

SmartBug2.0 User Guide

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1 SMARTBUG2.0 MODULE WITH OPTIONAL ADD-ON BOARD

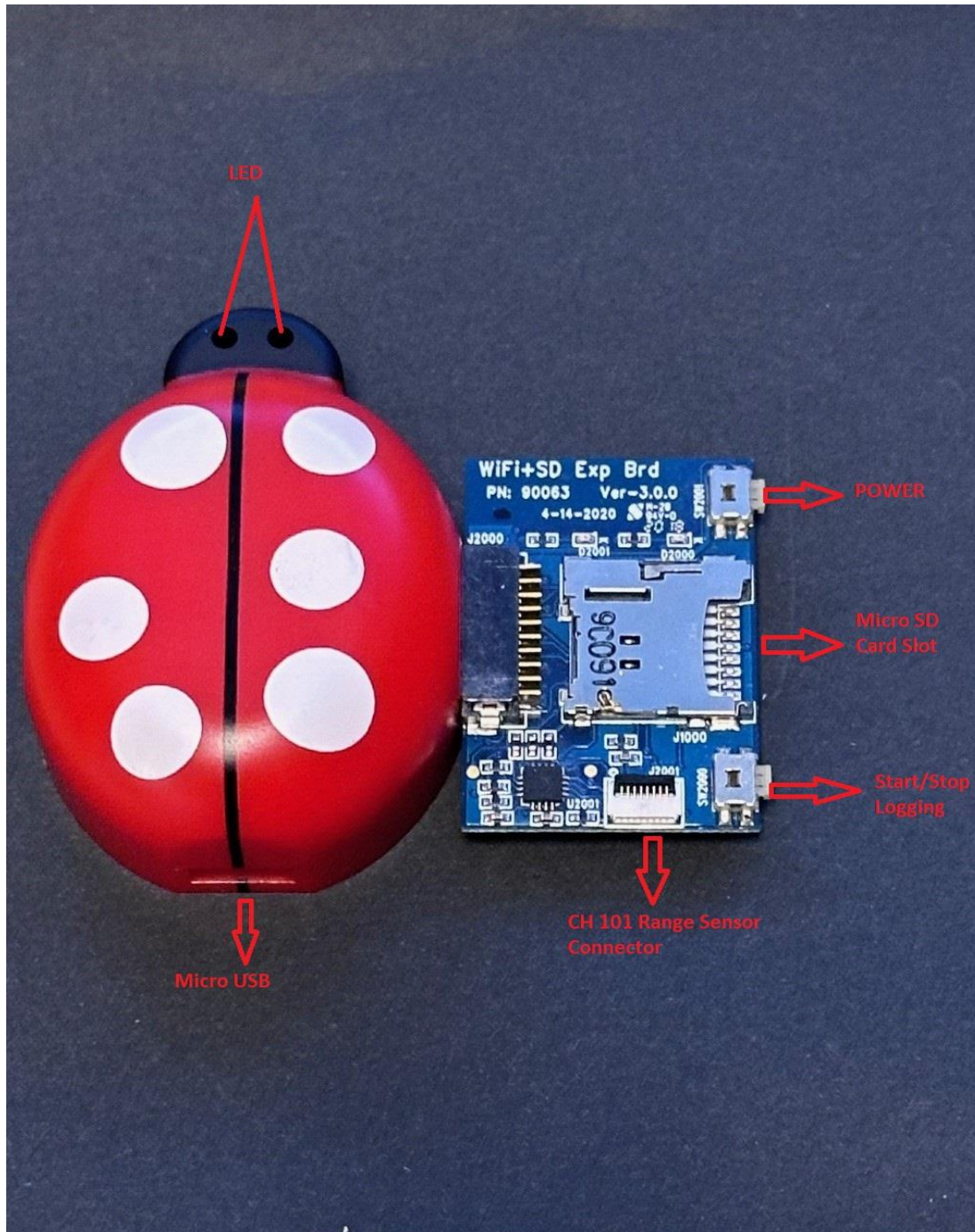


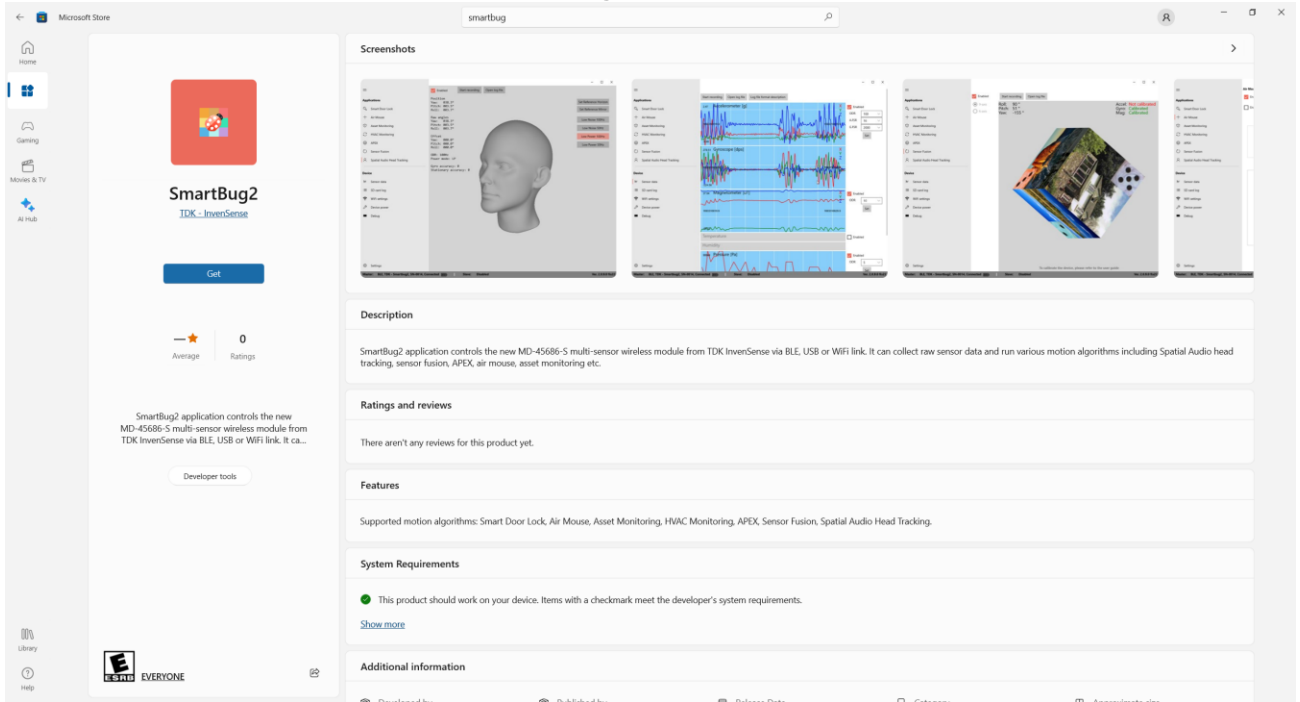
Figure 1. SmartBug2.0 Module

Part Number	Supported Features	Software
MD-45686-S	SmartBug 2.0 standard edition Head tracking, Air Mouse, Sensor Fusion, Asset monitoring, APEX etc.	SmartBug 2.0 Windows App
MD-42688-P-XB	Add-on board with Wi-Fi, SD card and Ultrasonic sensor	SmartBug 2.0 Windows App

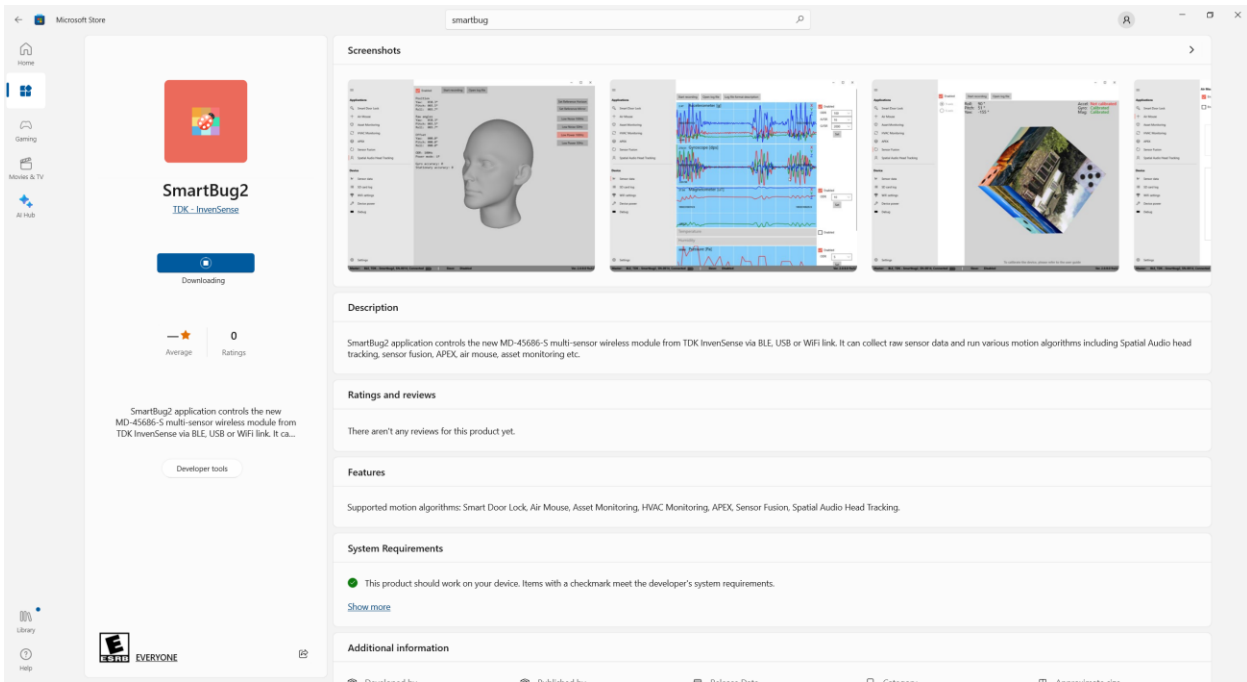
The SmartBug2.0 software requires SmartBug 2.0 standard edition (MD-45686-S) hardware. If your hardware is SmartBug 2.0 Machine learning addition (MD-45686-ML), a firmware update is needed before connecting to SmartBug 2.0 Software. Please refer to chapter 16 “OTA Firmware Upgrade” for more detail.

2 INSTALLING AND RUNNING SMARTBUG2.0 APP

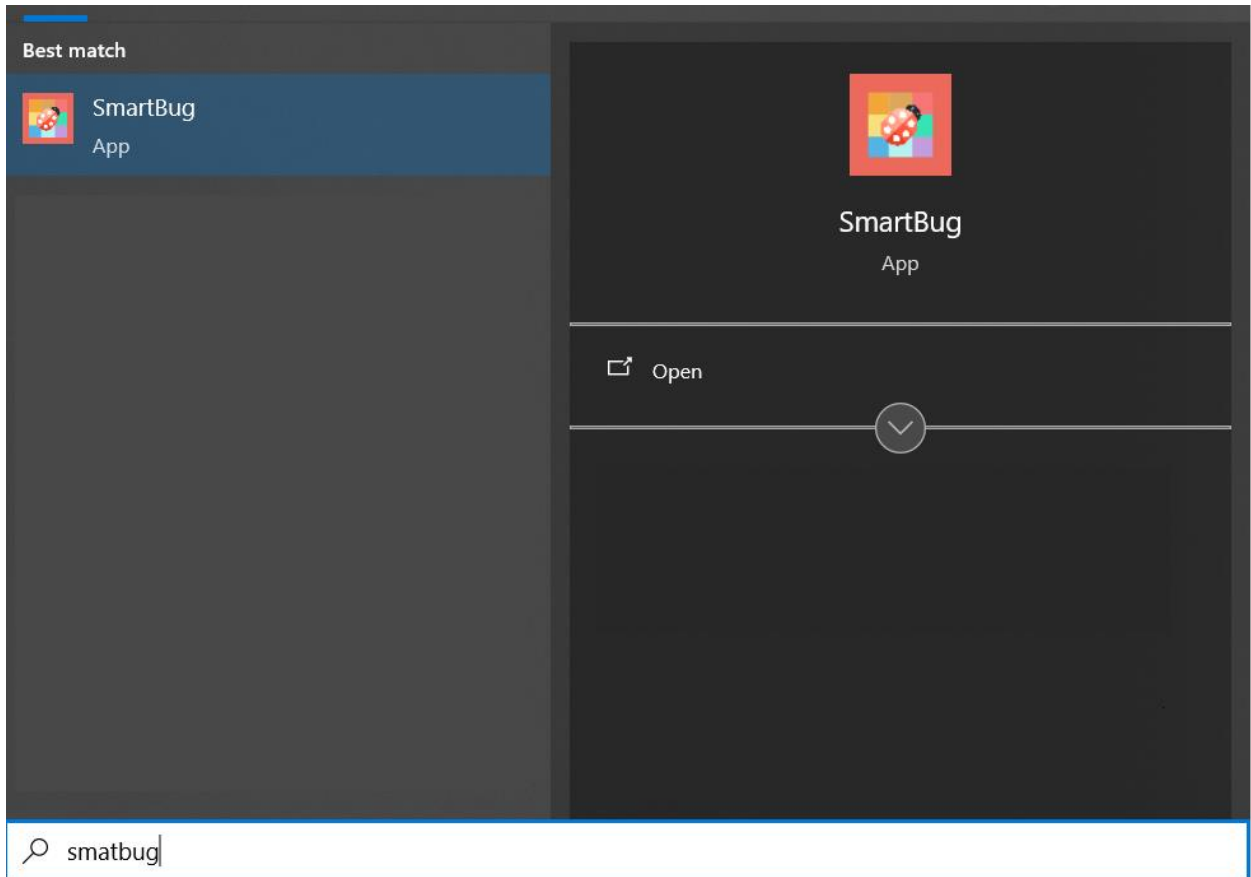
1. Go to the Microsoft App Store and search for **SmartBug2**



2. Click on **Get**.



3. Go to the **Type here to search** Window and type **Smart**. Then select the **SmartBug2.0** to run the SmartBug2.0 app. It can also be pinned to the taskbar for quick access.



3 CONNECTING TO THE SMARTBUG2.0 MODULE

There are three types of connections available on the SmartBug2.0 Module to connect to the SmartBug2.0 App:

- BLE (Bluetooth Low Energy)
- USB
- WiFi

For a WiFi connection, an **Add-On board** will be required.

Step 1: Connect to USB cable to turn on and charge the module. When the USB cable is connected, the green LED will start blinking. Battery charging will occur while the USB cable is connected. The USB connection can also be used to access SmartBug2.0 features through the App while in USB Mode

Step 2: Disconnect the cable. If the LED is blinking red, more charging is needed. If the LED is blinking blue, it is charged enough, and it is now advertising for a BLE connection with the SmartBug2.0 App.

Step 3: If BLE is not connected to the SmartBug2.0 App and the module experiences no motion within 30 seconds, the module will go into sleep mode, and the LED will turn off. Some gentle physical motion will be required to turn on the module and start BLE advertisement again.

In order to enable WiFi, a BLE connection needs to be established first, and an Add-On board needs to be connected to the SmartBug2.0 module.

The detailed procedure to connect BLE, USB, or WiFi for Master and slave is given below:

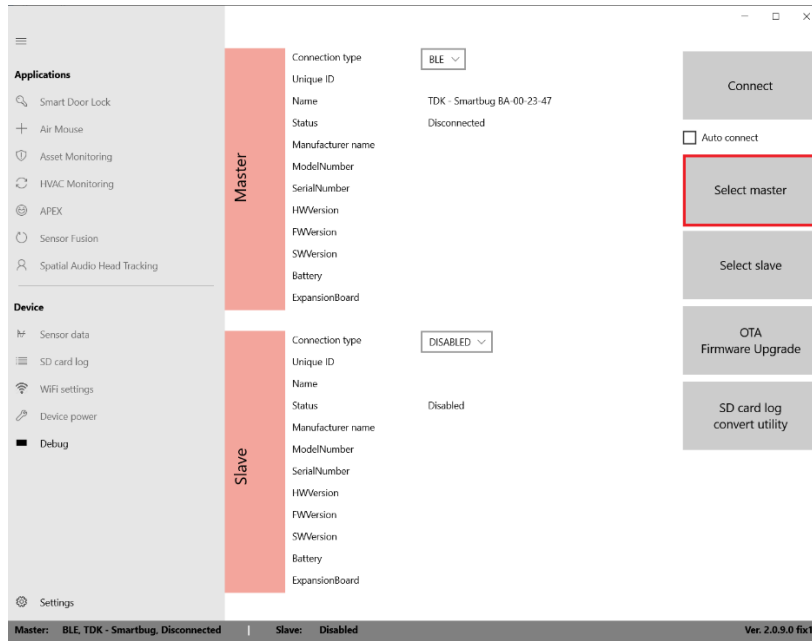
Note: Slave mode should only be used for the HVAC application.

3.1 BLE CONNECTION

1. Go to the **Settings** page.



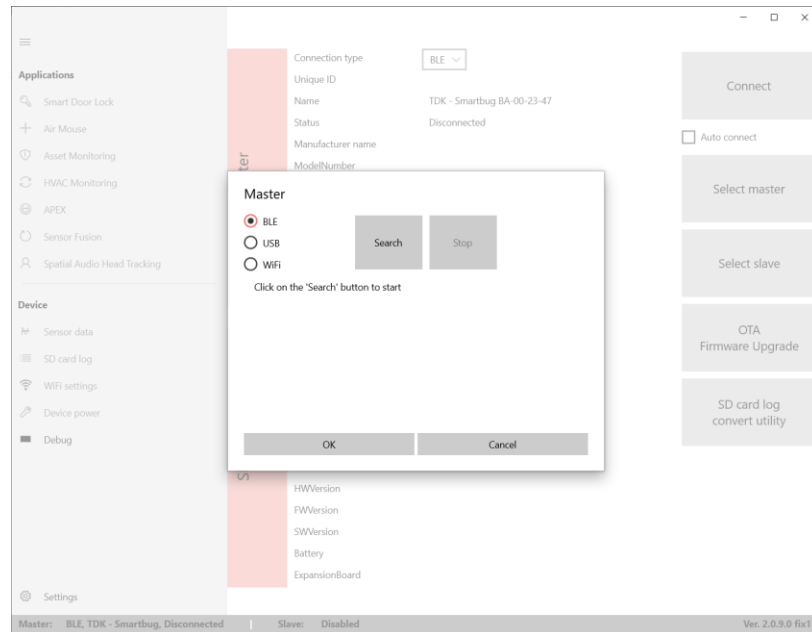
2. Click **Select master** to choose the connection type.



