MySignals SW

eHealth and Medical IoT Development Platform

Technical Guide

libelium

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1. MySignals Software Development Platform

1.1. General and safety information

The following list shows just some of the actions that produce the most common failures and warranty-voiding cases.

Failure to comply with the recommendations of use will entail the guarantee cancellation.

Software:

- Update firmware version only using Libelium Smart Devices App . If a different Software is used, MySignals can be damaged and can become unresponsive. This use will void the warranty.
- Use only MySignal Web Server Application or MySignals Mobile APP in order to configure and setup your account and device.
- Do not unplug any connector while uploading code. MySignals can become unresponsive. This use will void the warranty.
- Do not connect or disconnect any sensor or connector while MySignals is ON. MySignals can become unstable or unresponsive, and internal parts can be damaged.

Hardware:

- Do not handle black stickers seals on both sides of the enclosure (Warranty stickers). Their integrity is the proof that MySignals has not been opened. If they have been handled, damaged or broken, the warranty is void.
- Do not open MySignals in any case. This will automatically make the warranty void.
- Do not handle the four metallic screws of MySignals.
- Do not submerge MySignals in liquids.
- Do not place nodes on places or equipment where it could be exposed to shocks and/or big vibrations.
- Do not expose MySignals to temperatures below -10ºC or above 50ºC.
- Do not connect any sensor not provided by Libelium.
- Do not power MySignals with other power sources than the original provided by Libelium.
- **Connect any sensor not provided by Libelium only under your responsability.**

The document "General Conditions of Libelium Sale and Use" can be found at:

www.libelium.com/development/waspmote/technical_service

1.2. Conditions of use

General:

- Read the "General and Safety Information" section carefully and keep the manual for future reference.
- Read carefully the "General Conditions of Sale and Use of Libelium". This document can be found at: www.libelium.com/development/waspmote/technical_service. As specified in the Warranty document the client has 7 days from the day the order is received to detect any failure and report that to Libelium. Any other failure reported after these 7 days may not be considered under warranty.
- Use MySignals in accordance with the electrical specifications and in the environments described in the "Electrical Data" section of this manual.
- MySignals and its components and modules are supplied as a final product. This product have an enclosure to protect it from dust, humidity and other environmental interactions.
- Do not place MySignals in contact with metallic surfaces; they could cause short-circuits which will permanently damage it.

Remember that inappropriate use or handling of MySignals will immediately invalidate the warranty.

If you have any doubt you can post your question at: https://www.libelium.com/forum/

Note: *Do not connect or disconnect any sensor or connector while MySignals is ON. MySignals can become unstable or unresponsive, and internal parts can be damaged.*

1.3. Disclaimer

MySignals Products are not medical devices or healthcare services, nor are they intended for medical diagnosis, cure, mitigation, treatment, advice or prevention of disease. MySignals Products are not finished products, so they are not intended to be purchased by End Users, but by developers, researchers and OEM Customers. Read our Terms & Conditions before buying for a complete understanding.

Access to the Terms & Conditions at:
https://libelium.com/downloads/MySignals-Terms-and-Conditions.pdf

2. General view

MySignals is a development platform for medical devices and eHealth applications. You can use MySignals to develop your eHealth web, Android or iOS applications or even to add your own sensors to build new medical devices.

MySignals allows you to measure more than **20 biometric parameters** such as pulse, breath rate, oxygen in blood, electrocardiogram signals, blood pressure, muscle electromyography signals, glucose levels, galvanic skin response, lung capacity, snore waves, patient position, airflow and body scale parameters (weight, bone mass, body fat, muscle mass, body water, visceral fat, Basal Metabolic Rate and Body Mass Index). These broad sensing portfolio makes MySignals the most complete eHealth platform in the market.

Figure : My Signal Software Development Platform

All the data gathered by MySignals is encrypted and sent to the user's private account at Libelium Cloud through WiFi or Bluetooth. The data can be visualized in a tablet or smart phone with Android or iPhone Apps.

Libelium offers two different API's for developers to access the information. The **Android / iOS** API allows to get information directly from MySignals using Bluetooth Low Energy (BLE). The **Cloud API** allows to access to the user's private account and get the information previously stored to be visualized in a third party platform.

You can find all the info at: http://www.my-signals.com

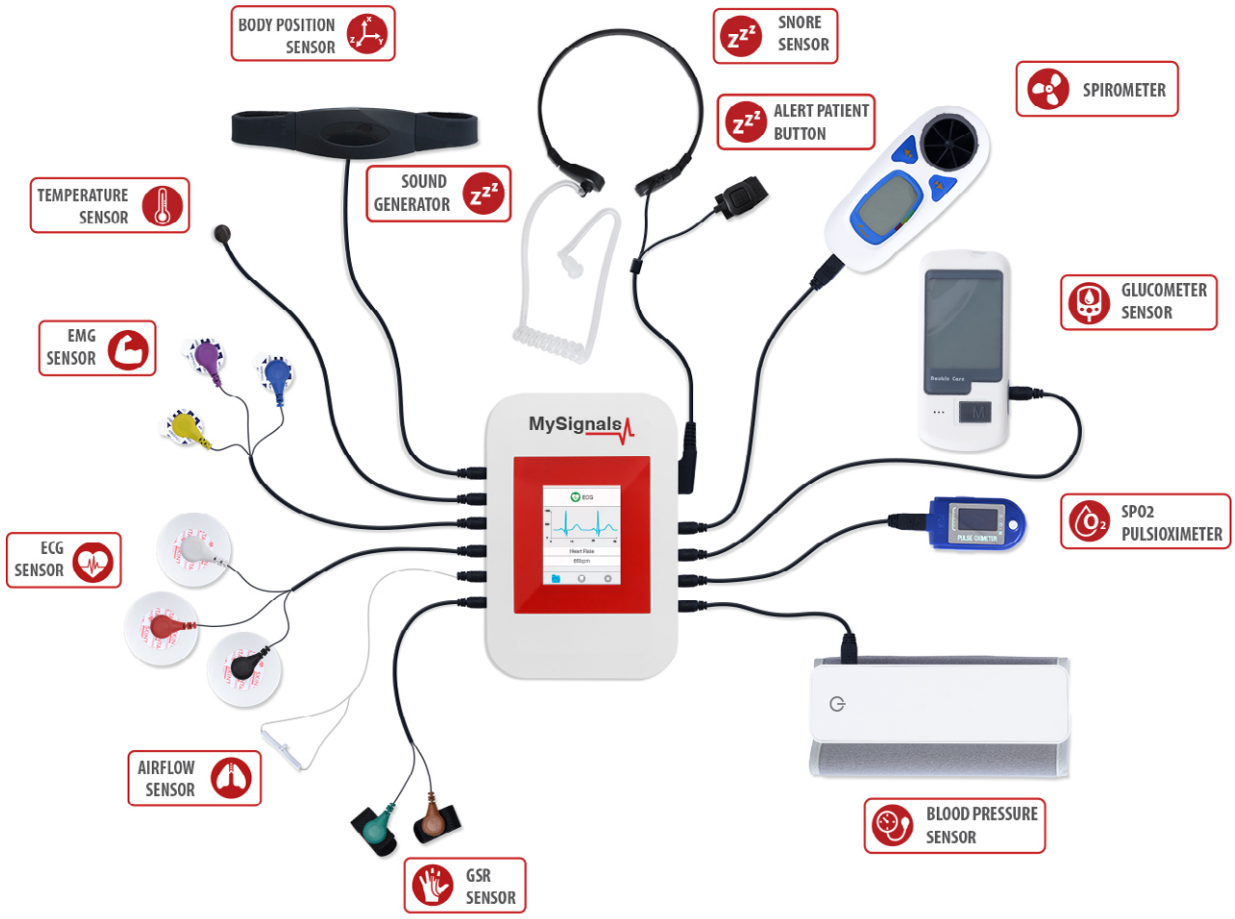


Figure : My Signal Software Development Platform with sensors

2.0.1. Specifications

MySignals allows you to measure 20 different biometric parameters such as pulse, breath rate, oxygen in blood, electrocardiogram signals, blood pressure, muscle electromyography signals, glucose levels, galvanic skin response, lung capacity, snore waves, patient position, airflow and body scale parameters (weight, bone mass, body fat, muscle mass, body water, visceral fat, Basal Metabolic Rate and Body Mass Index). These broad sensing portfolio makes MySignals the most complete eHealth platform in the market.

Figure : My Signal Software Development Platform

- Monitoring EMG signals.
- Monitoring ECG signals.
- Monitoring Snore signals.
- Airflow control of user.
- Body temperature data.
- Galvanic skin response measurements.
- Body position detection.
- Pulse and oxygen functions. Wireless or wired version.
- Blood pressure control device. Wireless or wired version.
- Glucometer monitor. Wireless or wired version.
- Spirometer monitor.
- Body Scale. Wireless version.

This information is used to monitor in real time the state of a user or to get sensitive data in order to be subsequently analysed for medical diagnosis. Biometric information gathered is wirelessly sent using two connectivity options available: Wi-Fi or Bluetooth Low Energy 4.0.

Data can be visualized in standalone mode, sent to the Cloud in order to perform permanent storage or visualized and storaged in real time by sending the data directly to a Smartphone. iPhone and Android applications have been designed in order to easily manage and storage the user's information.

With CE / FCC / IC Certifications what makes it perfect to be used in any kind of project.

NOTE: *MySignals Software Development Platform is a hardware closed device. It is ready to be used as a web and mobile App's development platform with the sensors distributed by Libelium. If you want to integrate new sensors (wired, BLE, BT) or program the device with a personal firmware use the MySignals HW model.*

3. Hardware

Figure : Top view of MySignals Software

Included on MySignals device:

- Micro-Controller Circuit
- Power Supply Circuit
- Sensor Circuits
- Bluetooth Low Energy module
- WiFi module
- Jack Sensor Connectors

3.1. Electrical Data

The MySignals Software can be powered by an external power supply.

General power supply

Operating Current	2 A
Operating Voltage	5V
Input Voltage (recommended)	7-9 V
Input Voltage (limit)	7-12 V

Specific power supply

DC Current per I/O Pin	20 mA [Max]
DC Current for 3.3V	1 A [Max]
DC Current for 5V	1 A [Max]
Input Voltage (limit)	7-12 V

Plug in /out the power supply adapter included with MySignals to turn ON or OFF the device. Make sure that the power adapter is placed indoors

Figure : MySignals Software powered

Plug it into the corresponding power supply connector. Power supply unit is included with Mysignals. Do not use any third party power supply with it.

You can see all the information about the power supply in the label included in MySignals device.

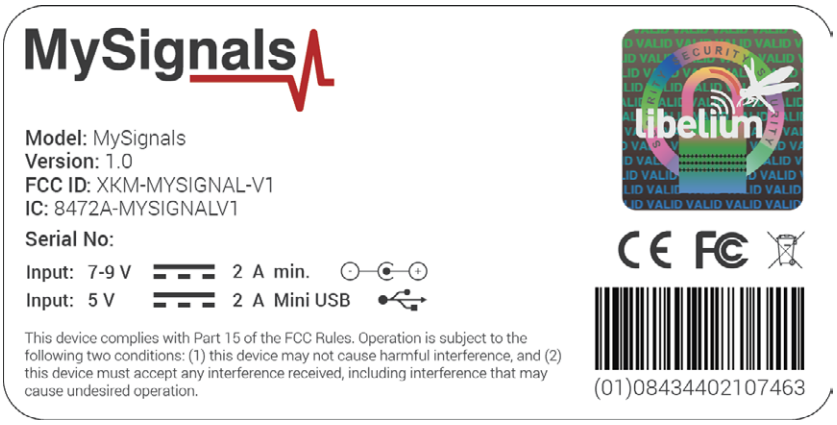


Figure : Certification MySignals label

Note: *Do not connect or disconnect any sensor or connector while MySignals is ON. MySignals can become unstable or unresponsive, and internal parts can be damaged.*

3.2. USB Data Transfer

This connector is used to update code into MySignals with a male USB to male Mini USB cable provided by Libelium. Just connect one side of the cable to this connector, removing protection cap from MySignals and connect the other side to a PC to update a code.

Figure : MySignals Software USB connector

MySignals include a protective cap for this connector. When uploading processes are finished, do not forget to use again protection cap to keep the connector clean from dust.

Figure : MySignals Software with protective cap

3.3. Data Interface

Data can be visualized by 3 different modes:

- Standalone mode: using the basic graphic TFT Integrated in the device.
- Mobile APP'S: using the native Android / iOS connectivity to send all the data to the smartphone.
- Web Server: you can also access to the history of the information gathered by connecting to the Cloud through a web browser or using the native iOS / Android App's.

Figure : MySignals Software Development Platform standalone with APP and Server

3.4. Wireless Communications

MySignals Software have two connectivity options available integrated: Wi-Fi or Bluetooth Low Energy 4.0.

Figure : MySignals Software Development Platform with Wireless Communication logos

Data may be sent directly to the Cloud via WiFi or using your smartphone (BLE)

Figure : Connectivity MySignals diagram

The data gathered by MySignals is encrypted and sent to the developer's private account at the Libelium Cloud.

(Developers may use their own Cloud too to store the information. More info in the API section below).

4. Software

4.1. MySignals Firmware

The MySignals Software Development Platform includes a high level firmware that control all the features of the device at the same time.

4.1.1. Version 1.0.0 – Release Notes

- First Beta of MySignals Software Development Platform Firmwarte.
- Copyright (C) 2016 Libelium Comunicaciones Distribuidas S.L.
- http://www.libelium.com
- September 20, 2016

Issues are resolved since last release V0.0.0:

Features:

- 3 communication modes: standalone, WiFi connectivity and BLE connectivity
- 3 monitorization modes: standalone, Smartphone Mobile APP and Web Server Application
- 11 sensors availables in BLE mode
- In the communication link layer: AES 128 encryption for BLE and WPA2 and AES 256 encryption for Wifi.
- 16 sensors availables in WiFi and standalone mode.
- Graphic interface with detail and general modes.
- Touchscreen control integrated.
- Specific MySignals BLE profile.

Next features:

- Full integration of 16 sensors in BLE mode
- Internal data storage in Standalone mode.
- Graph selection in Standalone mode.
- Language selection in Standalone mode

4.2. MySignals Cloud

MySignals allows to share data with the cloud, and perform real-time analysis.

MySignals Web Server Application is a real-time large-dataset viewing and plotting tool and has built-in data analysis functionality. It is very user-friendly and contains many powerful built-in features. MySignal Web Server Application is an application that allows you to configure Mysignals for creating profiles and users and help you to visualize all the data measured.

This application is available in:

https://cloud.libelium.com/mysignals/

MySignals web allows you to playback your previously recorded sessions and zoom in and out of specific periods. MySignals is our easy-to-use, versatile, and scalable software for real-time biosignals visualization, capable of direct interaction with MySignals. It includes sensor data acquisition from multiple devices, and multiples users.

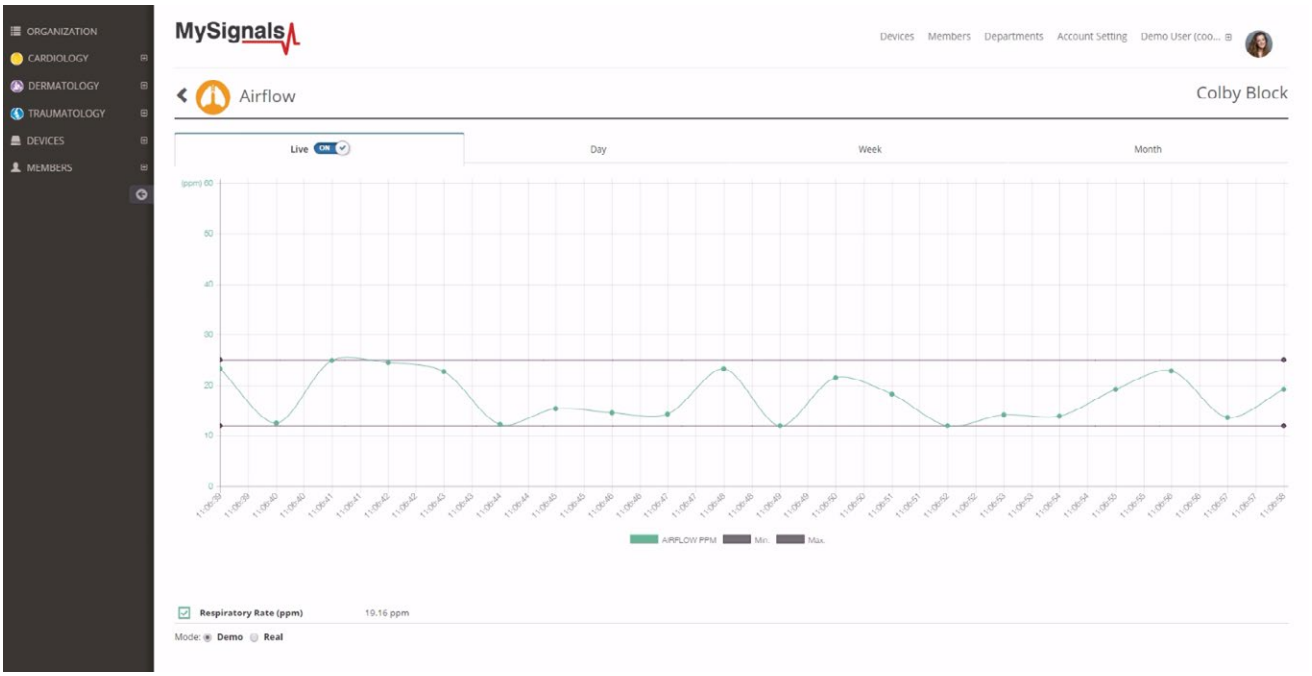


Figure : MySignals website

Users can read the data stored in the Cloud by using the Open API available.

It allows users to authenticate and save their information to a third Cloud platform or visualize it in an external web or mobile App:

- Open API Features
- HTTP Rest Calls
- JSON Files Management
- Authentication + Read Calls
- Retreive your data and visualize it in your own Apps
- Duplicate the data in your own Cloud Server

4.3. MySignals Mobile APP

The Bluetooth Low Energy module integrated may perform direct communications with iPhone and Android devices.

We have developed the application MySignals, for both iPhone and Android platforms. The application may be also downloaded from the official App markets.

Official app markets URL's:

https://itunes.apple.com/app/id1138747630

https://play.google.com/store/apps/details?id=com.libelium.mysignals

MySignals device will send data to the mobile App in case the BLE mode is enabled. In this case the App will upload the data to the Cloud. The App can also be used to navigate through the users history at the Libelium Cloud.

Figure : APP logo

4.3.1. Encryption and bonding

In older Bluetooth standards, the user needed to pair with a remote device before connecting it. On the Bluetooth 4.0 standard, the user can connect to other remote BLE devices without any pairing process. Even the user can use advertisements to send a few amount of data, as it has been described in previous sections. However, these processes are not secure.

The Bluetooth 4.0 standard uses **AES-128 link layer encryption**. The encryption can be used in the connection processes to make them secure. The encryption of the connection can be started using a dedicated command. providing the handler of the established connection. The handler is usually zero, unless other connections are enabled.

On the other hand, the bonding processes are the long term storage of encryption keys used by each BLE module. Keys are defined as 6 digit numbers with a range from 000000 to 999999. Starting a connection with bonding will imply next steps:

- 1. MySignals SW advertises
- 2. MySignals APP detects advertisements of MySignals SW
- 3. MySignals APP starts a connection with MySignals SW
- 4. MySignals APP request bonding
- 5. Both nodes exchange keys: bonding key appear in MySignals SW TFT screen.
- 6. Both nodes store keys for future usage

4.4. Libelium Smart Devices App

Libelium Smart Devices App is the Java application used to upgrade the FW of MySignals SW.

Download at:

http://downloads.libelium.com/mysignals/mysignals_java/SmartDeviceApp_linux64.zip
http://downloads.libelium.com/mysignals/mysignals_java/SmartDeviceApp_macosx64.zip
http://downloads.libelium.com/mysignals/mysignals_java/SmartDeviceApp_windows32.zip

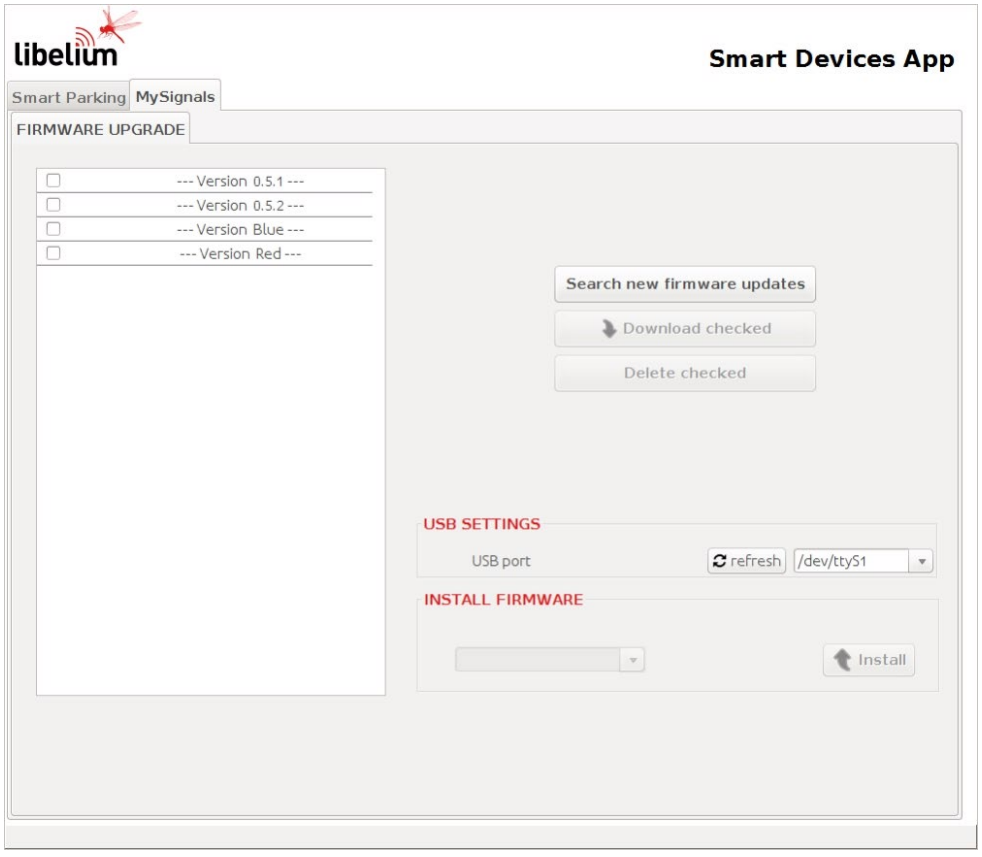


Figure : Updater Tool Interface

Follow the step-by-step instructions for setting up the Libelium Smart Devices App on your computer and connecting it to MySignals devices.

Download the application and select the Mac, Windows, or Linux version, depending on what machine you have. Installation on each machine is straightforward:

- On Windows, you'll have a .zip file. Double-click it, and drag the folder inside to a location on your hard disk. It could be Program Files or simply the desktop, but the important thing is for the processing folder to be pulled out of that .zip file. Then double-click Mysignals_Updater.exe to start.
- The Mac OS X version is also a .zip file. Double-click it and drag the Libelium Smart Devices App icon to the Applications folder. If you're using someone else's machine and can't modify the Applications folder, just drag the application to the desktop. Then double-click the Libelium Smart Devices App icon to start.
- The Linux version is a .tar.gz file, which should be familiar to most Linux users. Download the file to your home directory, then open a terminal window, and type: tar xvfz Mysignals_Updater-xxxx.tgz

5. Data Access

MySignals SW includes three different modes to access all the information gathered from the sensors:

- Standalone Mode: MySignals does not send the data. It is just visualized on the TFT screen.
- Bluetooth Connection Mode: MySignals send the data to a mobile phone using the BLE connection. The data is gathered an visualized by the MySignals App. Then if the Cloud option is enable, the data will be also transferred to the user's account at the Libelium Cloud.
- Server Connection Mode: MySignals uses the WiFi connectivity to send the data directly to the Libelium Cloud.

5.1. MySignals Standalone Mode

This mode consists on displaying the information from the sensors directly on the MySignals screen without any other external device. All you need is to navigate through the menus on the screen following this instructions.

Note: *MySignals includes a stick to navigate through the menu options of the touchscreen. Please use it for a correct function of the device interface.*

Figure : Touchscreen stick included

5.1.1. Using Standalone Mode

First of all power the device with the Libelium MySignals power supply.

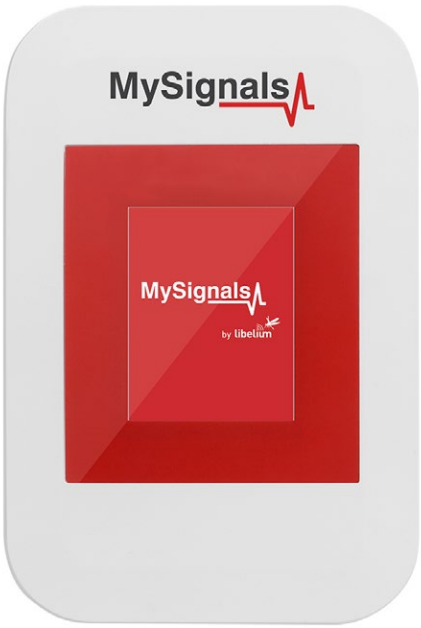


Figure : TFT intro image

To access this mode you must leave unchecked both options in the setup menu: Bluetooth Connection or Server Connection. Click directly on "Start Monitoring" button.

Figure : TFT mode configuration

Then you will enter in “Select Sensors” screen where you must select all the sensors that you want to measure. Selected sensors are in blue color and unselected sensors are in gray color.

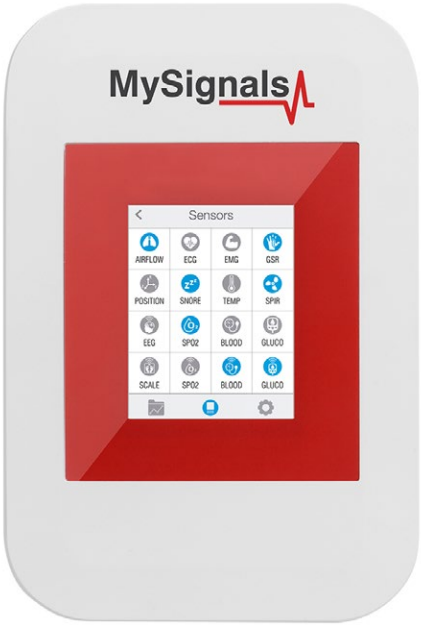


Figure : TFT Select Sensor

Once you have completed your selection you must click on “Data” button, which you can find at the left end of the bottom toolbar.

In "Data" screen you will be able to see in one glance the main information of all sensors at once. The selected sensors will be green and sensors are not selected in orange.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

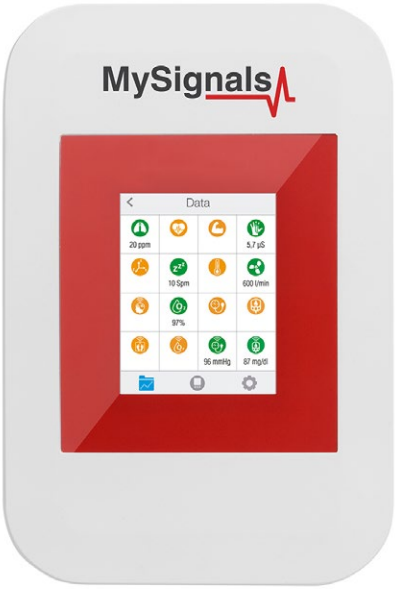


Figure : TFT data

If you are interested in viewing all the information in one particular sensor simply you have to click on it to enter a detail sensor view. On this screen you can see a graph of one of the sensor values and all the detailed information on a list view.

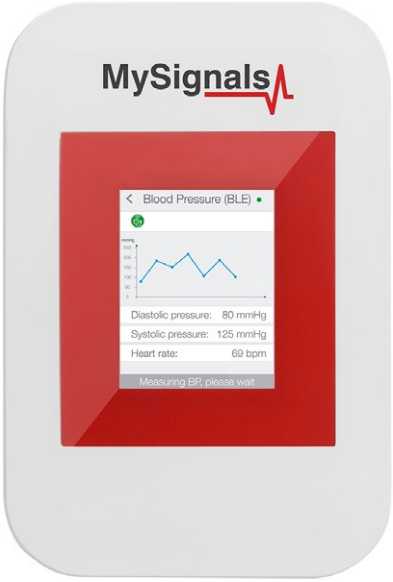


Figure : TFT detail view

At any time you can navigate back to return to the previous screen by clicking the arrow on the top left of the screen.

NOTE: *The Firmware of MySignals SW manages all the sensors at the same time and monitors the response of the screen and the touchscreen. For this reason sometimes during the measurement of different sensor like blood pressure or other wireless sensors it will be able to perform one action at the same time, you have to wait it to finish before being able to navegate or interact with the screen again.*

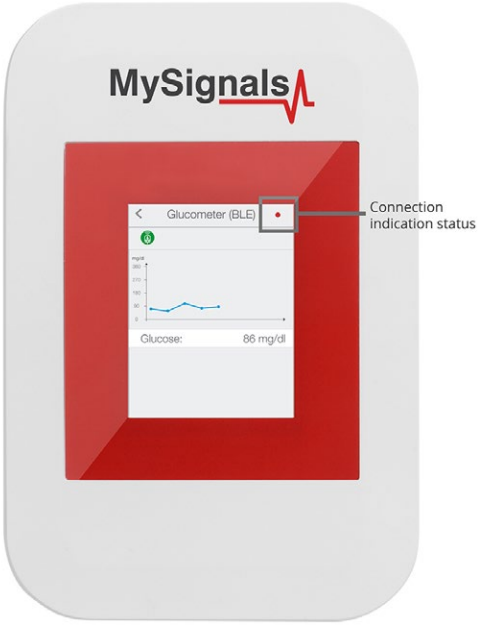


Figure : Detail mode Web Server

- Red color indicate that you can not use the touchscreen in this moment. So try to maintent the zone pressed until you receive a visual response on the tft.
- Green color indicate that you can use the touchscreen as usual.

There is available too in the bottom of the screen a black zone where mysignals will write text indications about the actual state of the device.

5.2. MySignals Mobile APP

The Bluetooth connectivity may perform direct communications with iPhone and Android devices without the need of an intermediate router.

First of all you must download MySignals app in your store. The app is available for Android and iPhone.

5.2.1. Using Bluetooth Connection Mode

Below and to avoid any connection problems we recommend restarting the Bluetooth on your device if you already had it previously activated. We recommend doing this every time you open the app again. In order to do this go to Settings in your device, then Bluetooth and turn it off and on.

Sometimes you will need to configure the connection with MySignals using the Android or iOS settings.

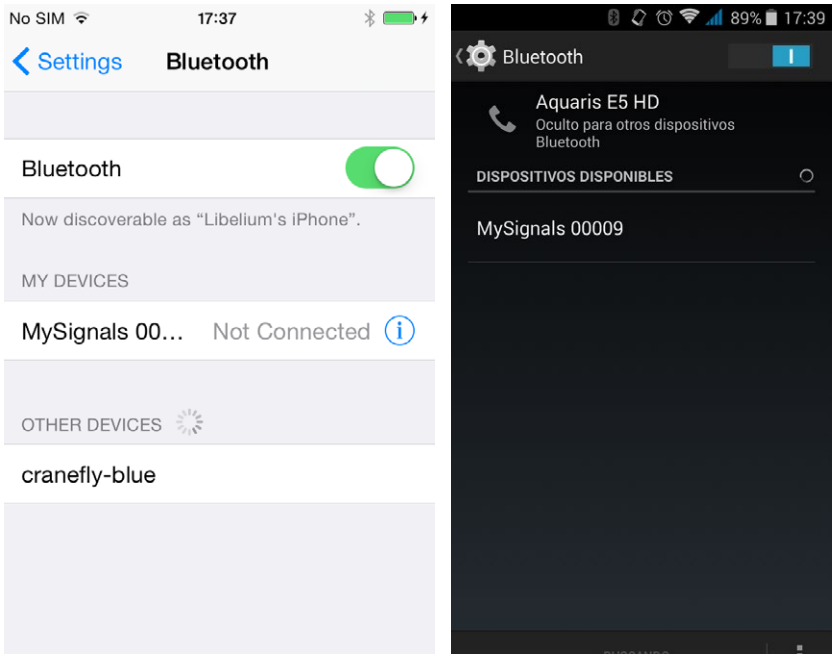


Figure : Settings BLE configuration

The first time a user starts MySignals application, it will be needed a setup assistant to configure all aspects related to MySignals configuration like user name, password (already set in our back end), profile, WiFi settings and MySignals selection. We will create a setup assistant with straightforward screens with all field and information to guide the user through this assistant.

This assistant in needed if you want to use Server Connection Mode and MySignals Web Server Application because MySignals Mobile APP send all the WiFi network, user account and configuration information using Bluetooth Connectivity. The maximum number or characters that you can use in this settings are 20.

The first time you open the APP you will see some configuration screens:

- First of all in the "Login" screen enter youruser and password. In case you don't have an username or password please contact our Sales Dep. at sales@libelium.com.
- An account can have one or more MySignals devices, this is why an user can purchase more than one device. Then we mustcreate a MySignals Manager profile to provide a list of devices and perform some basic operation on them
- This Manager Profile can add/delete/modify/select an MySignals device. This information should be synchronized with cloud to get all devices up to date for a given account.
- As each MySignals is tied to each single user, we should download a list of devices each time an user log in , this way we do not mix MySignals from different accounts.

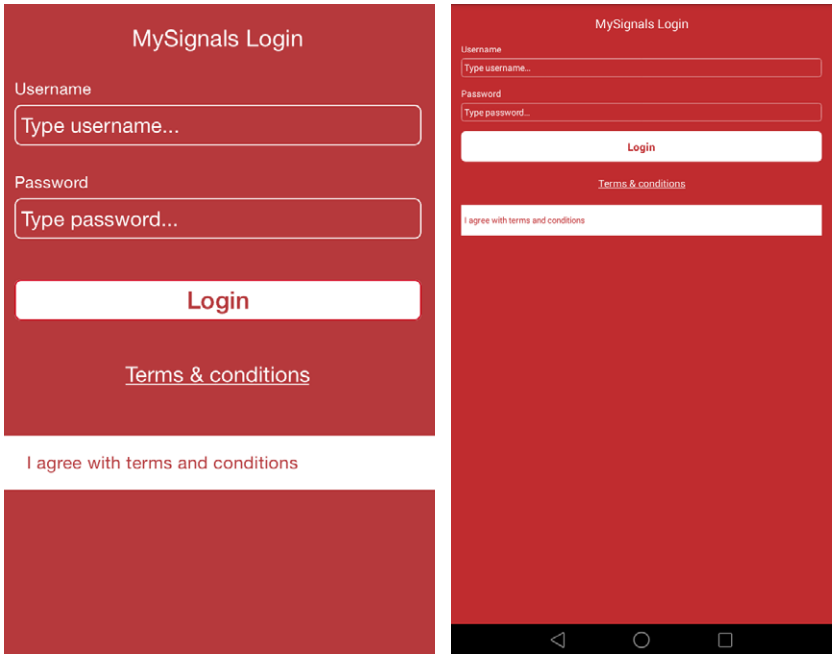


Figure : APP login

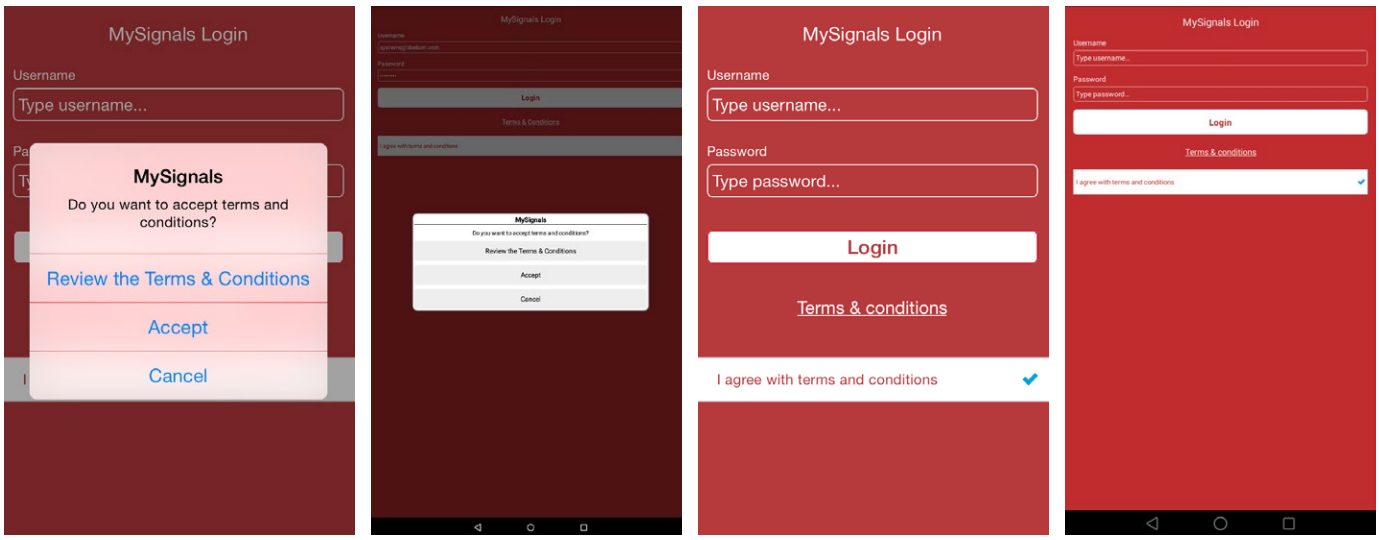


Figure : T&C section

- Now we move to the next screen "Profile" and enter our Manager Profile personal info.

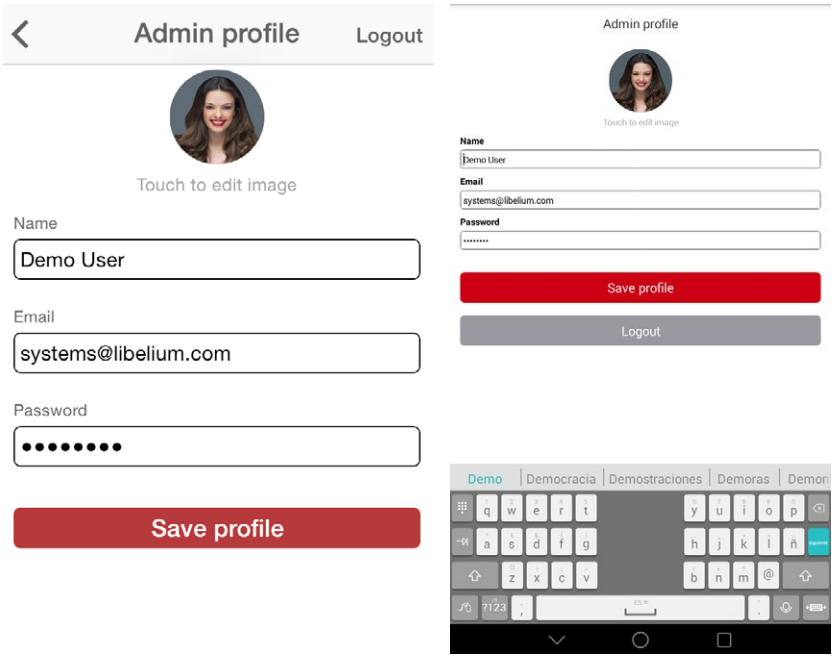


Figure : APP profile

- Go to the next screen "WiFi". Here you will need to provide your WiFi SSID name and your WiFi password in order to transmit this information to the MySignals device (this way it will be able to connect to the WiFi AP directly). This is the only way that MySignals can connect to the WiFi network in your home if you are also interested in using the Server mode.

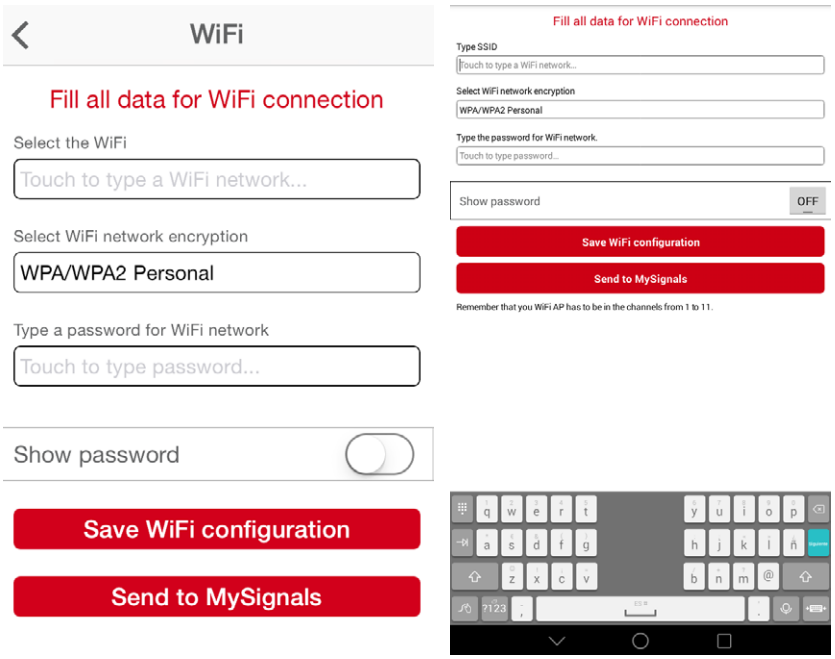


Figure : APP WiFi configuration

- Once arrived to the last configuration screen, before doing anything here in the phone app, you must power on MySignals, select "Bluetooth Connection" on configuration screen and click "Start Monitoring" button.

Figure : TFT BLE selected

When you see "Not Connected" message on the screen and a gray Bluetooth icon on MySignals screen, you can click on "Search for MySignals" in you phone app.

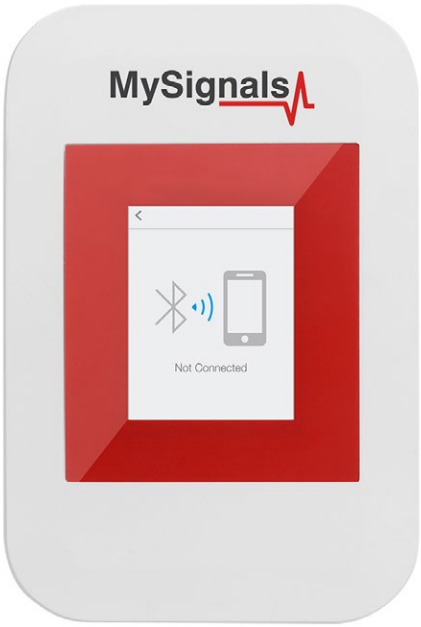


Figure : TFT BLE not connected

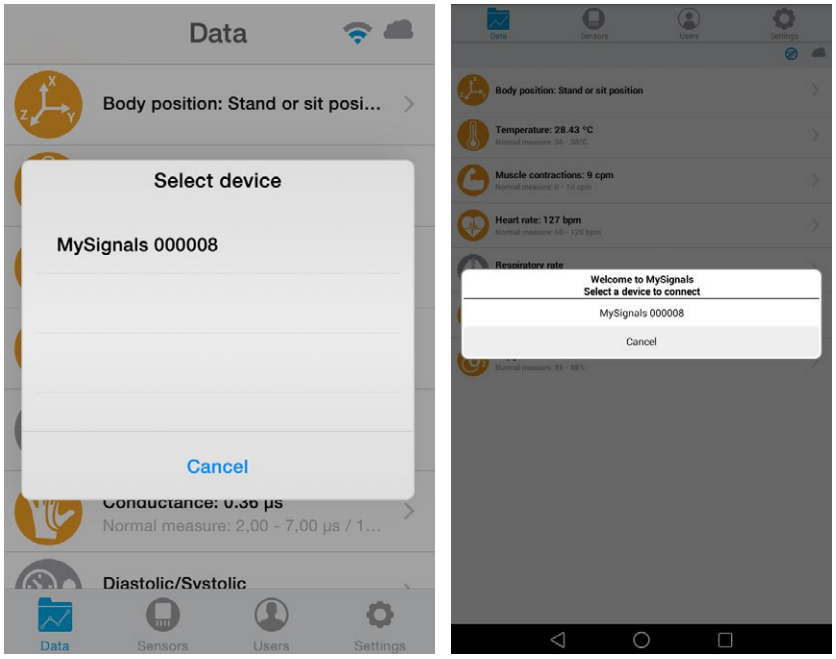


Figure : APP searching

Select your MySignals device on the list. Now if the bluetooth connection is working well, you will have to enter in your phone the code that you will see in blue color figures in MySignals screen. If you are using Android please check your notification center if your phone doesn't ask you to enter the code automatically.

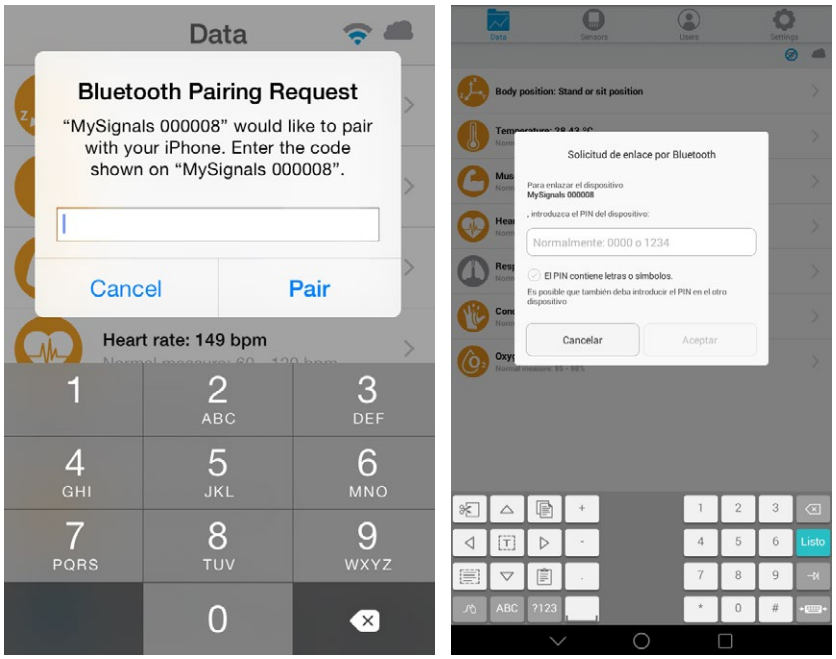


Figure : APP device list

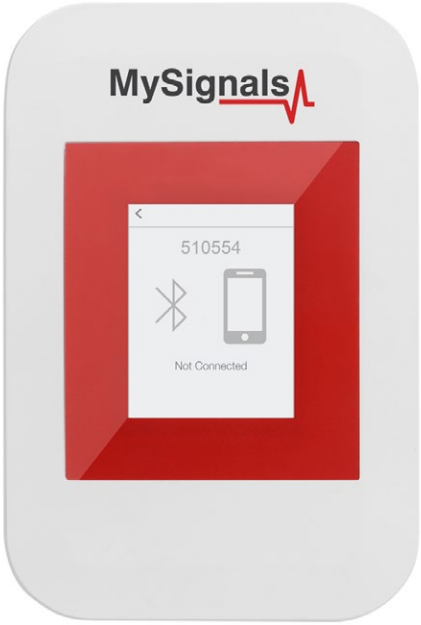


Figure : Bluetooth PIN

- The next screen is "Sensors", where you must select all the sensors that you want to measure. Selected sensors are in blue color and unselected sensors are in gray color.

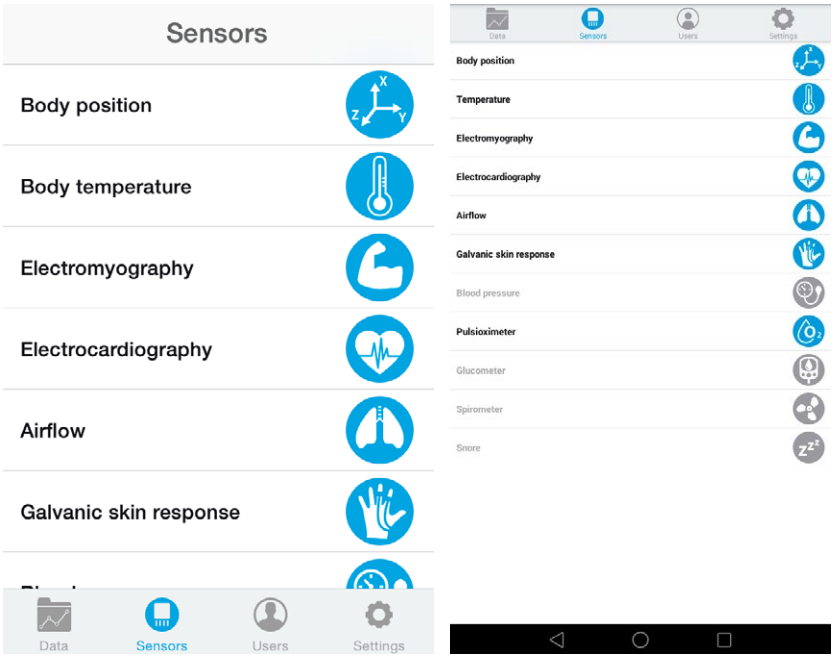


Figure : APP sensor selection

MySignals device will send data to application using two modes:

- In **General mode** the MySignals device will send all values for all sensors, this is used for main sensors screen where we show a list of selected sensors by the user with its values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

- Regarding to **Detail mode**, it is used when the application shows a detailed view from sensor, MySignals will only send data for this single selected sensor. The application will send a sign to MySignals to switch on and off this mode.

When the MySignals device establish a pairing with the application it send information in Datagram mode by default.

Once you have completed your selection you must click on "Data" button, which you can find at the left end of the bottom toolbar.

