 BMPxxx 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.

BMPxxx is a high precision digital pressure sensor with ultra-low power, low voltage electronics. These characteristics are optimized for the use in mobile applications, PDAs, GPS navigation devices, and outdoor equipment.

1.3.   Key features of BMPxxx

1. Temperature measurement
2. I2C interface
3. Low power
4. Low noise
5. Lead and halogen free
6. RoHS-Complaint

1.4.   Advantages of BMPxxx

1. High precision
2. Ultra-low Power
3. Low altitude
4. Low voltage
5. Fast data conversion time

2 Getting Started

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

2.1 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.
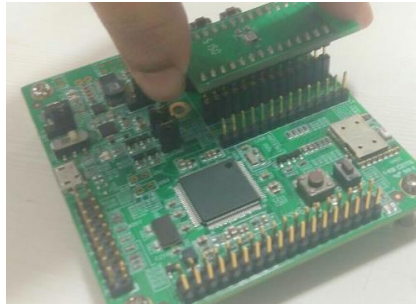
Figure 1 : Insert sensor for APP2.0

Figure 2 : Insert sensor for APP3.0

- Connect the board and PC using a USB cable/Bluetooth.
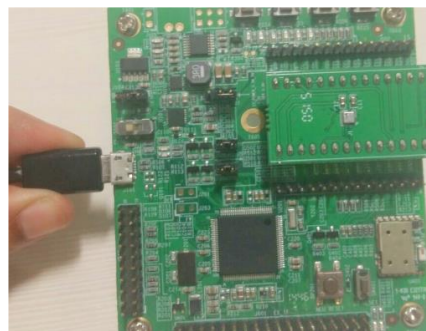
Figure 3 : Connect board and PC for APP2.0
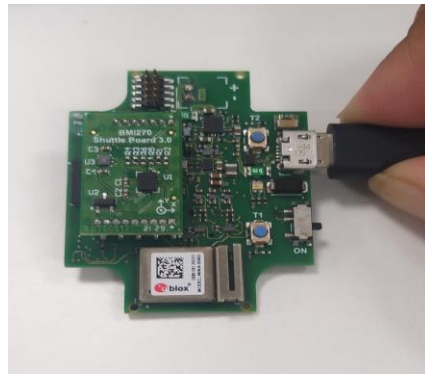
Figure 4 : Connect board and PC for APP3.0

- Turn the on/off switch ON. The LED glows.
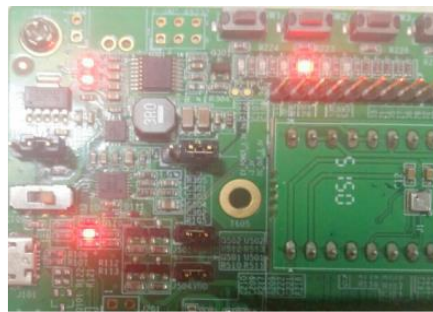
Figure 5 : Connection complete for APP2.0
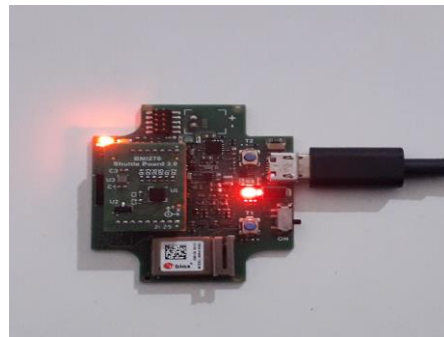
Figure 6 : Connection complete for APP3.0

2.2 Upgrading Firmware

2.2.1 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:
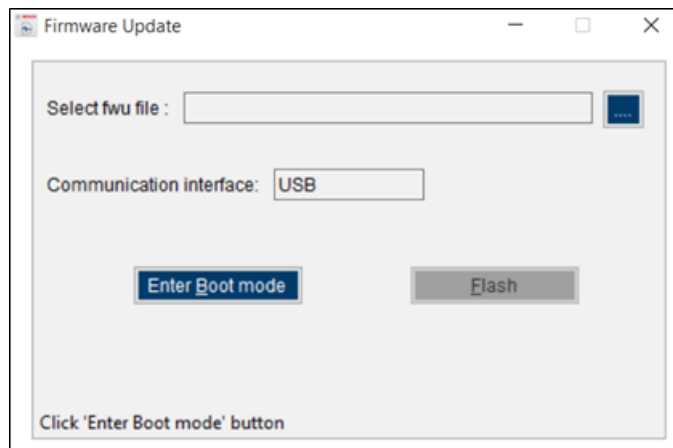
Figure 7 : Firmware upgrade window

▪ Click Enter Boot mode.
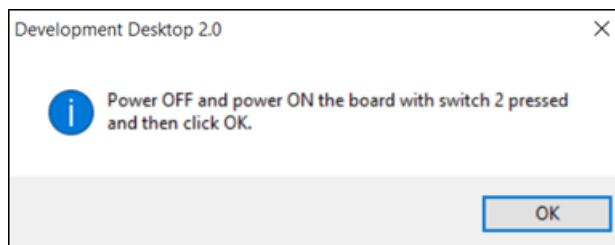
Figure 8 : Application Boot Loader

