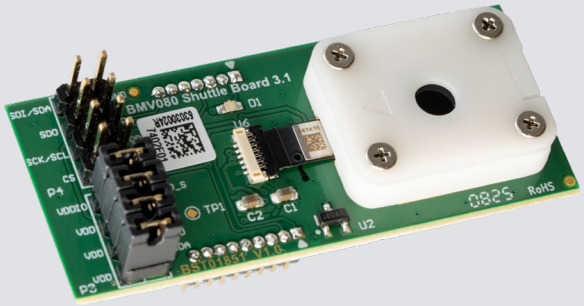
BMV080

Ultra-mini Particulate Matter Sensor



BMV080 Ultra-mini Particulate Matter Sensor - Web App Quick Guide

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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. The technical details and legal disclaimer of the respective product data sheet apply.

Table of Contents

List of Figures

1 Introduction

Bosch Sensortec offers the BMV080 Web App Software for enabling the evaluation of the particulate matter sensor BMV080. The demonstration and develop environment consists of three components:

1. Engineering Board: The Bosch Sensortec Application board 3.1 functions as interface translator from the sensor interface (I2C or SPI) to a USB interface, thereby enabling PC software to communicate with the sensor on the shuttle board. For further details, please refer to the Application board documentation.
2. BMV080 Shuttle Board: The BMV080 Shuttle Board 3.1 allows straightforward access to the sensor pins via a simple socket and can be directly connected into the Bosch Sensortec Application board 3.1. For further details, please refer to the BMV080 documentation (including BMV080 Shuttle Board 3.1 Flyer).
3. BMV080 Web App: Utilizing the BMV080 Web App provided by Bosch Sensortec, users can configure sensor parameters and read, display, and capture data on a connected PC or laptop running Windows. The user interface enables configuration of sensor parameters, presents sensor readings in a graphical format and facilitates data logging of the particulate matter measured by the sensor. For a detailed description, please refer to the following pages in this document.

For a detailed description of the BMV080 particulate matter sensor or details on systems integration requirements, please refer to the BMV080 Ultra-mini Particulate Matter Sensor – Datasheet (BST-BMV080-DS000).

2 Getting Started with the BMV080 Web App

The BMV080 Web App is a browser-based interface designed for evaluating the BMV080 particulate matter sensor using the BMV080 Shuttle Board 3.1 in combination with the Application Board 3.1. It enables real-time measurements, sensor configuration, and data export of particulate matter (PM) readings. The Web App is part of SDK version 11.2 or later and is optimized for use with Chromium-based browsers such as Chrome, Edge, or Opera.

Key features of the Web App:

- Visualization of the PM1, PM2.5, and PM10 mass concentrations [µg/m^3] in real time
- Time-resolved visualization of historical PM1, PM2.5, and PM10 mass concentrations [µg/m3]
- Option to configure sensor and measurement settings
- Option to export the collected sensor readings

2.1 Requirements

2.1.1 Browser Requirements

- The supported Browsers are Chromium-based browsers such as Google Chrome, Microsoft Edge, etc.
- If the app is opened in an unsupported browser, an error message will be shown, and the app will not load.

2.1.2 Operating System Requirements

The minimum requirements on the working environment are the following:

- Operating system: Windows 11, 64-bit version*
- Ports: USB 3.0 or USB 2.0
- Bluetooth ®: 5.0 or higher

* The operation of the Web App in other platforms is currently untested.

2.1.3 Tool Requirements

- BMV080 SDK version 11.2.0 or later (please refer to the BMV080 product page for the latest version).
- COINES SDK version 2.10.4 or later needs to be installed.
- USB driver
    - As part of the COINES SDK installation process please also install the USB driver for the application board. This can be installed either during the COINES installation process or by running the app_board_usb_driver.exe found in the driver subdirectory of the COINES SDK installation.

2.2 Preparation

Prior to operation of the Web App, the associated firmware needs to be flashed to the engineering board. The steps to perform this action are as follows:

1. Connect the application board with the mounted BMV080 shuttle board the PC:
    - Via USB cable (USB micro to USB A): recommended connection method
    - Via Bluetooth Low Energy (BLE): connect the application board to another power source and keep it within the BLE range
2. Navigate to the Web App directory within the SDK, ‘BMV080-SDK-vX.Y.Z\apps\web_app_bst_application_board’
3. Verify or update the variable COINES_INSTALL_PATH in the firmware upload script.
    - The install path of the COINES SDK is referenced in the upload script ‘upload_bmv080_web_app_firmware.bat’ under variable COINES_INSTALL_PATH.
    - By default, the standard installation path of the COINES SDK is used. If the COINES SDK is installed in a different location, this variable needs to be updated.
    - Please note that the firmware upload process only requires the utilities under the subdirectory ‘tools’ of the COINES SDK.
4. Run the ‘upload_bmv080_web_app_firmware.bat’ to upload the provided firmware file (bmv080_web_app_firmware.bin) from BMV080 SDK.

