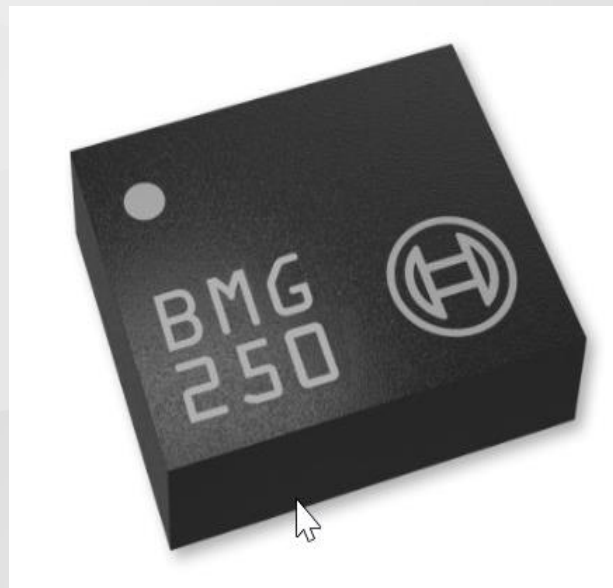


BMGxxx Desktop Development 2.0 User Manual



BMGxxx 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.

1. About user manual

This manual describes the installation and usage of the Development Desktop 2.0 User Interface(DD2.0 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 DD2.0 UI to demonstrate use of the BMGxxx.

1.2 DD2.0 UI Overview

DD2.0 UI is a PC based software used to read, capture, and display sensor data. To display the sensor data of BMGxxx on DD2.0 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. DD2.0 UI automatically detects the sensor that has been plugged in and starts the corresponding software application.

1.3 Sensor Communication:

DD2.0 UI software supports both SPI and I²C to communicate with the sensor.

1.4 Graphical display:

DD2.0 UI displays the sensor data and interrupts in different graphical formats.

1.5 Data logging:

DD2.0 UI offers data logging of the sensor data.

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2. About the BMGxxx

► The BMGxxx is a three-axes-gyroscope device. It consists of a MEMS element and an ASIC within one package. It is capable to measure angular rates in three perpendicular room dimensions X, Y and Z-axis and to provide the corresponding the output signals.

► Key features

1. 3-axis gyroscopic sensor evaluation
2. Small size
3. Switch able full-scale ranges – in total 5 ranges
4. Internal low-pass filters 10, 25, 50, 100, 200 Hz
5. 16-Bit resolution
6. Adjustable on-chip oscillator
7. Self-wakeup
8. Wake-up time in fast power mode is only 10 ms
9. Interrupt engine
10. SPI & I²C interface supported

3. Getting Started

The below sections highlight the procedure to set up connections between BMGxxx, DD2.0 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 DD2.0 UI.
- Insert the shuttle board and application board.

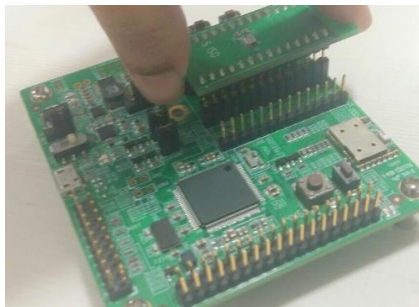


Figure 1 : Insert sensor

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



Figure 2 : Connect board and PC

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

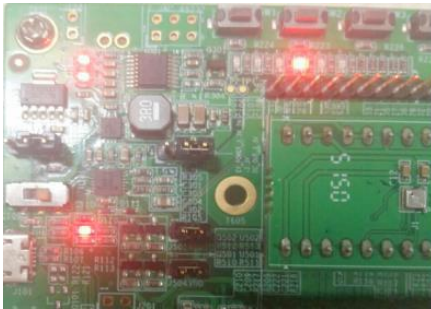



Figure 3 : Connection complete

3.2 Startup View

To start the DD2.0 UI software:

► Click **Start -> Programs -> Development Desktop 2.0**.