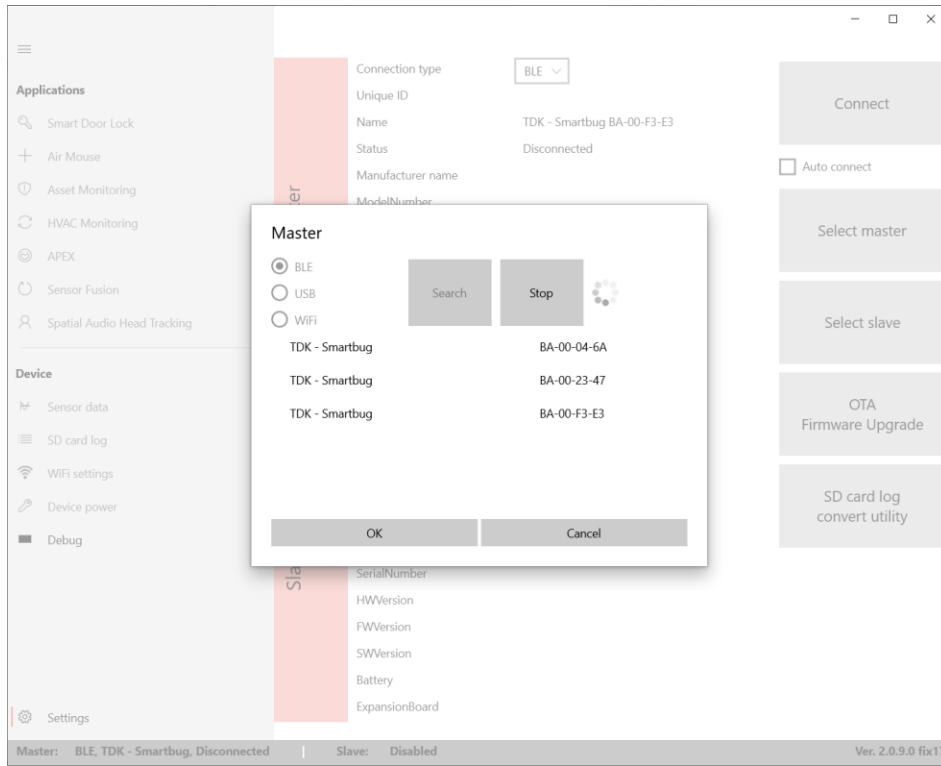
3. Select one of three options: **BLE**, **USB**, or **WiFi**.

Bluetooth Discovery Routine

1. Click on **Search** to discover the SmartBug.2.0 module.

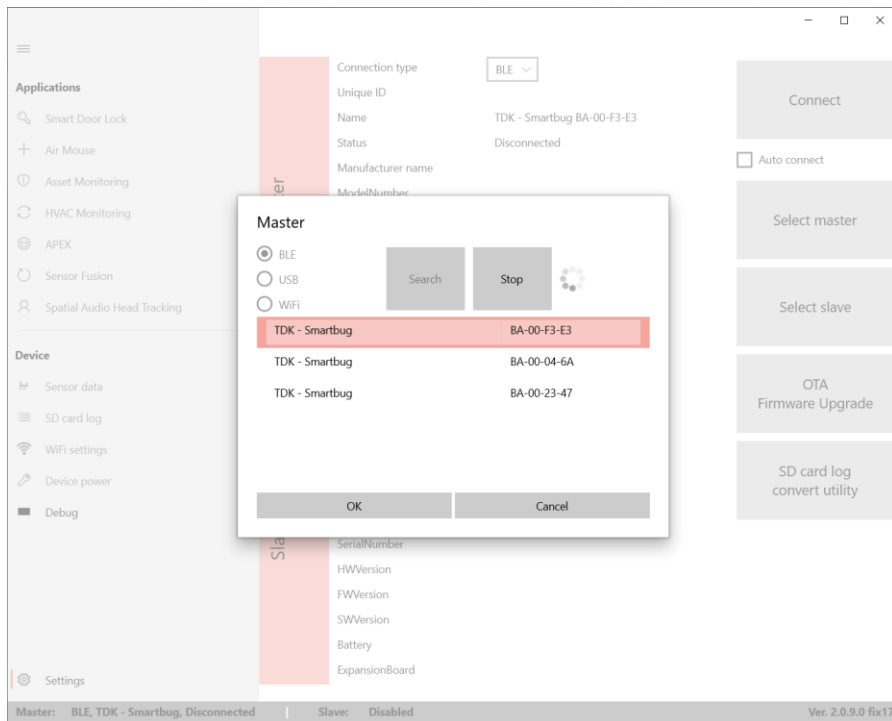


2. Bluetooth Device Detection:



3. Bluetooth Device Selection

- a. Select the device and click **OK**.
- b. If there are more than one Smartbug showed on the list, you can compare the blue tooth ID number with the SN number on the back of the Smartbug

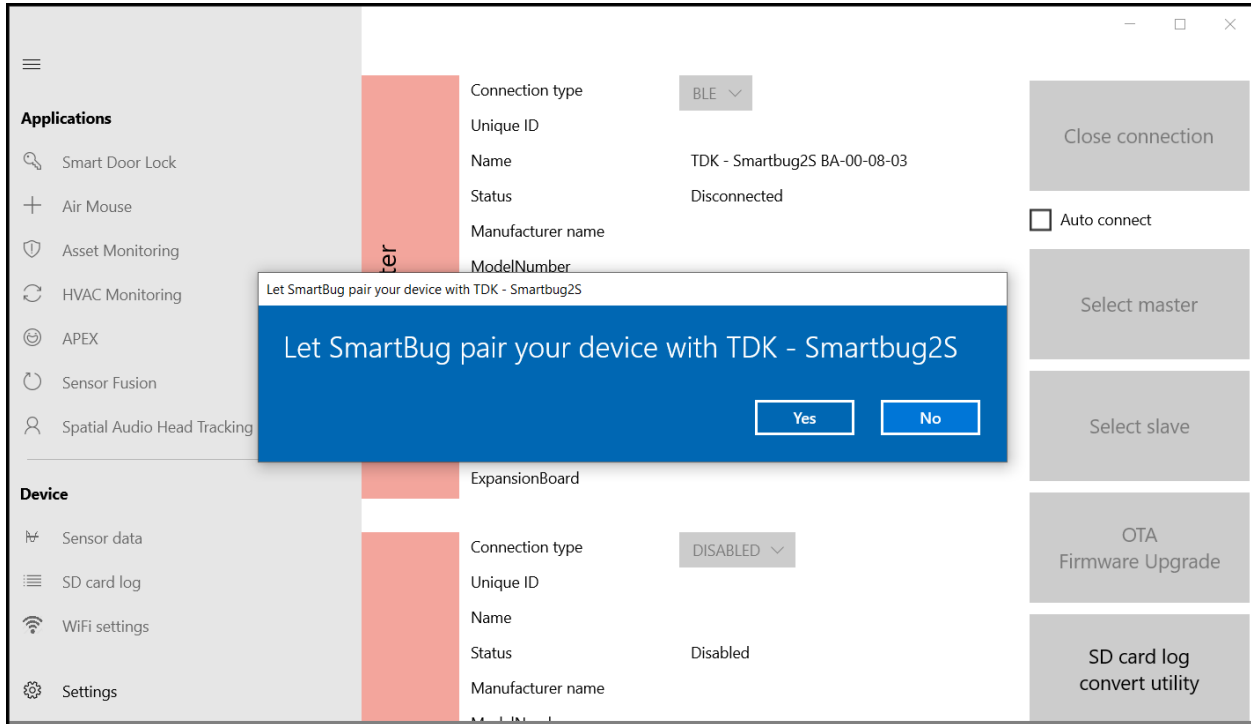


When the BLE device is selected, press the **Connect** button to connect the SmartBug2.0 module to the SmartBug2.0 App. After clicking connect, wait a few seconds until the Master device parameters appear. If the **Auto connect** checkbox is checked, the selected device will connect automatically on the application restart.

Connecting BLE for the first time

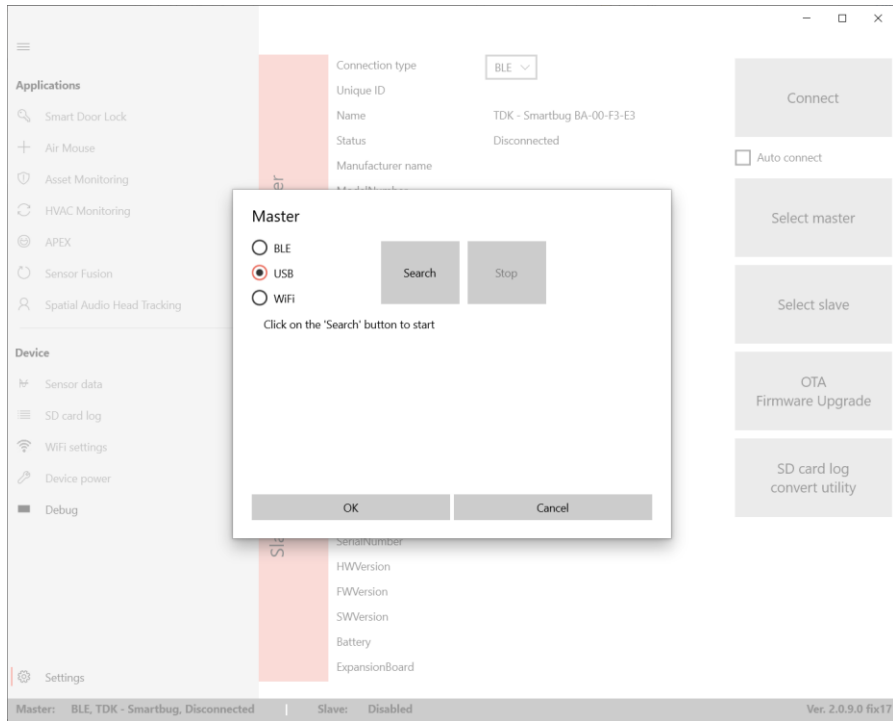
When connecting BLE for the first time, the app will ask to pair with it. Click **Yes**.

The pairing is a secure BLE connection required by the Air mouse HID driver. This ensures smooth functionality of the Air Mouse Application and smooth overall BLE connectivity.

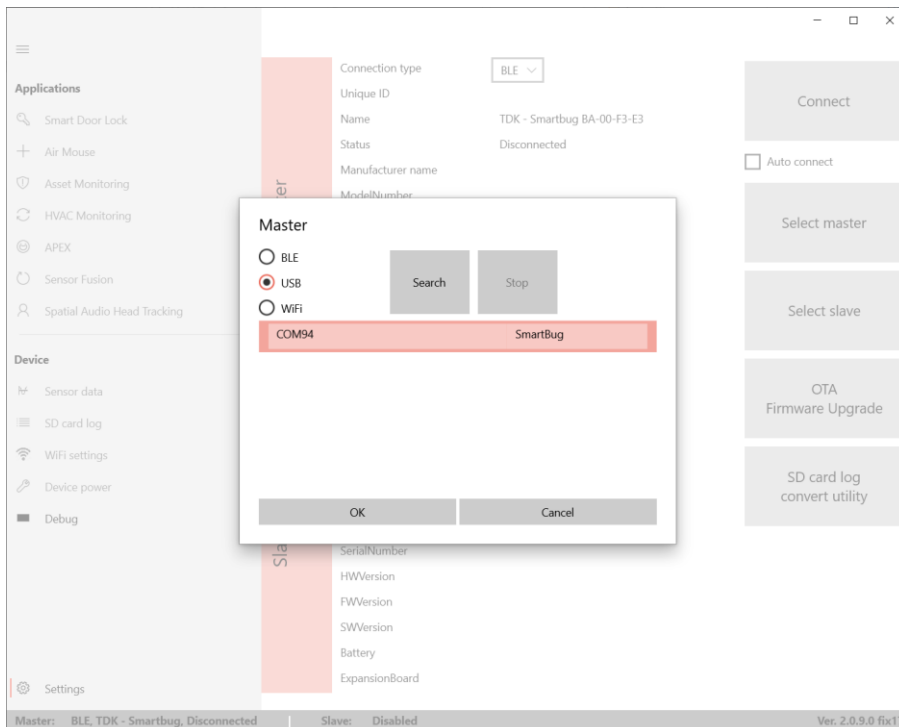


3.2 USB CONNECTION

1. USB Device Detection
 - a. Click on **Search** to discover the SmartBug2.0 module.



2. USB Device Selection
 - a. Select the device and click **OK**.



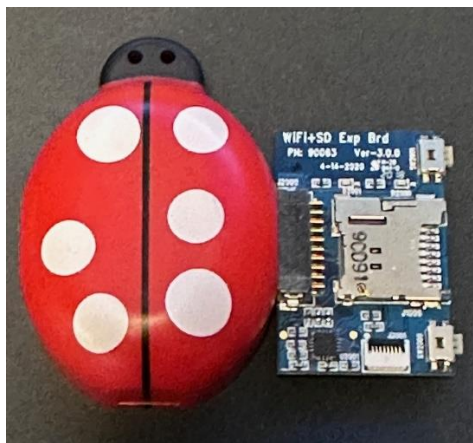
When USB device is selected, press the **Connect** button to connect the SmartBug2.0 module to the SmartBug2.0 App. After clicking connect, wait a few seconds until the Master device parameters appear. If the **Auto connect** checkbox is checked, the selected device will connect automatically on the application restart.

3.3 WIFI CONNECTION

The Add-On board (Wi-Fi) can only be connected when the module is in Power Down mode. Follow the steps below to connect the Add-On board:

Step 1: The SmartBug2.0 board should be reset or powered down in the **Device Power** window by using the **Power Down** or **Reset** feature on SmartBug2.0 App. See Section 15 for more details.

Step 2: Once, the module is completely powered down, connecting the Add-On board is recommended. The physical connection of WiFi + SD card Add-On board with the module is shown below:



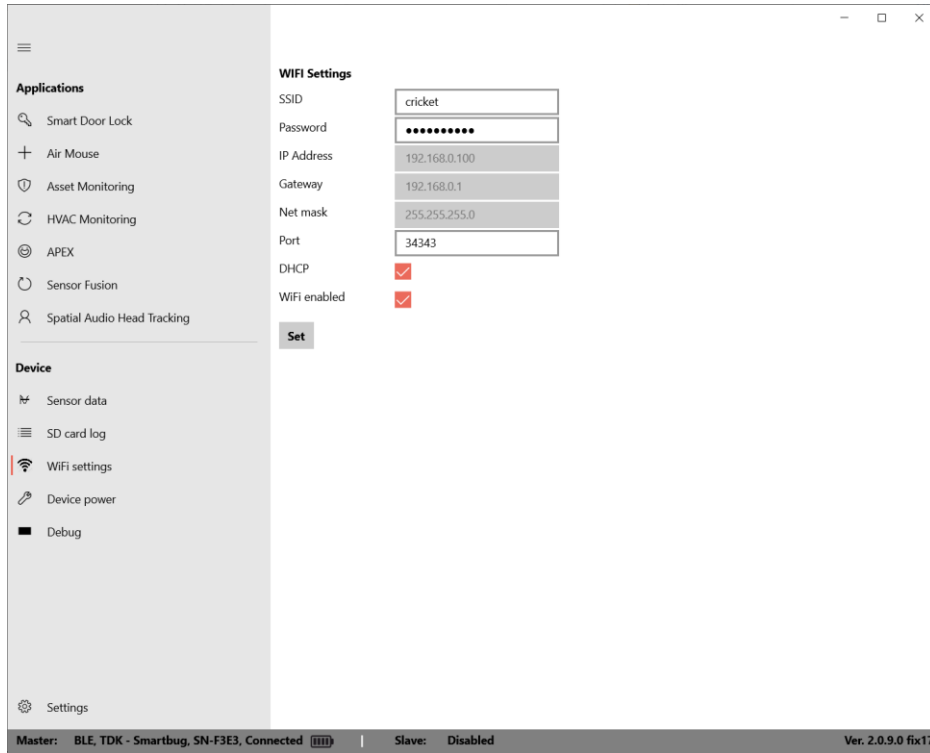
Step 3: Turn-on the module again. There are two methods to turn on the module after power down:

1. Once the Add-On board is connected in **Power Down** mode, use the Power button on the Add-On card to turn on the module in BLE mode.
2. Once the Add-On board is connected in **Power Down** mode, connect the USB cable to turn on the module and remove the USB cable to enable BLE mode.

