Sensing is life

AS7058 Evaluation Kit

Quick Start Guide
v1.00

27/04/2023

AS7058 Evaluation Kit

Quick Start Guide

AS7058 EVK

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Logging Data

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Contents of the AS7058 Evaluation kit

AS7058 Evaluation Kit Parts

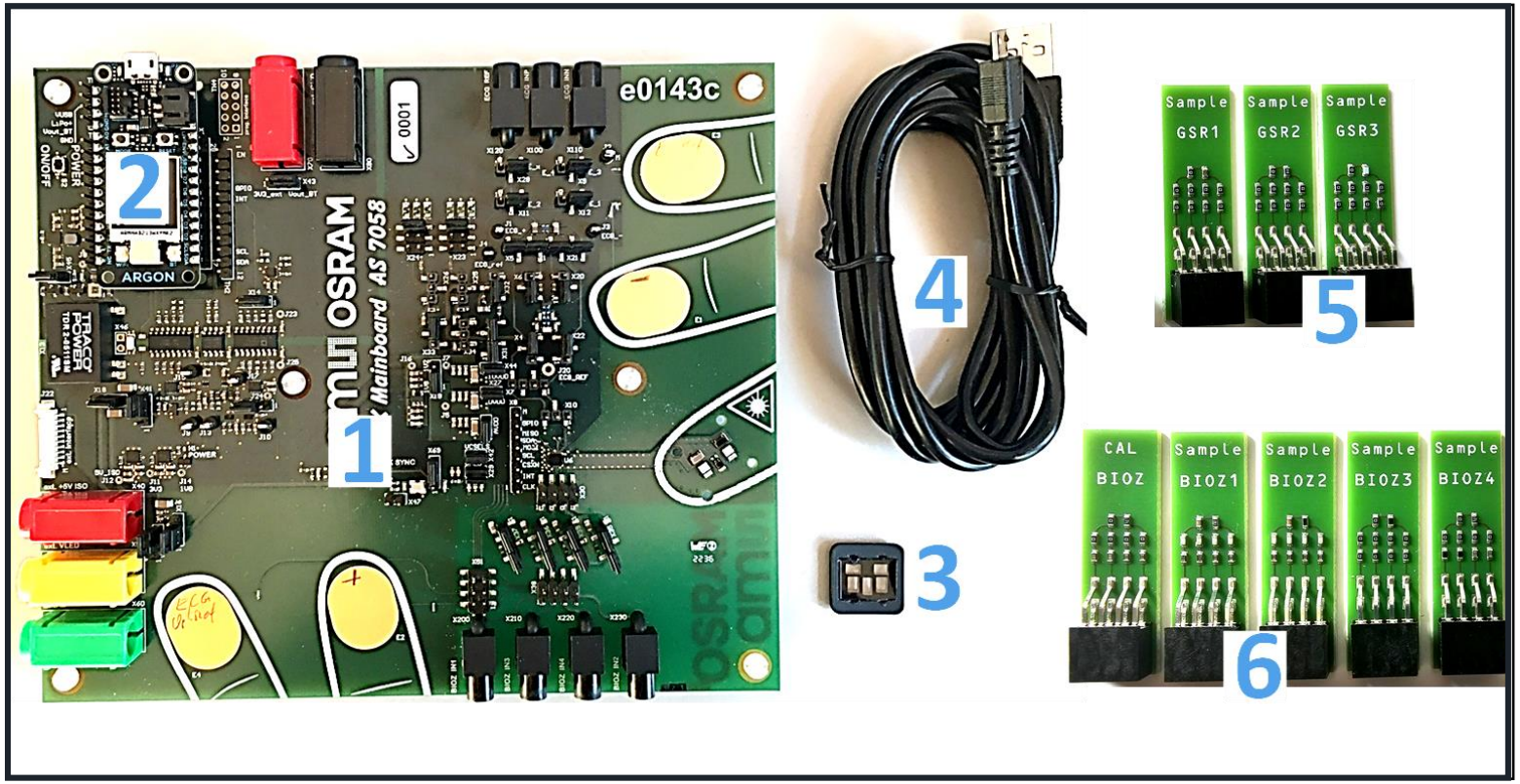


Fig. 1: AS7058 Evaluation Kit out of the box

Out of the Box

1 – AS7058 EVK Mainboard

2 – Microcontroller Board with USB & BLE interface

3 – Optical Stack

4 – Micro USB cable

5 – 3x GSR Samples

6 – 5x BioZ Samples (“CAL BIOZ” for BioZ Calibration)

Contents of the AS7058 Evaluation kit

Main parts of the Evaluation Kit

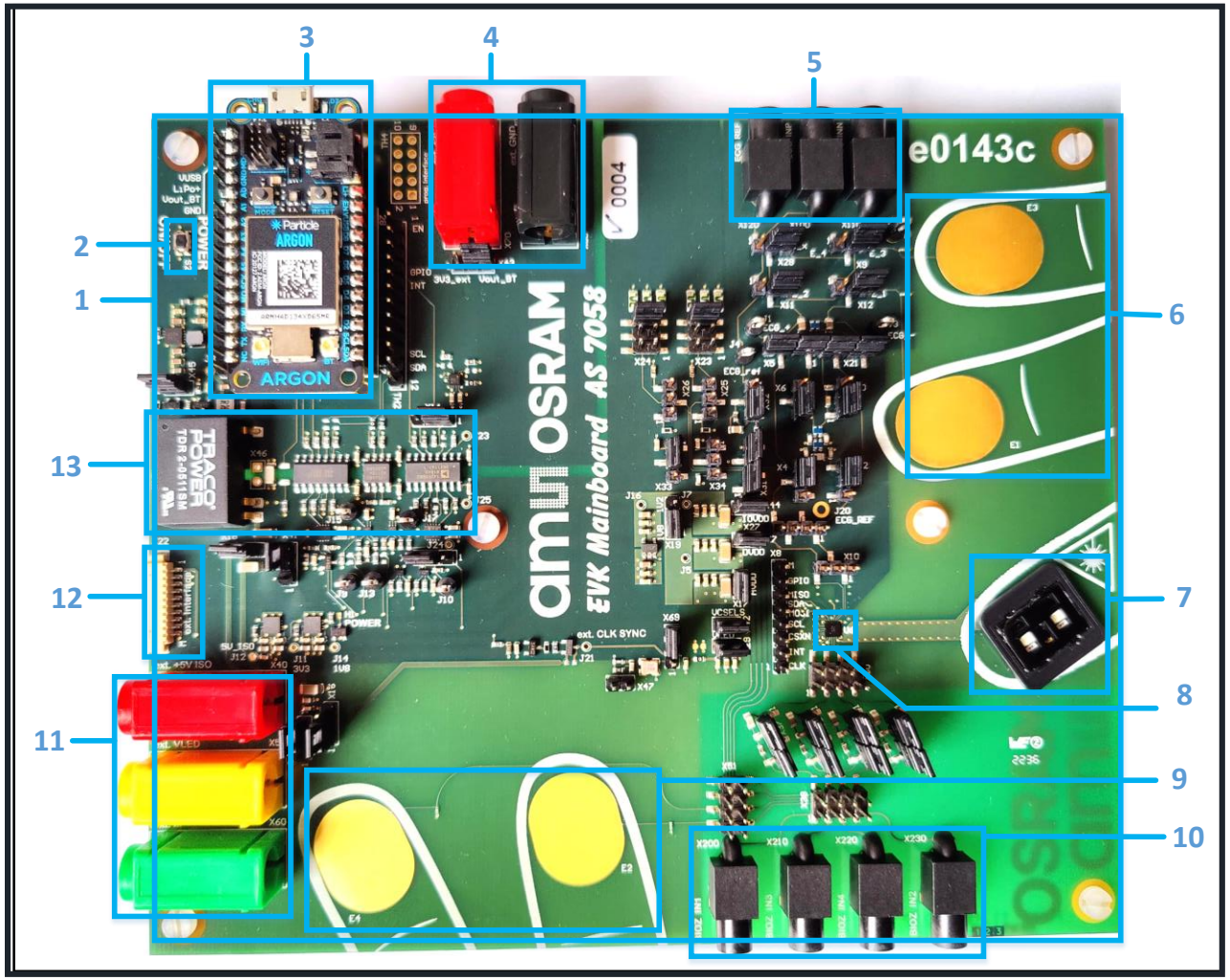


Fig. 2: AS7058 Evaluation Kit top view

Key

1 – AS7058 EVK Mainboard

2 – AS7058 EVK On/Off Button (S2)

3 – Microcontroller board with USB & BLE interface

4 – External 3V3 power supply & GND ports

5 – External ECG Connector

6 & 9 – Electrodes for ECG, EDA and Bio-impedance measurement

7 – Optical Stack for PPG

8 – AS7058 Sensor

10 – External BioZ Connector

11 – External 5V0 power supply, LED Power Supply & GND ports

12 – External Sensor Interface

13 – Electrical Isolation

AS7058 PC Software

Installation

To install, start the installer executable and follow the instructions as shown in *Fig. 3* below (from left to right).

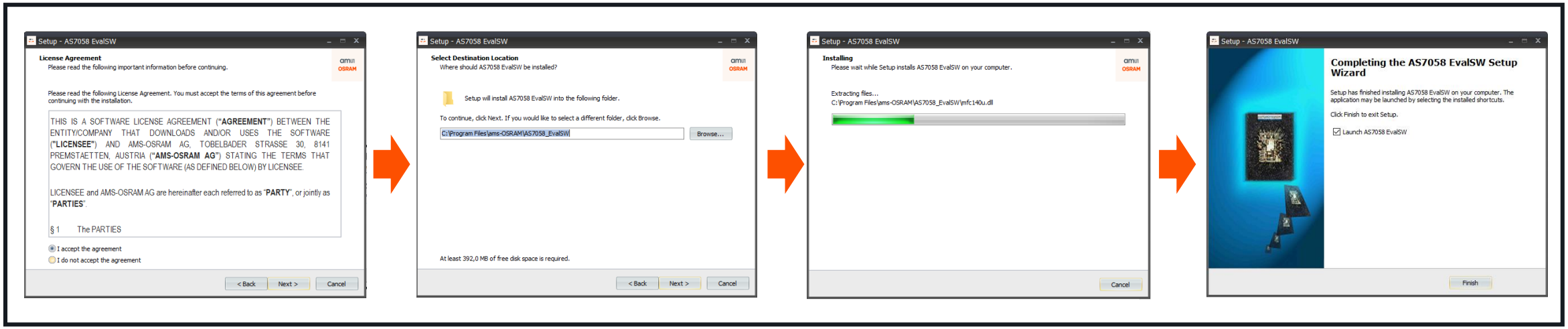
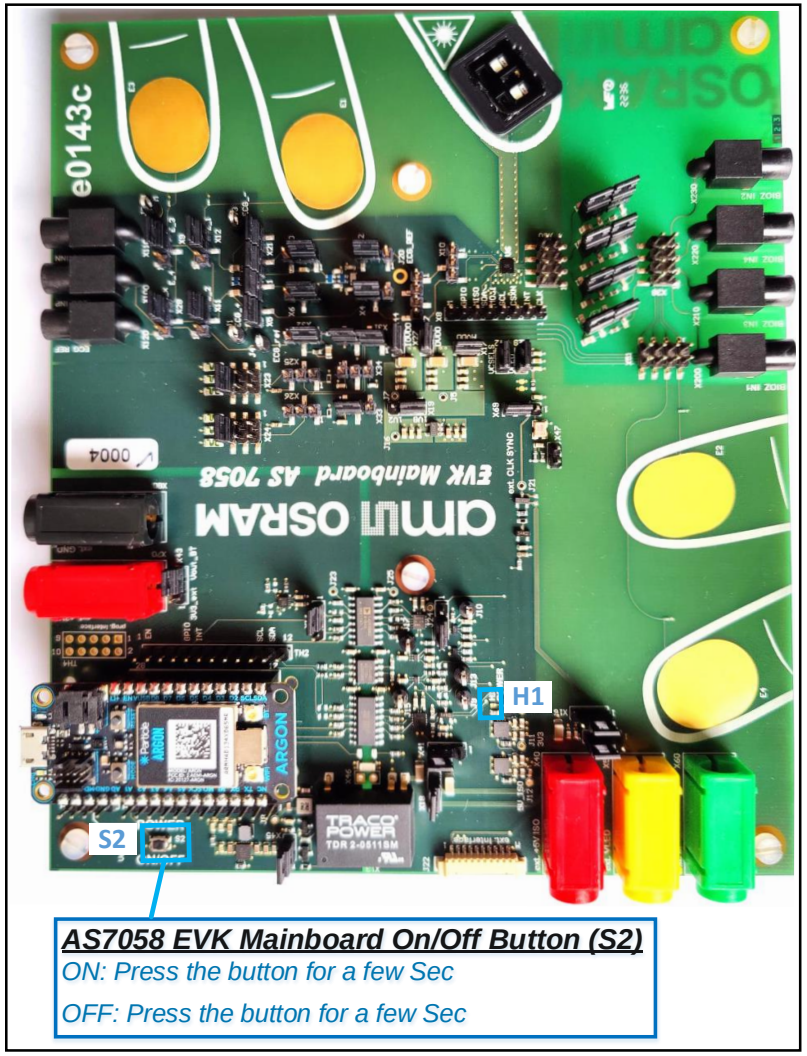


Fig. 3: AS7058 Software Installation Steps

Setup

Getting Started



1. Connect the micro USB cable to the board and plug it into your computer.
2. Then, press the S2 button for one second to turn on the AS7058 EVK.
3. The green LED on the Microcontroller board will light up as soon as the board is powered.
4. The green LED (H1) on the mainboard will light up as soon as the board is powered.
5. Afterward, start the EVK GUI software.

