

# PhytSigns 8 Channel Recorder Quick Start Guide

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## 1. Getting started

Welcome to the wonderful world of crop electrophysiology. The pictures below show the components of a standard PhytSigns 8 Channel Recorder:

### PhytSigns V3:



### PhytSigns V3 components:

1. The sensor itself
2. Electrodes to be inserted into the plant (labelled LEAF 1 to 8) and reference electrodes to be inserted into the soil or plant stem, closer to the soil than the active electrode (labelled GND 1 to G8)
3. Power cable

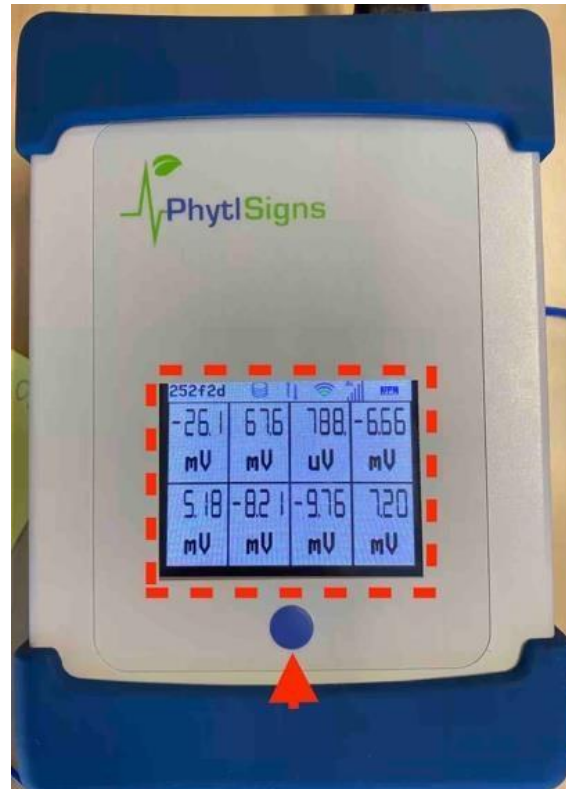
### 1.1. Connecting the PhytSigns sensors

It's easy to get started. Here is a suggested method.

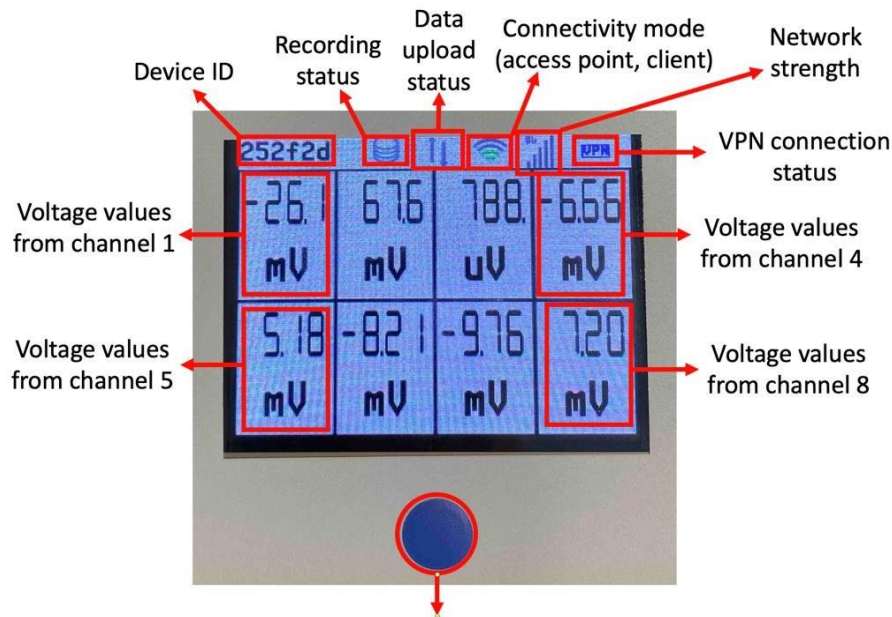
1. Move the sensor near to the plants you want to measure and arrange the electrode cables in pairs by channel number (LEAF1 with GND1 etc). Connect the power cable to the sensor (but not yet to the electricity).
2. Connect each pair of electrodes to a plant you wish to monitor. The active electrode should be placed closer to the top of the plant and is usually inserted in the stem or a leaf stalk. The ground electrode should be placed in the stem, closer to the substrate, or directly in the substrate, depending on the application. We can suggest placement for your own use case.
3. Once all the plants are connected, plug the power cable into the main electricity supply and the recordings begin.

