

# BMI08x

## Desktop Development 2.1 User Manual



### BMI08x 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 intended to users who wish to use DD2.1 UI to demonstrate use of the BMI08x.

### 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 BMI08x 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 I<sup>2</sup>C 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 BMI08x

The technical specifications of the BMI08x sensor are as seen below:

Table 1 : The technical specifications of the BMI08x sensor

Parameter	Technical Data
Digital Resolution	Accelerometer (A): 16-bit Gyroscope (G): 16-bit
Resolution	(A): 0.1 mg (G): 0.004°/s
Measurement range and sensitivity (calibrated)	(A): ± 2g: 16384 LSB/g ± 4g: 8192 LSB/g ± 8g: 4096 LSB/g ± 16g: 2048 LSB/g (G): ± 125°/s: 262.144 LSB/°/s ± 250°/s: 131.072 LSB/°/s ± 500°/s: 65.536 LSB/°/s ± 1000°/s: 32.768 LSB/°/s ± 2000°/s: 16.384 LSB/°/s
Zero-g offset (typ., over life-time)	(A): ± 20 mg (G): ± 1°/s
TCO	(A): ± 0.2 mg/K (G): ± 0.015 °/s/K
Noise density (typ.)	(A): 120 µg/√Hz (G): 0.014 °/s/√Hz
Bandwidths (programmable)	5 Hz ... 684 Hz
Selectable output data rates	12.5 Hz ... 2 kHz
Digital inputs/outputs	SPI & I2C, 4x digital interrupt
Supply voltage (VDD)	2.4 ... 3.6 V
I/O supply voltage (VDDIO)	1.2 ... 3.6 V
Current consumption (full operation)	5.15 mA
LGA package	3 x 4.5 x 0.95 mm <sup>3</sup>

## 3 Getting Started

The below sections highlight the procedure to set up connections between BMI08x, 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.