▪ 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.
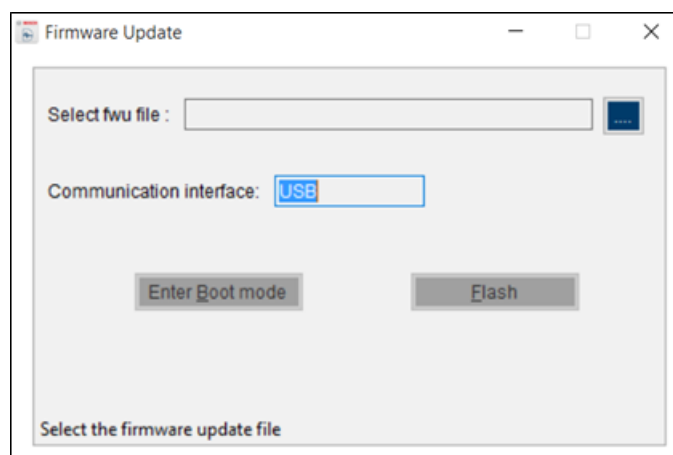
Figure 9 : Boot mode Detected

▪ Select the default firmware update file (*.fwu2) from the DD2.1 UI installation directory in the folder Firmware.
▪ Click Flash.
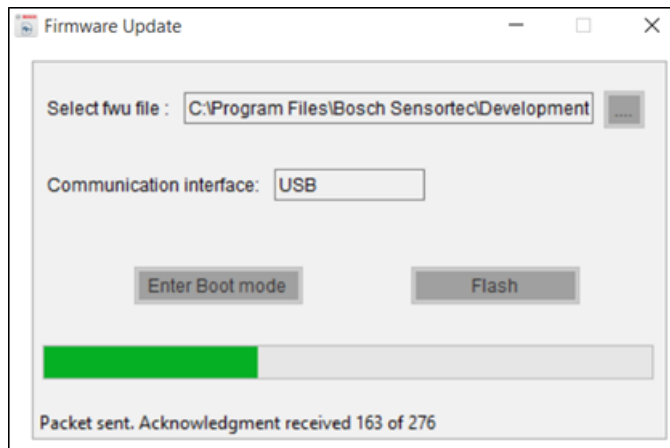
Figure 10 : Firmware upgrade completion

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

2.2.2 For App 3.0 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:
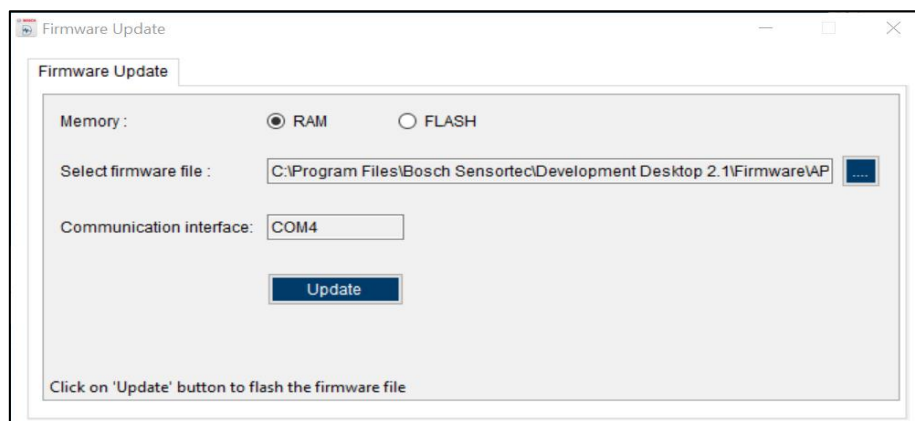
Figure 11 : Firmware upgrade window

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

▪ Choose RAM or FLASH option to flash the latest recommended firmware file.
▪ The file path will get automatically chosen/selected in the select firmware file path textbox. User can also select the firmware as required.
▪ Click on Flash.
▪ 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.
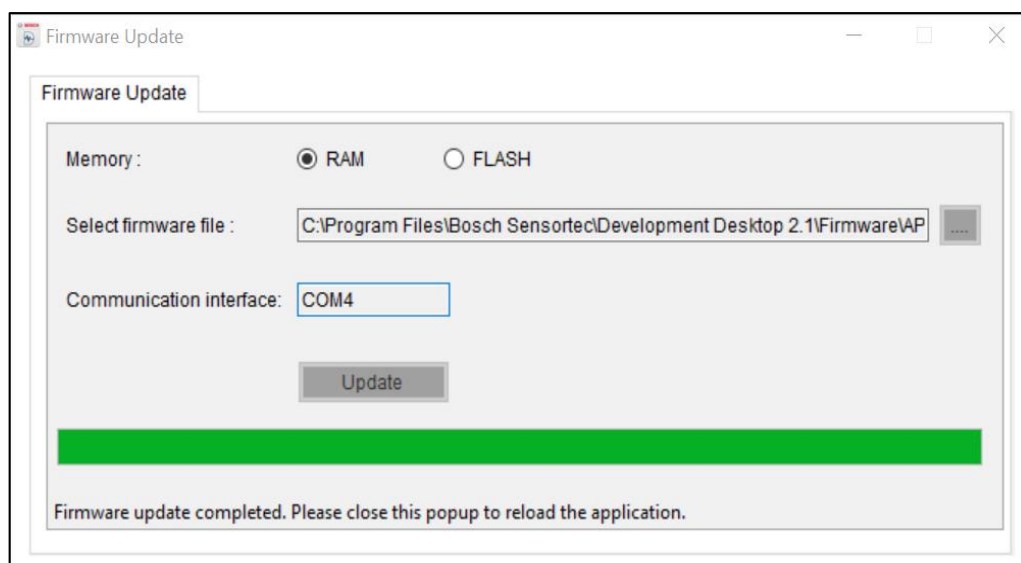
Figure 12 : Firmware upgrade completion