## 1.2. Turn on PhytSigns device equipped with LCD screen (V3):

The latest version of PhytSigns is equipped with an LCD screen on the device (red frame on the figure below) that displays the status, current values of the recording and the most important information about the device. The blue button below the display (red arrow on the figure) allows switching between the different information screens of the display and restoring the factory settings of the device (see description below).



After connecting the device to the electrical grid, the PhytSigns logo appears on the screen for a few seconds during system loading. When system loading is complete, the initial screen with the current voltage values of all 8 channels and additional information about the device is displayed:



Press the button to:

- 1 quick press - go to another screen.
- longer press takes you to the beginning of the next section (click and hold – the screen will tell you what it's moving on to).
- an even longer click, and the screen will give you a 3 second count down timer until it turns off the backlight (screen) - keep button pressed until timer expires.

From the home screen, users can go to other screens where more detailed information about the device and recordings can be seen:

- Screens 2-9 - Magnified voltage readings from individual channels 1 to 8.
- Screen 10 - Voltage traces of plant signals (trends) for all channels
- Screens 11-18 - Individual voltage traces of the plant signals from channels 1 to 8.
- Screen 19 - Frequency spectrum for all channels from 1 to 8.
- Screens 20-27 - Frequency spectra for individual channels 1 to 8.
- Screen 28 - Recording Info.
- Screen 29 - Device info (**device factory reset - hold blue button for 5 seconds, release for 5 seconds and then hold again for 5 seconds**)
- Screen 30 - Wi-Fi connection info
- Screen 31 - Access Point Info (**switch from Client Mode to Access Point Mode - hold down the blue button for 5 seconds, release for 5 seconds, then press again for 5 seconds**)
- Screen 32 - Ethernet info.
- Screen 33 - Mobile network internet - 4G - info.
- Screen 34 - VPN Info.

### 1.3. Connect a smart device or laptop to the sensor

The sensor is programmed to start up as a Wi-Fi **Access Point**. This happens automatically. To manage the PhytSigns devices and make recordings you need to connect a laptop or smart device to the system.

1. On your phone or laptop search for Wi-Fi signals. You should be able to see a network named 'PhytSigns-ID'. The ID can be found on the screen or on the device label (on the side of the sensor). Connect to this network.
2. Open a browser and type in **192.168.0.1**

You will now see a live view of the signal and you can see all the options to control the device, including recording etc.

## 2. What can be seen using the sensor?

You can go through all the buttons on your screen, but the following steps are important:

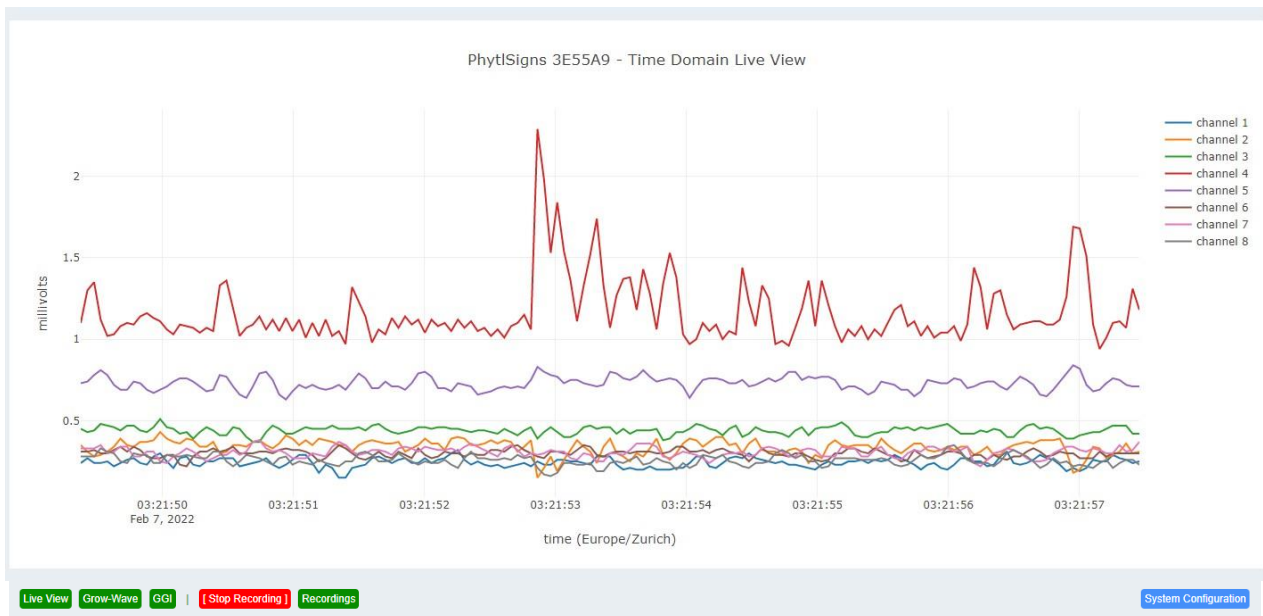
1. The system will prompt you to synchronize the clock if it detects a difference of more than 10 seconds between the system clock time and your browser time. Please do so.
2. Connect your system to a network if it does not have a simcard inside; this is explained in more detail in the next section (Connecting the system to your Wi-Fi network).

### 2.1. LiveView

You will see a LiveView of the plant signals. If you touch, water or mist the plant, you will see a change in the signal. You can focus on one plant by clicking the channel number on the right side of the image.

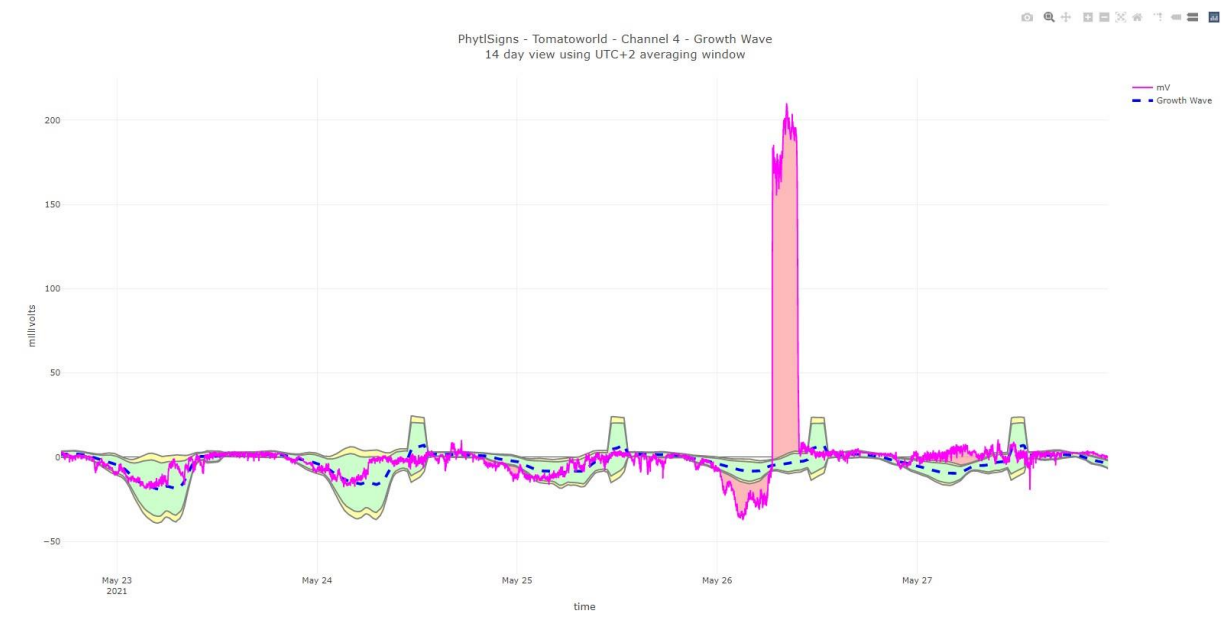
Different plants have different baseline voltages and this varies depending on the amount of light, the period of the day and the level of soil moisture, as well as other factors related to plant stress.