Fig. 4: AS7058 Evaluation Kit power ON

AS7058 PC Software

GUI Overview

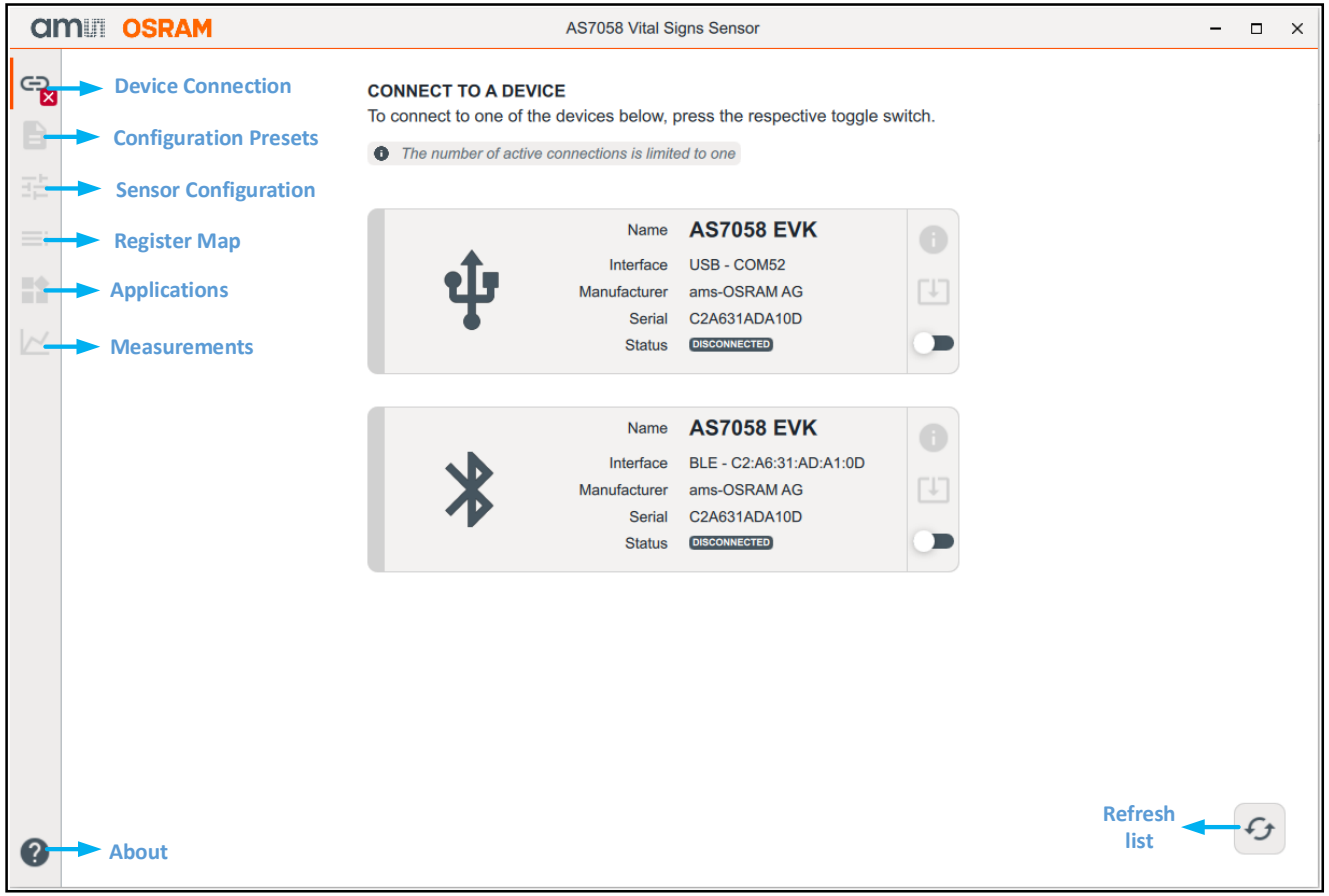


Fig. 5: Overview of the GUI

The Graphical User Interface (GUI) consists of seven main segments (*Fig. 5*):

- **Device Connection:** To connect the AS7058 EVK to the software.
- **Configuration Presets:** A few configuration presets are provided to help the user quickly start using the device.
- **Sensor Configuration:** Adjusts the settings for each parameter.
- **Register Map:** Displays the value of each register and can control the sensor status.
- **Applications:** This tab contains vital signs application-related parameters.
- **Measurements:** This tab displays HRM, SpO2, ECG & Bioimpedance readings along with a graph of the ADC count.
- **About:** Shows information regarding the software and Python versions.
- **Refresh list:** If Windows does not automatically recognize the device, press this Refresh button and wait for the board to be recognized.

Note: The other segments are only activated after the connection to the evaluation kit is established.

AS7058 PC Software

GUI Overview – Device Connection Tab

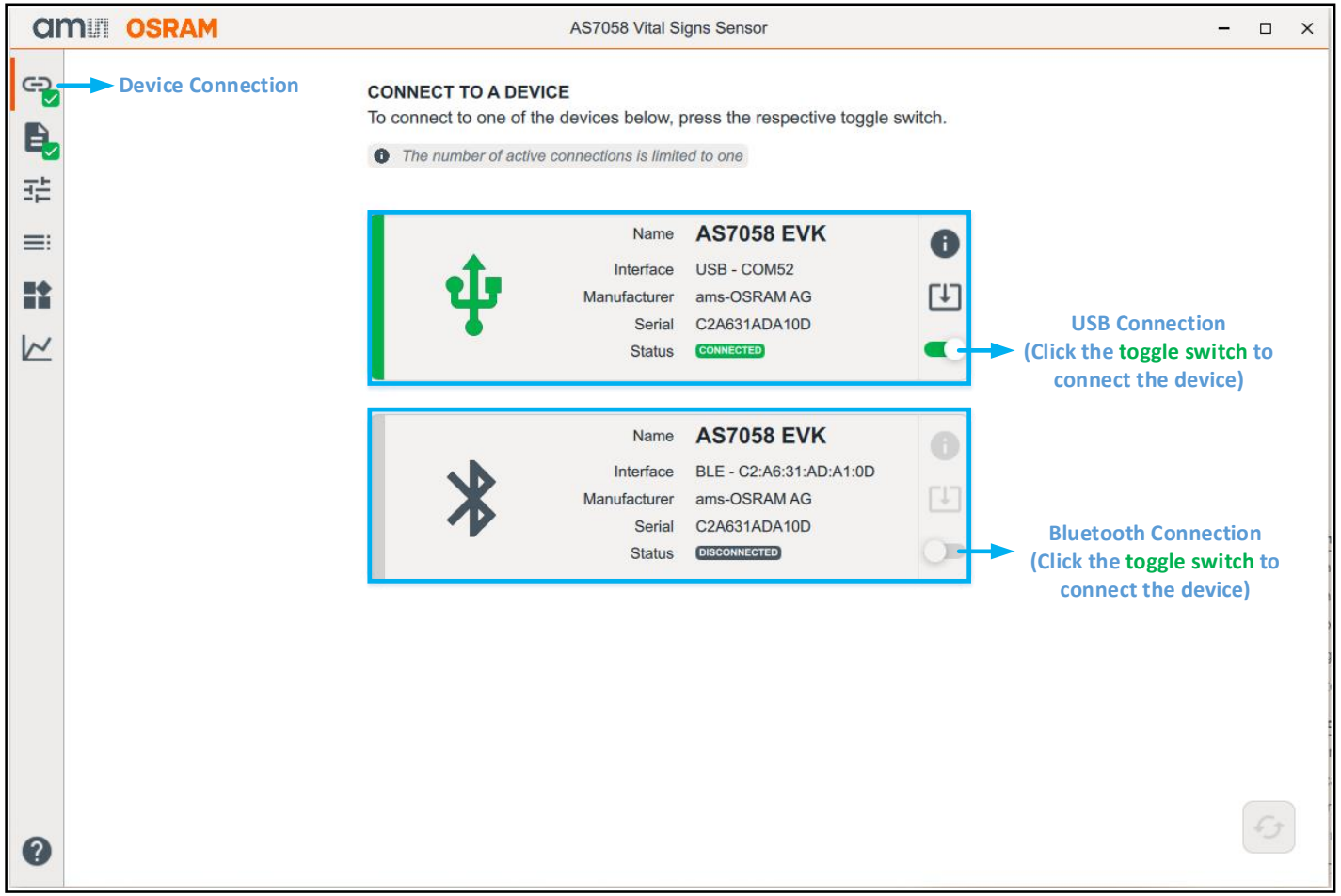


Fig. 6: Overview of the GUI – Device Connection

After launching the EVK GUI, the “Device Connection” tab is displayed.

The GUI has two ways to communicate with the device:

1. Wired connection via the micro USB connector.
2. Wireless connection via the BLE (refer to page 4).

The GUI application is available on Windows-based PCs and macOS.

AS7058 PC Software

GUI Overview – Configuration Presets Tab

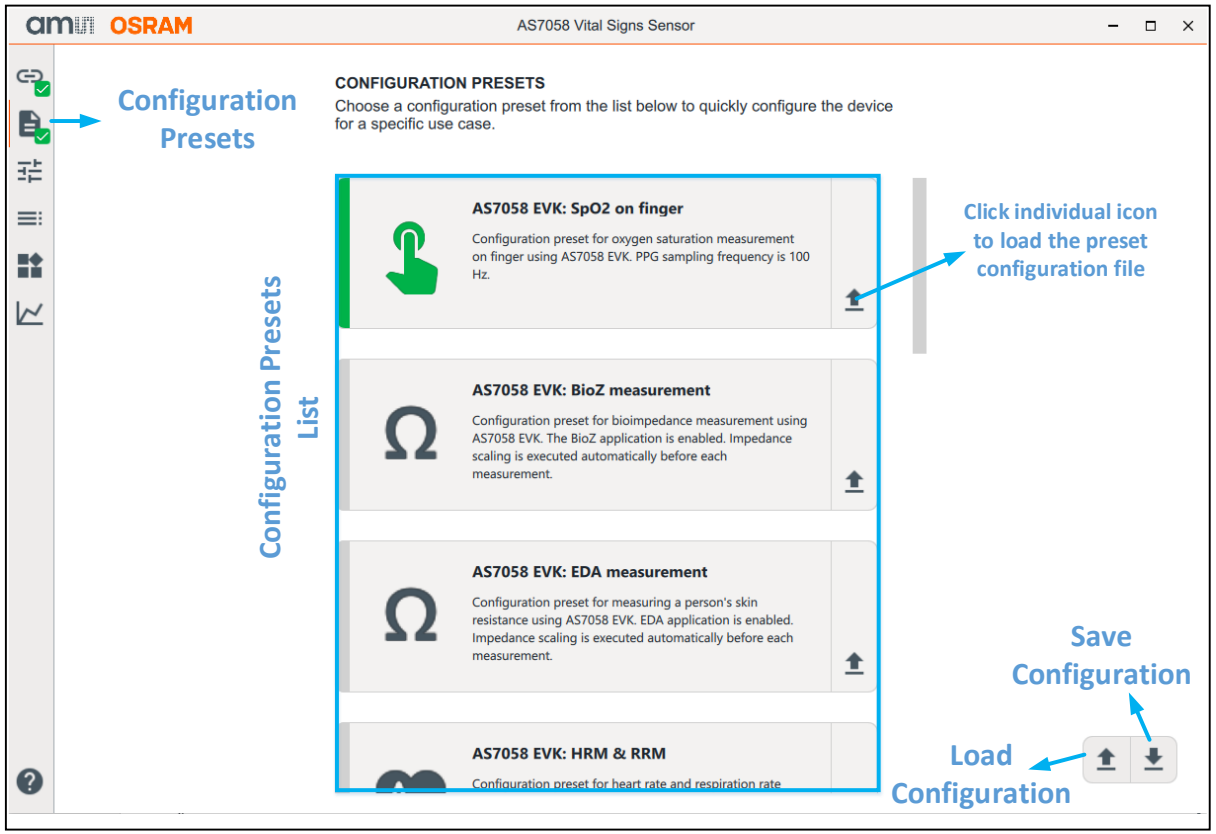


Fig. 7: Overview of the GUI – Configuration Presets

A few configuration presets are provided to help the user quickly start using the device. These can be chosen from the "Configuration Presets" Tab. Each file comes with a description, letting the user know what measurements can be done using them:

- **AS7058 EVK: SpO2 on finger -** SpO2 monitoring on the finger at a PPG sampling frequency of 100 Hz. The SpO2 result is not calibrated.
- **AS7058 EVK: PPG & ECG -** This is a test configuration for simultaneous ECG & PPG measurements using the EVK.
- **AS7058 EVK: ECG 1kHz -** For an ECG measurement on the finger using the EVK. The sampling frequency is 1 kHz and the total gain is 128.
- **AS7058 EVK: ECG & Lead-off -** For an ECG measurement on the finger and lead-off detection using the AS7058 EVK.
- **AS7058 EVK: HRM & RRM -** Heart Rate and respiration rate monitoring on the finger at a PPG sampling frequency of 200 Hz, with PRV measurement enabled.
- **AS7058 EVK: EDA Measurement -** This is a configuration for measuring changes in a person's skin resistance.
- **AS7058 EVK: BioZ Measurement -** This is a configuration for measuring a person's body impedance with the AS7058 EVK.
- **AS7058 Wired-WB: HRM on wrist -** Heart Rate monitoring on the wrist when a wired wrist demo is connected.
- **AS7058 Wired-WB: SpO2 on wrist -** SpO2 measurement on the wrist when a wired wrist demo is connected.