Or

► Double click the  DD2.0 UI software icon on the desktop.

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

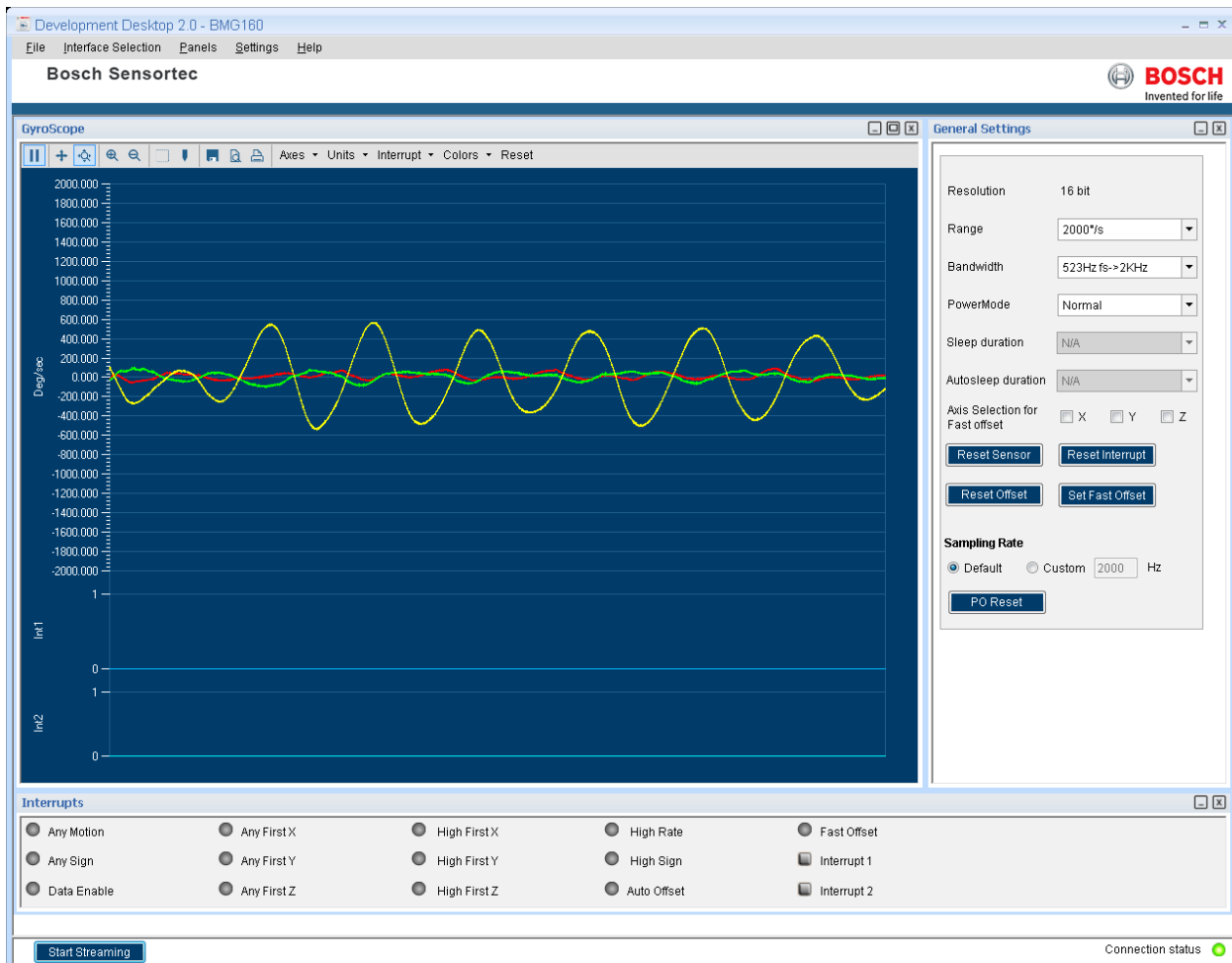


Figure 4 : DD2.0 Startup View

- ▶ Additional panels/views can be opened by selecting views from panel menu item.
- ▶ If the connection status indicator glows green, the Board and the PC are connected. Once you press the **Start** button, the sensor signals are plotted on the graph.
- ▶ If you press the **Stop button**, the plotting of sensor signals is stopped.