In addition, you can see a menu by clicking on the title. In this menu you can change the graphs update frequency and the duration of the visible period (60 second by default).



## 2.2. PhytSigns Grow-Wave

Another interesting feature that comes with the device is the Grow-Wave. To access this feature, click the "Grow-Wave" button on the bottom left of the screen. The Grow-Wave shows the signal (similar to the LiveView of 1 channel) in pink, but also shows the predicted normal behaviour of a plant as a blue dotted line. If nothing happens, the mV (pink line) remains in the green area, near the Grow-Wave and the plant continues as predicted. Once the mV reaches the yellow area, it means the plant is starting to behave differently. When it breaks the predicted pattern, a red shadow is drawn, indicating that something has caused an interruption in normal behaviour.



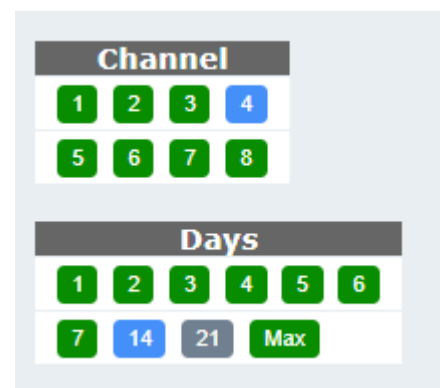
Note: It will take a few days for the Grow-Wave to be visible because the sensor needs time to calculate the predicted behaviour of plants.

Once enough days have been recorded, you can choose to view the behaviour of the plant signals over several days or weeks by clicking on the corresponding channel and days in the upper left of the screen (see image in the next section).

## 2.3. Grey buttons that cannot be clicked on

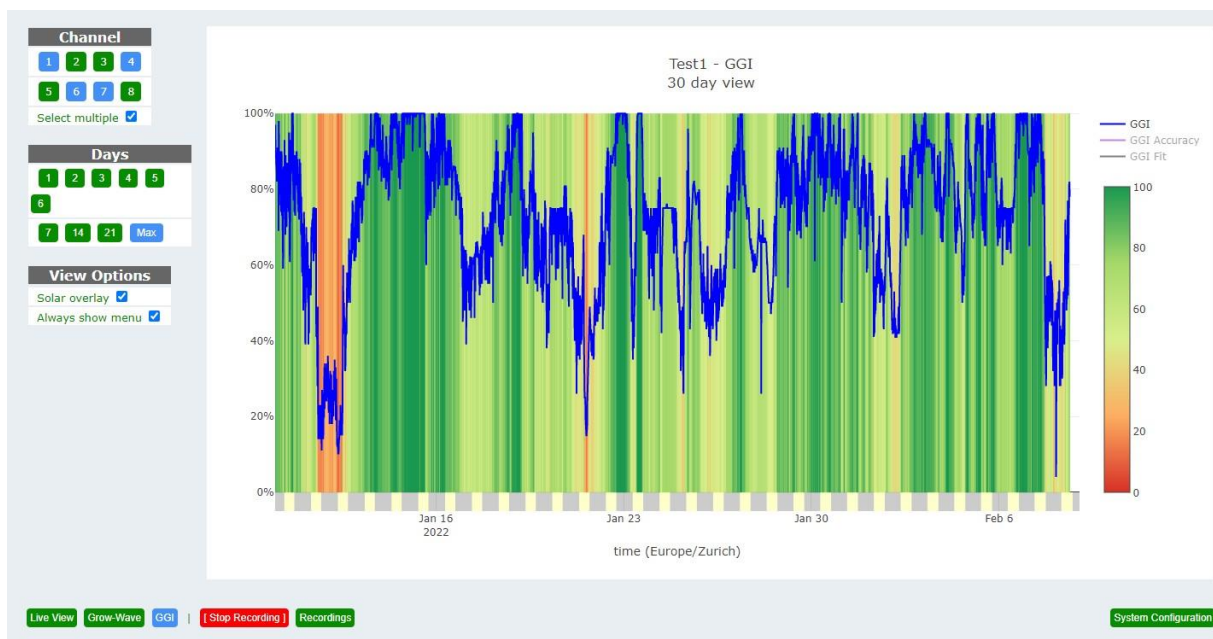
In some cases, buttons will be greyed out and cannot be clicked. An example of this is shown in the image to the right, where not enough data is yet available to calculate the Grow-Wave for days21.