To save the current configuration settings, click the Save Configuration button (*Fig. 7*). This opens the Save Configuration File dialog box. Enter a file name, choose the file location, and save it as a JSON file. Lastly, click Save to save the file.

To load a JSON configuration, click the Load Configuration button (*Fig. 7*). This opens the Select Configuration File dialog box. Then, select the JSON configuration file you want to load, and click Open.

AS7058 PC Software

GUI Overview – Sensor Configuration Tab

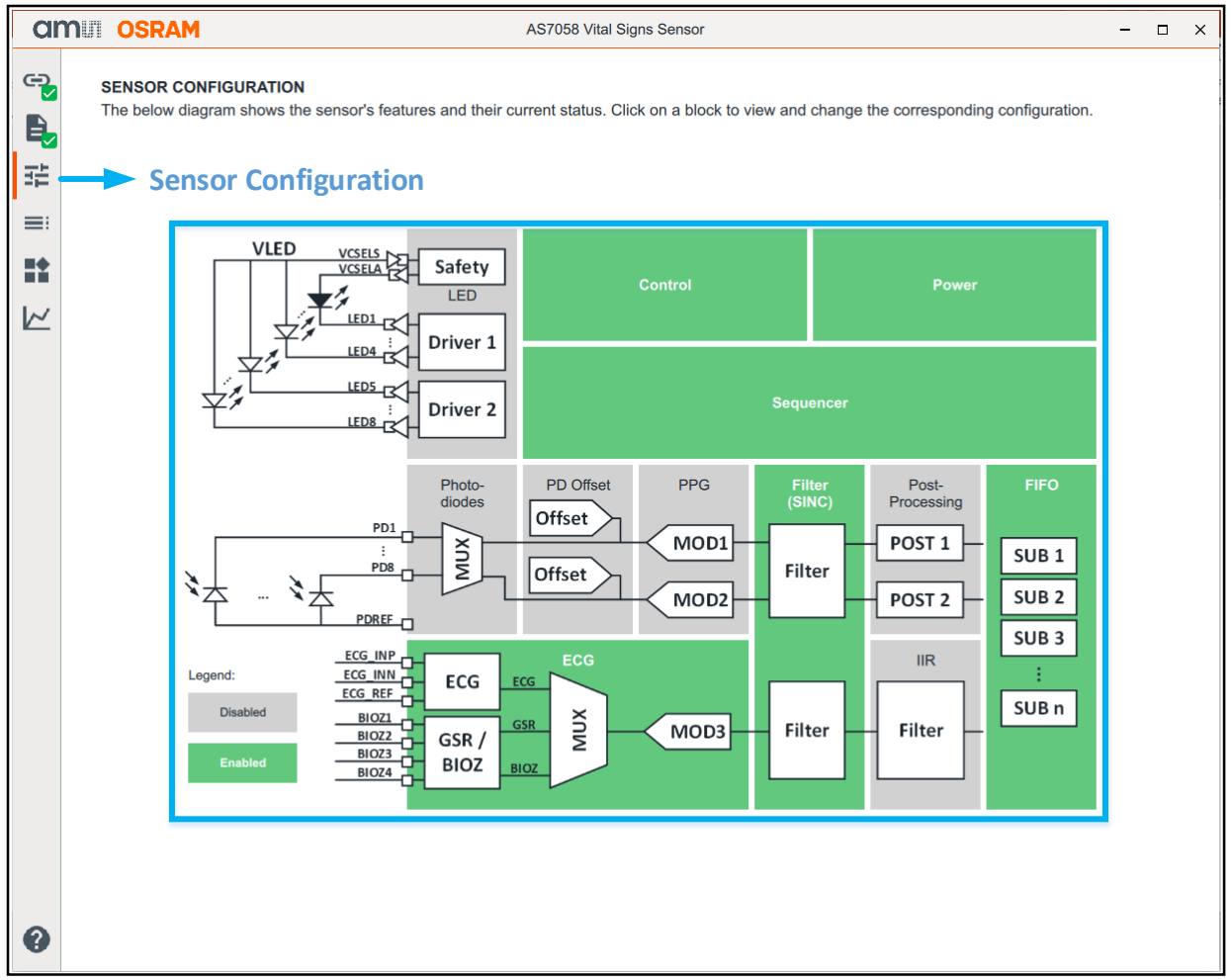


Fig. 8: Overview of the GUI - Sensor Configuration

The device parameters can be configured in the Sensor Configuration tab. This tab presents the various functional blocks of the AS7058 as separate rectangular blocks. After choosing a configuration preset, the enabled blocks are highlighted in green, and the disabled blocks are shown in grey.

The parameters contained within each block can be monitored/modified by selecting the individual blocks.

Note: Any change in the configuration parameter takes effect only after it is saved - before exiting the corresponding block.

AS7058 PC Software

GUI Overview – Register Map Tab

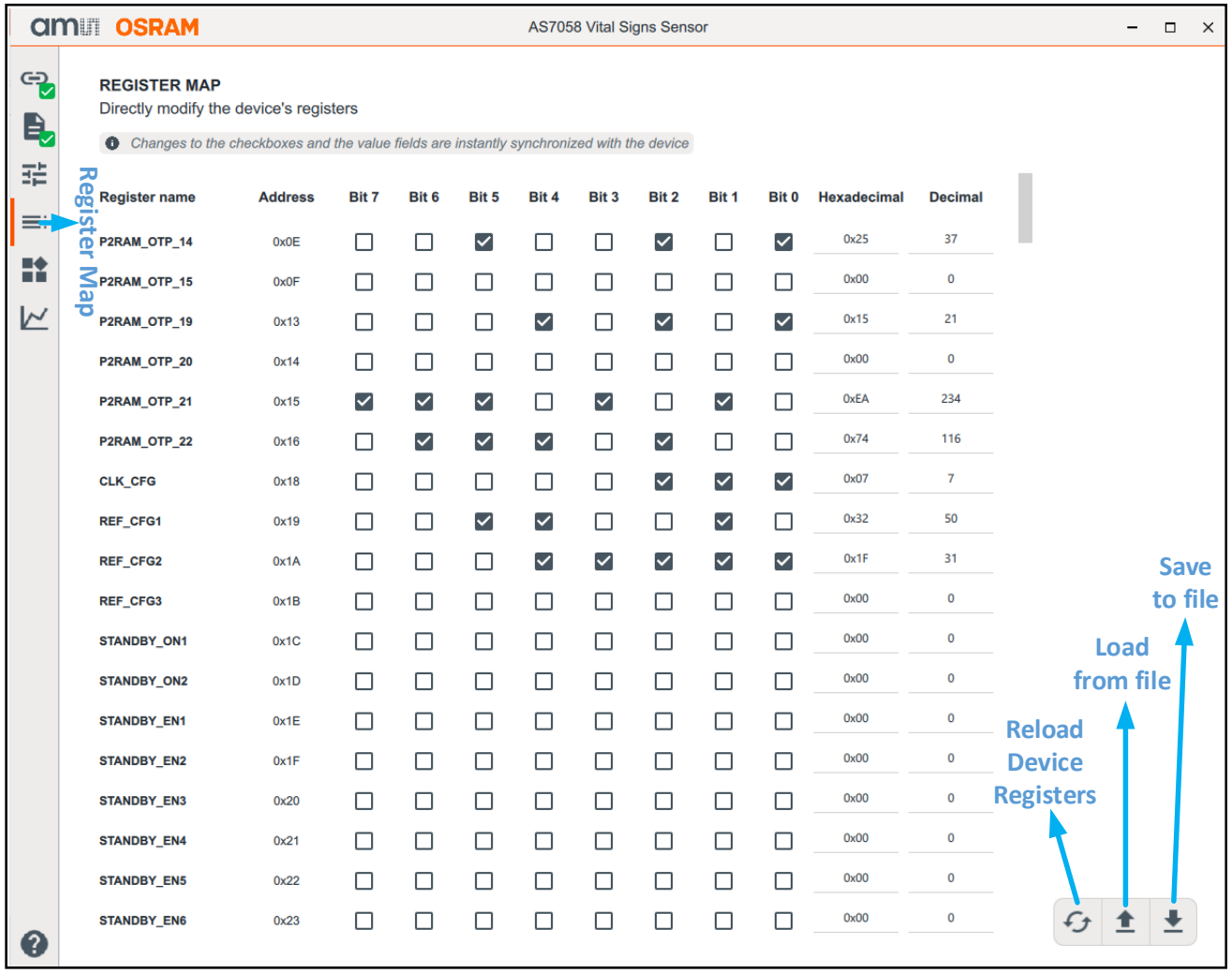


Fig. 9: Register Map Overview

To check the current register Map, click on the Register Map tab. In the Register Map window:

- The register values can be updated.
- New register values can be entered.

To save the current register map, click on Save to file. This opens the Save dialog box. Enter a file name, choose the file location, and save it as a CSV file. Lastly, click Save to save the file.

To load new register lists (CSV file), click the Load from file button. This opens the Open dialog box. Select the CSV file you want to load, and click Open.

AS7058 PC Software

GUI Overview – Application Tab I

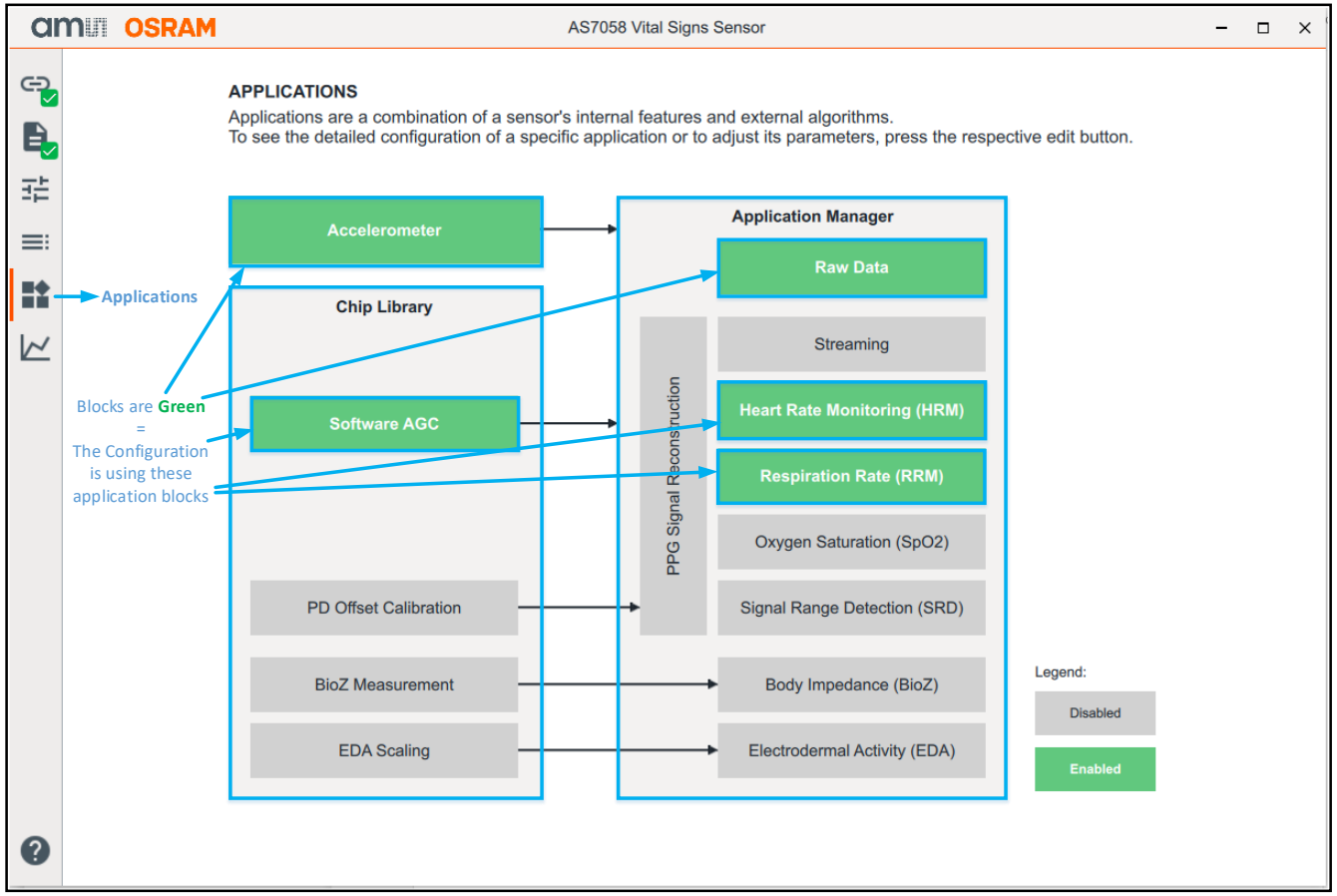


Fig. 10: Overview of the GUI - Applications

Software and vital signs application-related parameters can be found under the Applications tab.