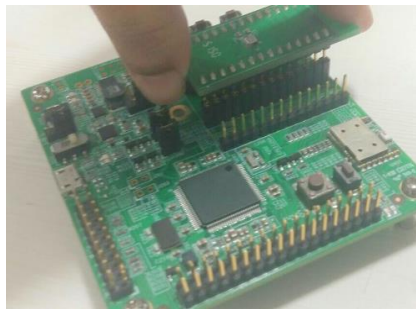


Figure 1 : Insert sensor for APP2.0



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

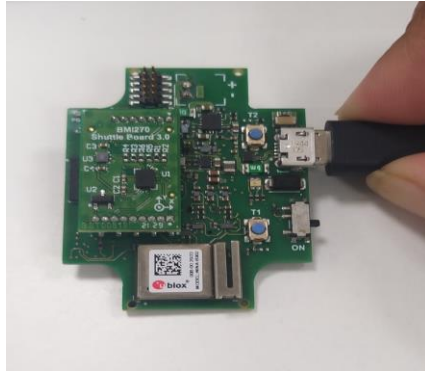


Figure 4 : Connect board and PC for APP3.0

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

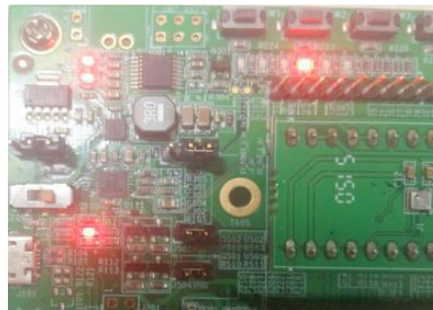


Figure 5 : Connection complete for APP2.0

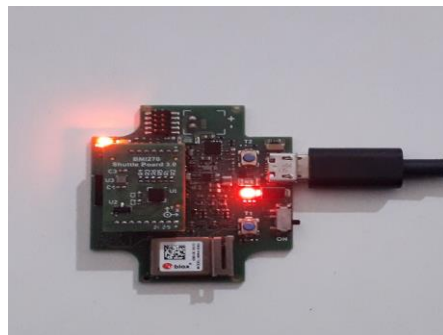



Figure 6 : Connection complete for APP3.0

## 3.2 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  on the desktop.

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

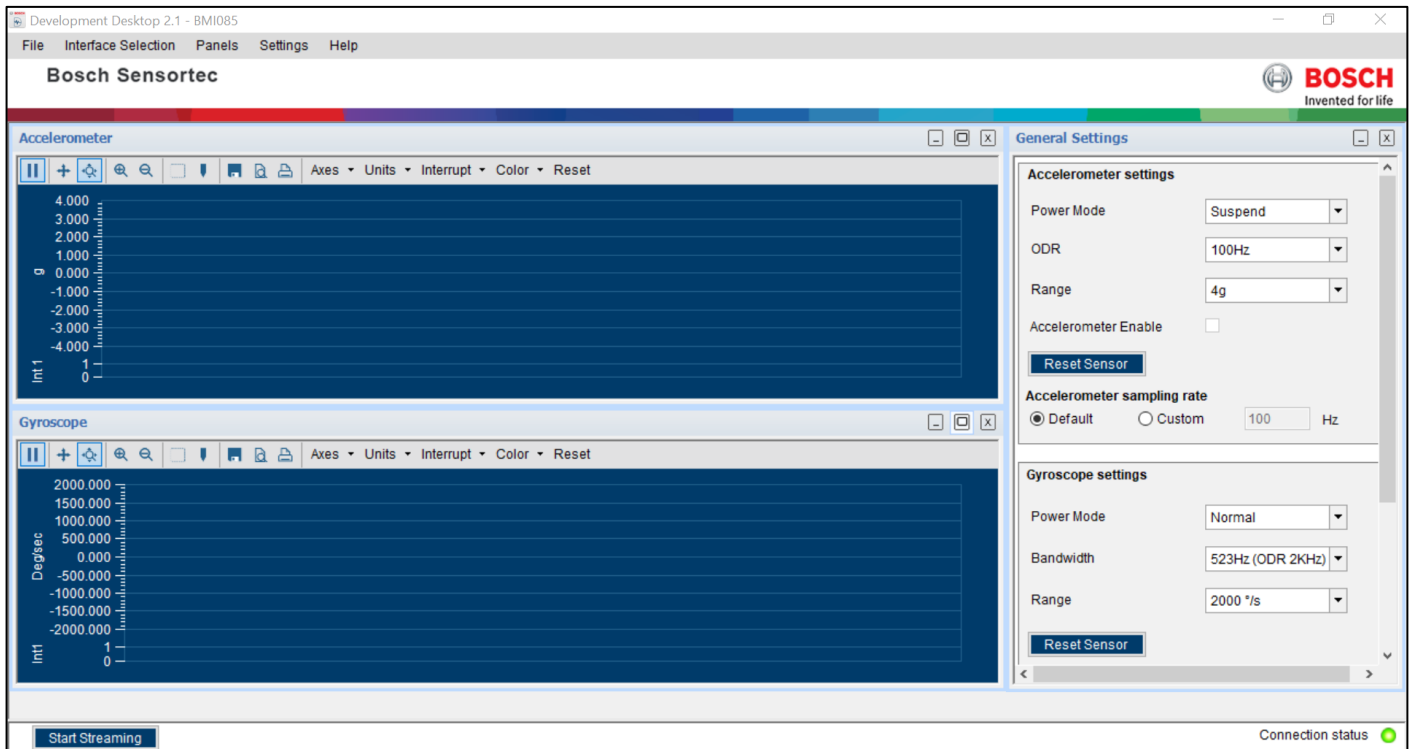


Figure 7 : DD2.1 Startup View

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

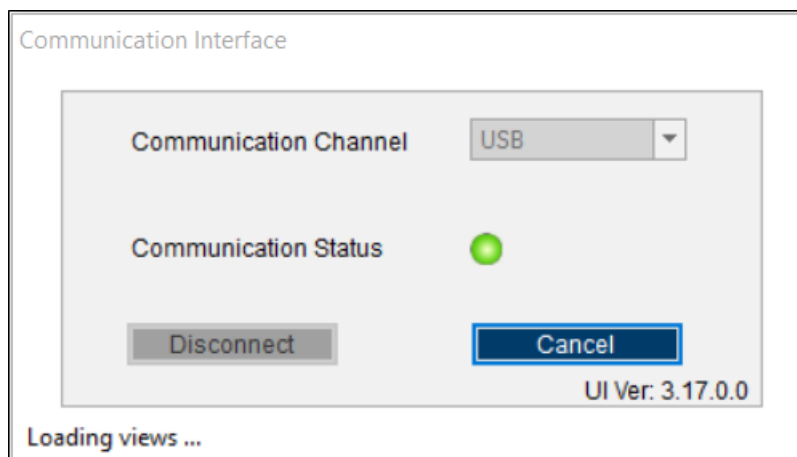
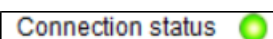