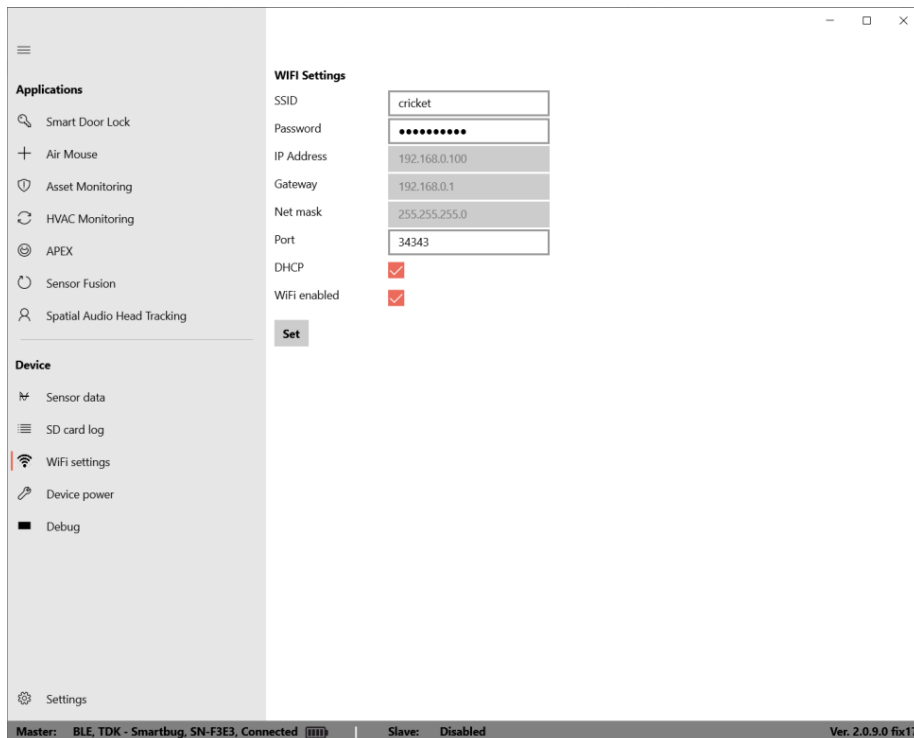
When the BLE connection is established, and the Add-On card is safely connected, the WiFi connection is allowed.

The WiFi should be configured in the **WiFi Settings** menu item. If the DHCP is chosen, the IP Address, Gateway, and Net mask selections will be disabled. This means that the IP address will be assigned by the WiFi router and will be detected by the WiFi discovery feature.

Note: It is important that the system (laptop/PC) running the SmartBug2.0 app and the SmartBug2.0 module are on the same WiFi network for the SmartBug2.0 module to work on WiFi

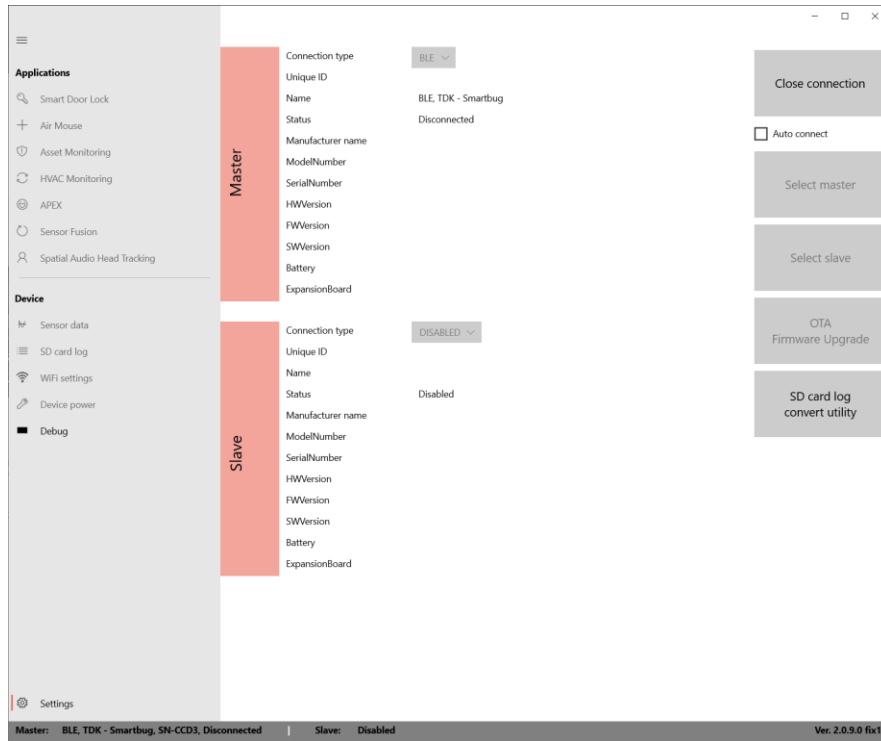


Once the **Set** button is pressed, the device will disconnect the BLE and initiate the WiFi connection to the specified router. The BLE link status will change to **Disconnected** and the module's blue LEDs will turn off and the green LED on the Add-On board will blink. This means the device is now connected to the WiFi router and is ready to communicate through a TCP socket.

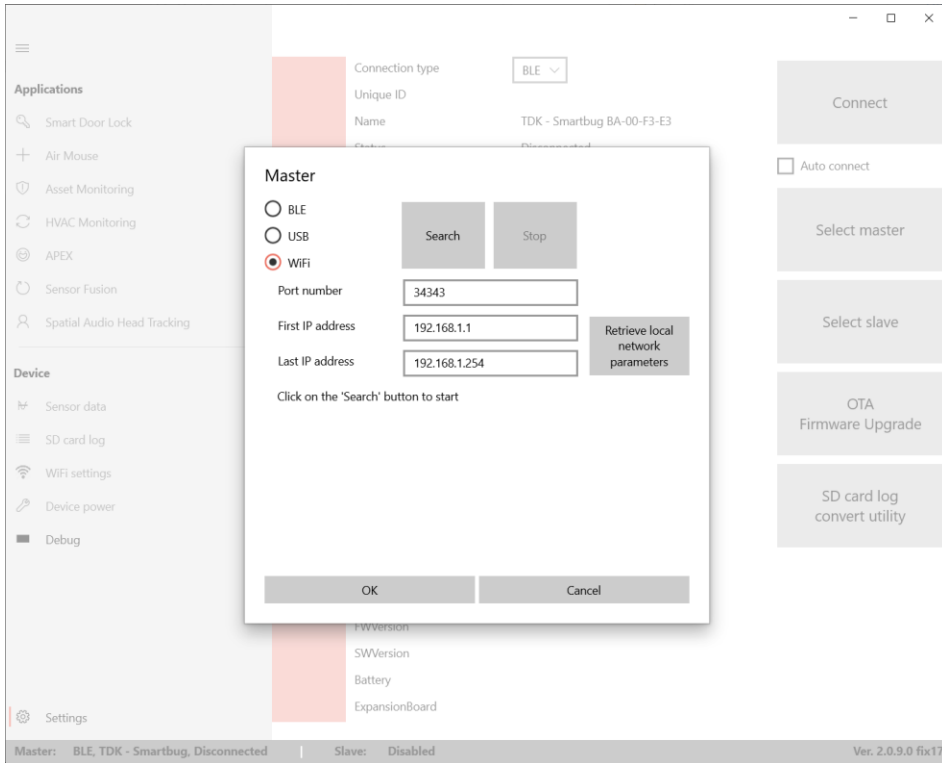


WiFi Socket Selection

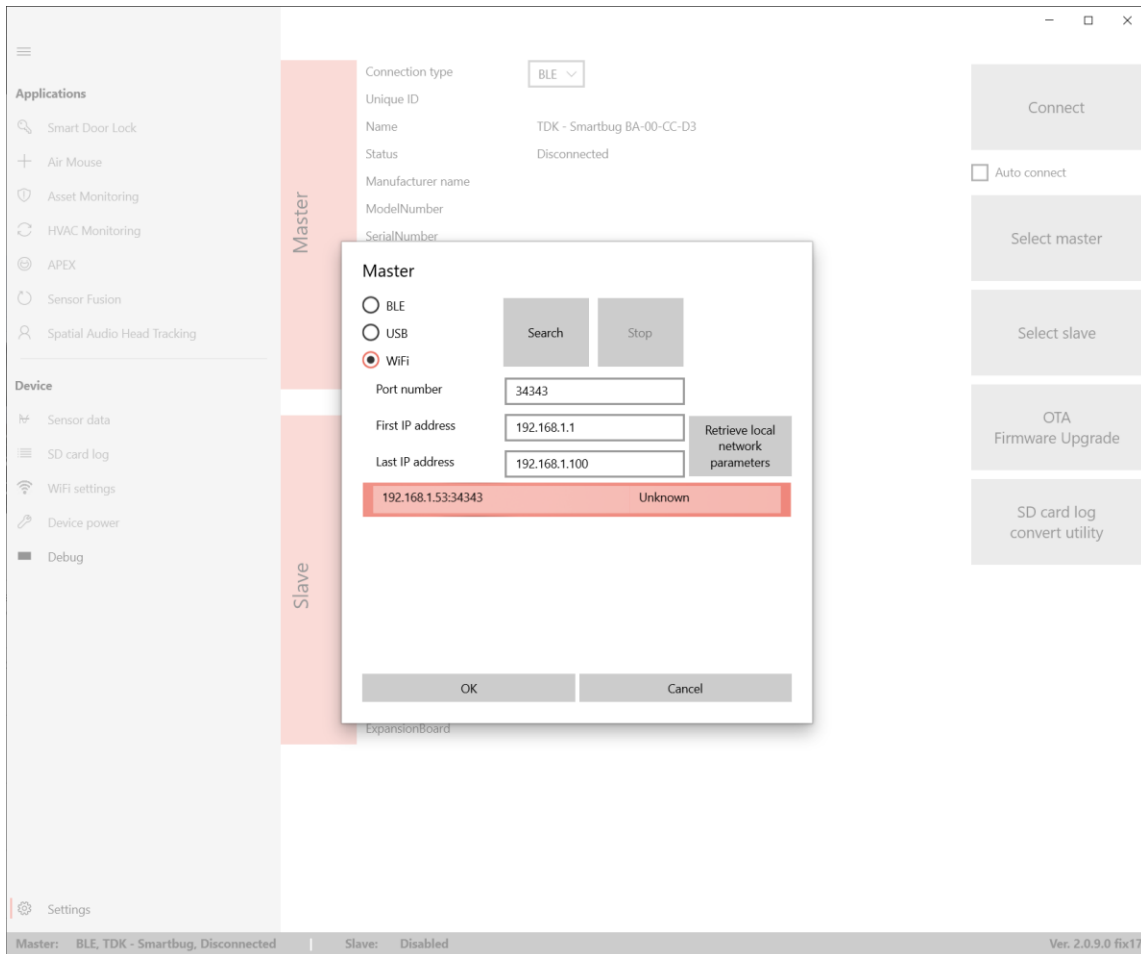
1. Disconnect from the BLE: In the **Settings** menu, click **Close connection** button, and then click on **Select Master** to go to the master device selection.



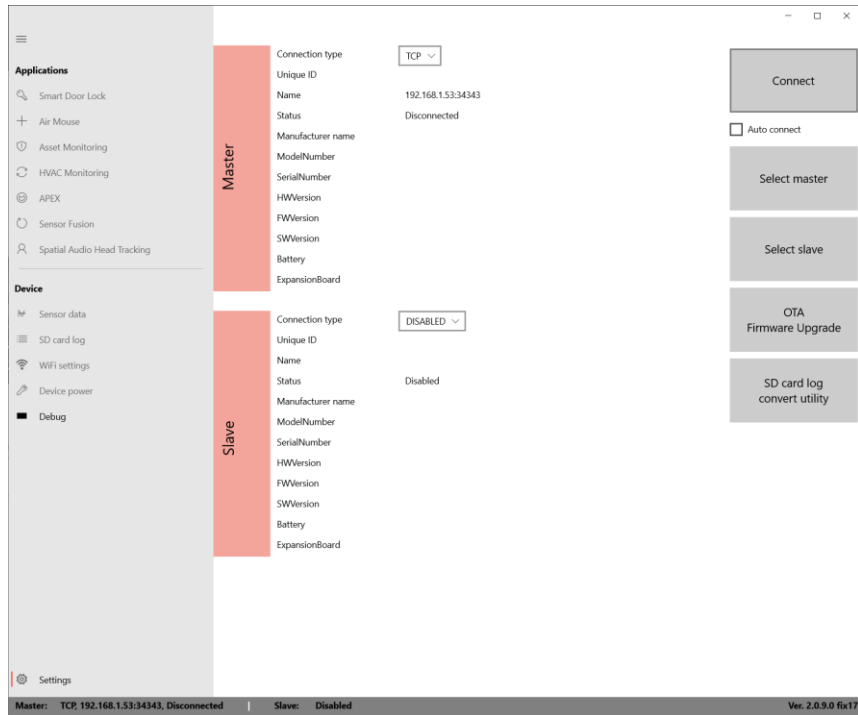
2. Click on the WiFi option.
3. Click on **Retrieve local network parameters** to populate the first and last IP Address sections (for DHCP mode). This button retrieves the active network settings of your system and displays the first and last IP Address based on Subnet Mask of the router.
4. Click on **Search** to locate the SmartBug2.0 module on the same WiFi network.



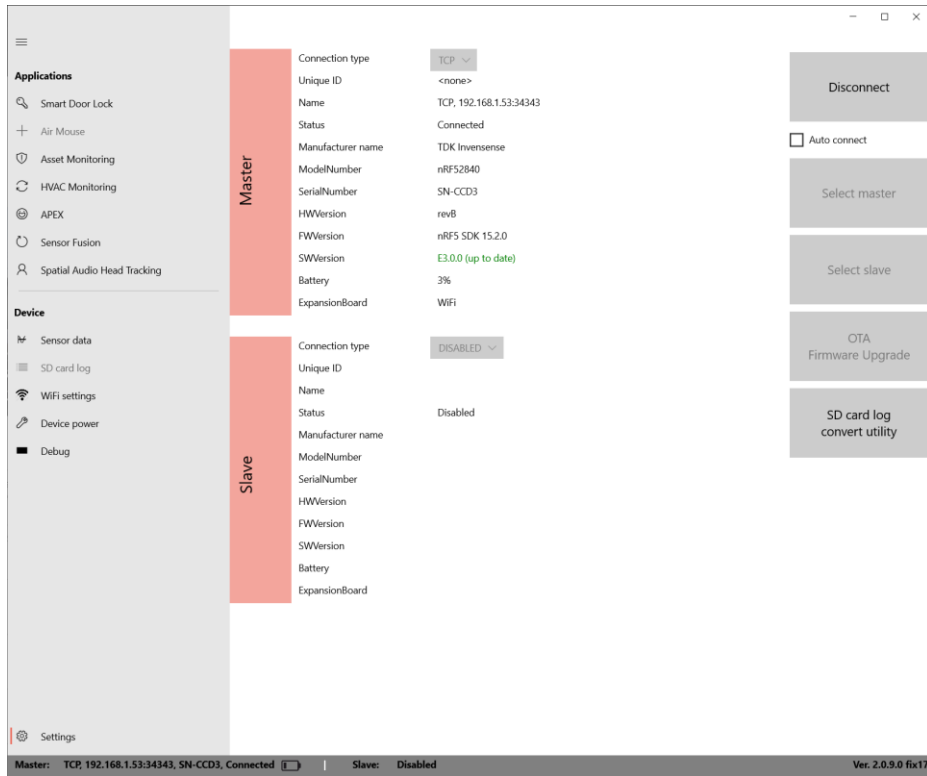
5. Select the found device.



6. Now it is ready for WiFi connection.



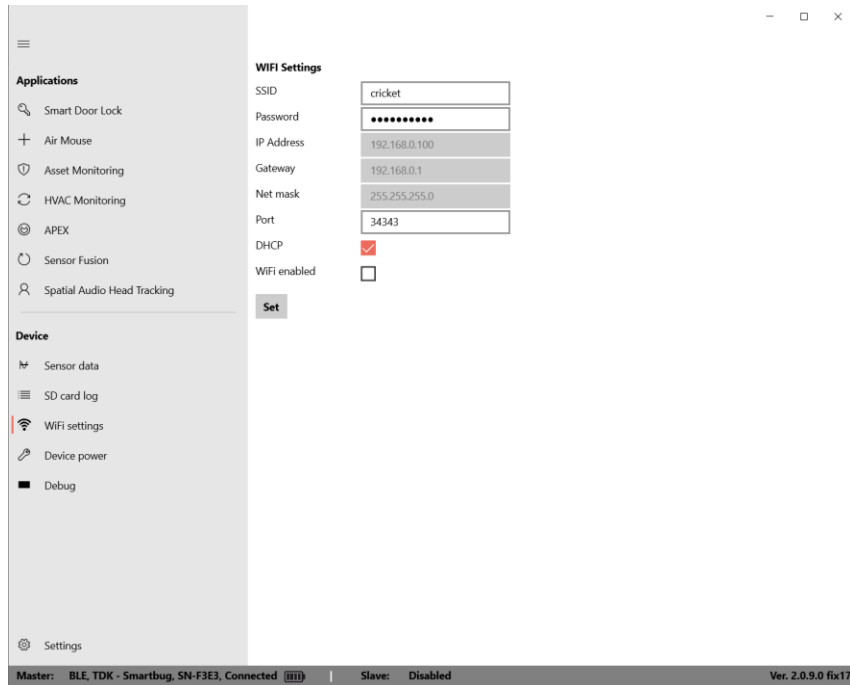
7. Use the **Connect** button to connect over the WiFi network.