- **Accelerometer (ACC):** The accelerometer configuration configures the logging of ACC data and the sampling frequency.
- **Chip Library:** A driver which handles communication with the AS7058 AFE and is used to configure the device and perform measurements.
  - **Software AGC (PD Offset & LED Control):** The AGC algorithm monitors the ADC values and regulates the PPG signal within the defined range by varying the offset current and LED current.
  - **PD Offset Calibration:** This is used to perform PPG measurements with the enabled hardware-implemented PD offset control. This is also called Advanced Automatic Offset Control (AAOC).
  - **BioZ Measurement:** This contains a proprietary algorithm for calibration and measurement result correction.
  - **EDA Scaling:** Contains an algorithm for measurement results correction.

AS7058 PC Software

GUI Overview – Application Tab II

Software and vital signs application related parameters can be found under the Applications tab (Fig. 10).

- **Application Manager:** This connects the Chip Library with the included Bio Applications. It receives measurement data from the AS7058 Chip Library and combines it with accelerometer data.
    - **Raw Data:** The results of an analog-to-digital converter's (ADC) conversion are represented as a digital number with varying resolution on the bit length and settings used.
    - **Streaming:** Extended ADC values that include the corresponding PD offset value.
    - **Heart Rate Monitoring (HRM):** The HRM application takes the defined PPG signal as an input and estimates the heart rate in beats per minute.
    - **Respiration Rate (RRM):** The RRM application takes the defined PPG signal as an input and estimates the respiration rate in beats per minute.
    - **Oxygen Saturation (SpO2):** The SpO2 application estimates the peripheral oxygen saturation in percent, based on the PPG signal acquired using RED and IR LEDs.
    - **Signal Range Detection (SRD):** The SRD application is used to support proximity detection based on the amplitude of the PPG signal. The proximity range is defined based on the configuration of the upper and lower thresholds.
    - **PPG Signal Reconstruction:** This removes the discontinuities in the ADC output signal when the PD offset current changes and restores the full DC component of the signal while maintaining the extended dynamic range.
    - **Body Impedance (BioZ):** The BioZ application is used to measure a person's body impedance.
    - **Electrodermal activity (EDA):** The EDA application is used to measure changes in a person's skin resistance.

AS7058 PC Software

GUI Overview – Measurement Tab

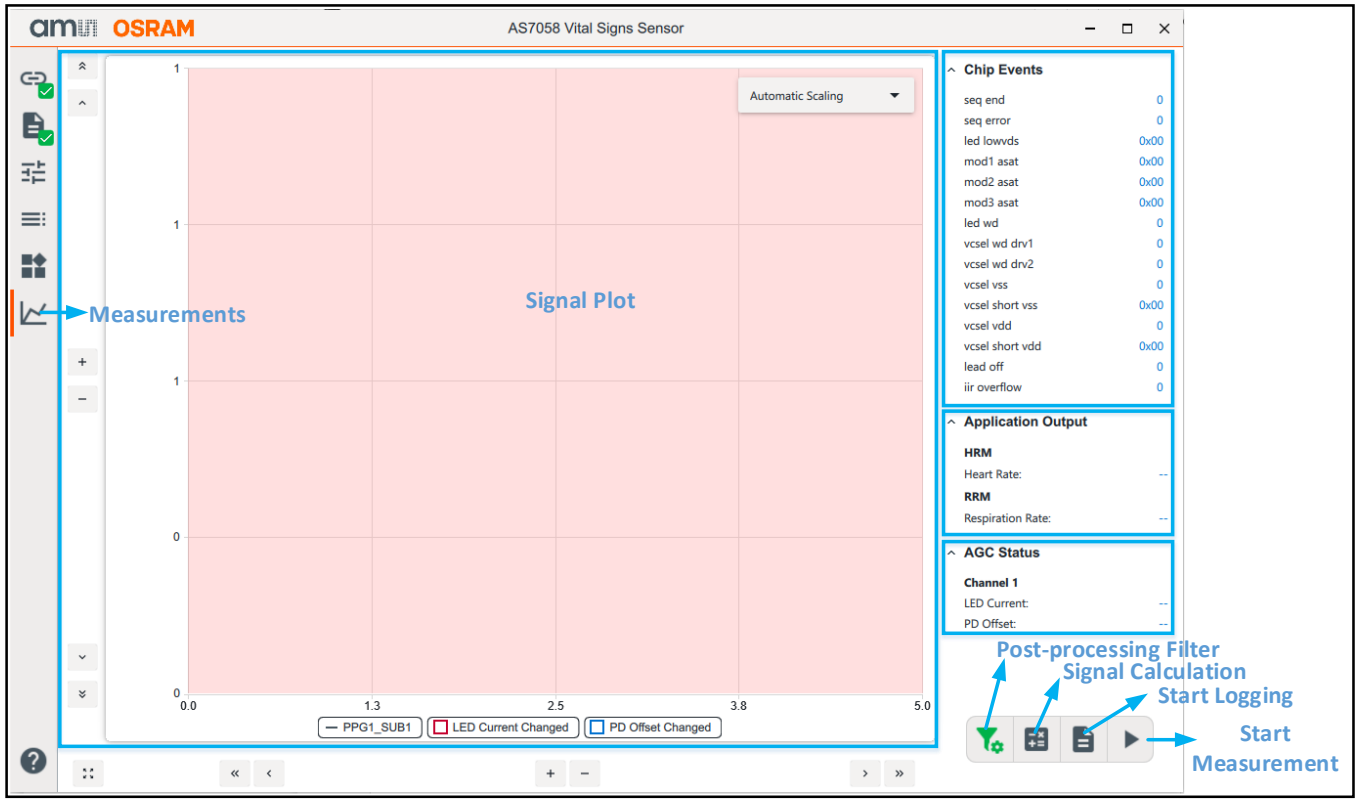


Fig. 11: Overview of the GUI – Measurements

A measurement can be started after setting the parameter for a specific application. Click on the “Start Measurement” button to run the sensor module and observe the “Chip Events”, “Application Output”, and “AGC Status” (*Fig. 11*).

- **Start Measurement:** This button starts the process.
- **Chip Events:** Here, VCSELs, MODs, Lead-off, and Sequencer runtime conditions can be observed.
- **Application Output:** Heart Rate and SpO2 values will be displayed here, and the SRD condition can also be observed.
- **AGC Status:** The AGC status for the LED current and PD offset can be observed here.
- **Signal Plot:** The PPG ADC count and ECG Raw count can also be displayed on this graph.
- **Start Logging:** To save the measurement data, click the Start Logging button (*Fig. 11*). Afterward, the GUI prompts the user to select a file name and the data will be saved in CSV format.
- **Signal Calculation:** Set the signal calculation or enter your own formula.
- **Post-Processing Filter:** Different software post-processing filters have been implemented to improve the quality of the output signal. The plot area in Fig. 11 displays the post-processing filter.

AS7058 PC Software

GUI Overview – About Tab

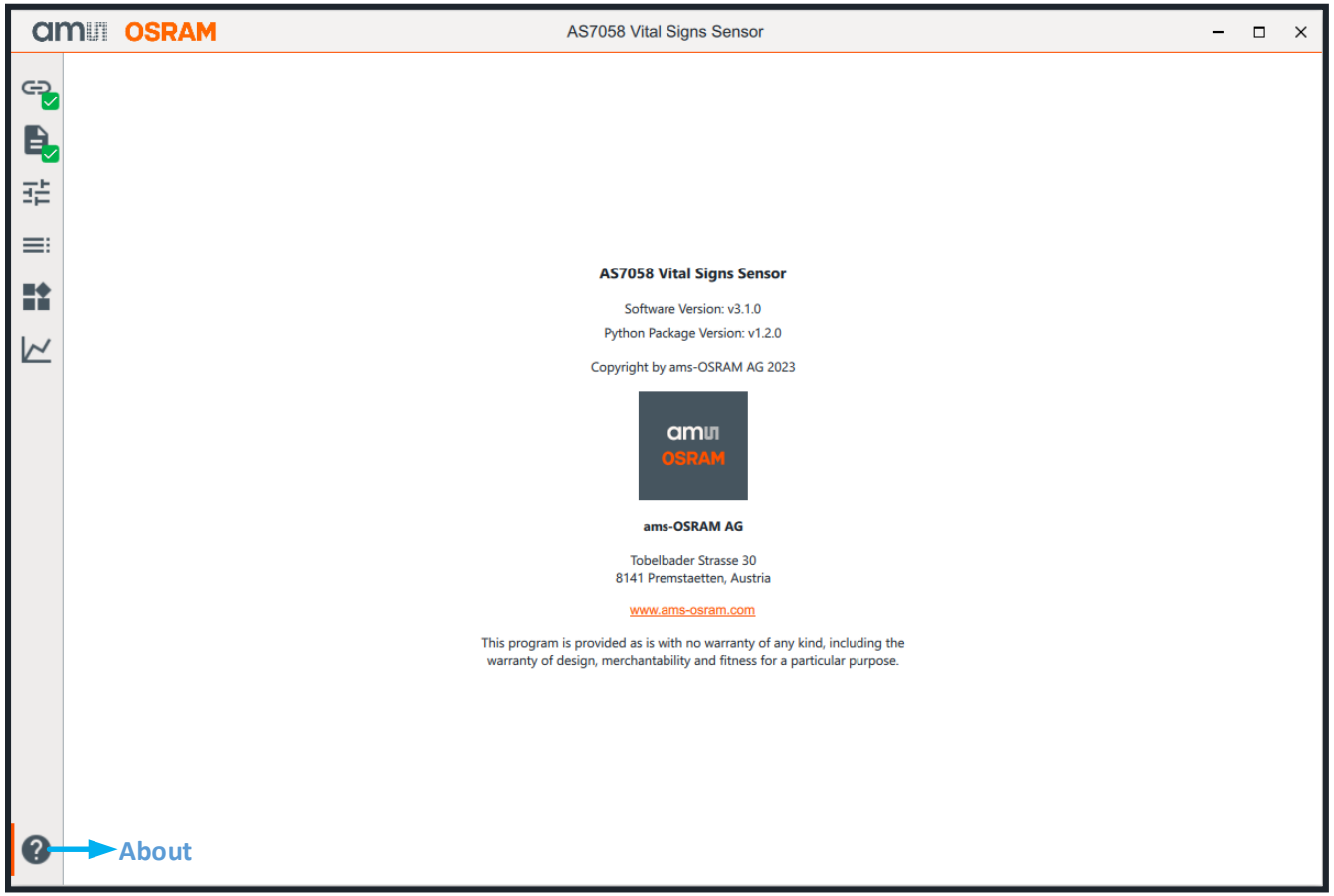


Fig. 12: Overview of the GUI - About

This About tab provides the software name, software version number, python package version number, copyright information, and the ams-OSRAM company link.