Figure 8 : Communication Status

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



► Other menu options include:

1. File
2. Interface Selection
3. Panels
4. Settings
5. Help

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



### 3.3 Upgrading Firmware

#### 3.3.1 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:

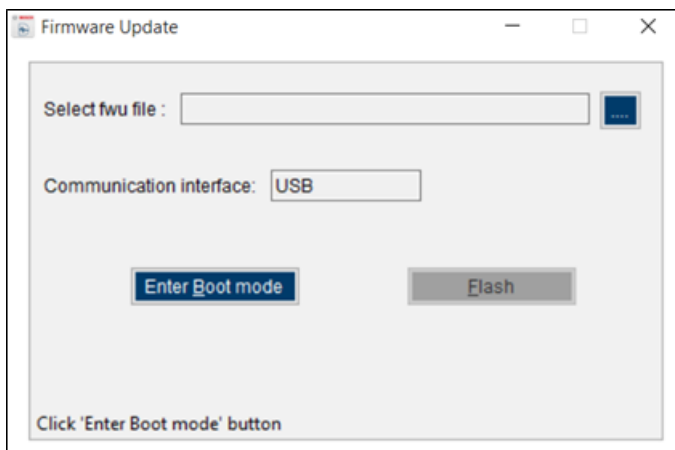


Figure 9 : Firmware upgrade window

- Click Enter Boot mode.

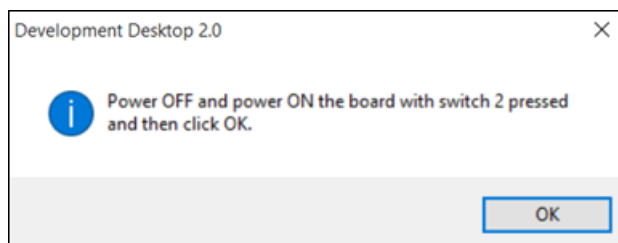


Figure 10 : Application Boot Loader

- 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**.

