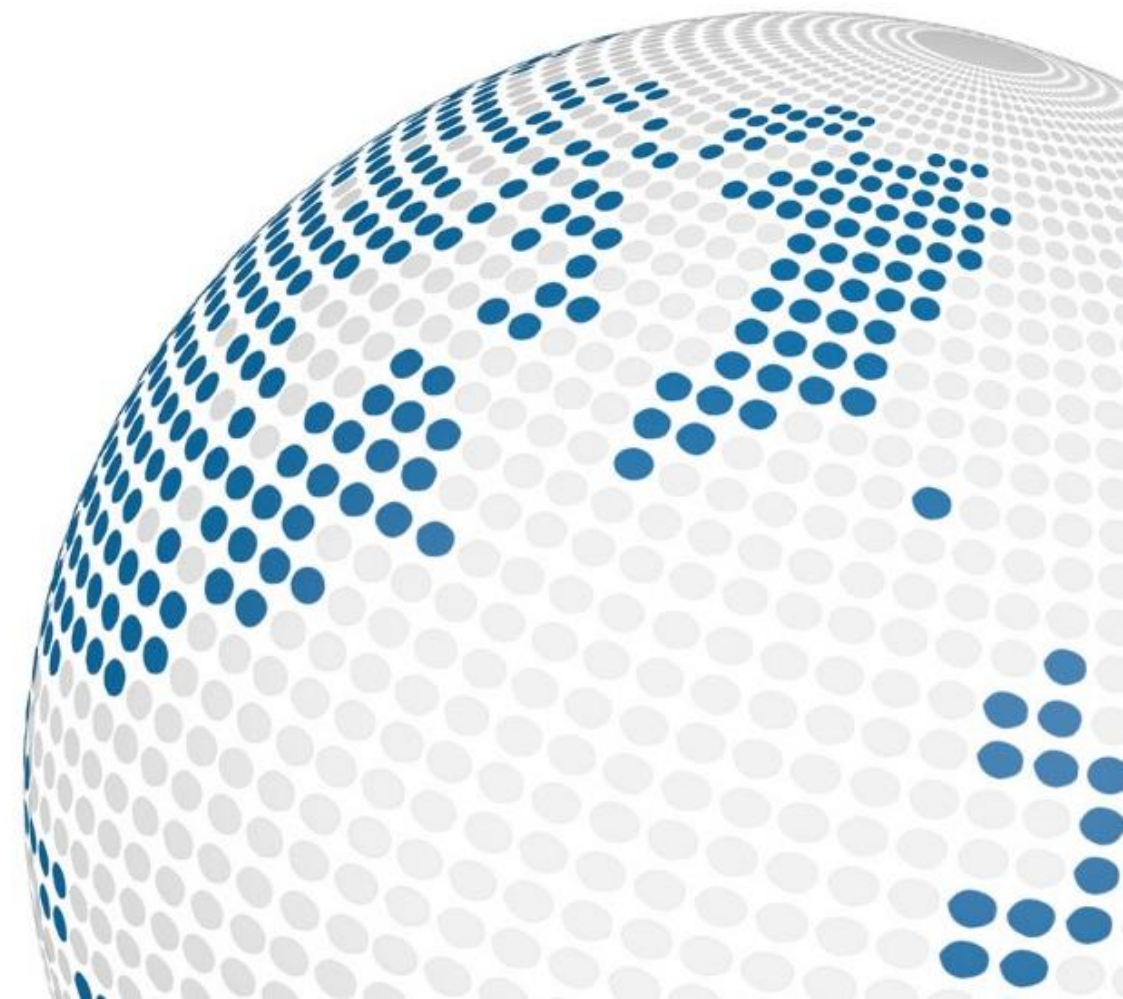


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Shaping the world with sensor solutions