AS7058 EVK

Finger Positioning on the Optical Stack & Electrodes

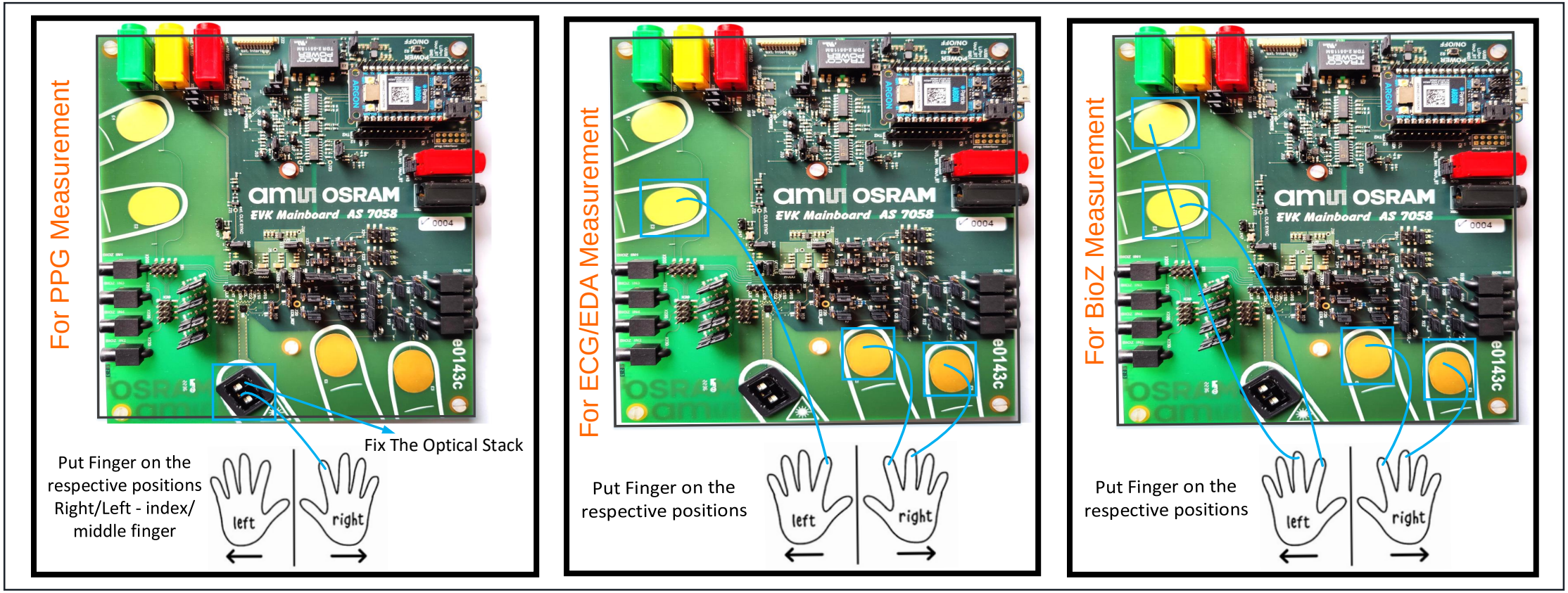


Fig. 13: Finger positioning for PPG, ECG, EDA & BioZ measurements on the AS7058

Measurement Conditions

- ✓ Place the evaluation kit on the table or flat surface.
- ✓ Rest your forearms and hands on the table and let the finger tips rest on the optical stack.
- ✓ Keep a light touch on the optical stack & electrodes – no need to squeeze or press down too firmly.
- ✓ Abrupt movements or vibrations during measurement should be avoided.

AS7058 PC Software

Starting a PPG/Finger Measurement for HRM & RRM

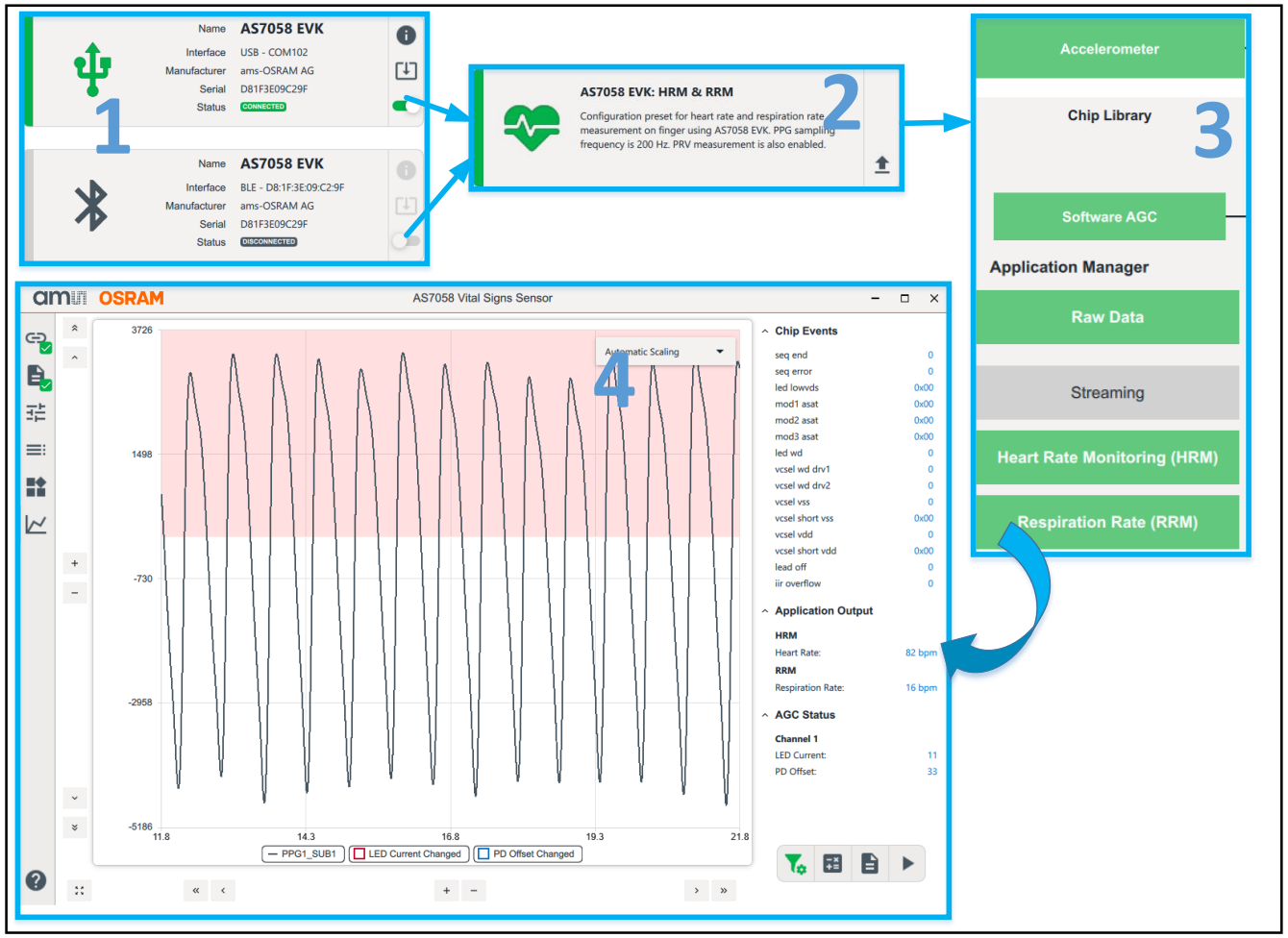


Fig. 14: HRM & RRM Measurement

1. Firstly, press the S2 sensor button for 1 second to power on the sensor. Afterward, connect the AS7058 EVK via the correct COM port or BLE number.
   - After successfully connecting, the USB or BLE icon will change color to green. The green LED (USB connection) or blue LED (BLE connection) on the microcontroller board will blink as soon as the connection between the evaluation board and the GUI is established.
2. After connecting, select the correct configuration file from the configuration presets provided (“AS7058 EVK: HRM & RRM” when using a PPG signal) in the Configuration Presets tab.
3. In the Applications tab, the AGC, HRM & RRM algorithms will be activated, and ACC will also be enabled.
4. Afterward, click the “Measurements” tab, followed by the “Start Measurement” button.
5. Then, place a finger on the LED/PD module, and subsequently, you will see the PPG raw data plot in the Graph window and the heart rate & respiration rate in the application output window.
6. Lastly, position the fingers, as shown in Fig. 13 (page 16).

AS7058 PC Software

Starting a PPG/Finger Measurement for SpO2

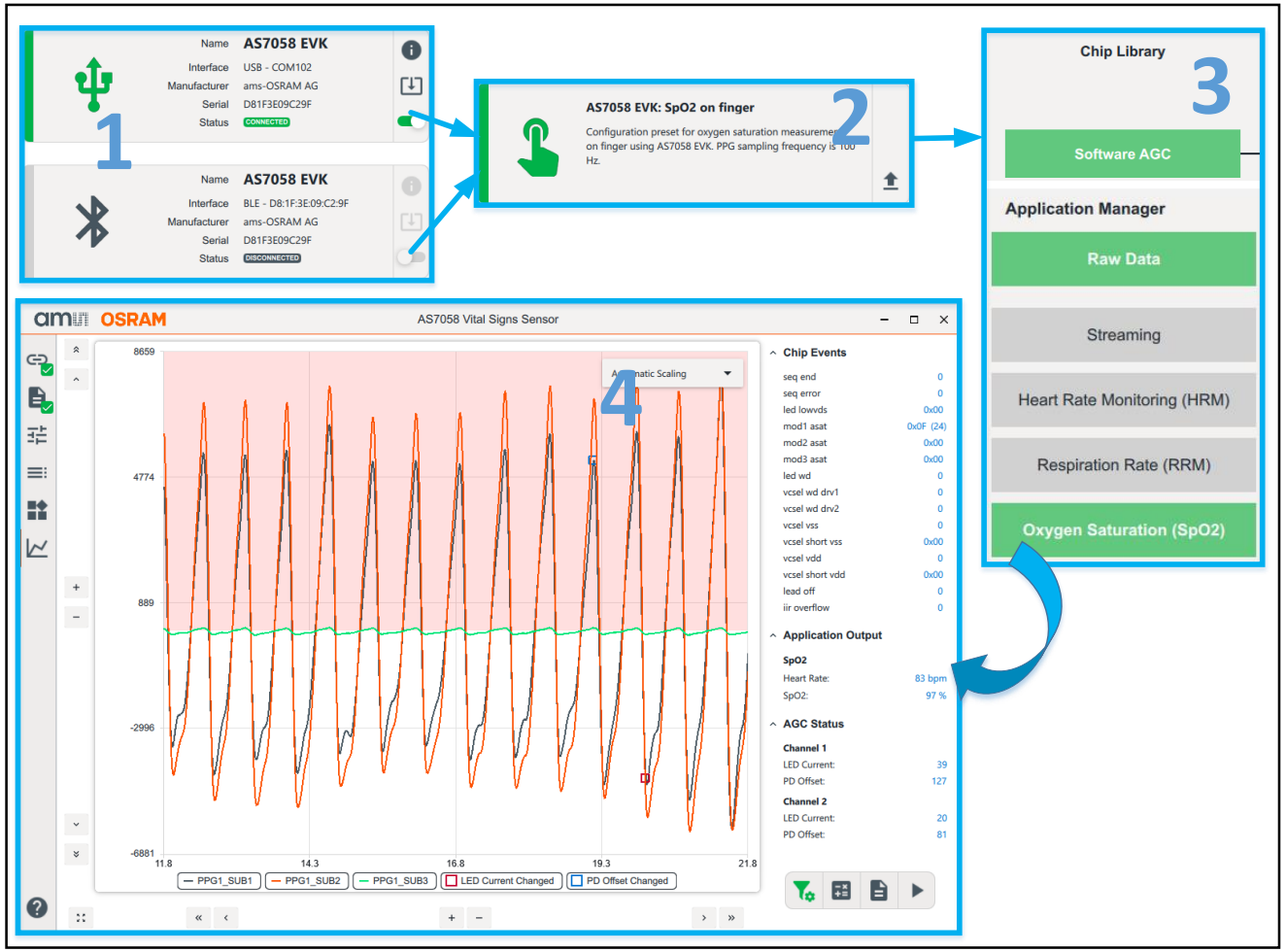


Fig. 15: SpO2 Measurement

1. Firstly, press the S2 sensor button for 1 second to power on the sensor. Afterward, connect the AS7058 EVK via the correct COM port or BLE number.
   - After successfully connecting, the USB or BLE icon will change color to green. The green LED (USB connection) or blue LED (BLE connection) on the microcontroller board will blink as soon as the connection between the evaluation board and the GUI is established.
2. After connecting, select the correct configuration file from the configuration presets provided (“AS7058 EVK: SpO2 on finger” when using a PPG signal) in the Configuration Presets tab.
3. In the Applications tab, the AGC and SpO2 algorithms will be activated.
4. Afterward, click the “Measurements” tab, followed by the “Start Measurement” button.
5. Then, place a finger on the LED/PD module, and subsequently, you will see the PPG raw data plot in the Graph window, and the heart rate & SpO2 in the application output window.
6. Lastly, position the fingers, as shown in Fig. 13 (page 16).