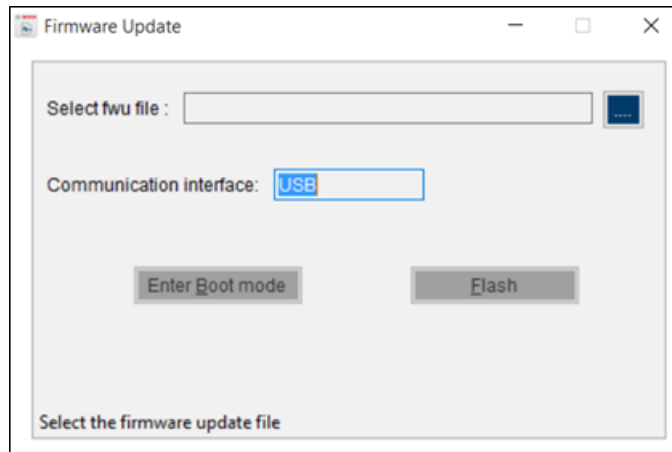


Figure 11 : Boot mode Detected

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

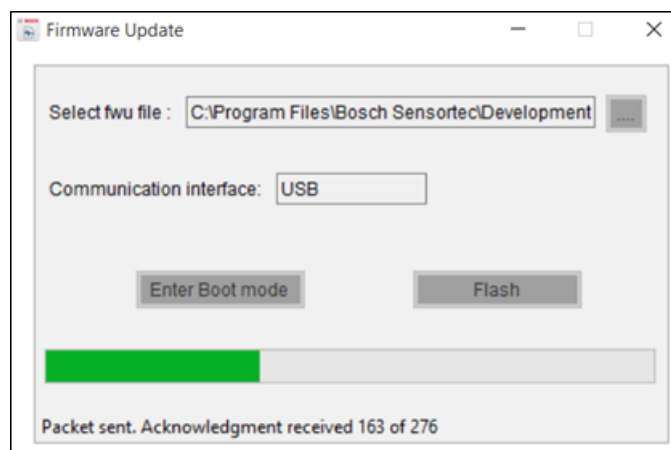


Figure 12 : Firmware upgrade completion

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

### 3.3.2 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:

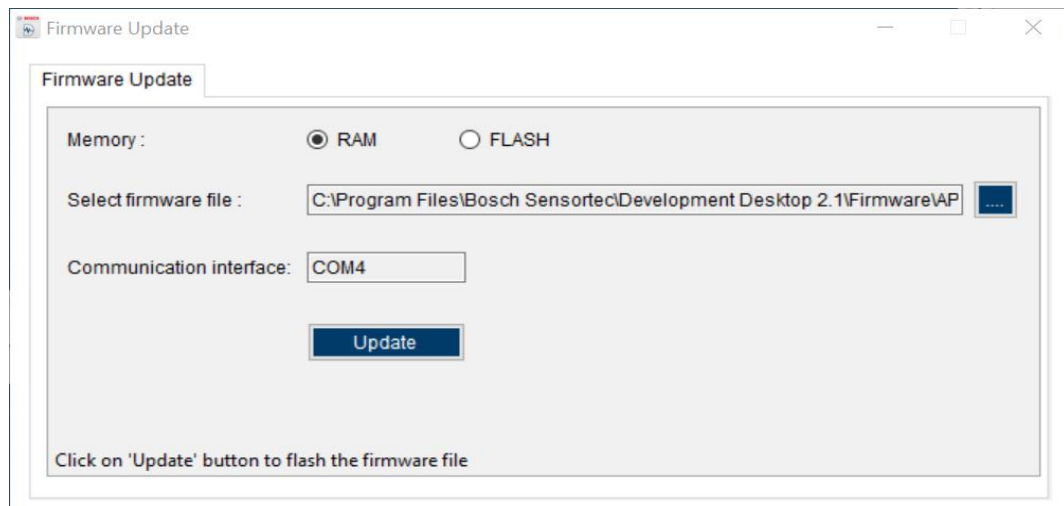


Figure 13 : Firmware upgrade window

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 FLASH 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.

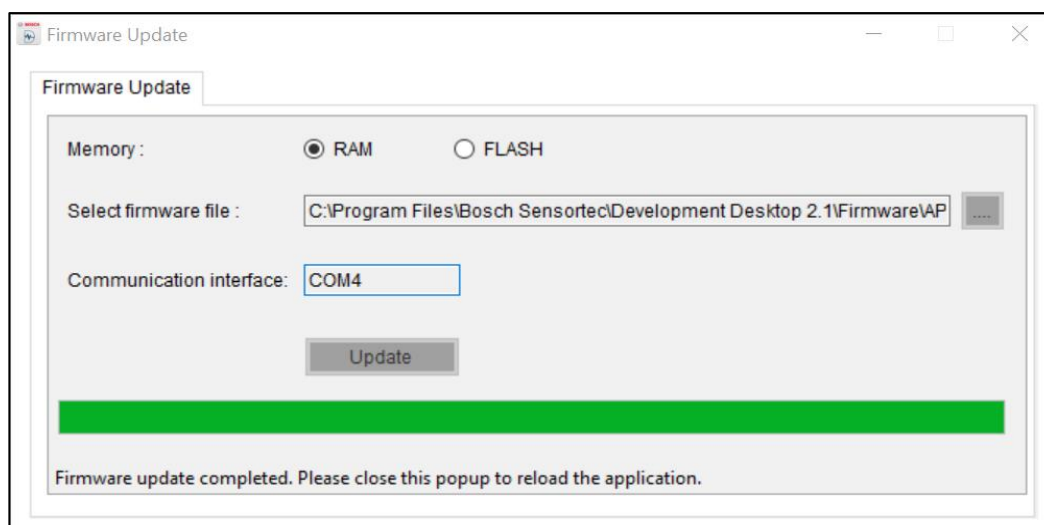


Figure 14 : Firmware upgrade completion

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 BMI08x in DD2.1 UI are discussed in the below sections.

### 4.1 Sensor Data Monitoring

DD2.1 UI offers sensor data monitoring for both accelerometer and magnetometer in BMI08x.