2020-09-01



AS7038GB/AS7038RB Evalkit

User Guide

Contents

How to use

AS703x PC Software

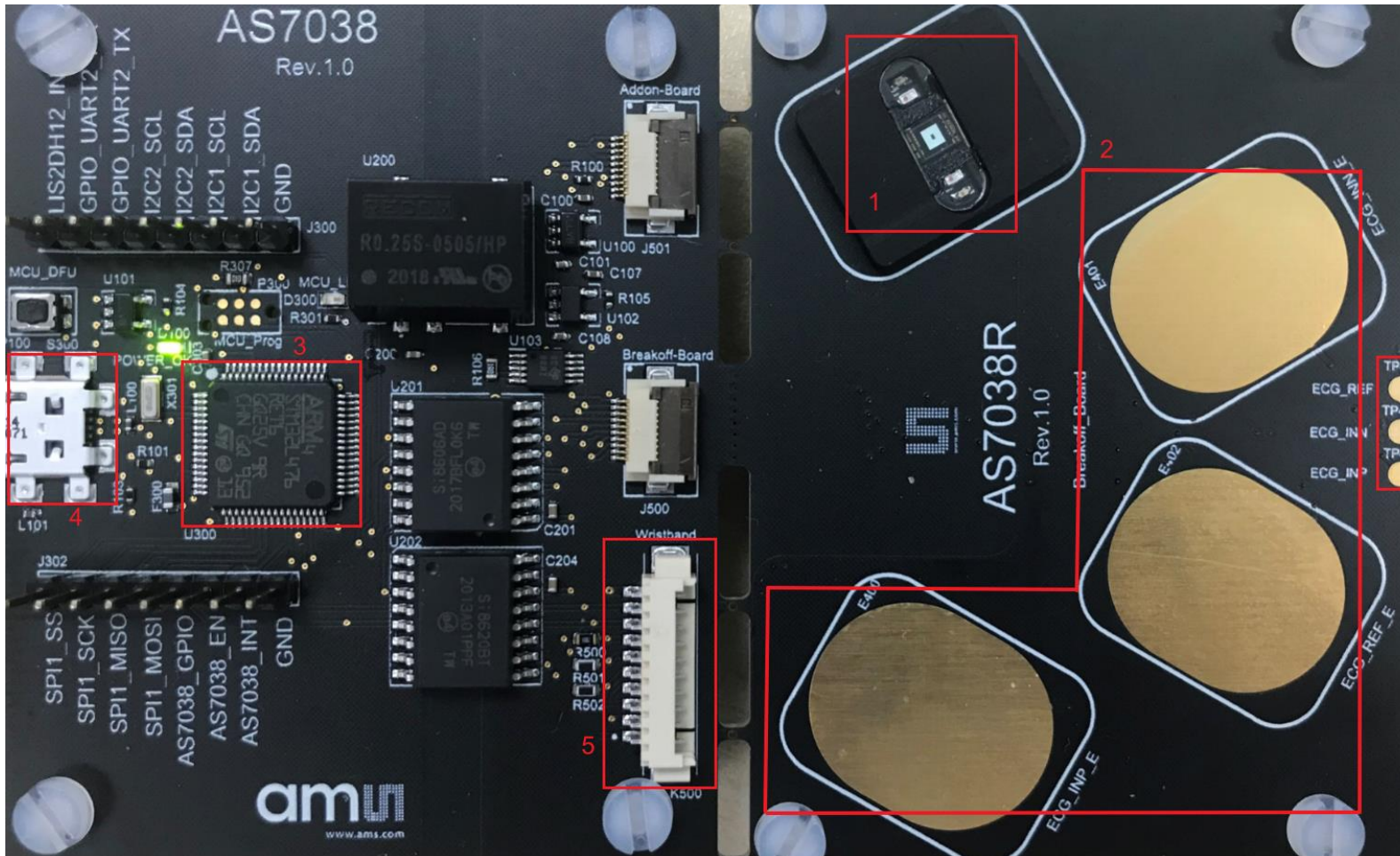
Safety Requirements

FW Upgrade over USB

Contents of the AS7038GB/AS7038RB Evaluation kit

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Sensing is life.

Evaluation kits main parts



1. AS7038GB/AS7038RB* Sensor with LEDs
2. ECG electrodes pads
3. Microcontroller
4. USB connector
5. Connector to optional AS7038 Wristband