AS7058 PC Software

Starting an ECG Raw Data Measurement

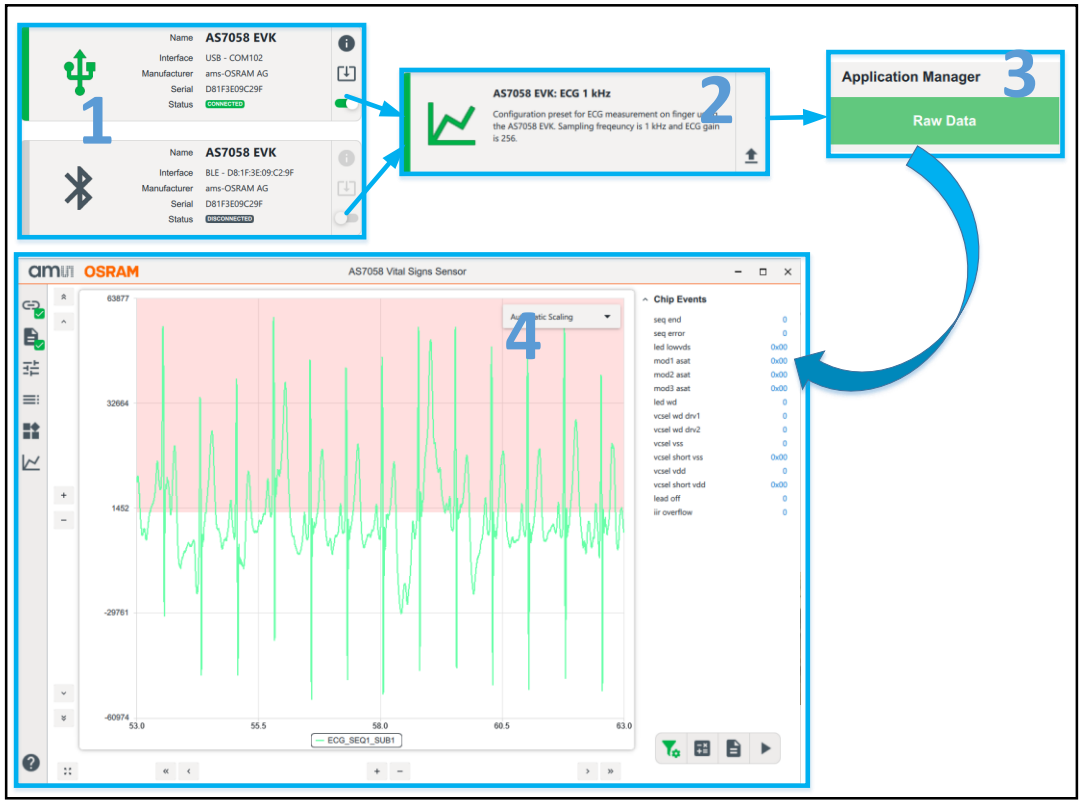


Fig. 16: ECG Measurement

1. Firstly, press the S2 sensor button for 1 second to power on the sensor. Afterward, connect the AS7058 EVK via the correct COM port or BLE number.
   - After successfully connecting, the USB or BLE icon will change color to green. The green LED (USB connection) on the microcontroller board will blink as soon as the connection between the evaluation board and the GUI is established.
2. After connecting, select the correct configuration file from the configuration presets provided (“AS7058 EVK: ECG 1kHz” when using electrodes) in the Configuration Presets tab.
3. In the Applications tab, the Raw data will be activated.
4. Afterward, click the ‘Measurements’ tab, followed by the ‘Start Measurement’ button.
5. Then, place your fingers on the electrodes, and subsequently, you will see the ECG raw data plot in the Graph window.
6. Lastly, position the fingers, as shown in Fig. 13 (page 16).

Note: Please check the Jumper setting for the ECG electrodes:
For ECG (INN) => jumper X12 => E1 => connect 2-3
For ECG (INP) => jumper X11 => E2 => connect 2-3
For ECG (Ref) => jumper X9 => E3 => connect 2-3

AS7058 PC Software

Starting an PPG & ECG Raw Data Measurement

Fig. 17: PPG & ECG Measurement

Note: Please check the Jumper setting for the ECG electrodes:
For ECG (INN) => jumper X12 => E1 => connect 2-3
For ECG (INP) => jumper X11 => E2 => connect 2-3
For ECG (Ref) => jumper X9 => E3 => connect 2-3

1. Firstly, press the S2 sensor button for 1 second to power on the sensor. Afterward, connect the AS7058 EVK via the correct COM port or BLE number.
   - After successfully connecting, the USB or BLE icon will change color to green. The green LED (USB connection) on the microcontroller board will blink as soon as the connection between the evaluation board and the GUI is established.
2. After connecting, select the correct configuration file from the configuration presets provided (“AS7058 EVK: PPG & ECG” when using electrodes and a PPG signal) in the Configuration Presets tab.
3. In the Applications tab, the AGC algorithm and Raw data will be activated.
4. Afterward, click the measurements tab, followed by the Start Measurement button.
5. Then, place your fingers on the electrodes, a finger on the LED/PD module, and and subsequently, you will see the PPG raw data plot and the ECG raw data plot in the Graph window.
6. Lastly, position the fingers, as shown in Fig. 13 (page 16).

AS7058 PC Software

BioZ Measurement Setup

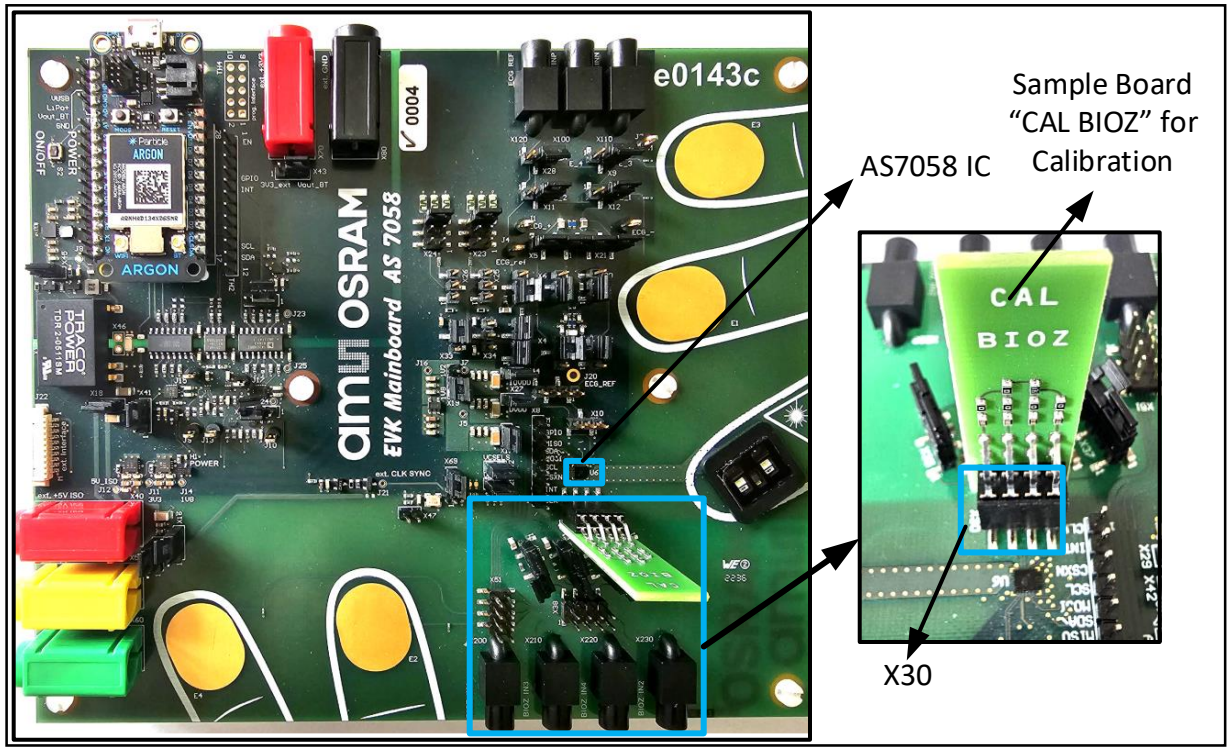


Fig. 18: BioZ Measurement steps

To run the BioZ application, it is required to have a BioZ reference board for calibration and measurement. Additionally, it is important to know the body, wrist, and finger impedance values (Magnitude & Phase) of the BioZ reference board, which is used for calibration. These values must be placed under the “Known Reference Impedance” block.

To set up the AS7058 for BioZ measurement, perform the steps below:

1. Connect the reference board to X30 as shown in Fig. 18.
2. Then, connect the “CAL BIOZ” sample board for the BioZ calibration to the X30 connector (Fig. 18).

The jumper settings should be set as below:

- Open pin X51 completely; (1-2;3-4; 5-6 and 7-8)
- Close pins JP35, 36, 37 and 39.

Note: For more details, please refer to the ams-OSRAM AS7058 BioZ Application Note document.

AS7058 PC Software

BioZ Measurement Steps

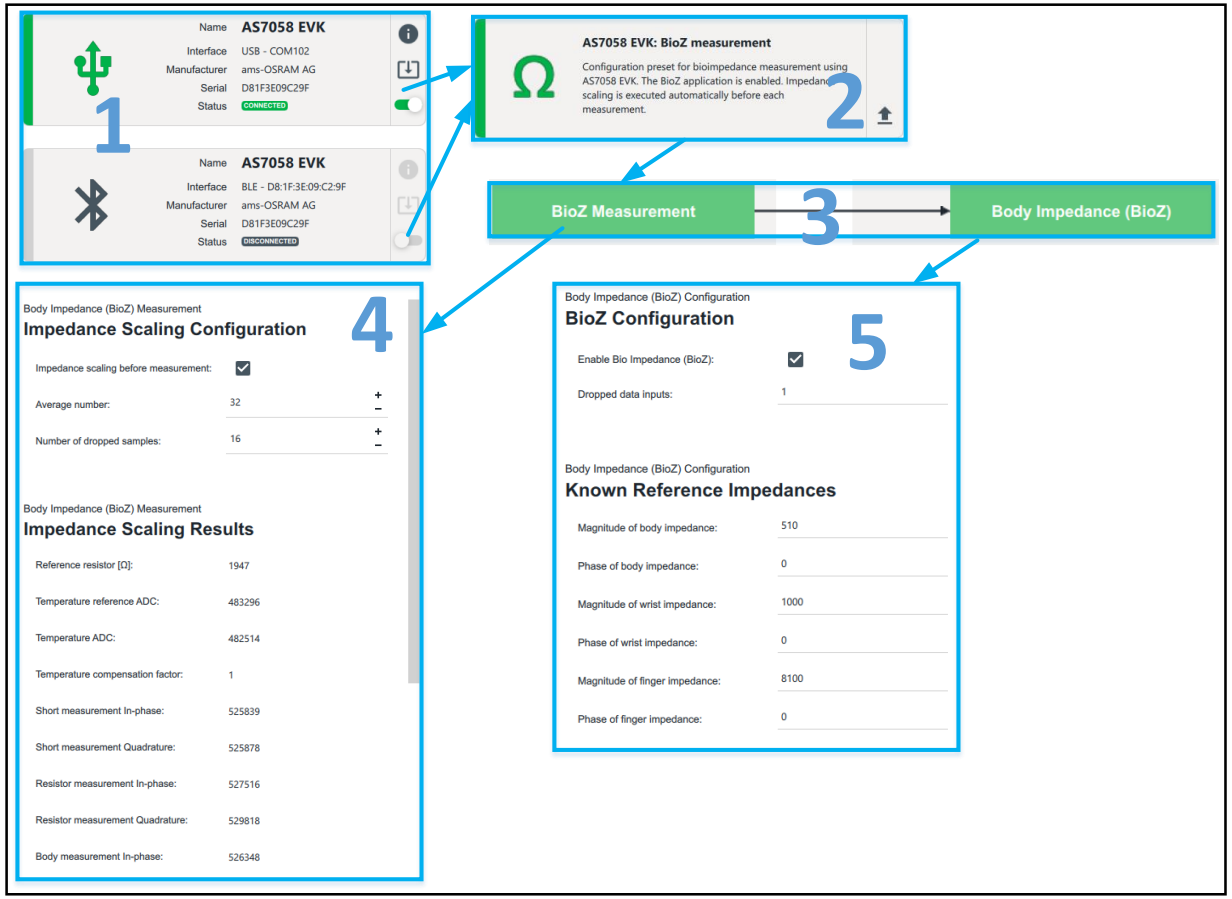


Fig. 19: Known Reference Impedances & Impedance Scaling Result blocks for BioZ Configuration

1. Firstly, press the S2 sensor button for 1 second to power on the sensor. Afterward, connect the AS7058 EVK via the correct COM port or BLE number.
   - After successfully connecting, the USB or BLE icon will change color to green. The green LED (USB connection) or blue LED (BLE connection) on the microcontroller board will blink as soon as the connection between the evaluation board and the GUI is established.
2. After connecting, select the correct configuration file from the configuration presets provided (“AS7058 EVK: BioZ Measurement” when using the BioZ feature) in the configuration tab.
3. In the Applications tab, the BioZ Measurement and Body Impedance (BioZ) will be activated.
   - Based on the AS7058EVK, typical values of the impedance scaling results are already entered in the “Impedance Scaling Results” block, which is labeled in the “BioZ Measurement” block in Fig. 19 as number 4.
   - ams-OSRAM provides five sample boards (one for calibration and the other four for testing). Typical magnitude and Phase values of the reference board are already entered in the “Known reference Impedance” block, as shown in Fig. 19 as number 5 in the “Body Impedance” block.