#### 4.1.1 Accelerometer

1. To view accelerometer data, go to **Menu -> Panels -> Accelerometer**, or click **Alt + A**.
2. When an interrupt occurs, the changes in accelerometer data can be seen in the interrupt plotter.

#### 4.1.2 Gyroscope

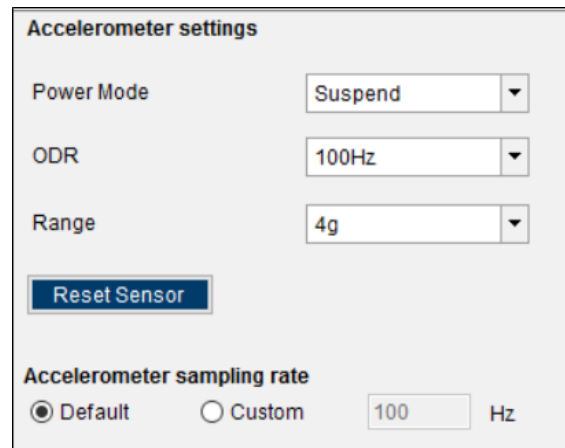
1. To view the Interrupts plotter, **Menu -> Panels -> Gyroscope**, or click **Ctrl + Alt + G**.
2. When an interrupt occurs, the changes in gyroscope data can be seen in the interrupt plotter.

### 4.2 General Settings

The General Settings panel is present in the right side of the DD2.1 UI screen. The various general settings available in BMI08x as discussed in the below sections:

#### 4.2.1 Accelerometer Settings

The accelerometer settings panel is as seen below:



The image shows a software interface titled "Accelerometer settings". It contains three dropdown menus: "Power Mode" set to "Suspend", "ODR" set to "100Hz", and "Range" set to "4g". Below these is a blue button labeled "Reset Sensor". At the bottom, there is a section for "Accelerometer sampling rate" with two radio buttons: "Default" (which is selected) and "Custom". Next to the "Custom" option is a text input field containing the number "100" followed by the unit "Hz".

Figure 15 : Accelerometer settings

- **Power Mode:** To choose the operating mode for streaming, select the power mode from the drop-down list. The different power modes available are:
  1. Suspend mode (to disable sensor streaming)
  2. Normal Mode
- **ODR:** To choose the Output Data Rate (ODR), select the relevant values from the drop-down list which are:
  1. 12.5 Hz
  2. 25 Hz
  3. 50 Hz
  4. 100 Hz
  5. 200 Hz
  6. 400 Hz
  7. 800 Hz
  8. 1600 Hz
- **Range:** To set a range, the user must select any one of the following options from the range drop-down list
  1. 2g
  2. 4g
  3. 8g
  4. 16g
- To reset all values to its default state, click
- The two sampling rates offered by DD2.1 UI for BMI08x 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 12.5 Hz and 2000 Hz.
- Select relevant value by clicking the radio button next to the option name.

**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.

### 4.2.2 Gyroscope Settings

The Gyroscope settings panel is as seen below:

**Gyroscope settings**

Power Mode: Normal

Bandwidth: 532Hz (ODR 2KHz)

Range: 2000 °/s

**Reset Sensor**

**Gyroscope sampling rate**

☒ Default ☐ Custom 2000 Hz

Figure 16 : Gyroscope settings

- **Power Mode:** To choose the operating mode for streaming, select the power mode from the drop-down list. The different power modes available are:
  1. Normal Mode
  2. Suspend Mode (to disable sensor streaming)
  3. Deep Suspend Mode
- **Bandwidth:** To select the bandwidth of output streaming for gyroscope, select the relevant option from the drop-down list next to the option name. The different available bandwidths are:
  1. 523Hz (ODR 2 KHz)
  2. 230 Hz (ODR 2 KHz)
  3. 116 Hz (ODR 1 KHz)
  4. 47 Hz (ODR 400 Hz)
  5. 23 Hz (ODR 200 Hz)
  6. 12 Hz (ODR 100 Hz)
  7. 64 Hz (ODR 200 Hz)
  8. 32 Hz (ODR 100 Hz)
- **Range:** To choose the range, select the relevant value from the drop-down list. The range values available are:
  1. 2000°/s
  2. 1000°/s
  3. 500°/s
  4. 250°/s
  5. 125°/s
- To reset all values to its default state, click **Reset Sensor**
- The two sampling rates offered by DD2.1 UI for the BMI08x sensors are:
  - Default: A pre- defined sampling rate value supported by the sensor.
  - Custom: User-defined sampling rate value. Custom sampling rate can only be a value between 100 Hz and 2000 Hz.
- Select relevant value by clicking the radio button next to the options.