*Notes: This is a picture of showing AS7038RB only

Setup

Getting Started

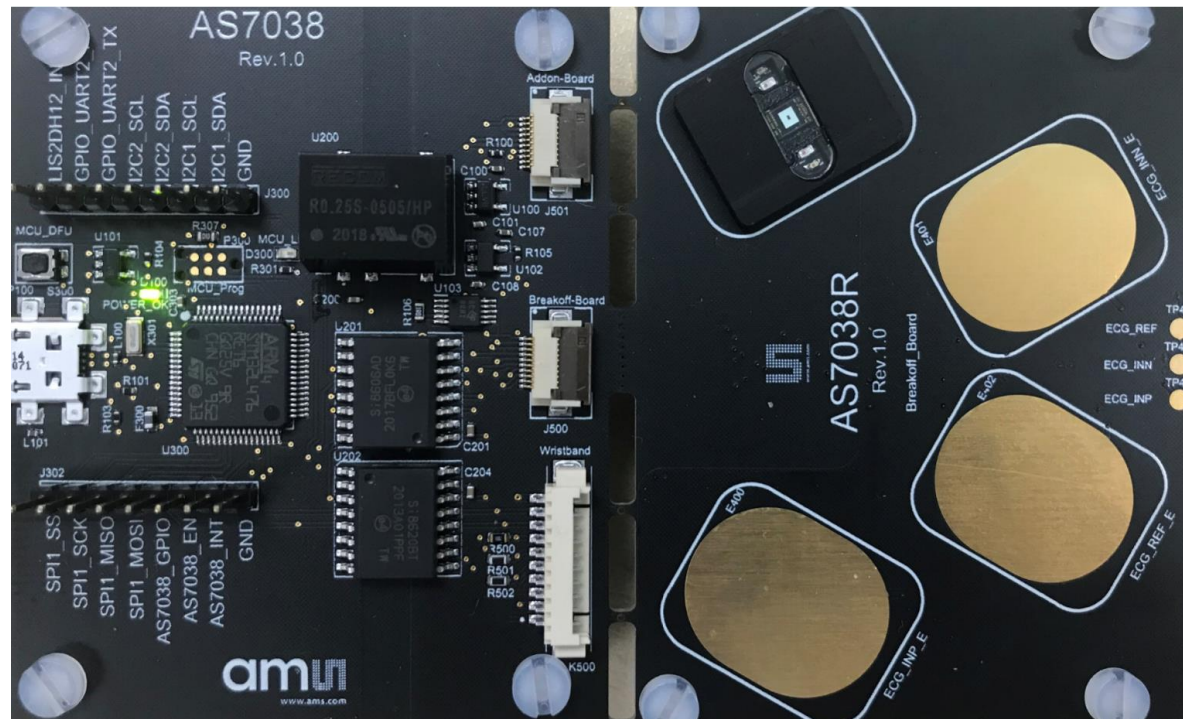
1. Download the Evalkit Software from <https://ams.com/as7038rb#tab/tools> or copy from the USB stick
2. Install the Evalkit Software
3. Optionally connect electrodes to the external electrodes connection
4. Connect the micro USB to USB cable to the board and plug it into your computer
5. The green LED will turn ON as soon as the board is powered
6. Start the client software

Note: For external ECG functionality customer needs to build their own cabling harness
The pinout of the electrode connection is as follows



Connector for External Electrodes
(Molex PicoBlade 53261-0471)

Pin 4 – ECG_INP
Pin 3 – ECG_INN
Pin 2 – ECG_REF
Pin 1 – GND





AS703x PC Software

Starting a PPG measurement (Apply for AS7038G)

The screenshot shows the AS703x Vital Signs Sensor software interface. The window title is "AS703x Vital Signs Sensor" and the menu bar includes "File", "View", "Settings", and "Help". The interface is divided into several sections:

- 1:** The "COM12" port selection dropdown menu.
- 2:** The "PPG_Finger" configuration preset dropdown menu.
- 3:** The "AS703x settings" panel, which includes buttons for "LEDs", "Photodiodes", "TIA", "OFE", "Sequencer", "ADC", "Interrupts", "ECG amplifier", "Electrical analog frontend", "Light to frequency", and "GPIOs".
- 4:** The "Controller settings" panel, which includes a button for "PD offset & LED current control".
- 5:** The "Start" button.
- 6:** The "PPG - OFE1 ADC channel" graph showing ADC Counts (0 to 15000) over Time (s) (0 to 10). The graph displays a rising PPG waveform.
- 7:** The "ECG - ECG Output ADC channel" graph showing ADC Counts (0 to 15000) over Time (s) (0 to 10). The graph is currently empty.
- 8:** The "Application output" panel, which includes checkboxes for "HRM" (checked) and "HRV" (unchecked), and a "BP" checkbox.
- 9:** The "Heart Rate" section, which displays "Heart Rate: 81 (0)", "Heart Rate Variability: --", "Systolic BP: --", "Diastolic BP: --", "Arterial Elasticity: --", and "Vagal Tone: --".
- 10:** The "Controller info" section, which displays "Current consumption", "Temperature: 0.00C°", "PD offset: 0 nA", and "LED current: 1.08 mA".
- 11:** The "LED current" value, 1.08 mA.
- 12:** The status bar at the bottom left, which displays "User configuration running ... User measurement stopped".
- 13:** The status bar at the bottom right, which displays "FW 1.1.0.0" and "AS703x".



