

EO AFRICA EXPLORERS

PRISMA 4 AFRICA

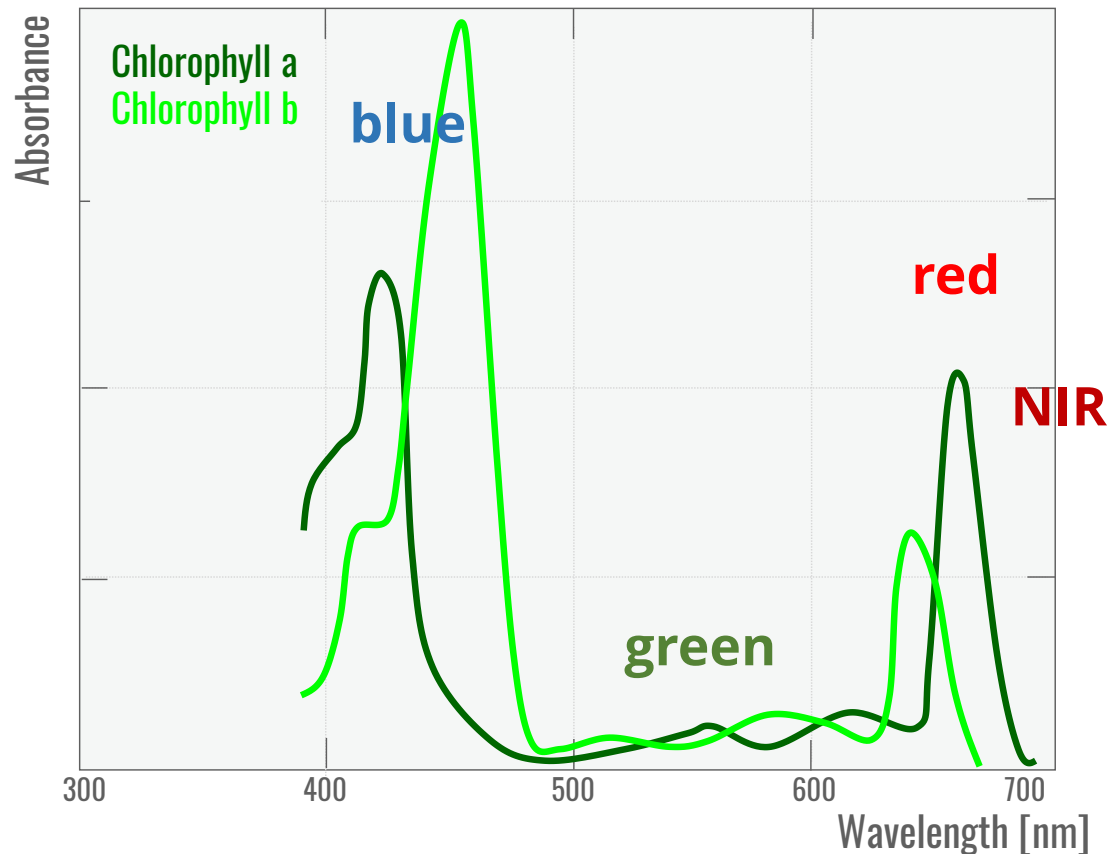
Theory and practice of chlorophyll measurements in plant leaves

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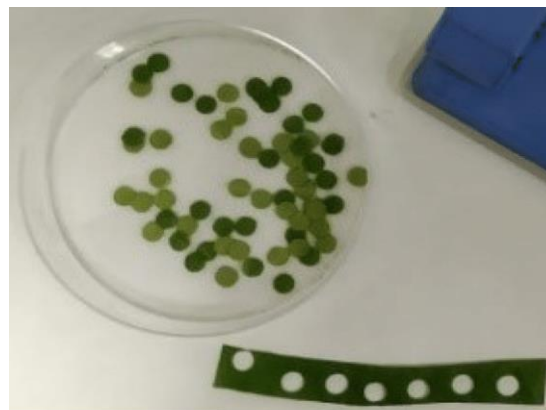
Leaf chlorophyll a+b



Chlorophyll in the leaves of plants is mainly present in two forms: Chlorophyll a and b. These pigments have specific light absorption features, absorbing most light in the blue and red bands and much less in the green and in the NIR (near infra-red). That's why we see the leaves as green.