4. Working with DD2.0 UI

DD2.0 UI offers complete access to BMGxxx sensor.

4.1 Sensor Data and Interrupts Monitoring

BMGxxx sensor compromises of Gyro in a single package and the sensor signals can be monitored accordingly.

4.1.1 Gyroscope

- ▶ This panel plots real time sensor signals from the gyro on the graph. 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.
- ▶ To view this panel, click on Panels in the main menu and select Gyro. Alternately, **Ctrl + P** can be used as a shortcut.



Figure 5 : Gyroscope data in plotter

4.1.2 Gyroscope Interrupts

- ▶ This view shows the real time interrupt status from the gyro BMGxxx sensor. The round LEDs are the sensor interrupt status and the square LEDs are the interrupt pin status. The Interrupt occurrence can be visualized by the LED status to green.
- ▶ To view this panel, click on Panels in the main menu and select **Gyro Interrupts**. Alternately, **Alt + G** can be used as a shortcut.



Figure 6 : Gyroscope Interrupts

4.2 Data Export

- ▶ The angular rate values of 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. At least, one axis and the corresponding at least one unit must be to enable data log.
- ▶ Follow these steps to carry out the data export:
 1. Click Data Export (**or**) **CTRL + D**.

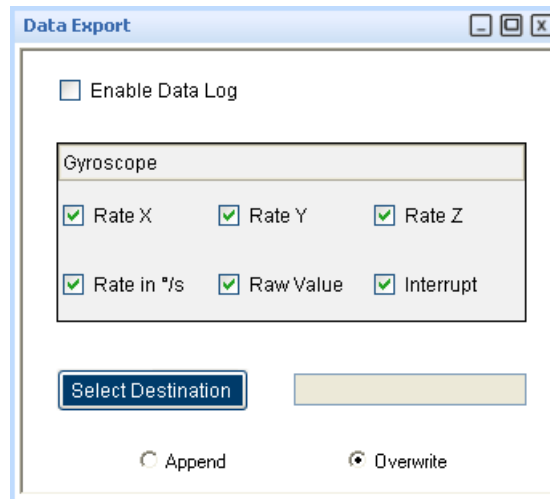


Figure 7 : Data export window

2. Click the **Select Destination** to select the destination path.

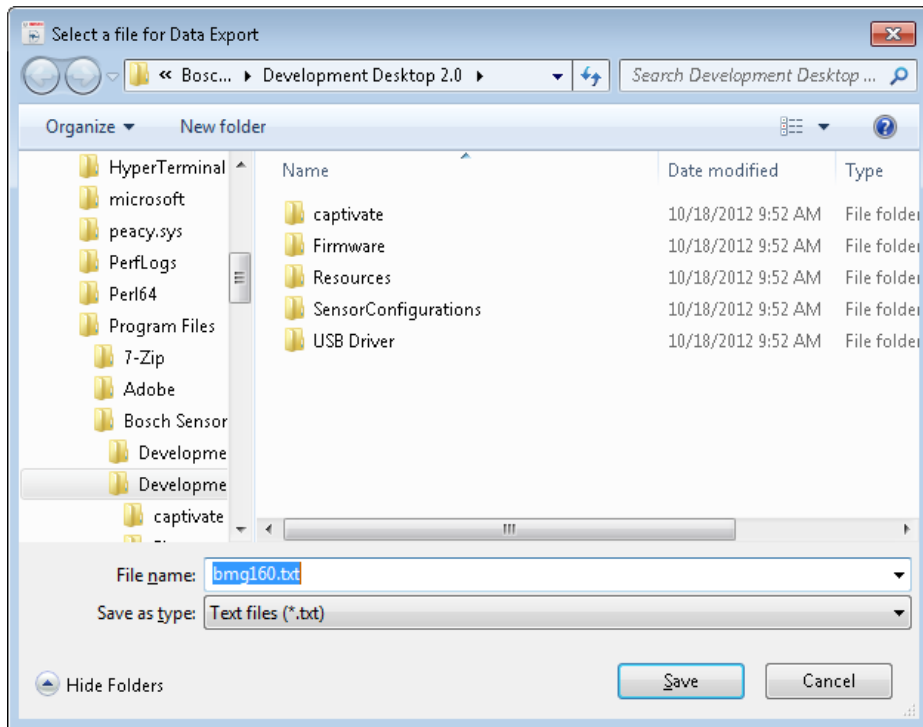


Figure 8 : select the file location

3. Enable the axis data to be logged. Change the toggle button to append or overwrite. Then click **OK**. 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 to it.
4. Check the **Enable Data Log** check box.

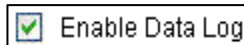


Figure 9 : Enable datalog check box

5. Click the **Start** button to plot the angular rate signals in the graph. Click **Stop** to end the plotting of the angular rate signals in the graph. The output of the angular rate signals is saved in the desired destination path.

4.3 Sensor Configuration

DD2.0 UI allows user to configure the sensor without any limitations. The configurations can be classified as basic and advanced configuration. The entire basic configurations are available in the **General Settings** panel. The advance configuration can be accessed by various panels available under **Memory Map** and **Register Access**.