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

2.3 Startup view

To start the DD2.1 UI software:
▪ Click Start > Programs > Development Desktop 2.1.
   Or

▪ Double click the DD2.1 UI software icon ![icon] on the desktop. The Graphical User Interface (GUI) of the software is as seen below:
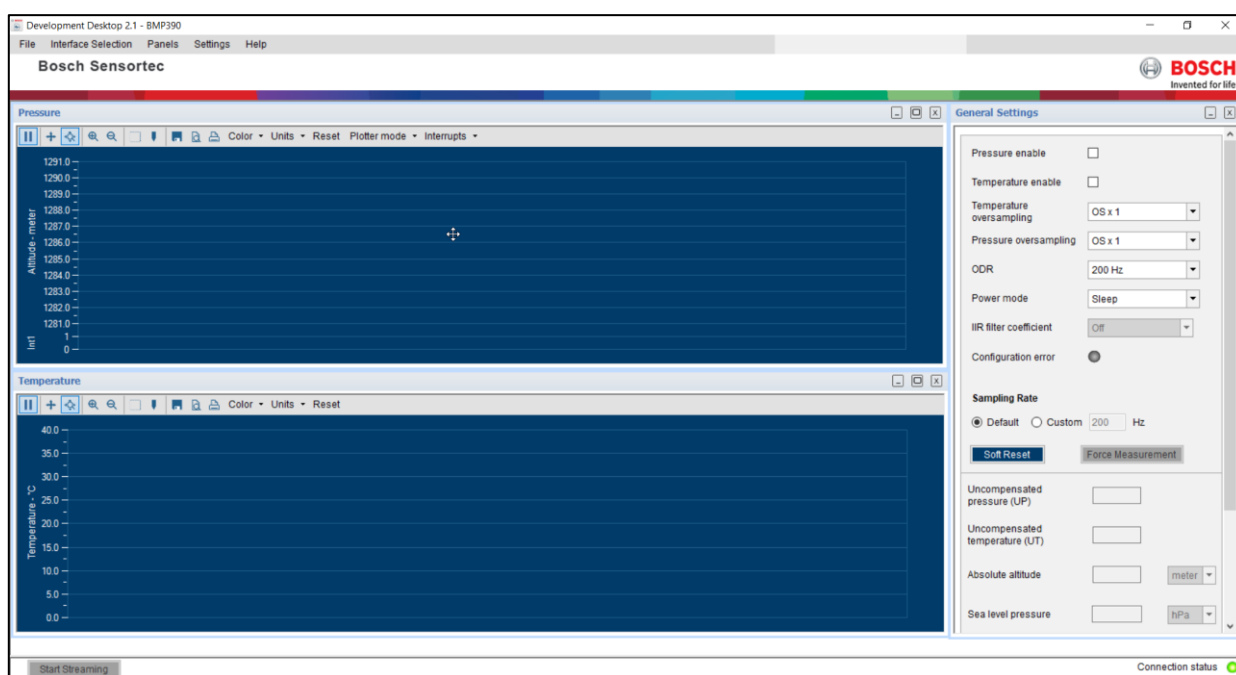
Figure 13 : DD2.1 UI Start-up View

▪ To view additional panels/views, go to Panels ->Views.

- When the connection status indicator glows green, the Board and the PC are connected.
- To plot sensor signals on the graph, press Start.
- To stop sensor signal plotting on the graph, click Stop.

3 Working with Development Desktop 2.1 − BMPxxx sensor

DD2.1 UI offers complete access to BMPxxx sensor.

3.1 Sensor Data

BMPxxx is an absolute barometric pressure sensor. Its small dimensions, its low power consumption and the high-end performance allow the implementation in a wide range of applications

3.1.1 Altitude data

- The altitude is plotted on the plotter and displayed in the dial. The plotter plots real time sensor signals. The altitude data is plotted by enabling the pressure measurement.
- The sensor data can be analyzed by using graph features like Play/Pause, view history, graph speed, Zoom In/Out, Zoom particular area in the graph, save, and print current instance.

- DD2.1 UI offers the functionality to represent altitude data in the following units:
  - m: meter
  - ft.: feet

- To view this panel, go to **Menu -> Panels -> Altitude**, or click **Ctrl+P**.
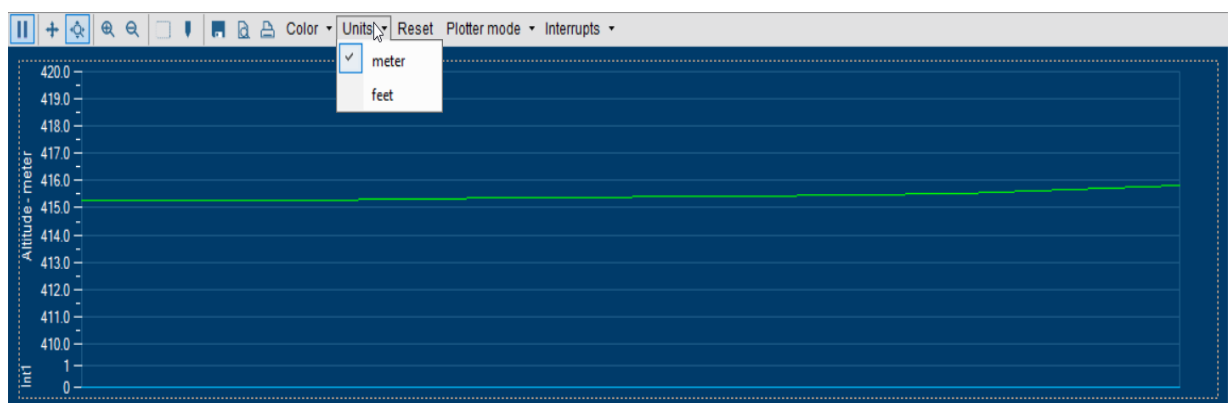
Figure 14 : Altitude Plotter

- To view the altitude data on the dial, go to **Menu -> Panel -> Altimeter**.