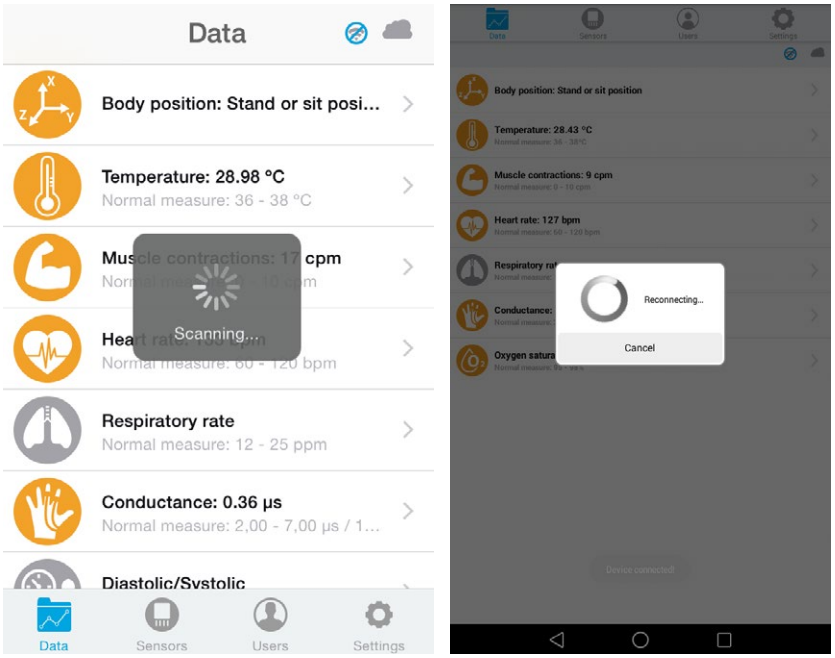


Figure : Connecting

In “General mode” screen you will be able to see in one glance the main information of all sensors at once. The latest received sensor info will be green, the sensors with old received info will be orange and sensors that hasn't received info will be gray.

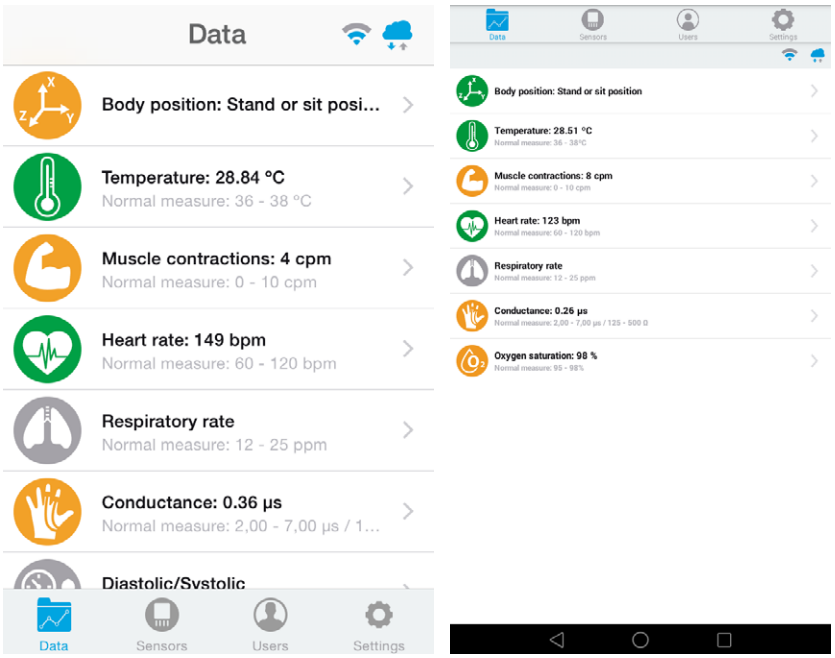


Figure : APP general mode

If you are interested in viewing all the information in one particular sensor simply go tot he "Detailed View" of that sensor. On this screen you can see a graph of one of the sensor values and all the detailed information on a list view.

***IMPORTANT:** In the detailed view only information coming from that specific sensor is received and send to the Cloud. If you want to receive and store information coming from many sensors at the same time you should use the "General view" screen.*

***IMPORTANT:** Due to the high amount of information generated in the realtime pulse waves (ECG, airflow, snore), the information sent to the Cloud account is the summary of the information gathered (heart pulse, breath rate, snore rate and muscle contraction rate).*

Figure : APP detail mode

At any time you can navigate back to return to the previous screen by clicking the arrow on the top left of the screen.

NOTE: *At any time you can Activate / Deactivate the sinchronization of the information being sent to your Cloud Account by just pressing the Cloud icon on the top right corner.*

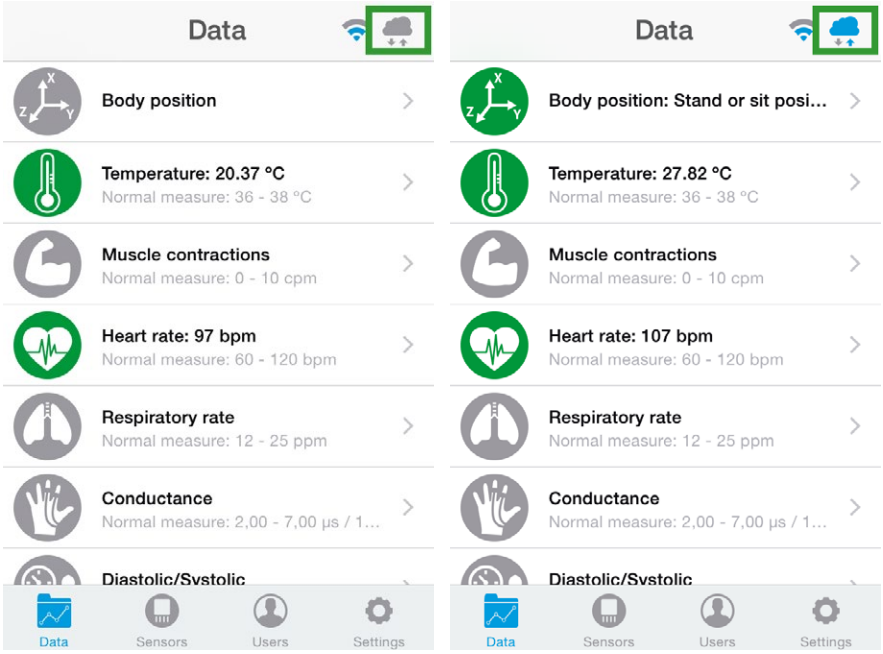


Figure : Cloud sinchronization button

Using the users section you are able to select and modify the user profile.

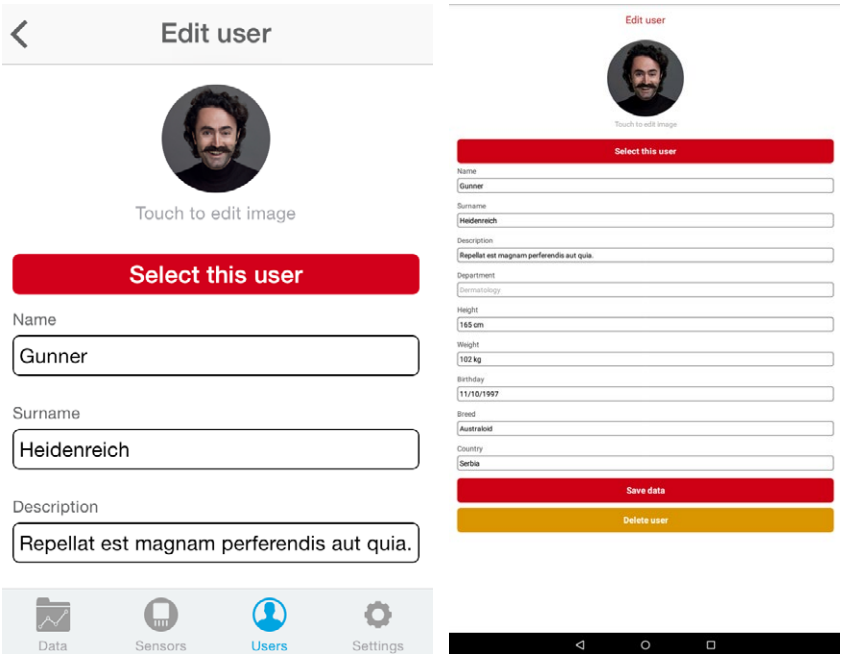


Figure : APP user configuration

Or organize tthem in different departments.

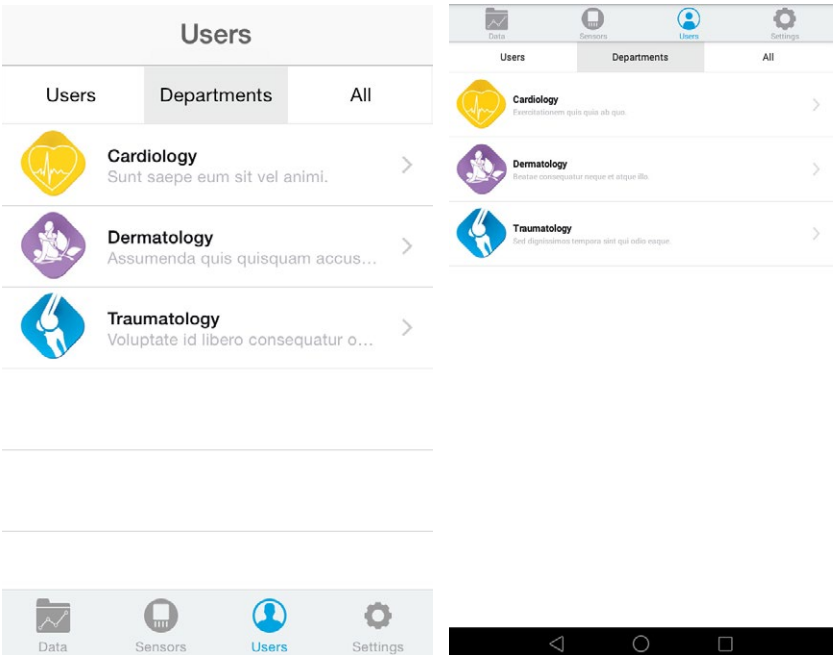


Figure : APP department sections

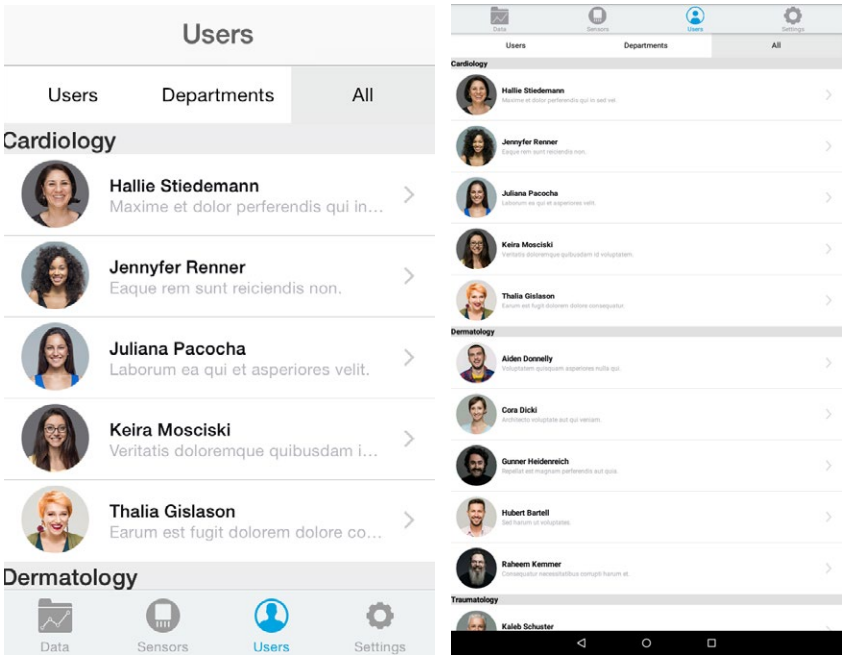


Figure : APP department organization

There are several basic configuration screens: language, profile, user…. Where you can change your basic configuration.

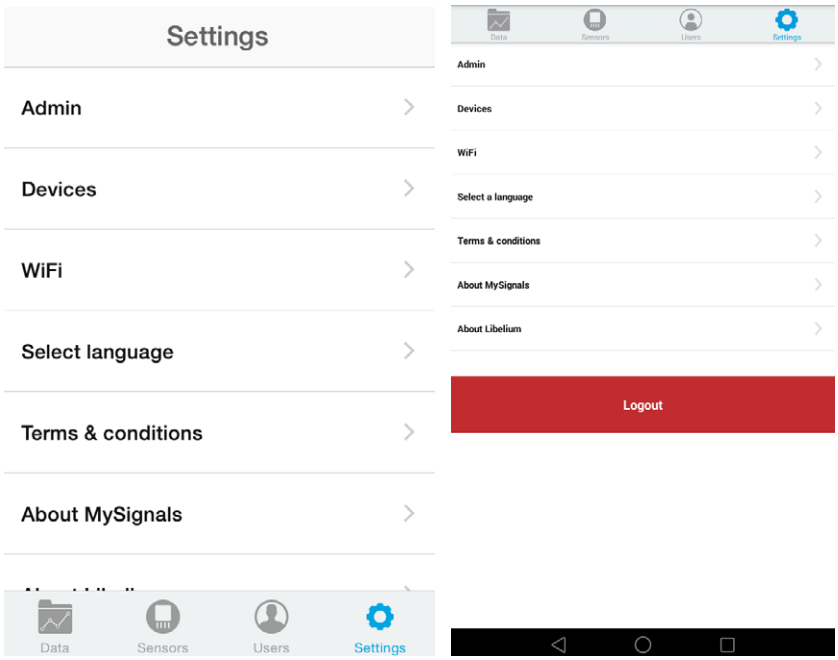


Figure : APP settings mode

- You can logout and login with another mysignals account:

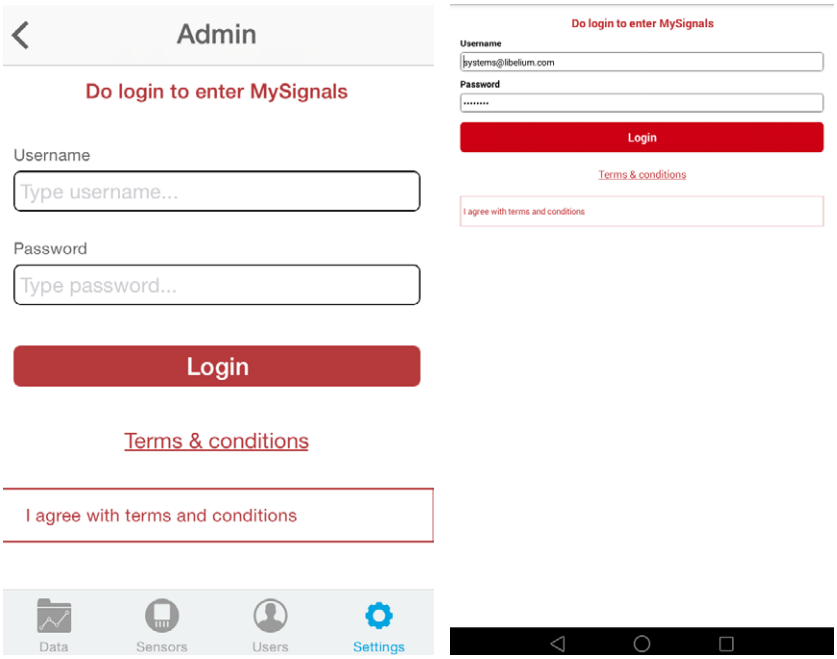


Figure : APP settings login

- You can change the language of the appication

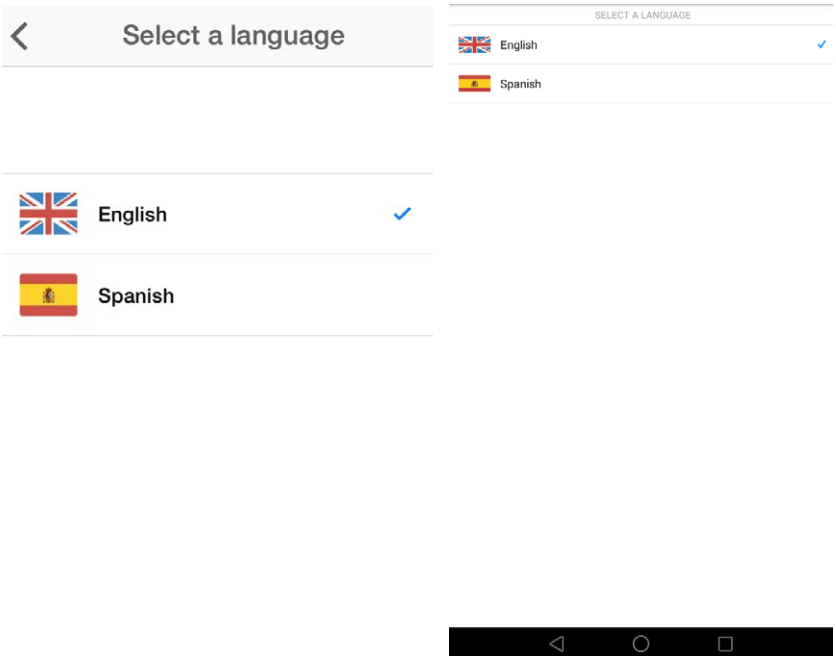


Figure : APP settings language

-You can change the device MySignals connected to the APP.

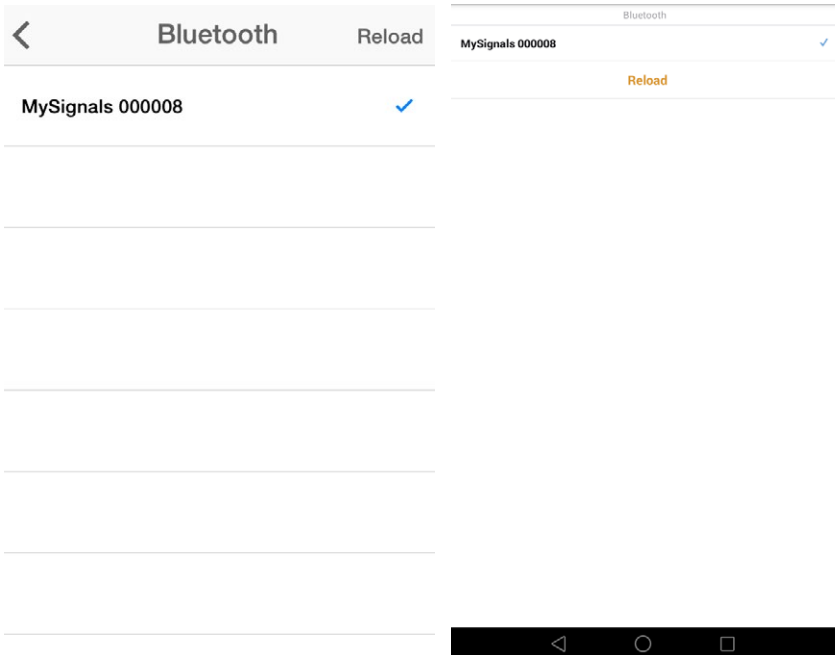


Figure : APP settings devices

There is available a extra configuration section in the TFT where you can see your configuration info active: wifi, account, user… You can use the DELETE button in order to delete the spirometers measures stored in the sensor (it should be connected when you press it).

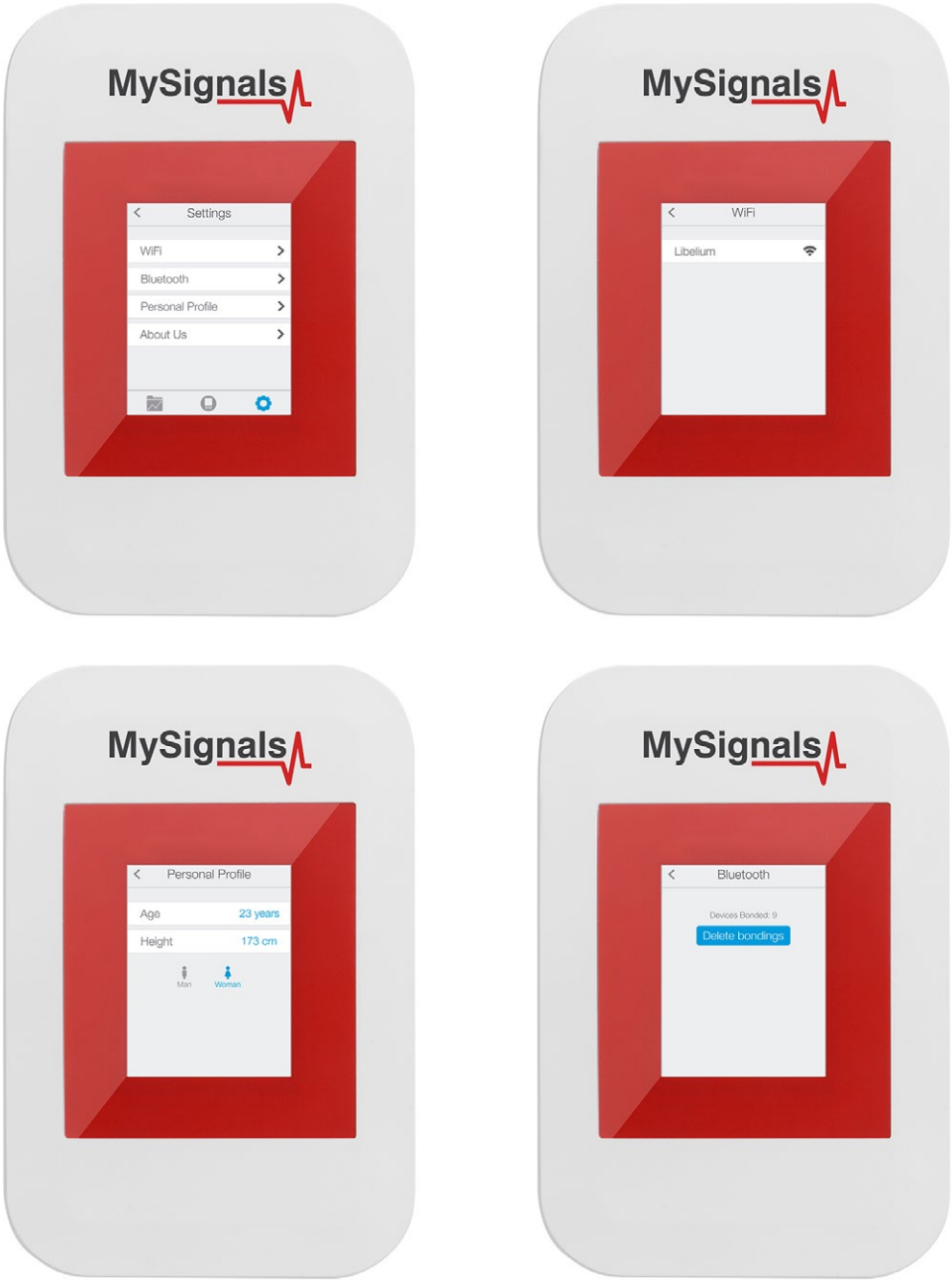


Figure : TFT settings and others.

Troubleshooting:

Here you can find a solution for all possible know issues the user can face on MySignals applications (iPhone/iPad and Android).

- **Android:**
  - Do not start the mobile application until MySignals device is in bluetooth mode. The mobile application needs bluetooth communication to read data from MySignals device.
  - Sometimes the Bluetooth stack becomes corrupted due to use of other bluetooth applications, when this situation happens, the applications sometimes does not connect to MySignals device, to solve this issue switch off and switch on bluetooth device on device settings.
  - In some android devices, when the user switch off and on the bluetooth radio, the mobile device loses all bonded devices, at this point the user must delete the bonding connections on MySignals device.
  - On Android devices the popup dialog to introduce de passkey does not show on screen, this is due to bluetooth stack is malfunctioning, the solution is to switch off and on the bluetooth radio on device settings.
  - When the user deletes bonded connections on MySignals device and mobile device the MySignals device does not show PIN passkey to create a new bonding connection, at this point the user should exit and enter again from bluetooth mode on MySignals device.
  - On Android devices, the user can create a new bonded connection using bluetooth section in mobile device. To perform this action go to Settings application →Bluetooth and touch the listed device to start a new bonding action.
  - It is not possible to delete bonded devices in MySignals mobile application, to delete a bonded device go to settings application from your Android device and select Bluetooth section, there you can get the list of bonded devices, you can delete the desired application on that point.
  - If the user deletes a bonded device in Android device then the bonded connection must be deleted on MySignals device too.
  - As general rule, the bluetooth stack has different implementation on Android devices, it depends the hardware manufacturer, so when the bluetooth stack fails most of issues can be solved by switching off and on the bluetooth radio on settings application on Android devices.
  - When the user select a single sensor mobile application communicates with MySignals device, the communication time can last a couple of seconds. The user must wait until the new values arrives.
  - Connection time with MySignals can last until one minute, bluetooth connection and communication time depends n each manufacturer, some of then are faster and some of them are slower. Wait until the connection between mobile application and MySignals device finishes.
  - If sensor notifications does not arrive there could be a bonding problem or MySignals device is stuck, check that MySignals device can exit from bluetooth mode to check the MySignals state also exit from mobile application and kill it from background to start a new bluetooth connection between the mobile application and MySignals device.

- **iPhone/iPad:**
  - Do not start the mobile application until MySignals device is in bluetooth mode. The mobile application needs bluetooth communication to read data from MySignals device.
  - Sometimes the Bluetooth stack becomes corrupted due to use of other bluetooth applications, when this situation happens, the applications sometimes does not connect to MySignals device, to solve this issue switch off and switch on bluetooth device on device settings.
  - It is not possible to delete bonded devices in MySignals mobile application, to delete a bonded device go to settings application from your iOS device and select Bluetooth section, there you can get the list of bonded devices, you can delete the desired application on that point.
  - If the user deletes a bonded device in iOS device then the bonded connection must be deleted on MySignals device too.
  - As general rule, when the bluetooth stack fails most of issues can be solved by switching off and on the bluetooth radio on settings application on iOS devices.
  - When the user select a single sensor mobile application communicates with MySignals device, the communication time can last a couple of seconds. The user must wait until the new values arrives.
  - Connection time with MySignals can last until one minute. Wait until the connection between mobile application and MySignals device finishes.
  - If sensor notifications does not arrive there could be a bonding problem or MySignals device is stuck, check that MySignals device can exit from bluetooth mode to check the MySignals state also exit from mobile application and kill it from background to start a new bluetooth connection between the mobile application and MySignals device.

MySignals mobile applications was tested on these devices:

Brand	Model	OS version	Memory	Kernel
BQ	Edison 3	4.4.2	2 GB	v3.4.67
Apple	iPad 2	8.4.1	512 MB	v5.4.00
Apple	iPhone 4S	8.3	512 MB	v5.4.00
LG	G2	5.0.2	2 GB	v3.4.0
Moto	G2	6	1 GB	v3.4.42
Nexus	10	5.1.1	2 GB	v3.4.67
Nexus	4	5.1.1	2 GB	v3.4.0
BQ	Aquaris E5 HD	4.4.2	2 GB	v3.4.67
Huawei	T1 7.0	4.4.2	1 GB	v3.10.17

5.2.2. Installing to an iPhone

Installation:

a) Download the application from App Store:

- Then double click on the icon, or right click and open with iTunes.
- Inside iTunes, on the left panel, click on DEVICES->Your Device.
- Select on the top "Apps", and select Sync Apps. Drag into the desired screen e-Health app.

Once installed, the app appears in your iPhone/iPod screen.

The App shows the information the nodes are sending which contains the sensor data gathered.

5.2.3. Installing to an Android

Installation:

a) Download the application from Android Market:

Once installed, the app appears in your device screen.

The App shows the information the nodes are sending which contains the sensor data gathered.

5.3. MySignals Cloud Application

The data sent via WiFi o BLE through the APP can be visualized on MySignals website.

Navigate through the history of previously stored data or even create many users in order to save the biometric information linked to a specific profile.

MySignals allows to share data with the cloud, and perform real-time analysis.

How do I ensure the privacy of the biometric data sent?

Privacy is one of the key points in this kind of applications. For this reason the platform includes several security levels:

- In the communication link layer: WPA2 for Wifi and AES256 encryption.
- In the BLE communication: Bonded and encrypted connection
- In the application layer: by using the HTTPS (secure) protocol we ensure a point to point security tunnel between each sensor node and the web server (this is the same method used in bank transfers).

Figure : Detail mode Web Server

- Red color indicate that you can not use the touchscreen in this moment. So try to maintent the zone pressed until you receive a visual response on the tft.
- Green color indicate that you can use the touchscreen as usual.
- There is available too in the bottom of the screen a black zone where mysignals will write text indications about the actual state of the device.

5.3.1. Using Server Connection Mode

If you are interested in using this mode you first need to follow the steps in previous section “Bluetooth Connection mode” in order to transmit to MySignals all the required information to send the ddata to the server: database user and password, and your local WiFi name and password.

Figure : TFT WiFi configuration

If all the info entered in the last point is correct you will see a WiFi connection screen and automatically it will direct you to "Select Sensors" screen. Here you can use everything as if you were in Standalone mode, with the only difference that the sensor data will be automatically sent to the server. You must select all the sensors that you want to measure. Selected sensors are in blue color and unselected sensors are in gray color.

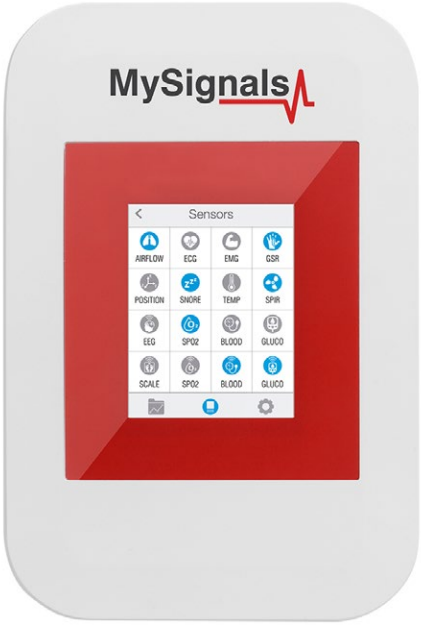


Figure : TFT Select Sensor

Once you have completed your selection you must click on "Data" button, which you can find at the left end of the bottom toolbar.

In "Data" screen you will be able to see in one glance the main information of all sensors at once. The selected sensors will be green and sensors are not selected in red.

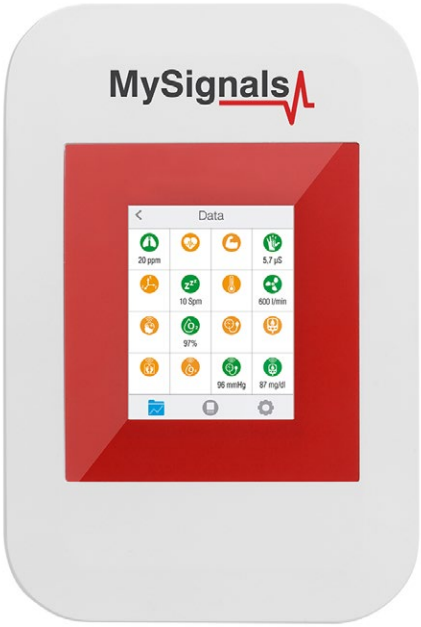


Figure : TFT General Sensor

If you are interested in viewing all the information in one particular sensor simply you have to click on it to enter a detail sensor view. On this screen you can see a graph of one of the sensor values and all the detailed information on a list view.

Figure : TFT Detail Sensor

NOTE: *At any time you can Activate / Deactivate the sinchronization of the information being sent to your Cloud Account by just pressing the Cloud icon on the top right corner.*

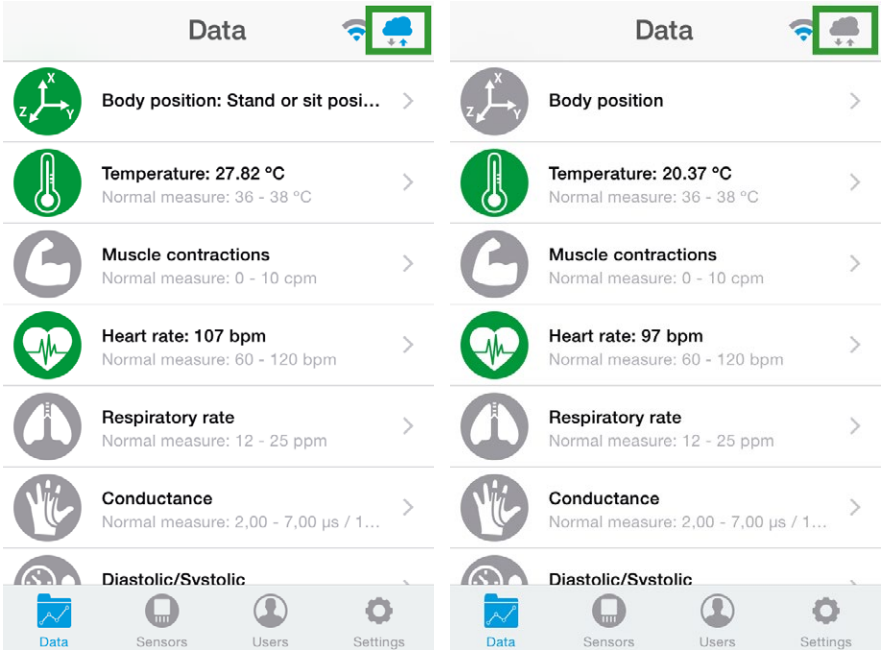


Figure : Cloud sinchronization button

At any time you can navigate back to return to the previous screen by clicking the arrow on the top left of the screen.

MySignals application will have an user account to login into the system, this account is important to make cloud call and store information. If the user does not have an account the user cannot use MySignals application.

To access to the Libelium Cloud using your web browser go to: https://cloud.libelium.com/mysignals/

If you don't have user/passw please contact to our Sales Dep. at: sales@libelium.com

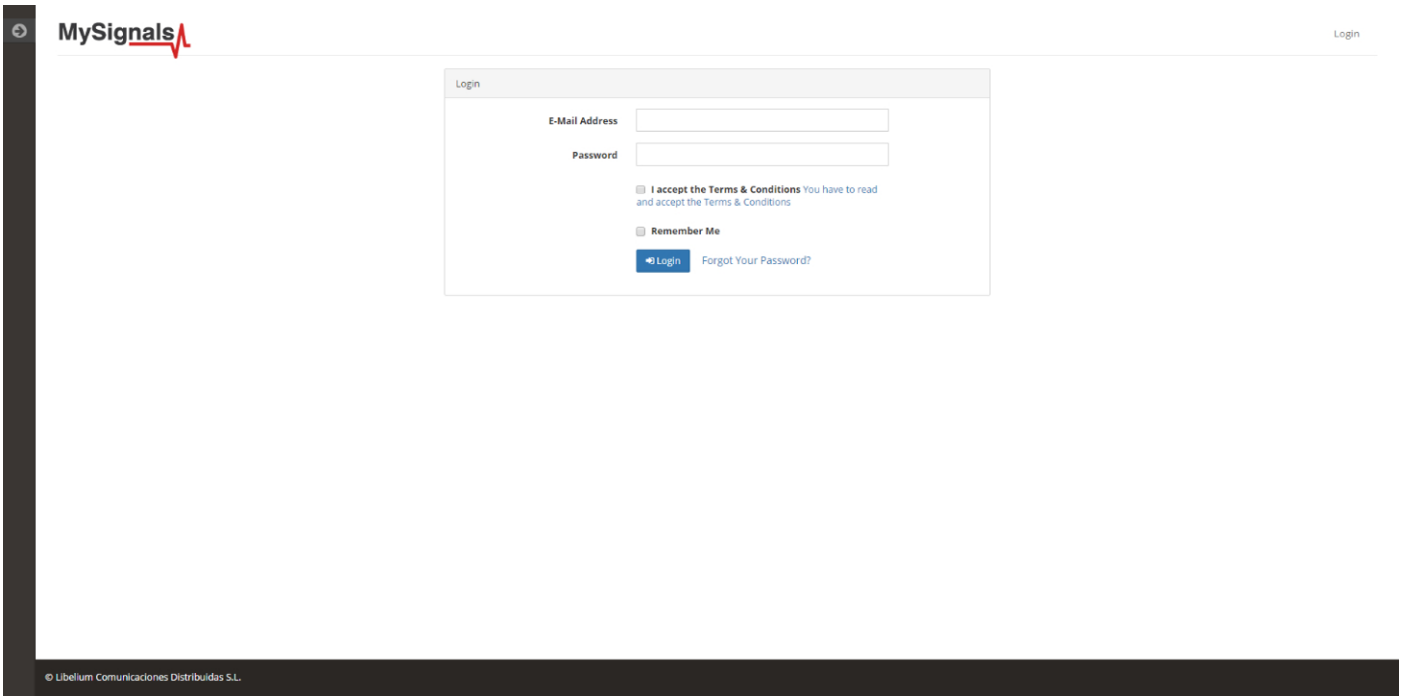


Figure : MySignals login

You can use the "Forgot your password" if you have problems with your login.

In each account you may have several user profiles. You can create, delete or modify your users.

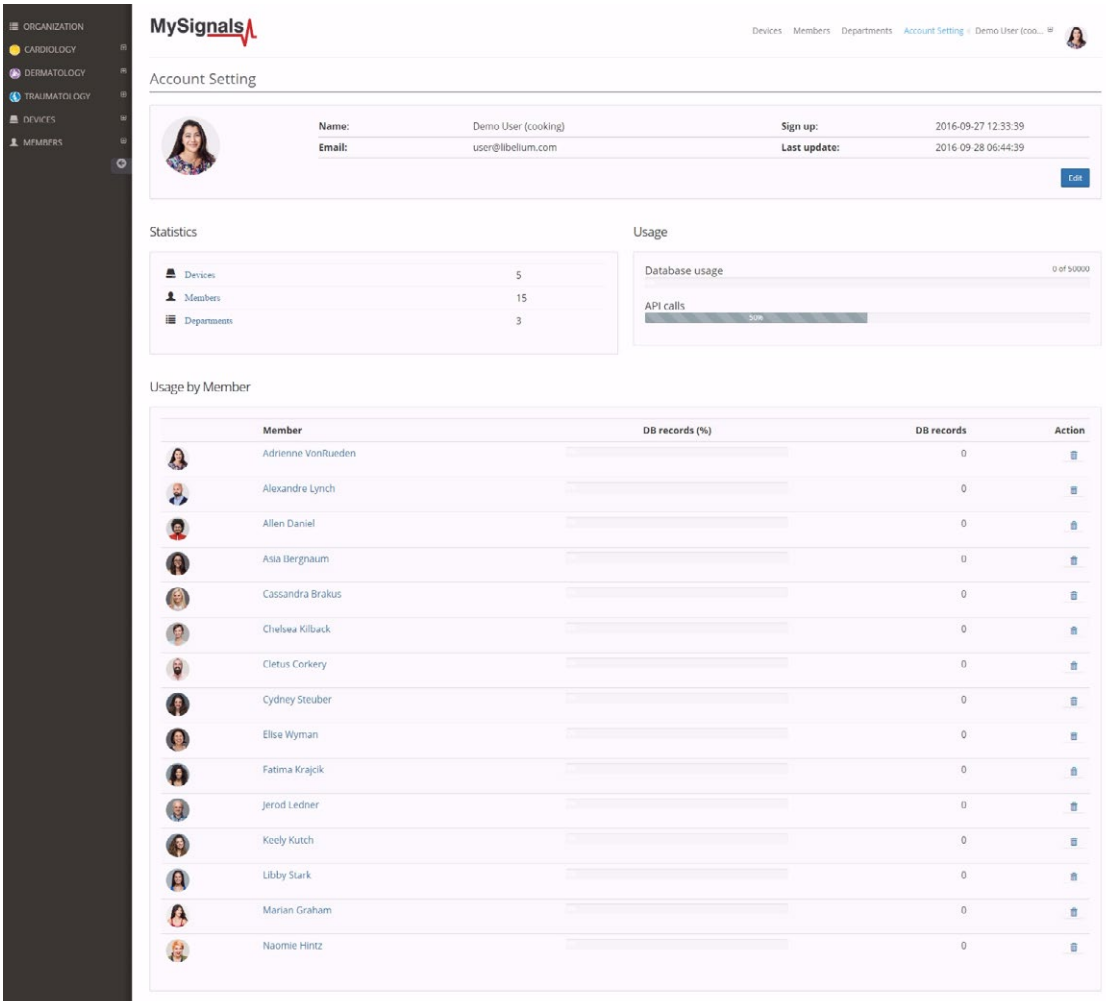


Figure : MySignals user

When the user starts the MySignals application for the first time and setup assistant prompts the user will be able to create a profile once the user logs in. It will show you a "First Steps" wizard in order to help you with the profile and device configuration.

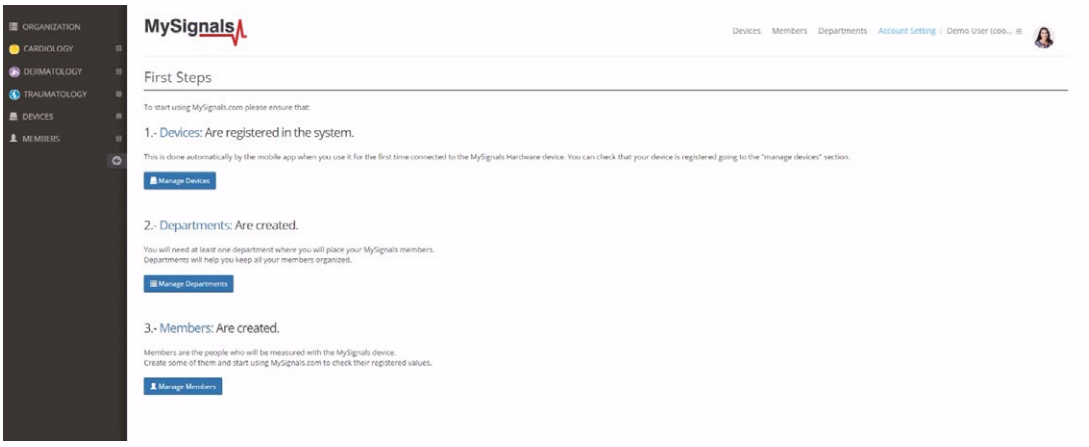


Figure : MySignals first steps

Each profile should be synchronized with cloud to be up-to-date with user information.

To configure MySignals application for each device, we will need to set common parameters.

You can see all the data of each device or user in the user's data section. device or user in the User Data section.

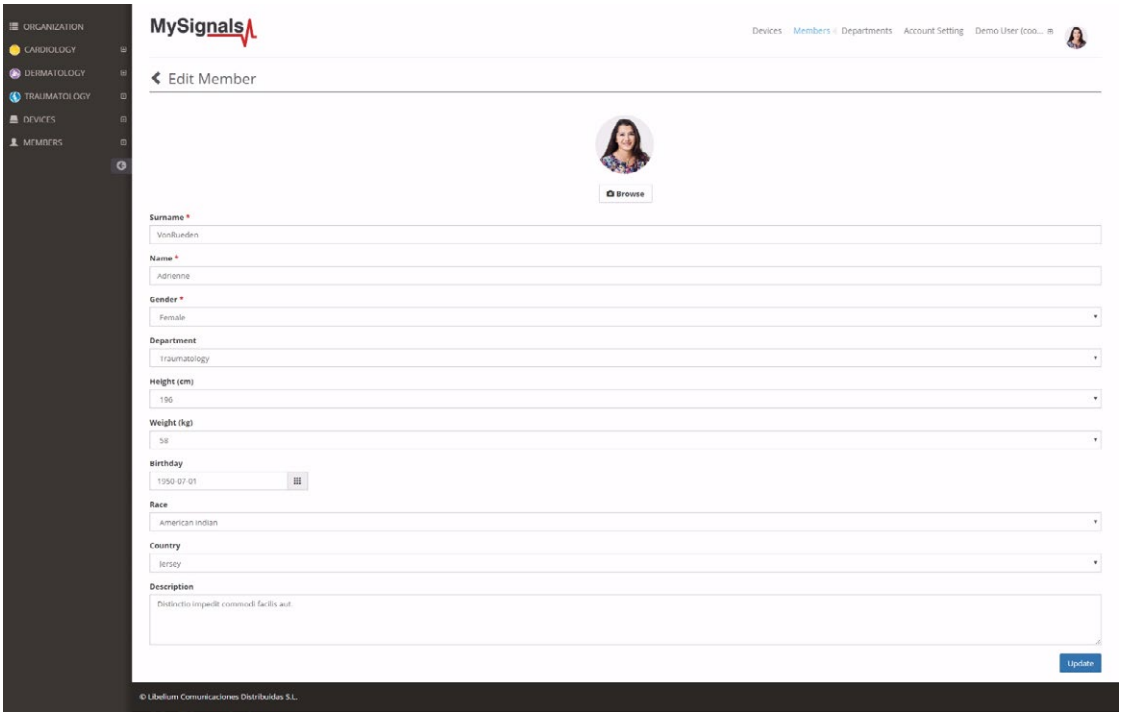


Figure : User Data MySignals Web

Using the Department, User or Device configuration sections you can create, configure or delete them.

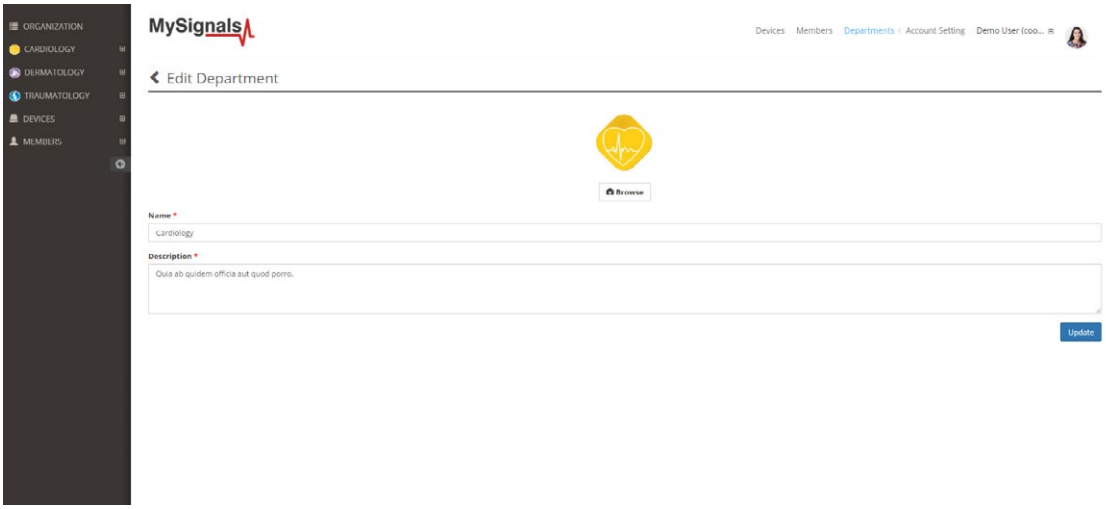


Figure : Department configuration MySignals Web

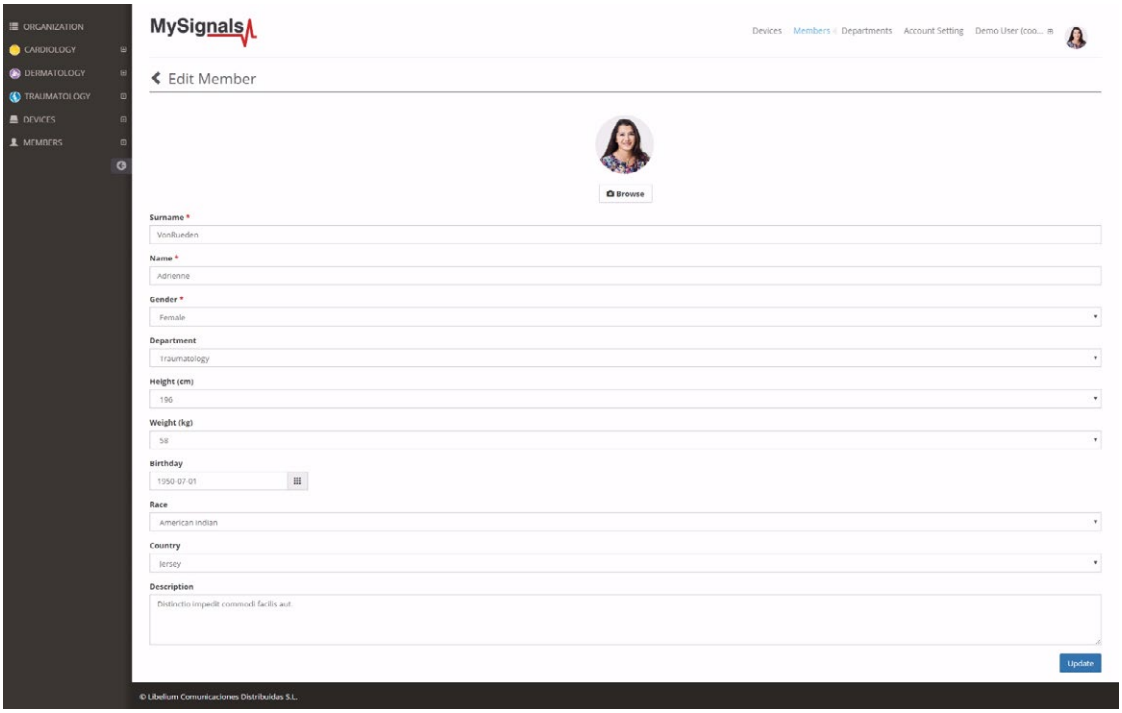


Figure : User configuration MySignals Web

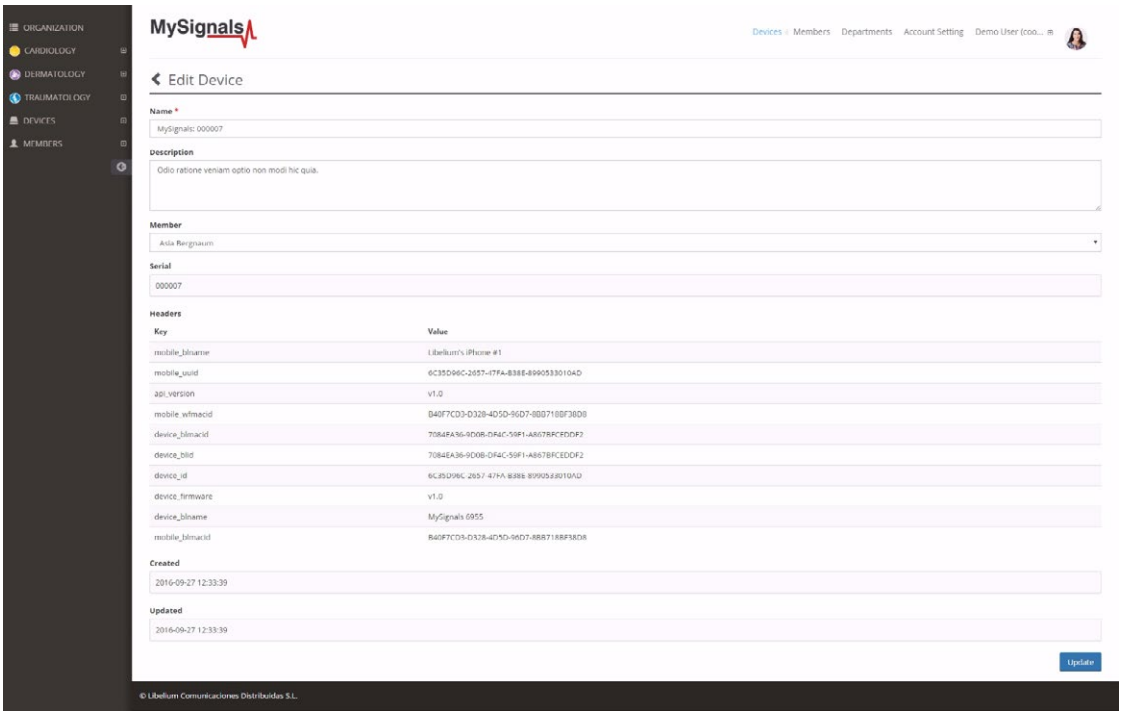


Figure : Devide configuration MySignals Web

You can configure too your personal profile.