If you see a grey button, you can hover over it to see why it cannot be clicked.



## 2.4. PhytSigns GGI (Grouped Growth Index)

To get a better idea of the status of multiple plants at a given time, it is possible to view the Grouped Growth Index. This can be done via the 'GGI' button on the bottom left of the screen. This Growth Index is based on the Grow-Wave and calculates a score per channel to indicate whether a signal is inside or outside the Grow-Wave at a certain moment. A score close to 100% means the plant is following a predictable rhythm and the further the signal falls outside the Grow-Wave, the lower the score will be. The GGI (the blue line) is an average of this score of all selected channels and can provide information about changing climate conditions, for example. In addition, a colour code is also visible based on the blue line; green means a signal close to 100% and the more red the signal becomes, the further all signals fall outside the Grow-Wave.



In addition, as with the Grow-Wave, various options can be clicked in the menu on the left. It is possible to change the channels on which the calculation is based by clicking on them to turn them on (blue) or off (green). It is also possible to select how many days are visible (provided enough data has already been recorded), by clicking on the desired number of days in the 'Days' menu. The Solar overlay option shows day and night in a coloured box below the GGI.

Note: It will take a few days to see the GGI because the sensor needs time to calculate the predicted behaviour of plants.



## 2.5. Recordings

Recordings begin as soon as the device is turned on. Click on the Recordings button to see your recordings. You can now click on Graph for recordings that are currently running (the lowest directory) and choose the channel you want to visualize. In addition, you can add experimental notes such as the type and time of the interventions by clicking Add Event.

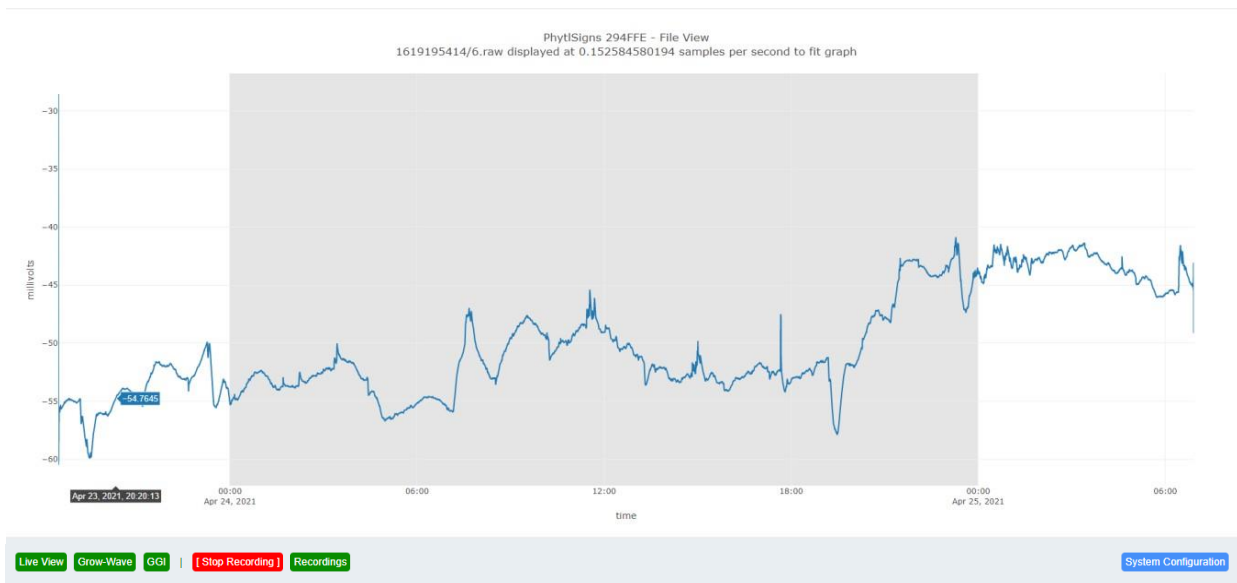
Data Storage Details				Recording Time	
Size	Available	In Use		Remaining	
54.07 GB	54.01 GB	55.99 MB	0%	1831.54 hours	