Figure 15 : Altimeter Dial

3.1.2 Temperature data

- The temperature is plotted and displayed on the plotter.
- The sensor data can be analyzed by using graph features like Play/Pause, view history, graph speed, Zoom In/Zoom Out particular area in the graph, save and print current instance.
-
- The temperature data can be represented in following units:
  - ▶ ℃ - Degree Celsius
  - ▶ ℉ - Degree Fahrenheit
  - ▶ K – Kelvin

- To view this panel, go to **Menu** -> **Panels** -> **Temperature**, or click **Ctrl+T**.
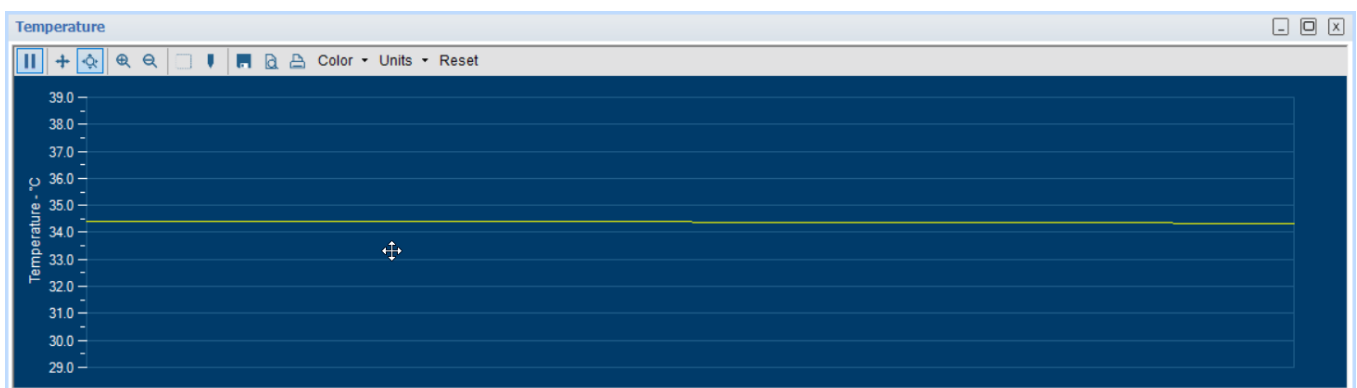
Figure 16 : Temperature Plotter

3.2 Data Export

- The output values of the pressure, altitude and temperature signal is logged to a file by using the option Data Export.
- By default, it is saved as a text file in the destination path of the application.
- To export data, follow the steps below:

  - ▶ Go to **Menu -> Panels -> Data Export** or **Click ALT + D**.
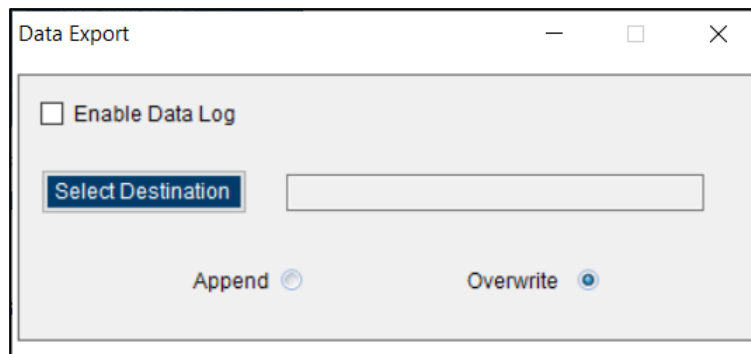
Figure 17 : Data Export window

▶ In the destination path, click **Select Destination**.
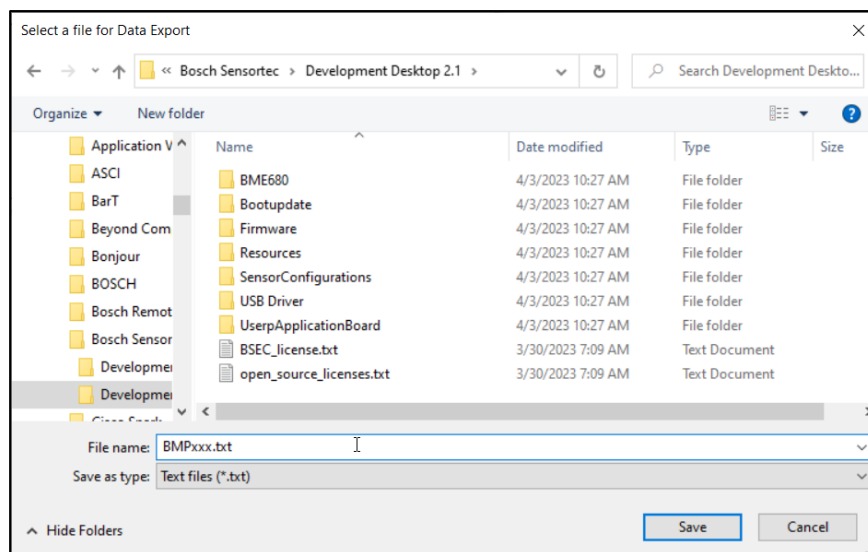
Figure 18 : Select Destination

Note: In **Append** mode, the new data is appended to the selected file. In **Overwrite** mode, the old data is erased from the selected file and the data from the new measurement is saved onto it.