4.3.1 Selecting Gyro Bandwidth

- ▶ Two different streams of sensor data are available, unfiltered and filtered. The unfiltered data is sampled at 2 kHz. The sampling rate of the filtered data depends on the selected filter bandwidth and is always twice the selected bandwidth.
- ▶ The band width can be selected from the **General Settings** panel. Use the **Bandwidth** dropdown menu



Figure 10 : Gyroscope bandwidth

4.3.2 Selecting Gyro Range

The gyro range setting configures the measurement range of the gyro sensor. The range can be selected from the **General Settings** panel.

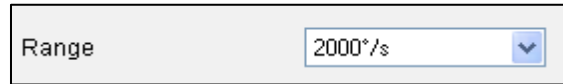


Figure 11 : Gyroscope range

4.3.3 Selecting Gyro Operation Mode

BMGxxx gyro sensor can be configured to any one of the operation modes by selecting the options available in the drop down menu. The operation mode can be selected from the **General Settings** panel

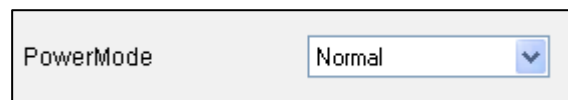


Figure 12 : Gyroscope modes

Note:

For a detailed description of the sensors power saving modes and their applications, refer to the BMGxxx sensor data sheet.

4.3.4 Reset Sensor

- ▶ A soft reset causes all user configuration settings to be overwritten with their default values and sensor enters to the normal mode.
- ▶ Click the **Reset button** to soft reset the sensor.



Figure 13 : Reset sensor

4.3.5 Reset Interrupt

This will reset any active interrupt. The interrupt will again occur only if the interrupt is enabled and the particular interrupt condition occurs.



Figure 14 : Reset interrupts

4.3.6 Binary View

- ▶ In the 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 can be helpful in writing direct values to the sensor memory map.
- ▶ The value entered is converted to binary format and is displayed in the **Binary** text box.
 1. Click **Write** to transfer values to the actual registers.
 2. Click **Read** to read the current register setting of the sensor in the memory map window.
- ▶ To launch this view, click on Panels in the main menu and select Memory Map -> Binary View. Alternately, Ctrl + B can be used as a shortcut.