Directory	MBs	Samples	Start	UTC	Stop	UTC	Seconds	ESR	Options
1645027521	0.03	1,050	2022-02-16 17:05:21	+1.00	2022-02-16 17:05:26	+1.00	5.27	199.36	Metadata Delete
1645027528	0.04	1,343	2022-02-16 17:05:28	+1.00	2022-02-16 17:05:34	+1.00	6.41	209.48	Metadata Delete
1645027536	0.06	1,883	2022-02-16 17:05:36	+1.00	2022-02-16 17:05:44	+1.00	8.52	220.97	Metadata Delete

Delete All Directories

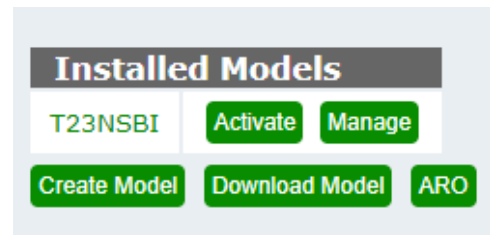
For older recordings, you will see Metadata files that will be useful if you are going to load the data into MatLab or another signal processing program. You can also click on the name of the directory. It will contain every file you have recorded. These files will be labelled as 1.raw etc. For each recording, the unit will automatically generate a graph of the entire recording (click the Graph button).



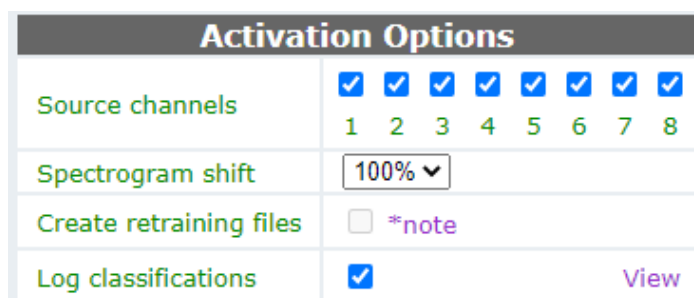


## 2.6. PhytSigns Models (optional)

Vivent is constantly updating the Machine Learning models it can provide to customers. These can also be made available on your device. Once activated, you can click on the 'models' button at the bottom. You will see a button that says 'Download Model' where you can choose one of the freely available models and run it on your sensor to give you an idea of possible stressors.



Once the model is downloaded, you can click on 'Manage' to open a new screen. Many things can be adjusted that have to do with retraining the model with your data. If you want to use the model on your own, under 'Activation options' click on all the channels you want the model to run on, as shown in the picture. If you want to save the predictions to a .csv file, you can also click on "Log classifications". Once that is done, click on 'Update'.



Now you can choose to activate the model, by clicking 'Activate' next to the model name.

This shows flashing channels being tested. When you click on a channel, you can see the live forecasts. The first time it will take a while for you to see the forecasts, depending on the settings of the model.

If you want to see historical forecasts for a longer period of time, you can click on the model name and on 'Graph' next to one of the classification log files. If classifications were logged, it is also possible to download a .csv-file with all the predictions per channel.

## 2.7. Navigating within the charts

There are several icons in the upper right corner of all the graphs found on the device:



The most commonly used icon is the photo camera, which allows you to save the current image as a .png file on the computer. The next 5 icons are associated with zooming in and out of the graph. The house icon will return the image to the original view. Feel free to test them all or hover over them to get more explanations.