5. Verify that the upload is successful as shown in the screen shown in the figure below.
6. Launch the BMV080 Web App by clicking on the script ‘launch_bmv080_web_app.bat’. This opens the application on the system default web browser. Alternatively, opening the ‘index.html’ file on a Chromium-based browser will launch the BMV080 Web App.

```
dfu-util 0.9

Copyright 2005-2009 Weston Schmidt, Harald Welte and OpenMoko Inc.
Copyright 2010-2019 Tormod Volden and Stefan Schmidt
This program is Free Software and has ABSOLUTELY NO WARRANTY
Please report bugs to http://sourceforge.net/p/dfu-util/tickets/

Invalid DFU suffix signature
A valid DFU suffix will be required in a future dfu-util release!!!
Opening DFU capable USB device...
ID 108c:ab39
Run-time device DFU version 0110
Claiming USB DFU Interface...
Setting Alternate Setting #1 ...
Determining device status: state = dfuIDLE, status = 0
dfuIDLE, continuing
DFU mode device DFU version 0110
Device returned transfer size 64
Copying data from PC to DFU device
Download        [=========================] 100%       185420 bytes
Download done.
state(5) = dfuDNLOAD-IDLE, status(0) = No error condition is present
Done!
can't detach
Resetting USB to switch back to runtime mode
Press any key to continue . . .
```

Figure 1: Console output upon successful firmware upload

3 Running the BMV080 Web App

3.1 Environmental conditions

Please refer to Section 4.1.1 of the BMV080 Datasheet (BST-BMV080-DS000) for the physical arrangements before running a measurement.

3.2 Web App Overview

Located on the left, the navigation drawer provides access to all main features:

- **Current Reading:** View real time PM concentrations [µg/m^3] sensor readings.
- **Past Readings:** View historical data in time charts.
- **Settings:** This page allows the user to change sensor parameters.
- **Connect/Disconnect Serial:** Connect or disconnect the sensor via USB serial interface.
- **Connect/Disconnect BLE:** Connect or disconnect the sensor via Bluetooth Low Energy.
- **Start/Stop Streaming:** Begin or end data acquisition from the sensor.
- **Export Data:** Download collected data.
- **Help:** Access help content.
- **About:** View license and legal information.
- **Version:** View app and sensor firmware versions.

3.3 Connection

By clicking the ‘Connect Serial’ button, the sensor can be connected via USB (serial) interface. Alternatively, the sensor can be connected via Bluetooth Low Energy (BLE) by clicking the ‘Connect BLE’ button. However, USB connection is recommended. Please refer to the images below for an example of a successful connection.