AS7058 PC Software

BioZ Calibration and Measurement

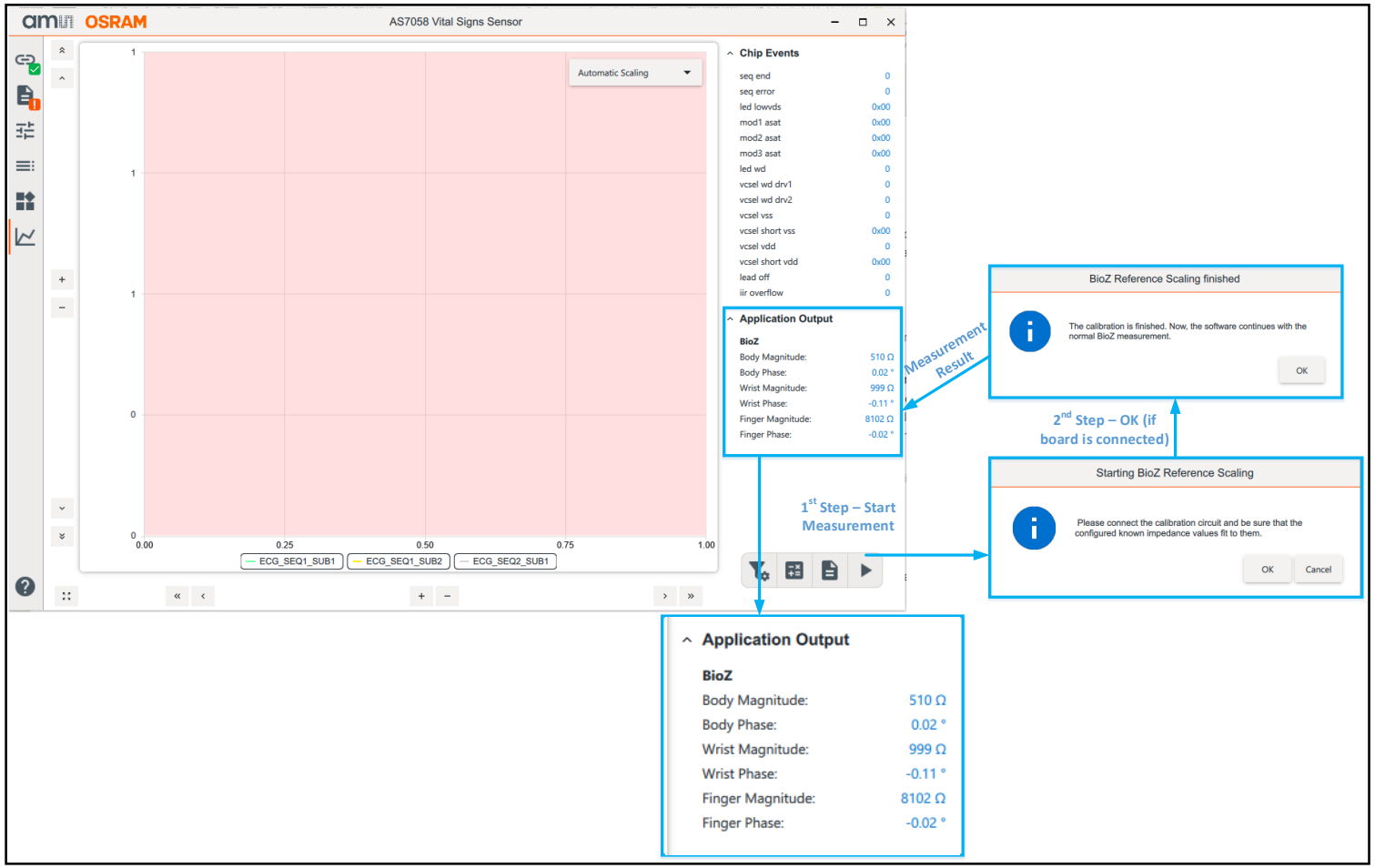


Fig. 20: BioZ Measurement

1. In the measurement stage, the impedance and Impedance scaling values are considered for the calibration.
2. Click the Measurements tab, followed by the Start Measurement button.
3. After clicking the “Start Measurement” button, the software performs the calibration.
4. Do not disconnect the “CAL BIOZ” reference sample board during calibration.
5. When the calibration finishes, the software continues with the normal BioZ measurement.
6. On the application output window, BioZ values from the reference board, i.e. Body Magnitude, Body Phase, Wrist Magnitude, Wrist Phase, Finger Magnitude, and Finger phase can be seen.
7. Place the other samples on the X30 connector, and subsequently, you will see the BioZ values, i.e. Body Magnitude, Body Phase, Wrist Magnitude, Wrist Phase, Finger Magnitude, and Finger phase, in the application output window.

AS7058 PC Software

EDA Measurement Setup

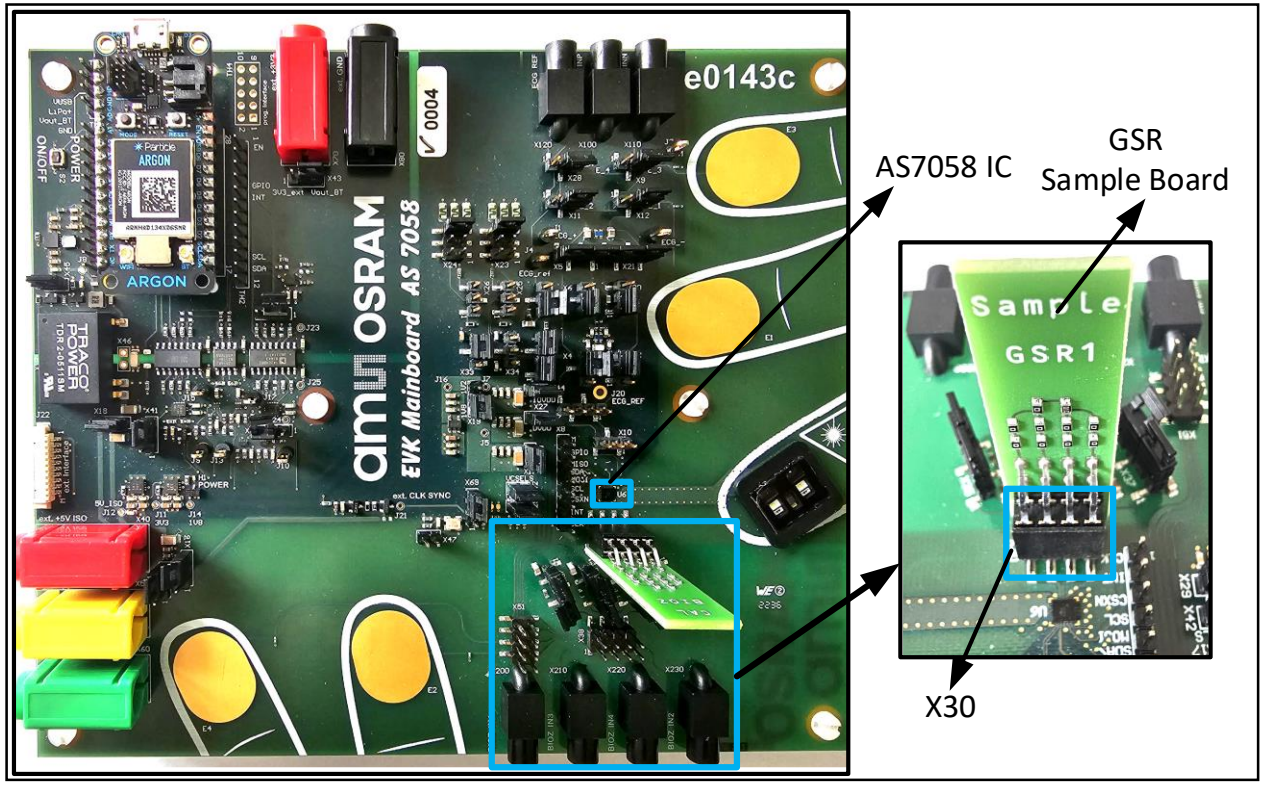


Fig. 21: EDA Measurement Steps

To run the EDA application, it is best to have a test board for measurement. Additionally, it is important to know the resistance of the EDA test boards.

ams-OSRAM provides three sample boards for EDA testing with the resistance details.

To set up the AS7058 for EDA measurement, perform the steps below.

1. Connect the reference board to X30 (Fig. 21).
2. Then, connect the sample boards for EDA application to the X30 connector as shown in Fig. 21.

The jumper settings should be set as below:

- Open pin X51 completely; (1-2;3-4; 5-6 and 7-8)
- Close pins JP35, 36, 37 and 39.

AS7058 PC Software

EDA Measurement Steps

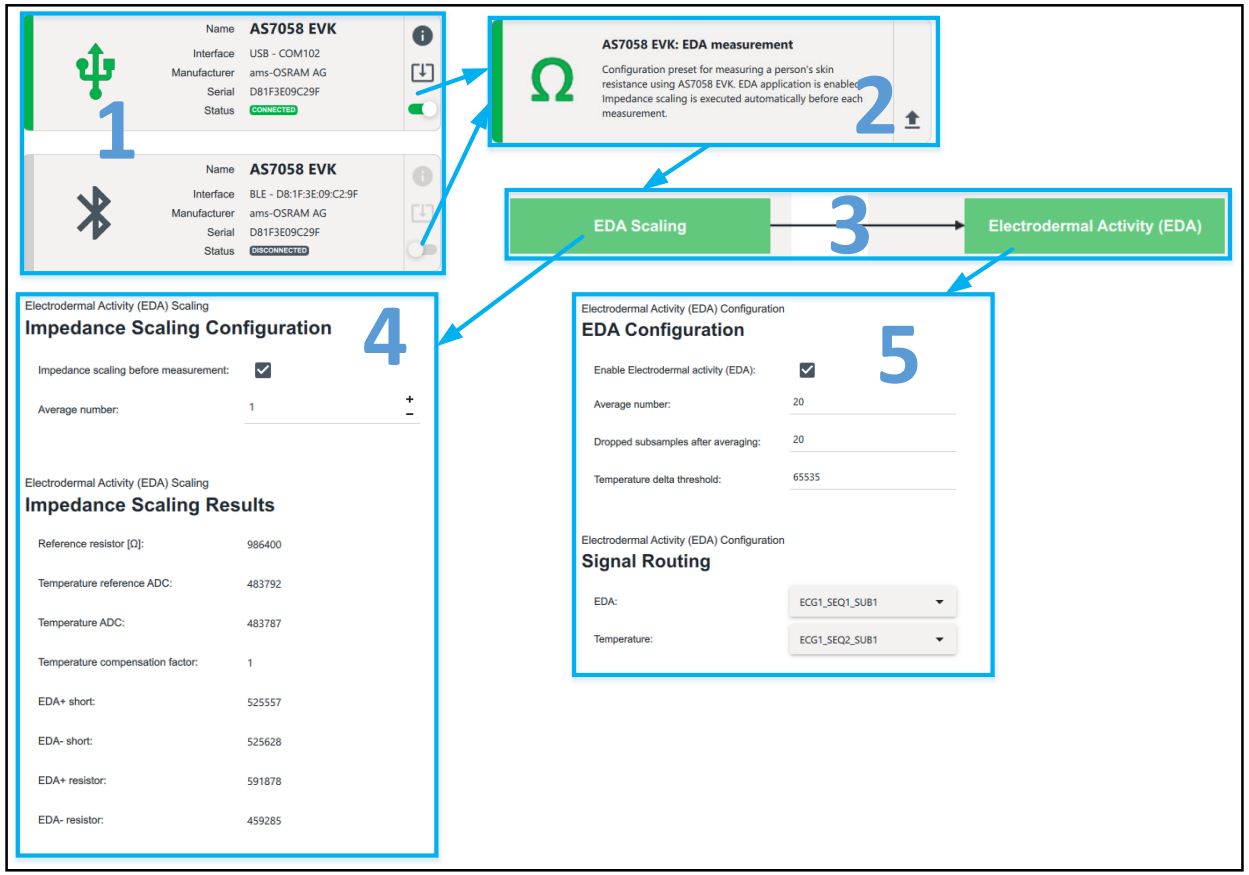


Fig. 22: EDA Application Tab

1. Firstly, press the S2 sensor button for 1 second to power on the sensor. Afterward, connect the AS7058 EVK via the correct COM port or BLE number.
   - After successfully connecting, the USB or BLE icon will change color to green . The green LED (USB connection) or blue LED (BLE connection) on the microcontroller board will blink as soon as the connection between the evaluation board and the GUI is established.
2. After connecting, select the correct configuration file from the configuration presets provided (“AS7058 EVK: EDA Measurement” when using the EDA feature) in the configuration tab.
3. In the Applications tab, the EDA Scaling and Electrodermal Activity (EDA) will be activated.
   - Based on the AS7058EVK, typical values of the impedance scaling are already entered in the “Impedance Scaling configuration” block, which is shown in Fig. 22 as number 4 in the “EDA Scaling” block.
   - The present configuration uses an average number of 20, 20 dropped subsamples after averaging, and a temperature delta threshold of 65535.
     - ECG1_SEQ1_SUB1 is selected as the signal source for the alternating EDA+/EDA- signal for EDA.
     - ECG1_SEQ2_SUB1 is selected as the temperature signal source for EDA.