4.3.7 Offset View

- ▶ Offset in measured signals can have several causes but there are unwanted and disturbing in many cases. Therefore four digital compensation methods are offered. These are slow, fast and manual compensation as well as inline calibration.
- ▶ The compensation is performed with the filtered data, and is then applied to both, unfiltered and filtered data.
- ▶ The OFFSET View can be selected by clicking on panels-> memory map-> OFFSET view.

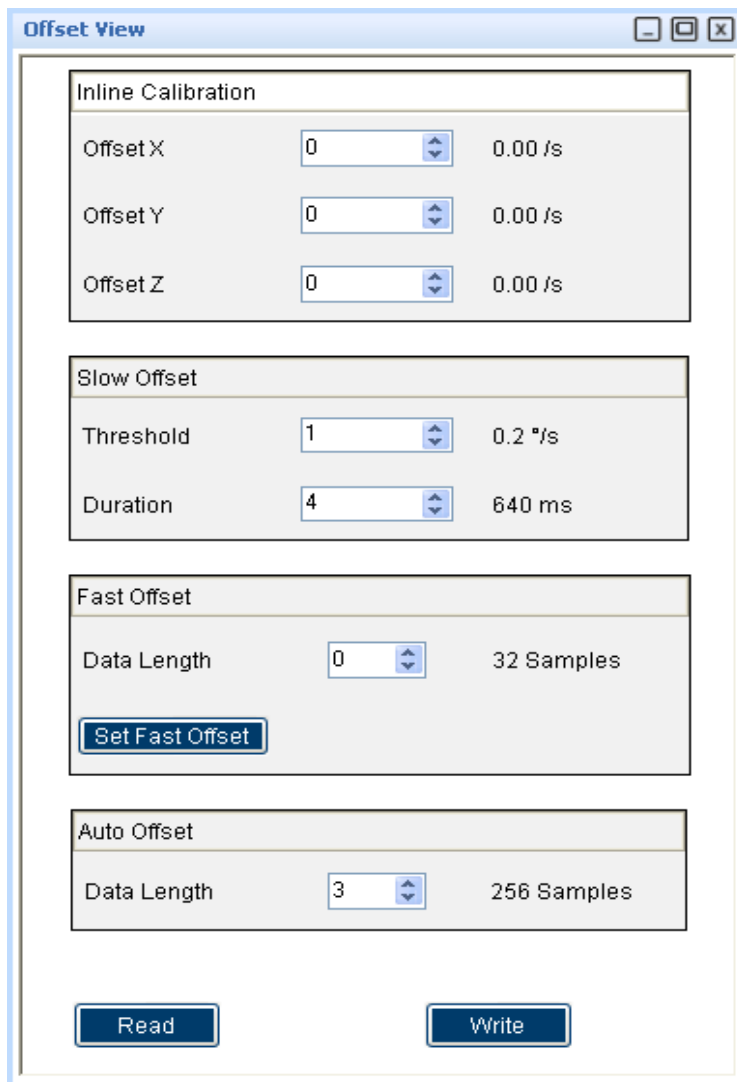


Figure 15 : Offset view

4.3.8 Interrupt configuration

The BMGxxx is equipped with three programmable interrupt engines. Each interrupt can be independently enabled and configured. The BMGxxx provides two interrupt pins INT1 and INT2; interrupts can be freely mapped to any of these pins.

4.3.8.1 General features

- ▶ An interrupt is cleared depending on the selected interrupt modes which is common to all the interrupts. There are three different interrupt modes: non latched, latched and temporary. The mode will be selected according to value in latch duration the panels-> memory map->interrupt view->Sleep and latch interrupt.
 1. In non-latched mode the interrupt status bit and the selected pin is cleared as soon as activation condition is not valid. Exceptions to this behaviour are new data orientation and flat interrupts, which will automatically get reset after a fixed time.
 2. In latched mode the interrupt status bit and the selected pin are latched permanently. This will be cleared only on reset interrupt.
 3. In temporary mode an asserted interrupt status bit and the selected pin are cleared after a defined period of time.
- ▶ It is strongly recommended to set the interrupt parameters prior to enabling the interrupt. Changing the parameters of an already enabled interrupts may cause unwanted interrupt generation and generation of false interrupt history.