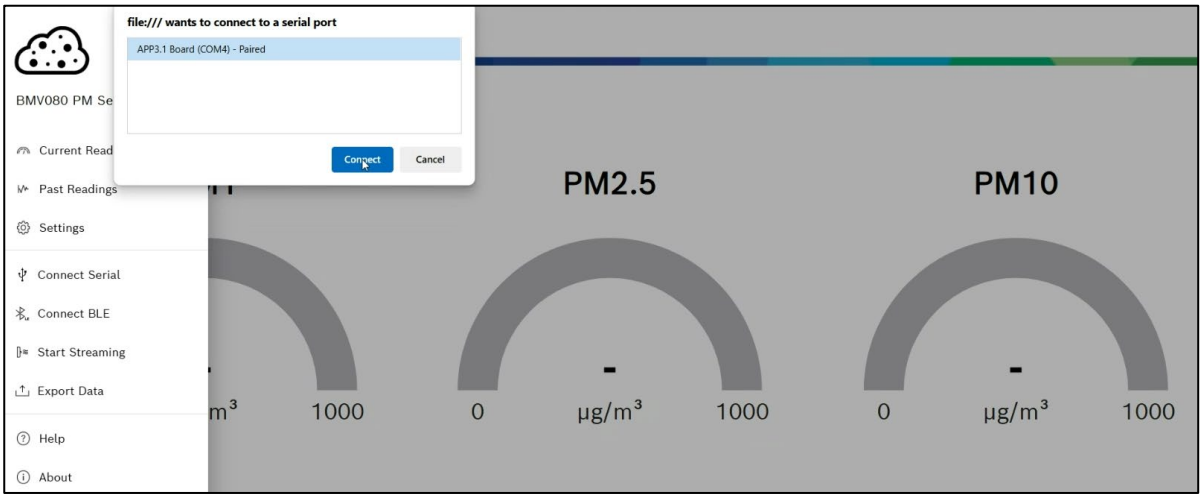

Figure 2: Connecting via USB

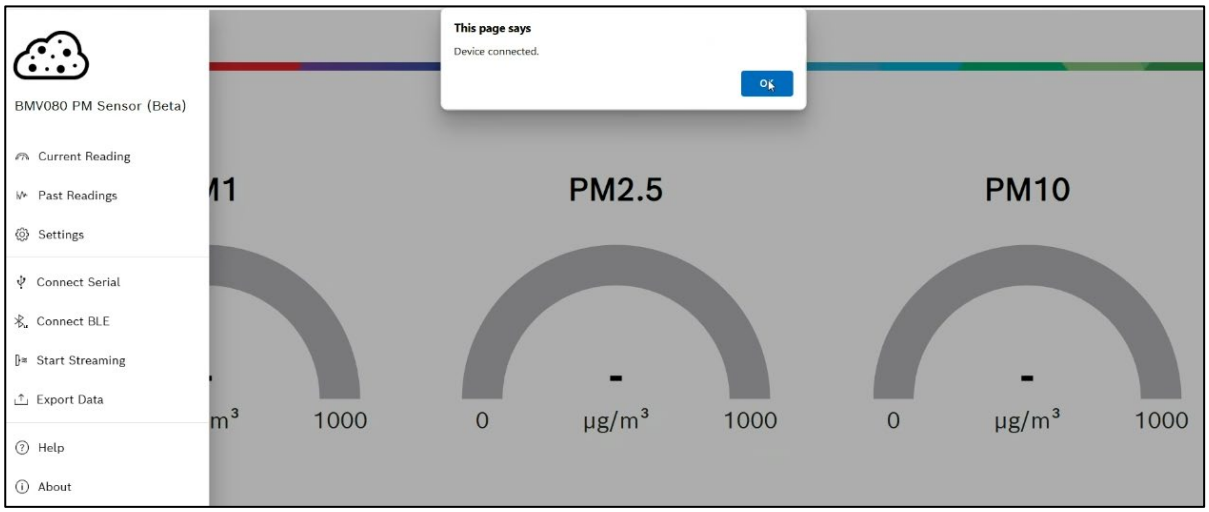

Figure 3: Successful USB connection

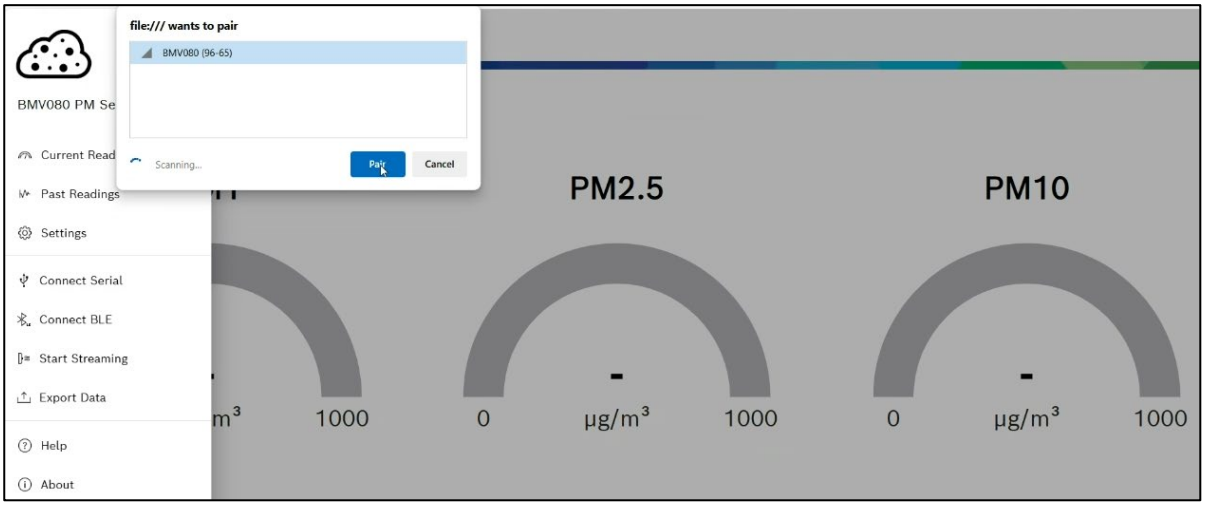

Figure 4: Connecting via BLE

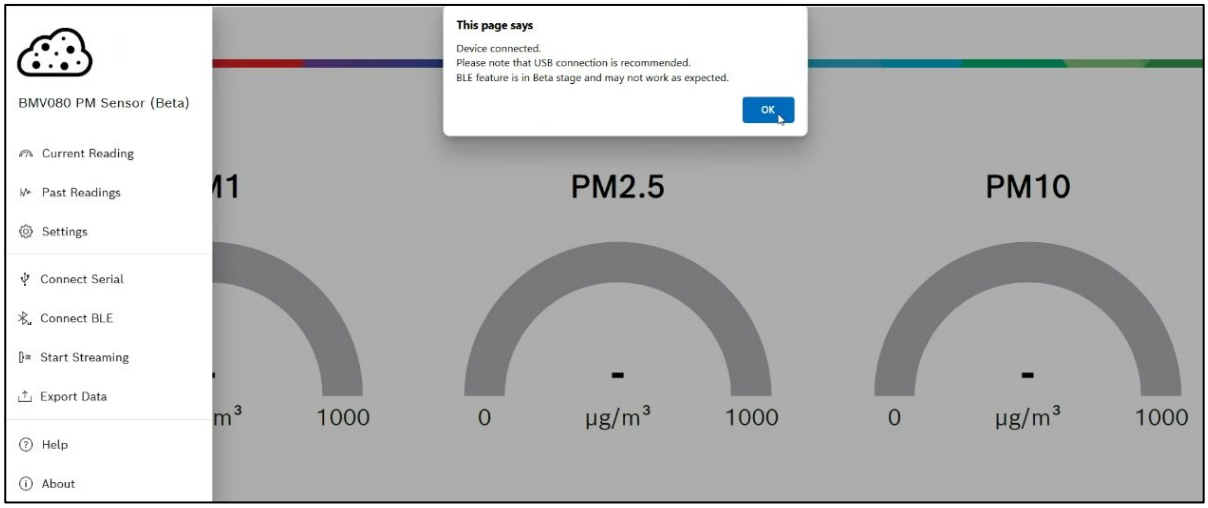

Figure 5: Successful BLE connection

3.4 Configuration

On the Settings page, the sensor can be configured before or after a measurement as shown below

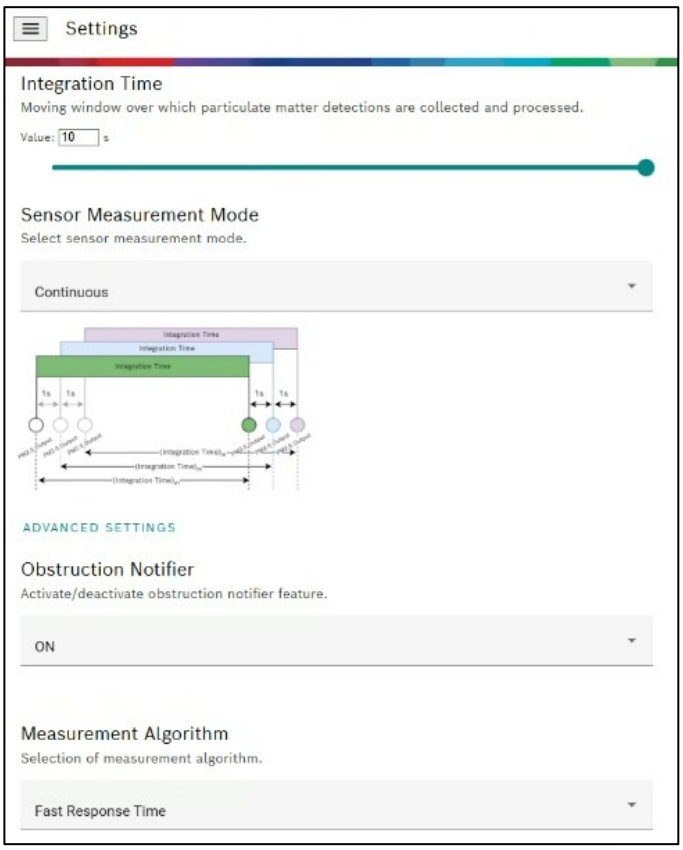

Figure 6: Settings

The settings are the following:

- **Integration Time:** The integration time represents a moving time window during which the sensor collects and processes particulates to arrive at the PM mass concentration readings.
- **Measurement Mode:** It is possible to configure the BMV080 in 2 measurement modes, depending on the use case:
    - **Continuous Measurement Mode:** The continuous mode delivers a particulate matter mass concentration reading with a defined output data rate of 1.03 seconds.
    - **Duty Cycling Measurement Mode:** In duty cycling mode, the sensor delivers a particulate matter mass concentration reading after every duty cycling period. The duty cycling period, which is the time between two consecutive measurements, is configurable by the user. The minimum value configurable as duty cycling period is equal to the integration time and the maximum value is currently limited to 3600 seconds in the Web App.
- **Advanced Settings:** Additional configuration options (toggle button).
- **Obstruction Notifier:** Obstruction notifier is a feature to detect obstructions in front of the optical path of the sensor and informs user with a notification message when it is enabled.
- **Measurement Algorithm:**
    - High Precision: high response time, high precision, low fluctuation
    - Balanced: balanced response time, balanced precision, balanced fluctuation
    - Fast Response Time: low response time, low precision, high fluctuations (default for duty cycling mode)

3.5 Measurement

3.5.1 Starting a measurement

Having connected and (optionally) configured the sensor, a measurement can be started by clicking the 'Start Streaming' button. Once a measurement has started, please allow approximately 10s to get a stable signal. In scenarios of low mass concentration of-particulate matter, the BMV080 needs to collect enough statistical data to deliver a precise result. The sensor readings are visualized in two views.

3.5.2 Current Reading (Gauge View)

- Gauges show the PM concentrations [µg/m^3] in real time.
- The gauges move as the PM concentration in the proximity of the sensor changes over time.
- If an obstruction is detected, a warning message and help icon are shown.