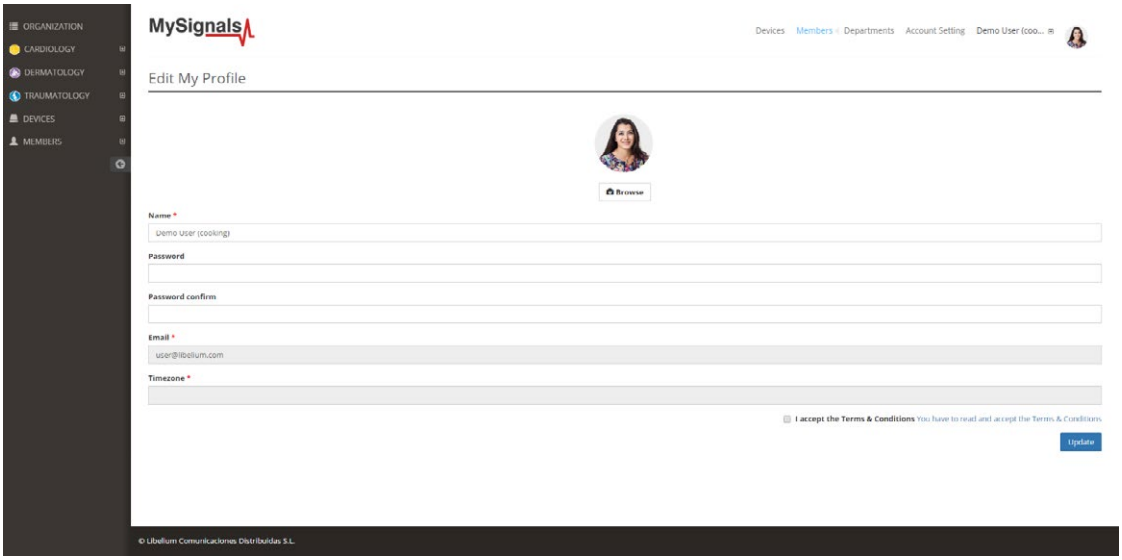


Figure : Personal profile MySignals Web

Now you can select the patient or device that you want monitor.

First of all choose the sensor that you want to visualize. You can use the fast access menu situated on the left side of the Web Server.

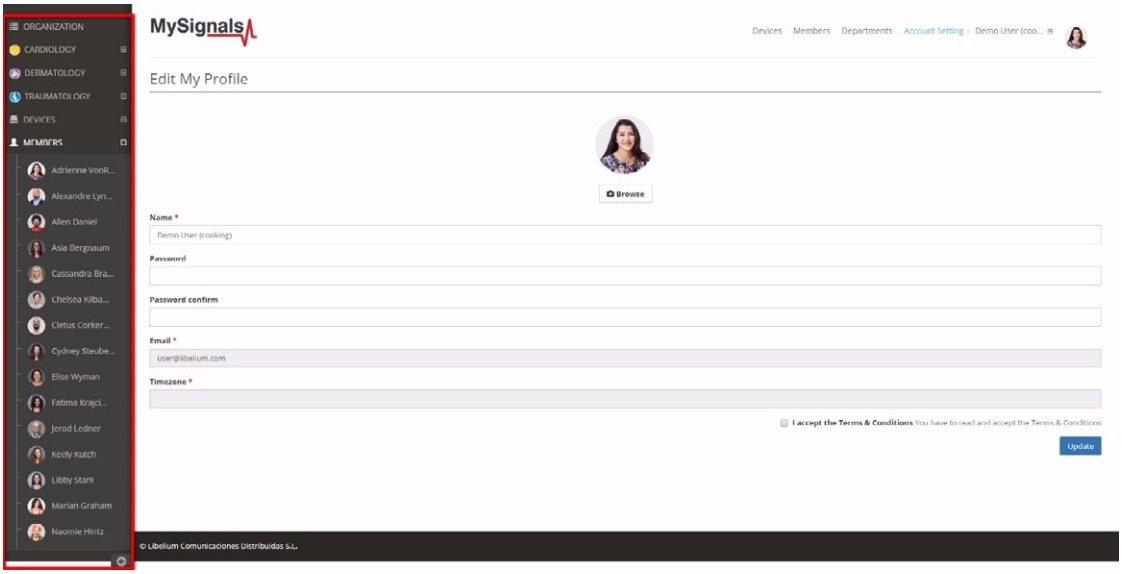


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

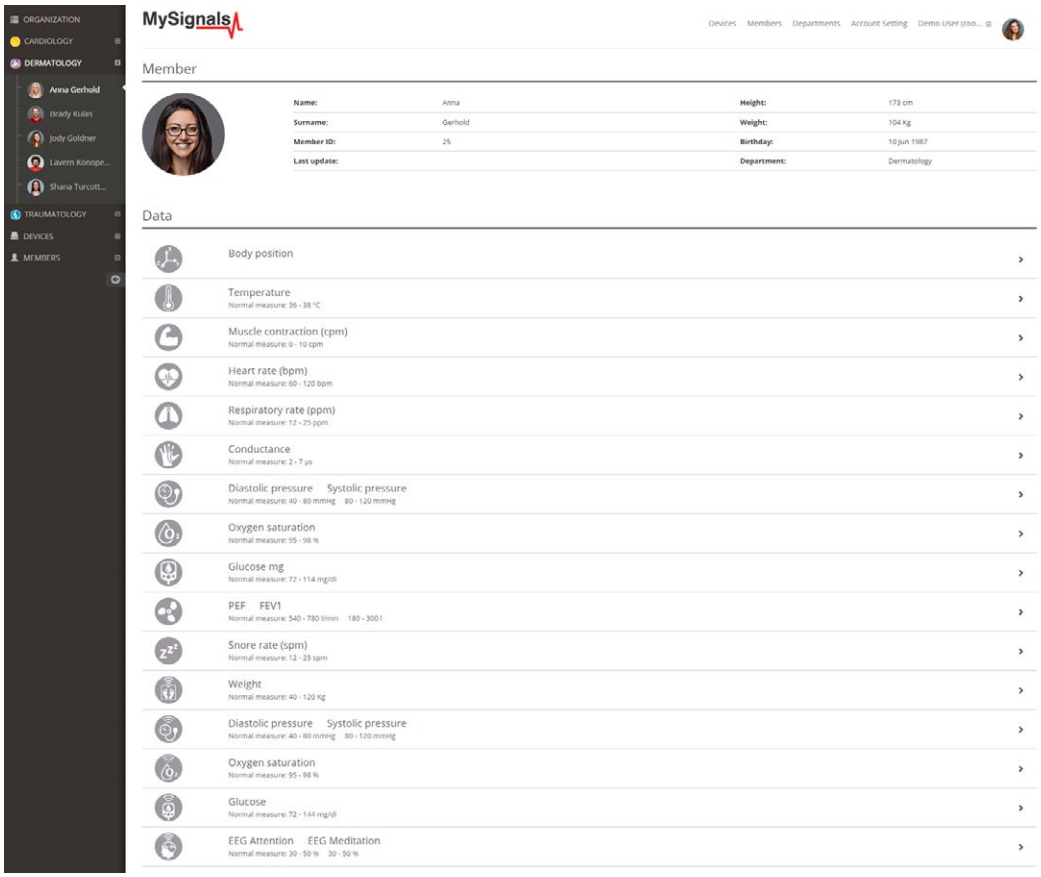


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

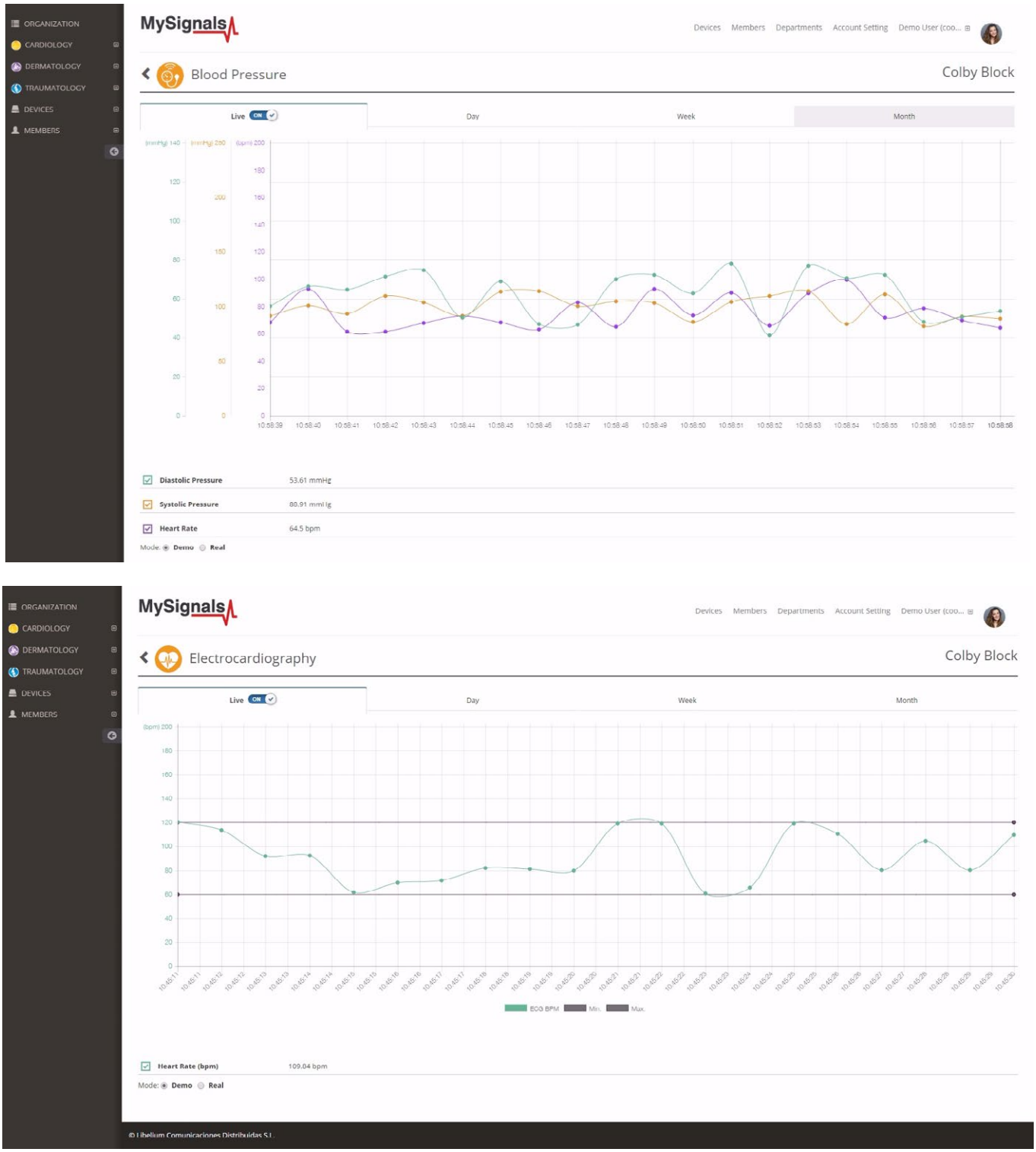


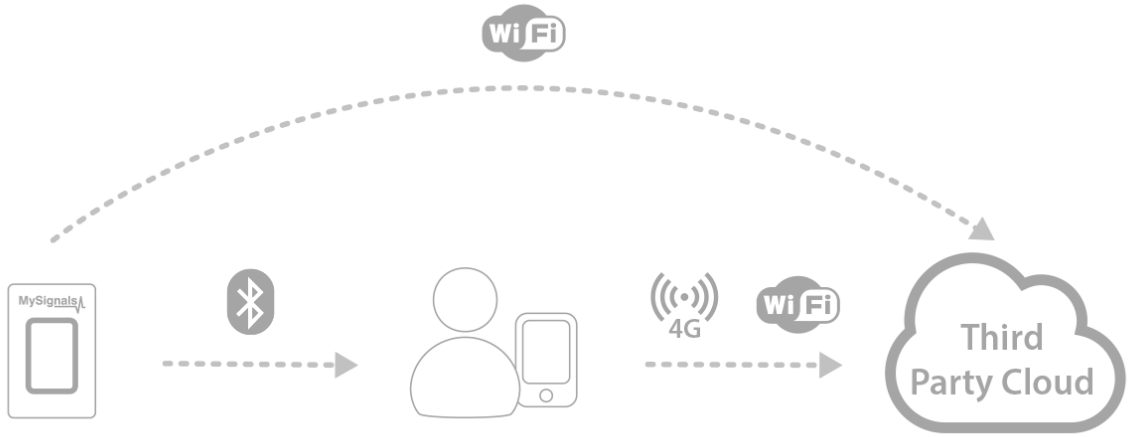
Figure : Detail mode Web Server

> ***Note:*** *The tabs 'day', 'week', 'month' in the charts represent the historical data of the member for this last periods of time. You will need to provide some data to the cloud before you can see values here.*
>
> *For instance the 'day' tab shows data sorted by hours. you will need to wait 1 hour until you can see values here. The same applies to the other tabs.*

5.4. Using a third party Cloud

Developers may migrate the information stored in the Libelium Cloud to a third party Cloud server easily using the API Cloud provided.

Developers may also send the information coming from MySignals to a third party Cloud server using their own App programmed with our Android or iOS API (using BLE). In the case of MySignals HW the information may be sent directly using the WiFi radio.



6. Sensors

MySignals allows you to measure more than 15 different biometric parameters such as pulse, breath rate, oxygen in blood, electrocardiogram signals, blood pressure, muscle electromyography signals, glucose levels, galvanic skin response, lung capacity, snore waves, patient position, airflow and body scale parameters (weight, bone mass, body fat, muscle mass, body water, visceral fat, Basal Metabolic Rate and Body Mass Index). These broad sensing portfolio makes MySignals the most complete eHealth platform in the market.

We offer broad range of both wired and wireless sensors:

Figure : MySignals Software Development Platform with Sensors

- My Signals Snore
- My Signals Body Position
- My Signals Electrocardiogram (ECG)
- My Signals Electromyography (EMG)
- My Signals Galvanic Skin Response (GSR)
- My Signals AirFlow
- My Signals Temperature
- My Signals Glucometer
- My Signals Blood pressure monitor
- My Signals Pulsioximeter SPO2
- My Signals Spirometer
- My Signals Pulsioximeter SPO2 (BLE)
- My Signals Blood pressure monitor (BLE)
- My Signals Glucometer (BLE)
- My Signals Scale (BLE)

This information is used to monitor in real time the state of a user or to get sensitive data in order to be subsequently analysed for biometric analysis. Biometric information gathered can be wirelessly sent using two connectivity options integrated available: Wi-Fi or Bluetooth Low Energy 4.0.

Note: *Do not connect or disconnect any sensor or connector while MySignals is ON. MySignals can become unstable or unresponsive, and internal parts can be damaged.*

6.1. Wired Sensors

MySignals Software Development Platform can work with 11 different wired biometric sensors.

MySignals has a new improved connection system. It is very easy-to-use jack-connectors method.

Figure : MySignals Software Development Platform with Wired Sensors

6.1.1. Pulse and Oxygen in Blood (SPO2)

6.1.1.1. Sensor features

Description: Pulse oximetry a noninvasive method of indicating the arterial oxygen saturation of functional hemoglobin.

Oxygen saturation is defined as the measurement of the amount of oxygen dissolved in blood, based on the detection of Hemoglobin and Deoxyhemoglobin. Two different light wavelengths are used to measure the actual difference in the absorption spectra of HbO2 and Hb. The bloodstream is affected by the concentration of HbO2 and Hb, and their absorption coefficients are measured using two wavelengths 660 nm (red light spectra) and 940 nm (infrared light spectra). Deoxygenated and oxygenated hemoglobin absorb different wavelengths.

Figure : Pulse and Oxygen in Blood (SPO2)

Deoxygenated hemoglobin (Hb) has a higher absorption at 660 nm and oxygenated hemoglobin (HbO2) has a higher absorption at 940 nm . Then a photo-detector perceives the non-absorbed light from the LEDs to calculate the arterial oxygen saturation.

A pulse oximeter sensor is useful in any setting where a patient's oxygenation is unstable, including intensive care, operating, recovery, emergency and hospital ward settings, pilots in unpressurized aircraft, for assessment of any patient's oxygenation, and determining the effectiveness of or need for supplemental oxygen.

Acceptable normal ranges for patients are from 95 to 99 percent, those with a hypoxic drive problem would expect values to be between 88 to 94 percent, values of 100 percent can indicate carbon monoxide poisoning.

The sensor needs to be connected to the specific SPO2 jack connector in MySignals board and it works with direct connector power supply.

Measurement:

Parameter	Unit	Range
Pulse	ppm	25~250 ppm
SPO2	%	35-100%

6.1.1.2. Connecting the sensor

Connect the sensor in the SPO2 connector indicated in the MySignals Hardware board. The sensor cable have only one way of connection to prevent errors and make the connection easier. Use the mini-USB connector to link the SPO2 with the MySignals board, using the jack connector of the cable in this side.

Figure : MySignals Hardware Development Platform with SPO2 connected

Place the SPO2 on your finger as shown in the image below.

Figure : SPO2 connection diagram

Insert your finger into the sensor and press ON button.

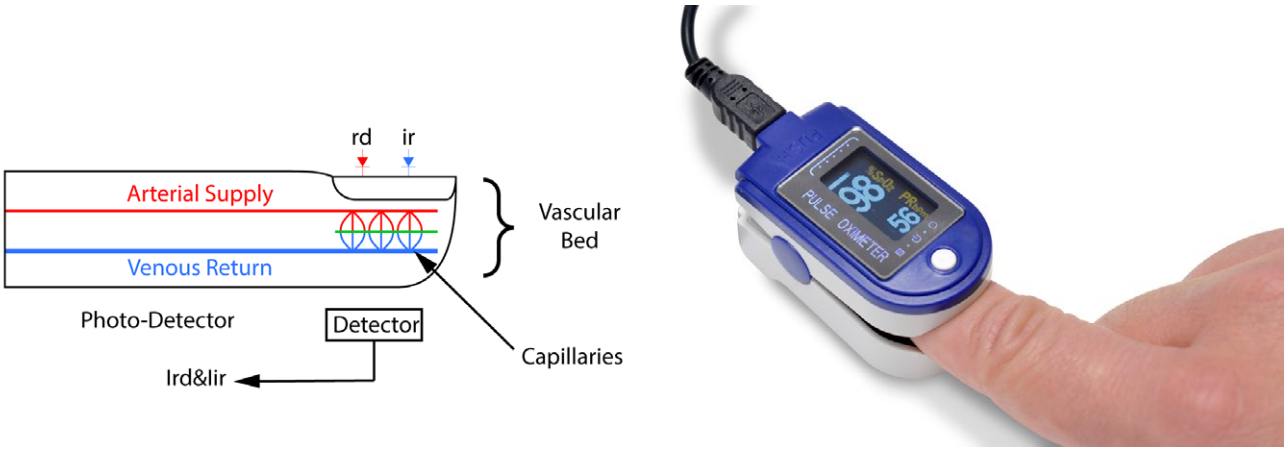


Figure : MySignals Hardware Development Platform with SPO2 situated in the user body

After a few seconds you will get the values in the sensor screen of the sensor and in the visualization method programmed.

6.1.1.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

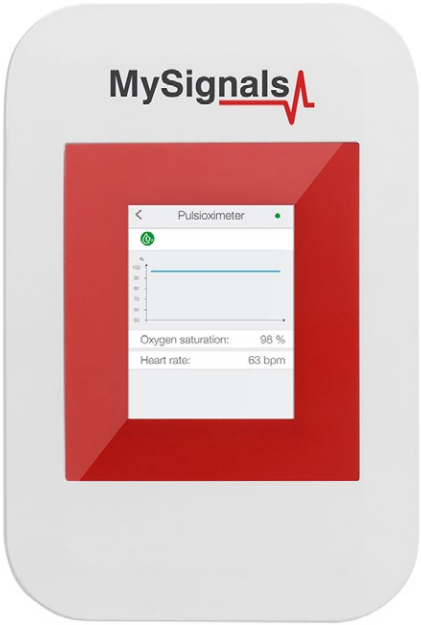


Figure : Detail mode

MySignals APP

This is an example of sensor viewing in MySignals APP Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use your smartphone touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo APP

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

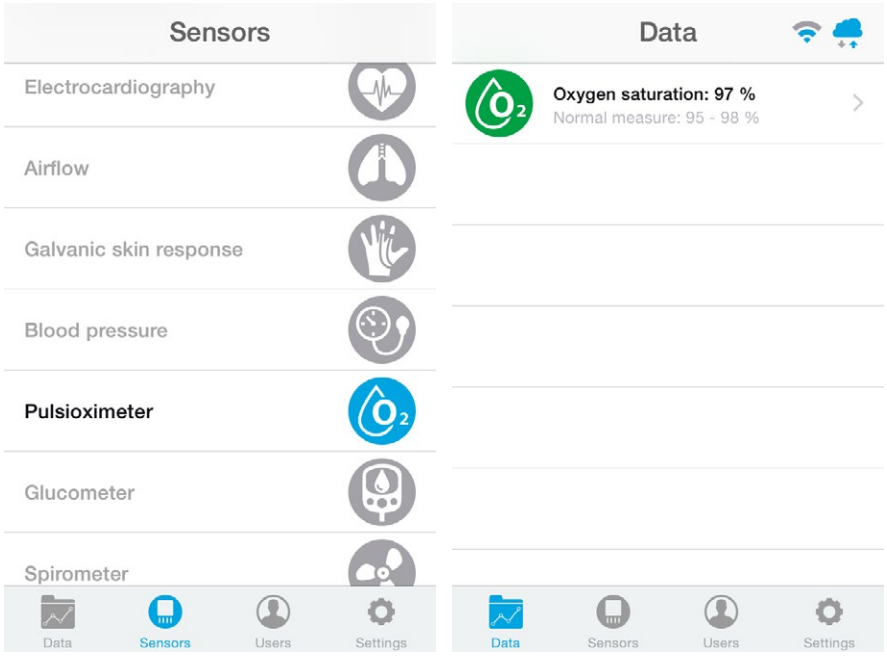


Figure : General mode and selecting general mode APP

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

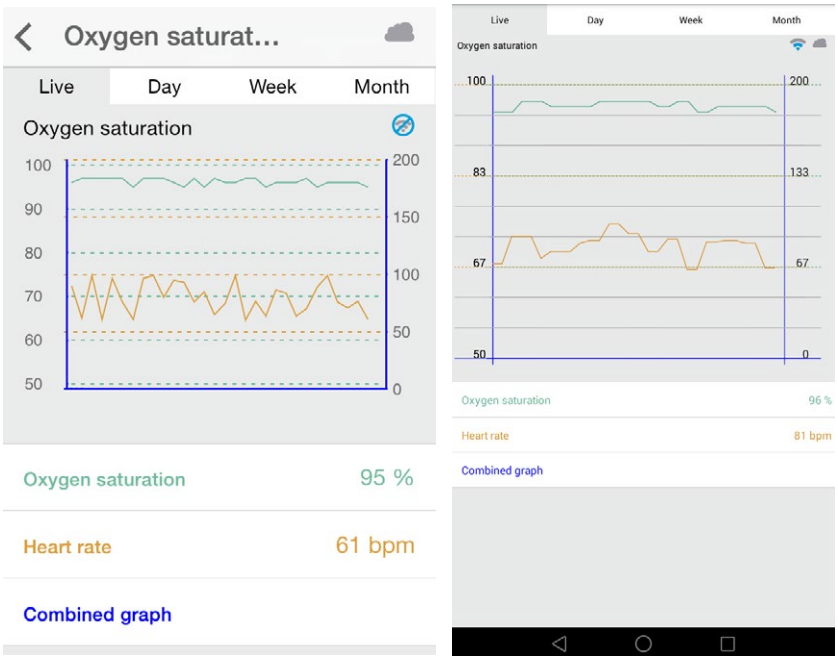


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

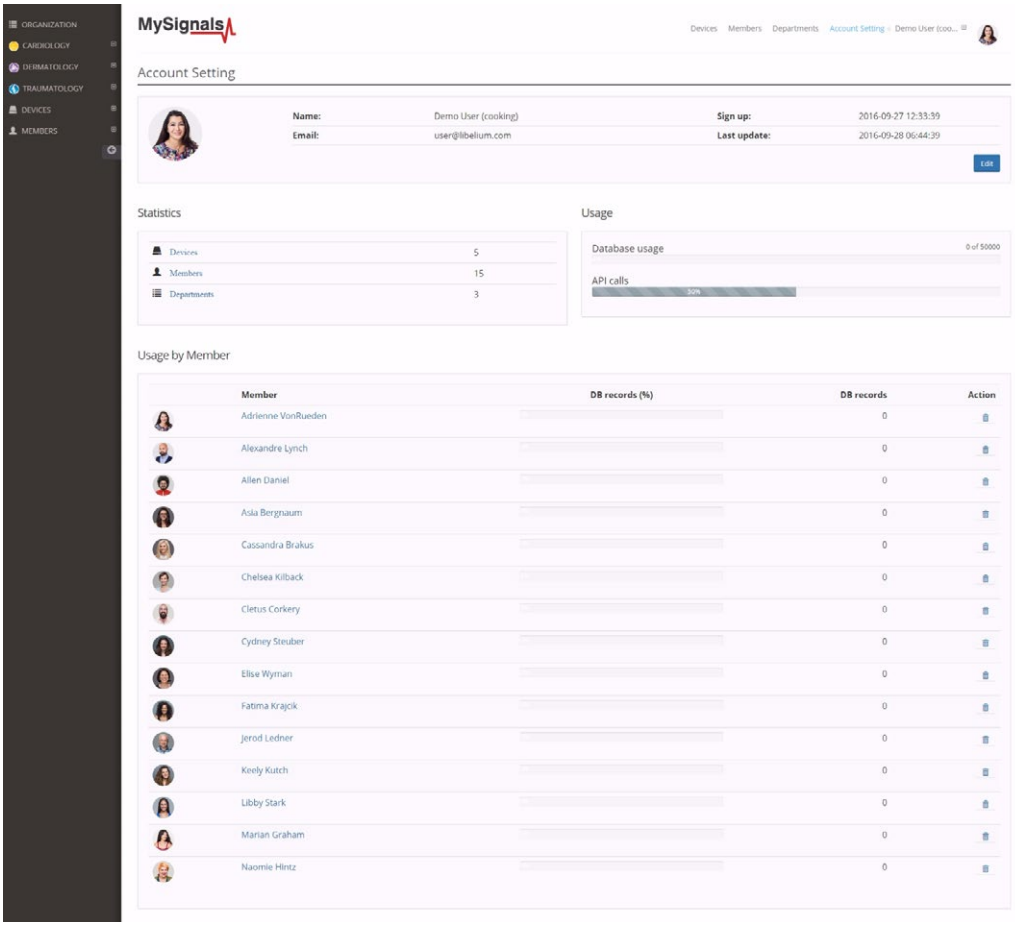


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

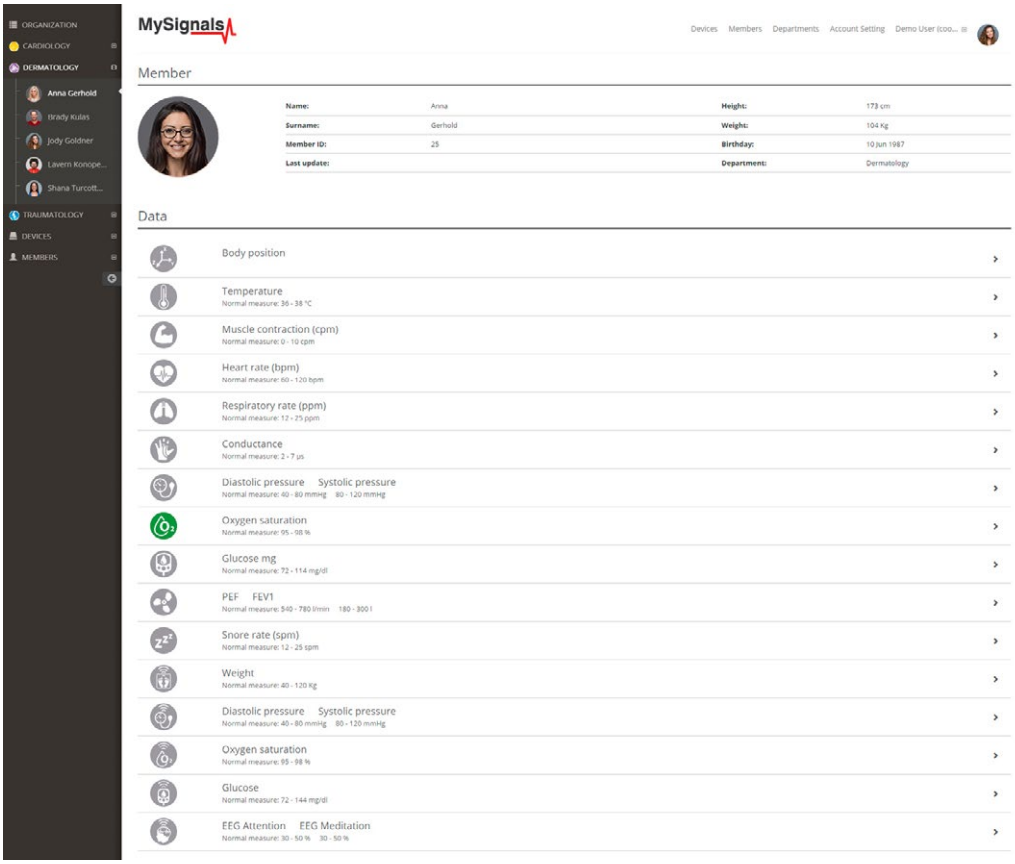


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

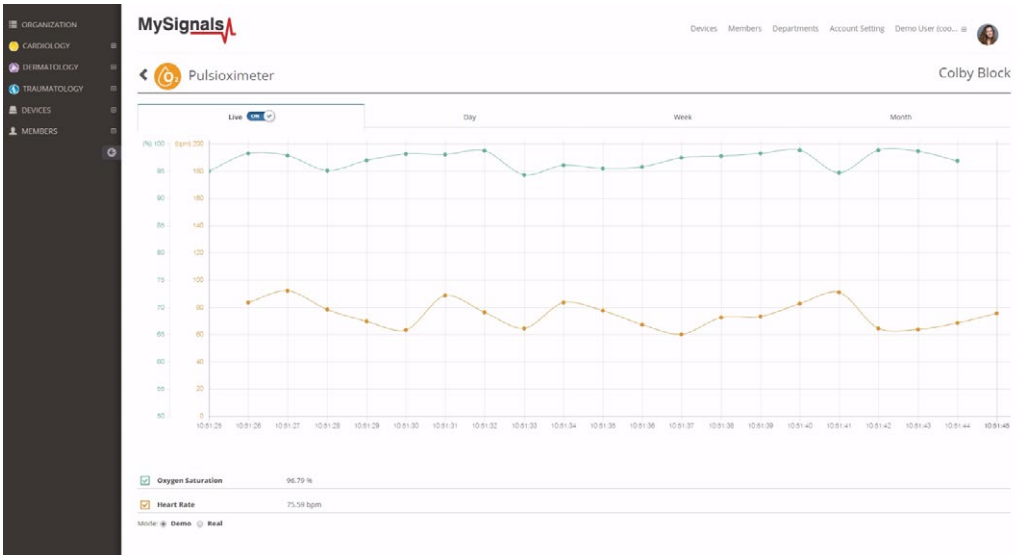


Figure : Detail mode Web Server

6.1.2. ECG

The Electrocardiogram Sensor (ECG) has grown to be one of the most commonly used medical tests in modern medicine. Its utility in the diagnosis of a myriad of cardiac pathologies ranging from myocardial ischemia and infarction to syncope and palpitations has been invaluable to clinicians for decades.

The accuracy of the ECG depends on the condition being tested. A heart problem may not always show up on the ECG. Some heart conditions never produce any specific ECG changes. ECG leads are attached to the body while the patient lies flat on a bed or table.

6.1.2.1. Sensor features

Description: The electrocardiogram (ECG) is a diagnostic tool that is routinely used to assess the electrical and muscular functions of the heart. The sensor use "Continuous telemetry electrocardiogram" for a prolonged monitoring including the use of three ECG electrodes.

Figure : ECG Sensor

The sensor needs to be connected to the specific ECG jack connector in MySignals board and it works with direct connector power supply.

What is measured or can be detected on the ECG (EKG)?

- The orientation of the heart (how it is placed) in the chest cavity.
- Evidence of increased thickness (hypertrophy) of the heart muscle.
- Evidence of damage to the various parts of the heart muscle.
- Evidence of acutely impaired blood flow to the heart muscle.
- Patterns of abnormal electric activity that may predispose the patient to abnormal cardiac rhythm disturbances.
- The underlying rate and rhythm mechanism of the heart.

Schematic representation of normal ECG

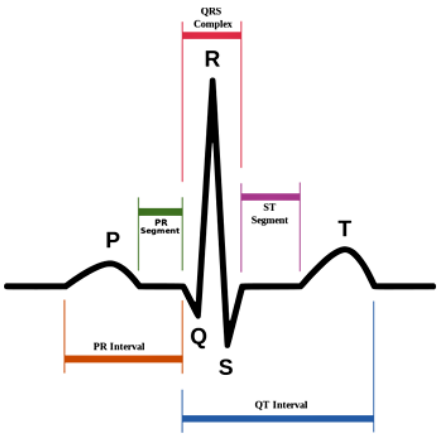


Figure : ECG Signal representation

Measurement:

Parameter	Unit	Range
Pulse rate	BPM (Beats per minute)	0-200 bpm
Electrocardiogram signal	Volts	0-5V

6.1.2.2. Connecting the sensor

Connect the jack sensor in the ECG connector indicated in the MySignals Hardware board. The sensor cable have only one way of connection to prevent errors and make the connection easier.

Figure : MySignals Hardware Development Platform with ECG connected

Connect the ECG lead to the electrodes.

Figure : ECG connecting ECG electrodes

***NOTE:** Connect the ECG Electrodes to the ECG sensor before placing them in the user body.*

Remove the protective plastic. You can use a specific conductive gel in order to improve the quality signal of the sensor.

Figure : ECG electrodes removing protective plastic

This sensor use disposable pre-gelled electrodes.

These high quality disposable electrodes are to be used to measure EEG, ECG and EMG. They are to be used once and are very handy because of integrated gel. They adhere very well to the skin and are clean to use.

The snap-on connector can easily be pushed on or removed from the electrode lead.

Place the electrodes as shown below.

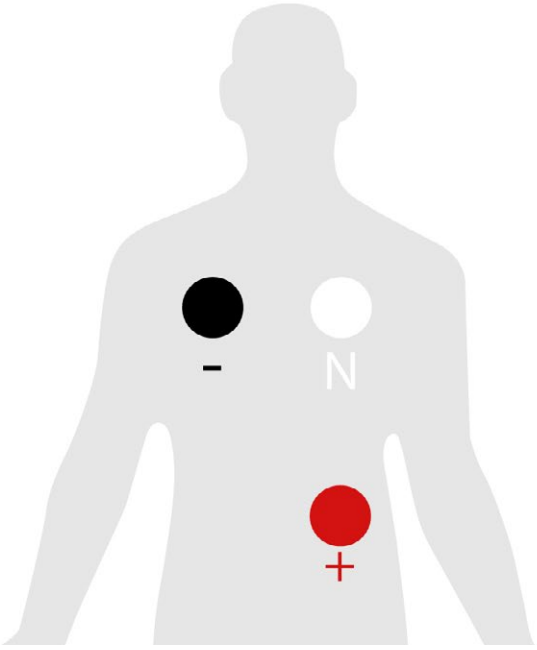


Figure : ECG position diagram

After a few seconds you will get the values in the visualization method programmed.

NOTE: *The sensor is designed to work on a user in supine position and under conditions of maximum relaxation. It is recommended not use this sensor in environments with excessive electromagnetic noise.*

6.1.2.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. Y8ou can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

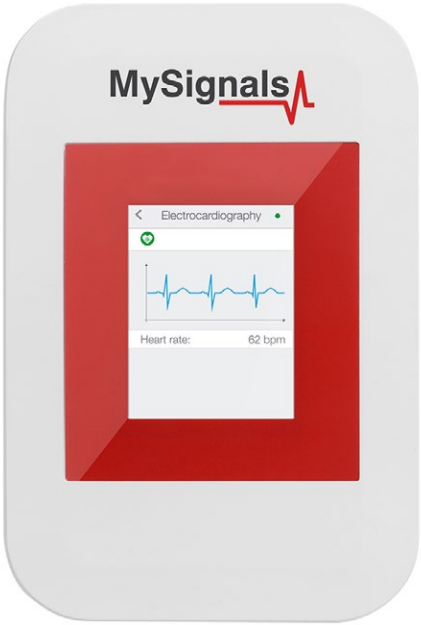


Figure : Detail mode

MySignals APP

This is an example of sensor viewing in MySignals APP Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use your smartphone touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo APP

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

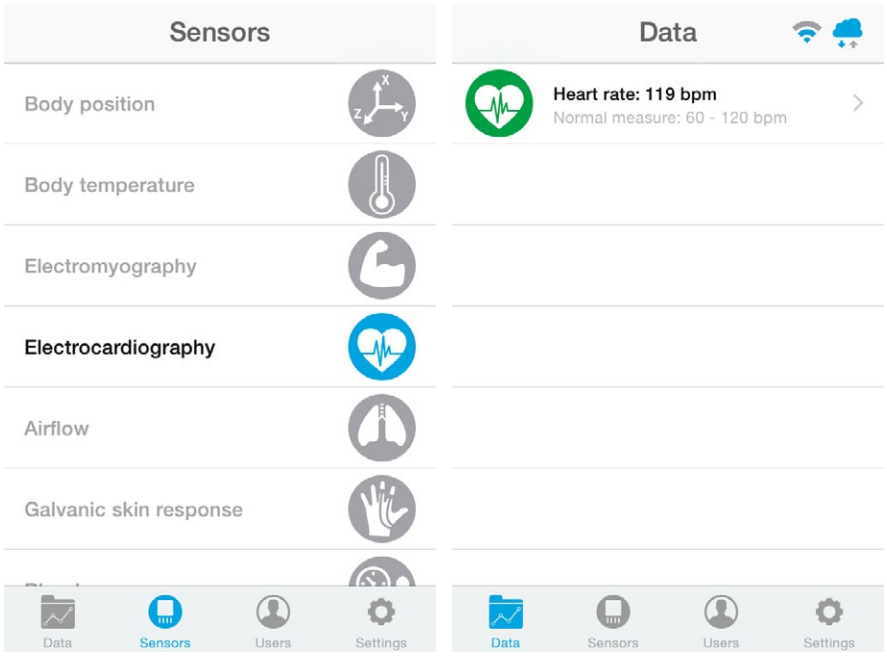


Figure : General mode and selecting general mode APP

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

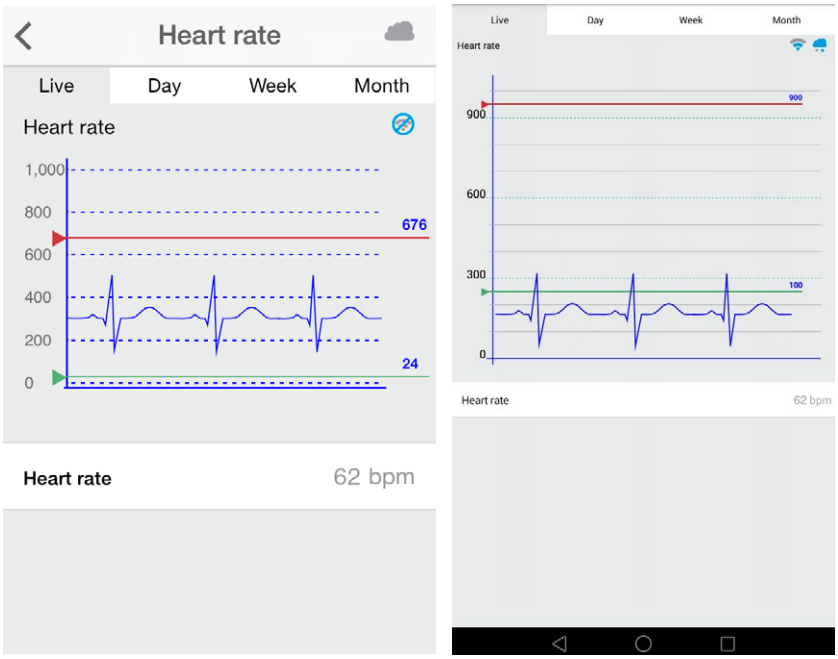


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

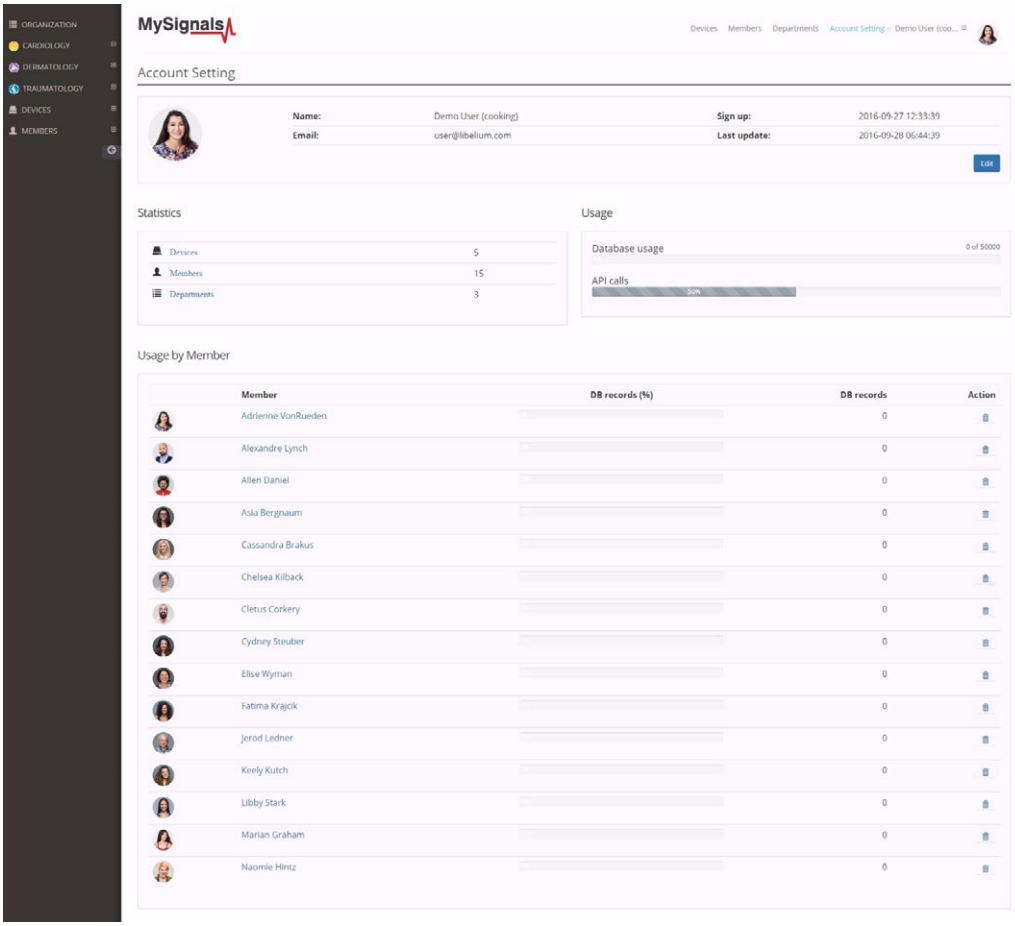


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

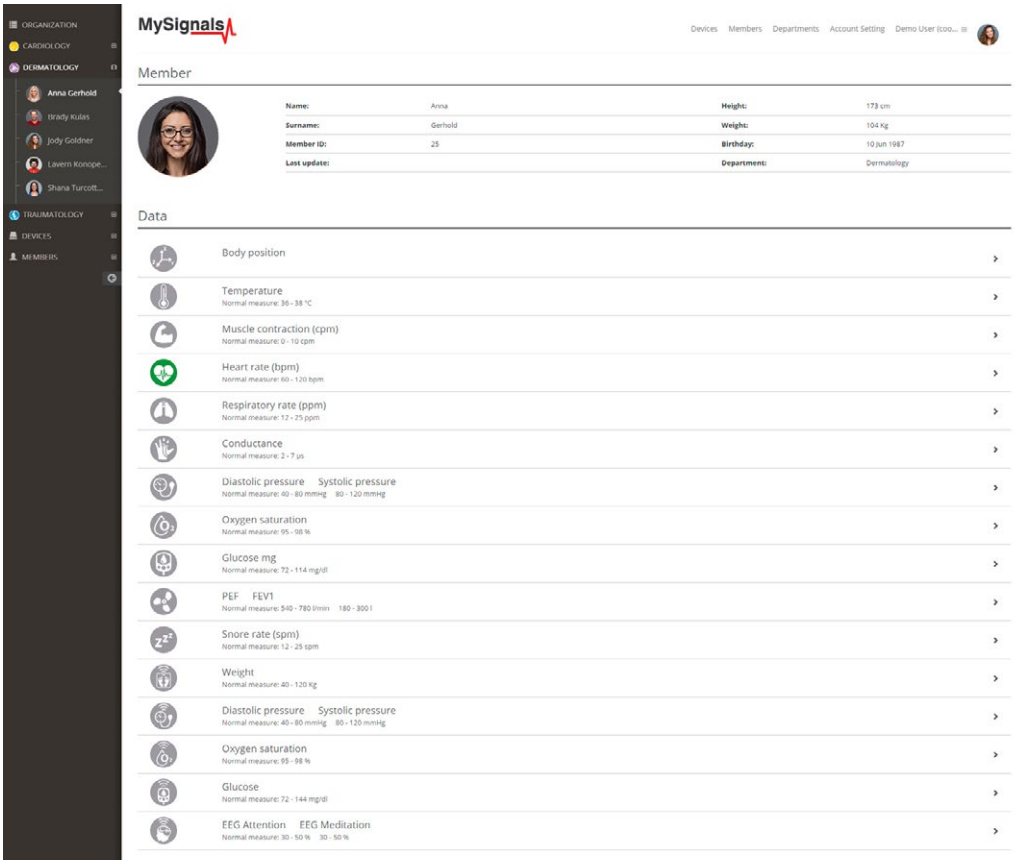


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

Figure : Detail mode Web Server

6.1.3. Airflow

Anormal respiratory rates and changes in respiratory rate are a broad indicator of major physiological instability, and in many cases, respiratory rate is one of the earliest indicators of this instability. Therefore, it is critical to monitor respiratory rate as an indicator of patient status. AirFlow sensor can provide an early warning of hypoxemia and apnea.

6.1.3.1. Sensor features

Description: The nasal / mouth airflow sensor is a device used to measure the breathing rate in a patient in need of respiratory help or person. This device consists of a flexible thread which fits behind the ears, and a set of two prongs which are placed in the nostrils. Breathing is measured by these prongs.

The specifically designed cannula/holder allows the thermocouple sensor to be placed in the optimal position to accurately sense the oral/nasal thermal airflow changes as well as the nasal temperature air. Comfortable adjustable and easy to install.

Figure : Airflow Sensor

The sensor needs to be connected to the specific Airflow jack connector in MySignals board and it works with direct connector power supply.

Measurement:

Parameter	Unit	Range
Respiratory rate	PPM (Peaks per minute)	0-60 ppm
Breathing intensity	Volts	0-3,3V

6.1.3.2. Connecting the sensor

Connect the sensor in the Airflow connector indicated in the MySignals Hardware board. The sensor cable include 2 pieces and it have only one way of connection to prevent errors and make the connection easier.

Figure : MySignals Hardware Development Platform with Airflow connected

The sensor integrate a extension cable with a "keyhole" connector. This middle connector have specific position in order to have the correct polarity. Please check the marks includes in the side of both connectors.

Figure : 2 pieces polarity Airflow cable

Place the sensor as shown below.