- Change the toggle button to append or overwrite.
- Click **OK**.
- Check the Data Export check box.
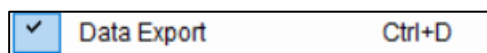
- Click **Start** to plot the sensor signals in the graph.
- Click **Stop** to stop plotting.
- The output of the sensor signals is saved in the desired destination path

3.2 Mode Selection

3.2.1 Power Modes

For BMP58x

- DD2.1 UI supports four different power mode – **Standby, Normal, Forced and Non-stop mode**.
- To modify the power mode value, go to **General settings.**
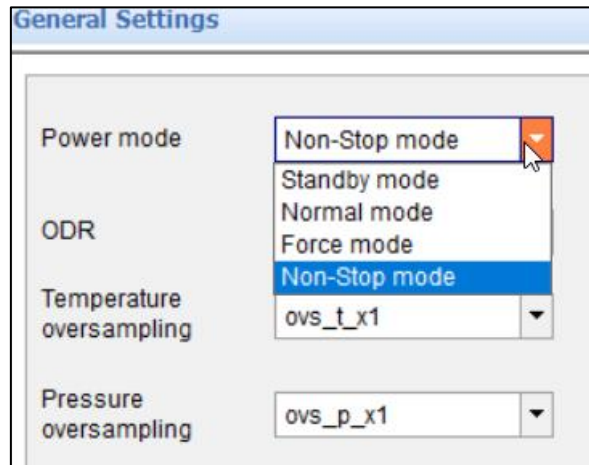
Figure 19 : BMP58x Power Modes

Power Mode	Details
Standby Mode	Low Power consumption, no measurement ongoing
Normal Mode	Measurement in configured ODR
Force Mode	Forced one time measurement
Non-stop Mode	Repetitive measurements without further duty-cycling

Table 1 : BMP58x Power Mode

For BMP390

- DD2.1 UI supports three different power mode – **Sleep, Normal and Forced mode**.
- To modify the power mode value, go to **General settings**
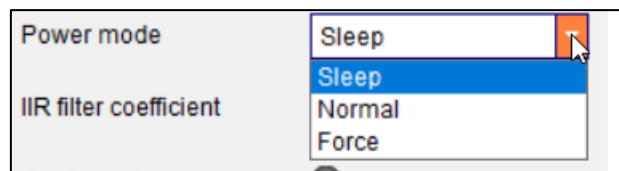
Figure 20: BMP390 Power Modes

Power Mode	Details
Sleep Mode	Low Power consumption, no measurement ongoing
Normal Mode	Measurement in configured ODR
Force Mode	Forced one time measurement

Table 2 : BMP390 Power Mode

3.3.2 Pressure and Temperature Oversampling

- BMP58x measures either Temperature or both Pressure and Temperature whereas BMP390 measures Pressure and Temperature.
- Oversampling extends the measurement time per measurement by the oversampling factor
- Higher oversampling factors offer decreased noise at the cost of higher power consumption.
- To select Pressure and Temperature oversampling ratio, go to General Settings.
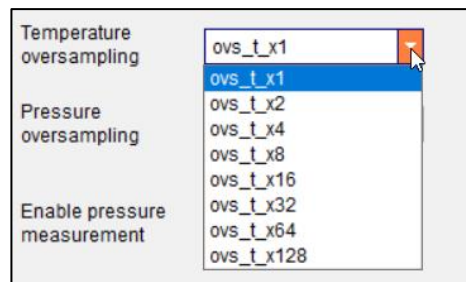
Figure 21 : Temperature Oversampling
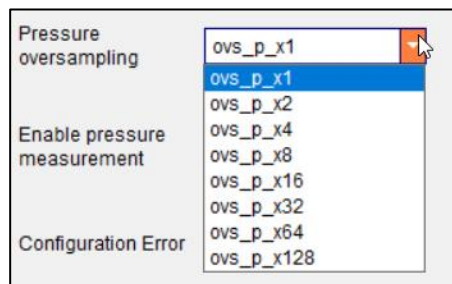
Figure 22 : Pressure Oversampling

- In BMP58x to enable Pressure or Altitude measurement, Go to **General settings** and enable the checkbox "**Enable Pressure measurement**"
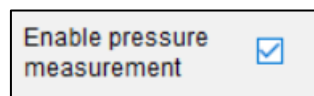
Figure 23: BMP58x - Enable Pressure Measurement

- In BMP390, Pressure and Temperature measurements can be enabled or disabled. To do so, navigate to **General settings** and check or uncheck the "**Pressure Enable**" and "**Temperature Enable**" checkbox
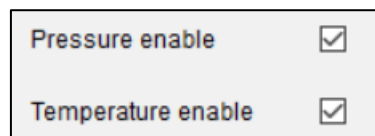
Figure 24: BMP390 - Pressure & Temperature Enable