Returning from WiFi to BLE mode

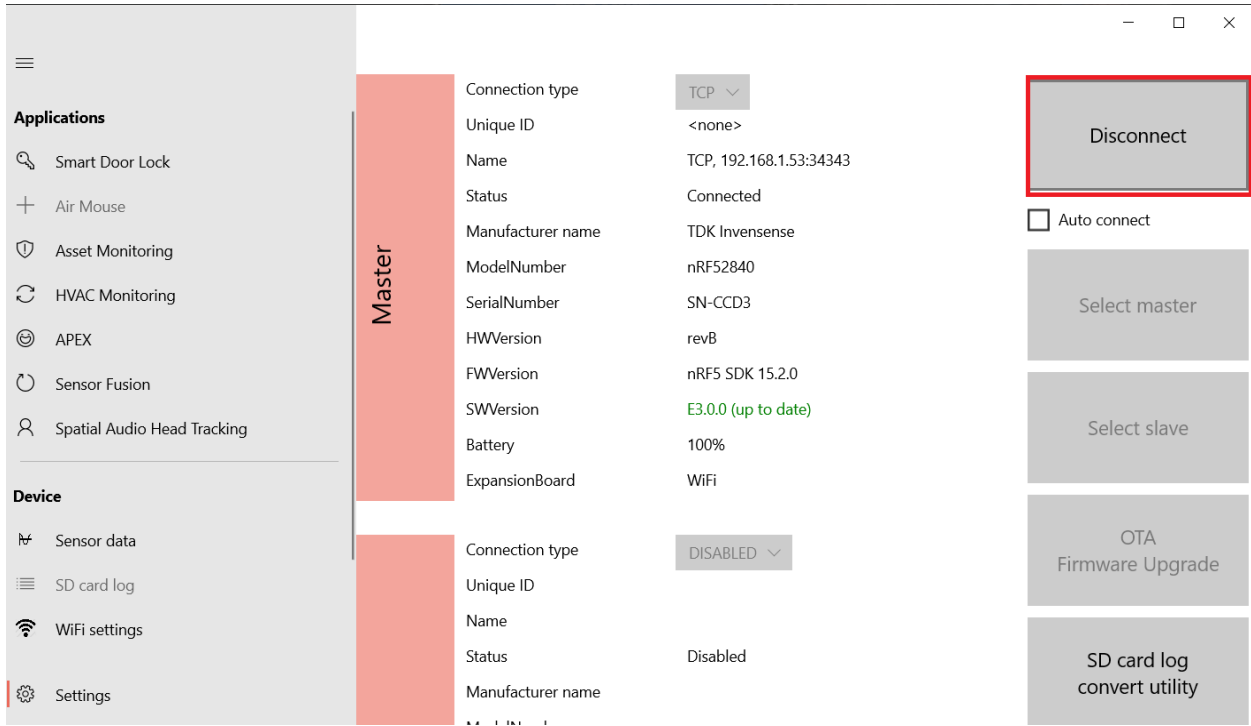
There are two approaches to implement this:

1. WiFi can be disabled through the WiFi settings menu. Such a transition occurs when a user unchecks the **WiFi enabled** checkbox and clicks on the **Set** button. The WiFi connection will be lost and the blue LEDs start blinking, indicating that it is now in the BLE advertisement mode.



- In order to go back to BLE mode, press and hold the power and log switches on Add-On board simultaneously for 5 seconds.

This puts the device into BLE advertisement mode. Now click on **Disconnect** and **Connect BLE** to enable BLE again. The BLE select master process is not required to connect to the same SmartBug2.0 board, because its information is saved by the application. A user can simply select the connection type **BLE** and click the **Connect** button.

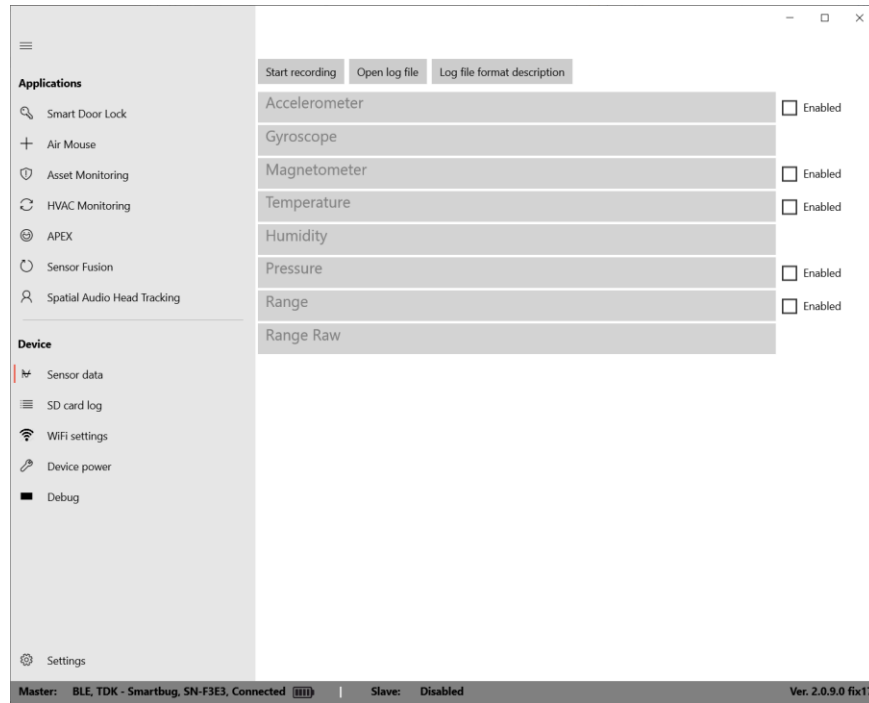


Note: Wi-Fi/BLE mode will not work if a USB cable is connected at any point to charge the module. The module will switch to USB mode.

4 SENSOR DATA MODE

1. Select **Sensor data** window

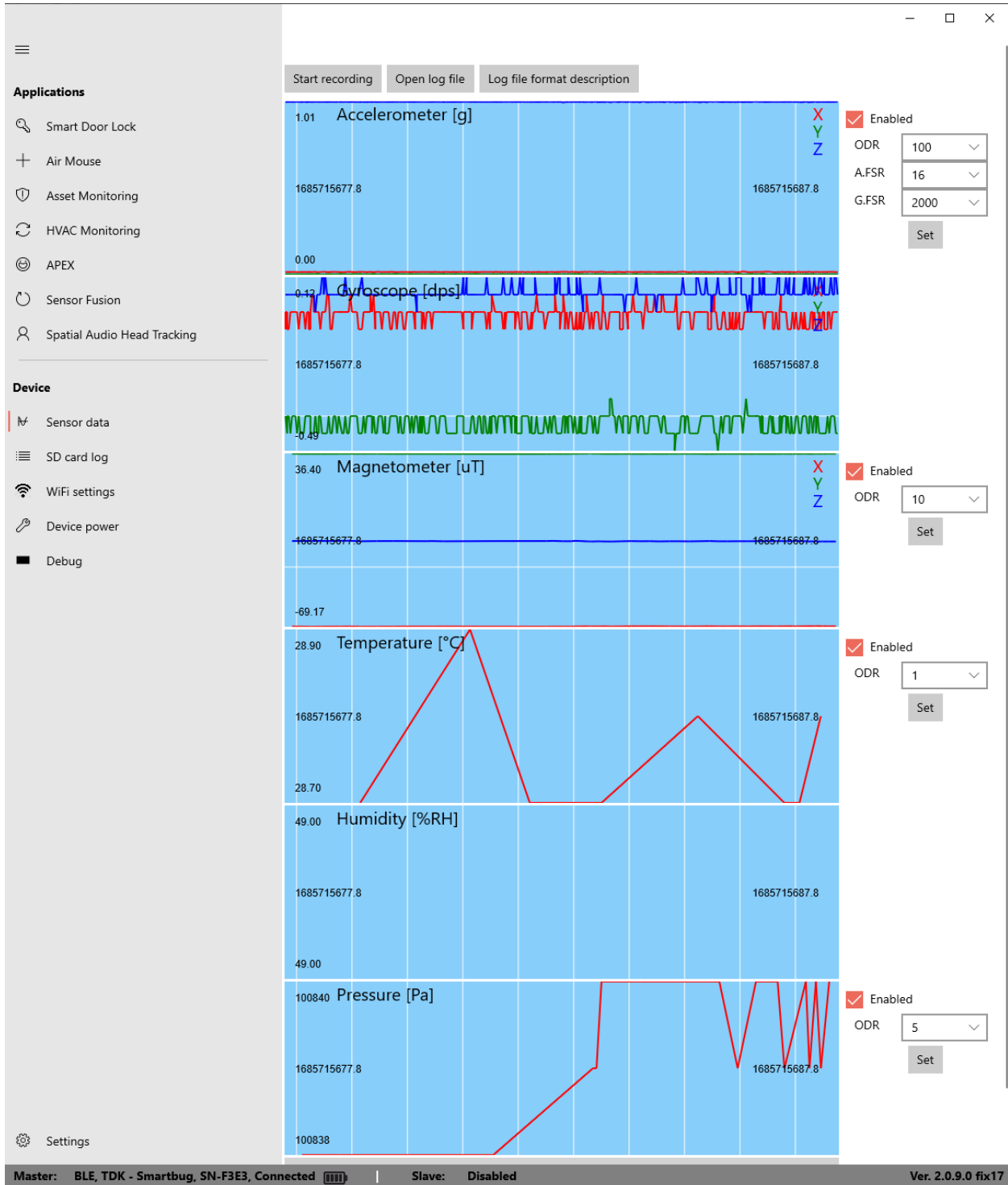
This window is the most important section of the app. This allows users to stream multi-sensor data (from IMU, magnetometer, temperature, humidity, ultrasonic, and pressure sensors) and record that data into log files. It also provides tuning parameters to finetune the desired raw sensor data.



Note: All the sensors, except Chirp Range sensor CH101, are physically mounted inside the SmartBug2.0 module. The CH101 connector comes with WiFi + SD Add-On board. The physical connection of CH101 module with the Add-On board through FFC Cable is shown below:



2. Select the sensor(s) by selecting the **Enabled** checkboxes.



Note: You can stream and log data from all the sensors at the same time.

3. Enable data recording by selecting the **Start recording** button.

The screenshot displays the InvenSense data recording application interface. On the left, there are two main sections: **Applications** (Smart Door Lock, Air Mouse, Asset Monitoring, HVAC Monitoring, APEX, Sensor Fusion, Spatial Audio Head Tracking) and **Device** (Sensor data, SD card log, WiFi settings, Device power, Debug). At the top, there are three buttons: **Start recording** (highlighted with a red box), **Open log file**, and **Log file format description**.

The main area contains six sensor data plots, each with its own configuration panel on the right:

- Accelerometer [g]**: Shows X (red), Y (green), and Z (blue) axes. Configuration: Enabled, ODR: 100, A.FSR: 16, G.FSR: 2000.
- Gyroscope [dps]**: Shows X (red), Y (green), and Z (blue) axes. Configuration: Enabled, ODR: 10.
- Magnetometer [uT]**: Shows X (red), Y (green), and Z (blue) axes. Configuration: Enabled, ODR: 1.
- Temperature [°C]**: Shows a single red line. Configuration: Enabled, ODR: 5.
- Humidity [%RH]**: Shows a single red line. Configuration: Enabled, ODR: 5.
- Pressure [Pa]**: Shows a single red line. Configuration: Enabled, ODR: 5.

Each plot has a time range from 1685715808.7 to 1685715818.7. The bottom status bar shows: **Master: BLE, TDK - Smartbug, SN-F3E3, Connected (||||)** | **Slave: Disabled** | **Ver. 2.0.9.0 fix17**.

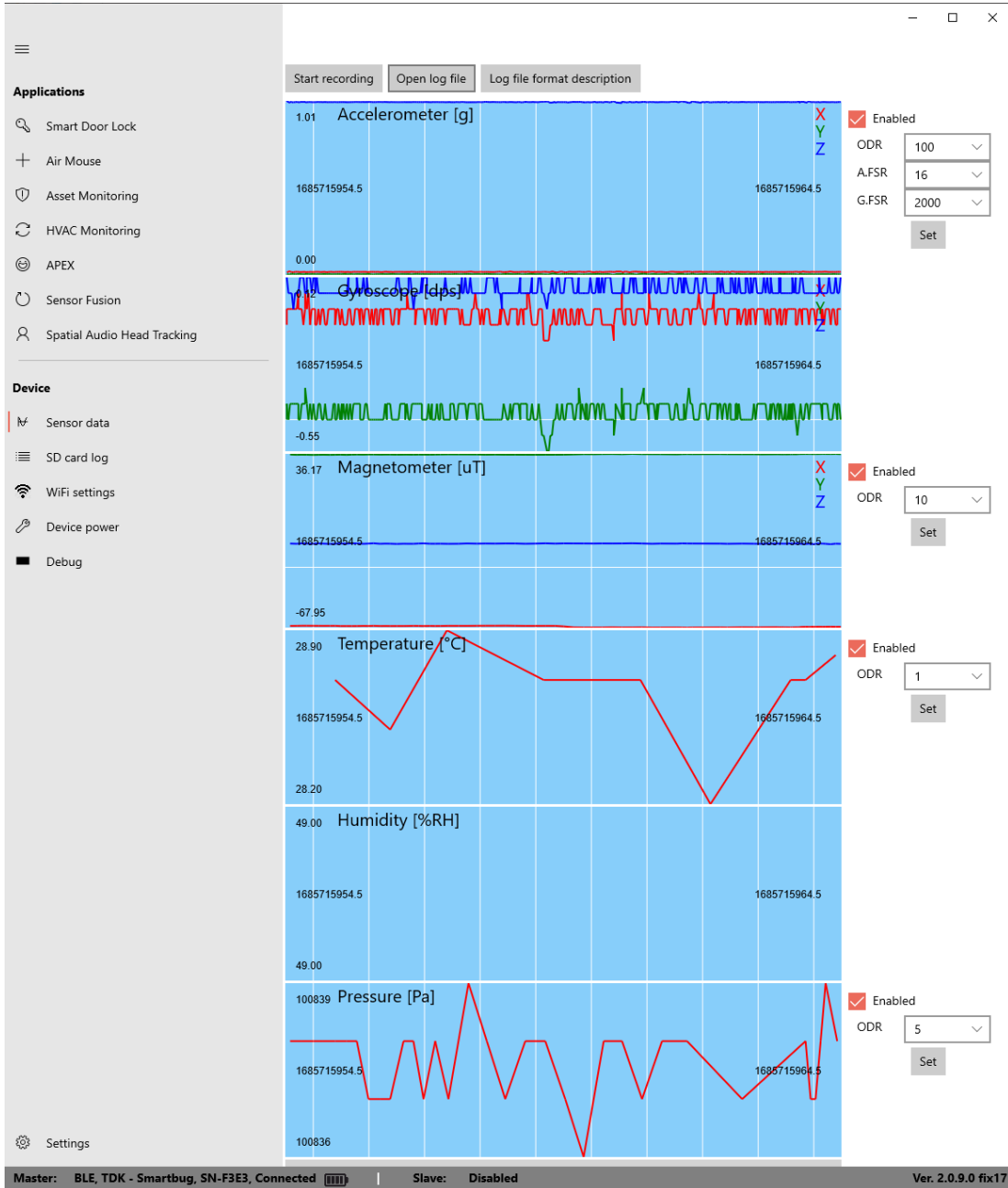
4. After data has been recorded, disable data recording by clicking on the **Stop recording** button.

The screenshot displays the InvenSense Smartbug application interface. On the left, a sidebar lists various applications and device settings. The main area shows a grid of sensor data plots. At the top, there are three buttons: 'Stop recording' (highlighted with a red box), 'Open log file', and 'Log file format description'. The sensor plots include:

- Accelerometer [g]:** Shows three axes (X, Y, Z) with a range from -0.01 to 1.01. Settings: Enabled, ODR: 100, A.FSR: 16, G.FSR: 2000.
- Gyroscope [dps]:** Shows three axes (X, Y, Z) with a range from -0.18 to 0.18.
- Magnetometer [uT]:** Shows three axes (X, Y, Z) with a range from -67.86 to 36.05. Settings: Enabled, ODR: 10.
- Temperature [°C]:** Shows a single axis with a range from 28.40 to 28.80. Settings: Enabled, ODR: 1.
- Humidity [%RH]:** Shows a single axis with a range from 48.00 to 49.00.
- Pressure [Pa]:** Shows a single axis with a range from 100837 to 100840. Settings: Enabled, ODR: 5.

At the bottom of the interface, a status bar shows: Master: BLE, TDK - Smartbug, SN-F3E3, Connected; Slave: Disabled; Ver. 2.0.9.0 fix17.

5. Click **Open log file** to view recorded data with Microsoft Excel.



6. Use **Log file description** to understand the sensor IDs and units in log file.

Log file description

Master sensor id:

- 1 - Accelerometer [g] X,Y,Z
- 2 - Gyroscope [dps] X,Y,Z
- 3 - Magnetometer [uT] X,Y,Z
- 4 - Temperature [°C]
- 5 - Humidity [%RH]
- 6 - Pressure [Pa]
- 8 - Range, Amplitude [mm]

Slave sensor id:

- 106 - Pressure [Pa]

Close

7. Maximum ODR supported on different interfaces for streaming and logging.

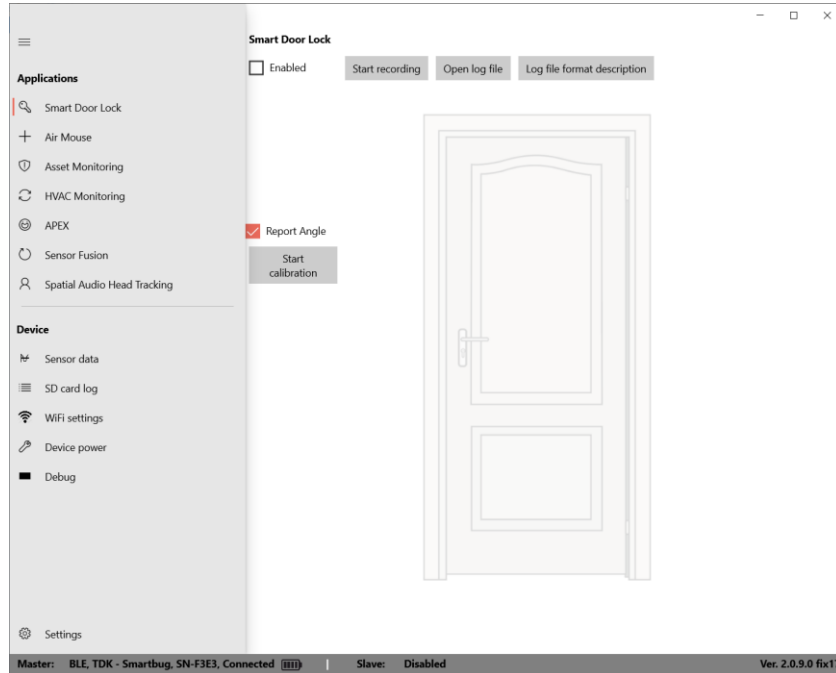
SENSOR ODR	ACCEL	GYRO	MAG	PRESSURE	HUMIDITY/TEMPERATURE	ULTRASOUND
ODR Options	25 / 50 / 100 / 200 / 1000 / 2000		10 / 50 / 100 / 200	1 / 5 / 10	1 / 5 / 10	1 / 5 / 10
Maximum ODR BLE	100		100	10	10	10
Maximum ODR USB	200		200	10	10	10
Maximum ODR WiFi	2000		200	10	10	10

5 SMART DOOR LOCK

1. Open the **Smart Door Lock** Application window

Click the **Enabled** checkbox to enable status notification from the smart door lock. Start calibration by clicking Start Calibration

The calibration can be re-run at any time by clicking the **ReStart calibration** button.