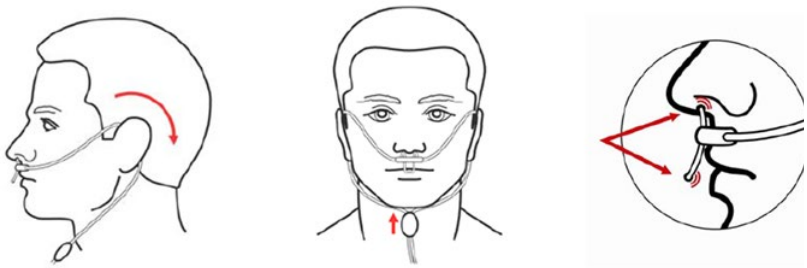
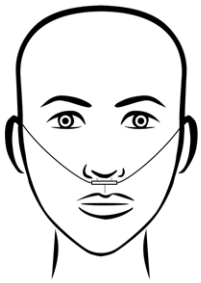


Figure : Airflow position diagram

The galvanic skin sensor has two contacts and it works like a ohmmeter measuring the resistance of the materials. Place your sensor as shown in the image below.



MySignals Hardware Development Platform with Airflow situated in the user body

After a few seconds you will get the values in the visualization method programmed.

> ***NOTE:*** *Position the sensor in the correct position as you can see in the diagram connection, and wait 3-5 minutos in order to stabilize the sensor measure.*

6.1.3.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

Figure : Detail mode

MySignals APP

This is an example of sensor viewing in MySignals APP Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use your smartphone touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo APP

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

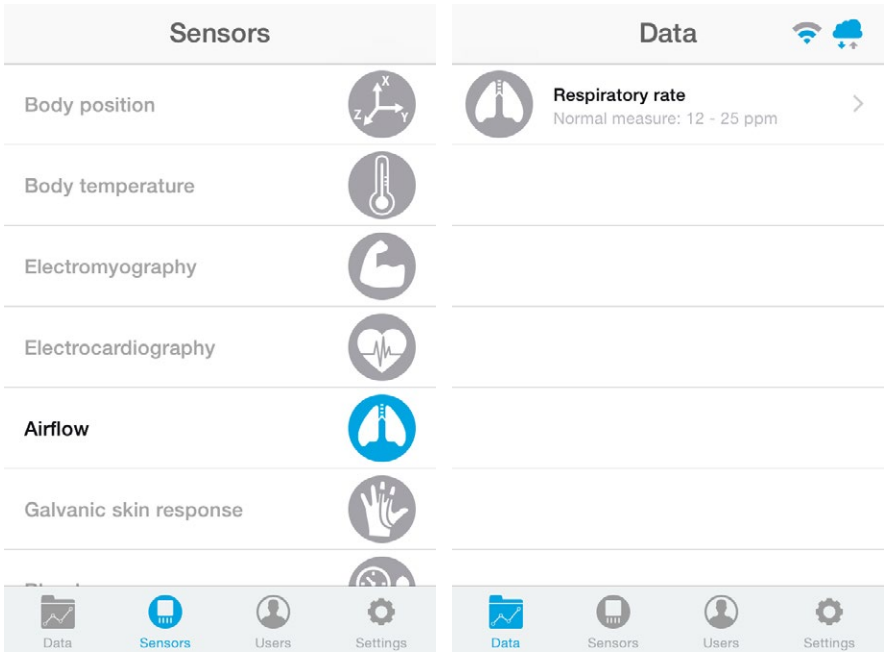


Figure : General mode and selecting general mode APP

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

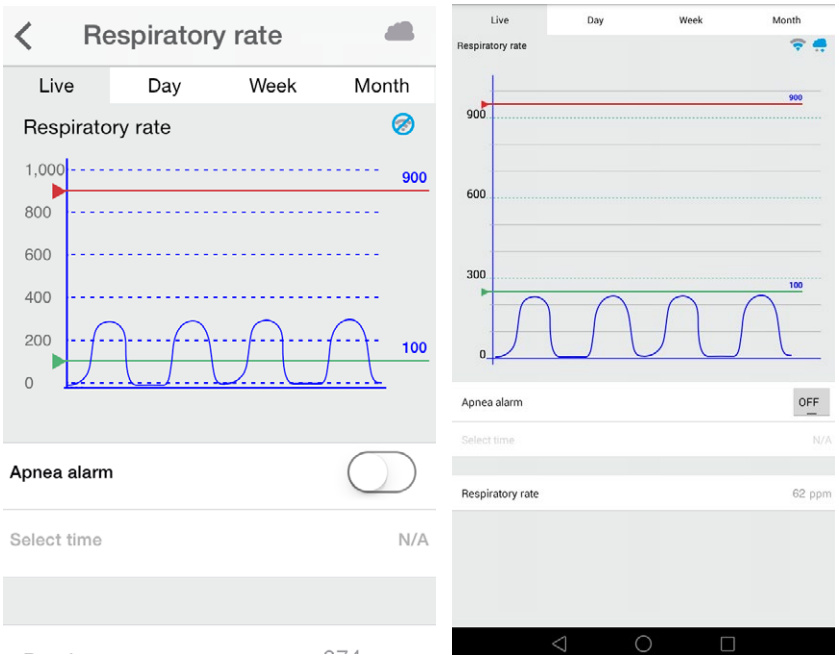


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

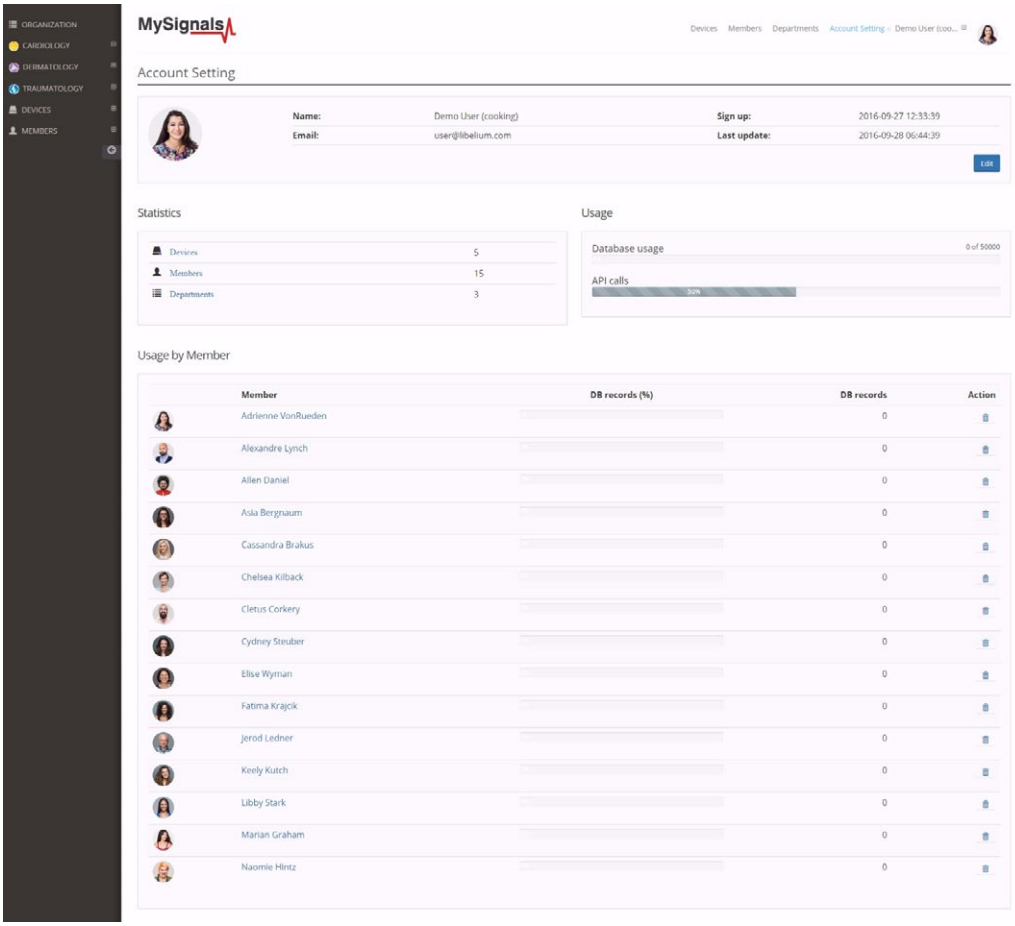


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

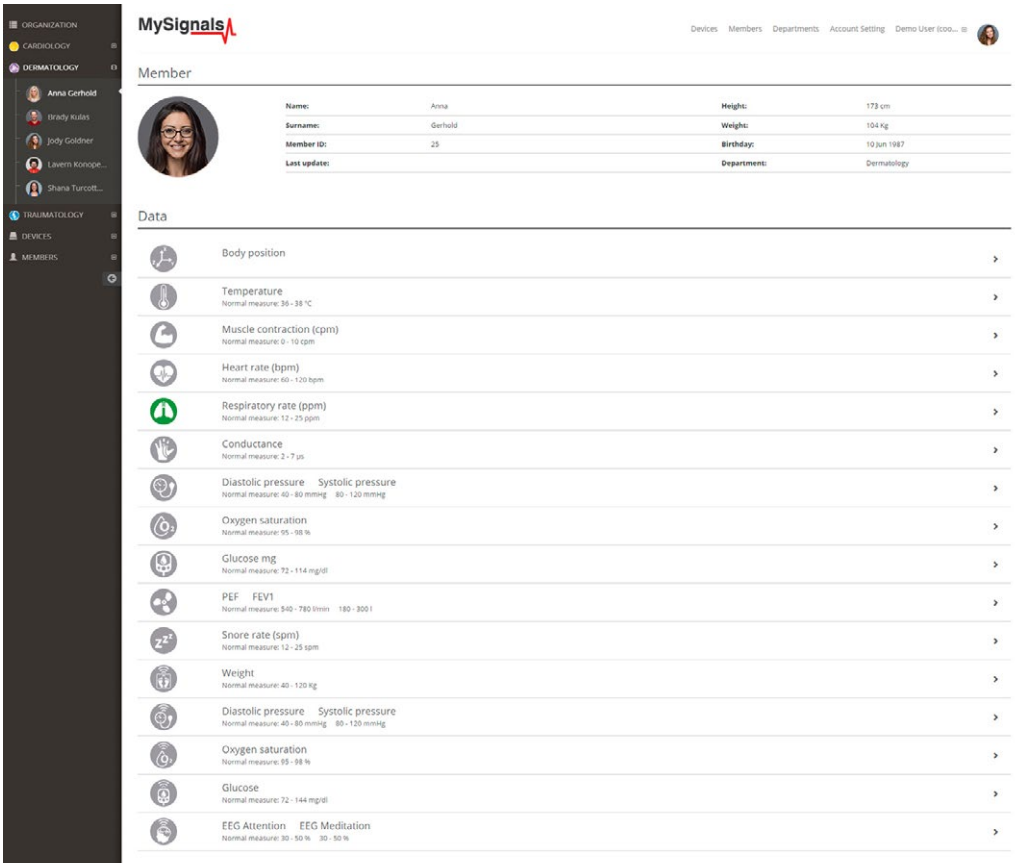


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

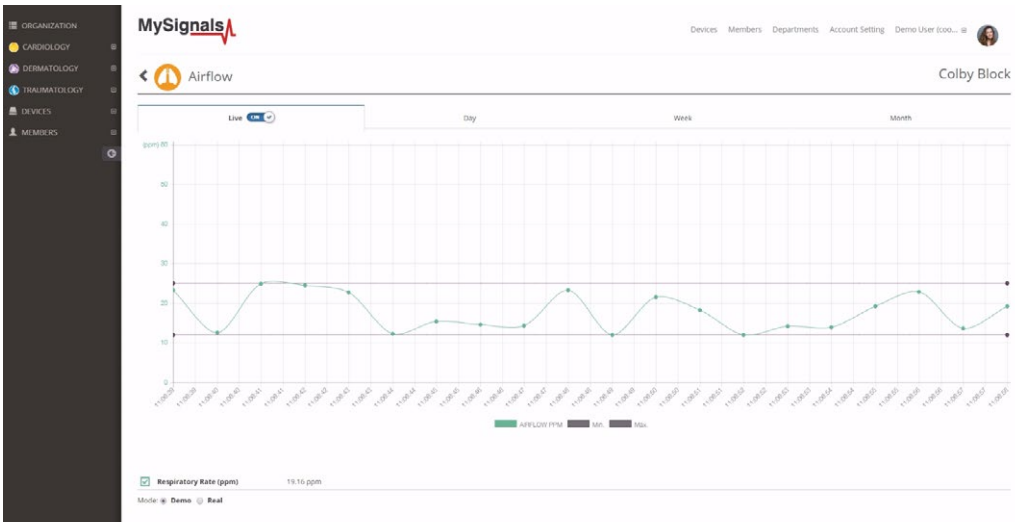


Figure : Detail mode Web Server

6.1.4. Blood Pressure Monitor

Blood pressure is the pressure of the blood in the arteries as it is pumped around the body by the heart. When your heart beats, it contracts and pushes blood through the arteries to the rest of your body. This force creates pressure on the arteries. Blood pressure is recorded as two numbers—the systolic pressure (as the heart beats) over the diastolic pressure (as the heart relaxes between beats).

6.1.4.1. Sensor features

Description: Monitoring blood pressure at home is important for many people, especially if you have high blood pressure. Blood pressure does not stay the same all the time. It changes to meet your body's needs. It is affected by various factors including body position, breathing or emotional state, exercise and sleep. It is best to measure blood pressure when you are relaxed and sitting or lying down.

Figure : Blood Pressure sensor

Classification of blood pressure for adults (18 years and older)

	Systolic (mm Hg)	Diastolic (mm Hg)
Hypotension	< 90	< 60
Desired	90–119	60–79
Prehypertension	120–139	80–89
Stage 1 Hypertension	140–159	90–99
Stage 2 Hypertension	160–179	100–109
Hypertensive Crisis	≥ 180	≥ 110

High blood pressure (hypertension) can lead to serious problems like heart attack, stroke or kidney disease. High blood pressure usually does not have any symptoms, so you need to have your blood pressure checked regularly.

SPECIAL FEATURES:

- Automatic measurement of systolic, diastolic and pulse
- 80 measurement results with time & date stored in the device

KEY SPECIFICATIONS

- Measurement method: Oscillometric system
- Measuring range: Pressure 0-300 mmHg
- Pulse 30~200 p/min
- Measuring accuracy: Pressure≤±3 mmHg
- Pulse ≤ 5%
- Operating environment: Temperature 10 - 40ºC
- Relative humidity ≤ 80%

The sensor needs to be connected to the specific Blood Pressure Monitor jack connector in MySignals board and it works with internal rechargeable battery. Use the Blood pressure specific cable in order to charge the sensor connected to MySignals.

Figure : Blood Pressure sensor with charger cable connected

Measurement:

Parameter	Unit	Range
Systolic pressure	mm Hg	0-300 mmHg
Diastolic pressure	mm Hg	0-300 mmHg
Pulse	ppm	30~200 ppm

6.1.4.2. Connecting the sensor

Connecting the sensor

Connect the sensor in the Blood Pressure connector indicated in the MySignals Hardware board. The sensor cable have only one way of connection to prevent errors and make the connection easier. Use the mini-USB connector to link the Blood Pressure monitor with the MySignals board, using the normal jack connector (3.5mm) of the cable in this side.

Before start using the sphygmomanometer we need to connect the sensor in MySignals board. After that we can get all the information contained in the device.

Figure : Cable connection Blood Pressure

Place the sphygmomanometer on your arm (biceps zone) as shown in the image below.

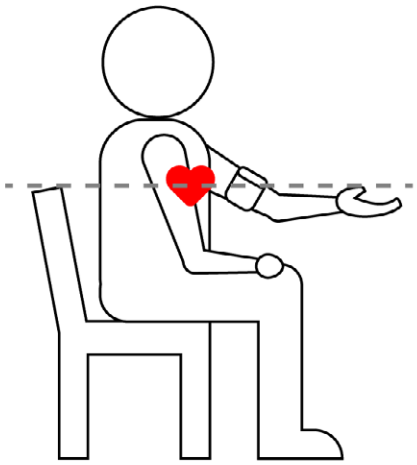


Figure : Blood Pressure connection diagram

Turn on the sphygmomanometer cuff (press ON button). The sensor will begin to make a measurement. In order to measure correctly is important to maintain the arm and the cuff in the correct position.

Figure : Blood Pressure sensor ON button

Do not make abrupt movements or the measure will be not reliable.

The sphygmomanometer will take a few moments to calculate the blood pressure reading.

Figure : MySignals Hardware Development Platform with Blood Pressure situated in the user body

After a few seconds you will get the values in the visualization method programmed.

6.1.4.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

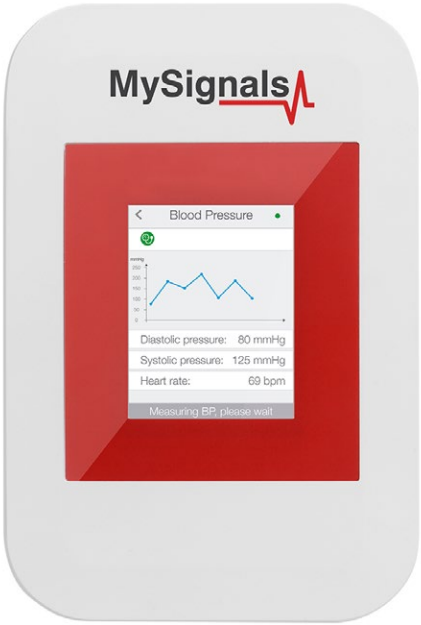


Figure : Detail mode

MySignals APP

This is an example of sensor viewing in MySignals APP Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use your smartphone touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo APP

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

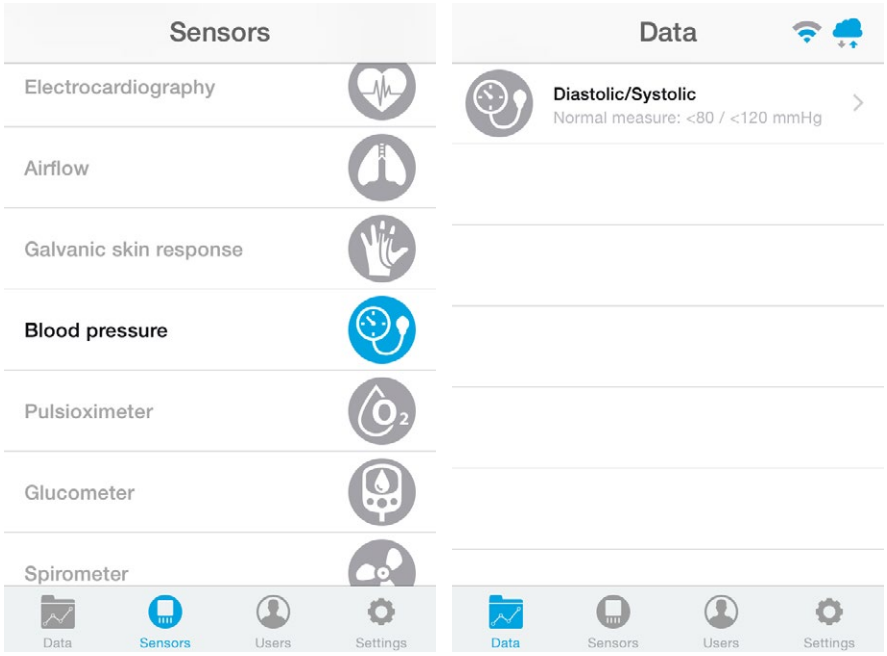


Figure : General mode and selecting general mode APP

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

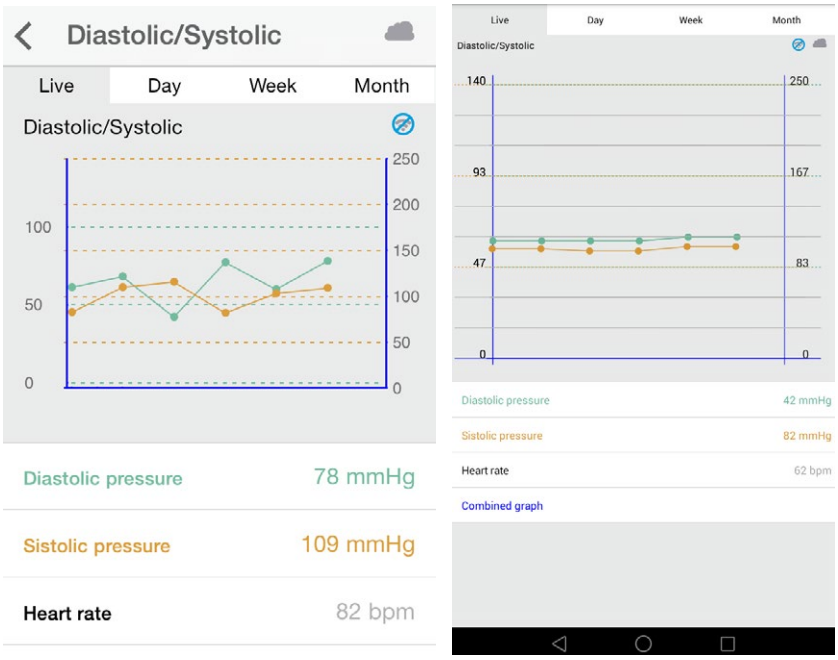


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

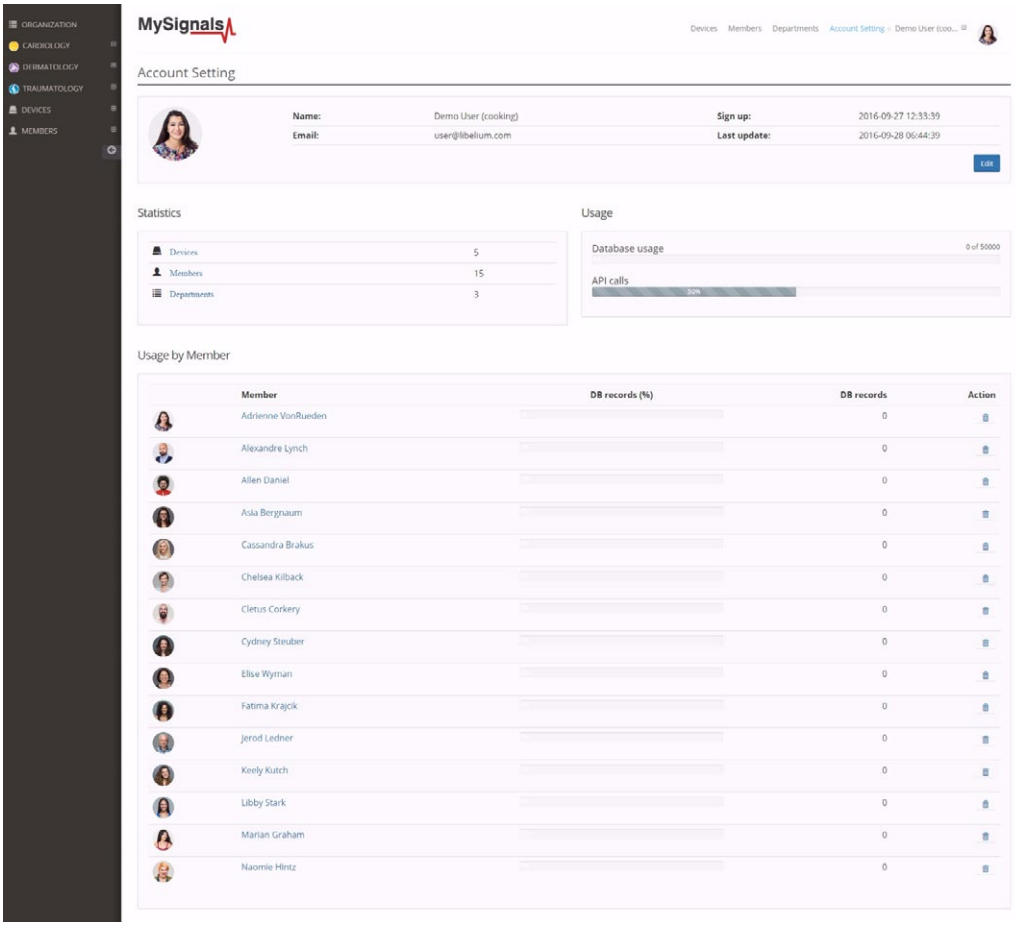


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

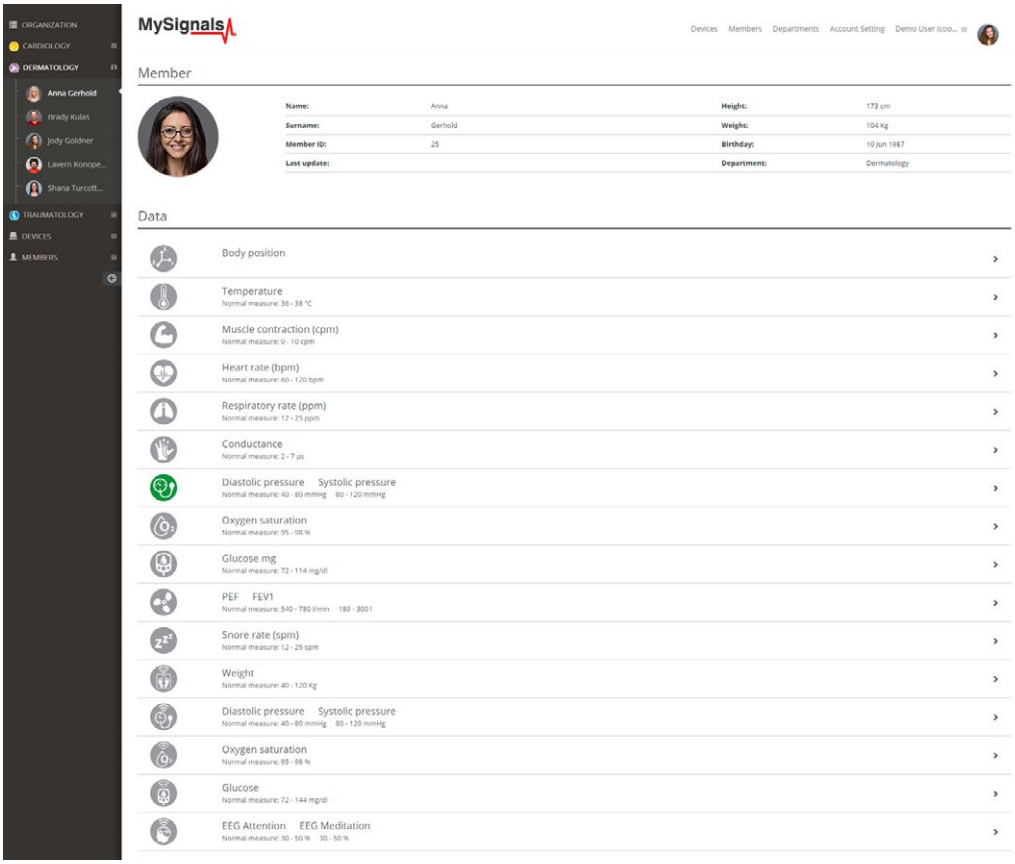


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

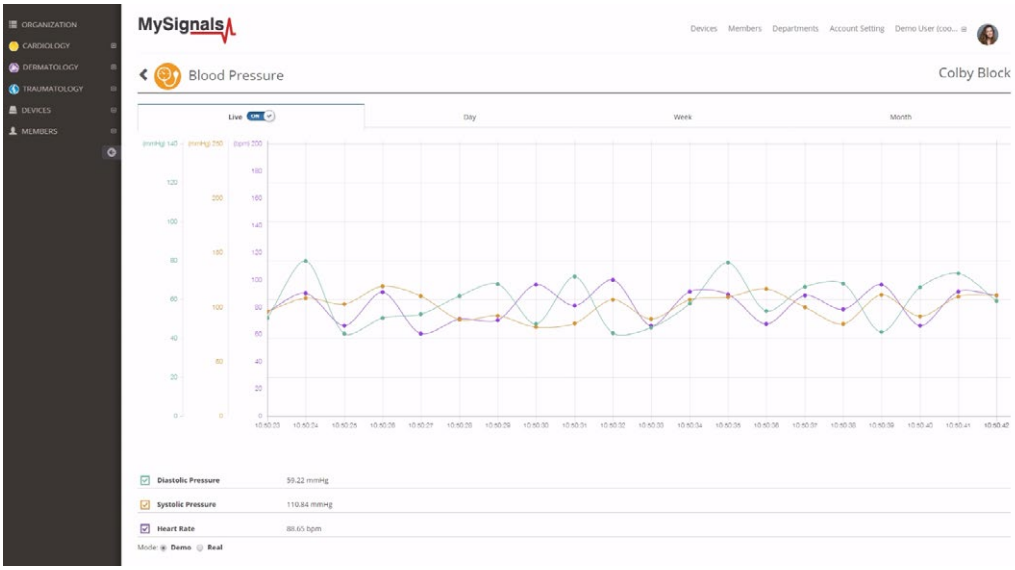


Figure : Detail mode Web Server

6.1.5. Glucometer

Despite widely variable intervals between meals or the occasional consumption of meals with a substantial carbohydrate load, human blood glucose levels tend to remain within the normal range. However, shortly after eating, the blood glucose level may rise, in non-diabetics, temporarily up to 7.8 mmol/L (140 mg/dL) or a bit more.

6.1.5.1. Sensor features

Description: Glucometer is a medical device for determining the approximate concentration of glucose in the blood. A small drop of blood, obtained by pricking the skin with a lancet, is placed on a disposable test strip that the meter reads and uses to calculate the blood glucose level. The meter then displays the level in mg/dl or mmol/l.

Figure : Glucometer sensor

The sensor needs to be connected to the specific glucometer jack connector in MySignals board and it works with internal batteries.

6.1.5.2. Connecting the sensor

Connect the sensor in the Glucometer connector indicated in the MySignals Hardware board. The sensor cable have only one way of connection to prevent errors and make the connection easier. Use the mini-jack connector (2.5mm) to link the Glucometer with the MySignals board, using the normal jack connector (3.5mm) of the cable in this side.

Before start using the glucometer we need one measure at least in the memory of the glucometer. After that we can get all the information contained in the glucometer (date, glucose value).

Figure : Insert strip in the glucometer.

Place a test strip in the machine when the machine is ready. Watch the indicator for placing the blood to the strip.

Figure : Ready for measurement glucometer

Clean the end of your index finger with rubbing alcohol before pricking it with an sterile needle or lancet.

***NOTE**:The needles or lancets are not provided.*

Figure : Lancet glucometer method 1

Pierce your finger tip on the soft, fleshy pad and obtain a drop of blood. The type of drop of blood is determined by the type of strip you are using

Figure : Lancet glucometer method 2

Place the drop of blood on or at the side of the strip.

Figure : Drop glucometer method 1

Figure : Drop glucometer method 2

The glucometer will take a few moments to calculate the blood sugar reading.

Figure : Glucometer measure

The glucometer will store the value in the memory.

In order to extract the data from the glucometer to the Arduino, connect the cable as show in the picture.

Figure : Cable connection

You should view in the glucometer screen the message "P-C", that indicates the correct connection.

Figure : PC indication glucometer

The maximum recommended number of measures stored in the glucometer is 5. Please delete all the measures after it using the glucometer button. (press it several times and then use the M button)

Figure : Configuration button in the glucometer

You can turn off the device holding the M button during 3 seconds.

Figure : Configuration button in the glucometer B

Setting time

In order to use the date and time in each measure it is neccesary to set correctly this parameters in the device.

Figure : MySignals Hardware Development Platform with Glucometer DATE

Set time information after insert new batteries. Use the button allocated in the batteries backpack in order to initialize the configuration of these parameters.

6.1.5.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

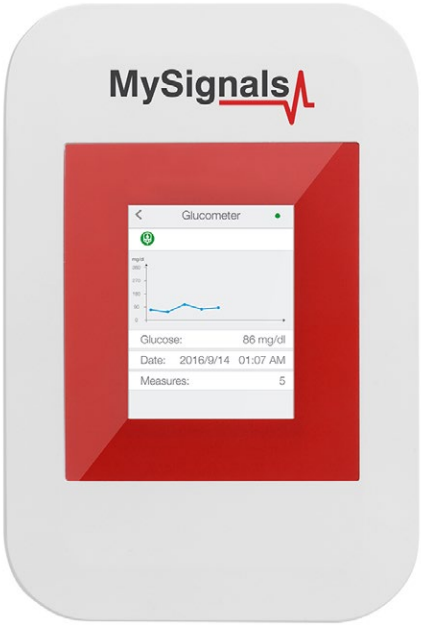


Figure : Detail mode

MySignals APP

This is an example of sensor viewing in MySignals APP Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use your smartphone touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo APP

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

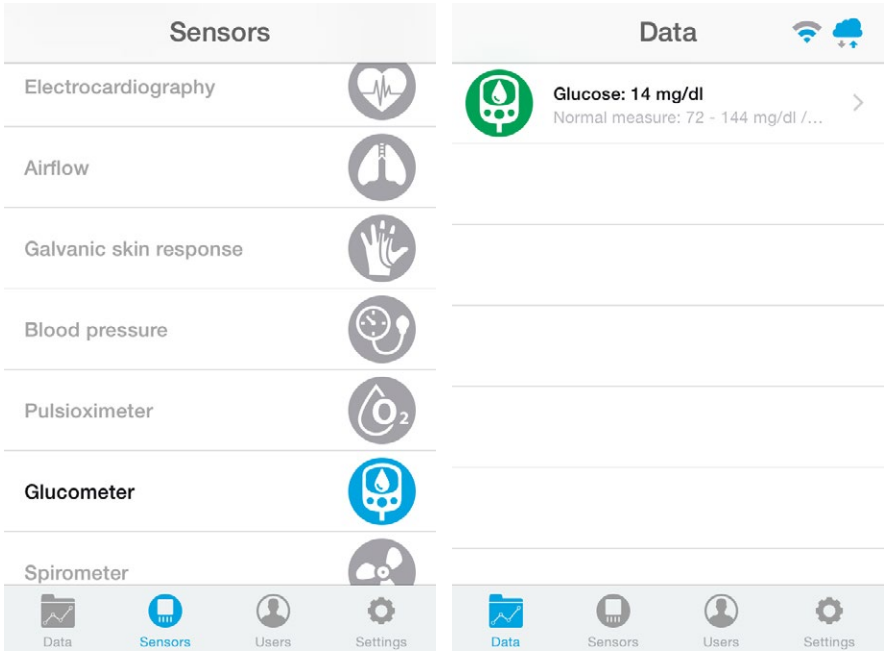


Figure : General mode and selecting general mode APP

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

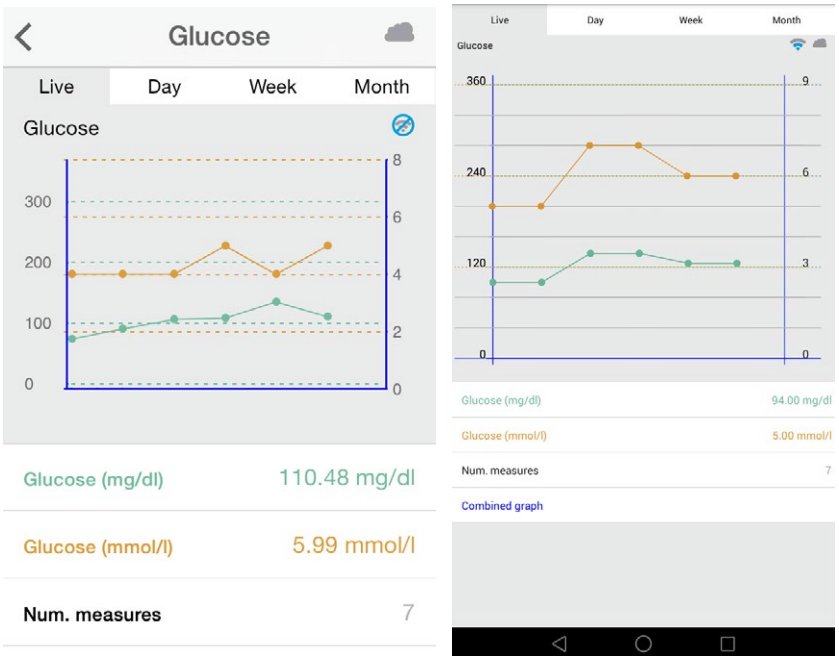


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

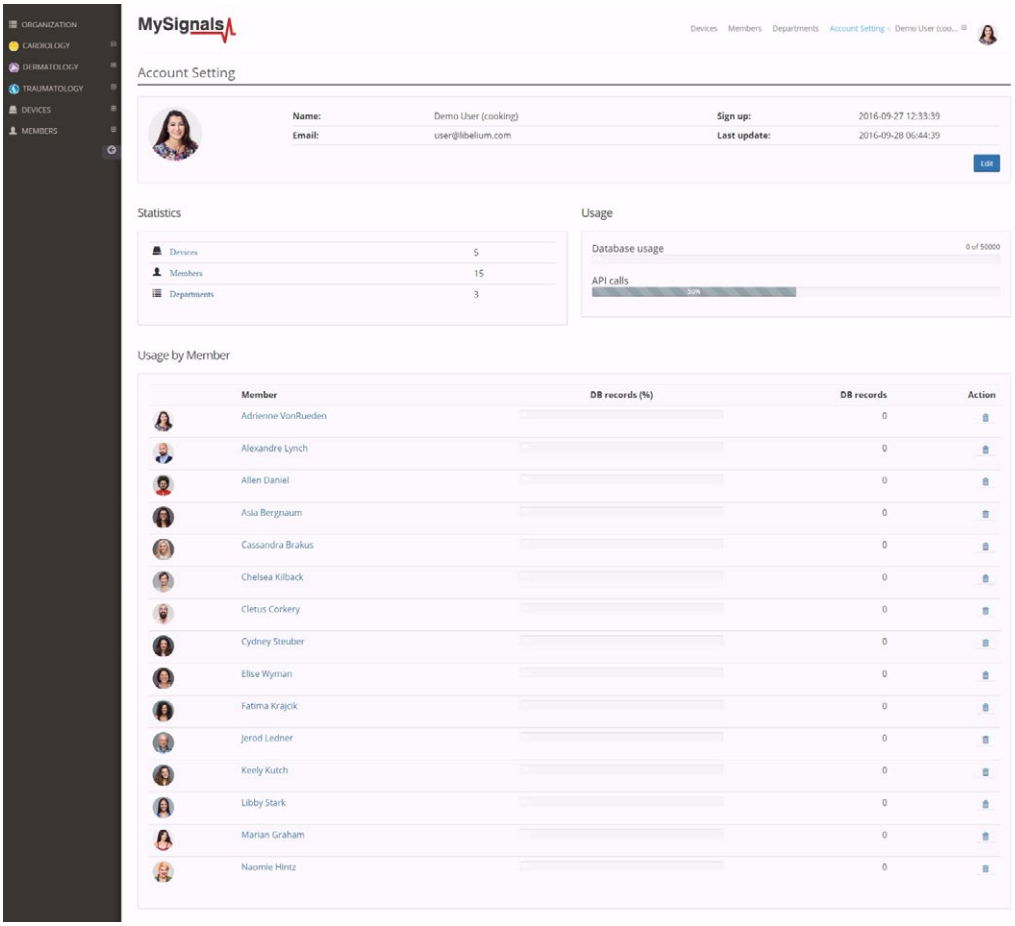


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

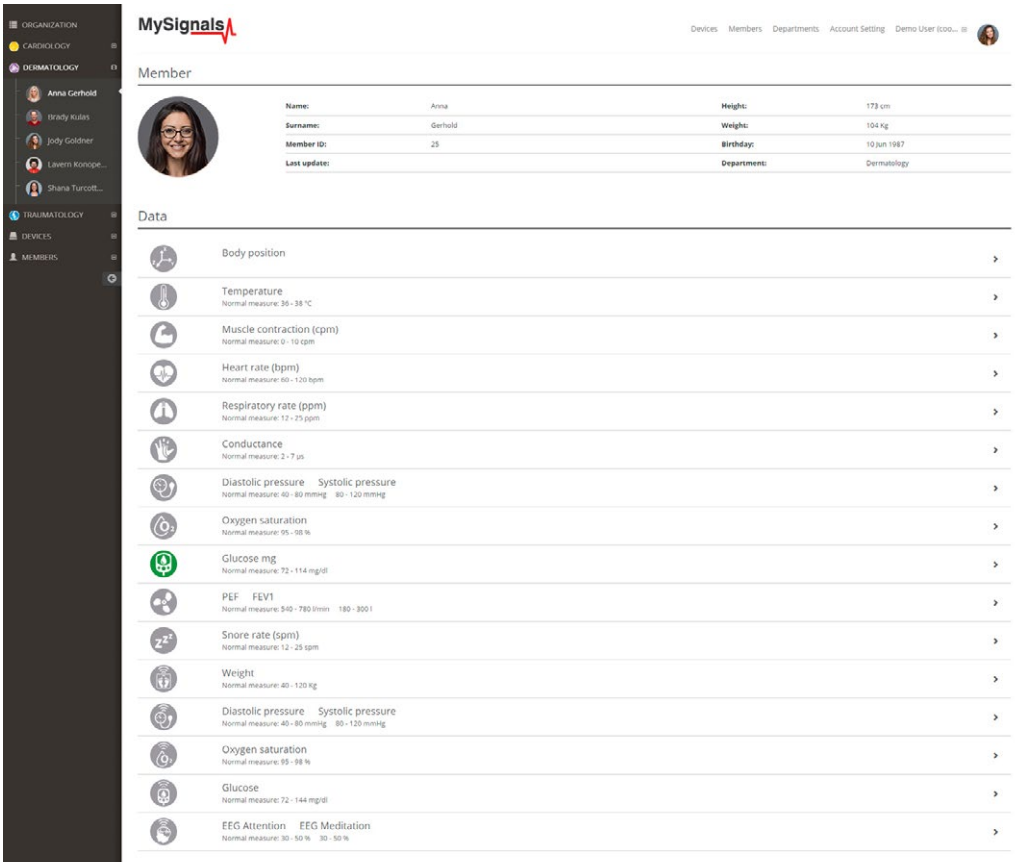


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

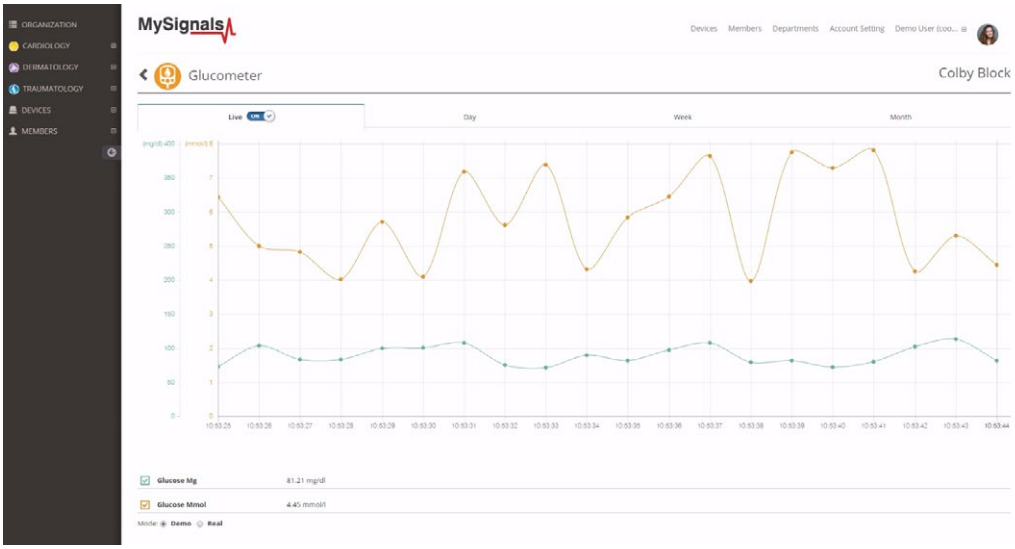


Figure : Detail mode Web Server

6.1.6. Temperature

Body temperature depends upon the place in the body at which the measurement is made, and the time of day and level of activity of the person. Different parts of the body have different temperatures.

The commonly accepted average core body temperature (taken internally) is 37.0°C (98.6°F). In healthy adults, body temperature fluctuates about 0.5°C (0.9°F) throughout the day, with lower temperatures in the morning and higher temperatures in the late afternoon and evening, as the body's needs and activities change.

6.1.6.1. Sensor features

Description: Exacon D-S18JK sensor allows you to measure this key parameter for body monitoring.

Figure : Temperature Sensor

It is of great medical importance to measure body temperature. The reason is that a number of diseases are accompanied by characteristic changes in body temperature. Likewise, the course of certain diseases can be monitored by measuring body temperature, and the efficiency of a treatment initiated can be evaluated by the physician.

Hypothermia <35.0 °C (95.0 °F)
Normal 36.5–37.5 °C (97.7–99.5 °F)
Fever or Hyperthermia >37.5–38.3 °C (99.5–100.9 °F)
Hyperpyrexia >40.0–41.5 °C (104–106.7 °F)

The sensor needs to be connected to the specific Temperature jack connector in MySignals board and it works with direct connector power supply.

Measurement:

Parameter	Unit	Range
Body Temperature	Degree Celsius (°C)	0-50ºC

6.1.6.2. Connecting the sensor

Connect the sensor in the Temperature connector indicated in the MySignals Hardware board. The sensor cable have only one way of connection to prevent errors and make the connection easier.

Figure : MySignals Hardware Development Platform with Temperature connected

Place your sensor as shown in the image below.

Figure : Temperature sensor connection diagram

Make contact between the metallic part and your skin. Use a piece of adhesive tape to hold the sensor attached to the skin.

Figure : MySignals Hardware Development Platform with Temperature situated in the user body

After a few seconds you will get the values in the visualization method programmed.