3.3.3 Output Data Rate (ODR)

- Both BMP390 and BMP58x performs temperature and pressure measurement with a configurable frequency which is Output Data Rate
- Maximum and minimum value for ODR is based on the power mode and oversampling value
- In DD2.1 UI, go to General settings to select the ODR value
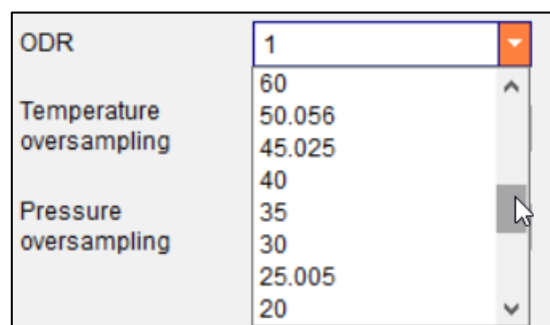
Figure 25 : Sampling/ Data Velocity Rate

3.3.4 Sampling Rate

- The two sampling rates offered by DD2.1 UI for BMPxxx are:
  - ▶ **Default**: A pre- defined sampling rate value supported by the sensor. A pre-defined sampling rate value.
  - ▶ **Custom**: User-defined sampling rate value. Custom sampling rate can only be a value between 0.125 Hz and 240 Hz.
- Select relevant value by clicking the radio button next to the option name.
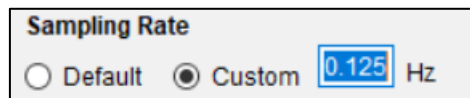
Figure 26: Sampling Rate

Note: When the DD2.1 UI is launched, sampling rate will be Default. When you wish to input a custom sampling rate, please enter the value next to the corresponding option

3.4 Reset sensor

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

3.4.1 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

3.4.2 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

3.5 Sensor data

- The following information is available in the text box of **General Settings**.
  - Absolute Altitude (Units: meter & feet)
  - Sea level pressure (Units: hPa, mmHg & PSI)
  - Absolute pressure (Units: hPa, mmHg & PSI)
  - Absolute temperature (Units: ℃, ℉ & K)
  - UID

Figure 27 : Sensor Data

3.6 Memory map

3.6.1 Binary view

- In **Binary View,** the sensor registers are identified by their addresses. The values displayed are the actual representation of the sensor memory map.
- If exact addresses of the sensor registers are known, this view is used to write direct values to the sensor memory map.
- The value entered is converted to binary and displayed in the binary text box.
  - ▶ Click **Write** to transfer values to actual registers.
  - ▶ Click **Read** to read the current register settings.

- To launch **Binary View**, go to **Menu -> Panels -> Memory Map -> Binary View**, or click **Ctrl +B**.

Figure 28: Binary View

3.6.2 Interrupt view

- BMPxxx provides an interrupt pin (INT) to which below interrupts/events can be mapped

  - ▶ Data Ready Interrupt
    - This interrupt is triggered when new pressure and/or temperature data is available

>   ▶   Pressure Out of range interrupt
>   >   ▪   The out-of-range (OOR) interrupt is triggered when the pressure value is outside a defined range for a defined number of samples

>   ▪   To launch **Interrupt View**, go to **Menu -> Panels -> Memory Map -> Interrupt View,** or click **Ctrl +I**
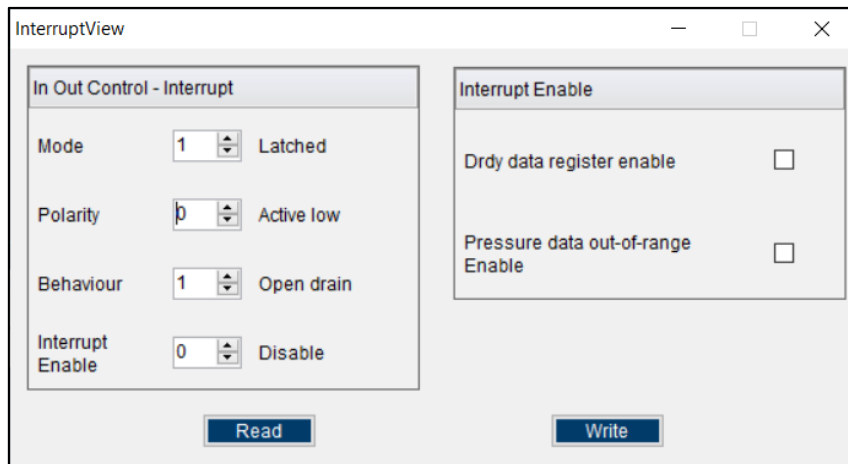
Figure 29: Interrupt View