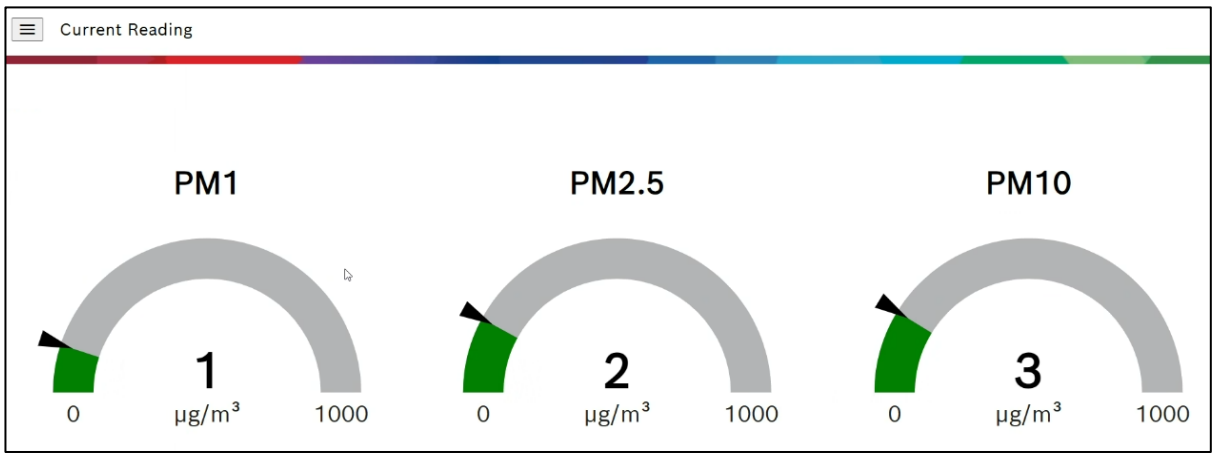

Figure 7: Current Reading

Obstruction notification:

- Reflections caused by objects in the optical path of the BMV080 can influence the sensor functionality
- While occasional obstruction (e.g. by waving of hands) is filtered out by the BMV080 sensor without influencing the sensor performance, a static obstruction (i.e. fixed object) could influence sensor functionality.
- When the BMV080 sensor detects static obstruction, a "Obstruction detected" notification is flagged and PM2.5 measurements are unavailable during this time.
- In the BMV080 Web App, the user is notified during such events.
- Clicking on the question mark next to the "Obstruction detected" notification gives a brief description advising the user to remove objects in the optical path of the BMV080 sensor.
- For more details about Obstruction refer to BMV080 Datasheet (BST-BMV080-DS000), Chapter 4.1

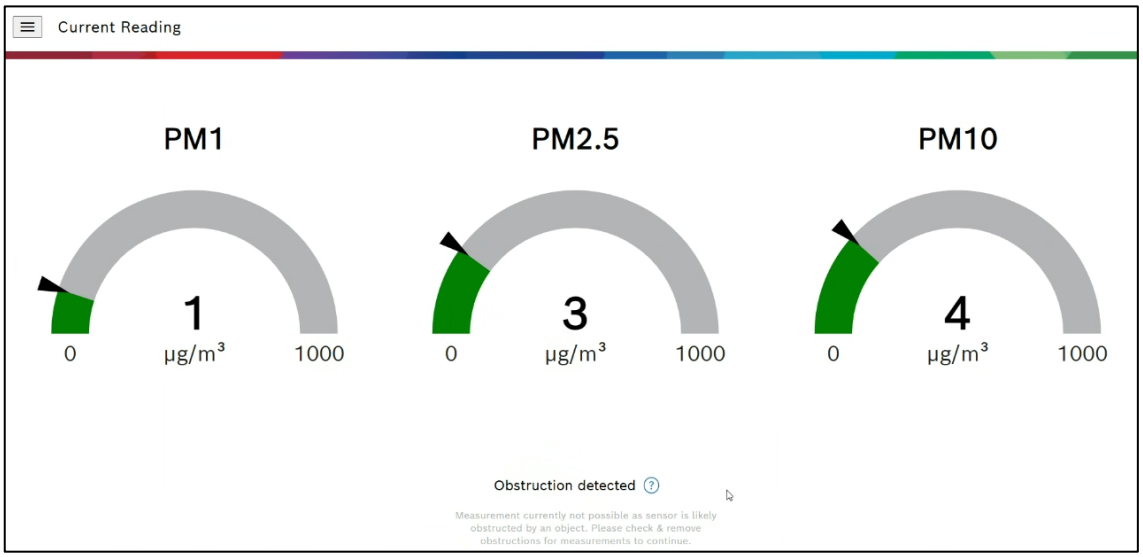

Figure 8: Current Reading with obstruction notification

3.5.3 Past Readings (Chart View)

- Graphs provide a time-resolved visualization of PM1, PM2.5, and PM10 concentrations [µg/m³].
- The time charts visualize also historical PM mass concentration readings.
- Charts are responsive and resize automatically.
- During a measurement, the charts show the last 60 sensor readings, however, a history of the last 18,000 sensor readings are accessible.