4.3.8.2 New data interrupt

- ▶ This interrupt serves for synchronous reading of angular rate data. It is generated after storing the new value of z-axis angular rate data in the data register. The interrupt is cleared automatically when the data acquisition starts.
- ▶ The interrupt can be enabled by going to panels-> memory map->interrupt view and clicking on the data. If it needs to be mapped with the two interrupt pins INT1 and INT2 click on int1 and int2. The high Rate threshold

4.3.8.3 Any motion

- ▶ Slope / any motion detection uses the slope between two successive angular rate signals to detect the changes in motion. An interrupt is generated when the slope exceeds a preset threshold. It is cleared soon as soon as the slope falls below the threshold. In order to suppress false triggers the interrupt is only generated (cleared) if a certain no N of consecutive slope data points is larger (small) than the threshold.
- ▶ The interrupt can be enabled (disabled) for each axis by going to panels-> memory map->interrupt view and
- ▶ Clicking on the Slope X, Y, Z. If it needs to be mapped with the two interrupt pins INT1 and INT2 click on int1 and int2.
- ▶ The threshold can be selected from the panels-> memory map->interrupt view ->Any motion slope settings -> threshold. Slope samples and Awake duration can be set through the respective text boxes in Any motion settings

4.3.8.4 High- rate interrupt

- ▶ This interrupt is based on the comparison of angular rate data against a high angular rate threshold for the detection of shock or other high- angular rate events.
- ▶ The interrupt can be enabled or disabled by clicking on the high angular rate G in panels-> memory map->interrupt view->Interrupt mapping. Each axis can be enabled by clicking on X, Y, Z.
- ▶ The high Rate threshold is set for each axis through the selection box threshold in High- Rate X-axis, Y-axis and Z-axis settings. The High-Rate duration can be also set through duration time.
- ▶ The high Rate threshold hysteresis can be set through threshold hysteresis text box.
- ▶ After selecting all these write image need to be clicked.

4.4 FIFO view

- ▶ The BMGxxx features an integrated FIFO memory capable of storing 100 frames. Conceptually each frame consists of x, y, z axis which are sampled at same point in time.
- ▶ FIFO can be operated in three modes.
 1. FIFO mode
 2. STREAM mode
 3. BYPASS mode

4.5 Register Access

- ▶ This view provides direct access to the sensor registers. If the correct register address of the sensor memory map is known, this view can be very useful. The values can be read from or can be written to the sensor register.
- ▶ To launch this view, click on Panels in the main menu and select **Register Access**. Alternately, **Ctrl + R** can be used as a shortcut.

5. General Troubleshooting

Follow below guidelines while working with DD2.0 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 DD2.0 UI, close and restart DD2.0 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).