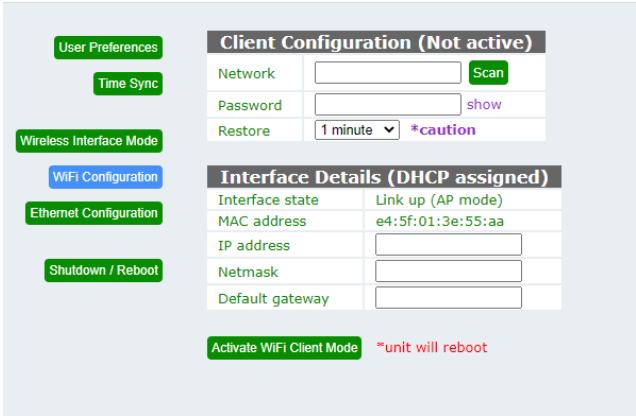
### 3. Connecting the system to your Wi-Fi network

So far, you have been connected to the device via its own Wi-Fi Access Point. You can also connect it through your local Wi-Fi network. This allows you, your colleagues and Vivent to monitor the signals from a distance.

Click System Configuration > Wireless Interface Mode and if the country is incorrect, change the country to your country. Then select **Client Mode** from the second drop-down menu.



Click the Scan button to find your local networks. Choose the network and enter the password if necessary. Then click update.



The system will reboot, which takes 2 - 3 minutes. You will lose the connection to the device, however it is now possible to monitor from a distance, which is explained in the sections below. The most frequently used mode of access, is via Guest Access which can be set up by Vivent.

### 3.1. Guest access

Log in to <http://guest.phytlsigns.com> for device access.



Vivent SARL Chemin de Varmey 1, 1299 Crans-pres-Celigny, Switzerland  
Registered in Canton Vaud, Switzerland CH-600.4.015.162-0



This server is for authorised PhytSigns users only.  
Please install the [Vivent CA Certificate](#) then [click here](#) for secure access.

The first time you will be required to install a security certificate, which can be done by clicking the Vivent CA Certificate. More details on installing this certificate are given in section 'Safety certificate installation'. Once the certificate is installed you can continue and enter your credentials, which you will have received by email from Vivent.



Your connected devices appear in this new window with an access link to the device. Click this link to see the LiveView (and other features) from this device, as explained in section 'What can be seen using the sensor?'.



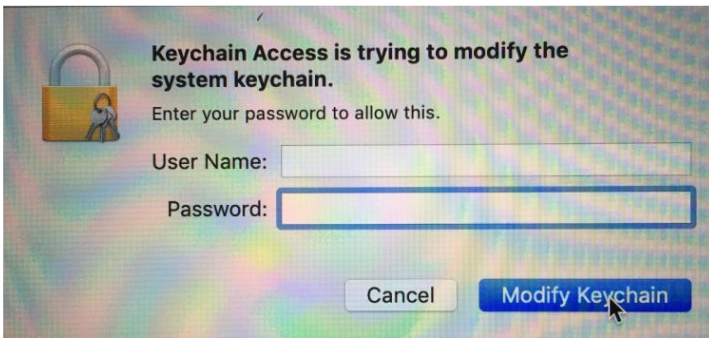
### 3.2 Safety certificate installation

The ca.crt file is a CA (Certificate Authority) Root Certificate. It is a digital certificate that has been signed by Vivent SARL and is publicly distributable. The certificate is used to provide secure, private communication between end-user software (for example: Chrome, Firefox, Safari, Internet Explorer/Edge web browsers) and Vivent's web servers such as <http://guest.phytlsigns.com>.