- Select the appropriate COM port name from the drop down box (1)
- Click the connect button 
- Connect button will change its icon to  upon successful connection
- The two status boxes on the bottom right side will turn green and show the FW number currently flashed on the board (13)
- Select [AS7038G_PPG_OFE_Finger](#) or [AS7038G_PPG_ULP_Finger](#) from the built in configuration presets (2)
- Optionally check and change AS703x settings
- Start the measurement with a click on the [Start](#) button
- Put the index finger on the AS7038 to measure the PPG signal
- The PPG waveform will be displayed in the PPG window of the GUI (6)
- The Heart Rate (HRM) and Heart Rate Variability (HRV) will be displayed on the right hand side of the window (9)
- The numbers in curly brackets show how many seconds have passed since the last result was reported

AS703x PC Software

Starting a combined PPG/ECG measurement (Apply for AS7038G)

The screenshot shows the AS703x Vital Signs Sensor software interface. The window title is "AS703x Vital Signs Sensor" and it has a menu bar with "File", "View", "Settings", and "Help". The interface is divided into several sections:

- 1:** A dropdown menu showing "COM12" as the selected COM port.
- 2:** A "Configuration presets" dropdown menu showing "PPG_ECG" selected.
- 3:** A "AS703x settings" panel with various hardware and software options like LEDs, Photodiodes, TIA, OFE, Sequencer, ADC, Interrupts, ECG amplifier, Electrical analog frontend, Light to frequency, and GPIOs.
- 4:** A "Controller settings" panel with "PD offset & LED current control" selected.
- 5:** A "Start" button.
- 6:** A graph titled "PPG - OFE1 ADC channel" showing a PPG waveform. The y-axis is "ADC Counts" (0 to 15000) and the x-axis is "Time (s)" (0 to 10).
- 7:** A graph titled "ECG - ECG Output ADC channel" showing an ECG waveform. The y-axis is "ADC Counts" (0 to 15000) and the x-axis is "Time (s)" (0 to 10).
- 8:** An "Application output" panel with checkboxes for "HRM", "HRV", and "BP".
- 9:** A panel showing vital signs: Heart Rate (59 (0)), Heart Rate Variability, Systolic BP, Diastolic BP, Arterial Elasticity, and Vagal Tone.
- 10:** A "Controller info" panel showing "Current consumption" (Temperature: 0.00C°).
- 11:** A panel showing "PD offset: 1.60 µA" and "LED current: 1.08 mA".
- 12:** A status bar at the bottom left showing "ECG and PPG measurement".
- 13:** A status bar at the bottom right showing "FW 1.1.0.0" and "AS703x".


- Select the appropriate COM port name from the drop down box (1)
- Click the connect button 
- Connect button will change its icon to  upon successful connection
- The two status boxes on the bottom right side will turn green and show the FW number currently flashed on the board (13)
- Connect ECG electrodes to the electrode connection
- Select **AS7038G_PPG_ECG_finger** from the built in configuration presets (2)
- Optionally check and change AS703X settings.
- Start the measurement with a click on the **Start** button.
- The green AS7038 LEDs will turn on, Start button's caption will change to **Stop**
- Put the index finger on the AS7038
- The PPG waveform will be displayed in the PPG window of the GUI. (6)
- The ECG waveform will be displayed in the ECG window of the GUI. (7)

AS703x PC Software

Starting a SPO2 measurement (Apply for AS7038R)

The screenshot displays the AS703x Vital Signs Sensor software interface. The main window is titled "AS703x Vital Signs Sensor" and includes a menu bar (File, View, Settings, Help) and a toolbar. The interface is divided into several sections:

- Configuration presets:** A dropdown menu showing "AS7038R_SPO2_20Hz_finger" (labeled 2).
- AS703x settings:** A list of hardware components including LEDs, Photodiodes, TIA, OFE, Sequencer, ADC, Interrupts, ECG amplifier, Electrical Analog Frontend, Light to frequency, and GPIOs (labeled 3).
- Application settings:** A section for "Signal Routing" and "SpO2" (labeled 4).
- Controller settings:** A section for "PD offset & LED current control" (labeled 5).
- Logging:** A checkbox for "SpO2 Data Logging" (labeled 6).
- Stop button:** A button labeled "Stop" (labeled 7).
- COM port:** A dropdown menu showing "COM3" (labeled 1).
- Connect button:** A button with a plug icon (labeled 8).
- Application output:** A section with checkboxes for HRM, HRV, and SpO2 (labeled 9).
- Status boxes:** Two boxes on the bottom right showing "Heart Rate 65 (0)" and "SpO2 93 (0)" (labeled 10).
- Controller info:** A section showing various sensor parameters like Current consumption, Temperature, and LED currents (labeled 11).
- Graphs:** Two graphs showing "ADC channel: TIA" and "PPG - OFE1 ADC channel" (labeled 8 and 12).
- FW number:** A status bar at the bottom right showing "FW 2.2.0.3" and "AS7038R" (labeled 12).

- Select the appropriate COM port name from the drop down box (1)
- Click the connect button (8)
- Connect button will change its icon to  upon successful connection
- The two status boxes on the bottom right side will turn green and show the FW number currently flashed on the board (12)
- Select [AS7038R_SPO2_20Hz_finger](#) or [AS7038R_SPO2_200Hz_finger](#) from the built in configuration presets (2)
- Optionally check and change AS703X settings.
- Start the measurement with a click on the **Start** button.
- The red AS7038 LEDs will turn on, Start button's caption will change to **Stop**
- Put the index finger on the AS7038
- The PPG waveform will be displayed in the pop-up window of the GUI. (8)
- The Heart Rate (HRM) and SPO2 will be displayed on the right hand side of the window (10)
- The numbers in curly brackets show how many seconds have passed since the last result was reported

AS703x Signal optimization

Two settings have a major impact on signal strength and quality:

- LED current
- OFE gain
- TIA gain

LED current has a direct impact on signal strength with minimal impact on noise.

OFE gain will increase overall signal strength but also increase noise.

We recommend the following settings to begin with and start experimenting from there:

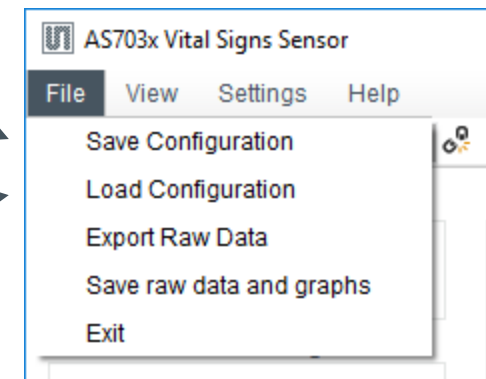
Use case	LED current [mA]	OFE gain	TIA gain
Finger	0.768	4-8	2M-3M
Light skin wrist	2	8	7M
Dark skin wrist	5	16	7M

AS703x PC Software

Saving and loading configuration

To save the current configuration settings, click on the **File** → **Save Configuration** menu. This will open the **Save Configuration File** dialog box. Enter file name and choose the file location, then click **Save**.

To load a previously exported configuration, click on the **File** → **Load Configuration** menu. This will open the **Select Configuration File** dialog box. Select the configuration file from which to load settings and click **Open**.



AS703x PC Software

Raw data logging and exporting

By default, during measurement the raw data from the AS703x is logged in memory. When a measurement is stopped, this data can be exported to a .csv file by clicking on the **File** → **Export Raw Data** menu and selecting the file location and file name in the **Save File** dialog box.