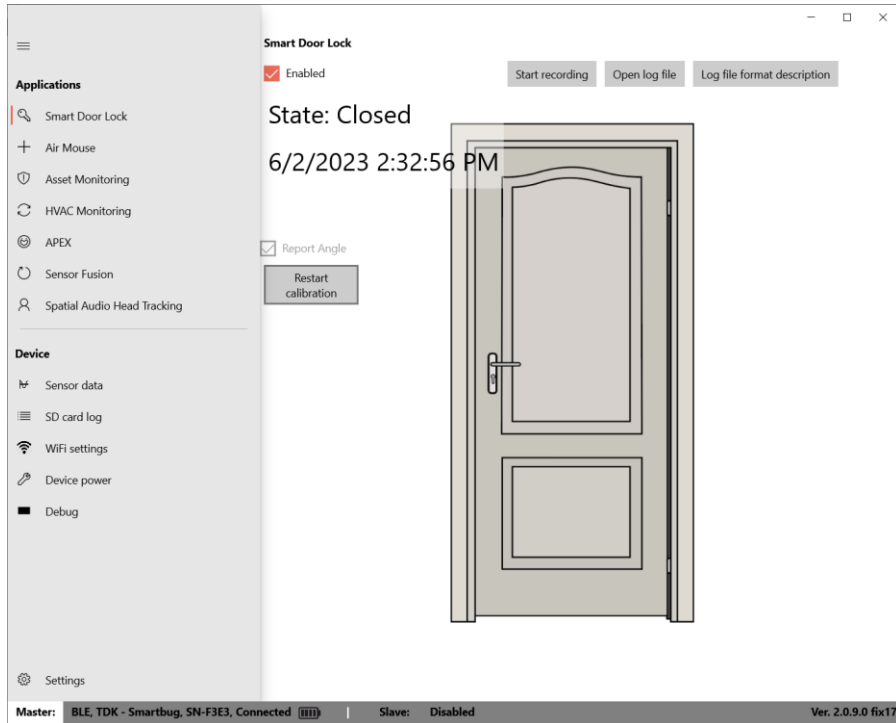


2. Place the device on a door

Please make sure that the device is completely static and is not subject to any external motion for accurate open/close detection and calibration.

3. Calibrate

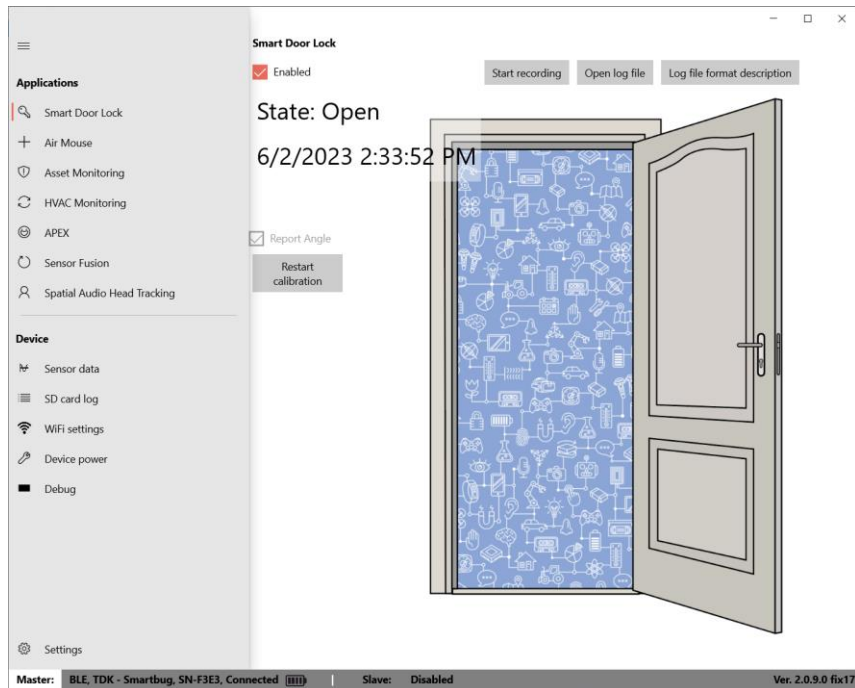
Click on start calibration it to calibrate the IMU sensor



4. Observe the Smart Door service status change: Open or Close
Open or close the door physically and observe the door state change.

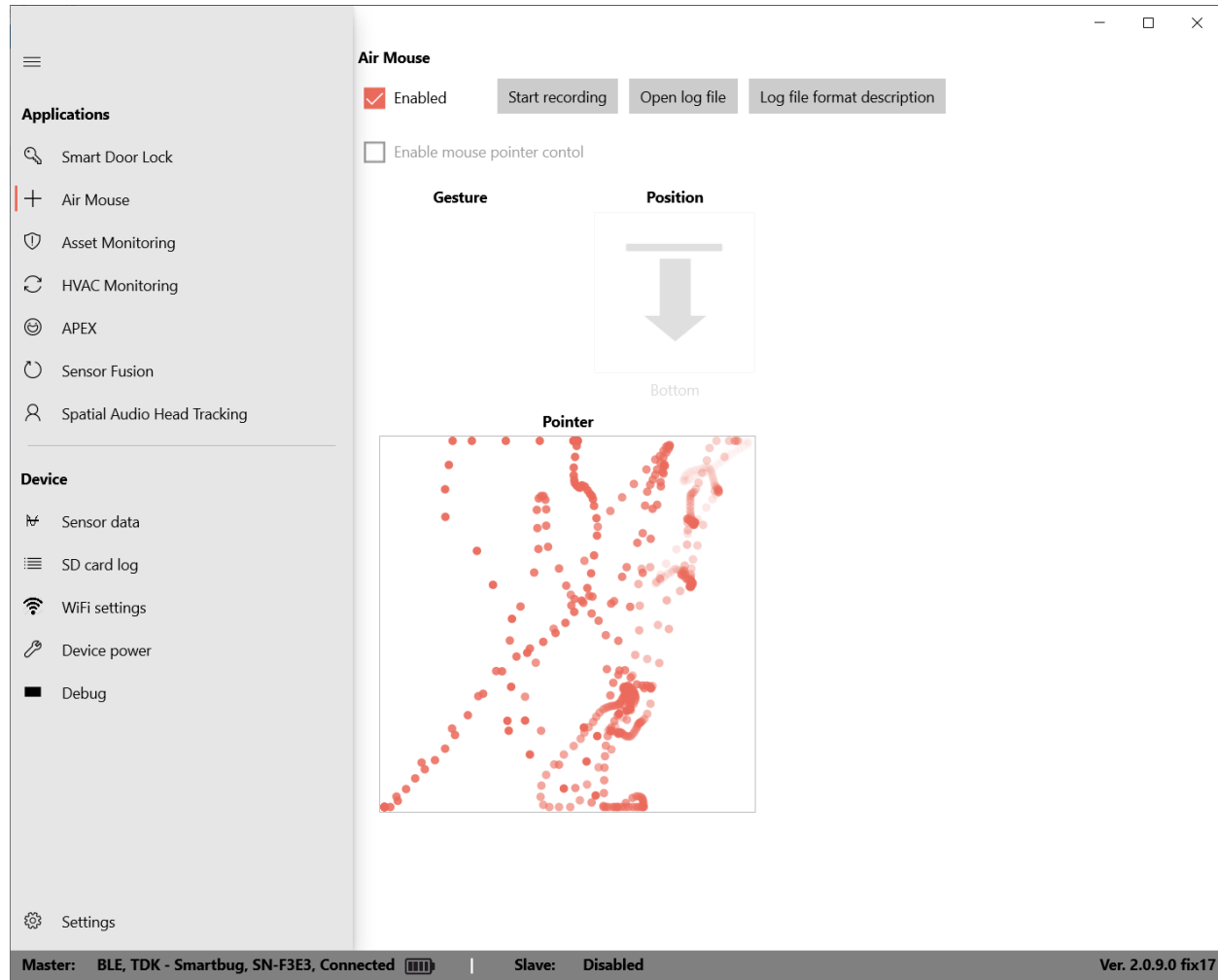
5. Log Smart Door Lock outputs with Angle:

The log file will record all door open and close events along with the door angle. When the angle is enabled by the **Enable Angle** checkbox, the SmartBug2.0 device will log the Smart Door Lock angle from the closed reference position. The states are also reported in the log file to correlate the Open/Close states to the Door lock angle.



6 AIR MOUSE

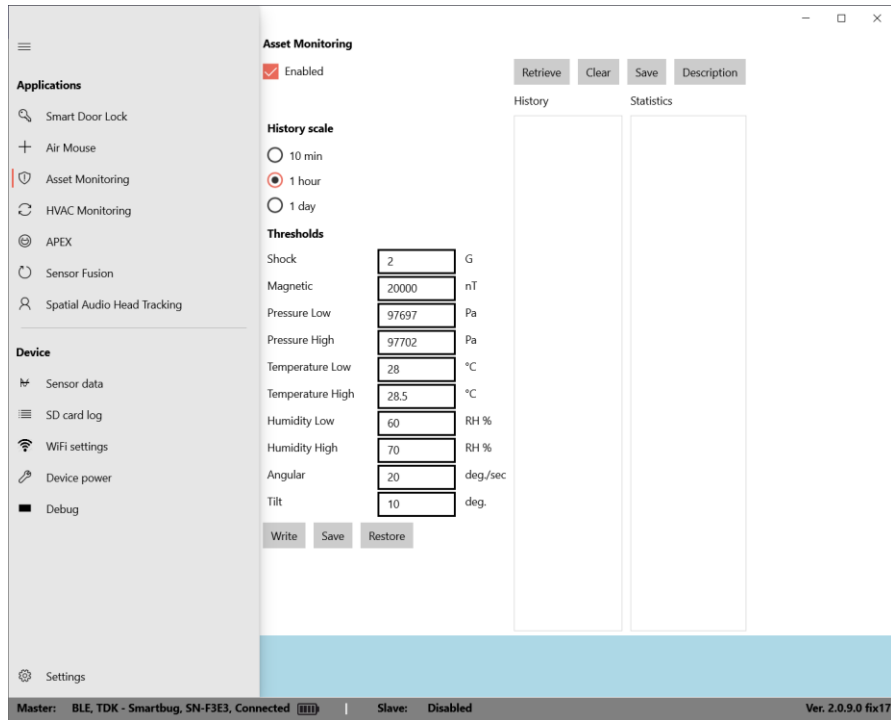
- 1) Click on Enable
- 2) AML has 3 outputs
 - a. Gesture
 - b. Position
 - c. Pointer



- 3) Gesture shows the gesture performed with the SmartBug2.0
 - a. Up
 - b. Down
 - c. Right
 - d. Left
 - e. Clockwise
 - f. Counter Clockwise
- 4) Position Shows the orientation of the device.
- 5) Pointer follows the motion of device in air.
- 6) Select Enable mouse pointer control to control mouse of the windows PC.

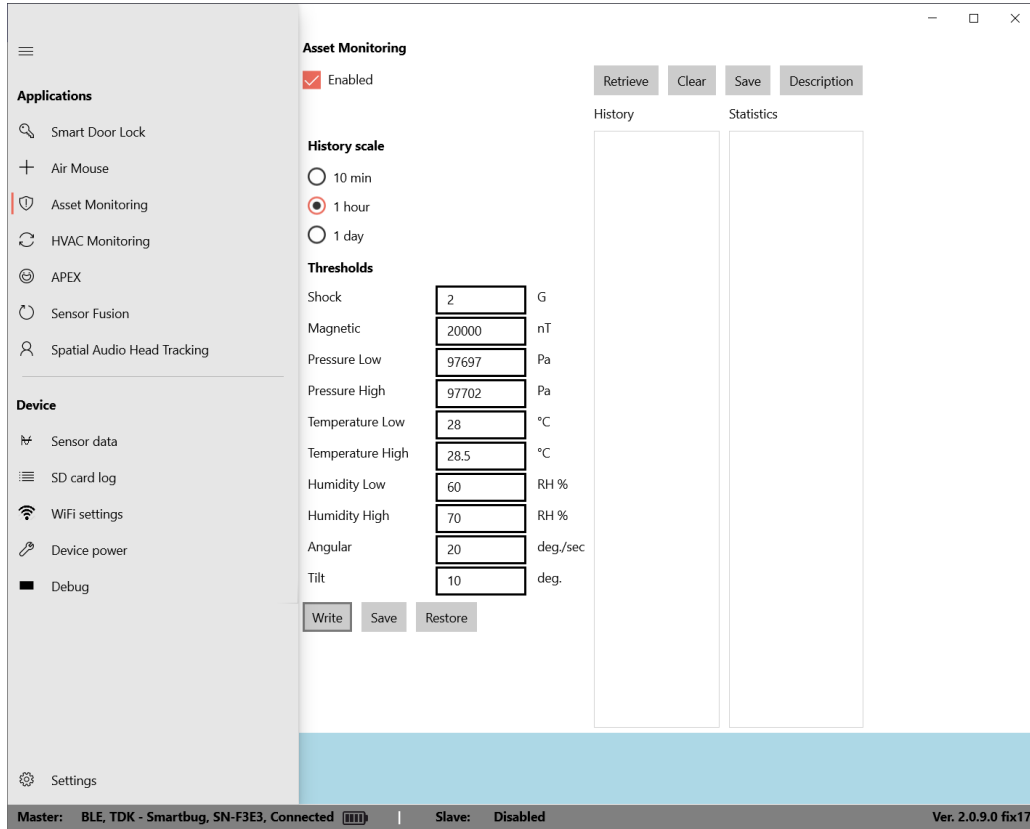
7 ASSET MONITORING

1. Select the **Enabled** checkbox to enable the **Asset Monitoring** SmartBug2.0 feature

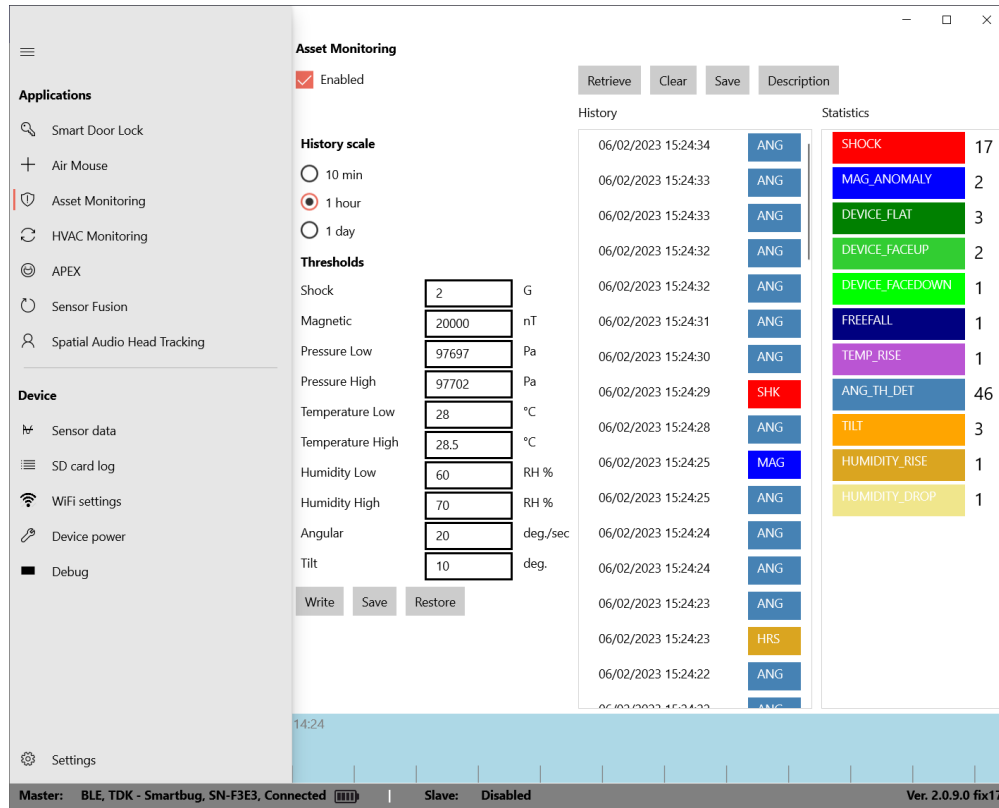


2. Configure the thresholds.

The threshold values need to be configured and new values can be entered. The new values can be saved in the configuration file with the **Save** button and then restored from the configuration by the **Restore** button in the new session. The new threshold values will be written to the device by clicking on the **Write** button.



- Place the SmartBug2.0 device on any box or package that needs to be monitored.
Start performing Asset Monitoring activities (shock, fall, environment changes) with the SmartBug2.0 device. The SmartBug2.0 device will now capture events.
- Click the **Retrieve** button to load the recorded events by the SmartBug2.0 device.
The history length can be set to the **10 min**, **1 hour**, or **1 day** before retrieving events.