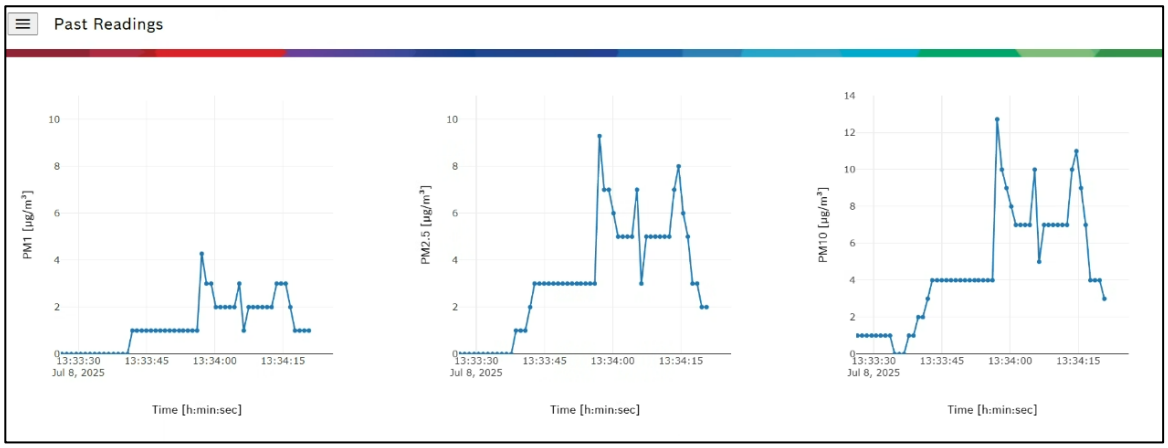

Figure 9: Past Readings

3.5.4 Stopping a measurement

A running measurement can be stopped by clicking the ‘Stop Streaming’ button. The user is offered the option to export the past sensor readings. For more details, please refer to the next section.

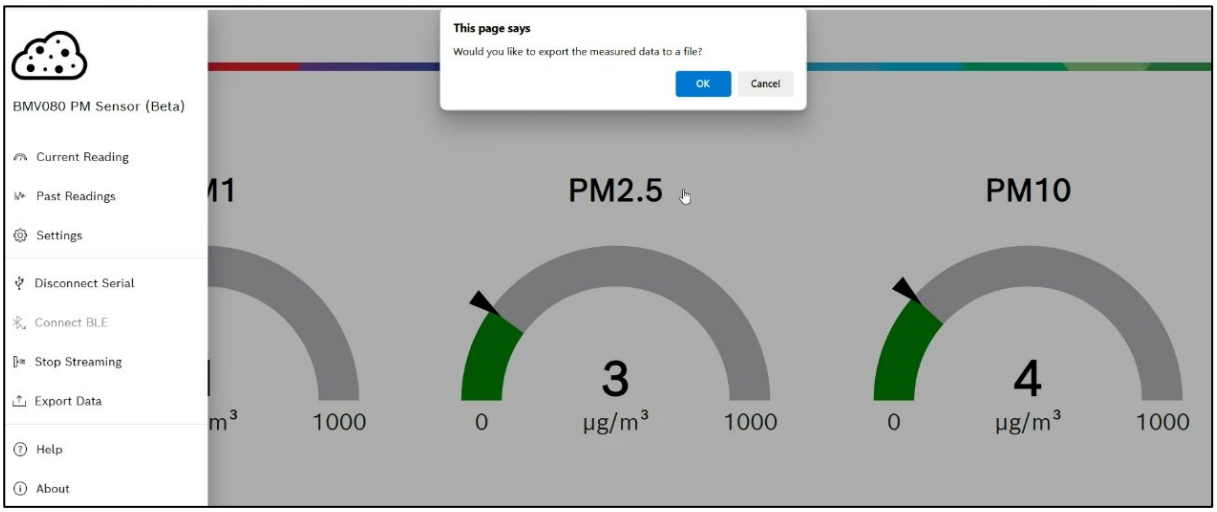

Figure 10: Stop measurement

3.6 Data Export

Measurement data can be exported to a *.csv log file either during or after stopping a measurement by clicking on the ‘Export Data’ button. Upon stopping a measurement, the user is also prompted with the option to export measurement data. The log file with the measurement data will be downloaded to the default system download location.
The data export feature has a limit of 3600 sensor readings. The data buffer which holds previous sensor readings is cleared when a new measurement is started. For recording longer measurements, it is recommended to modify the SDK API example for the application board and to store the USB serial output to a log file.