AS7058 PC Software

EDA Measurement

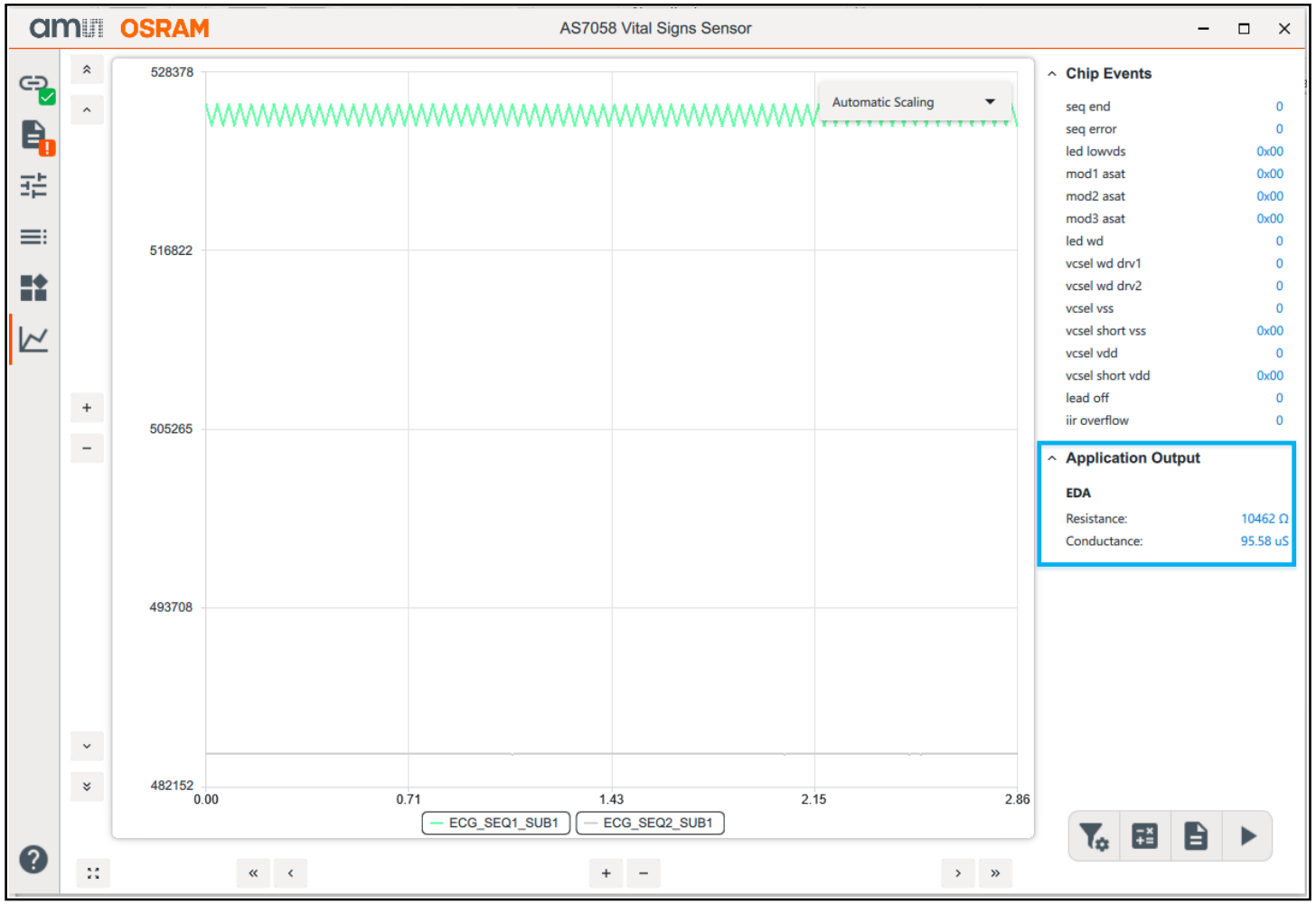


Fig. 23: BioZ Measurement

In the measurement stage, the impedance scaling values are considered for the measurement. To perform EDA measurements, follow the steps below:

1. Click the “Start Measurement” button, to start the measurement.
2. In the application output window, test board resistance and conductance values will be seen.
3. Lastly, place the samples on the X30 connector, and subsequently, you will see the resistance and conductance values.

AS7058 Plotting

Plot Area Selection

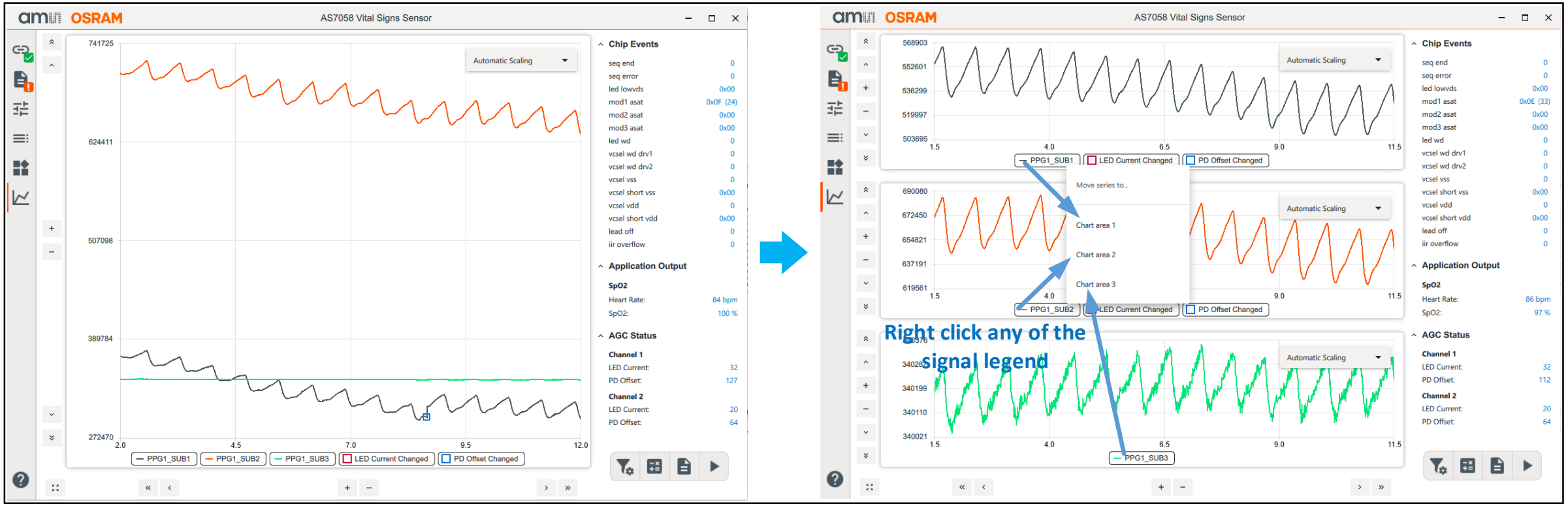


Fig. 24: Plotting

- When “Automatic Scaling” is enabled, the minimum and maximum values of the y-axis are automatically set.
- The display area can show a maximum of three plots. By default, the plot area displays all the signals in one plot.
- Left-clicking on the channel name in the legend opens a dialog window for displaying the signal in a different plot area. The plot area includes automatic scaling, manual scaling, and zooming functions.

AS7058 SW Enhancement Filter

To Improve Waveform Visualization in the Evaluation Software

Fig. 25: Enhancement Filter

The enhancement filter consist of selectable:

- Baseline removal: This removes the DC component of the signal.
- Denoising: This includes filters to remove the 50Hz/60 Hz line frequency and other high frequency noises from the signal.
- Signal inversion: This inverts the waveform to appear as a classical PPG waveform with systolic and diastolic peaks.

AS7058 Firmware upgrade

FW upgrade & Device Information

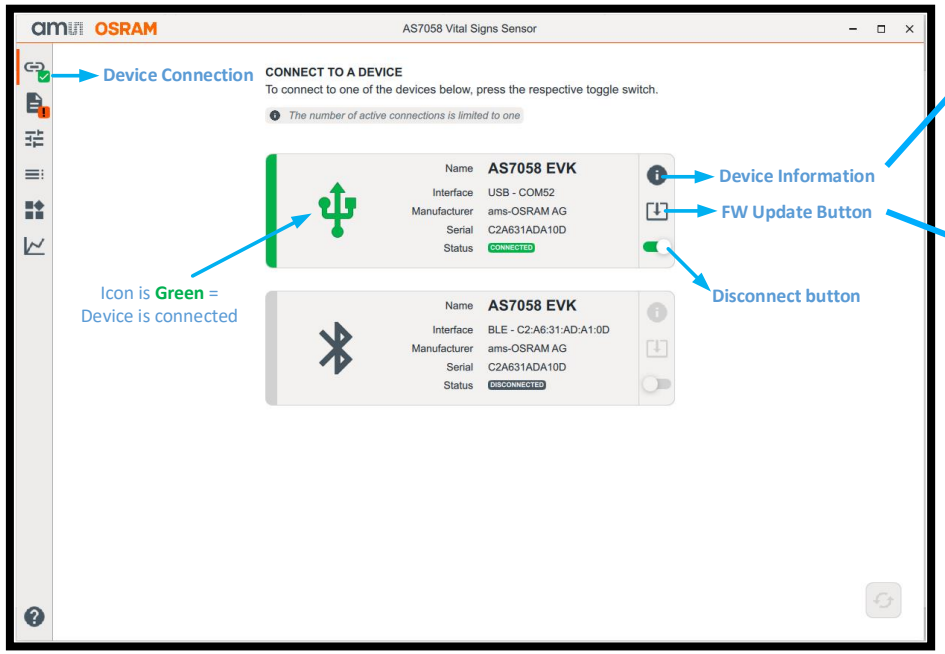


Fig. 26: Update Firmware via the GUI

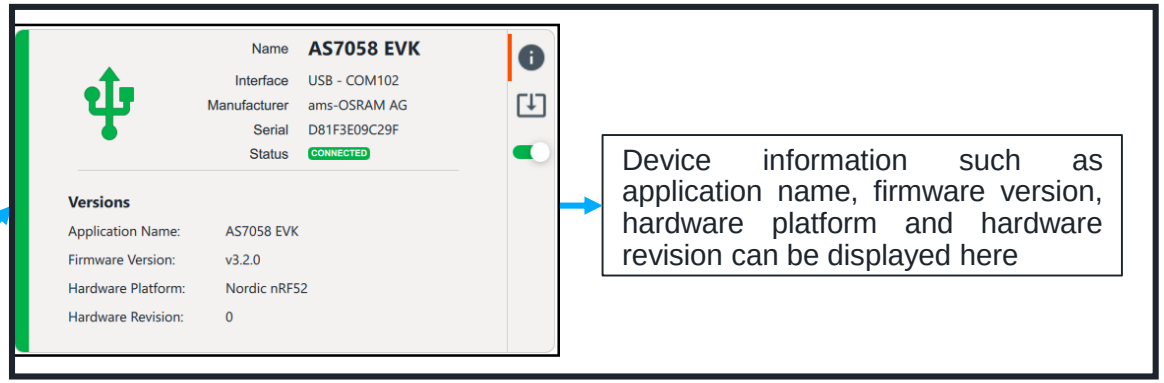


Fig. 27: Device Information

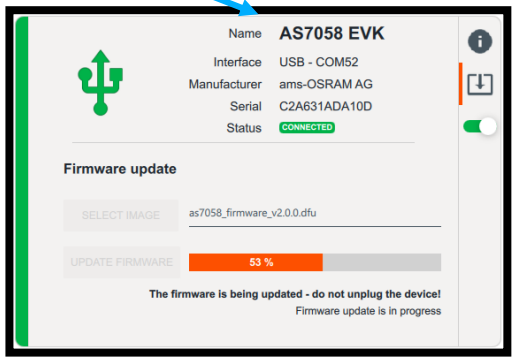


Fig. 28: Firmware update in progress

1. Obtain the latest DFU firmware file from ams-OSRAM.
2. Click on the tab Device Connection → Firmware Update → SELECT IMAGE … to navigate to the DFU file (the latest firmware file) → click UPDATE FIRMWARE
3. During the update process, the green LED on the BLE module will turn red and then multicolor.
4. After a successful update, the red and multicolored LED will turn green again.

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