3.6.3 FIFO View

>   ▪   In BMP390, to launch the FIFO view settings panel, go to **Menu -> Panels -> Memory Map -> FIFO View**, or click **Ctrl+F**.
>   ▪   To enable Start Streaming button,
>   >   ▶   Enable '**FIFO Mode**' by selecting Enabled from the drop down
>   >   ▶   To receive data of Pressure, Temperature or sensor time, select respective checkboxes
>   >   ▶   Select **FIFO Full** and **FIFO Watermark** to get interrupt status
>   >   ▶   Finally hit **Write** button to write the selected settings into the registers
>   >   ▶   Click on **Start Streaming** button to get the data
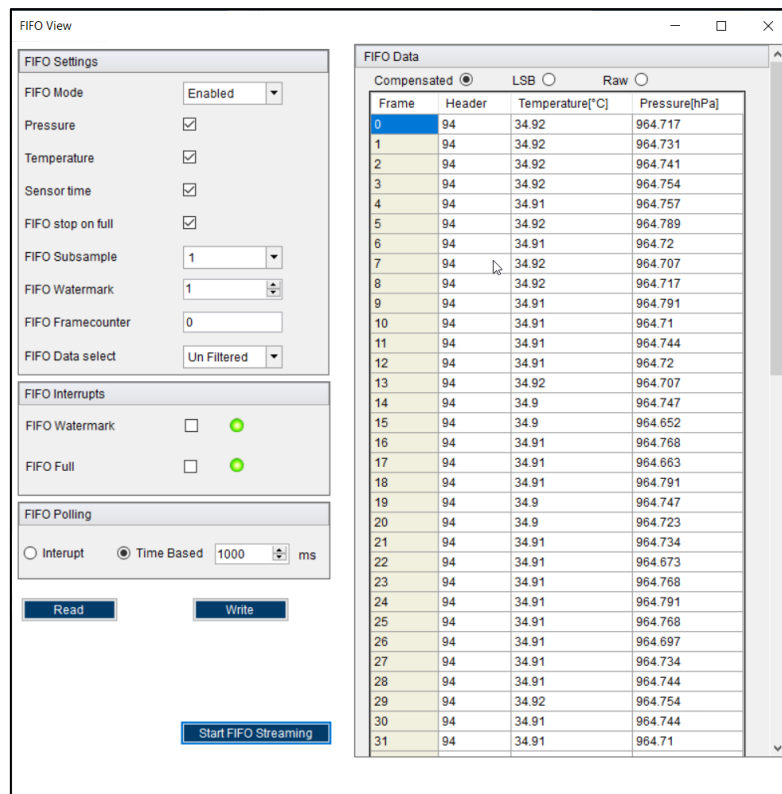
Figure 30: FIFO Streaming

Note: To get the values in FIFO Streaming, Enable Pressure or Temperature values and change the Power mode other than Sleep under General Settings

3.7 Register Access

- This view provides direct access to the sensor registers.
- The values can be read from or can be written to the sensor register.
- To launch this view, go to **Menu -> Panels -> Register Access**, or click **Ctrl +R**.
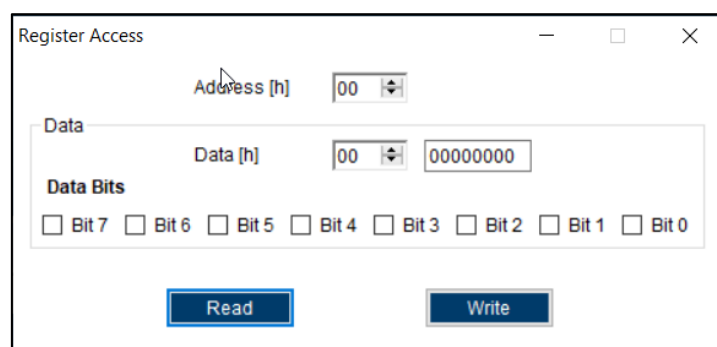
Figure 31: Register Access

3.8 Interrupts

- To view the Interrupts panel, go to **Menu -> Panels -> Interrupts**, or click **Ctrl+I**.
- When an interrupt occurs, the corresponding interrupt will glow **green** in the Interrupts panel as seen in the below figure:
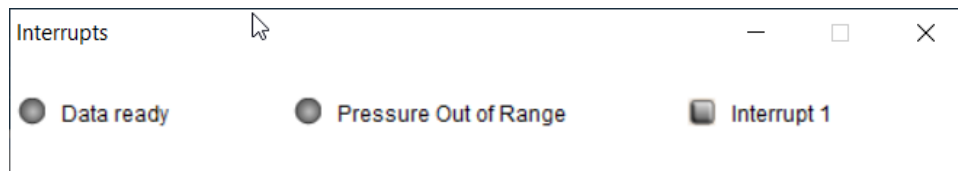
Figure 32: Interrupts

3.9 Calibration

▪ Calibration sea level pressure done by entering the reference sea level pressure.
▪ The reference altitude displayed.
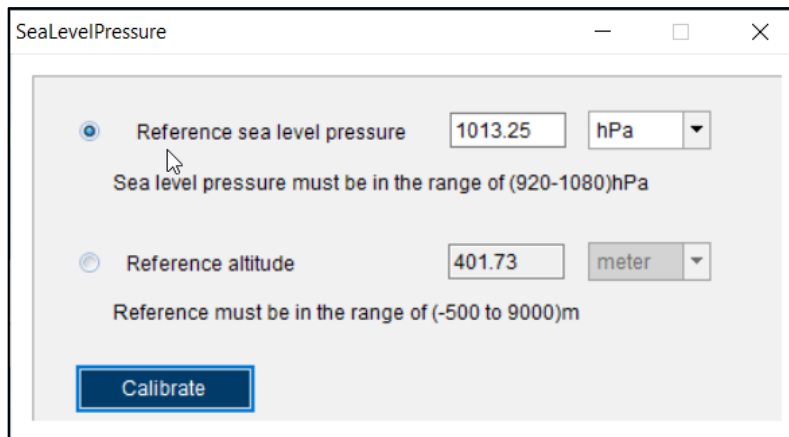
Figure 33 : Calibration

▪ DD2.1 UI offers the functionality to display the altitude data in the following units:
  ▶ m: meter
  ▶ ft.: feet

▪ DD2.1 UI offers the functionality to display the pressure data in the following units:
  ▶ hPa : hecto Pascal
  ▶ mmHg : mm of mercury
  ▶ PSI: Pounds per square inch.