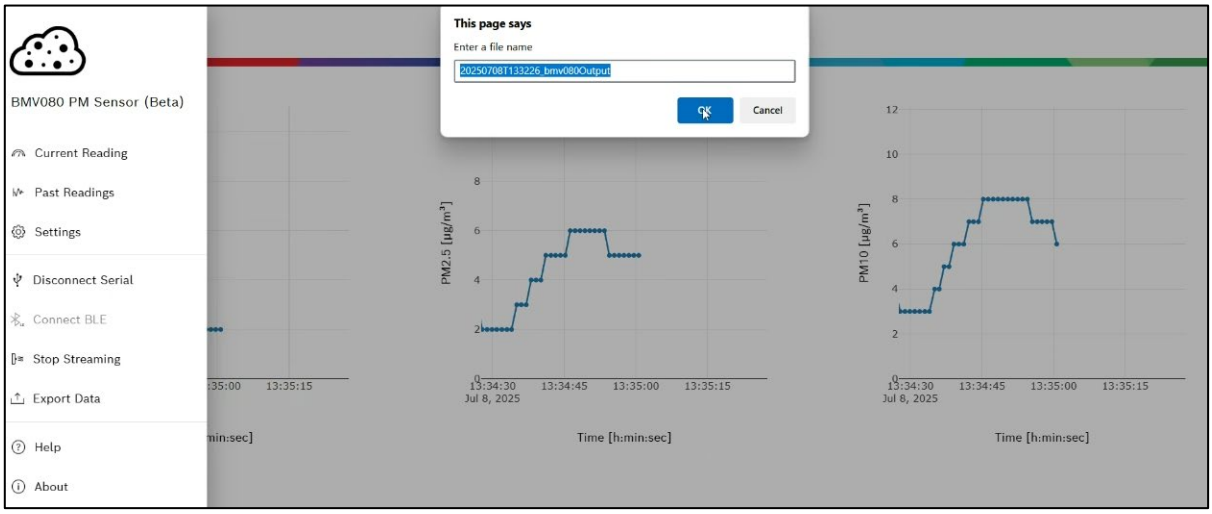

Figure 11: Export data – entering log file name

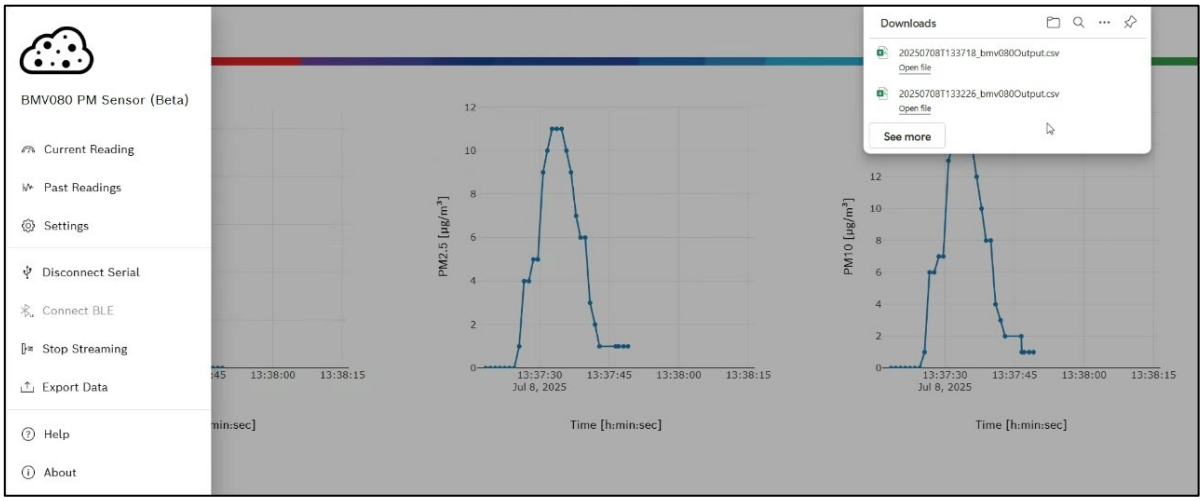

Figure 12: Export data - log file download

3.6.1 Log File Structure for Data Export

The BMV080 Web App log files for data export have a simple, straightforward structure and are saved in *.csv format, enabling quick and easy visualization using the preferred software (e.g., Microsoft Excel, MATLAB, etc.).
The file name follows the convention [Timestamp]_bmv080Output.csv. The log file contains the following information:

```
HEADER_START
# This file is generated by the BMV080 Web App
WebAppVersion="1.0.0"
SensorDriverVersion="24.1.0"
SensorId="D0LP19160C3D"
ObstructionDetection="1"
IntegrationTime="10"
DutyCycling="0"
DutyCyclingPeriod="12"
MeasurementAlgorithm="3"
ProcessingDate="20250708T133715"
HEADER_END
ISO Time Code;PM1 mass concentration [µg/m³];PM2.5 mass concentration [µg/m³];PM10 mass concentration [µg/m³];1
yyyymmddTHHMMSS;µg/m³;µg/m³;µg/m³;particles/cm³;particles/cm³;particles/cm³;-;-;-;-;-
String;Double;Double;Double;Double;Double;Double;Boolean;Boolean;Double;Double;Double
20250708T133746;0;1;2;8;8;8;0;0;0.06666667014360428;0.27569395303726196;53.75
20250708T133746;0;1;1;8;8;8;0;0;0.06666667014360428;0.27569395303726196;54
20250708T133747;0;1;1;8;8;8;0;0;0.06666667014360428;0.27569395303726196;54
20250708T133748;0;1;1;8;8;8;0;0;0.06666667014360428;0.27569395303726196;54
20250708T133749;0;1;1;8;8;8;0;0;0.06666667014360428;0.27569395303726196;54
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20250708T133751;0;1;1;8;8;8;0;0;0.06666667014360428;0.27569395303726196;54.25
20250708T133752;0;0;1;0;0;0;0;0;0.03333333507180214;0.27569395303726196;54.25
20250708T133753;0;0;1;0;0;0;0;0;0.03333333507180214;0.27569395303726196;54.25
20250708T133754;0;0;1;0;0;0;0;0;0.03333333507180214;0.27569395303726196;54.25