5. Click the **Save** button to save events to the **am_history.csv** file.

The screenshot displays the InvenSense Asset Monitoring application. On the left, a list of applications is visible, including Smart Door Lock, Air Mouse, Asset Monitoring, HVAC Monitoring, APEX, Sensor Fusion, and Spatial Audio Head Tracking. The central window shows the 'Asset Monitoring' settings, with the 'Save' button highlighted. A 'Log file description' dialog box is open, listing event IDs and their corresponding descriptions:

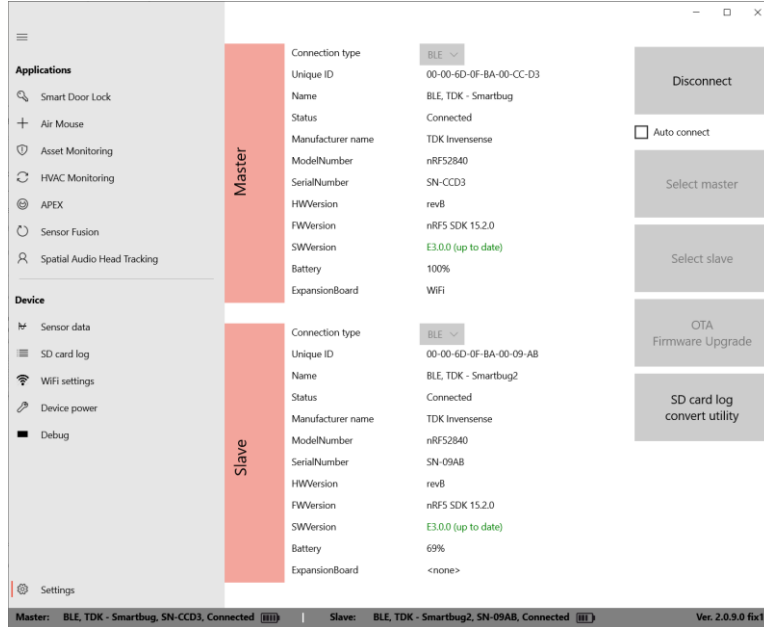
Event id:	Description
0	(SHK) SHOCK
1	(MAG) MAG_ANOMALY
2	(DFL) DEVICE_FLAT
3	(DFU) DEVICE_FACEUP
4	(DFD) DEVICE_FACEDOWN
5	(FFL) FREEFALL
6	(PRS) PRESSURE_RISE
7	(PDR) PRESSURE_DROP
8	(TRS) TEMP_RISE
9	(TDR) TEMP_DROP
10	(ANG) ANG_TH_DET
11	(TLT) TILT
12	(HRS) HUMIDITY_RISE
13	(HDR) HUMIDITY_DROP

The background shows a data table with columns A, B, and C, containing various sensor data points and timestamps.

8 HVAC MONITORING

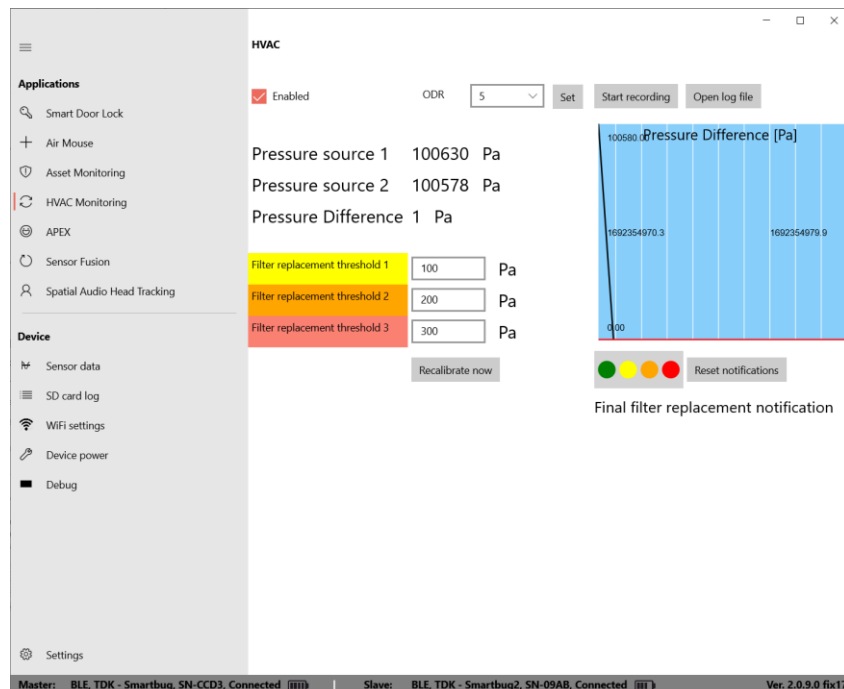
This application uses two pressure sensors (two SmartBug2.0 modules) to report the differential pressure output on HVAC filter systems or for any filter clogging application.

1. Make sure the slave device is configured and connected.



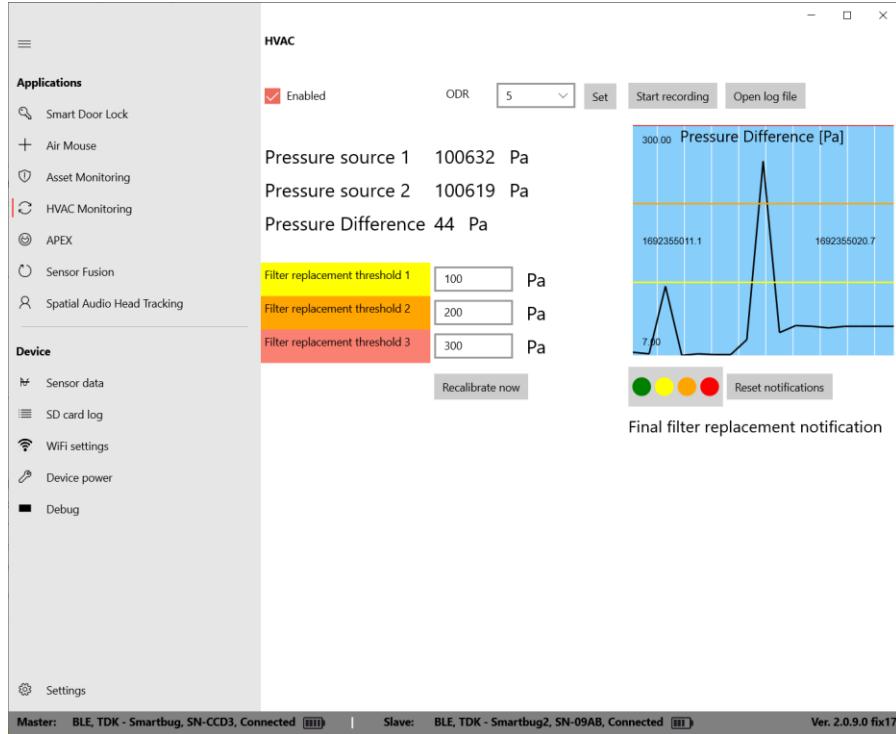
2. Select the **HVAC Monitoring** window and click on the **Enabled** checkbox to enable HVAC.
3. Place the two modules (with a pressure sensor each) on two sides of any air filter.
4. Click the **Calibrate now** button to calibrate the master and slave pressure sensors to the same level.

Two pressure sensors can show different pressure sensor readings, even when placed on the same altitude. The calibrate button ensures that the master and slave pressure have an initial differential pressure value close to zero Pascals. This ensures accurate differential pressure monitoring for HVAC filter monitoring type applications.



5. Observe the differential pressure change and filter replacement notification

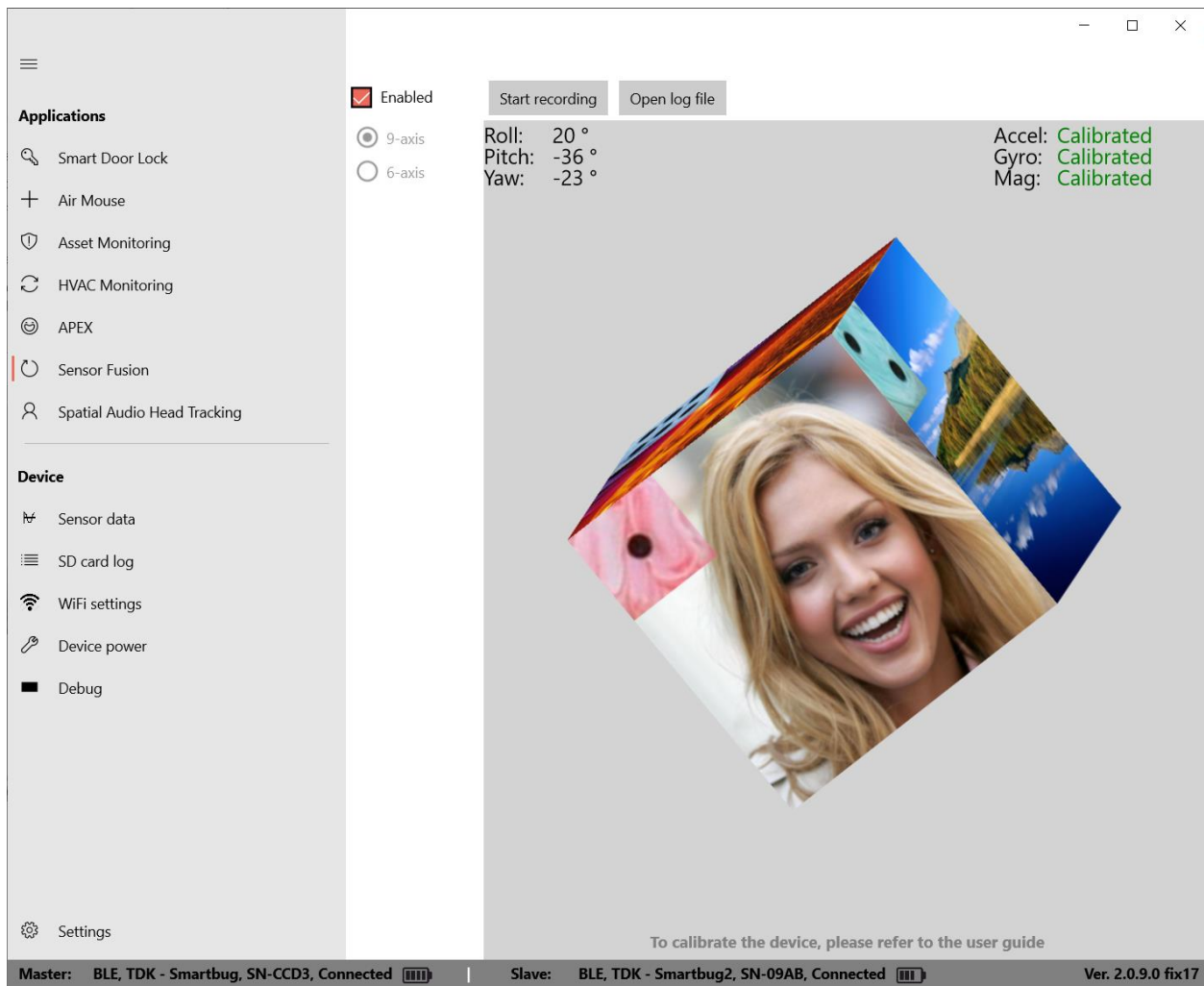
Once the pressure difference exceeds a threshold, the filter replacement notification is recorded. This picture shows that the second notification has been issued.



6. Record the differential pressure log along with absolute pressure sensor readings.

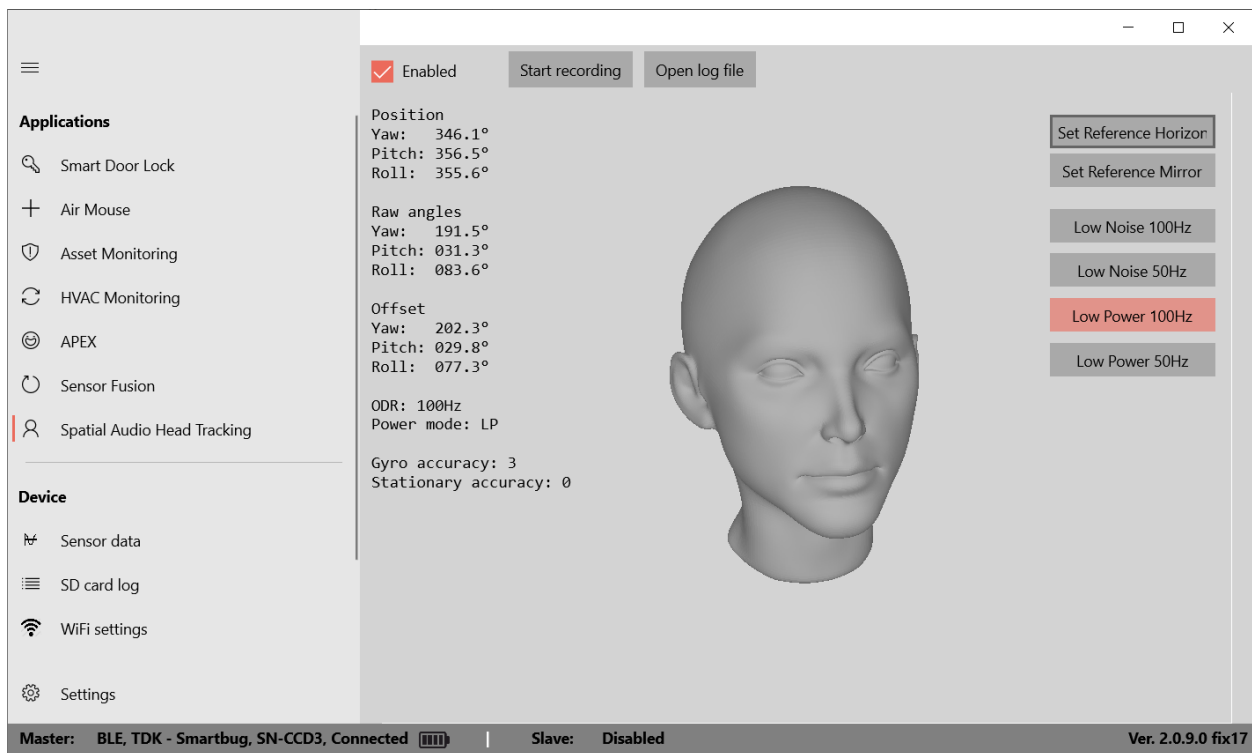
9 SENSOR FUSION

1. Select the **Sensor Fusion** window and click the **Enabled** checkbox to enable the Sensor Fusion demonstration.
2. Select the 6/9-axis fusion mode can be selected by choosing the **6/9-axis**.
3. In 6-axis sensor fusion demo, the board must be placed with LEDs in front of the screen when starting the algo.
4. Calibrate Gyro by keeping device steady for 2 seconds.
5. Calibrate accel with keeping 3 face up for 2 seconds each.
6. Calibrate the magnetometer by performing a figure-8 motion with the SmartBug2.0 device to ensure proper 9-axis calibration.
7. Start rotating the module and observe that the cube will follow the SmartBug2.0 board 3D orientation.
8. Click on **Start recording**. The recorded log contains the quaternion x, y, z, w values, received from the SmartBug2.0 and calculated yaw, pitch, roll values.



10 SPATIAL AUDIO HEAD TRACKING

9. Select the **Spatial Audio Head Tracking** window and click the **Enabled** checkbox to enable the demonstration.
10. Calibrate Gyro accuracy to 3 by keeping device steady for 3 seconds.
11. Place SmartBug2.0 on ear and face the screen.
12. Click on **Set Reference Horizon**.
13. Click on **Set Reference Mirror**.
14. Start rotating your head and see the head rotation on the screen.
15. Click on **Start recording**. The recorded log contains the quaternion x, y, z, w values, received from the SmartBug2.0.



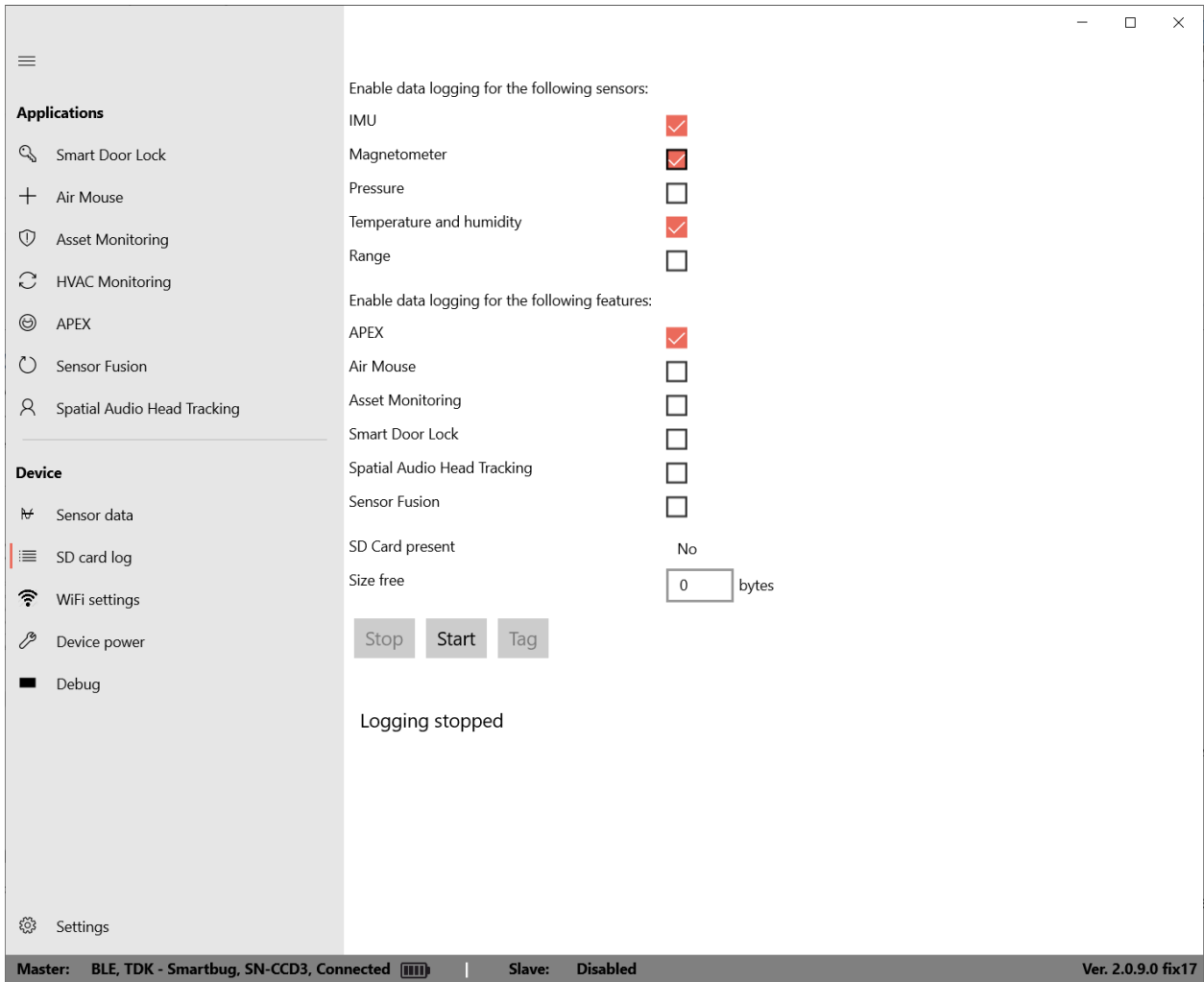
11 SD CARD LOGGING THROUGH THE APP

The SD card log window controls the log events that can be enabled by clicking on the checkboxes.