Leaf chlorophyll analysis



(a)



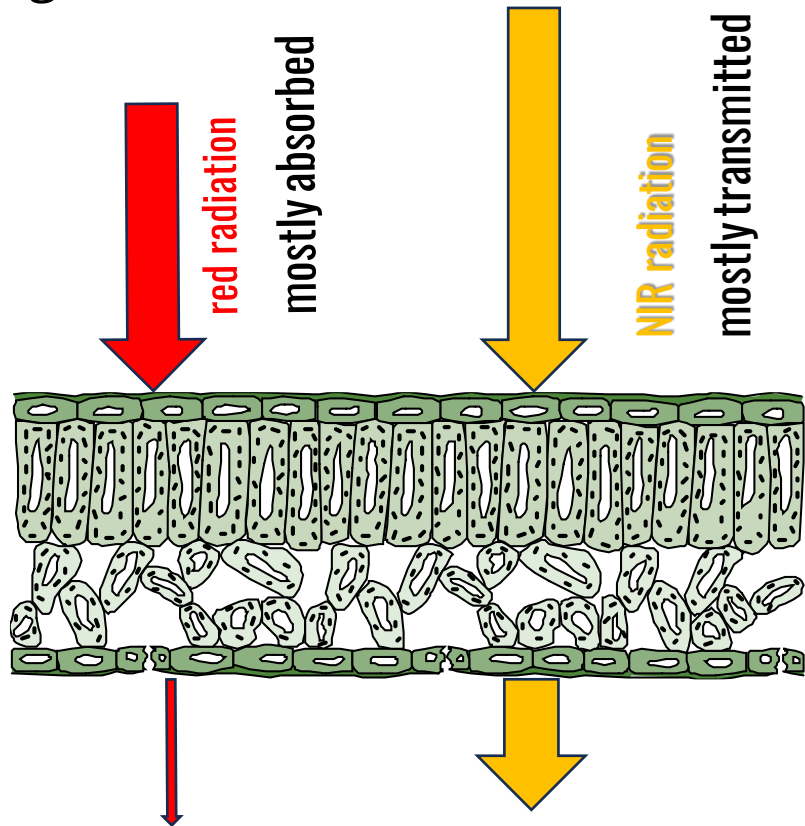
(b)

Chlorophyll analysis is quite time consuming and complicated



Indirect leaf chlorophyll determination

Some instruments for the rapid assessment of chlorophyll concentration in leaves have been developed since the 1990's, based on light transmission through the leaves



SPAD



AtLEAF



DUALEX



MC-100

atLEAF devices characteristics



	atLEAF CHL BLUE	atLEAF CHL PLUS	atLEAF CHL STD
Display	Alphanumeric LCD 16 characters x 2 rows		
Battery	2 x AA		
Bluetooth®			
Mobile app available for free download	✓	✗	✗
USB			
Windows software available for free download	✓	✓	✗
Calculate means on stored measures	✓	✓	✗
Max # of measures stored on device	9554	9554	64
Max # of measures names stored on device	490	490	✗
Sensor temperature	✓ ^(*,**)	✓ ^(**)	✗
Date&time	✓ ^(*,**)	✓ ^(**)	✗
Dimensions	6.9 x 2 x 1.8" (175 x 50 x 45mm)		
Weight Not including batteries	6.2oz (175g)	5.8oz (165g)	5.8oz (165g)

- Temperature and Time can be read on device
- (*) Temperature can be read and Date&time can be read/sync through the atLEAF App
- (***) Date&time can be read with all atLEAFsoft versions and temperature can be read and Date&time sync through PRO version