20250708T133755;0;0;0;0;0;0;0;0;0.03333333507180214;0.27569395303726196;54.25
20250708T133756;0;0;0;0;0;0;0;0;0.03333333507180214;0.27569395303726196;54.25
```

Figure 13: Log file

The file header contains information on the chosen settings for the measurement, whilst in the file body a semicolon separates the following fields:

- Time [yyyymmddTHHMMSS]
- PM2.5 mass concentration [µg/m^3]
- PM1 mass concentration [µg/m^3]
- PM10 mass concentration [µg/m^3]
- PM2.5 number concentration [particles/cm^3]
- PM1 number concentration [particles/cm^3]
- PM10 number concentration [particles/m^3]
- Reserved_0 (for internal use only)

- Reserved_1 (for internal use only)
- Reserved_2 (for internal use only)
- Obstruction flag: 0 – not obstructed, 1 – obstructed
- Outside Measurement Range flag: 0 – within the measurement range, 1 – outside of the measurement range
-

3.7 Disconnection

By clicking the ‘Disconnect Serial’ / ‘Disconnect BLE’ button, the sensor can be disconnected from the application. Please ensure that a running measurement is stopped by clicking on ‘Stop Streaming’ before disconnecting. Before physically disconnecting or powering down the sensor hardware, please ensure a safe disconnection by following the aforementioned steps. Refer to the images below for an example of a successful disconnection.

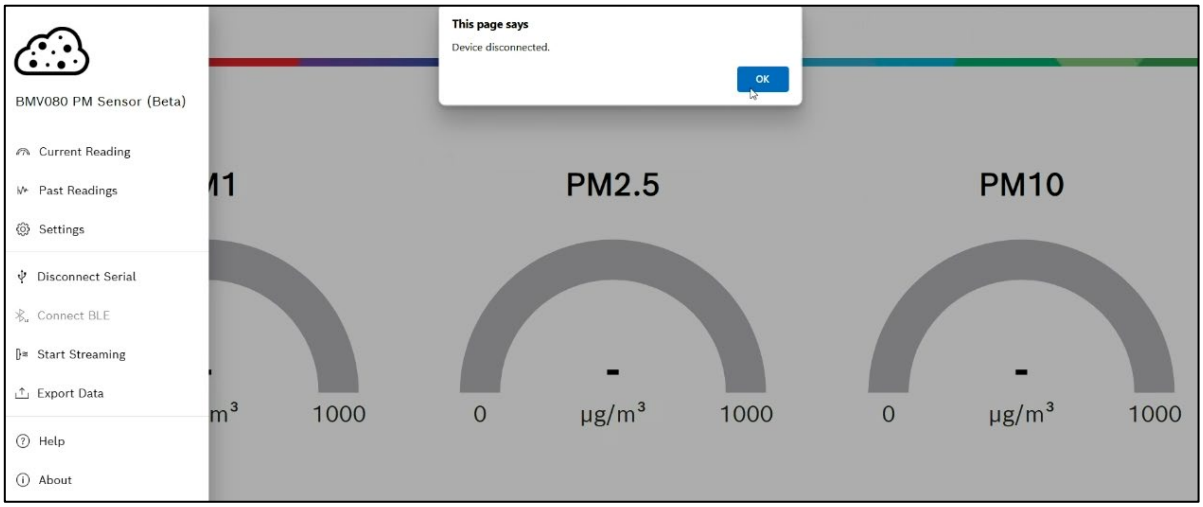

Figure 14: Disconnection

4 Legal Disclaimer

4.1 Engineering samples

Engineering Samples are marked with a specific date code. 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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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.

4.3 Application examples and hints

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5 Document History and Modification

Rev. No.	Chapter	Description of modification / change	Date
1.0	All chapters	Initial release	July 2025

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