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

- ▶ DD2.1 UI offers two kinds of data streaming for BMI08x. They are:
  1. **Polling:** In **Polling**, data is polled/ streamed at periodic time intervals. These time intervals are defined by the sampling rate.
  2. **Interrupt:** In **Interrupt**, data is streamed as and when data is ready. Select relevant value by clicking the radio button next to the options.

## 4.3 Panels

- ▶ To choose the panels for which you wish to view data, go to **Menu -> Panels**.

The different panels available for BMI08x are:

### 4.3.1 Binary View

- ▶ To view the data in binary format, go to **Menu -> Panels -> Memory Map -> Binary View**, or click **Ctrl+B**.
- ▶ The following panel appears:

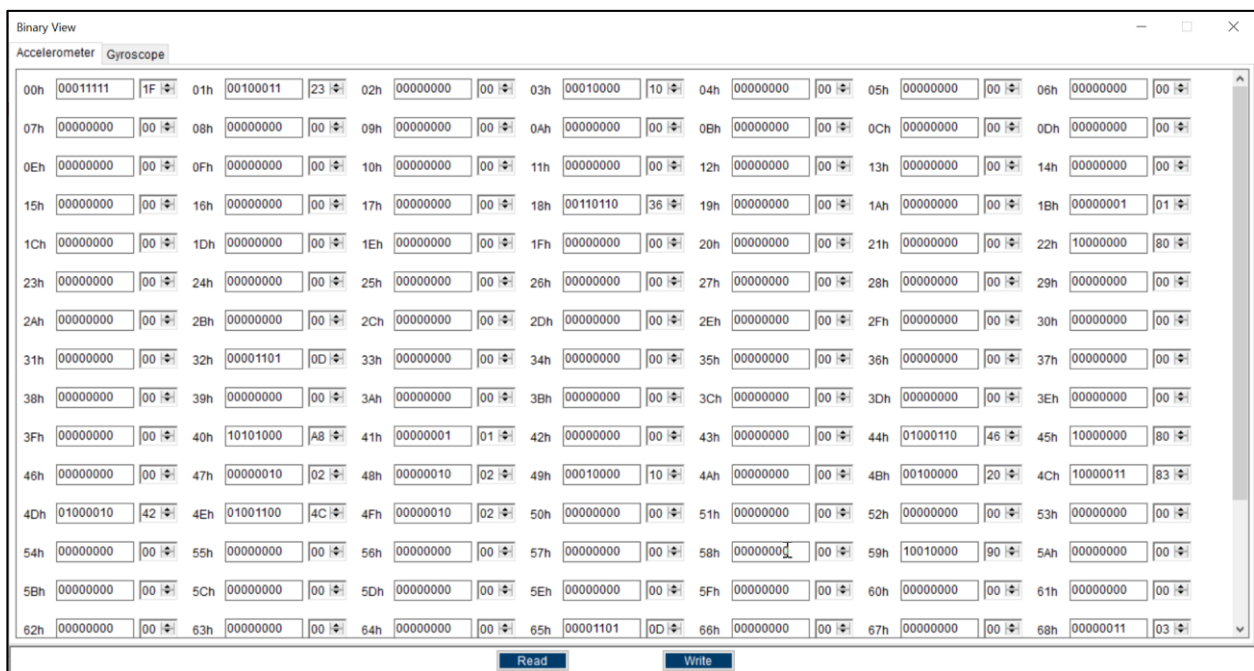


Figure 17 : Binary view

- ▶ **Binary View** is used to read or write values into multiple registers in one view. To implement this, follow the below steps:
  1. Enter the value in the box alongside the register name.
  2. As per requirement, click **Read/Write**.