1. Click on the **Start** button to start logging. The logging can be finished by the clicking **Stop** button.

Note: The SD card should be on a FAT32 file system with a maximum size of 4GB.

SD card must have at least 2MB free for logging



Note: The SD card logging feature in the app only works in BLE and standalone mode. When logging on SD card APEX and GAF cannot be set at the same time

12 STANDALONE SD CARD LOGGER

Note: SD Card should be on a FAT32 file system with maximum size of 4GB

12.1 ENABLE AUTONOMOUS SD CARD LOG WITHOUT THE SMARTBUG2.0 APP

1. Connect the SmartBug2.0 USB to a PC.
2. A Disk will mount on Windows. On the disk you have a file called **CONFIG.TXT**.
3. Edit this file with a text editor:

```

CONFIG.txt - Notepad
File Edit Format View Help
WIFI DISABLE INNVISITOR VISITORINVN 192.168.1.28 192.168.1.254 255.255.255.0 3333 0
WIFI_FW_UPGRADE DISABLE
ACCEL DISABLE 100 2
GYRO DISABLE 100 7
MAG DISABLE 50
PRES_TEMP DISABLE 10
HUM_TEMP DISABLE 5
ULTRASOUND DISABLE 50
APEX DISABLE 3 64 17 5 128 50
AML DISABLE
ASSET_MON DISABLE 15 1000 105000 108000 145 245 500 950 65 128
SMART_DOOR DISABLE 0
ROBOVAC DISABLE 0
3DOF DISABLE 1
    
```

4. After changing the configuration, close the file, and disconnect the USB.
5. You can start the SD Card logging by pushing the **SW2000** button for 2 seconds. LED 1 on the Add-On Board will start to blink every 3 seconds.
6. You can tag an event by pushing the **SW2000** button.
7. When you want to stop the log, push the **SW2000** button for 2 seconds.
8. You can restart a new log or connect the SmartBug2.0 USB to the USB to access your log files.

12.2 ENABLE ACCELEROMETER LOG

To enable the accelerometer, you must change the line starting with **ACCEL** and change **DISABLE** to **ENABLE**.

```

CONFIG.txt - Notepad
File Edit Format View Help
WIFI DISABLE INNVISITOR VISITORINVN
WIFI_FW_UPGRADE DISABLE
ACCEL DISABLE 100 2
GYRO DISABLE 100 7
MAG DISABLE 50
PRES_TEMP DISABLE 10
HUM_TEMP DISABLE 5
ULTRASOUND DISABLE 50
APEX DISABLE 3 64 17 5 128 50
AML DISABLE
ASSET_MON DISABLE 15 1000 105000 108000 145 245 500 950 65 128
SMART_DOOR DISABLE 0
ROBOVAC DISABLE 0
3DOF DISABLE 1
    
```

You can change some parameters. The format is:

ACCEL <ENABLE/DISABLE> <ODR> <FSR>

Accelerometer ODR in Hz can be set to 25, 50, or 100

Accelerometer FSR : 0 : 2G / 1 : 4G / 2 : 8G / 3 : 16G

Note: Accel and Gyro must be enabled together in CONFIG.txt.

12.3 ENABLE GYROSCOPE LOG

To enable the Gyroscope, you must change the line starting with **GYRO** and change **DISABLE** to **ENABLE**.

```

CONFIG.txt - Notepad
File Edit Format View Help
WIFI DISABLE INNVISITOR VisitorINV
WIFI_FW_UPGRADE DISABLE
ACCEL DISABLE 100 2
GYRO DISABLE 100 7
MAG DISABLE 50
PRES_TEMP DISABLE 10
HUM_TEMP DISABLE 5
ULTRASOUND DISABLE 50
APEX DISABLE 3 64 17 5 128 50
AMI NTSDRI F
    
```

You can change some parameters. The format is:

GYRO <ENABLE/DISABLE> <ODR> <FSR>

Gyro ODR in Hz can be set to 25, 50, or 100

Gyro FSR 0 : 16dps / 1 : 31dps / 2 : 62dps / 3 : 125dps / 4 : 250dps / 5 : 500dps / 6 : 1000dps / 7 : 2000dps

Note: Accel and Gyro must be enabled together in CONFIG.txt.

12.4 ENABLE MAGNETOMETER LOG

To enable the Magnetometer, you must change the line starting with **MAG** and change **DISABLE** to **ENABLE**.

```

CONFIG.txt - Notepad
File Edit Format View Help
WIFI DISABLE INNVISITOR VisitorINV
WIFI_FW_UPGRADE DISABLE
ACCEL DISABLE 100 2
GYRO DISABLE 100 7
MAG DISABLE 50
PRES_TEMP DISABLE 10
HUM_TEMP DISABLE 5
ULTRASOUND DISABLE 50
APEX DISABLE 3 64 17 5 128 50
AMI NTSDRI F
    
```

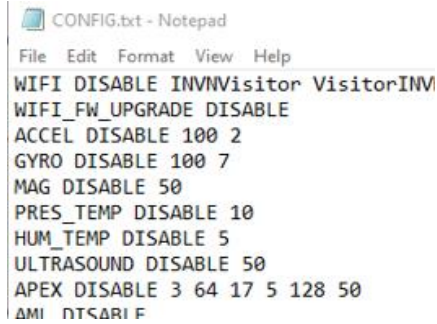
You can change some parameters. The format is:

MAG <ENABLE/DISABLE> <ODR>

Magnetometer ODR in Hz can be set to 10, 50, or 100

12.5 ENABLE PRESSURE AND TEMPERATURE LOG

To enable the Pressure and Temperature, you must change the line starting with **PRES_TEMP** and change **DISABLE** to **ENABLE**.



```
CONFIG.txt - Notepad
File Edit Format View Help
WIFI DISABLE INNVISITOR VisitorINV
WIFI_FW_UPGRADE DISABLE
ACCEL DISABLE 100 2
GYRO DISABLE 100 7
MAG DISABLE 50
PRES_TEMP DISABLE 10
HUM_TEMP DISABLE 5
ULTRASOUND DISABLE 50
APEX DISABLE 3 64 17 5 128 50
AMI DTSAIF
```

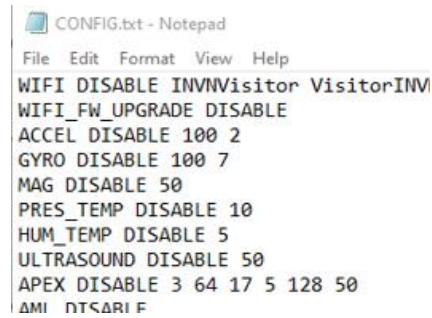
You can change some parameters. The format is:

PRES_TEMP <ENABLE/DISABLE> <ODR>

Pressure and Temperature ODR in Hz can be set to 1, 5, or 10

12.6 ENABLE HUMIDITY AND TEMPERATURE LOG

To enable the Humidity and Temperature, you must change the line starting with **HUM_TEMP** and change **DISABLE** to **ENABLE**.



```
CONFIG.txt - Notepad
File Edit Format View Help
WIFI DISABLE INNVISITOR VisitorINV
WIFI_FW_UPGRADE DISABLE
ACCEL DISABLE 100 2
GYRO DISABLE 100 7
MAG DISABLE 50
PRES_TEMP DISABLE 10
HUM_TEMP DISABLE 5
ULTRASOUND DISABLE 50
APEX DISABLE 3 64 17 5 128 50
AMI DTSAIF
```

You can change some parameters. The format is:

HUM_TEMP <ENABLE/DISABLE> <ODR>

Humidity and Temperature ODR in Hz can be set to 1, 5, or 10

12.7 ENABLE ULTRASONIC LOG

To enable the Ultrasound, you must change the line starting with **ULTRASOUND** and change **DISABLE** to **ENABLE**.

```

CONFIG.txt - Notepad
File Edit Format View Help
WIFI DISABLE INNVISITOR VisitorINV
WIFI_FW_UPGRADE DISABLE
ACCEL DISABLE 100 2
GYRO DISABLE 100 7
MAG DISABLE 50
PRES_TEMP DISABLE 10
HUM_TEMP DISABLE 5
ULTRASOUND DISABLE 50
APEX DISABLE 3 64 17 5 128 50
AMI_DT<ARI F
    
```

You can change some parameters. The format is:

ULTRASOUND <ENABLE/DISABLE> <ODR>

ULTRASOUND ODR in Hz can be set to 1, 5, or 10

12.8 ENABLE APEX FEATURE LOG

To enable the APEX feature, you must change the line starting with **APEX** and change **DISABLE** to **ENABLE**.

```

CONFIG.txt - Notepad
File Edit Format View Help
WIFI DISABLE INNVISITOR VisitorINV
WIFI_FW_UPGRADE DISABLE
ACCEL DISABLE 100 2
GYRO DISABLE 100 7
MAG DISABLE 50
PRES_TEMP DISABLE 10
HUM_TEMP DISABLE 5
ULTRASOUND DISABLE 50
APEX DISABLE 3 64 17 5 128 50
AMI_DT<ARI F
    
```

You can change some parameters. The format is:

APEX <ENABLE/DISABLE> <TAP_TMIN> <TAP_TMAX> <TAP_MIN_JERK_THR> <PED_STEP_CNT_TH> <PED_AMP_CNT_TH> <WOM_THR>

TAP_TMIN	TAP_TMAX	TAP_MIN_JERK_THR (UNIT: 16MG)	PED_STEP_CNT_TH	PED_AMP_TH_SEL	WOM_THR (UNIT: 4MG)
0 : 125 ms	0 : 250 ms	0 <= th <= 63	0 <= th <= 15	0 : 1006632 μG	0 < th < 255
1 : 140 ms	32 : 375 ms			16 : 1140650 μG	
2 : 156 ms	64 : 500 ms			32 : 1275068 μG	
3 : 171 ms	96 : 625 ms			48 : 1409286 μG	
4 : 187 ms				64 : 1543503 μG	
5 : 203 ms				80 : 1677721 μG	
6 : 218 ms				96 : 1811939 μG	
7 : 234 ms				112 : 1946157 μG	
				128 : 2080374 μG	
				144 : 2214592 μG	
				160 : 2348810 μG	
				176 : 2483027 μG	
				192 : 2617245 μG	
				208 : 2751463 μG	
				224 : 2885681 μG	
				240 : 3019898 μG	

Note: GAF cannot be turned ON with APEX. IMU ODR is 200Hz only.

12.9 ENABLE AIR MOUSE LIBRARY (AML) LOG

To enable the AML Feature, you must change the line starting with **AML** and change **DISABLE** to **ENABLE**.

```
APEX DISABLE 3 64 17 5 128 50
AML DISABLE
ASSET_MON DISABLE 15 1000 105000 108000 145 245 500 950 65 128
SMART_DOOR DISABLE 0
ROBOVAC DISABLE 0
3DOF DISABLE 1
```

12.10 ENABLE ASSET MONITORING LOG

To enable the Asset Monitoring Feature, you must change the line starting with **ASSET_MON** and change **DISABLE** to **ENABLE**.

```
APEX DISABLE 3 64 17 5 128 50
AML DISABLE
ASSET_MON DISABLE 15 1000 105000 108000 145 245 500 950 65 128
SMART_DOOR DISABLE 0
ROBOVAC DISABLE 0
3DOF DISABLE 1
```

You can change some parameters. The format is:

**ASSET_MON <ENABLE/DISABLE> <MAG_TH> <PRES_LOW_TH> <PRES_HIGH_TH> <TEMP_LOW_TH>
<TEMP_HIGH_TH> <HUM_LOW_TH> <THUM_HIGH_TH> <ANG_TH> <TILT_TH>**

Magnetic Threshold (in nT)	Pressure Low Threshold (in Pa)	Pressure High Threshold (in Pa)	Temperature Low Threshold (in °C x10)	Temperature High Threshold (in °C x10)	Humidity Low Threshold (in % x10)	Humidity High Threshold (in % x10)	Angular Threshold (in deg/secs x10)	Tilt Threshold (in deg x10)

12.11 ENABLE SMART DOOR LOCK LOG

To enable the Smart Door Lock Feature, you must change the line starting with **SMART_DOOR** and change **DISABLE** to **ENABLE**.

```
APEX DISABLE 3 64 17 5 128 50
AML DISABLE
ASSET_MON DISABLE 15 1000 105000 108000 145 245 500 950 65 128
SMART_DOOR DISABLE 0
ROBOVAC DISABLE 0
3DOF DISABLE 1
```

You can change some parameters. The format is:

SMART_DOOR <ENABLE/DISABLE> <ANGLE_REPORT>

ANGLE REPORT can be set to:

0: Only Door Event is log

100: Door Angle is log at 100 Hz

Any other values will be ignored.

12.12 ENABLE SENSOR FUSION LOG

To enable the 3DOF Feature, you must change the line starting with **3DOF** and change **DISABLE** to **ENABLE**.

```
APEX DISABLE 3 64 17 5 128 50
AML DISABLE
ASSET_MON DISABLE 15 1000 105000 108000 145 245 500 950 65 128
SMART_DOOR DISABLE 0
ROBOVAC DISABLE 0
3DOF DISABLE 1
```

You can change some parameters. The format is:

3DOF <ENABLE/DISABLE> <MODE>

Mode can select Fusion algorithm selected:

0 : 9-axis

1 : 6-axis

Note: No Data will be logged on SD Card till calibration is done. Keep SmartBug 2.0 steady for 10 seconds.

12.13 ENABLE GAF LOG

To enable the GAF Feature, you must change the line starting with **GAF** and change **DISABLE** to **ENABLE**.

```
APEX DISABLE 32 99 18 5 118 6
AML DISABLE
ASSET_MON DISABLE 2 20000 97697 97702 280 285 600 700 200 100
SMART_DOOR DISABLE 0
3DOF DISABLE 0
GAF DISABLE 100 0
```

You can change some parameters. The format is:

GAF <ENABLE/DISABLE> <ODR><MODE>

Mode can select Fusion algorithm selected:

0 : Low power

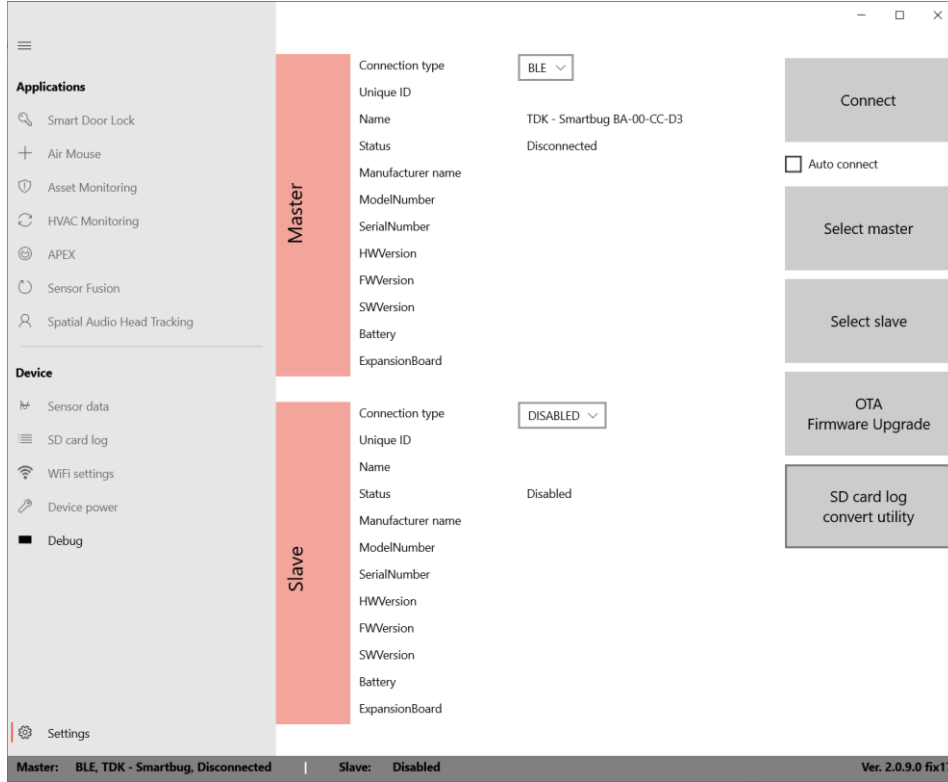
1 : Low noise

Note: APEX cannot be turned ON with GAF. IMU ODR is 50Hz or 100Hz only.