6.1.6.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

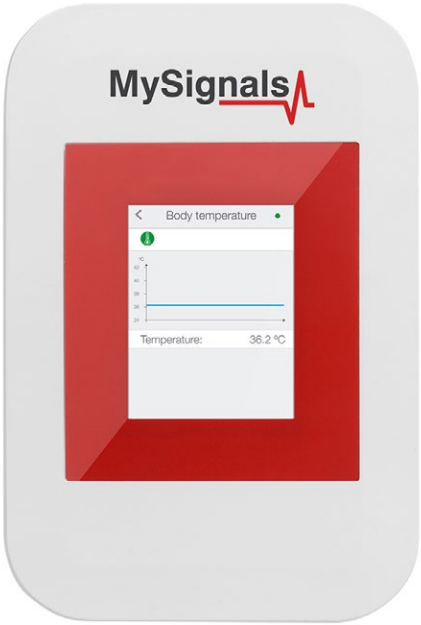


Figure : Detail mode

MySignals APP

This is an example of sensor viewing in MySignals APP Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use your smartphone touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo APP

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

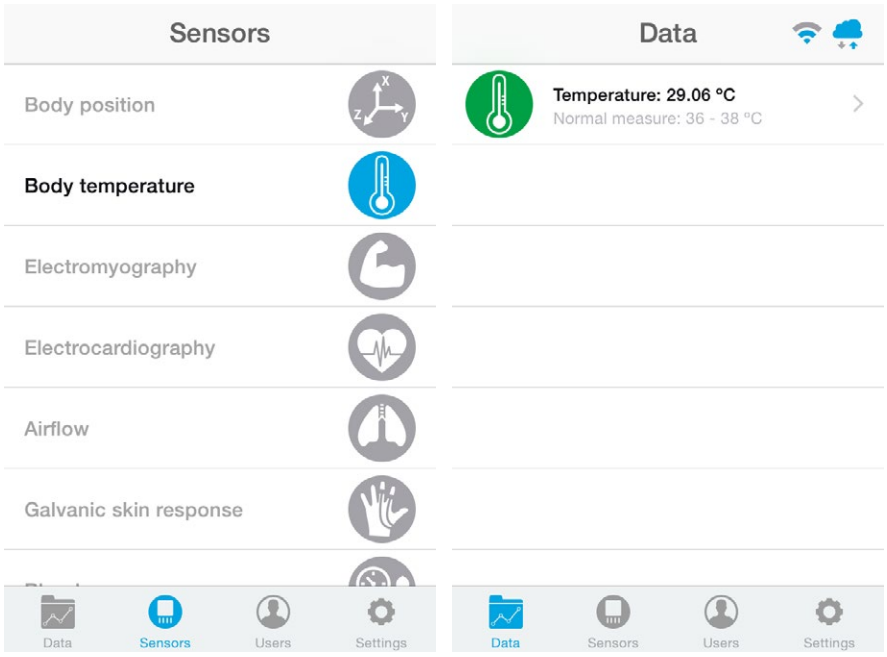


Figure : General mode and selecting general mode APP

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

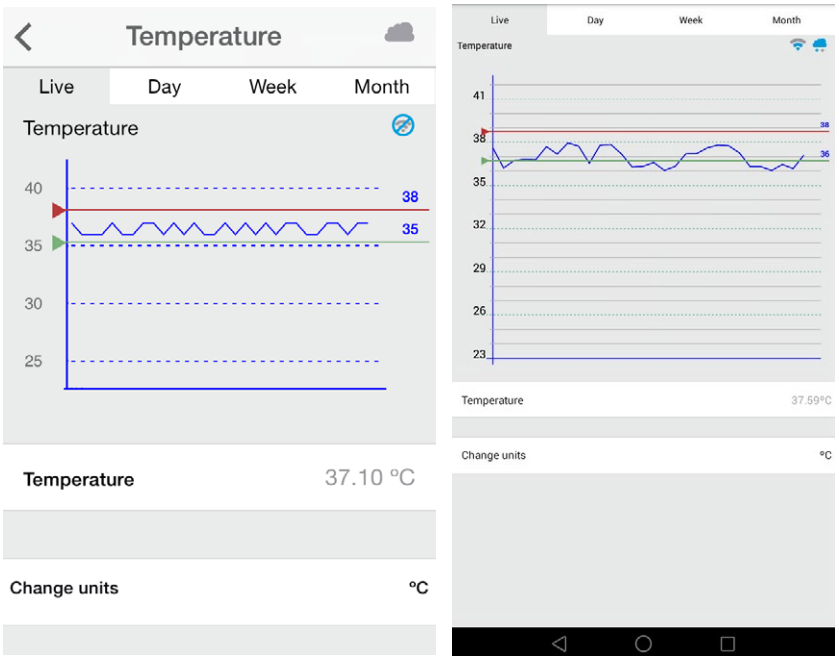


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

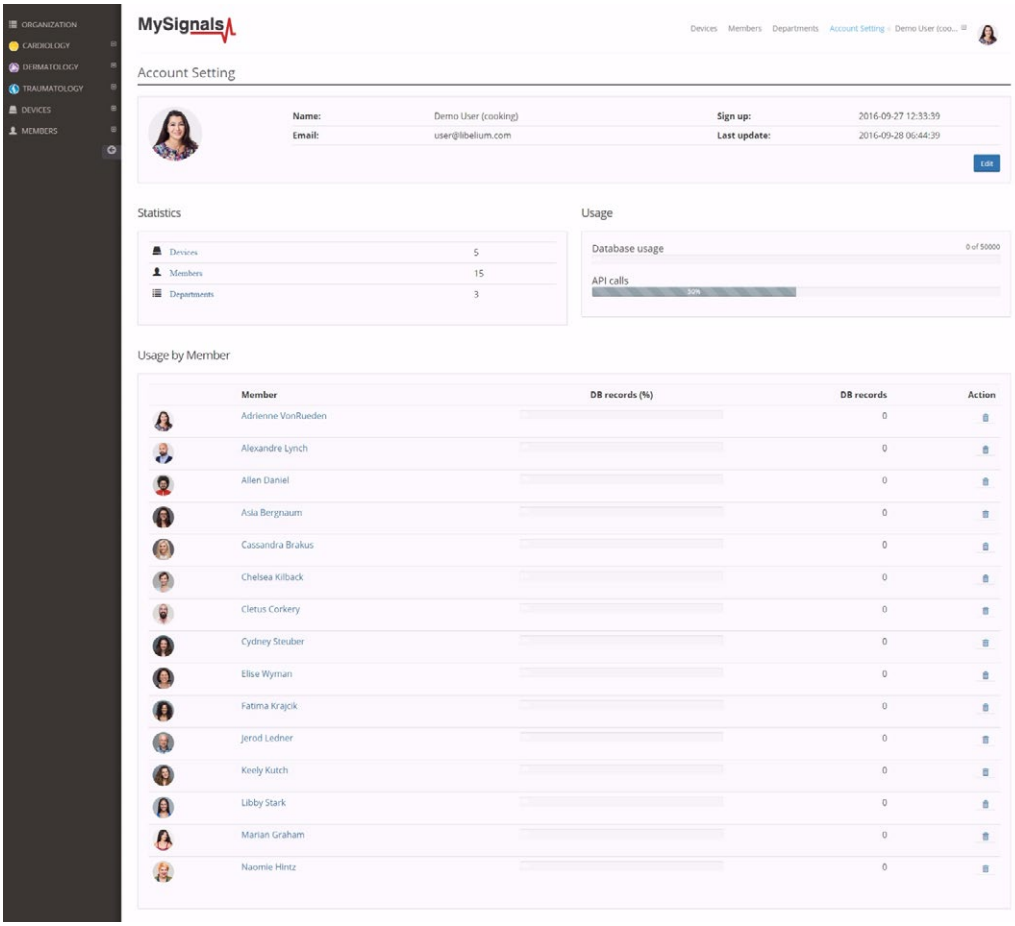


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

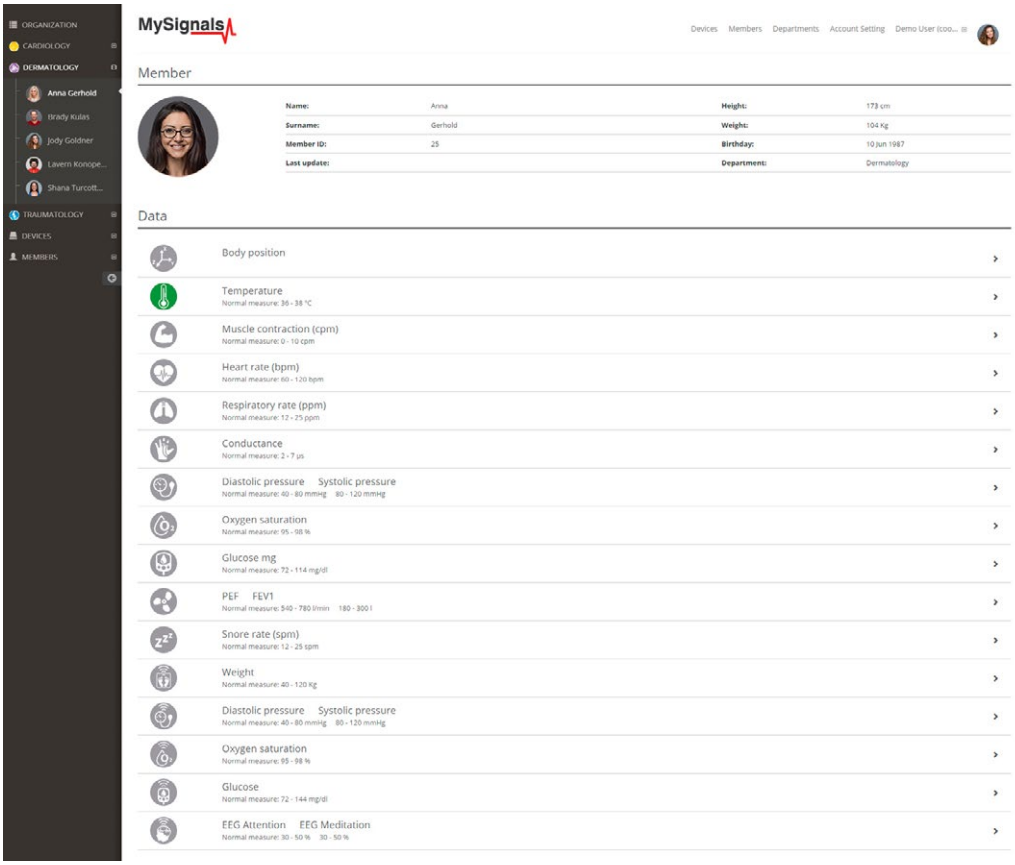


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

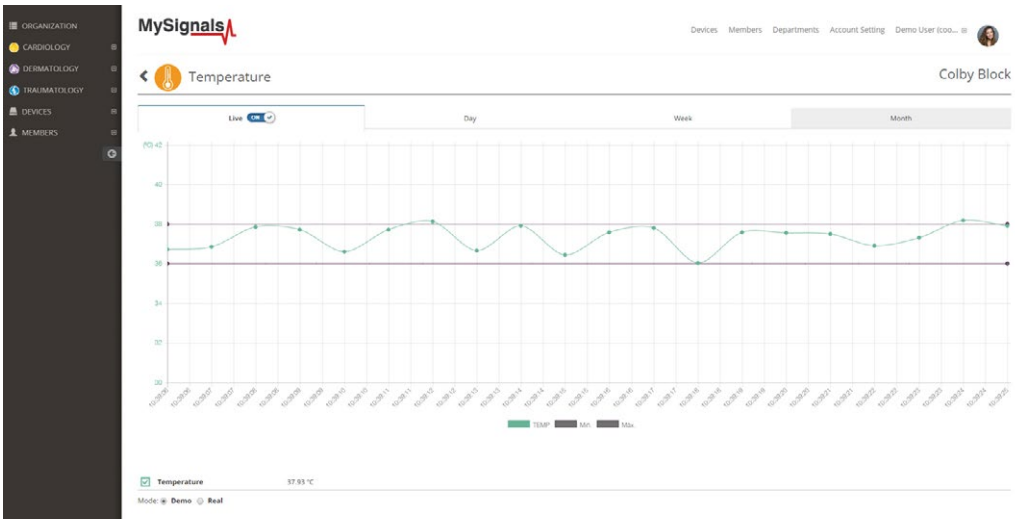


Figure : Detail mode Web Server

6.1.7. EMG

Electromyography (EMG) is an electrodiagnostic medicine technique for evaluating and recording the electrical activity produced by skeletal muscles. EMG is performed using an instrument called an electromyograph, to produce a record called an electromyogram. An electromyograph detects the electric potential generated by muscle cells when these cells are electrically or neurologically activated. The signals can be analyzed to detect medical abnormalities, activation level, or recruitment order, or to analyze the biomechanics of human or animal movement.

EMG testing has a variety of clinical and biomedical applications. EMG is used as a diagnostics tool for identifying neuromuscular diseases, or as a research tool for studying kinesiology, and disorders of motor control. EMG signals are sometimes used to guide botulinum toxin or phenol injections into muscles. EMG signals are also used as a control signal for prosthetic devices such as prosthetic hands, arms, and lower limbs.

There are two kinds of EMG: surface EMG and intramuscular EMG. Surface EMG assesses muscle function by recording muscle activity from the surface above the muscle on the skin. Surface electrodes are able to provide only a limited assessment of the muscle activity. Surface EMG can be recorded by a pair of electrodes or by a more complex array of multiple electrodes. More than one electrode is needed because EMG recordings display the potential difference (voltage difference) between two separate electrodes. Limitations of this approach are the fact that surface electrode recordings are restricted to superficial muscles, are influenced by the depth of the subcutaneous tissue at the site of the recording which can be highly variable depending of the weight of a patient, and cannot reliably discriminate between the discharges of adjacent muscles.

6.1.7.1. Sensor features

Description: An electromyograph detects the electrical potential generated by muscle cells when these cells are electrically or neurologically activated. The signals can be analyzed to detect medical abnormalities, activation level, recruitment order or to analyze the biomechanics of human or animal movement.

EMG signals are used in many clinical and biomedical applications. EMG is used as a diagnostics tool for identifying neuromuscular diseases, assessing low-back pain, kinesiology, and disorders of motor control. EMG signals are also used as a control signal for prosthetic devices such as prosthetic hands, arms, and lower limbs.

This sensor will measure the filtered and rectified electrical activity of a muscle, depending the amount of activity in the selected muscle.

Figure : EMG sensor

Use your muscles to control any type of actuator (motors, servos, lights ...) Interact with the environment with your own muscles. This sensor comes with everything you need to start sensing muscle activity with your Arduino.

The sensor needs to be connected to the specific EMG jack connector in MySignals board and it works with direct connector power supply.

Measurement:

Parameter	Unit	Range
Muscle rate	CPM (contractions per minute)	0-60 cpm
Muscle signal	Volts	0-5V

6.1.7.2. Connecting the sensor

Connect the sensor in the EMG connector indicated in the MySignals Hardware board. The sensor cable have only one way of connection to prevent errors and make the connection easier.

Figure : MySignals Hardware Development Platform with EMG connected

Connect the EMG lead to the electrodes.

Figure : EMG connecting EMG electrodes

Remove the protective plastic. You can use a specific conductive gel in order to improve the quality signal of the sensor.

Figure : EMG electrodes removing protective plastic

This sensor use disposable pre-gelled electrodes.

These high quality disposable electrodes are to be used to measure EEG, ECG and EMG. They are to be used once and are very handy because of integrated gel. They adhere very well to the skin and are clean to use.

The H124SG has a unique, patented pre-gelled adhesive side with non-irritating gel, especially developed to prevent allergic reactions. These foam electrode is latex free and therefore suitable for every skin type.

The snap-on connector can easily be pushed on or removed from the electrode lead.

Place the electrodes as shown below.

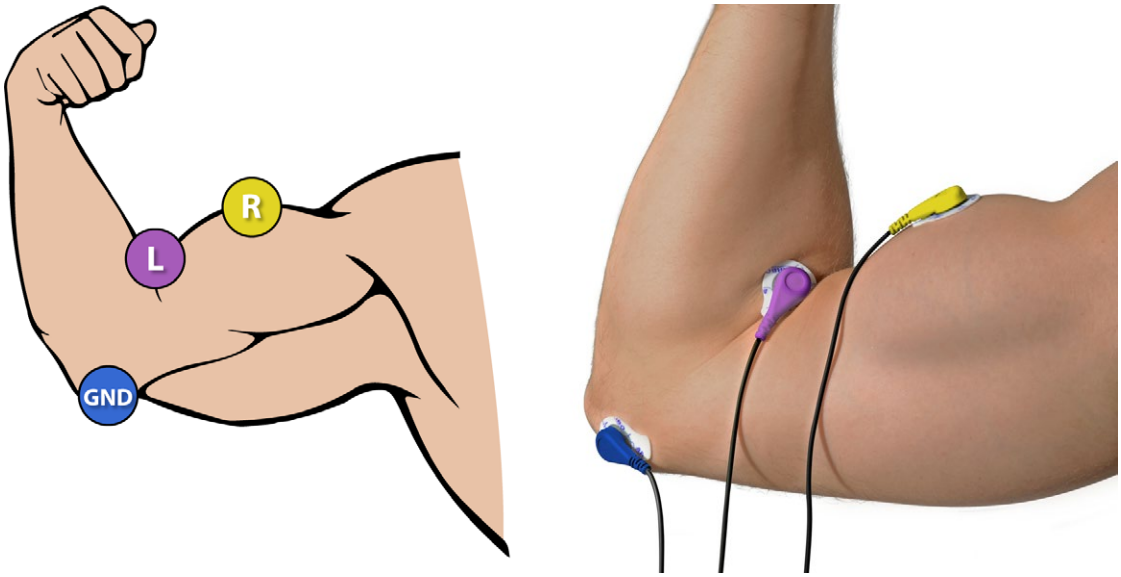


Figure : EMG position diagram

After a few seconds you will get the values in the visualization method programmed.

***NOTE**: It is recommended not use this sensor in environments with excessive electromagnetic noise.*

6.1.7.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

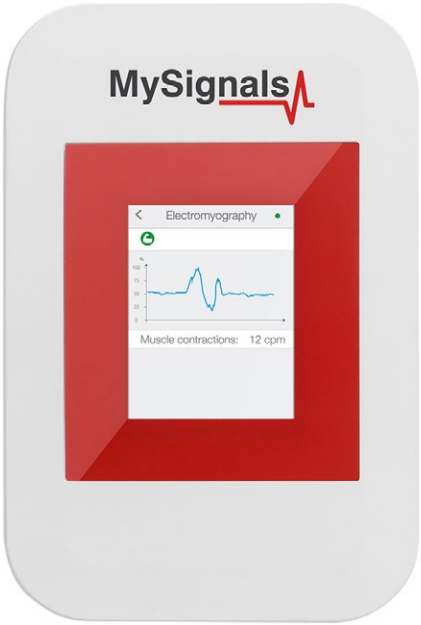


Figure : Detail mode

MySignals APP

This is an example of sensor viewing in MySignals APP Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use your smartphone touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo APP

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

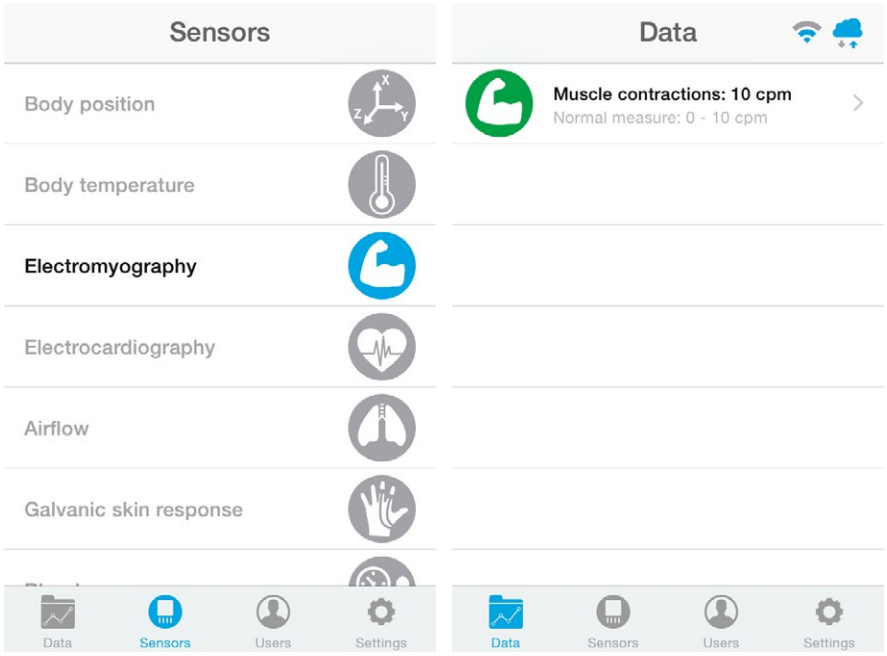


Figure : General mode and selecting general mode APP

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

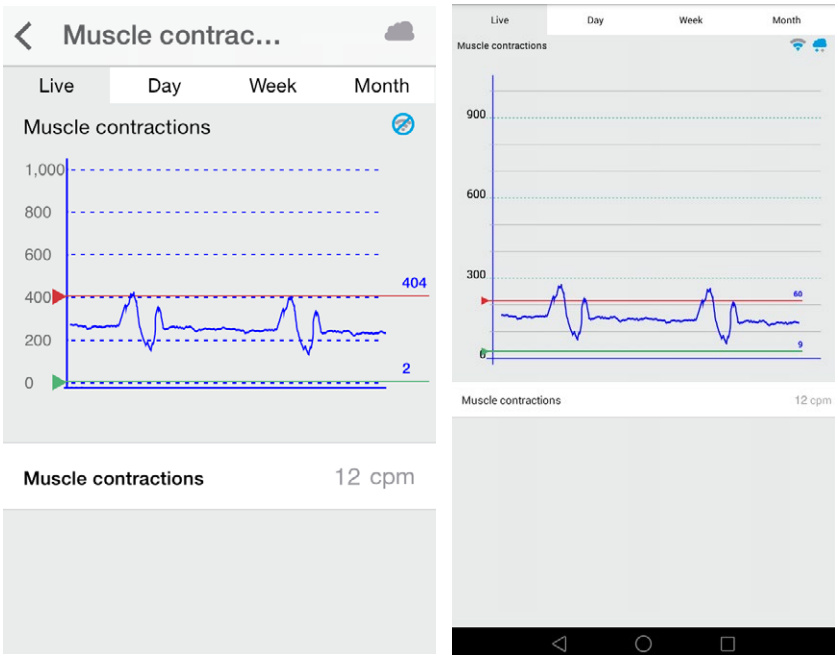


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

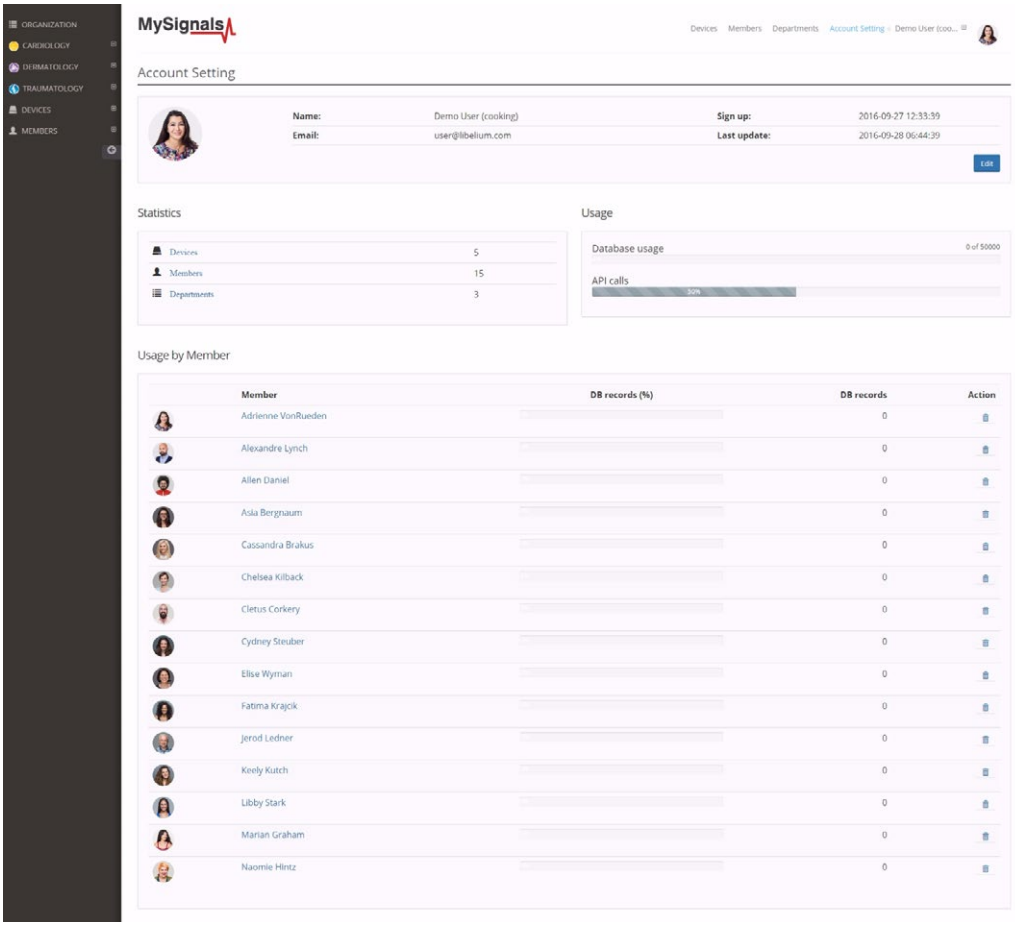


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

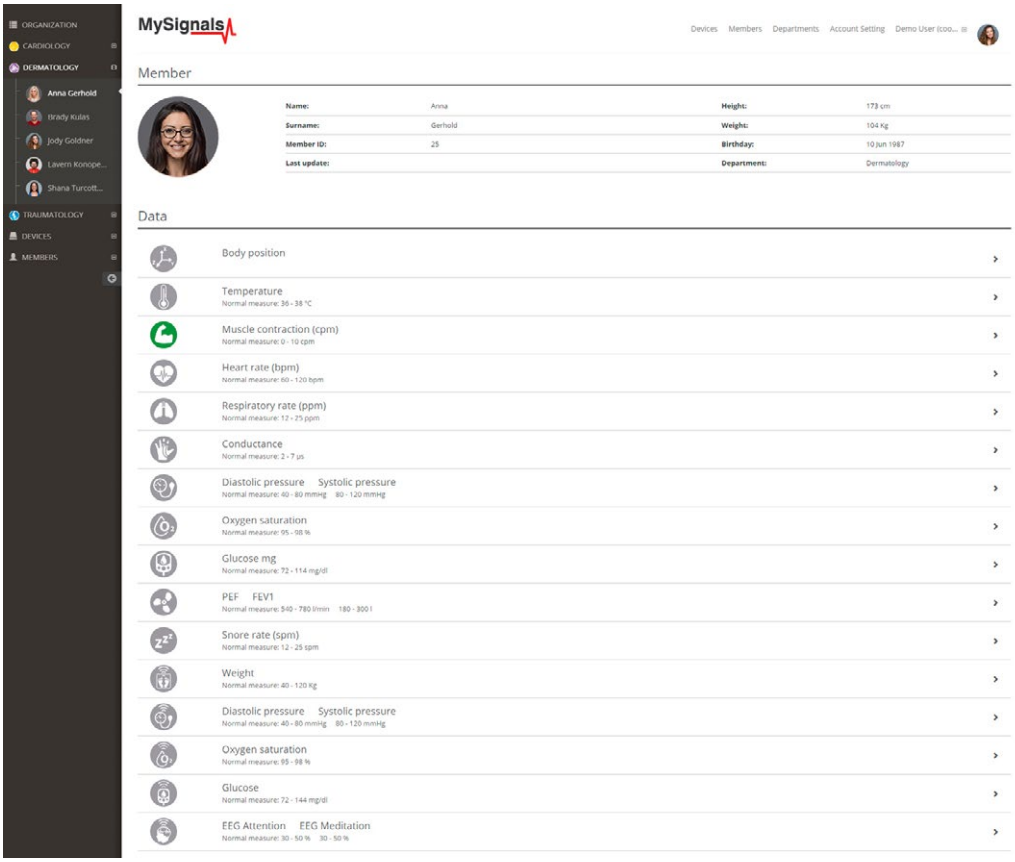


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

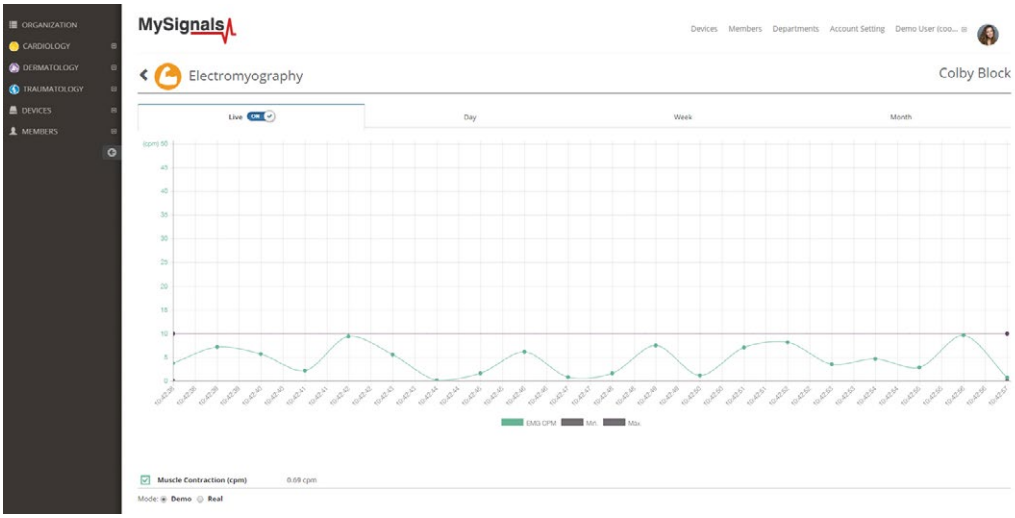


Figure : Detail mode Web Server

6.1.8. Spirometer

Spirometry (meaning the measuring of breath) is the most common of the pulmonary function tests (PFTs), measuring lung function, specifically the amount (volume) and/or speed (flow) of air that can be inhaled and exhaled. Spirometry is an important tool used for generating pneumotachographs, which are helpful in assessing conditions such as asthma, pulmonary fibrosis, cystic fibrosis, and COPD.

6.1.8.1. Sensor features

Description: MySignals Spirometer Peak Flow Meter is a hand-held pulmonary function measuring device that measures your maximum possible exhalation which is called peak expiratory flow (PEF) and forced expiratory volume in 1 second (FEV1).

Forced expiratory flow (FEF)

Forced expiratory flow (FEF) is the flow (or speed) of air coming out of the lung during the middle portion of a forced expiration.

Forced expiratory volume in 1 second (FEV1)

FEV1 is the volume of air that can forcibly be blown out in one second, after full inspiration. Average values for FEV1 in healthy people depend mainly on sex and age, according to the diagram at left. Values of between 80% and 120% of the average value are considered normal.

Figure : Spirometer sensor

It is suitable for children through adults who are capable of following the instructions for use. Because the Meter has an automatic memory, you can take the Meter with you the next time you connect to MySignals board for a review of many readings.

Accuracy requirement

Volume range	0.01L~9.99L	Airflow range	50 L/min ~900L/min
Volume accuracy	±0.050L or ±3%	Airflow accuracy	±10% or ±20L/min

Resolution

Volume resolution	0.01L	Airflow resolution	1L/min

Resistance to flow

Back pressure @ 660L/min	<0.11 KPa/sec
Back pressure @ 900L/min	<0.15 KPa/sec

The sensor needs to be connected to the specific Spirometer jack connector in MySignals board and it works with internal batteries.

Measurement:

Parameter	Unit	Range
Volume	l	0.01L~9.99L
Air flow	l/min	50 L/min ~900L/min

6.1.8.2. Connecting the sensor

Connect the sensor in the Spirometer connector indicated in the MySignals Hardware board. The sensor cable have only one way of connection to prevent errors and make the connection easier. Use the mini-USB connector to link the Spirometer with the MySignals board, using the normal jack connector (3.5mm) of the cable in this side.

Before start using the glucometer we need one measure at least in the memory of the Spirometer. After that we can get all the information contained in the Spirometer (date, PEF, FEV1).

Figure : Insert the disposable mouthpiece in the Spirometer.

1) Place a new disposable mouthpiece for each new user in the machine and press the ON button. When the machine is ready you can start the measurement. In this step the device should be disconnected to MySignals.

Figure : Ready for measurement Spirometer

Sit on the edge of your bed if possible, or sit up as far as you can in bed. Hold the spirometer in an upright position.

Place the mouthpiece in your mouth and seal your lips tightly around it. Breathe in fastly and as deeply as possible.

2) Press the ON button in order to turn off the device. It is necessary in order to store the measure correctly.

Figure : Spirometer measure

The glucometer will store the value in the memory.

3) In order to extract the data from the glucometer to the Arduino, connect the spirometer to Mysignals with the cable as show in the picture.

Figure : Cable connection

You should view in the glucometer screen a USB logo indication, that indicates the correct connection.

Figure : PC indication spirometer

Deleting data stored

The maximum recommended number of measures stored in the spirometer is 7. Please delete all the measures after it using the example code "spirometer_delete_measures" that you can find the the next sections.

Powering the sensor

It is very important to use batteries with more than 50% of charge in order to obten correctly the biometric information.

Setting time

In order to use the date and time in each measure it is neccesary to set correctly this parameters in the device.

Figure : MySignals Hardware Development Platform with Spirometer DATE

Set time information after insert new batteries. When you start with new batteries the sensor it initialize the configuration of these parameters. Use the buttons to configure this information.

Figure : Configuration button in the spirometer

6.1.8.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

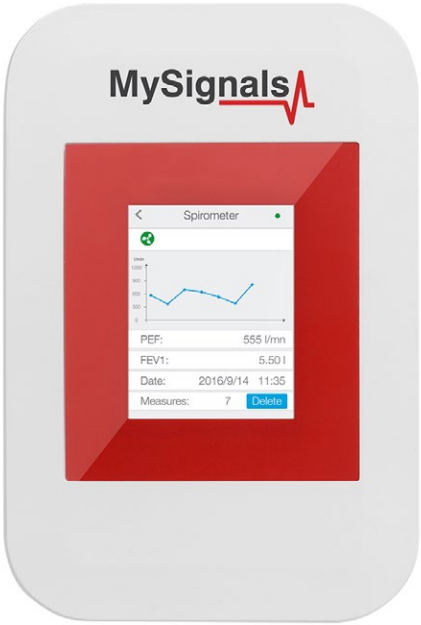


Figure : Detail mode

MySignals APP

This is an example of sensor viewing in MySignals APP Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use your smartphone touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo APP

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

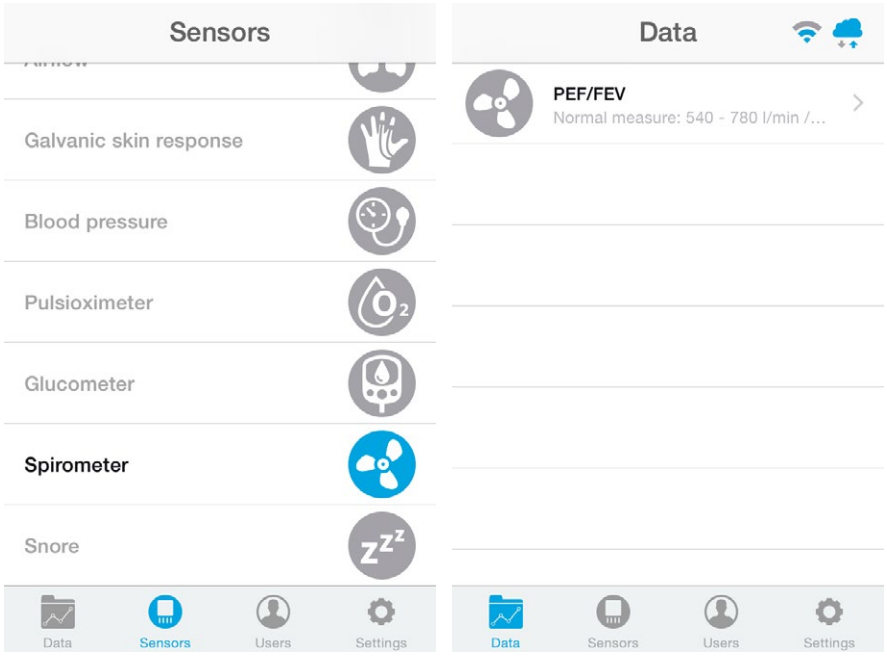


Figure : General mode and selecting general mode APP

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

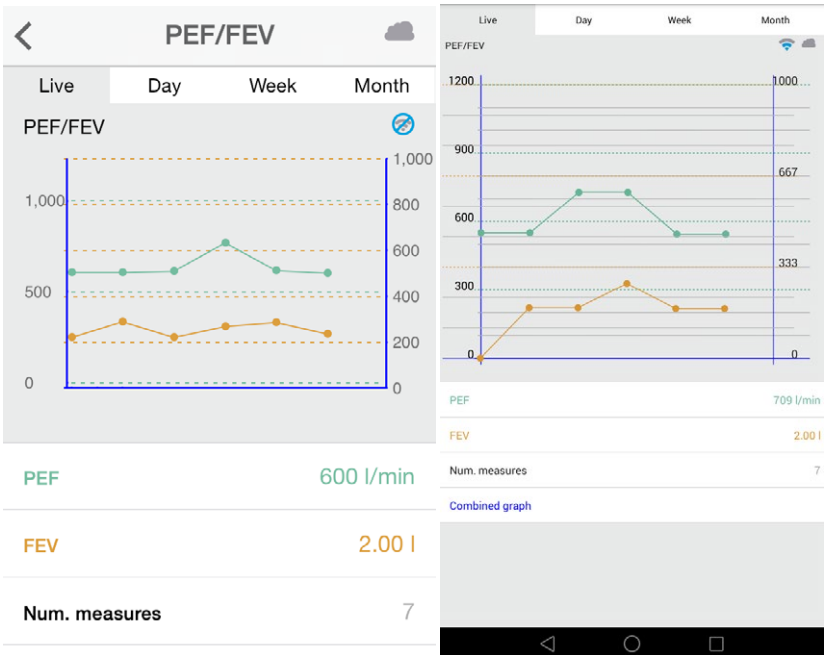


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

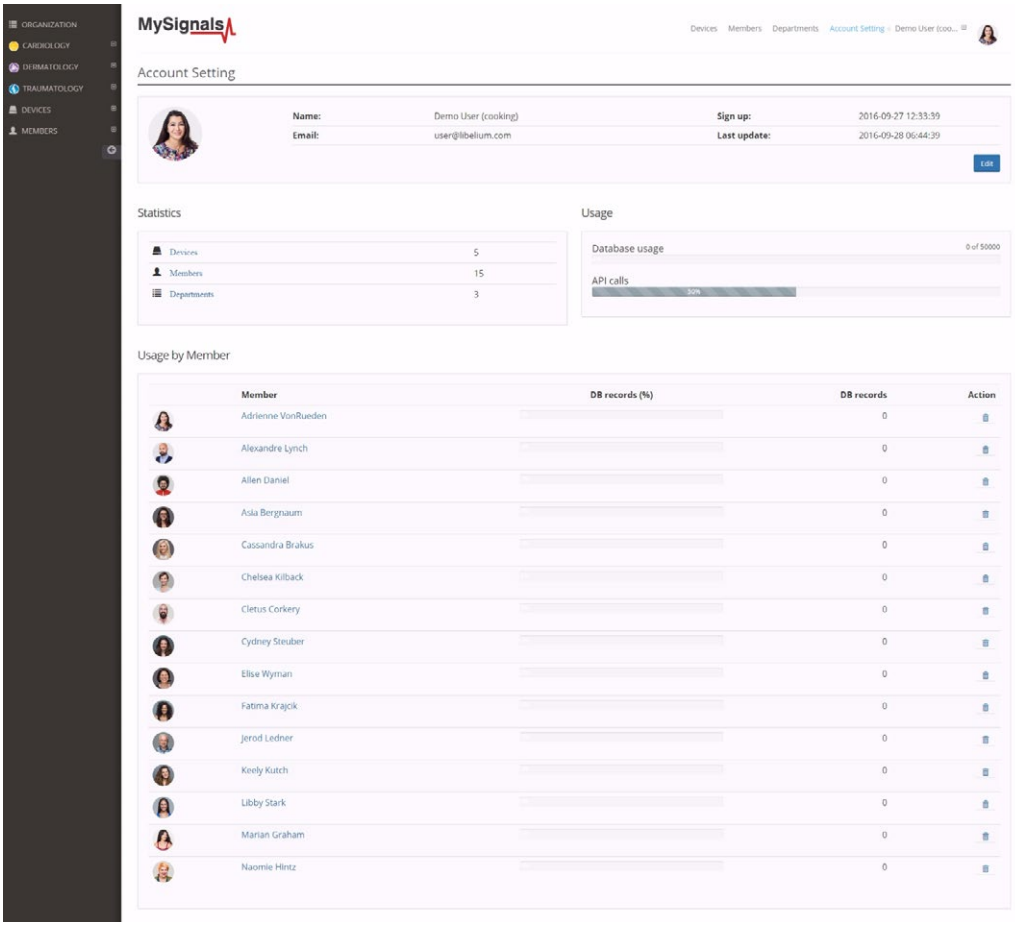


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

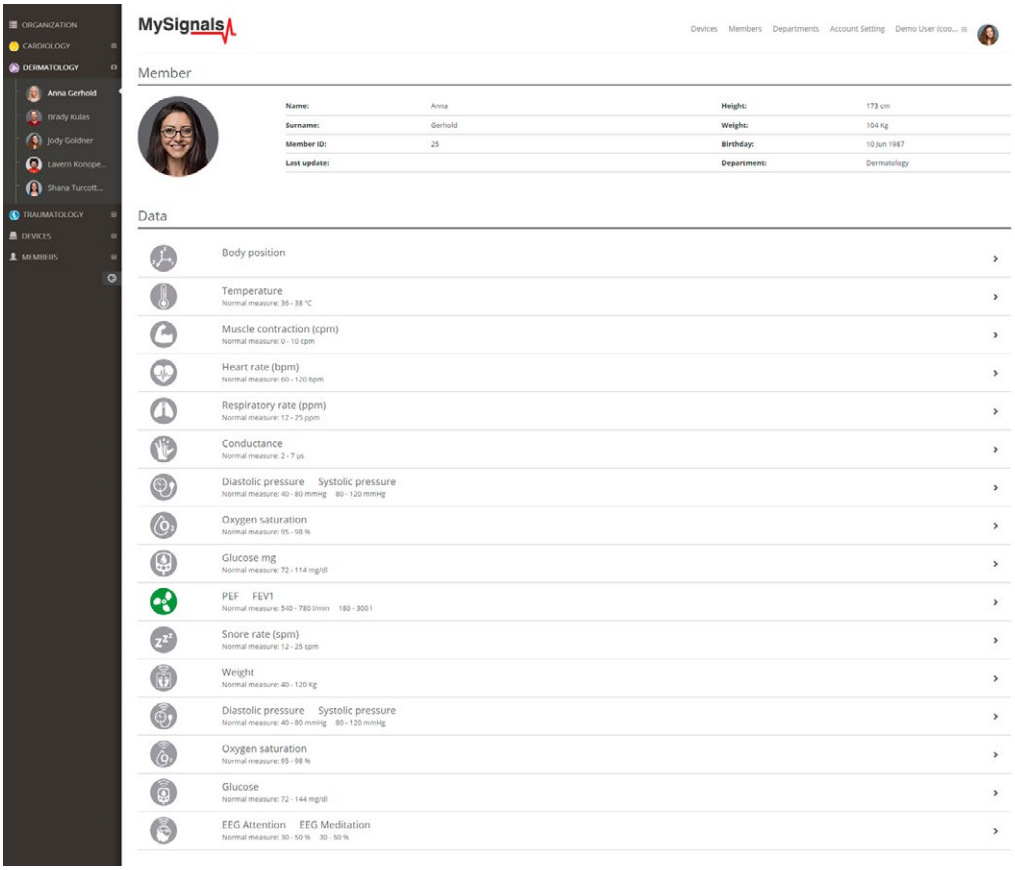


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

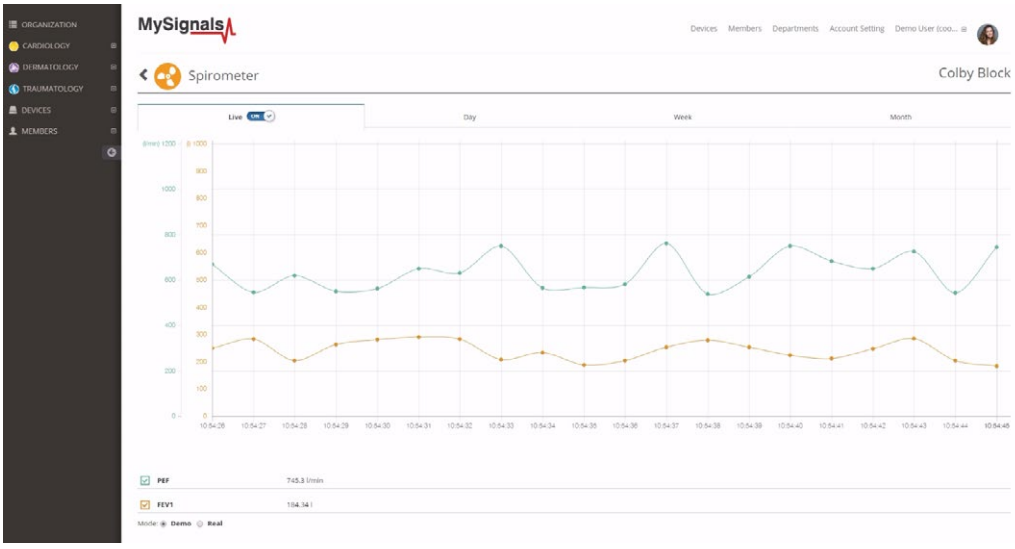


Figure : Detail mode Web Server

6.1.9. GSR

Skin conductance, also known as galvanic skin response (GSR) is a method of measuring the electrical conductance of the skin, which varies with its moisture level. This is of interest because the sweat glands are controlled by the sympathetic nervous system, so moments of strong emotion, change the electrical resistance of the skin. Skin conductance is used as an indication of psychological or physiological arousal, The Galvanic Skin Response Sensor (GSR - Sweating) measures the electrical conductance between 2 points, and is essentially a type of ohmmeter.

6.1.9.1. Sensor features

Description: This sensor measures the electrical conductance of the skin, which varies with its moisture level. This is of interest because the sweat glands are controlled by the sympathetic nervous system, so moments of strong emotion, change the electrical resistance of the skin.

Figure : GSR Sensor

In skin conductance response method, conductivity of skin is measured at fingers of the palm. The principle or theory behind functioning of galvanic response sensor is to measure electrical skin resistance based on sweat produced by the body. When high level of sweating takes place, the electrical skin resistance drops down. A dryer skin records much higher resistance. The skin conductance response sensor measures the psycho galvanic reflex of the body. Emotions such as excitement, stress, shock, etc. can result in the fluctuation of skin conductivity. Skin conductance measurement is one component of polygraph devices and is used in scientific research of emotional or physiological arousal.

The sensor needs to be connected to the specific GSR jack connector in MySignals board and it works with direct connector power supply.

Measurement:

Parameter	Unit	Range
Conductance	Siemens	0-20 Siemens
Resistance	Ohms	10K-100KOhms
Voltage	Volts	0-5V

Connecting the sensor

Connect the sensor in the GSR connector indicated in the MySignals Hardware board. The sensor cable have only one way of connection to prevent errors and make the connection easier.

Figure : MySignals Hardware Development Platform with GSR connected

Connect the GSR lead to the electrodes.

Figure : GSR connecting GSR electrodes

Place the electrodes as shown below.

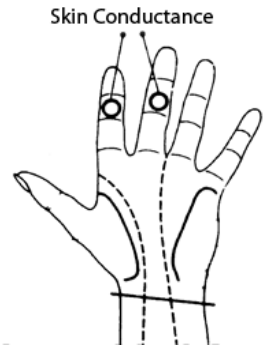


Figure : EMG position diagram

The galvanic skin sensor has two contacts and it works like a ohmmeter measuring the resistance of the materials. Place your fingers in the metallic contacts and tighten the velcro as shown in the image below.

Figure : MySignals Hardware Development Platform with GSR situated in the user body

After a few seconds you will get the values in the visualization method programmed.