### 4.3.2 Register Access

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

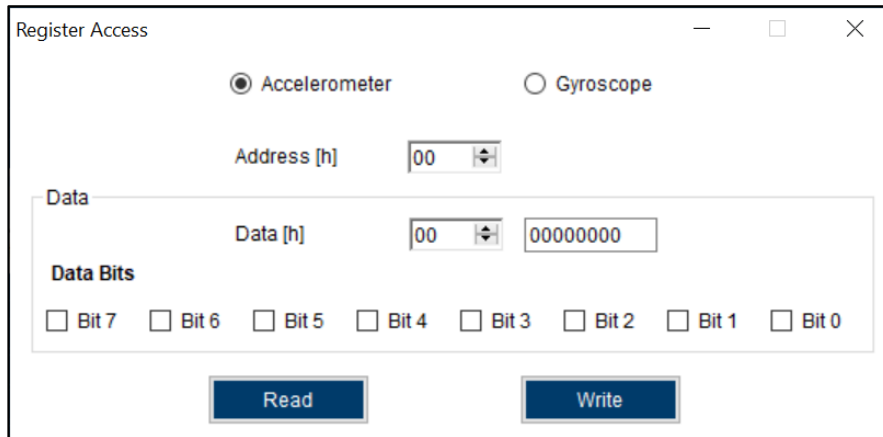


Figure 18: Register access

**Register Access** is used to read or write values into a register. To implement this, follow the below steps:

1. Enter the hexadecimal register address in **Address [h]**.
2. Enter the hexadecimal data you wish to read/ write in **Data [h]**.
3. Select the data bits into which data has to be written, or read from.
4. As per requirement, click **Read/Write**.

### 4.3.3 Data Export

- To save the output values plotted by DD2.1 UI, go to Menu -> Panels -> Data Export, or click Ctrl+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:
  1. Go to **Menu -> Panels-> Data Export**, or click **Ctrl + D**. The following window is displayed.

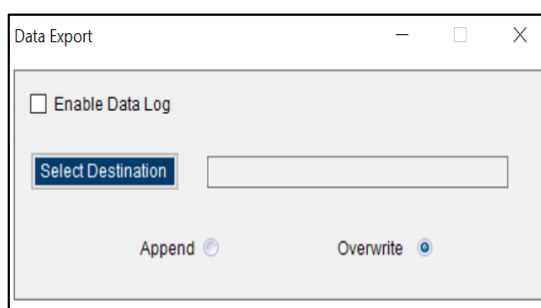


Figure 19 : Data export window

2. Check the checkbox **Enable Data Log**.
3. Click **Select Destination**, and select required destination folder.

**Note: The data log will be stored in the destination folder selected by you.**

4. 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**.
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.

#### 4.3.5 Default View

- ▶ To view the Default View, go to Menu -> Panels -> Default View, or click Ctrl+Shift+D.
- ▶ The DD2.1 UI will revert to its default GUI view.
- ▶ The panels available in this view are:
  1. Accelerometer Panel
  2. Gyroscope Panel
  3. General Settings Panel