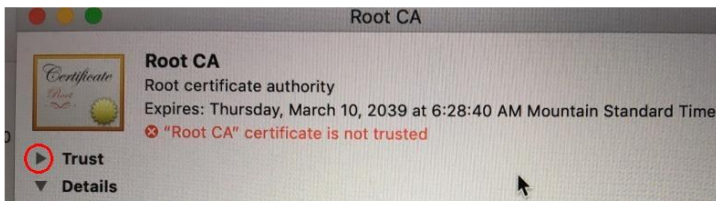
Open your browser and type <http://guest.phytlsigns.com> and click on "Vivent CA Certificate"

#### For Apple Users

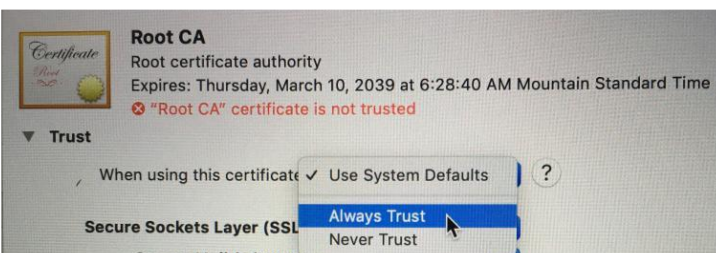
You will be asked to provide Admin credentials in order to add the certificate to the system keychain



In the Root CA window, click on the triangle beside Trust

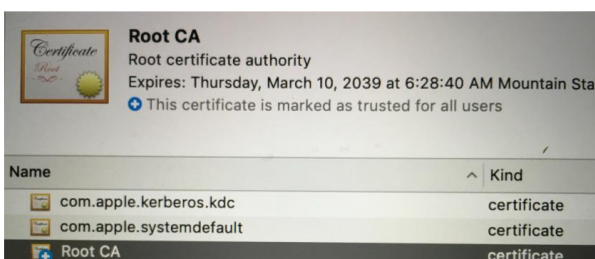


Change the setting *When using this certificate* to Always Trust



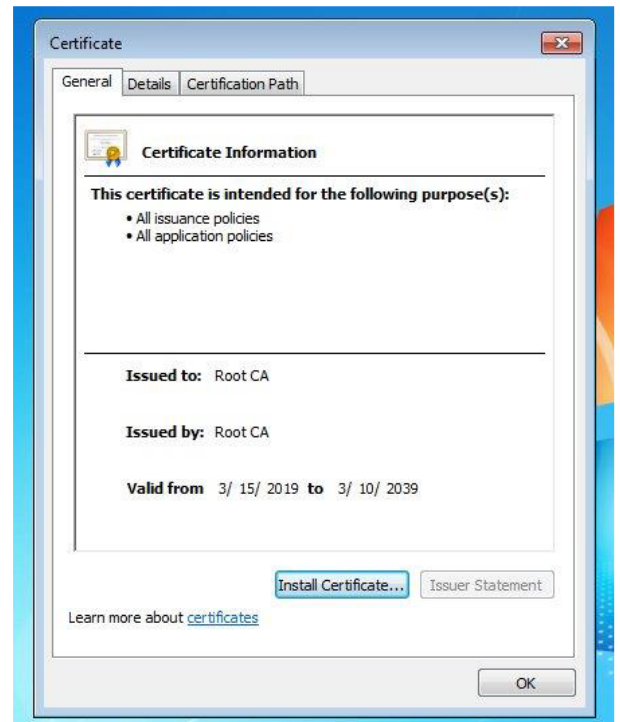
When you close the Root CA window, you will be asked to confirm changes by entering Admin credentials again.

If the certificate has been successfully installed the message *This certificate is marked as trusted for all users* will be visible:



#### For Window users

Select "Install Certificate" from the pop-up Certificate window:



Choose 'Place all certificates in the following store' and then click the **Browse** button. Find and select **Trusted Root Certification Authorities** from the menu in the pop-up window then click the OK button. Finally, click the Next button and then the finish button

### 3.3 Access via the same network as the device

If you are connected to the same WiFi network as your device, it is possible to connect using the local address: <https://ID.phytlsigns.local>. All Android devices and Apple devices such as iPhones, iPads, Macbooks, etc. can find the local address of the device, however the latest versions of Windows sometimes do not recognize .local properly.



There are also many additional settings possible (e.g. forwarding the data to other platforms); please contact Vivent for specific requirements.

Have fun getting to know your plants. Feel free to contact us at any time and we are keen to talk once you are ready.

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