6.1.9.2. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

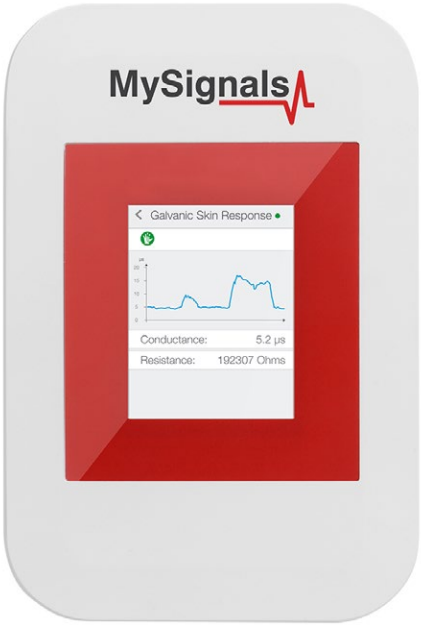


Figure : Detail mode

MySignals APP

This is an example of sensor viewing in MySignals APP Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use your smartphone touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo APP

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

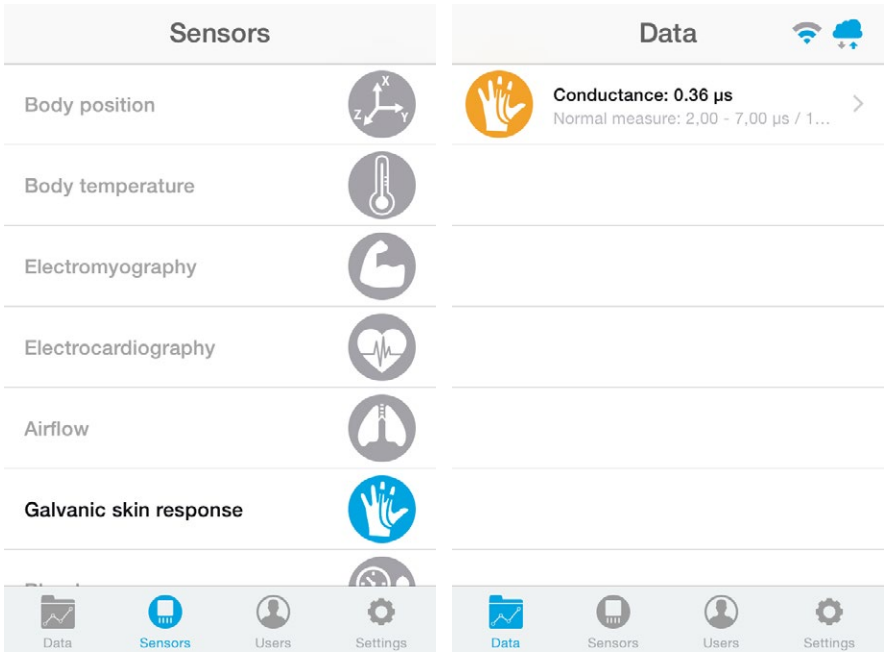


Figure : General mode and selecting general mode APP

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

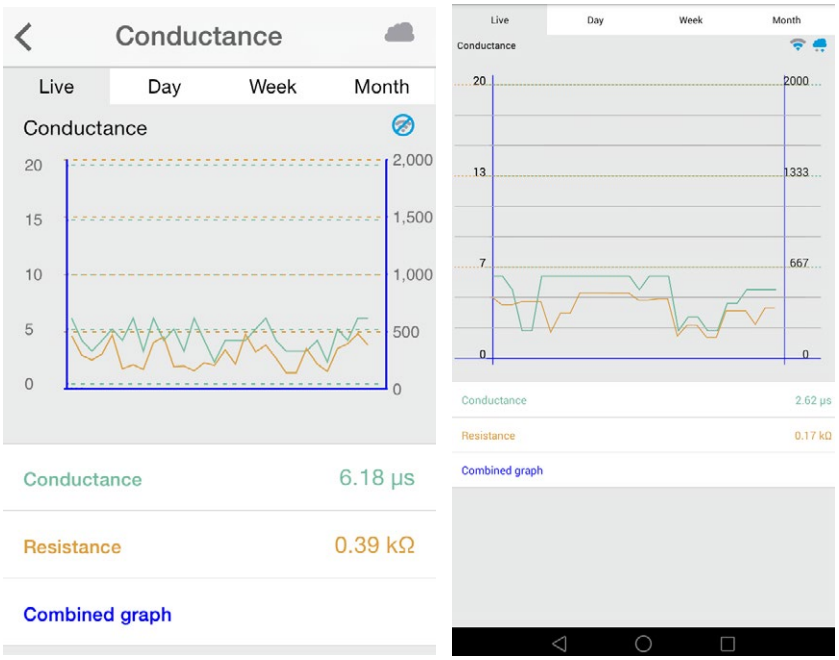


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

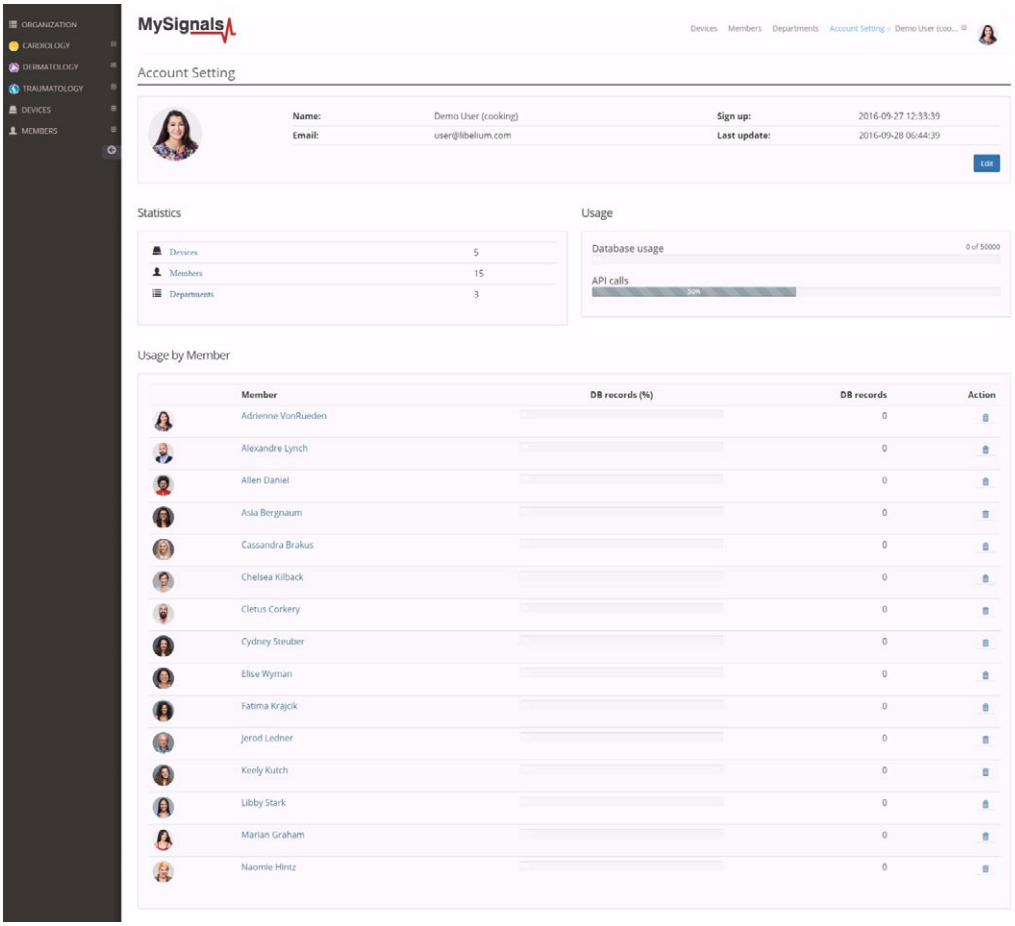


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

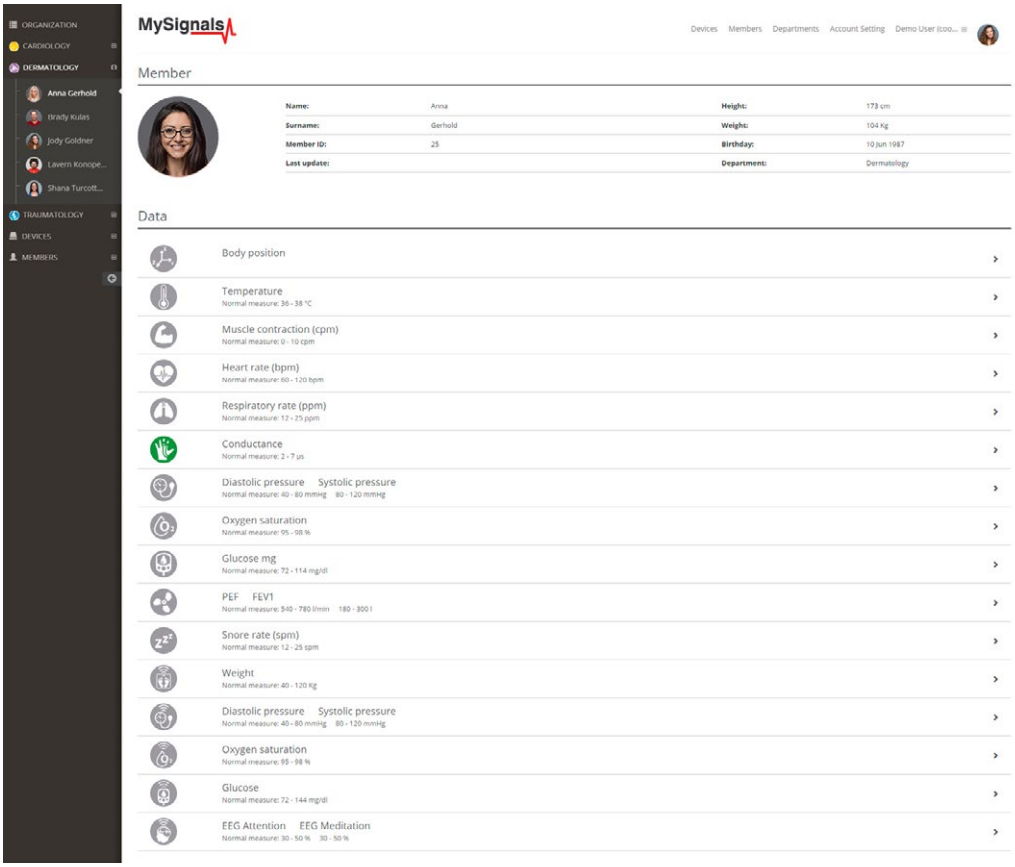


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

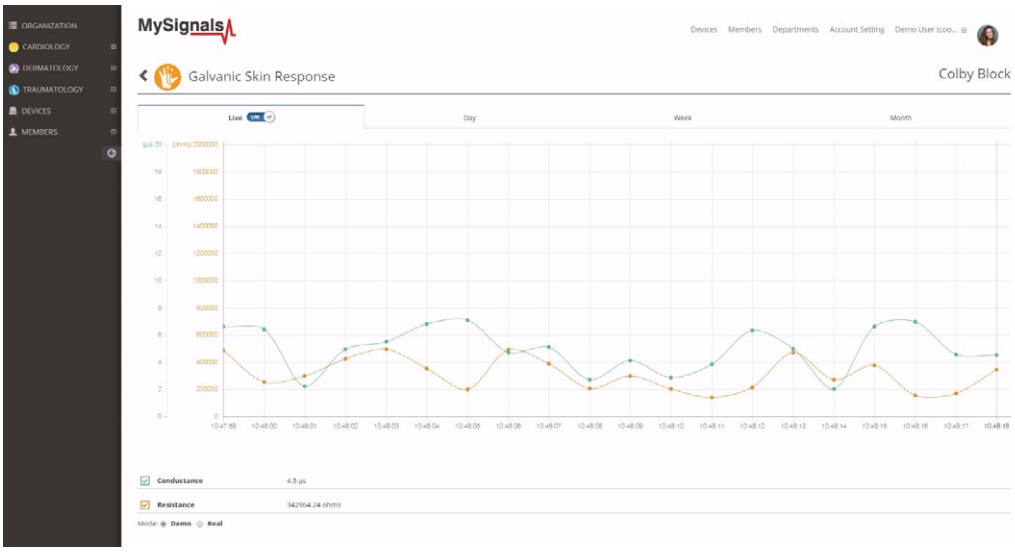


Figure : Detail mode Web Server

6.1.10. Body Position

Positions and movements made because of their relationships to particular diseases (i.e., sleep apnea and restless legs syndrome). Analyzing movements during sleep also helps in determining sleep quality and irregular sleeping patterns. The body position sensor could help also to detect fainting or falling of elderly people or persons with disabilities.

6.1.10.1. Sensor features

Description: The Patient Position Sensor (Accelerometer) monitors five different patient positions (standing/sitting, supine, prone, left and right.). Body Position Sensor uses a triple axis accelerometer to obtain the patient's position.

Figure : Body Position Sensor

Body Position Sensor uses a triple axis accelerometer to obtain the patient's position. It is an ultra small triaxial, low-g acceleration sensor I2C interface, aiming for lowpower consumer market applications. It allows measurement of accelerations in 3 perpendicular axes and thus senses tilt, motion, shock and vibration in cell phones, handhelds, computer peripherals, man-machine interfaces, virtual reality features and game controllers. The sensor needs to be connected to the specific Body Position jack connector in MySignals board and it works with direct connector power supply.

The sensor needs to be connected to the specific body position jack connector in MySignals board and it works with direct connector power supply.

- 2.0-3.6V V supply voltage
- ±2g/±4g/±8g/±16g selectable full-scale

Body positions:

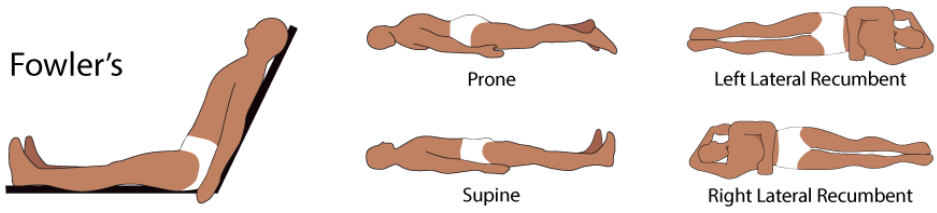


Figure : Human Body Positions

Measurement:

Parameter	Unit	Range
Body Position	Human Body Position	5 different positions

6.1.10.2. Connecting the sensor

Connect the jack sensor in the Body Position connector indicated in the MySignals Hardware board. The sensor cable have only one way of connection to prevent errors and make the connection easier.

Figure : MySignals Hardware Development Platform with Body Position connected

Place the tape around the chest and the connector placed down

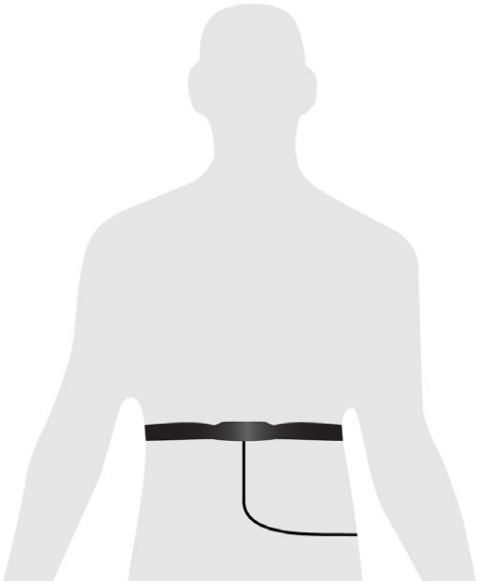


Figure : MySignals Hardware Development Platform with Body Position situated in the user body

After a few seconds you will get the values in the visualization method programmed.

6.1.10.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

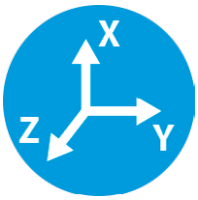


Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

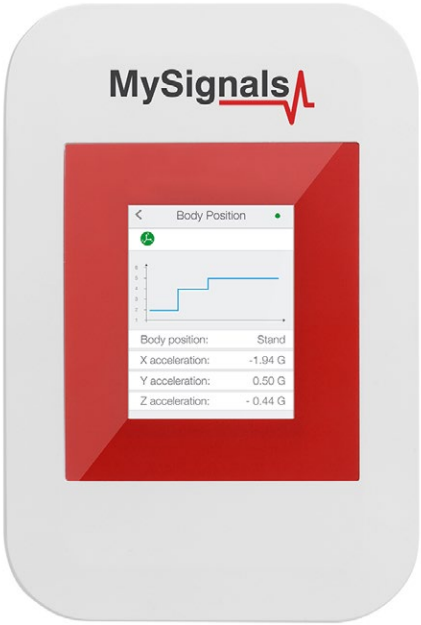


Figure : Detail mode

MySignals APP

This is an example of sensor viewing in MySignals APP Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use your smartphone touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

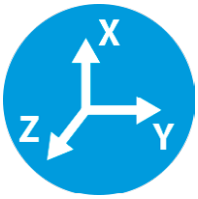


Figure : Selected sensor logo APP

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
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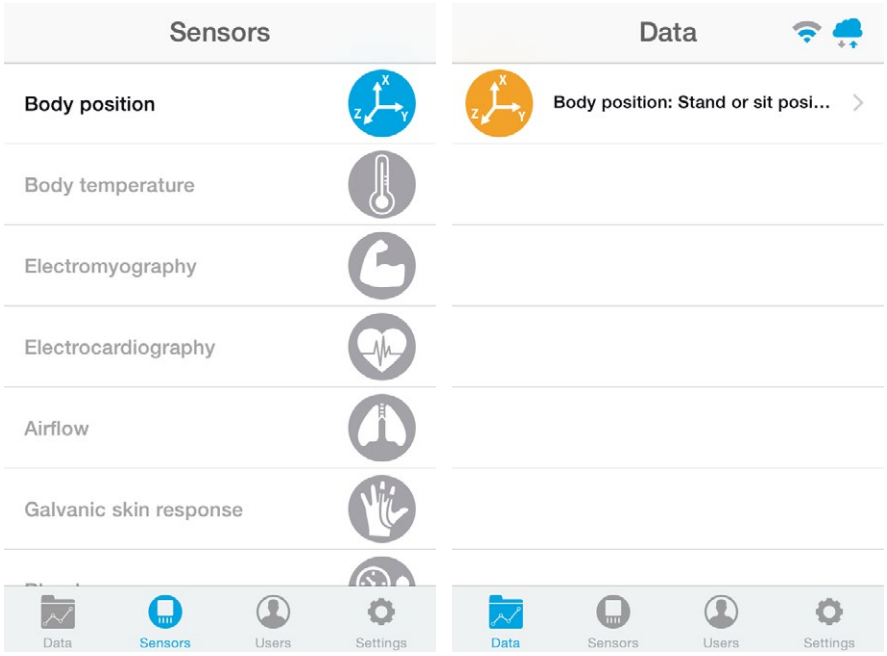


Figure : General mode and selecting general mode APP

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

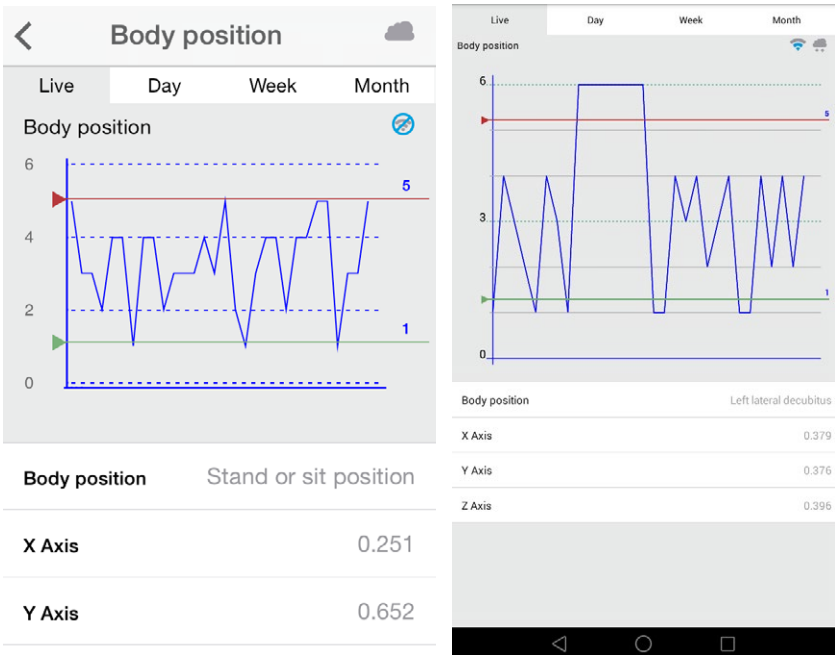


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

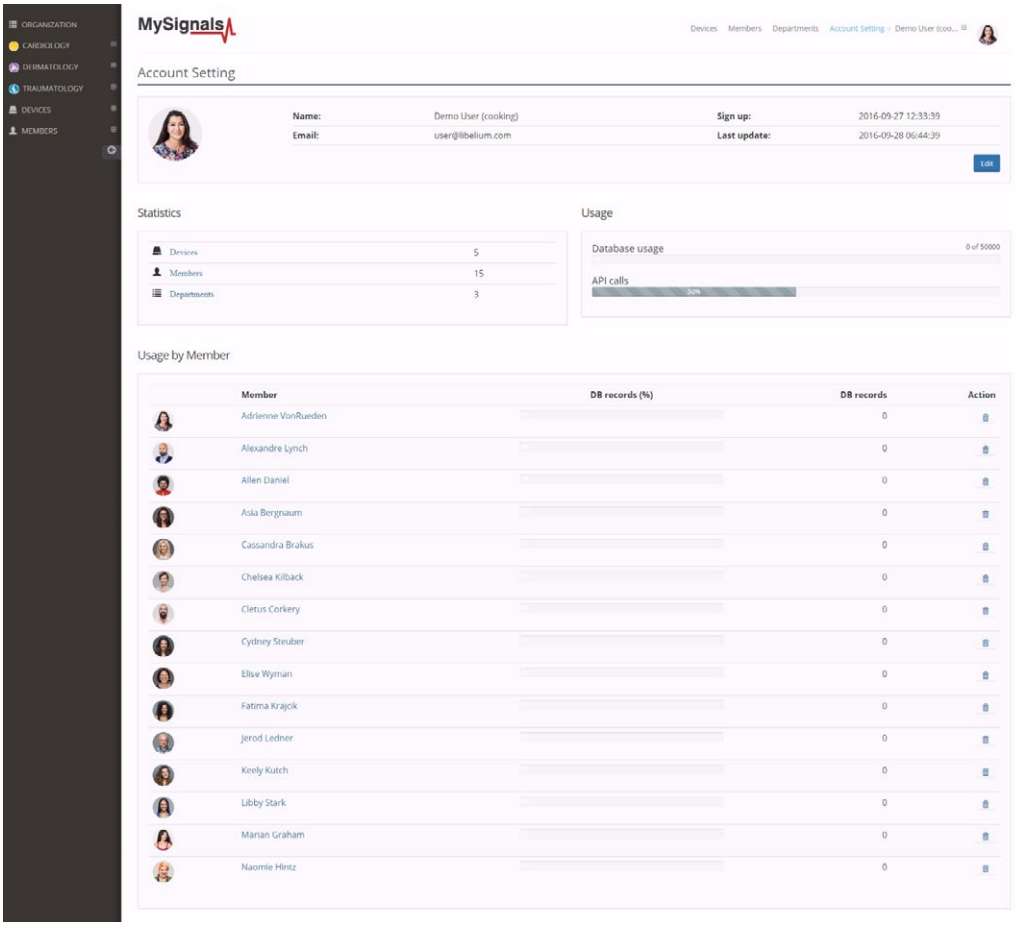


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

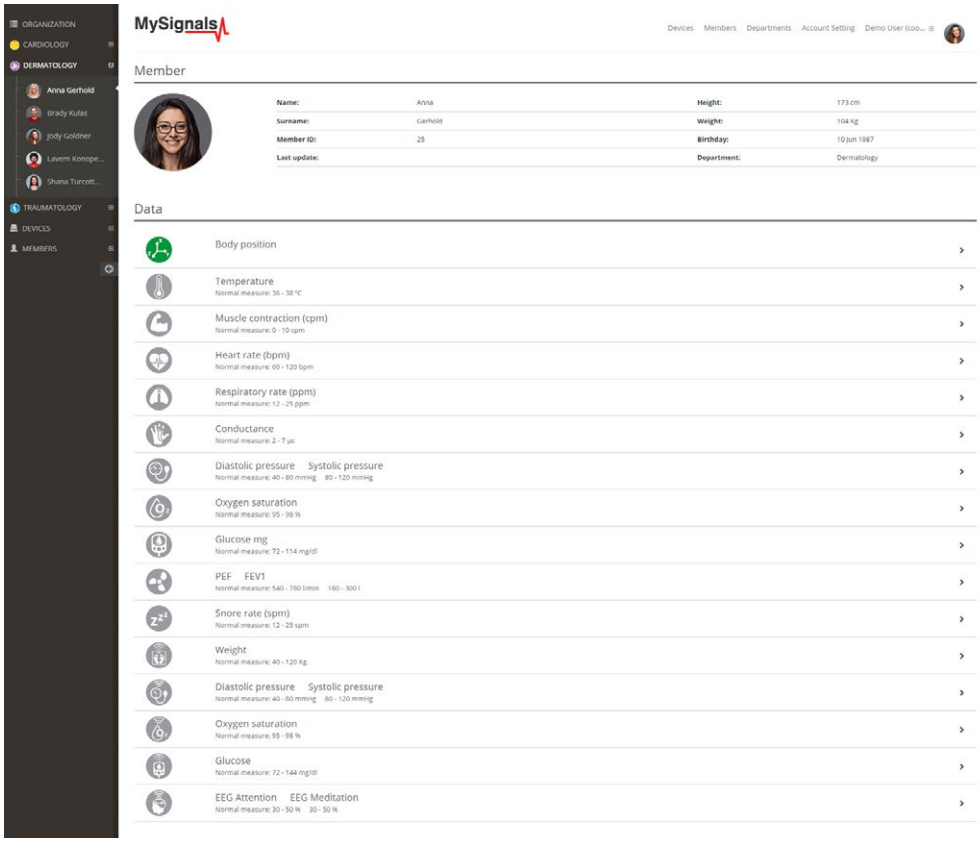


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

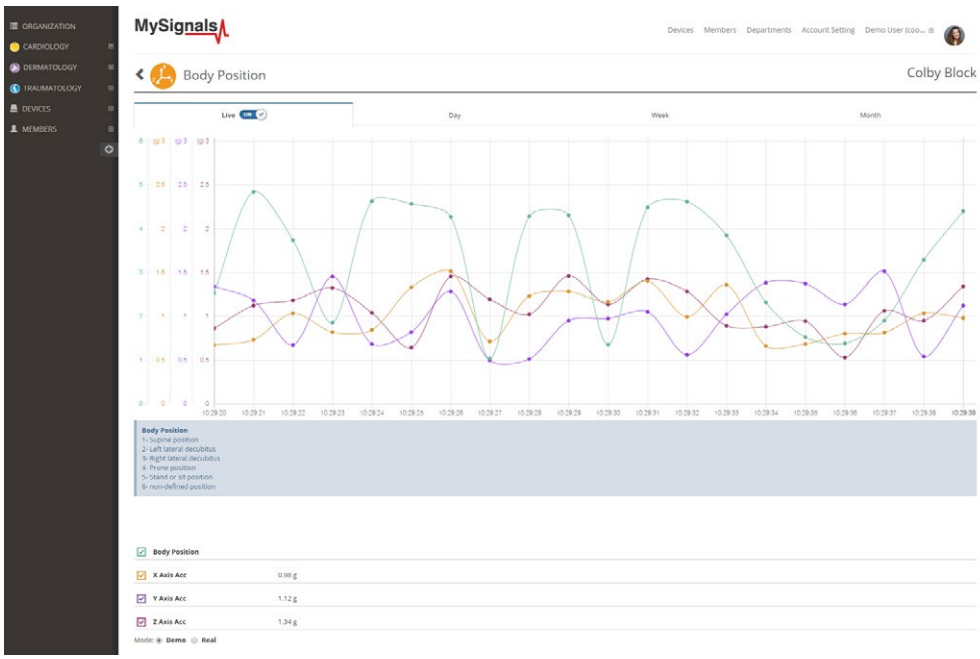


Figure : Detail mode Web Server

6.1.11. Snore

Snoring is a major symptom of obstructive sleep apnea (OSA). In most sleep studies, snoring is detected with a microphone. Since these studies analyze the acoustic properties of snoring, they need to acquire data at high sampling rates, so a large amount of data should be processed. Recently, several sleep studies have monitored snoring using a piezo snoring sensor. However, an automatic method for snoring detection using a piezo snoring sensor has not been reported in the literature. This study proposed the HMM-based method to detect snoring using this sensor, which is attached to the neck. The data from 21 patients with OSA were gathered for training and test sets. The short-time Fourier transform and short-time energy were computed so they could be applied to HMMs. The data were classified as snoring, noise and silence according to their HMMs. As a result, the sensitivity and the positive predictivity values were 93.3% and 99.1% for snoring detection, respectively. The results demonstrated that the method produced simple, portable and user-friendly detection tools that provide an alternative to the microphone-based method.

6.1.11.1. Sensor features

Description: This sensor attaches to the neck and records vibration. The sensor converts snoring, and other sounds in the audio range picked up through the skin, to a small analog voltage that provides a clear, reliable indication of the presence of these sounds.

Figure : Snore Sensor

Sound is absorbed via vibrations from the throat and transferred to the device which is then converted into analog signal. So, the throat method eliminates most background noise whether in the battle field or on the job site.

Snore sensor maintains constant contact with the patient's skin throughout movements or sweating so that you will consistently receive quality signals throughout the night with little to no artifact.

Vibration-type sensor unit:

- 1. With pretty good anti-noise performance
- 2. Detachable acoustic tube design
- 3. Translucent earbud, better for personal hygiene and discreet measurement
- 4. Comfortable With high-quality flexible plastic clip
- 5. Easy to be fixed on your desired place
- 6. Suitable for MySignals Hardware double-jack connector
- 7. Adjustable to suits neck size between 12" and 15".
- 8. Small PTT button right on the neck piece used to generate alerts.

The sensor needs to be connected to the specific Snore double jack connector in MySignals device and it works with direct connector power supply.

Measurement:

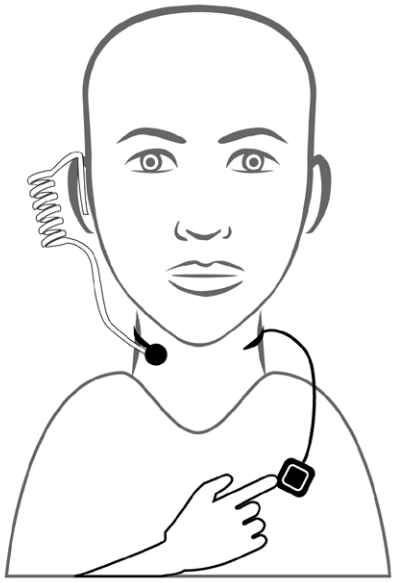
Parameter	Unit	Range
Snore rate	SPM (Snores per minute)	0-60 spm
Snore signal	Volts	0-5V

6.1.11.2. Connecting the sensor

Connect the sensor in the snore double connector indicated in the MySignals Hardware board. The sensor cable have only one way of connection to prevent errors and make the connection easier.

Figure : MySignals Software Development Platform with Snore connected

Place the sensor in your neck as you can see in the next image. You can use the translucent earbud speaker in your ear in order to detect acoustic alerts or messages.



After a few seconds you will get the values in the visualization method selected.

NOTE: *Position the sensor in the correct position as you can see in the diagram connection, and wait 3-5 minutos in order to stabilize the sensor measure.*

6.1.11.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

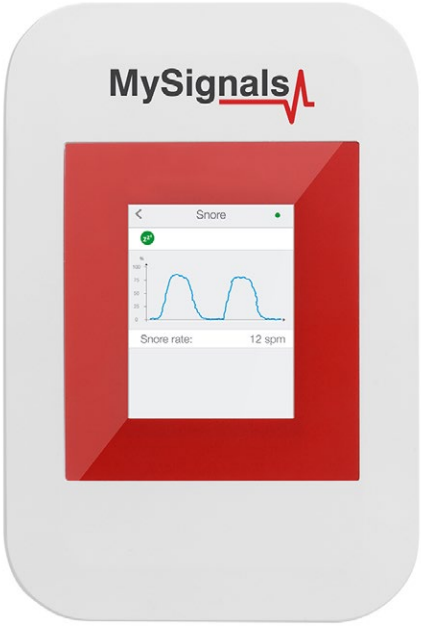


Figure : Detail mode

MySignals APP

This is an example of sensor viewing in MySignals APP Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use your smartphone touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo APP

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

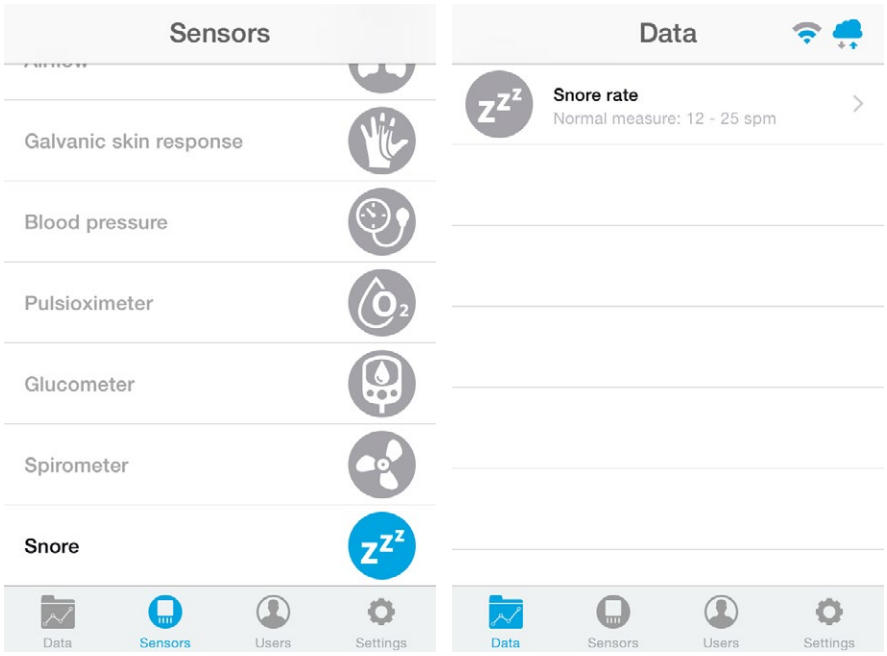


Figure : General mode and selecting general mode APP

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

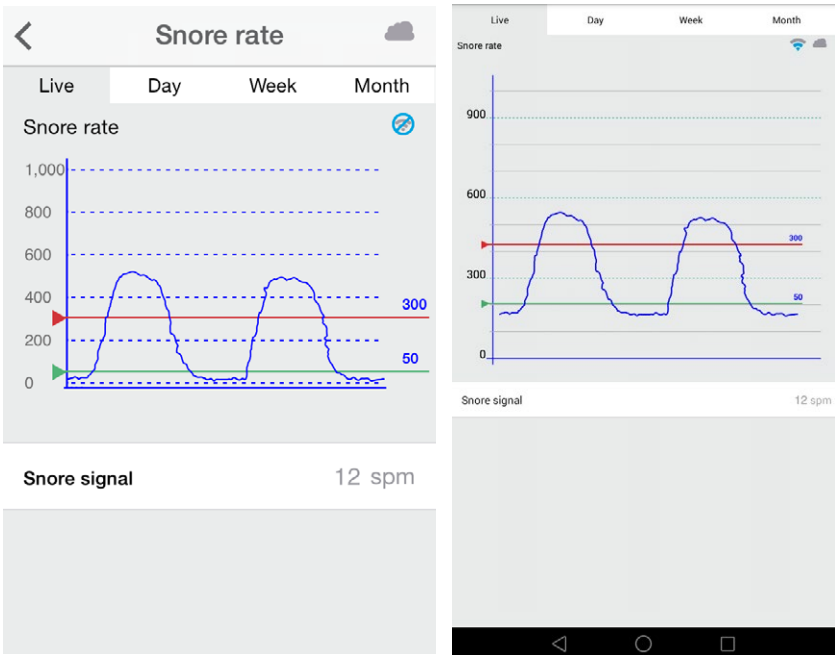


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

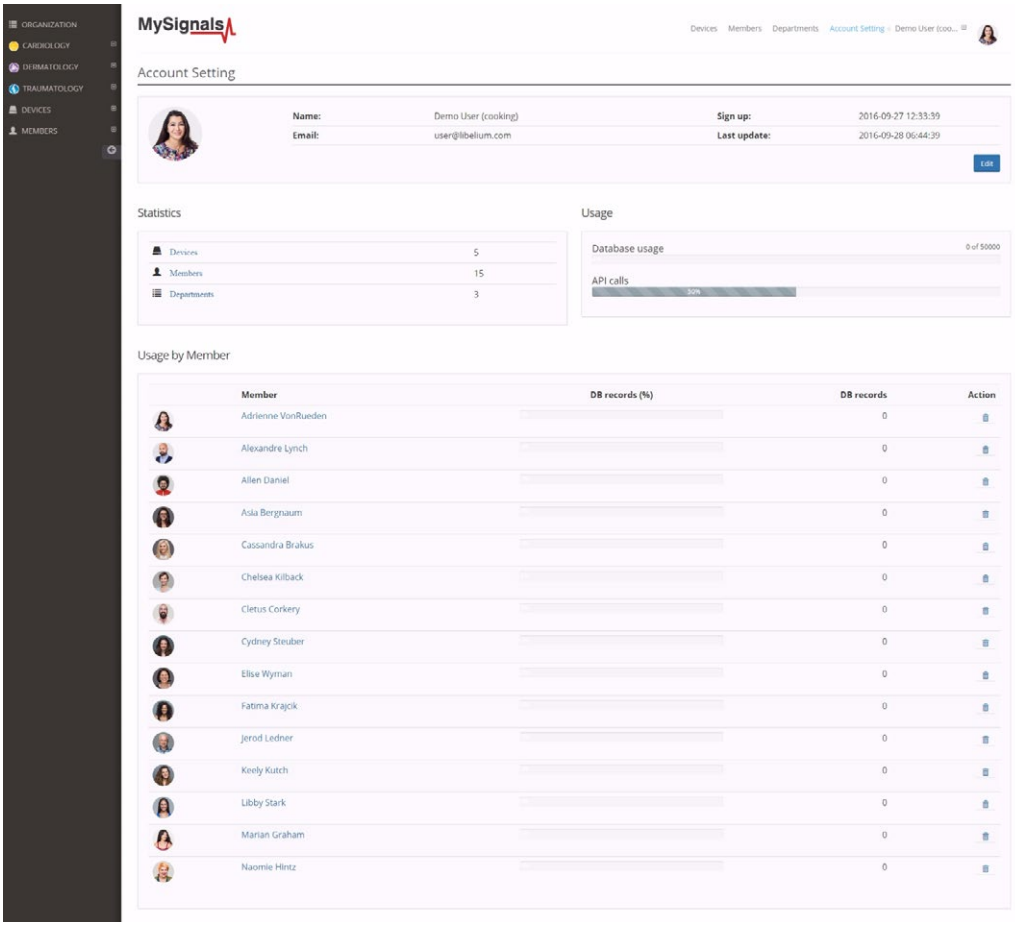


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

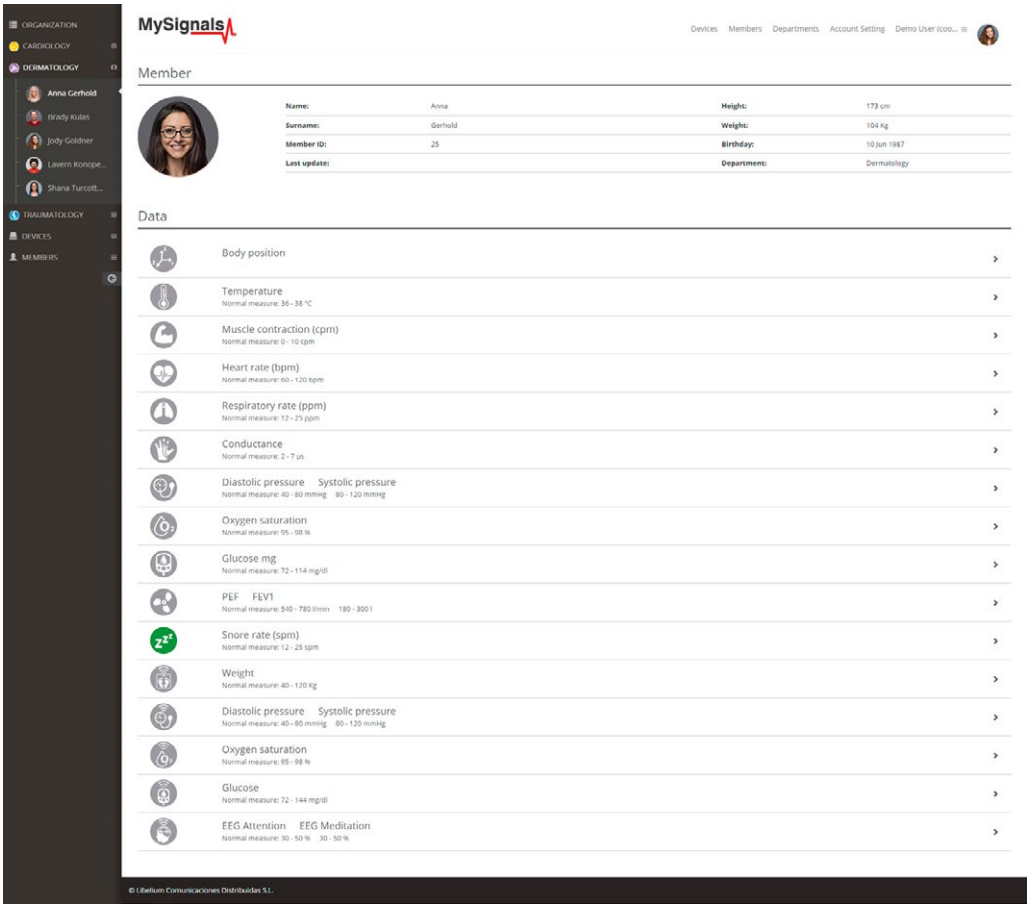


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

Figure : Detail mode Web Server

6.1.12. Wireless Sensors (BLE)

MySignals Hardware Development Platform can work with 4 different wireless biometric sensors using BLE connectivity.

- My Signals Glucometer (BLE)
- My Signals Blood pressure monitor (BLE)
- My Signals Pulsioximeter SPO2 (BLE)
- My Signals Scale (BLE)

My Signals can work too with a EEG optional BT2.0 device. If you are interested in this sensor, please contact with our commerial department.

- My Signals EEG

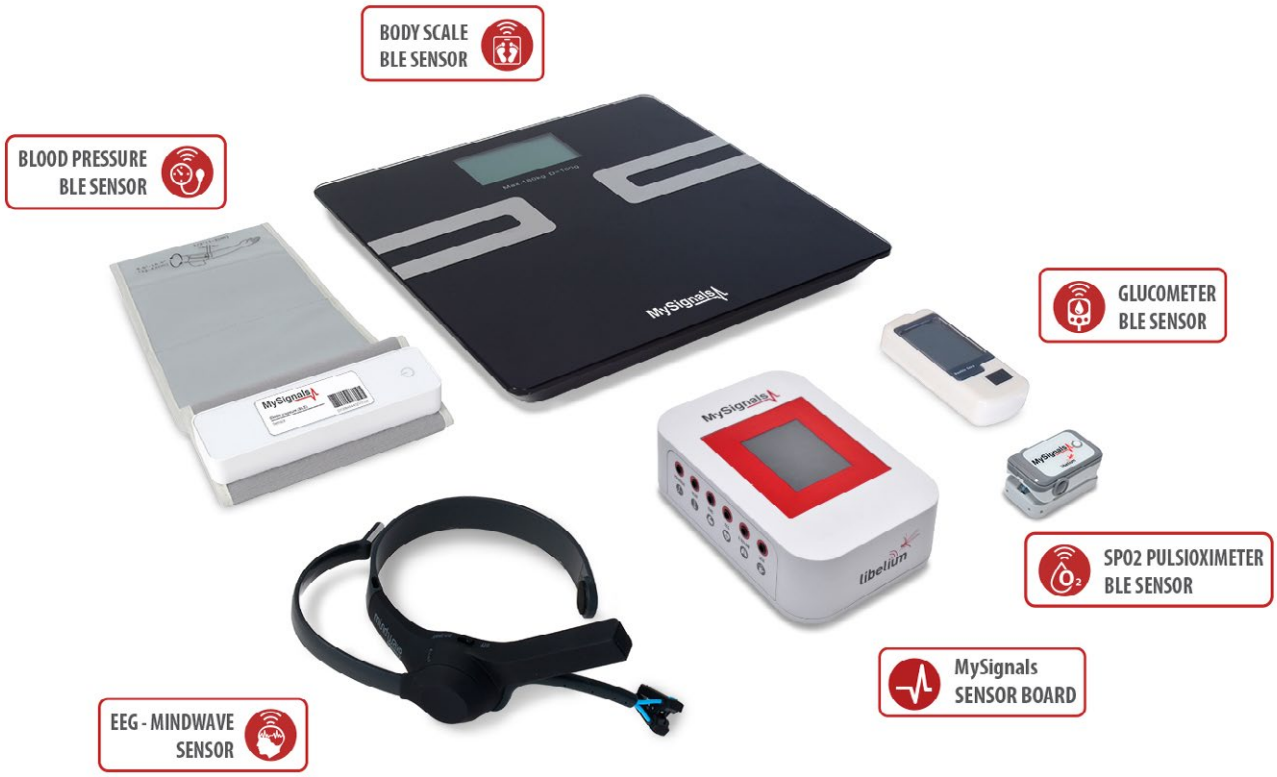


Figure : MySignals Hardware Development Platform with Wireless Sensors

> ***NOTE:*** *BLE sensors are not compatible with the mobile App for the moment, however you can used them in standalone and web server mode*

6.1.13. Body Scale (BLE)

Weighing scales (or weigh scales or scales) are devices to measure weight or calculate mass. Spring balances or spring scales measure weight (force) by balancing the force due to gravity against the force on a spring, whereas a balance or pair of scales using a balance beam compares masses by balancing the weight due to the mass of an object against the weight of a known mass or masses.

6.1.13.1. Sensor features

Description: Multipurpose personal portable digital weight health body scale.

Monitor your body weight like never before with a digital wireless body fat monitor. This bathroom scale uses a BLE connection to sync your weight, BMI, and body fat readings with your personal health dashboard.

Figure : Body Scale sensor

- Max Capacity : 150kg/330lb
- Display Readability : 0.1kg/0.2lb
- Weighing Units : kg. lb. st
- Platform : Tempered Glass + 18/8 SS
- LED Display

The sensor works with internal batteries.

Measurement:

Parameter	Unit	Range
Weight	Kilograms	5-150Kg
Bone	Percentage	0-100%
Body fat	Percentage	0-100%
Muscle mass	Percentage	0-100%
Body water	Percentage	0-100%
Visceral fat	Percentage	0-100%
BMI	Kcal	0-500Kcal
BMR	Kcal	0-500Kcal

6.1.13.2. Connecting the sensor

This sensor have not cable. This sensor send the data wirelessly to MySignals board.

- The device is designed to allow auto step on. The first time you use the scale please ignore the initial reading as this may reflect the factory settings. The scale will be accurate as of the second use.
- For better results, always remove your shoes and socks.
- It is advisable to always take measurement at the same time of the day.
- Readings can be misleading after intensive exercise, excessive dietingor under extreme dehydration.
- Always weigh/use the scale on a hard and flat surface.
- For children under 10 or adults over 100, the scale can only be used in regular weighing mode.
- For adults over 70, body builders or people with extreme fitness levels, there may be deviations in the measured data

This scale is available in kg or lb. You can set to the one you prefer by pressing the unit

Conversion button on the back of the scale (picture shown on the left). Press the unit conversion button when scale is powered off. LCD shows current weight unit. Press the button again to convert to another weight unit.

Figure : Configuration button

It is really important to remove your shoes and socks before stepping on the scale especially when you are using the scale in body analysis weighing mode. Assure that your feet are well positioned on the metallic sensors, otherwise the scale will not be able to determine your body composition.

Figure : MySignals Software Development Platform with Body Scale starting the measure

The sensor will begin to make a measurement. In order to measure correctly is important to maintain body in the correct position.

Wait until MySignals program indicate that it is connected with the BLE sensor.

Figure : Body Scale measure finished

Do not make abrupt movements or the measure will be not reliable.

The Body Scale will take a few moments to calculate the human body reading and send them wirelessly

Figure : MySignals Hardware Development Platform with Body Scale situated in the user body

After a few seconds you will get the values in the visualization method programmed.

Setting personal parameters

The first time you turn on your scale, it have defined default parameters (Gender, Height, Age...)

Parameters can be set using MySignals APP.

6.1.13.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

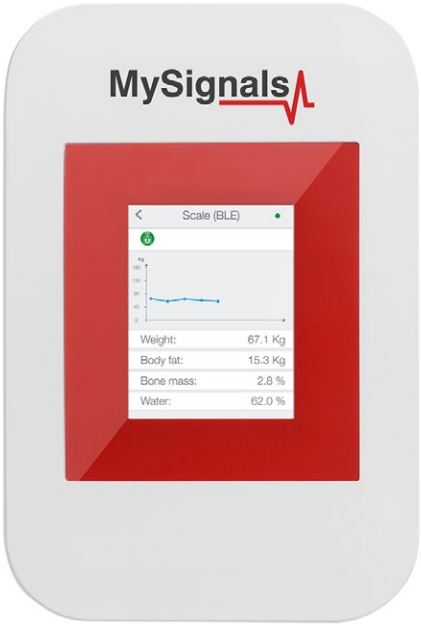


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

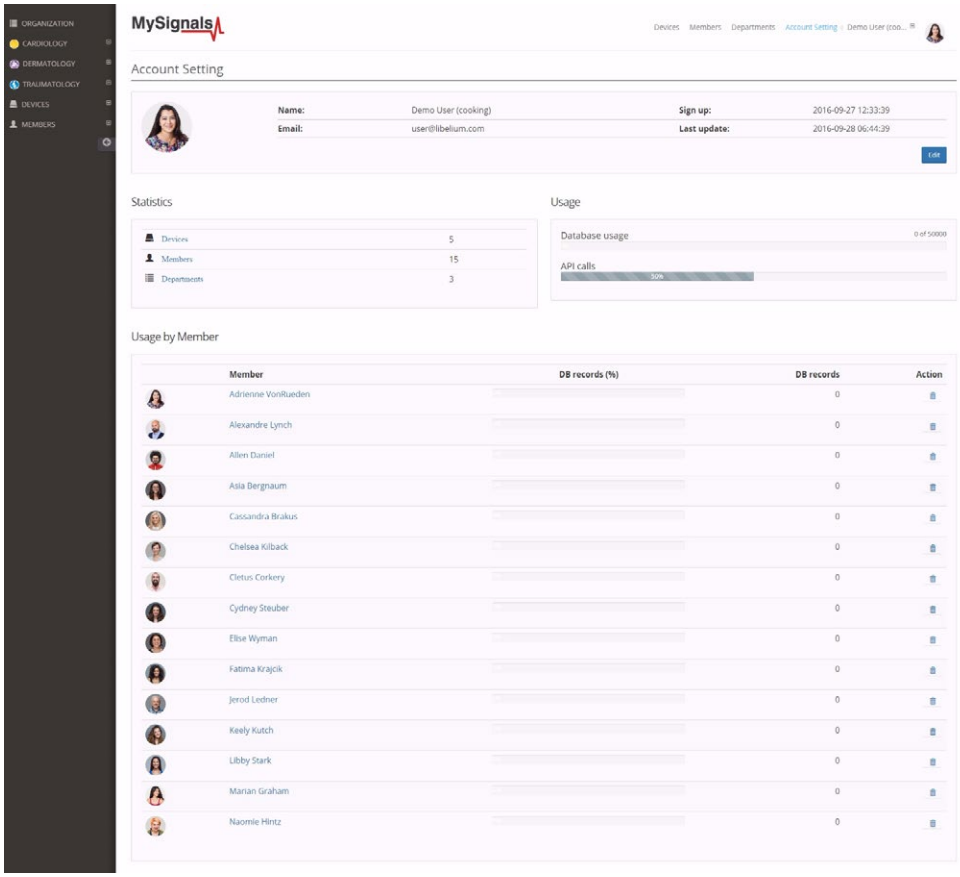


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

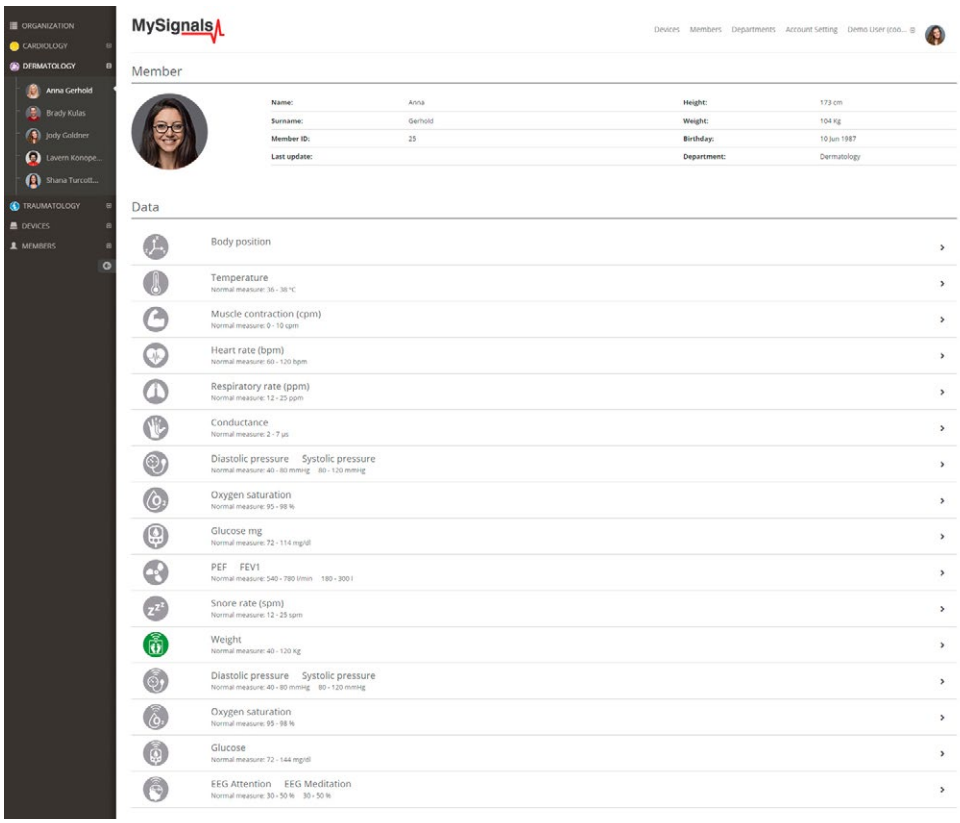


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

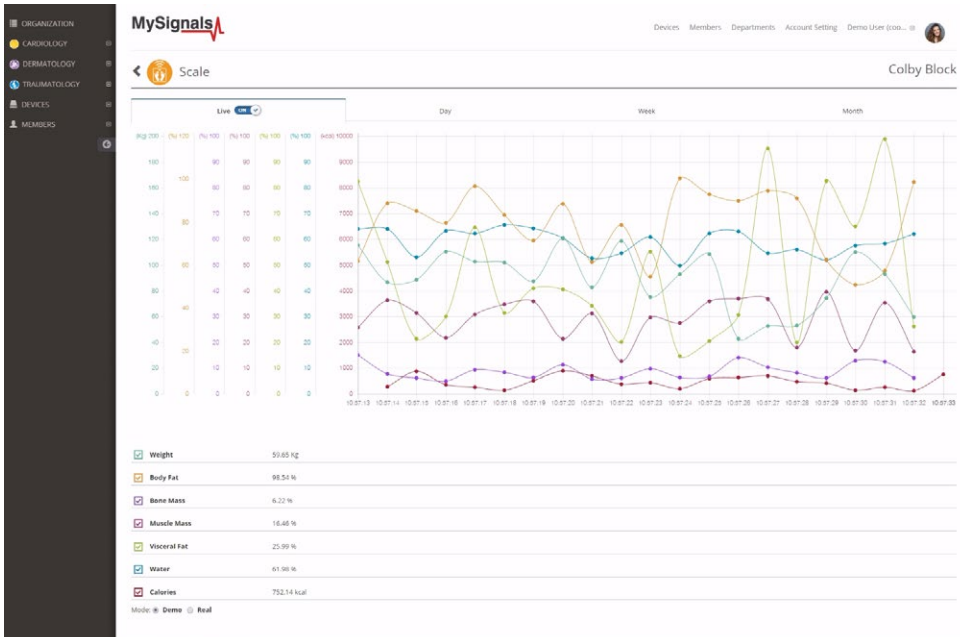


Figure : Detail mode Web Server

6.1.14. Pulse and Oxygen in Blood SPO2 (BLE)

6.1.14.1. Sensor features

Description: Pulse oximetry a noninvasive method of indicating the arterial oxygen saturation of functional hemoglobin.