▪ To access Calibration registers, go to **Menu -> Panels -> Calibration Registers** or click **Ctrl+Alt+C**

Figure 34: Calibration Registers

3.10 General Settings

▪ To view/hide the General Settings panel, go to **Menu -> Panels -> General Settings,** or click **Ctrl+G.**

4 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).
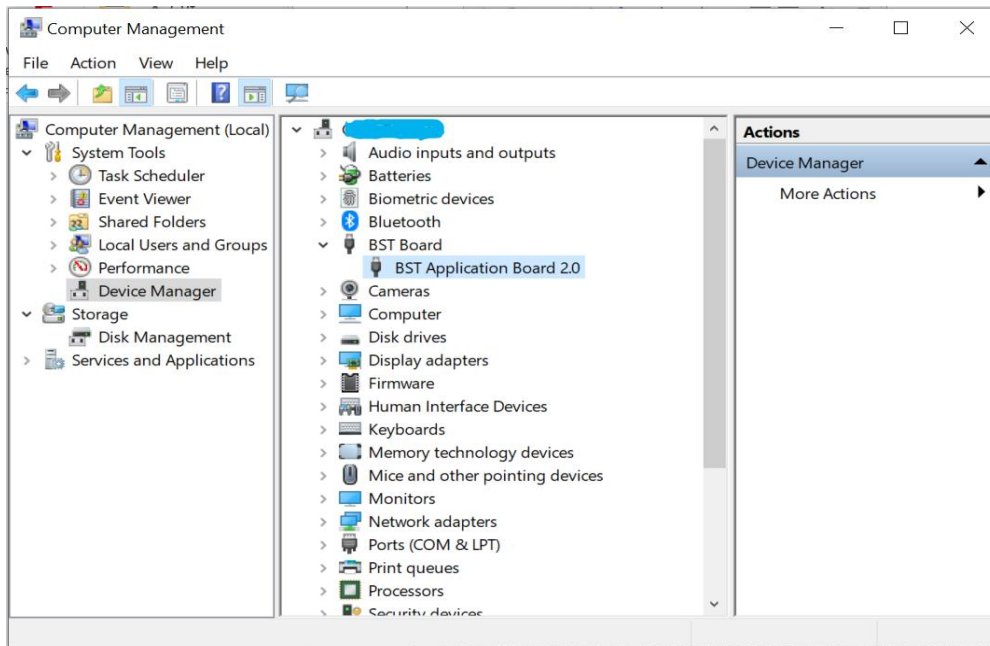
Figure 35 : Selecting USB device corresponding to application board

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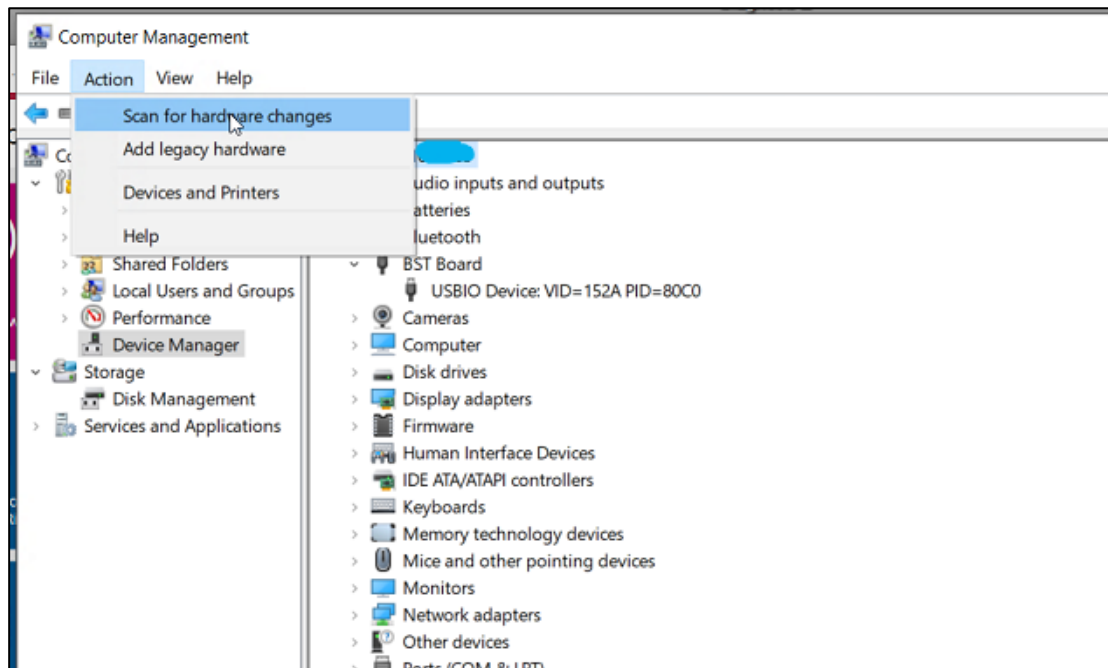

Figure 36 : USB driver installation

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

Table 3 : Trouble Shooting

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.

5 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.

6 Document history and modification

Rev. No	Chapter	Description of modification/changes	Date
1.0	BMPxxx User Manual – DD2.1	Initial release	April 2023

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