Raw data file format:

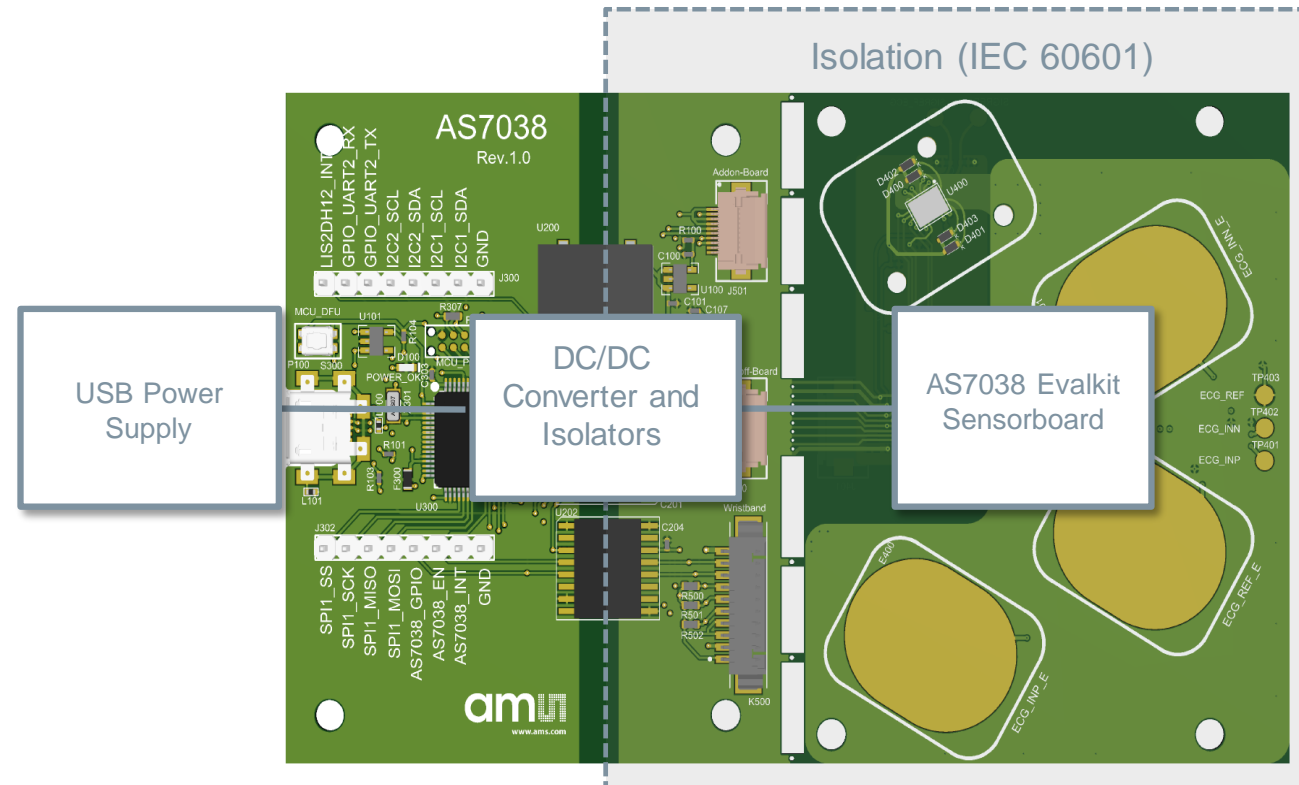
- First row has the column captions
- First column has the timestamp in **milliseconds**
- The rest of the columns contain the data from the enabled ADC channels

The screenshot shows the AS703x Vital Signs Sensor software interface. The 'File' menu is open, displaying options: Save Configuration, Load Configuration, Export Raw Data, Save raw data and graphs, and Exit. Below the menu, a 'Table data log' window is visible, containing a 'Parsed data log' table and an empty 'FFO data log' table. The 'Parsed data log' table has columns for Timestamp, TIA, TIA2, TIA3, OFE1, SD1, OFE2, and SD2. The 'FFO data log' table has columns for Timestamp, Value, LSB, and MSB. At the bottom right of the window, there are 'Save', 'Discard', and 'Close' buttons.