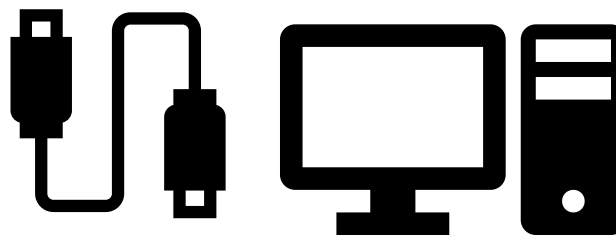


atLEAF CHL BLUE system components

Chlorophyll reader

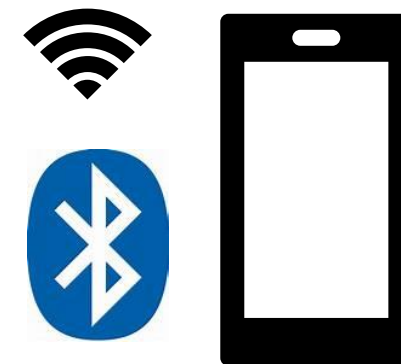


PC software



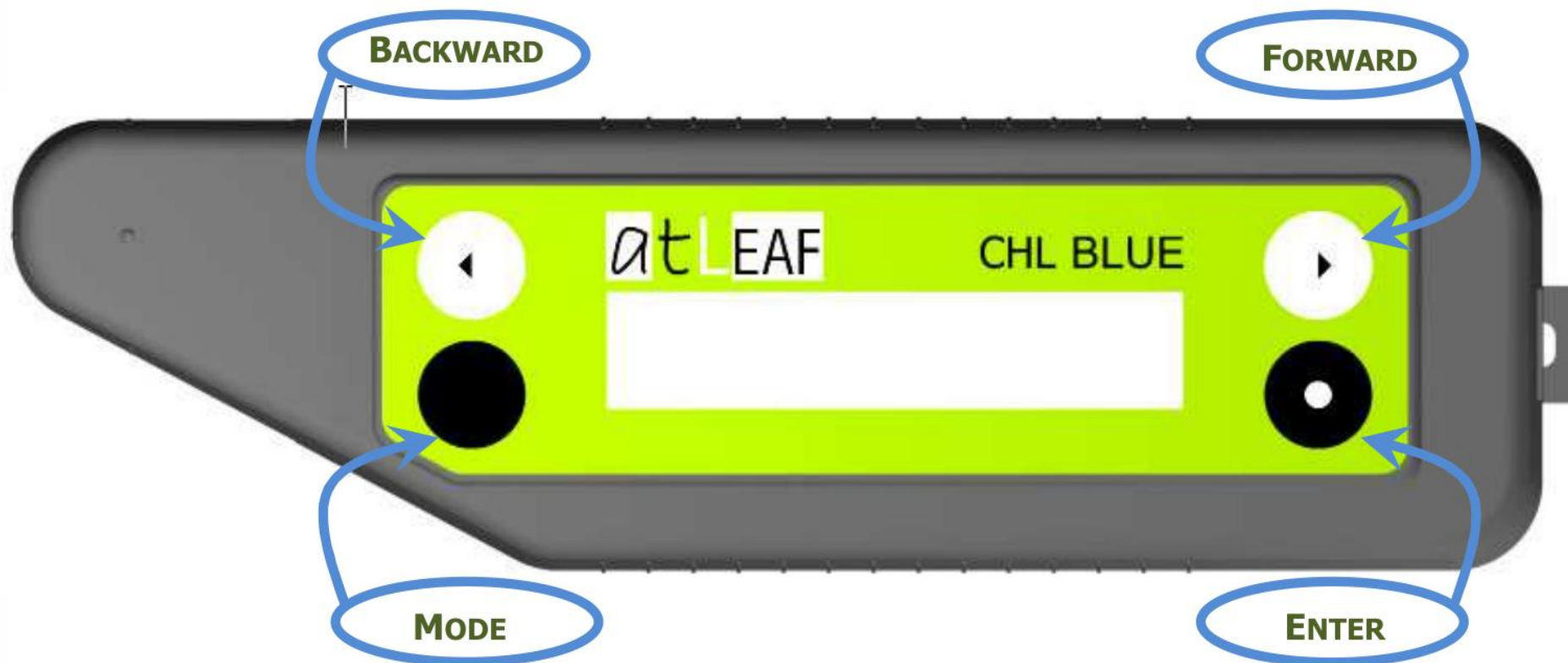
<https://download.atleaf.com/>

Smartphone app





Description of the AtLEAF device





Device modes

1 Measure

To perform a measurement

2 View measures

To review stored measurements

3 Clear last

To delete the last performed measurement

4 Clear all measures

To delete all measurements

5 Average

To view the average value of the stored measures

6 USB

To put the device in USB mode

7 Bluetooth

To enter device in Bluetooth BLE mode

8 Settings