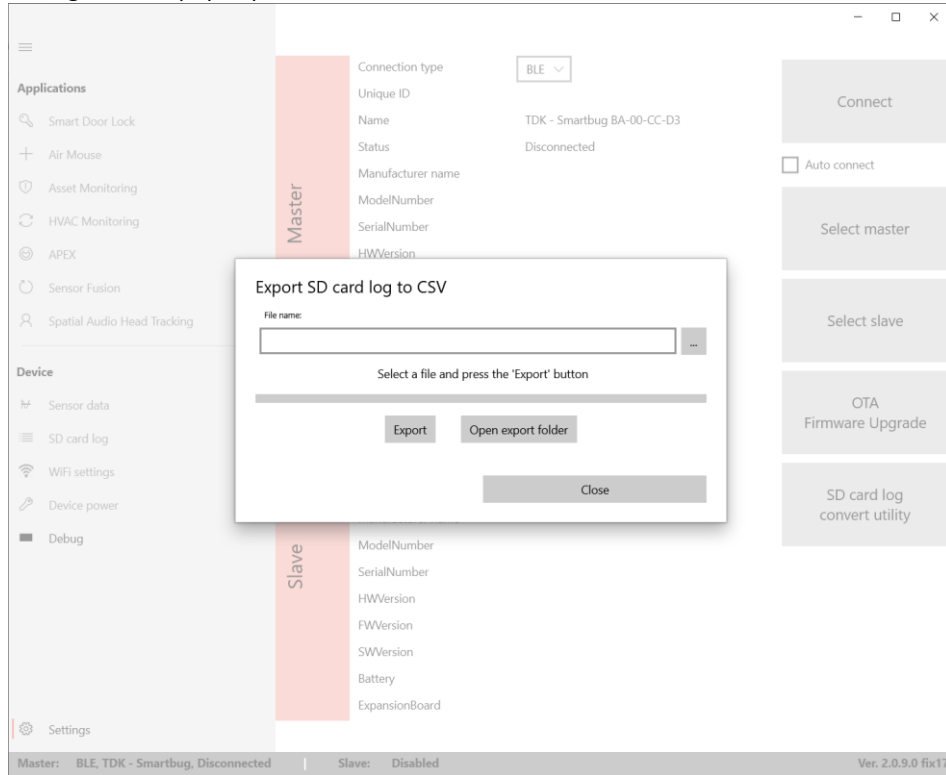
13 ACCESS SD CARD LOG

In order to access SD card log, connect SmartBug2.0 Module to PC with micro-USB cable.

1. Click on **SD card log convert utility**.



The following window pops up.



2. Browse to the log file on the SD Card drive and select it.
3. Click on **Export**.
4. After conversion is complete, click on **Open export folder** to view the extracted log files.

14 CONVERSION OF THE SD CARD LOGS

1. IMU Logs

a. Accelerometer

Conversion from output count to g

$$g = \text{count} * (\text{FSR}/32768)$$

where

Count = count read from sensor.

FSR = 2,4,8,16 selected by user.

Example

Count = 16384

FSR = 2

$$G = 16384 * (2/32768) = 1 \text{ g}$$

b. Gyroscope

Conversion from output to dps

$$\text{dps} = \text{count} * (\text{FSR}/32768)$$

where

Count = count read from sensor.

FSR = 16,32,64,125,250,500,1000,2000 selected by user.

Example

Count = 16384

FSR = 2000

$$G = 327 * (2000/32768) = 19.95 \text{ dps}$$

2. Magnetometer Logs

The logs are in 100s of uT.

Convert to uT by dividing the number by 100.

Example = 15040 = 150.4 uT

3. Pressure Logs

a. Pressure

Values are in Pascal.

b. Temperature

Values are in 10s of degC.

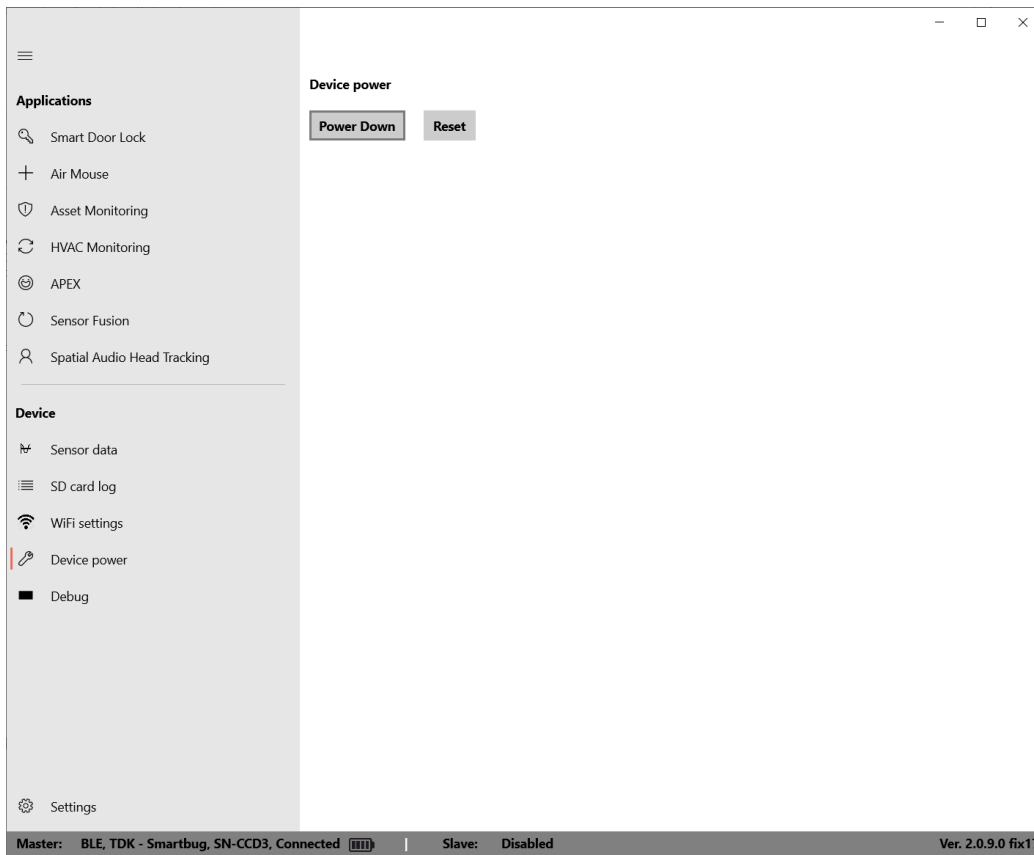
Convert to degC dividing the number by 10.

Example 313 = 31.3 degC

15 DEVICE POWER AND RESET

The SmartBug2.0 board can be reset or powered down in the **Device Power** window by using the **Power Down** or **Reset** button. The **Power Down** feature is required to connect the WiFi Add-On board with the module. Hot plugging should be avoided while the module is running. There are two methods to turn on the module after power down:

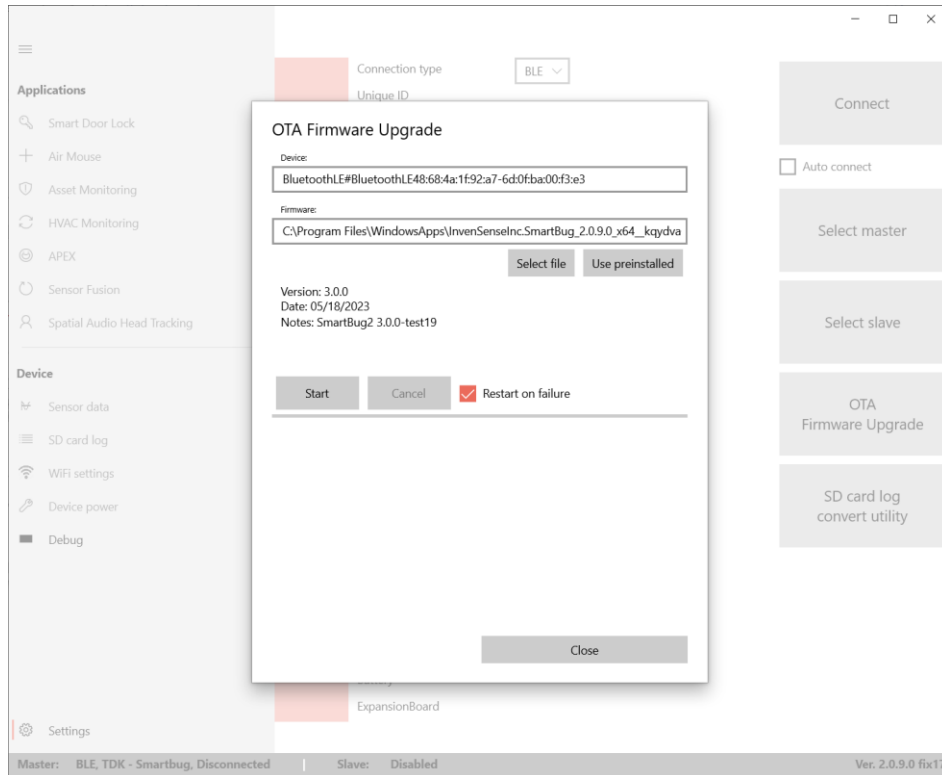
1. Once the Add-On board is connected in **Power Down** mode, use the **Power** button on the Add-On card to turn on the module.
2. Once the Add-On board is connected in **Power Down** mode, connect the USB cable to turn on the module and remove the USB cable to enable BLE mode.



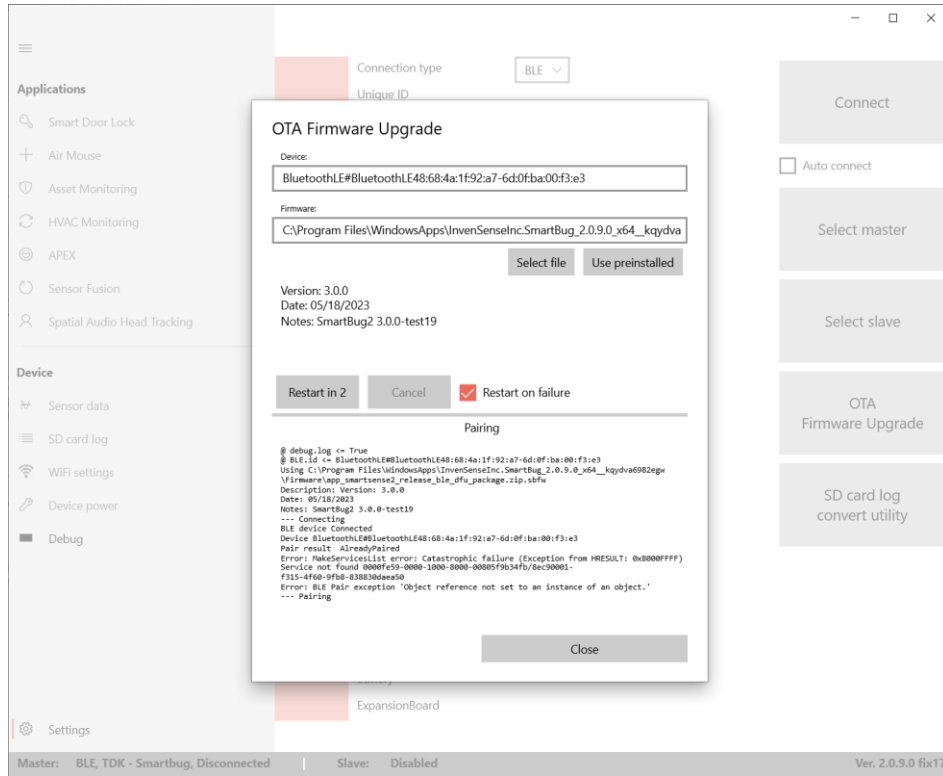
16 OTA FIRMWARE UPGRADE

OTA Firmware upgrade is a very valuable feature to upgrade the firmware on the SmartBug2.0 device. This can be used to ensure that the latest version of firmware is loaded on the device.

1. Disconnect the BLE connection.
2. Click **OTA Firmware Upgrade**.

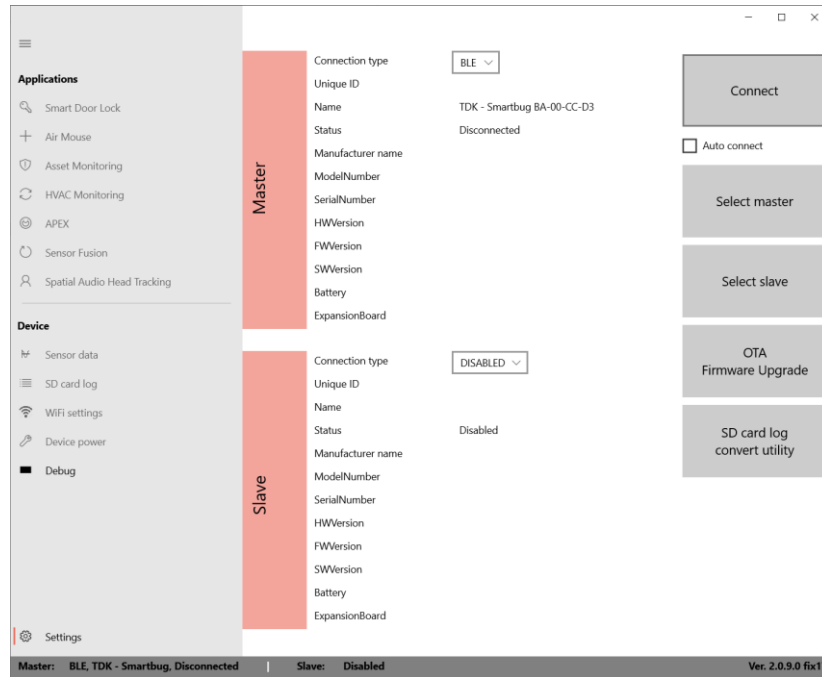


3. Click **Use preinstalled**. This option stores the latest version of firmware with the latest version of Smartbug2.0 app,
4. Click **Start**.



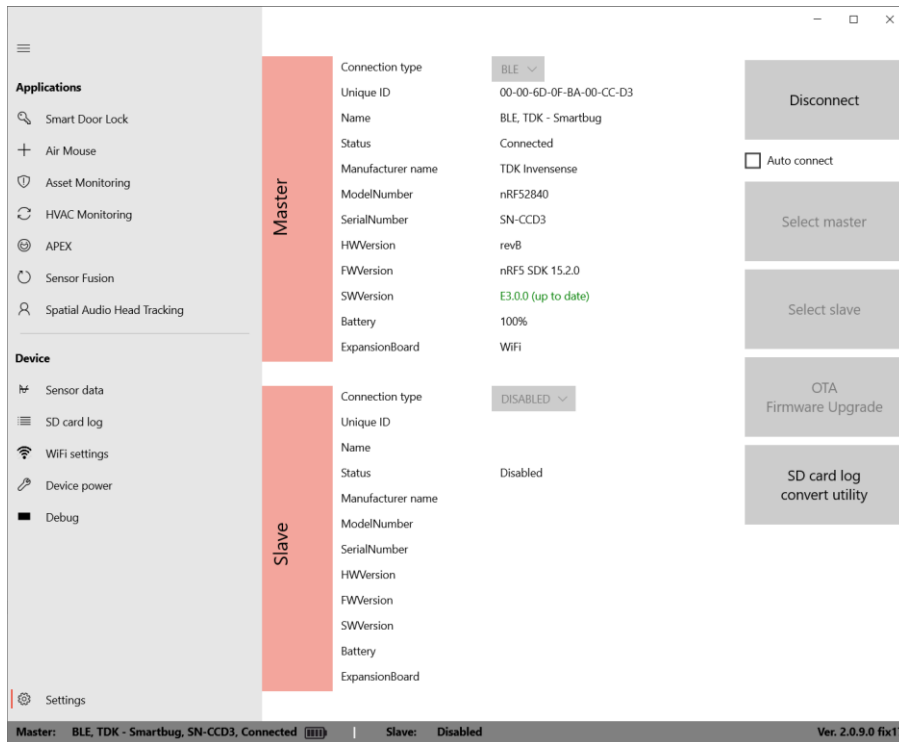
5. Click **Yes** on the pop-up window to unpair DfuTarg from the device.

6. Click **Connect** in the app.



7. Click **Yes** again on the pop-up window to pair SmartBug2.0 with your device.

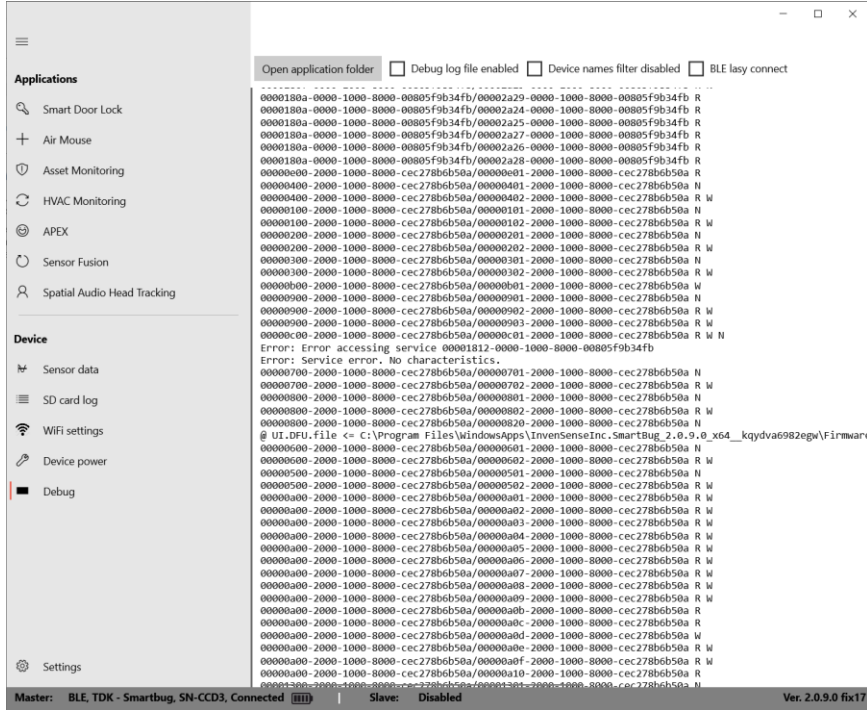
The version of the firmware should now be upgraded and can be seen in the Master device parameters with green status saying **up to date**.



17 USE DEBUG MENU TO SEE MESSAGES LOG

All activities in the app are recorded in the debug window. This can help with troubleshooting and debugging of the application.

The interface detailed messages can be enabled by the **Debug file enabled** check button. In this case, all communication messages will be logged into a file, located in the application data folder. The File Explorer can be launched to that folder by clicking the **Open application folder** button.



18 REVISION HISTORY

REVISION DATE	REVISION	DESCRIPTION
12/22/2023	1.0	Initial Release

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