Oxygen saturation is defined as the measurement of the amount of oxygen dissolved in blood, based on the detection of Hemoglobin and Deoxyhemoglobin. Two different light wavelengths are used to measure the actual difference in the absorption spectra of HbO2 and Hb. The bloodstream is affected by the concentration of HbO2 and Hb, and their absorption coefficients are measured using two wavelengths 660 nm (red light spectra) and 940 nm (infrared light spectra). Deoxygenated and oxygenated hemoglobin absorb different wavelengths.

Figure : Pulse and Oxygen in Blood (SPO2)

Deoxygenated hemoglobin (Hb) has a higher absorption at 660 nm and oxygenated hemoglobin (HbO2) has a higher absorption at 940 nm . Then a photo-detector perceives the non-absorbed light from the LEDs to calculate the arterial oxygen saturation.

A pulse oximeter sensor is useful in any setting where a patient's oxygenation is unstable, including intensive care, operating, recovery, emergency and hospital ward settings, pilots in unpressurized aircraft, for assessment of any patient's oxygenation, and determining the effectiveness of or need for supplemental oxygen.

Acceptable normal ranges for patients are from 95 to 99 percent, those with a hypoxic drive problem would expect values to be between 88 to 94 percent, values of 100 percent can indicate carbon monoxide poisoning.

The sensor works with internal batteries.

Parameter	Unit	Range
Pulse	ppm	25-50 ppm
SPO2	%	35-100%

6.1.14.2. Connecting the sensor

This sensor have not cable. This sensor send the data wirelessly to MySignals board.

Place the SPO2 on your finger as shown in the image below.

Figure : SPO2 connection diagram

Turn on the SPO2 (press ON button). The sensor will begin to make a measurement. In order to measure correctly is important to maintain finger in the correct position.

Wait until MySignals program indicate that it is connected with the BLE sensor.

Figure : SPO2 sensor ON button

Do not make abrupt movements or the measure will be not reliable.

The SPO2 will take a few moments to calculate the pulsioximeter reading and send them wirelessly

Figure : MySignals Hardware Development Platform with SPO2 situated in the user body

After a few seconds you will get the values in the visualization method programmed.

6.1.14.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

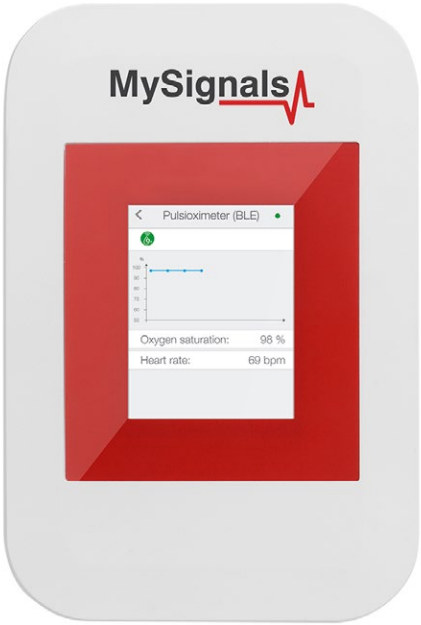


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

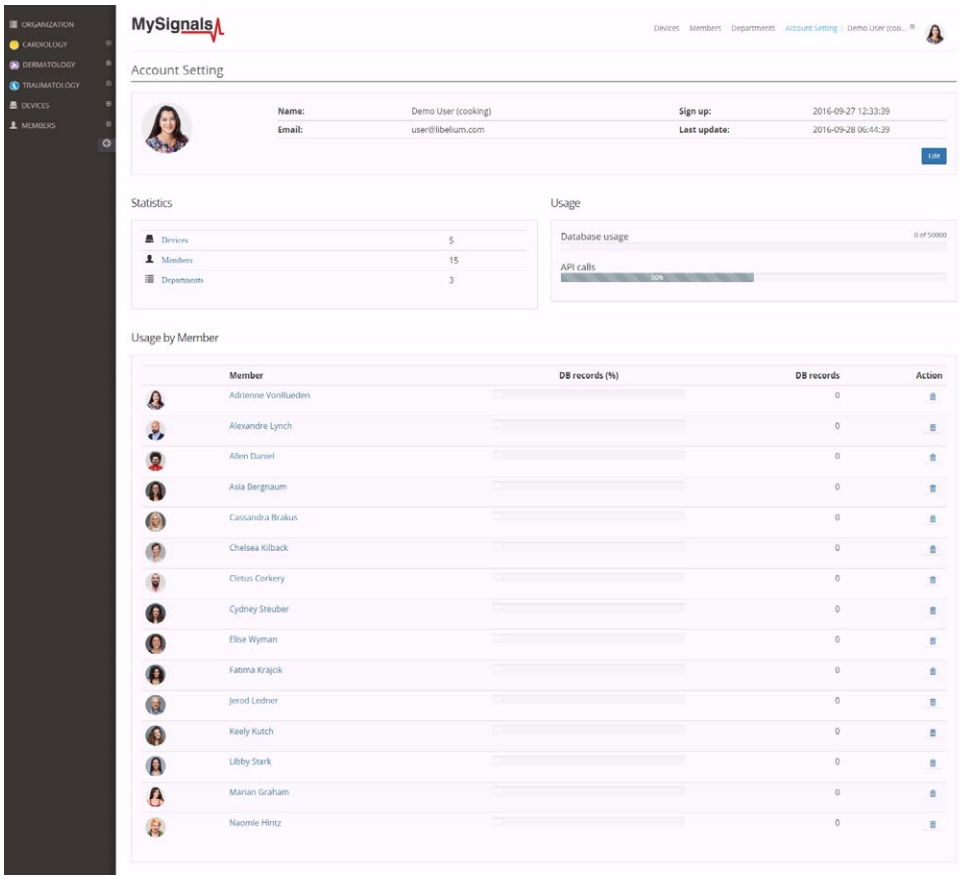


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

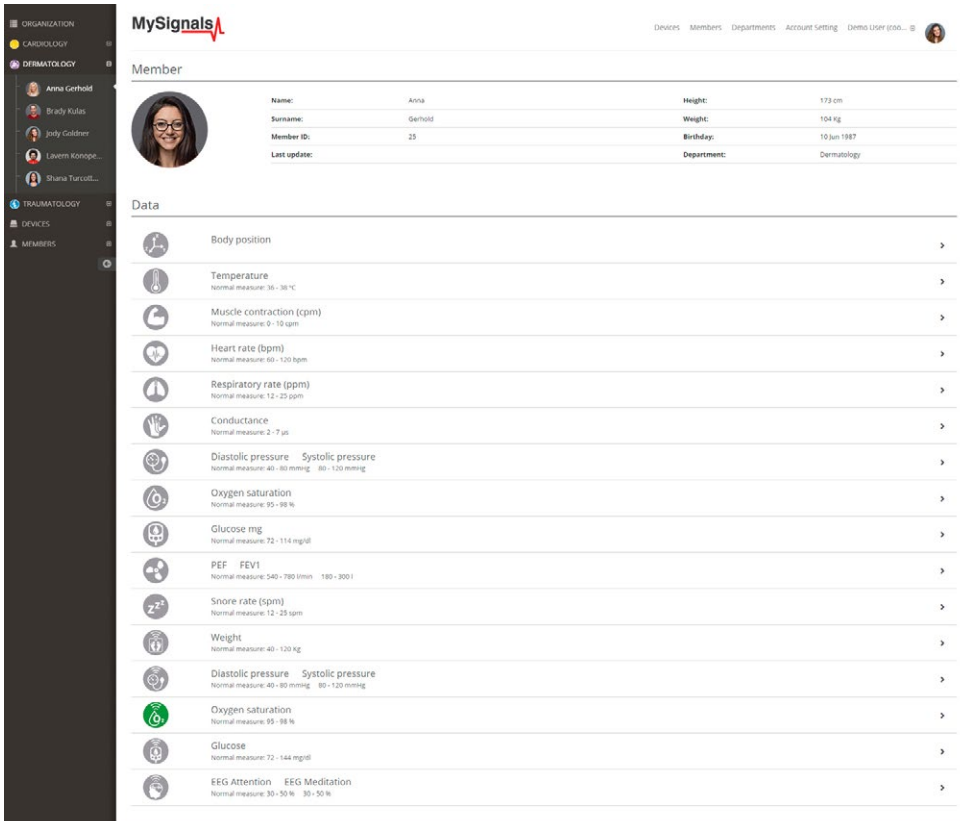


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

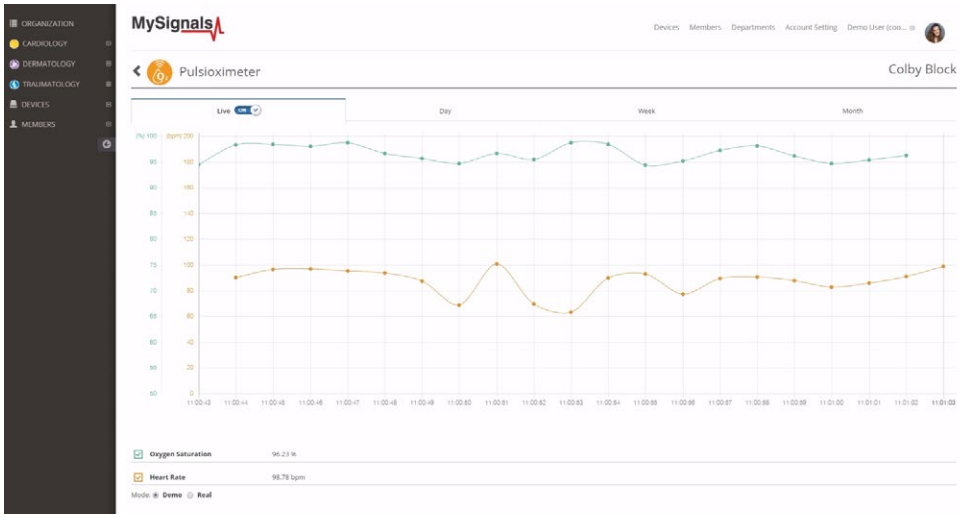


Figure : Detail mode Web Server

6.1.15. Blood Pressure Monitor (BLE)

Blood pressure is the pressure of the blood in the arteries as it is pumped around the body by the heart. When your heart beats, it contracts and pushes blood through the arteries to the rest of your body. This force creates pressure on the arteries. Blood pressure is recorded as two numbers—the systolic pressure (as the heart beats) over the diastolic pressure (as the heart relaxes between beats).

6.1.15.1. Sensor features

Description: Monitoring blood pressure at home is important for many people, especially if you have high blood pressure. Blood pressure does not stay the same all the time. It changes to meet your body's needs. It is affected by various factors including body position, breathing or emotional state, exercise and sleep. It is best to measure blood pressure when you are relaxed and sitting or lying down.

Figure : Blood Pressure sensor

Classification of blood pressure for adults (18 years and older)

High blood pressure (hypertension) can lead to serious problems like heart attack, stroke or kidney disease. High blood pressure usually does not have any symptoms, so you need to have your blood pressure checked regularly.

SPECIAL FEATURES:

- Automatic measurement of systolic, diastolic and pulse
- 80 measurement results with time & date stored in the device

KEY SPECIFICATIONS

- Measurement method: Oscillometric system
- Measuring range: Pressure 0-300 mmHg
- Pulse 30~200 p/min
- Measuring accuracy: Pressure ≤ ±3 mmHg
- Pulse ≤ 5%
- Operating environment: Temperature 10-40ºC
- Relative humidity ≤ 80%

The sensor works with internal rechargeable battery. Use the Blood pressure specific cable in order to charge the sensor connected to MySignals.

Figure : Blood Pressure sensor with charger cable connected

Measurement:

Parameter	Unit	Range
Systolic pressure	mm Hg	0-300 mm Hg
Diastolic pressure	mm Hg	0-300 mm Hg
Pulse	ppm	30-200ppm

6.1.15.2. Connecting the sensor

Connecting the sensor

This sensor have not cable. This sensor send the data wirelessly to MySignals board.

Place the sphygmomanometer on your arm (biceps zone) as shown in the image below.

Figure : Blood Pressure connection diagram

Turn on the sphygmomanometer cuff (press ON button). The sensor will begin to make a measurement. In order to measure correctly is important to maintain the arm and the cuff in the correct position.

Wait until MySignals program indicate that it is connected with the BLE sensor.

Figure : Blood Pressure sensor ON button

Do not make abrupt movements or the measure will be not reliable.

The sphygmomanometer will take a few moments to calculate the blood pressure reading and send them wirelessly

Figure : MySignals Hardware Development Platform with Blood Pressure situated in the user body

After a few seconds you will get the values in the visualization method programmed.

6.1.15.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

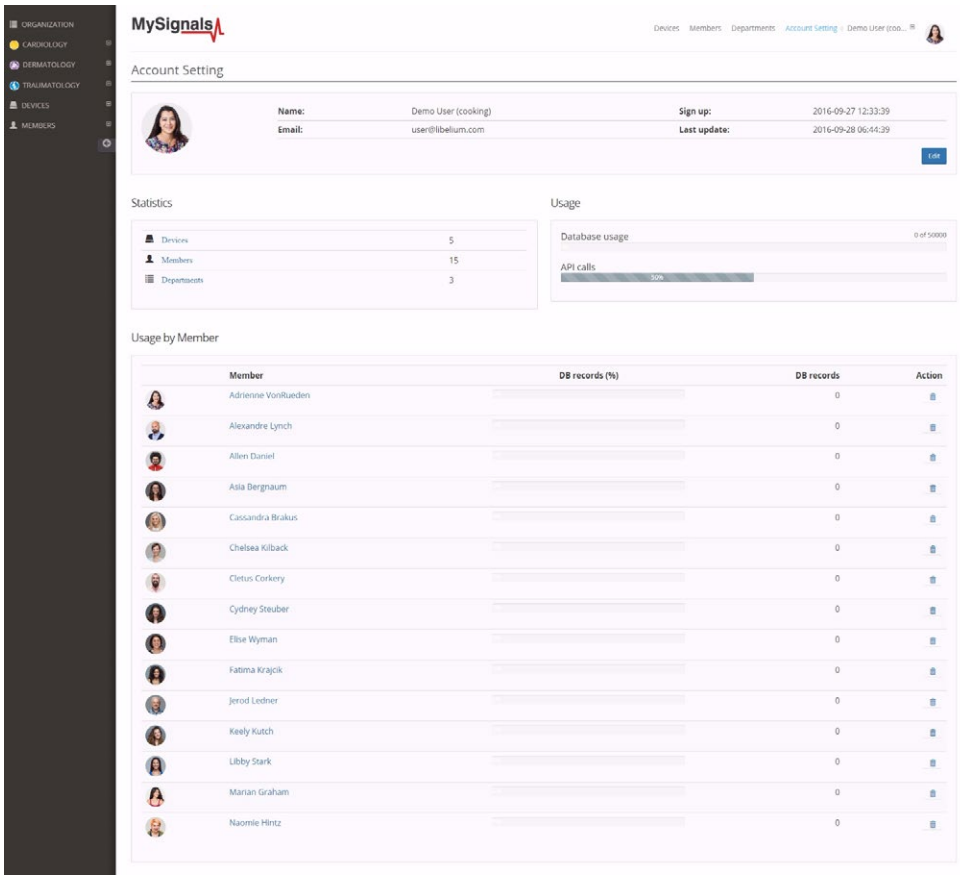


Figure : Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

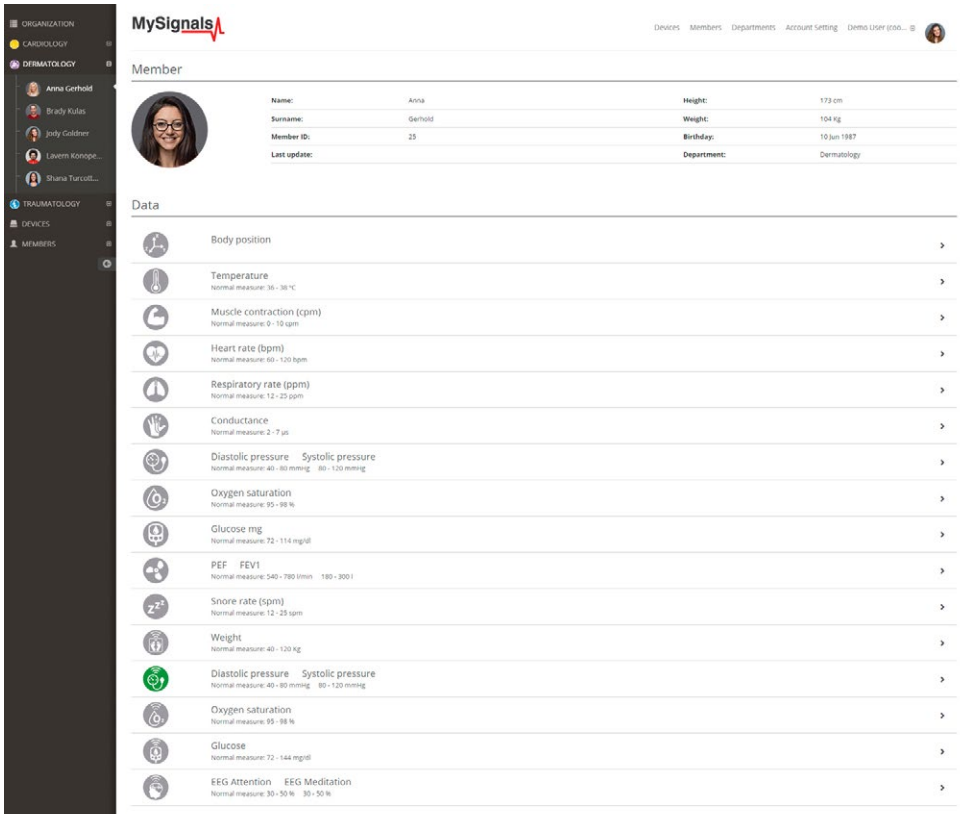


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

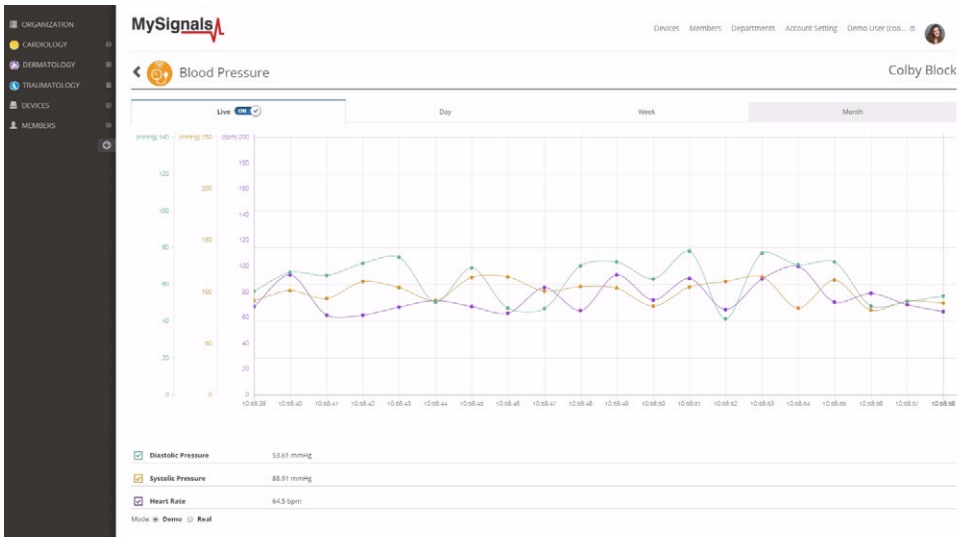


Figure : Detail mode Web Server

6.1.16. Glucometer (BLE)

Despite widely variable intervals between meals or the occasional consumption of meals with a substantial carbohydrate load, human blood glucose levels tend to remain within the normal range. However, shortly after eating, the blood glucose level may rise, in non-diabetics, temporarily up to 7.8 mmol/L (140 mg/dL) or a bit more.

6.1.16.1. Sensor features

Description: Glucometer is a medical device for determining the approximate concentration of glucose in the blood. A small drop of blood, obtained by pricking the skin with a lancet, is placed on a disposable test strip that the meter reads and uses to calculate the blood glucose level. The meter then displays the level in mg/dl or mmol/l.

Figure : Glucometer sensor

The sensor works with internal batteries.

6.1.16.2. Connecting the sensor

This sensor have not cable. This sensor send the data wirelessly to MySignals board.

Place a test strip in the machine when the machine is ready. Watch the indicator for placing the blood to the strip.

Figure : Insert strip in the glucometer.

Wait until MySignals program indicate that it is connected with the BLE sensor.

Figure : Ready for measurement glucometer

Clean the end of your index finger with rubbing alcohol before pricking it with an sterile needle or lancet.

***NOTE**:The needles or lancets are not provided.*

Figure : Lancet glucometer method 1

Pierce your finger tip on the soft, fleshy pad and obtain a drop of blood. The type of drop of blood is determined by the type of strip you are using

Figure : Lancet glucometer method 2

Place the drop of blood on or at the side of the strip.

Figure : Drop glucometer method 1

Figure : Drop glucometer method 2

The glucometer will take a few moments to calculate the blood sugar reading.

Figure : Glucometer measure

The glucometer send wirelessly the value to MySignals.

Figure : Diagram connection

When the glucometer send all the information, turn off the device.

6.1.16.3. Examples of use

Standalone Mode

This is an example of sensor measuring in Standalone Mode.

First of all select the sensor that you want to measure in the Select Sensors screen. Use the touchscreen pressing in the correct simbol. You can see the selected sensors logos in blue color.

Figure : Selected sensor logo

Then you can go to General Sensor screen using the left down corner logo. MySignals will start to monitor all the parameters in General Mode where it only show numeric values.

Figure : General mode and selecting general mode

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

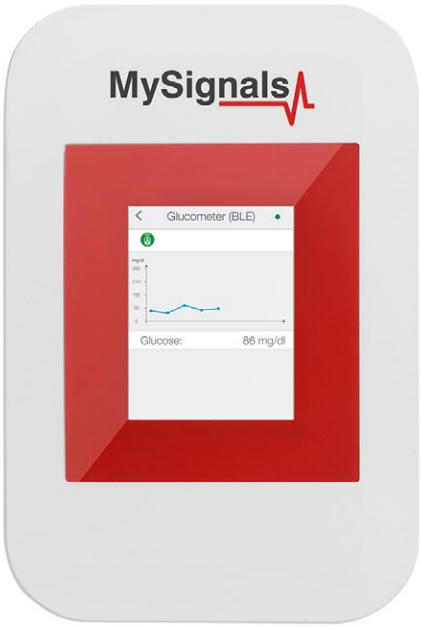


Figure : Detail mode

MySignals Web Server

This is an example of sensor viewing in MySignals Web Server Mode.

First of all choose the sensor that you want to visualize. You can use the fast menu situated in the left side of the Web Server. Choose a user or a device.

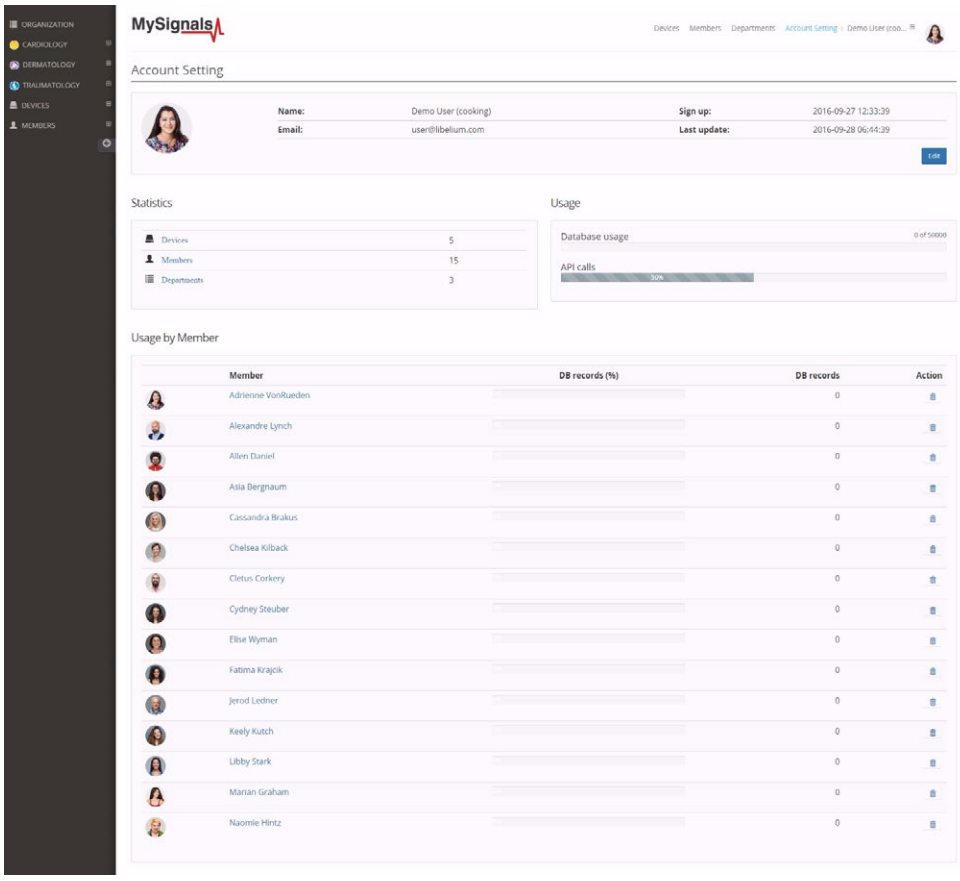


Figure : Figure: Select user or device

Then you can see the General Sensor page. MySignals Web Server will monitor all the parameters in General Mode where it only show numeric values.

You can see in this screen a color code in the sensor logos:

- Green: It is a real- time value measured in MySignals Software
- Orange: It is a old value measured in a previously connection of some time ago.
- Grey: It is that the sensor is not connected.

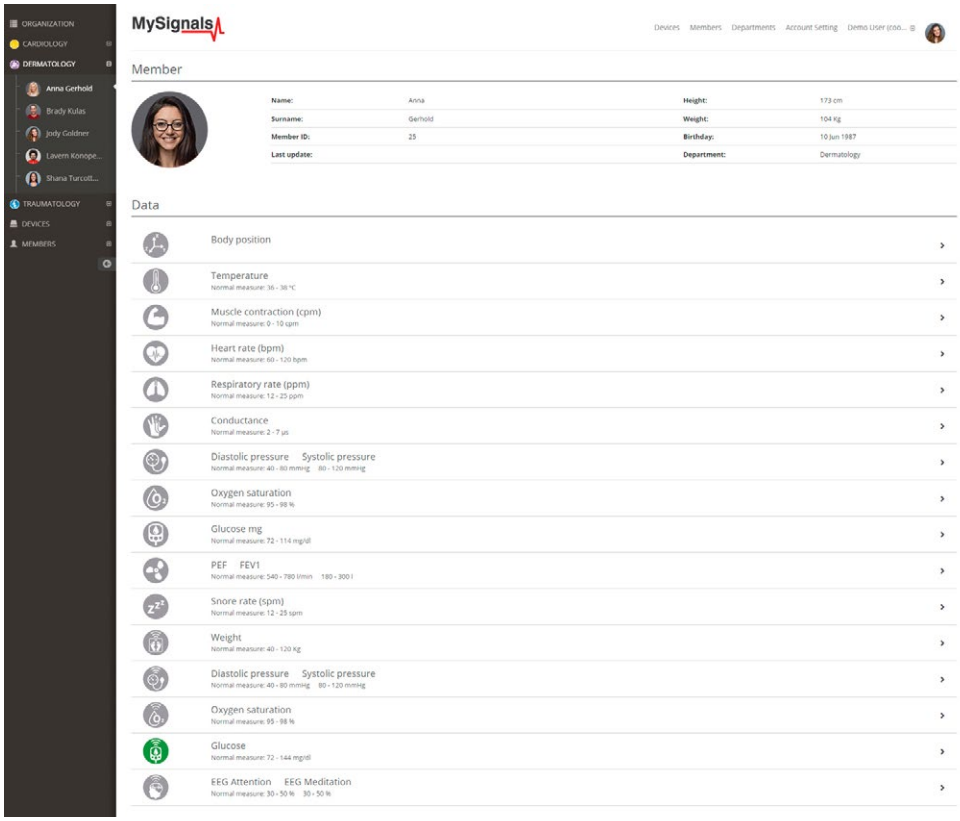


Figure : General mode Web Server

Finally, you can go to detail mode for each sensor selected. Press in the logo of the sensor in General Mode if you want to see the graphical and numeric values of a specific sensor.

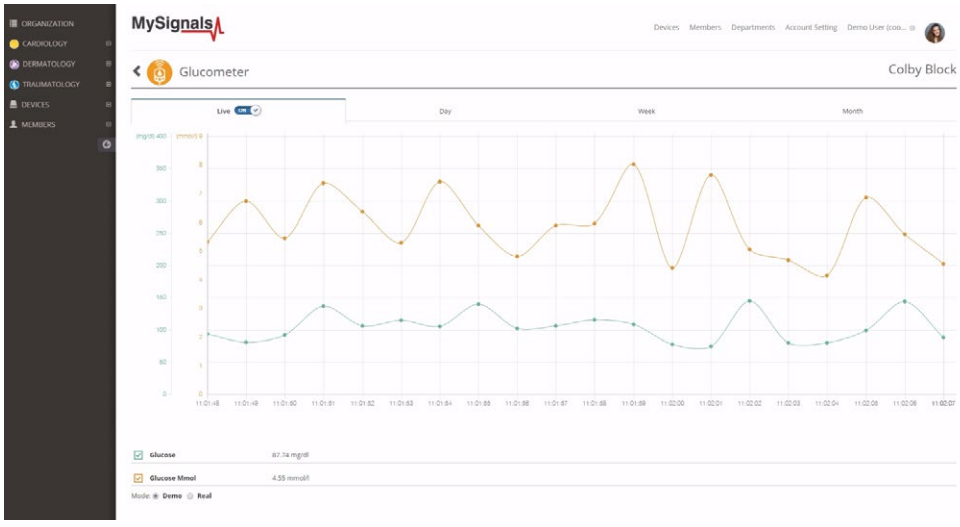


Figure : Detail mode Web Server

7. Updating Firmware

Libelium Smart Devices App allows users install new firmware versions and program the configuration of new Libelium products in a few clicks. Download the Java application at:

LINUX:
http://downloads.libelium.com/mysignals/mysignals_java/SmartDeviceApp_linux64.zip

MAC:
http://downloads.libelium.com/mysignals/mysignals_java/SmartDeviceApp_macosx64.zip

WINDOWS:
http://downloads.libelium.com/mysignals/mysignals_java/SmartDeviceApp_windows32.zip

INSTALLATION

First of all and before installing anything, users have to take into account the platform where the application is going to be installed. To install the Libelium Smart Devices App, it is compulsory to have installed the JDK 1.7 at least. If it is not installed in the computer, you can follow the steps and download it from this website:
https://docs.oracle.com/javase/8/docs/technotes/guides/install/install_overview.html

Once installed JDK, users have to download Libelium Smart Devices App. Copying and pasting this URL in a web browser, the file will be downloaded. Once downloaded it, users only have to extract the content of the zip file in a place with the right permissions, and finally execute the file called "SmarDeviceApp" that will initialize the application. Please, note that the extension of this file will depend on the operative system the user is using at the moment (sh for Linux and OSX, and bat for Windows).

7.1. Libelium Smart Devices App

This section explains every option that the application offer to users with the purpose of updating the device.

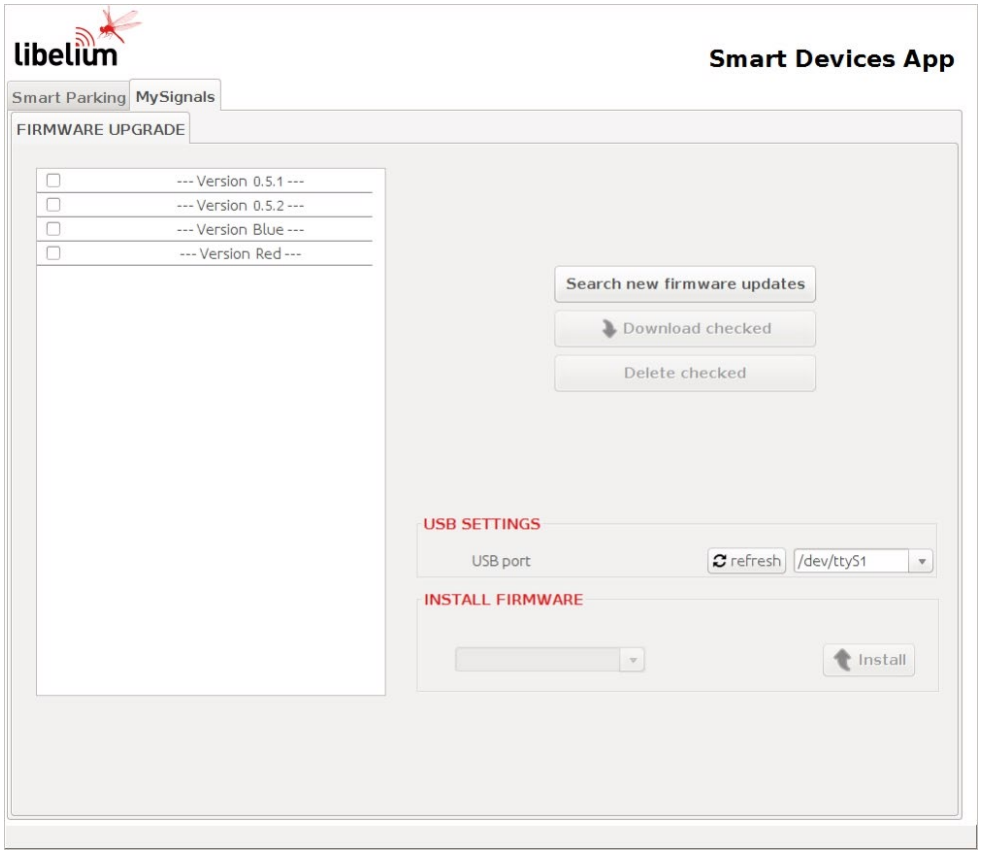


Figure : Libelium Smart Devices App

Step 1: Open the USB connector

Remove the protection cap of the USB connector.

Figure : USB protection cap

Step 2: Connect the USB cable to MySignals

Connect one side of the male-to-male USB cable to the USB connector.

Figure : USB programming cable

Step 3: Connect the USB cable to the PC

Users have to connect the device to the computer where the Smart Devices App is installed using the USB cable provided.

Now open Libelium Smart Devices App . If you do not have Libelium Smart Devices App already installed in your PC, then go to the Development section of Libelium website to download it.

Step 4: USB setting

Select the corresponding serial port by going to tools/serial port. If you are unable to see the proper USB port maybe you should install the latest FTDI drivers on your PC. Then, refresh the "USB settings" block which is in the middle part of the tab, clicking in "refresh" button. Once done it, the port where the device has been connected must be selected.

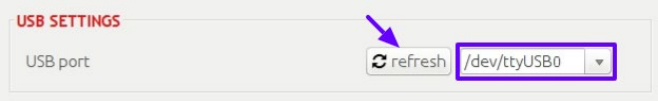


Figure : USB setting

Step 5: Download firmware versions

First of all click on the "Search new firmware updates" button. Then mark the desired version and click on "Download checked" button.

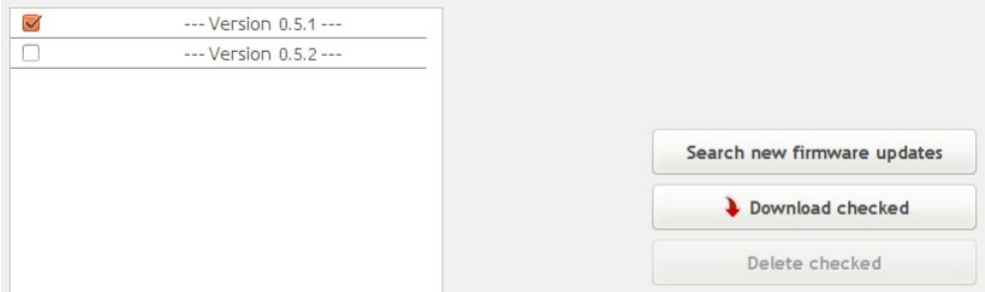


Figure : Firmware download

Step 6: Burn the new firmware

When this item is downloaded, a disk icon will be displayed near it. Once the firmware is downloaded, it is ready to be installed using the "Install Firmware" section at the bottom. In the drop-down will appear all downloaded versions. Select one and then hit on "Install" button.

Figure : Firmware downloaded

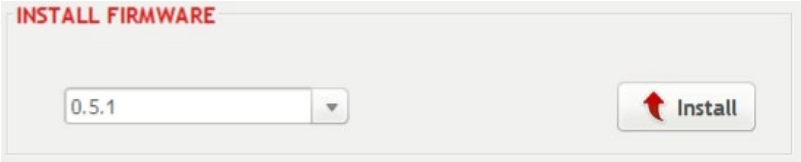


Figure : Firmware selected

Step 7: Optional – Deleting firmware

You can also delete the downloaded firmware marking the check from the list and then clicking on "Delete checked" button.

Figure : Delete option

WARNING: *DO NOT UNPLUG MYSIGNALS WHILE IT IS BEING UPGRADED OR IT MAY BE RENDERED USELESS! (THIS CASE IS NOT COVERED BY THE WARRANTY)*

8. MySignals API's

8.1. Cloud API

Libelium MySignal comes with a Cloud API that allows us to read data from our account.

We can see a list our members and read the values measured for a user by MySignal.

This data available in this RESTful API can be used by the customer to create new developments.

8.1.1. Basic configuration

There is no need to install anything but you can go to:

https://cloud.libelium.com/mysignals_documentation/api_web/

This is the representation of the API in Swagger format.

If you already know this tool you can skip this section and go to the next section (PHP Example).

Here you can browse all the available methods of the API and see the parameters that you need to use.LS

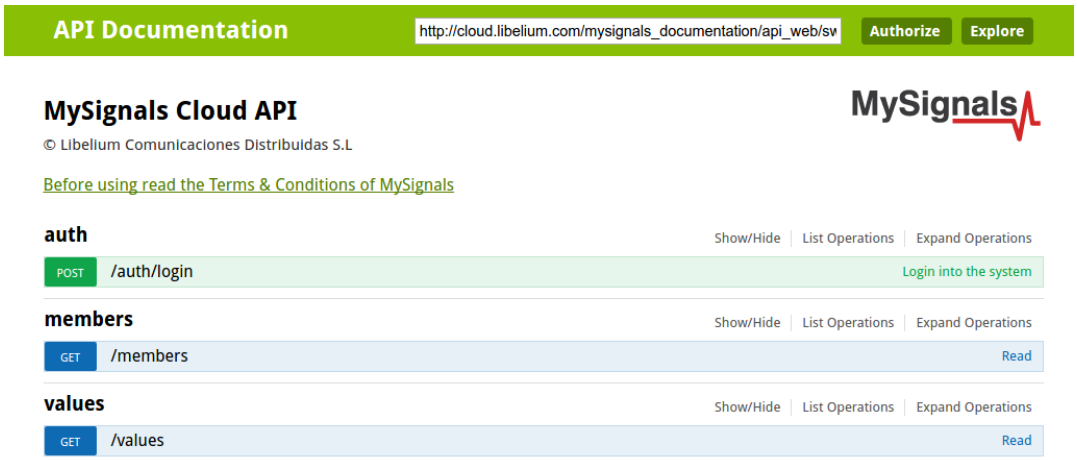


Figure : API methods availables

Is it possible to test the API from here following these steps:

Method 1: Login

Click over '/auth/login', fill the form with your email and password and click 'Try it out!'. If you provided the right data you should see something like this:

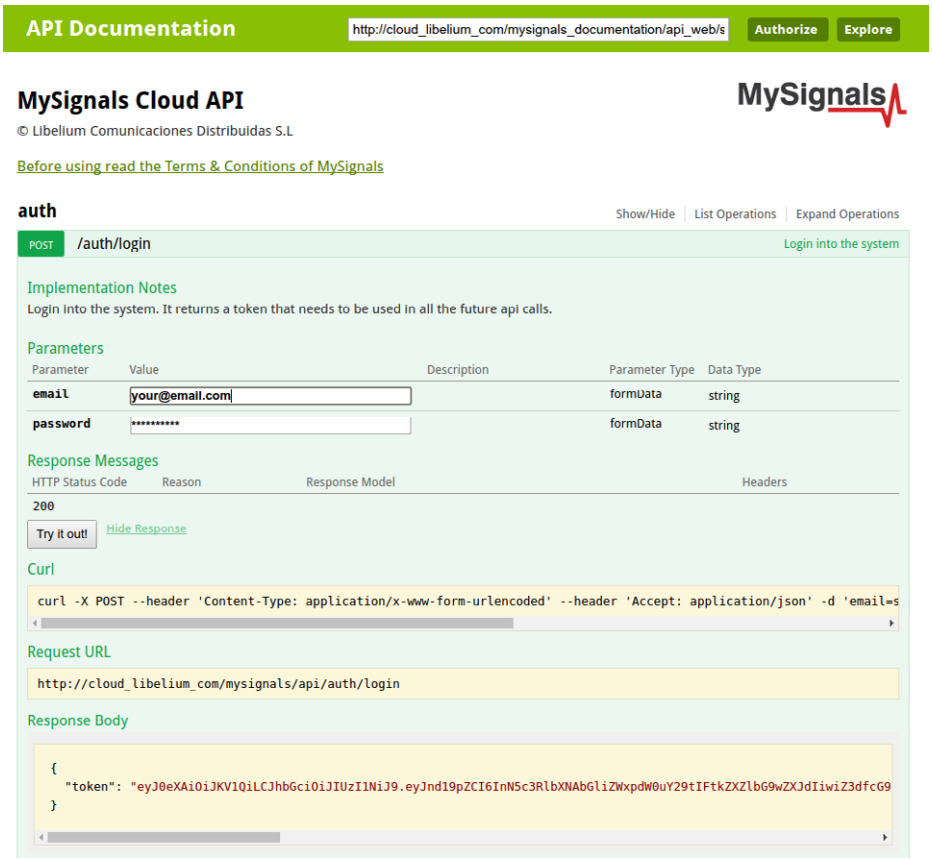


Figure : API login

The response body contains the token that you should use to access to your data in the following steps. Click 'Authorize', write 'Bearer <your token>' and click authorize.

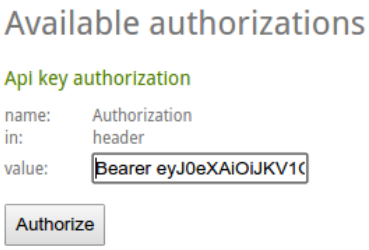


Figure : API add authorization token

Method 2: Get list of your members

Click in '/members' section and then "Try it out!" button.

You should see a list with your members.

I you don't see it please make sure that your followed all the instructions of the previous step (Login)

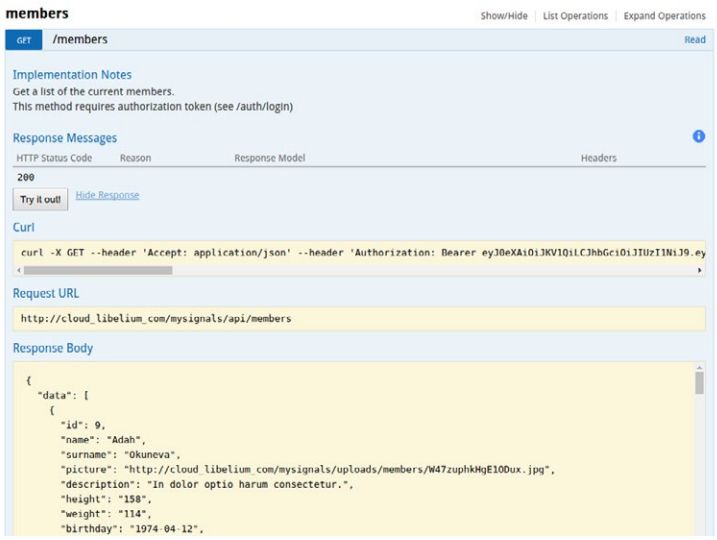


Figure : API members list

Method 3: Get the sensor values of a member

Click '/values' section and fill the parameters as in the picture. Then click "Try it out!" button.

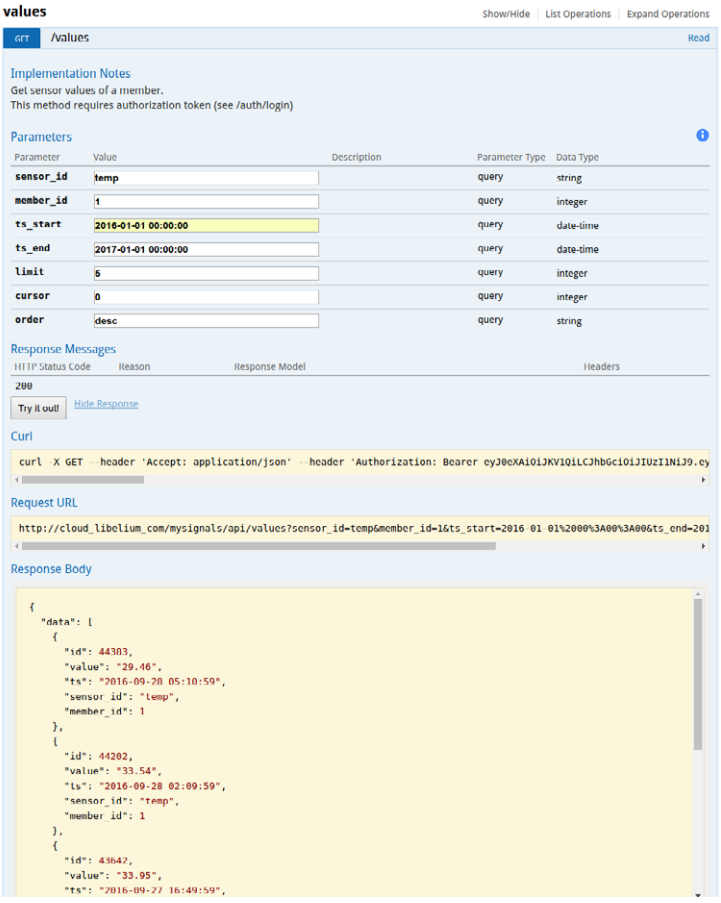


Figure : API get sensor values

Available values for sensor_id are:

sensor_id	name	units
position	Body position	1 supine, 2 left, 3 right, 4 prone, 5 stand or sit, 6 non-defined
position_x	X axis acc	g
position_y	X axis acc	g
position_z	X axis acc	g
temp	Temperature	º C
emg_cpm	Muscle contraction	cpm
ecg_bpm	Heart rate	bpm
airflow_ppm	Respiratory rate	ppm
gsr_us	Conductance	µs
gsr_ohms	Resistance	ohms
blood_dias	Diastolic pressure	mmHg
blood_syst	Systolic pressure	mmHg
blood_bpm	Heart rate	bpm
spo2_oxy	Oxygen saturation	%
spo2_bpm	Heart rate	bpm
gluco_mg	Glucose mg	mg/dl
gluco_mol	Glucose mmol	mmol/l
spir_pef	PEF	spir_pef
spir_fev	FEV1	spir_fev
snore_spm	Snore rate	spm
scale_ble_weight	Wheight	kg
scale_ble_bodyfat	Bodyfat	%
scale_ble_bonemass	Bonemass	%
scale_ble_musclemass	Musclemass	%
scale_ble_visceralfat	Visceralfat	%
scale_ble_water	Water	%
scale_ble_calories	Calories	kcal
blood_ble_dias	Diastolic pressure	mmHg
blood_ble_syst	Systolic pressure	mmHg
blood_ble_bpm	Heart rate	bpm
spo2_ble_oxy	Oxygen saturation	%
spo2_ble_bpm	Heart rate	bpm
gluco_ble_mg	Glucose	mg/dl
gluco_ble_mmol	Glucose mmol	mmol/l
eeg_ble_attention	EEG Attention	%
eeg_ble_meditation	EEG meditation	%

8.1.2. PHP example

There is an example that you can download from:
http://downloads.libelium.com/mysignals/mysignals_web/api_cloud_v1.zip

1.- Extract the zip with the example

2.- Download the 'httpfull' library and place it in the /includes directory

http://phphttpclient.com/downloads/httpful.phar

3.- Edit the file example.php and fill $email and $password with your values

4.- Go to your web browser and load the example.php page

This will log you in the system, get a list of your members and get the latest 5 temperature values of one of your users.

```
/*
 *
 *  Copyright (C) 2016 Libelium Comunicaciones Distribuidas S.L.
 *  http://www.libelium.com
 *
 *  This program is distributed WITHOUT ANY WARRANTY; without
 *  even the implied warranty of MERCHANTABILITY or FITNESS FOR A
 *  PARTICULAR PURPOSE.
 *
 *  By using it you accept the MySignals Terms and Conditions.
 *  You can find them at: http://libelium.com/legal
 *
 *
 *  Version:           0.1
 *  Design:            David Gascon
 */

include('includes/httpful.phar');

// Config
$email = 'your@email.com';
$password = 'your_password';

// API Vars
$api_base = 'https://api.libelium.com/mysignals';
$api_headers = ['Accept' => 'application/x.webapi.v1+json'];


//1.- Login
$parameters = json_encode([
    'email' => $email,
    'password' => $password
]);
$response_login = \Httpful\Request::post($api_base . '/auth/login')
    ->sendsJson()
    ->body($parameters)
    ->addHeaders($api_headers)
    ->send();
echo "1.- Login: <br><br>".$response_login->raw_body."<hr><br>";

//Save the Token in the header array.
if($response_login->code == 200){
    $api_headers['Authorization'] = 'Bearer '.$response_login->body->token;
}


//2.- Get my members
$response_members = \Httpful\Request::get($api_base . '/members')
```

```
    ->addHeaders($api_headers)
    ->send();

echo "2.- Get my members: <br><br><pre>".json_encode($response_members->body, JSON_PRETTY_
PRINT)."</pre><hr><br>";



//3.- Get values from the first of my members
if(count($response_members->body->data) >= 1){
    $member_id = $response_members->body->data[0]->id;

    $parameters = [
        'member_id' => $member_id,
        'sensor_id' => 'temp',
        'ts_start' => '2015-01-01 00:00:00',
        'ts_end' => '2017-01-01 00:01:00',
        'limit' => '5',
        'cursor' => '0',
        'order' => 'desc'
    ];
    $response_values = \Httpful\Request::get($api_base . '/values?'.http_build_
query($parameters))
        ->addHeaders($api_headers)
        ->send();

    echo "3.- Get values from one member (member_id= ".$member_id."): <br><br><pre>".json_
encode($response_values->body, JSON_PRETTY_PRINT)."</pre><hr><br>";
```

8.2. Android / iOS API

This guide intends to guide the user through some steps to communicate a MySignals device with the android and IoS library given. This guide will give some simple steps to accomplish the goal.