	Timestamp	TIA	TIA2	TIA3	OFE1	SD1	OFE2	SD2
1	0.00000	15673	15305		5189			
2	4.98000	11730	12709		258			
3	9.96000	15707	15224		255			
4	14.94000	11590	12836		254			
5	19.92000	15731	15128		254			
6	24.90000	11662	12768		255			
7	29.88000	15609	15174		257			
8	34.86000	11671	12988		251			
9	39.84000	15668	15133		255			
10	44.82000	11706	12925		256			
11	49.80000	15699	15037		258			
12	54.78000	11756	12922		253			
13	59.76000	15570	15129		256			
14	64.74000	11727	12921		257			
15	69.72000	15521	15176		255			
16	74.70000	11810	12919		255			
17	79.68000	15594	14998		255			
18	84.66000	11844	12945		257			
19	89.64000	15545	15163		255			
20	94.62000	11748	13000		255			
21	99.60000	15480	12404		260			

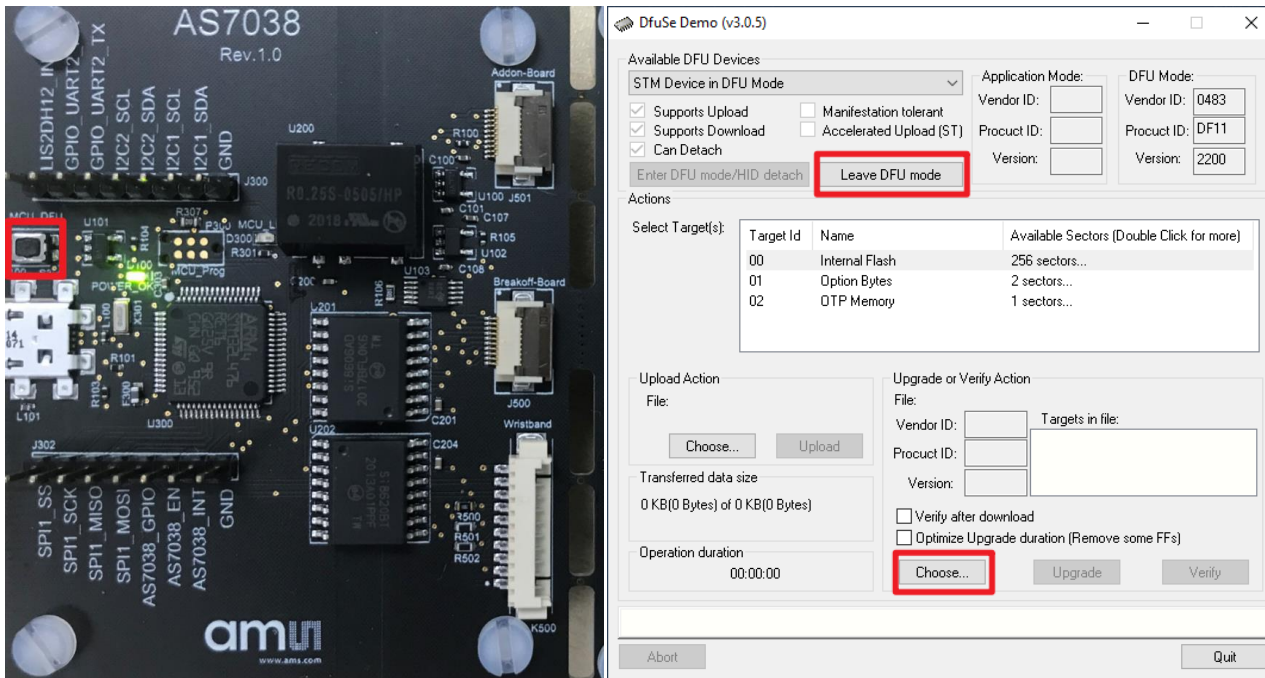
Safety compliance

The AS7038 Eval Kit is supplied by USB connection to the PC. In order to avoid a direct connection from the electrodes to the power grid, an IEC 60601-1 compliant RECOM DCDC converter (R0.25S-0505/H or R0.25S-0505/HP) is assembled on the board as well as isolator ICs for any other signals, which means that there is no physical connection between the break out part of the board and the power grid.



AS703x Firmware upgrade

Optional FW upgrade over USB



- Press and hold DFU taster on the board (next to the USB connector)
- Connect USB cable -> release DFU taster (The board is now in DFU mode)
- Start [DfuSeDemo.exe](#) from the folder \your SW install \ams\AS703x Vital Signs Sensor\extras\DFU
- In “Upgrade or Verify Action” ,Click on [Choose...](#), a window will pop-up
- Find the folder with the new firmware, select the FW and click [Open](#)
- Click [Upgrade](#)
- After FW upgrade, quit the DFU software by disconnecting the USB cable from the board or click “[Leave DFU mode](#)” button.
- Connect USB cable again, start the GUI. In the right bottom corner of the GUI, the new FW version will be shown.



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