## 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 has 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).

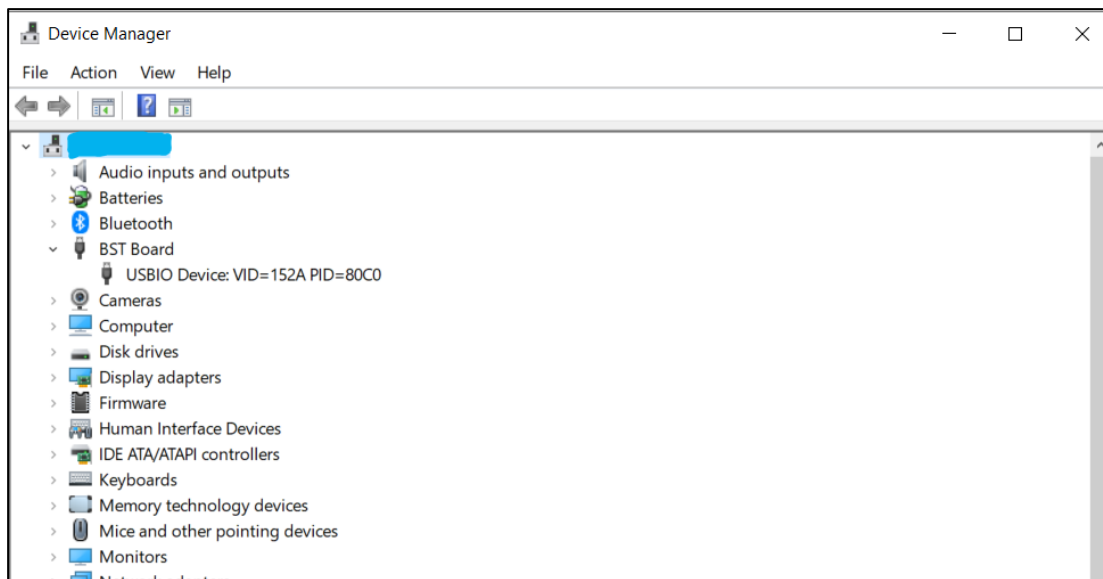


Figure 20 : Selecting USB device corresponding to application board

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

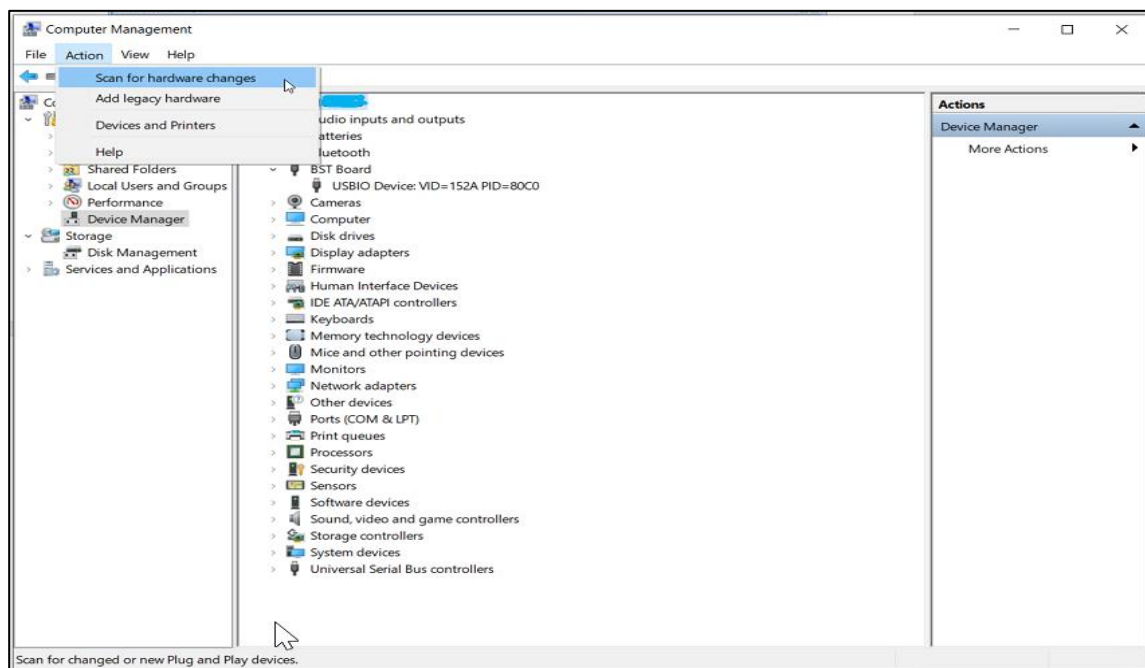


Figure 21 : USB driver installation

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

Table 2 : Troubleshooting Fixing

Condition	Possible cause	Solution
If <b>Communication Status</b> remains grey red after checking the <b>Start</b> Button.	Application Board is turned off.	<b>Power on</b> the application Board and restart the DD2.1 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 <b>Please connect application Board</b> 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 <b>Please connect Shuttle Board</b> is displayed.	Shuttle Board is not fixed properly.	Ensure that the Shuttle Board is correctly fixed in the Development Board.
Error message <b>Please select a path or file for logging</b> is displayed.	Destination path for saving the logged data is not defined.	Select the <b>Data Export</b> option in the file menu and specify the destination path.
Error message <b>Please select File from File Menu → Data Export option to proceed</b> is displayed.	Destination path not selected.	In the file menu, select the <b>Data Export</b> option and select the destination path.
Error message <b>Please Connect Valid Sensor</b> 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

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## 7 Document history and modification

Rev. No	Chapter	Description of modification/changes	Date
1.0		Initial release	January 2019
1.1		Adopt to new format	August 2020
1.2		Updated DD application version	April 2023

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