8.2.1. BLE Profile

Protocol: Bluetooth Low Energy

Data connection: internal AES128 BLE encryption, connection with bonding process with a restricted profile only available for bonded connection and pairing witth MITM (Man in the middle) with a PIN of 6 digits.

PROFILE BLE - MYSIGNALS

Service	Characteristic	Description	UUID	Properties	Protocol
"Generic Access Profile UUID: 2A00"	Device Name	MySignals 00001	2A00	Read	
	Device appearance	0	2A01	Read	
Device information UUID: 180A	Manufacturer Name	Libelium	2A29	Read	
	Module	MySIgnals Software	2A24	Read	
	Serial Number	MySignals ID 000001	2A25	Read	
	Software version	MySignals V1.0	2A28	Read	
Scan parameters UUID: 1813	Scan interval window	x	2A4F	Write_no_ response	
	Scan refresh	x	2A31	Notify	
Link loss UUID: 1803	Alert level	x	2A06	Read / Write	
User Service 1 **SETTINGS** UUID: eed82c0a-b1c2-401e-ae4a-afac80c80c72	1.0	WiFi name	985dc5e5-1d8c-405f-b50f-d29f700e13a1	Read / Write / Notify	ASCII codification, max. 20 char
	1.1	WiFi password	e1987994-6773-4196-94ee-3dc0474a74e2	Read / Write / Notify	ASCII codification, max. 20 char
	1.2	WiFi security	99946582-4ca1-43b3-aa79-020bf8fa0bff	Read / Write / Notify	"0: none 1: WEP 2: WPA/WPA2 Personal 3: WPA2 Personal 4: Dynamic WEP 5: WPA/WPA2 Enterprise 6: WPA2 Enterprise"
	1.3	Device_ID	88017ef1-515a-4029-b27b-6eb77f82e811	Read / Write / Notify	ASCII codification, max. 10 char
	1.4	Bluetooth Passkey	a5853c93-08af-4186-8dba-b4c0cc74a23b	Read / Write / Notify	ASCII codification, max. 10 char
User service 2 **USER PROFILE** UUID: 13744e03-9c88-4808-89a7-c2897e4e1b90	2.0	User name	b518989c-98c6-4e1c-a567-e8f48faa7e76	Read / Write / Notify	ASCII codification, max. 20 char

	2.1	User Data: birthdate, gender and height	9737456d-d754-460d-a22b-39ab73ccd0af	Read / Write / Notify	"YY/MM/DD
					Byte 1: year
					Byte 2: month
					Byte 3: day
					Byte 4: GENDER
					AA(HEX)Male // BB(HEX) Female
					Byte 5: height in centimeter"
					
					Byte 6: age

	2.2	User country	9f1c0185-57c6-4037-a4e8-9f5d3b3c0ca6	Read / Write / Notify	ASCII codification, max. 20 char

Service	Characteristic	Description	UUID	Properties	Protocol
User service 3 **SENSOR DATA** UUID: 5b552788-5c7b-4ce8-8362-Cf5dd093251d	3.0	Sensor list	e562b410-e8d2-4fe0-89c1-91432f108fe1	Read / Write / Notify	"Byte 1 and 2: Sensor protocol Byte 3: 00-General FF-Detail"
	3.1	Body Position	acfe574f-ceaf-4290-90d4-4a94b0c5b8ef	Read / Write / Notify	
	3.2	Body temperature	362ba79d-b620-41d3-89ee-48f865559129	Read / Write / Notify	
	3.3	Electromyography	3b54d144-a5f4-4444-aabc-7ada95be9498	Read / Write / Notify	
	3.4	Electrocardiography	ade7a273-89f9-49e1-b9d4-3cb36bce261b	Read / Write / Notify	
	3.5	Airflow	fe355d2b-d02c-477f-b397-9a728800de11	Read / Write / Notify	
	3.6	Galvanic Skin Response	e562b410-e8d2-d2d0-89c1-91432f108fe1	Read / Write / Notify	
	3.7	Blood Pressure	acfed3df-ceaf-4290-90d4-4a94b0c5b8ef	Read / Write / Notify	
	3.8	Pulsioximeter	362ba7aa-b620-41d3-89ee-48f865559129	Read / Write / Notify	
	3.9	Glucometer	aaa4d144-a5f4-4444-aabc-7ada95be9498	Read / Write / Notify	
	3.10	Spirometer	ade7a273-89f9-49e1-aaaa-3cb36bce261b	Read / Write / Notify	
	3.11	Snore	fe312d3b-d02c-477f-b397-9a728800de11	Read / Write / Notify	
	3.12	Scale (BLE)	e562b410-e8d2-4fe0-89d1-91333f108fe1	Read / Write / Notify	
	3.13	Blood Pressure (BLE)	acfe574f-c777-4290-90d4-4a94b0c5b8ef	Read / Write / Notify	
	3.14	Pulsioximeter (BLE)	362ba79d-6969-41d3-89ee-48f865559129	Read / Write / Notify	
	3.15	Glucometer (BLE)	3b54d696-a5f4-4444-aabc-7ada95be9498	Read / Write / Notify	
	3.16	Electroencephalography	ade7a273-89f9-49e1-b9d4-36666bce261b	Read / Write / Notify	

Figure : BLE profile table

HEXADECIMAL DATA PROTOCOL

- Characteristic: 3.0
- UUID: e562b410-e8d2-4fe0-89c1-91432f108fe1
- Properties: Read / Write
- Payload: 3 bytes

- Byte 1 and 2: Sensor protocol
- Byte 3: 00-General FF-Detail

Set the bit of the sensor that you want to measure. For example 86F3.

BLE sensor protocol example															
86								F3							
1	0	0	0	0	1	1	0	1	1	1	1	0	0	1	1
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Body temperature (Analogic)	Bit Reserved	SPO2 (UART)	Snore (Analogic)	Body Position (I2C)	GSR (Analogic)	EMG (Analogic)	Bit Reserved	ECG (Analogic)	Bit Reserved	Bit Reserved	Blood Pressure (UART)	Bit Reserved	Spirometer (UART) – Aux 2	Glucometer (UART) – Aux 1	Airflow (UART)
HIGH BYTE								LOW BYTE							
BYTE 2								BYTE 1							

Figure : BLE sensor protocol

Example of use:

```
SPO2: 20 00
BP: 00 10
Body Position:  08 00
Snore: 10 00
Glucometer: 00 02
ECG:00 80
Spirometer: 00 04
```

If you want to use the general mode complete the selected sensors with 00.

All sensor availables (not BLE):

```
1011 1110     1001 0111 → BE  97 00
```

If you want to use the detail mode of one sensor complete the selected sensor with FF.

Spirometer:

```
00 04 → 04 00 FF
```

8.2.2. Android SDK

On the Android part, we would use Eclipse Luna and Android 4.3.1 SDK, this library uses this SDK and Eclipse version as requirement, you can use higher version too.

Download here the complete SDK:
http://downloads.libelium.com/mysignals/mysignals_android/MySignalsConnectKit.jar.zip

http://downloads.libelium.com/mysignals/mysignals_android/MySignalsConnectKitDoc-android.zip

http://downloads.libelium.com/mysignals/mysignals_android/MySignalsConnectTest-android.zip

The example of use (MySignalsConnectTest) has a library developed by Libelium to connect with MySignals device: mysignalsconnectkit.jar. This is the only library available for android to connect with the device.

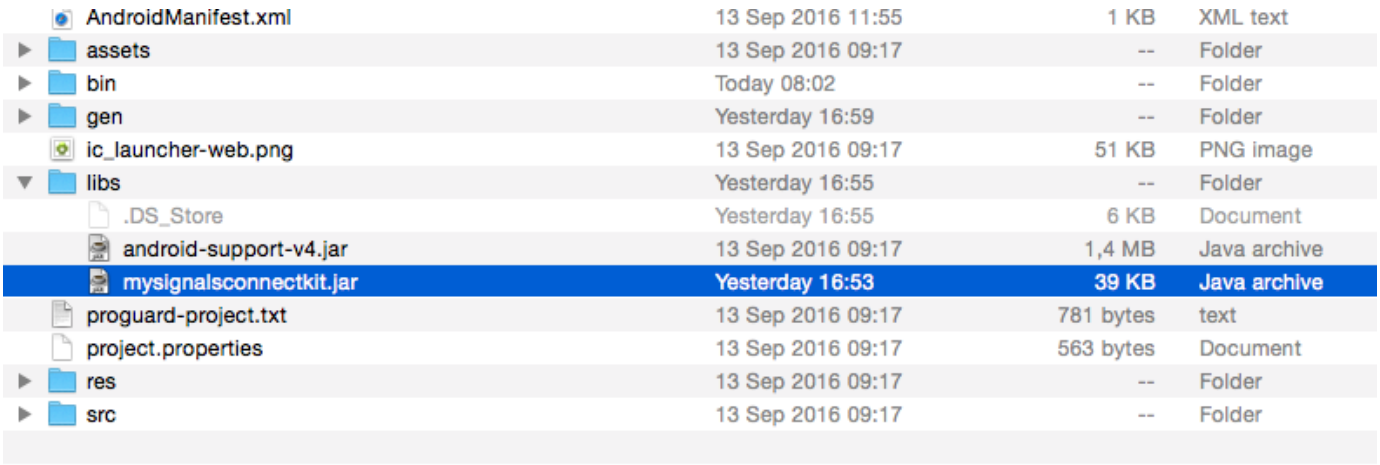


Figure : Android SDK library

8.2.2.1. Installation

- **Step 1:**

Create a new Android project in Eclipse, once you set a initial setup you can add the library. First of all, right click on your project and click Properties option from your project.

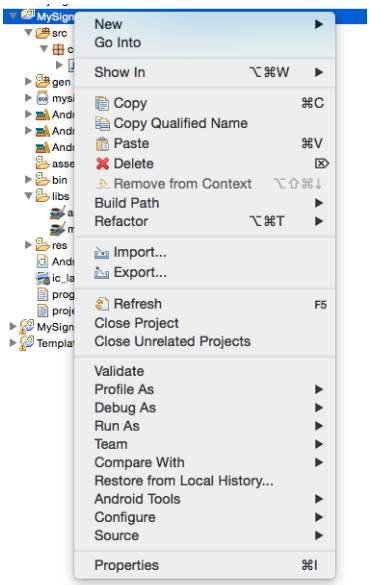


Figure : Eclipse project properties

- **Step 2:**

A new window will be shown, select the **Java Build Path** section placed on the left side, on the Libraries tab you can select the jar file to include it in your project. To do so, click on **Add External JARs**… button and navigate to mysignalsconnectkit.jar file, click on the jar file to add it.

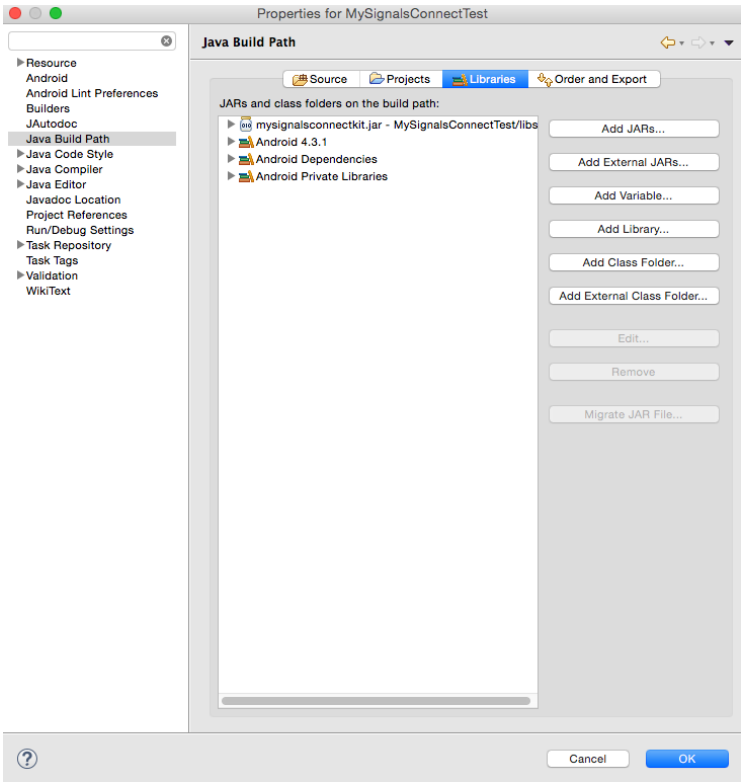


Figure : Eclipse libraries configuration

- **Step 3:**

In the **Order and Export** tab make sure that your library is checked.

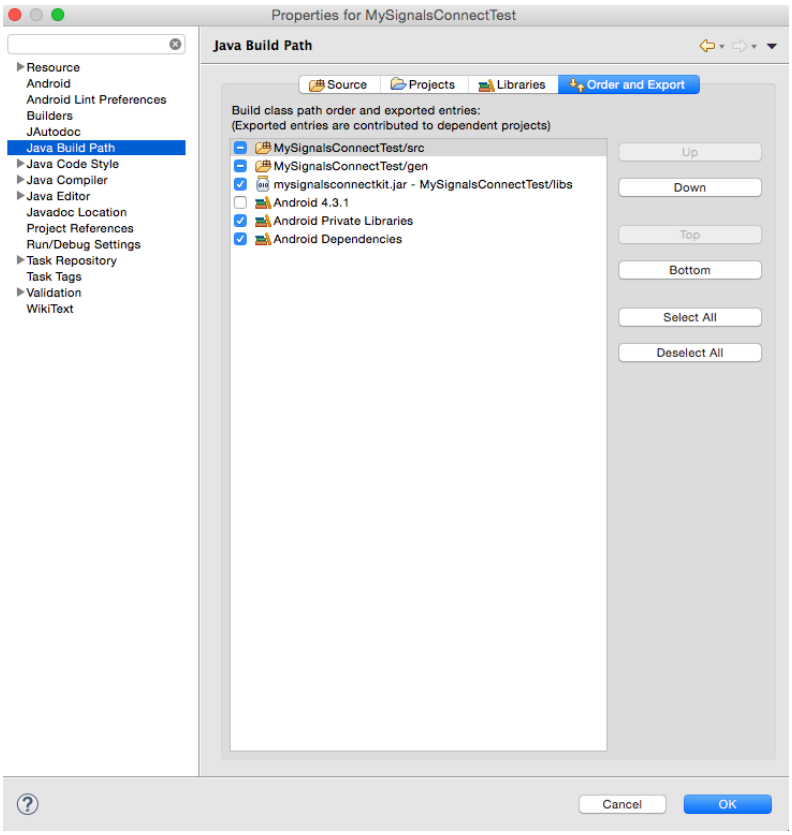


Figure : Eclipse export configuration

- **Step 4:**

Go back to project and open **AndroidManifest.xml**, set the accurate permissions to your project for using the library:

```
<uses-permission android:name="android.permission.BLUETOOTH" />
    <uses-permission android:name="android.permission.BLUETOOTH_ADMIN" />
    <uses-permission android:name="android.permission.BLUETOOTH_PRIVILEGED" />

    <uses-feature
        android:name="android.hardware.bluetooth_le"
        android:required="true" />
```

The final AndroidManifest.xml file setup should be like:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.libelium.mysignalsconnecttest"
    android:versionCode="1"
    android:versionName="1.0" >

    <uses-sdk
        android:minSdkVersion="18"
        android:targetSdkVersion="18" />

    <uses-permission android:name="android.permission.BLUETOOTH" />
    <uses-permission android:name="android.permission.BLUETOOTH_ADMIN" />
    <uses-permission android:name="android.permission.BLUETOOTH_PRIVILEGED" />

    <uses-feature
        android:name="android.hardware.bluetooth_le"
        android:required="true" />

    <application
        android:allowBackup="true"
        android:icon="@drawable/ic_launcher"
        android:label="@string/app_name"
        android:theme="@style/AppTheme" >
        <activity
            android:name=".MainActivity"
            android:label="@string/app_name" >
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />

                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
    </application>

</manifest>
```

Figure : Android manifest

8.2.2.2. Use

Now, we added the library to communicate with MySignals. The library creates a single instance to handle all the bluetooth logic. Then the user must create an array of sensors to show and implement an interface to receive the callback values.

On the example given, you can create a singleton instance with the piece of code:

```
try {

	mService = BluetoothManagerService.getInstance();

	mService.initialize(this);
	mService.setServicesCallback(MainActivity.this);
	mService.setCharacteristicsCallback(MainActivity.this);
	mService.setQueueCallback(MainActivity.this);

} catch (Exception e) {

}

scanBluetoothDevices();
```

There are three interface setups where the user must place the class where the callback will be sent:

```
mService.setServicesCallback(MainActivity.this);
mService.setCharacteristicsCallback(MainActivity.this);
mService.setQueueCallback(MainActivity.this);
```

This three initial interface setups are mandatory in order to connect, notify and get the values from sensors.

Then you can start scanning for new devices using `scanBluetoothDevices()` method:

```
private void scanBluetoothDevices() {

	bluetoothManager = BluetoothManagerHelper.getInstance();

	bluetoothManager.setInitParameters(this, this);

	List<BluetoothDevice> devicesBonded = bluetoothManager.getBondedDevices();

	if (devicesBonded.size() > 0) {

		selectedDevice = null;

		for (BluetoothDevice deviceItem : devicesBonded) {

			String name = deviceItem.getName();

			if (name != null) {

				if (name.toLowerCase().contains(kMySignalsId)) {

					Log.d("DEBUG", "Address: " + name);

					this.selectedDevice = deviceItem;

					break;
				}
			}
		}

		if (selectedDevice != null) {

			performConnection();
		} else {
```

```
                        bluetoothManager.startLEScan(true);
                }

        } else {

                bluetoothManager.startLEScan(true);
        }
}
```

As said, it is mandatory to create an array of sensors to get the data, then create this array of `LBSensorObject` objects. For instance, if the user wants to select the Body position sensor the object on the array of sensors must be like:

```
LBSensorObject object = LBSensorObject.newInstance();

object.tag = 1;
object.tickStatus = true;
object.uuidString = StringConstants.kUUIDBodyPositionSensor;

LBSensorObject.preloadValues(object);
sensors.add(object);
```

When the library starts scanning, it looks for MySignals devices, the device advertises itself with a MySignals prefix on its name, the callback for the results is given in `public void onListDevicesFound(ArrayList<BluetoothDevice> devices)` method, on this method create a new connection for a given MySignals device.

```
@Override
  public void onListDevicesFound(ArrayList<BluetoothDevice> devices) {

        for (BluetoothDevice deviceItem : devices) {

                String name = deviceItem.getName();

                if (name != null) {

                        if (name.toLowerCase().contains(kMySignalsId)) {

                                Log.d("DEBUG", "Address: " + name);

                                this.selectedDevice = deviceItem;

                                break;
                        }
                }
        }

        if (selectedDevice != null) {

                bluetoothManager.stopLeScan();

                boolean bonded = mService.startBonding(selectedDevice);

                if (bonded) {

                        Log.d("DEBUG", "Bonding starting...");
                }
        }
}
```

This method starts a new bonding with selected device (method `startBonding`) a passkey dialog will show and the user must type the PIN code given by MySignals device.

Once the connection is successfully bonded the callback will be on `public void onBonded()` method. At this point you should discover the service and characteristics to write on to select the sensors and subscribe for notifications.

```
	private void performConnection() {

		final Handler handler = new Handler();

		final Runnable postExecution = new Runnable() {

			@Override
			public void run() {

				try {

					if (mService != null) {

						if (mService.discoverServices()) {

							Log.d("DEBUG", "Device discoverServices: " + se-
lectedDevice.getAddress());
						}
					}
				} catch (Exception e) {

				}
			}
		};

		if (mService.connectToDevice(selectedDevice, MainActivity.this)) {

			Log.d("DEBUG", "Device connected!!");

			handler.postDelayed(postExecution, 2000);
		}
	 }
```

In the example the user discovers a service which contains the characteristic where the user must write the desired array of sensors. On `writeCharacteristicQueue` method the library send this array to MySignals device.

```
	BitManager bitManager = BitManager.newObject();
				bitManager.objectByte = BitManager.createByteObjectFromSensors(
selectedSensors, BLUETOOTH_DISPLAY_MODE.BLUETOOTH_DISPLAY_MODE_GENERAL, this);

				byte[] data = BitManager.convertToData(bitManager.objectByte);

				String dataString = data.toString();
				String hexByte = Utils.toHexString(data);

				Log.d("DEBUG", "hex dataString value: " + hexByte);
				Log.d("DEBUG", "dataString: " + dataString);

				mService.writeCharacteristicQueue(characteristicSensorList,
data);
```

At this method you can get all notification values on general view if you set `BLUETOOTH_DISPLAY_MODE.BLUETOOTH_DISPLAY_MODE_GENERAL` on createByteObjectFromSensors method or you can get a single detail from one sensors `BLUETOOTH_DISPLAY_MODE.BLUETOOTH_DISPLAY_MODE_DETAIL`.

Before trigger a subscribing action you must make sure that you do not have characteristics already notifying, this is due to android device can only notify a litlle amount of characteristics at the same time. (Android SDK >= 20, it can notify 15 characteristics, Android SDK = 19, it can notify 7 characteristics, Android < 19 can notify 5 characteristics).

This library can also subscribe to characteristics to notify the values, the method to accomplish this goal is writeCharacteristicSubscription.

```
for (BluetoothGattCharacteristic charac : selectedService.getCharacteristics()) {

                            for (LBSensorObject sensor : selectedSensors) {

                                  if (sensor.uuidString.toUpperCase().equals(charac.ge-
tUuid().toString().toUpperCase()) && sensor.tickStatus) {

                                        notifyCharacteristics.add(charac);

                                        mService.writeCharacteristicSubscription(charac,
true);
                                  }
                            }
                      }
```

This framework can also measure the signal power (RSSI), the dBm value will be callback on `public void onReadRemoteRssi(int rssi, int status)` method.

```
@Override
public void onReadRemoteRssi(int rssi, int status) {

      Log.d("DEBUG", "RSSI: " + rssi + " dBm - Status: " + status);
}
```

When the user subscribes the characteristic successfully the values will arrive on:

```
public void onCharacteristicChanged(BluetoothGattCharacteristic characteristic)
```

Use LBValueConverter to get the dictionary of values fort each sensor. For more information, use the example that uses the library.

```
@Override
public void onCharacteristicChanged(BluetoothGattCharacteristic characteristic) {

      try {

            String uuid = characteristic.getUuid().toString().toUpperCase();

            byte[] value = characteristic.getValue();

            if (value == null) {

                  return;
            }

            if (uuid.equals(StringConstants.kUUIDBodyPositionSensor)) {

                  HashMap<String, String> dataDict = LBValueConverter.
manageValuePosition(value);

                  Log.d("DEBUG", "kUUIDBodyPositionSensor dict: " + dataDict);
            }
…
}
```

8.2.3. iOS SDK

This guide intends to guide the user thru some steps to communicate a MySignals device with the framework given. This guide will give some simple steps to accomplish the goal.

Download here the complete SDK:
http://downloads.libelium.com/mysignals/mysignals_ios/MySignalsConnectKit.framework.zip

http://downloads.libelium.com/mysignals/mysignals_ios/MySignalsConnectKitDoc.zip

http://downloads.libelium.com/mysignals/mysignals_ios/MySignalsConnectTestFramework.zip

On the iPhone part, we would use Xcode 7.0 and iOS 8.3, this framework uses this SDK and Xcode version as requirement, you can use higher version too.

The example of use (MySignalsConnectTestFramework) has a framework developed by Libelium to connect with MySignals device: *MySignalsConnectKit.framework*. This is the only framework for iPhone available to connect with the device.

MySignalsConnectKit.framework was linked against arm architecture, so it is not possible to run it on the iPhone simulator, as it uses internal Bluetooth libraries to conncet with the hardware device:

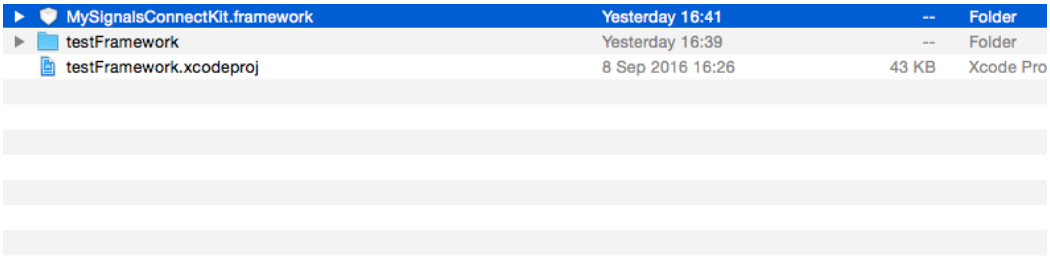


Figure : iOS SDK

8.2.3.1. Installation

Follow this steps to add this framework to your Xcode project:

- **Step 1:**

One you have created a new iPhone proyect from Xcode, click on your project name and navigate to **Build Phases** tab, then show **Link Binary With Libraries**:

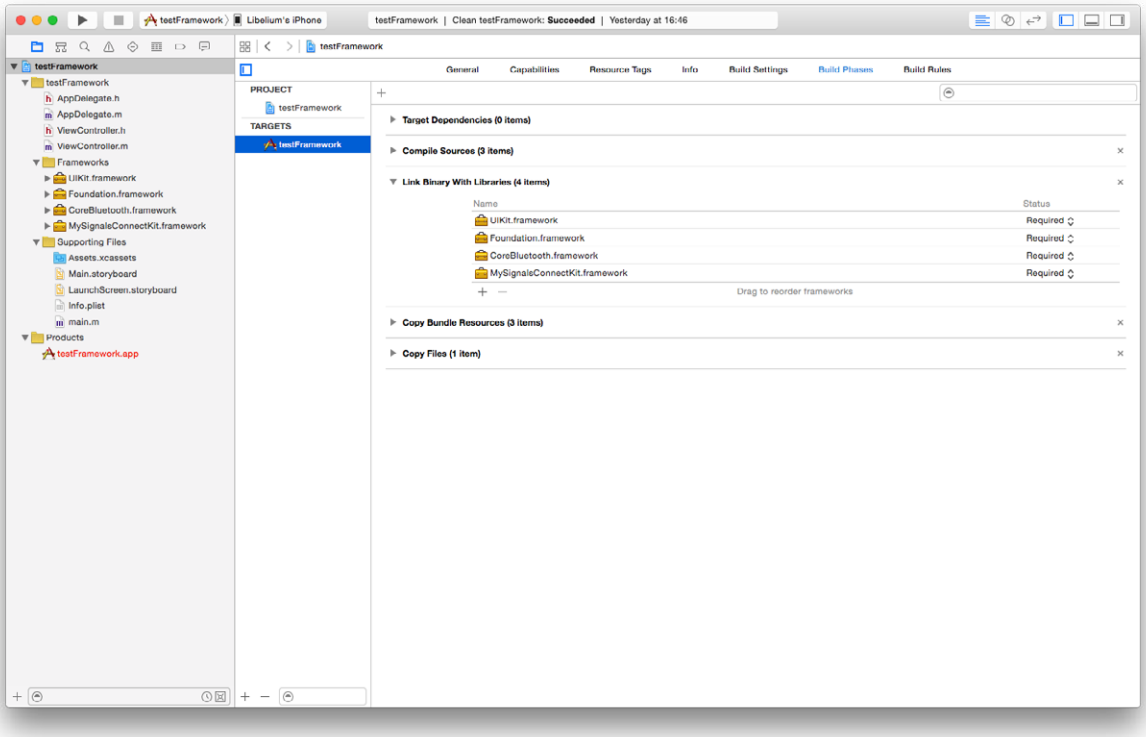


Figure : Framework configuration

- **Step 2:**

Click on "+" sign and an action sheet will show, search for **CoreBluetooth** and click on the result to add the bluetooth communication framework.

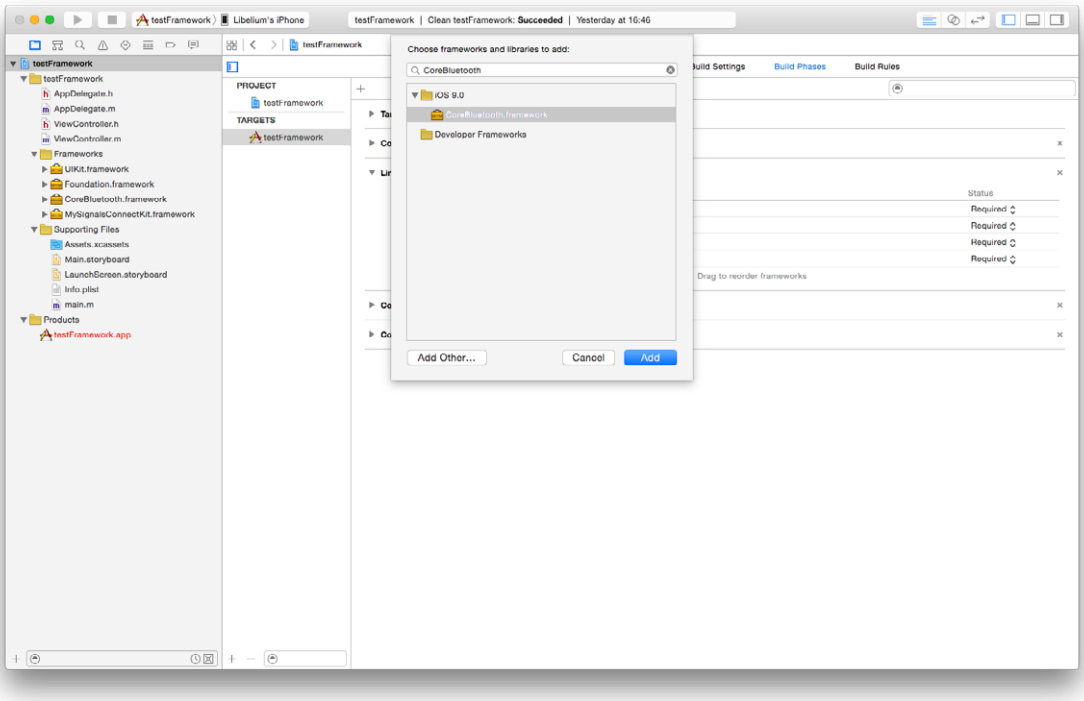


Figure : Add framework

- **Step 3:**

Now, it is time to add MySignals' framework. So, click again on "+" sign and click on **Add Other**… button. Navigate until the proyect folder or path where the framework was placed, then click on it to add to the project.

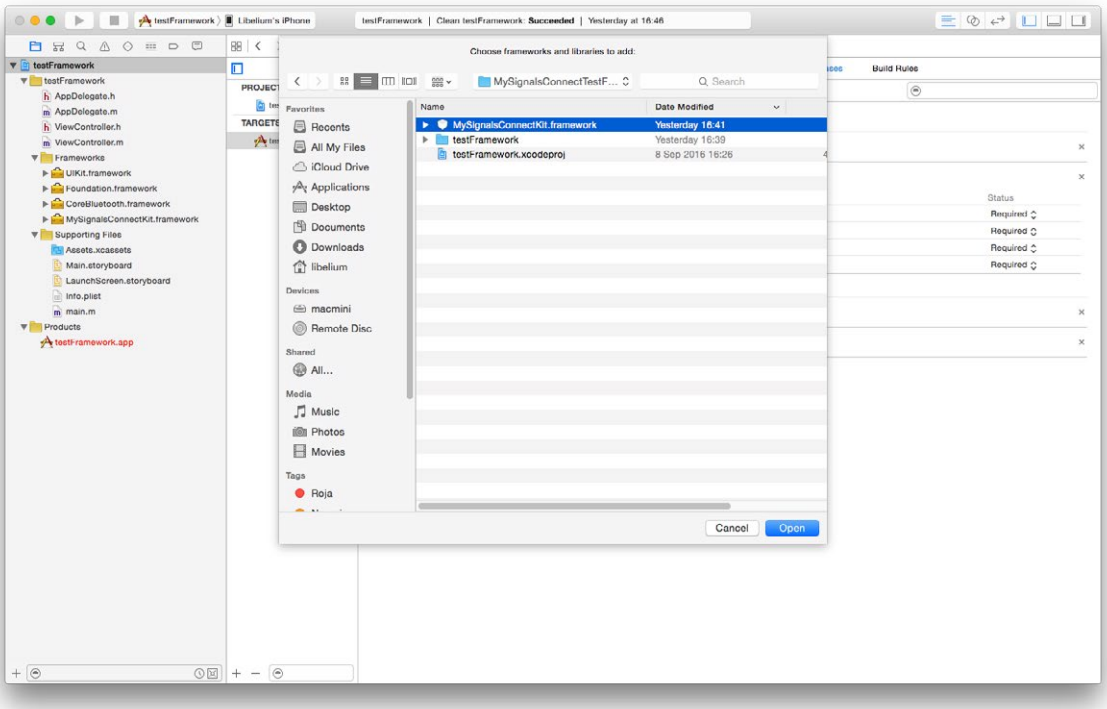


Figure : Select framework

- **Step 4:**

Last step, it is mandatory to add the framework on the binary at conpilation time, so on the upper left corner, click on the "+" sign and click the option **New Copy Files Phase**, a new section with show at the bottom of the **Copy Bundle Resource**s section.

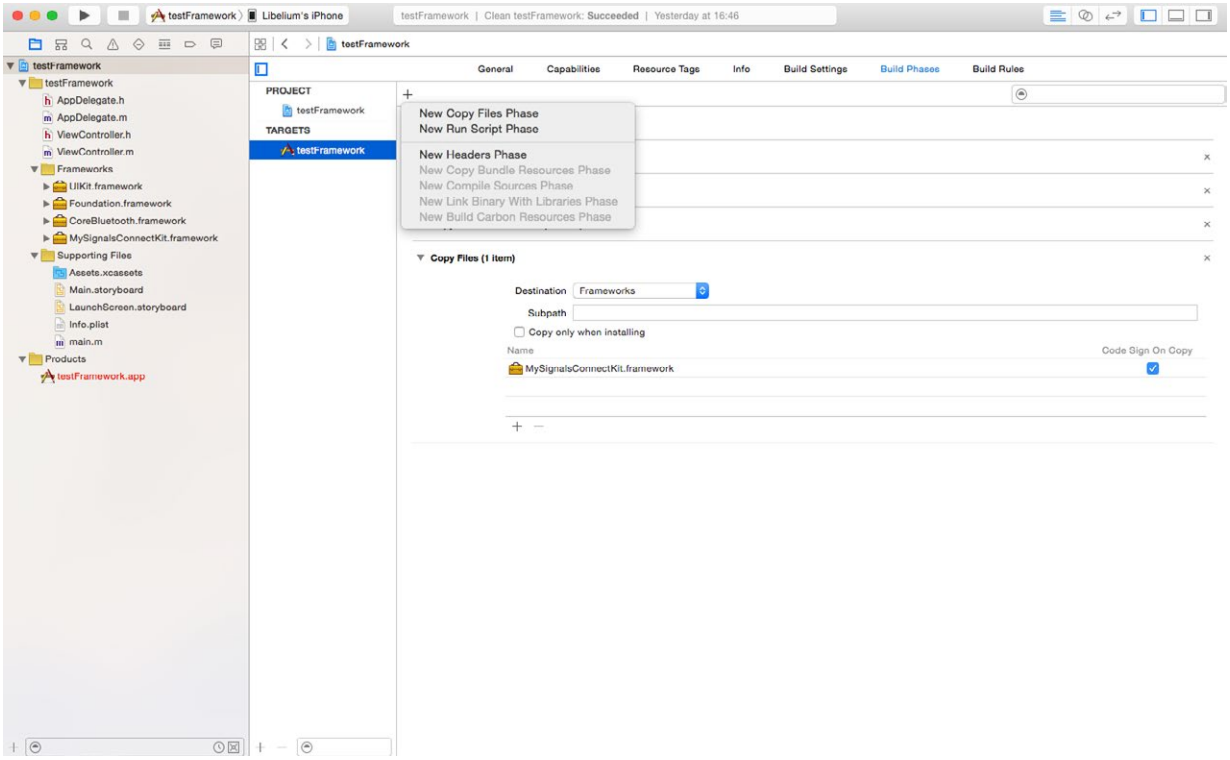


Figure : New phase copy

- **Step 5:**

On Destination option choose **Frameworks**, then add the framework **MySignalsConnectKit.framework** by clicking on "+" sign, click again on **Add Other**... button and look for the framework, make sure that once the framework was added the option **Code Sign On Copy** is checked. As a result your Xcode configuration should be like this:

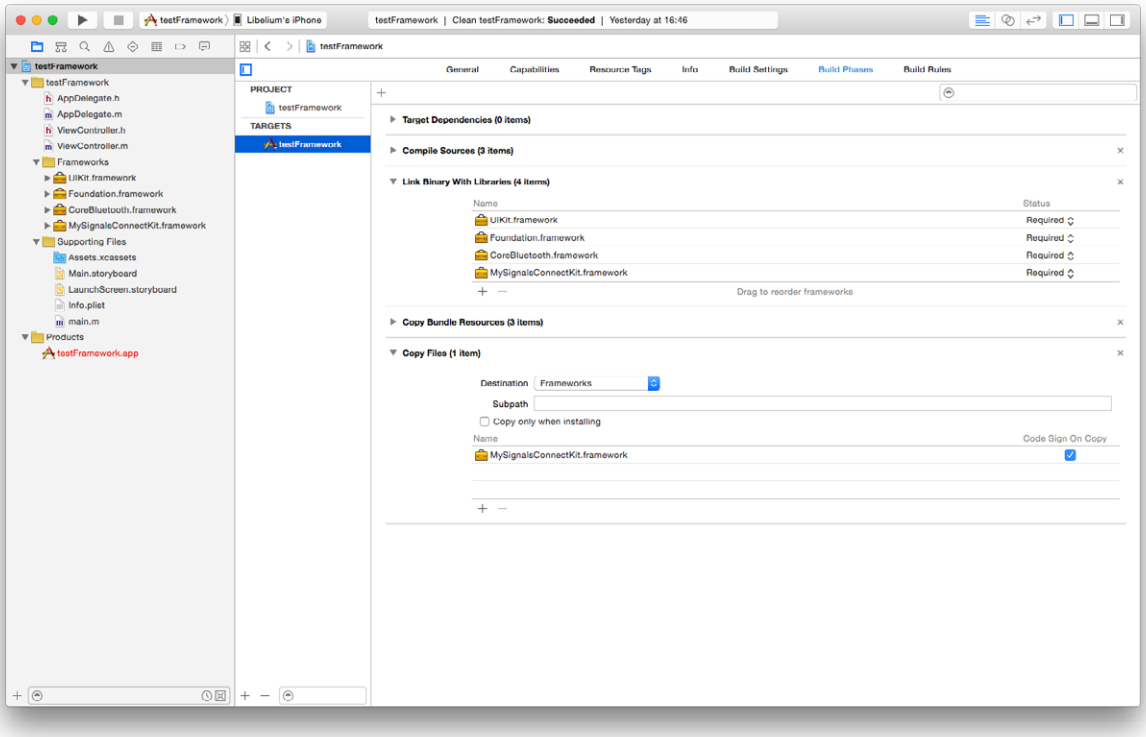


Figure : Copy files

8.2.3.2. Use

This framework establish a Bluetooth connection with MySignals device. The framework creates a singleton instance to handle all the bluetooth logic. Then the user must create an array of sensors to show and implement a protocol to receive the callback values.

On the example given, you can create a singleton instance with the piece of code:

```
if ([LBBluetoothManager isBluetoothLowEnergySupported])
    {
        self.instanceBluetooth = [LBBluetoothManager sharedInstance];

        [instanceBluetooth setDelegateDevice:self];

        [instanceBluetooth startScan];
    }
    else
    {
        NSLog(@"Bluetooth Low Energy not supported!!! - Please use a BLE device");
    }
```

The `setDelegateDevice`: method the the class where the values will be sent.

As said, it is mandatory to create an array of sensors to get the data, then create this array of `LBSensorObject` objects. For instance, if the user wants to select the Body position sensor the object on the array of sensors must be like:

```
    LBSensorObject *object = [LBSensorObject newInstance];
```

```
object.tag = 1;
object.tickStatus = YES;
object.uuidString = kUUIDBodyPositionSensor;

[object preloadValues];
[sensors addObject:object];
```

When the framework starts scanning, it looks for MySignals devices, the device advertises itself with a MySignals prefix on its name, the callback for the results is given in - `(void)didDiscoverPeripheral:(CBPeripheral *)peripheral advertisementData:(NSDictionary *)advertisementData` method, on this method create a new connection for a given MySignals device.

```
- (void)didDiscoverPeripheral:(CBPeripheral *)peripheral advertisementData:(NSDictionary *)
advertisementData
{
    if (peripheral != nil)
    {
        if ([advertisementData objectForKey:@"kCBAdvDataLocalName"])
        {
            NSString *deviceName = [advertisementData objectForKey:@"kCBAdvDataLocalName"];

            if ([deviceName.lowercaseString containsString:@"mysignals 000008"])
            {
                NSLog(@"peripheral: %@", advertisementData);

                [instanceBluetooth stopScan];

                self.connectedPeripheral = peripheral;
                instanceBluetooth.currentPeripheral = self.connectedPeripheral;

                [instanceBluetooth connectToPeripheral:peripheral];
            }
        }
    }
}
```

Once the connection is successfully the callback will be on - `(void)didConnectPeripheral:(CBPeripheral *)peripheral` method. At this point you should discover the service and characteristics to write on to select the sensors and subscribe for notifications.

```
- (void)didConnectPeripheral:(CBPeripheral *)peripheral
{
    if (peripheral != nil)
    {
        [instanceBluetooth setCurrentPeripheral:peripheral];

        NSLog(@"setCurrentPeripheral: %@", instanceBluetooth.currentPeripheral);

        [instanceBluetooth discoverServicesForPeripheral:peripheral];
    }
}
```

In the example the user discovers a service which contains the characteristic where the user must write the desired array of sensors. On `writeSelectedSensorToDevice` method the framework sends this array to MySignals device.

```
- (void)writeSelectedSensorToDevice
{
    if (charactWriteSensors != nil)
    {
        BitManager *bitManager = [BitManager newObject];

        bitManager.objectByte = [BitManager createByteObjectFromSensors:selectedSensors
forMode:BLUETOOTH_DISPLAY_MODE_GENERAL];

        NSData *dataSensors = [[NSData alloc] initWithData:[BitManager
convertToData:bitManager.objectByte]];

        NSLog(@"data hexadedimal sensors %@", [dataSensors hexadecimalString]);

        [instanceBluetooth writeCustomDataToCurrentPeripheral:dataSensors forCharacteristic
:charactWriteSensors];
    }
}
```

At this method you can get all notification values on general view if you set `BLUETOOTH_DISPLAY_MODE_GENERAL` on createByteObjectFromSensors method or you can get a single detail from one sensors `BLUETOOTH_DISPLAY_MODE_DETAIL`.

This framework can also subscribe to characteristics to notify the values, the method to accomplish this goal is `subscribeToCharacteristic:forPeripheral:`.

```
dispatch_async(dispatch_get_main_queue(), ^{

                            [instanceBluetooth subscribeToCharacteristic:characteristic
forPeripheral:peripheral];
                        });
```

This framework can also measure the signal power (RSSI), the dBm value will be callback on - `(void)didReadRSSI:(NSNumber *)RSSI error:(NSError *)error` method.

```
- (void)didReadRSSI:(NSNumber *)RSSI error:(NSError *)error
{
    if (error != nil)
    {
        NSLog(@"error: %@", error.localizedDescription);
    }
    else
    {
        NSString *rssiValue = [RSSI stringValue];

        NSLog(@"RSSI callback: %@", rssiValue);
    }
}
```

When the user subscribes the characteristic successfully the values will arrive on - `(void)peripheral:(CBPeripheral *)peripheral didUpdateValueForCharacteristic:(CBCharacteristic *)characteristic error:(NSError *)error`. Use `LBValueConverter` to get the dictionary of values fort each sensor. For more information, use the example that uses the framework.

```
- (void)peripheral:(CBPeripheral *)peripheral didUpdateValueForCharacteristic:(CBCharacteri
stic *)characteristic error:(NSError *)error
{
    NSString *uuid = characteristic.UUID.toString.uppercaseString;

    if (error)
    {
        NSLog(@"Error reading characteristics: %@", [error localizedDescription]);
    }
    else
    {
        NSData *dataValue = characteristic.value;

        if (dataValue.length == 0 || (id)dataValue == nil || (NSNull *)dataValue == [NSNull
null])
        {
            return;
        }

        if ([uuid isEqualToString:kUUIDBodyPositionSensor])
        {
            NSDictionary *dataDict = [LBValueConverter manageValuePosition:dataValue];

            NSLog(@"kUUIDBodyPositionSensor dict: %@", dataDict);
        }
….
}
```

9. 9 Documentation Changelog

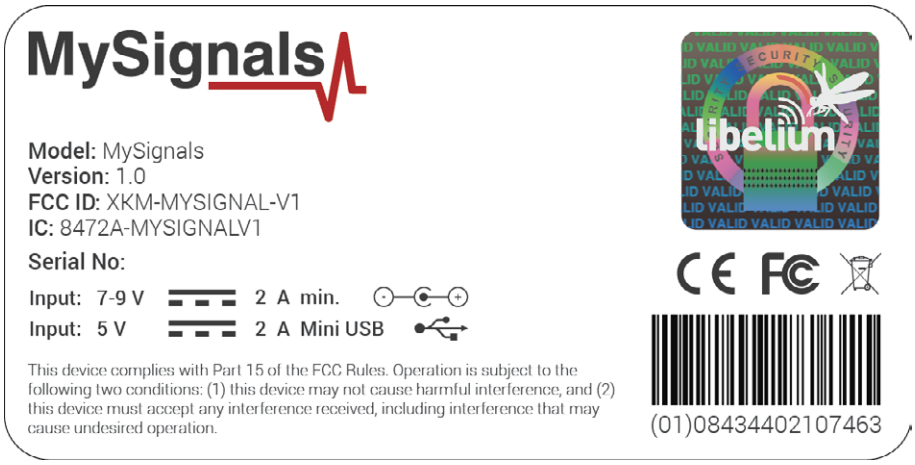
Version 0.0:

- Basic documentation generated for MySignals Software Development Platform

10. Certifications

My Signals SW is the first eHealth development platform to be fully certified. The user will benefit from a ready-to-work platform which is prepared and market-ready for the main regions on the world:

- CE (Europe)
- FCC (USA)
- IC (Canada)



Certifications identifiers:

- CE
- FCC ID: XKM-MYSIGNAL-V1
- IC: 8472A-MYSIGNALV1

Figure : Logos for the certifications obtained

11. Maintenance

- In this section, the term “MySignals” encompasses both the MySignals device itself as well as its sensors and extra components.
- Take care when handling MySignals, do not let it fall, knock it or move it suddenly.
- Avoid having the devices in high temperature areas as it could damage the electronic components.
- The sensors should be connected carefully. Do not force them when plugging in or out them as the connectors could be damaged.
- Do not use any type of paint on the device, it could harm the operation of the connections and closing mechanisms.Do not remove the permanent plastic frame which protects the screen.
- Remember that the warranty policy does not allow to open the enclosure or any sensor in any case.
- NEVER submerge the device in any liquid.
- Keep the device in a dry place and away from any liquids that might spill.

12. Disposal and recycling

- In this section, the term “MySignals” encompasses both the MySignals device itself as well as its sensors and extra components.
- When MySignals reaches the end of its useful life, it must be taken to an electronic equipment recycling point.
- The equipment must be disposed of in a selective waste collection system, and not that for urban solid residue. Please manage its disposal properly.
- Your distributor will inform you about the most appropriate and environmentally friendly disposal process for the used product and its packaging.

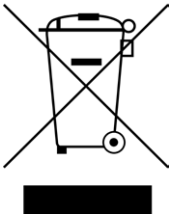


Figure : Disposal and recycling