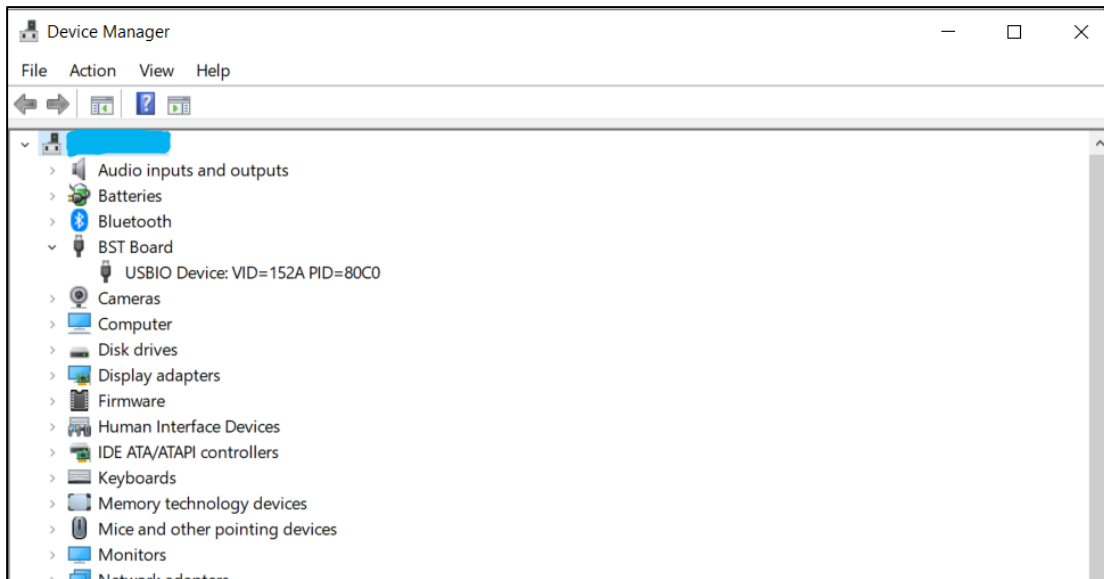


Figure 16 : Selecting USB device corresponding to application board

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

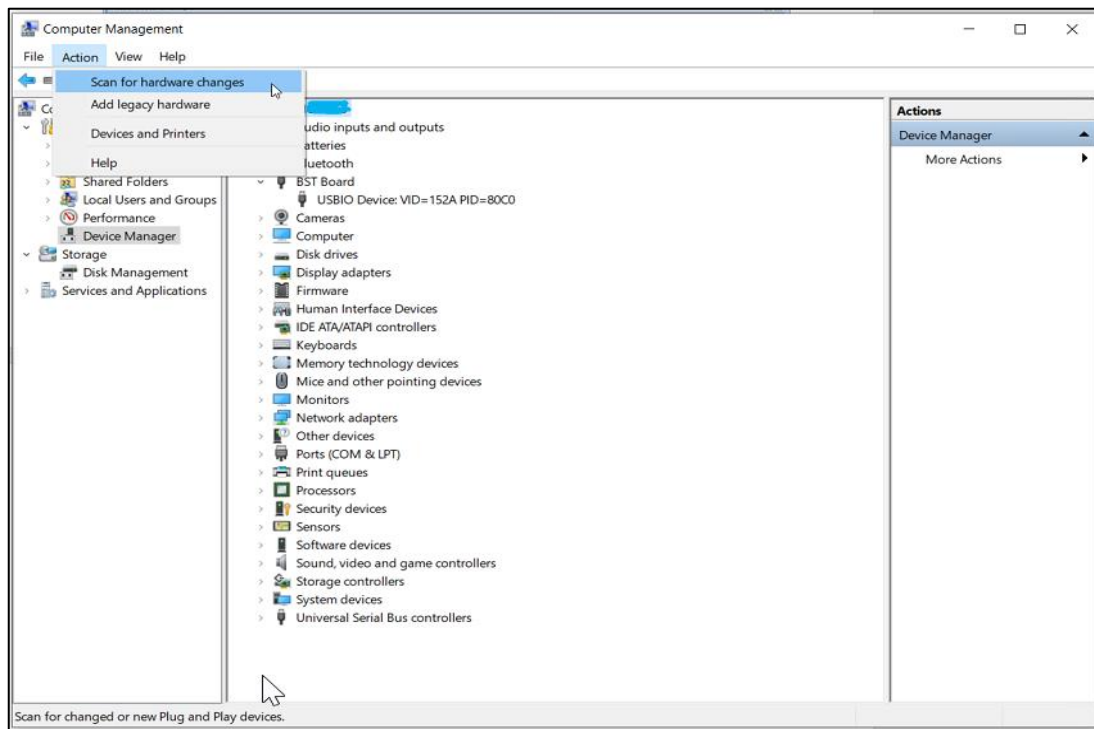


Figure 17 : USB driver installation

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

Table 1 : Troubleshooting Fixing

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 DD2.0 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.

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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		Changed the application icon	December 2012
1.2		Adopt to new format	August 2020

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