To view device info and to set parameters

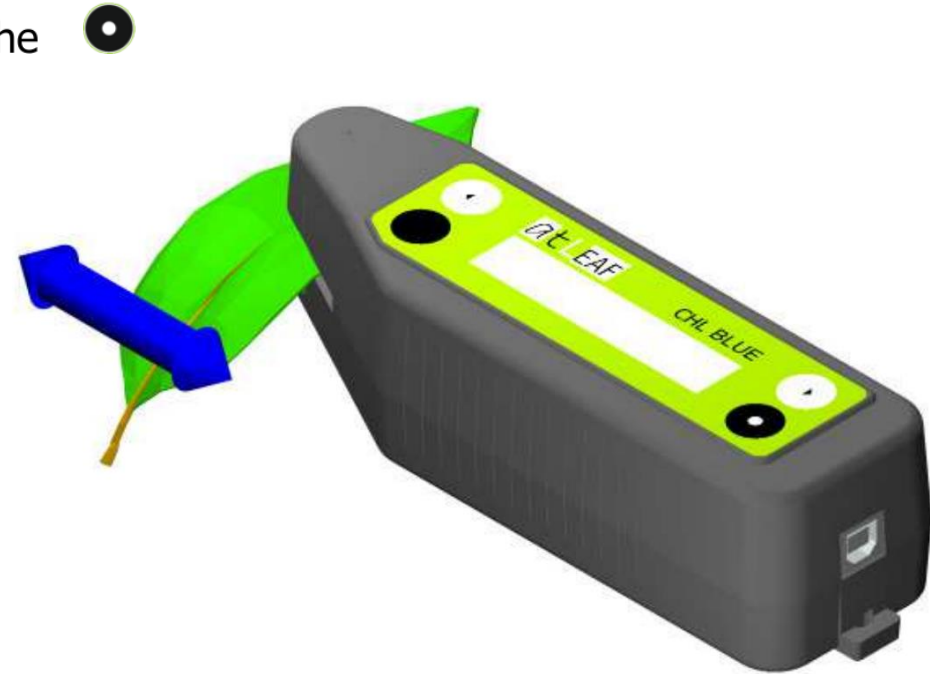
By pressing the MODE key, the device exits the actual control mode and goes through the modes, from 1 to 8, then 1 and so on.

Modes 2,3,4 are available only when at least one measure has been stored in the memory, while mode 5 is available when at least two measures have been stored in the memory.

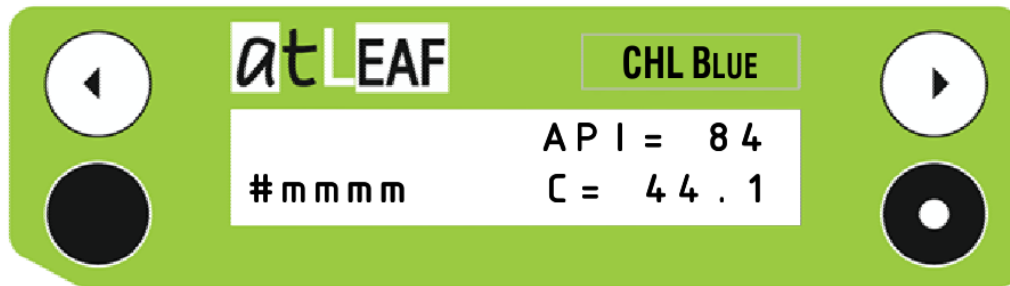
By pressing the ENTER key, the device enters the display mode.

How to take a single leaf chlorophyll reading using the device

- The measurement is performed by placing the leaf in the device and pressing the **ENTER** key (key on the bottom right):



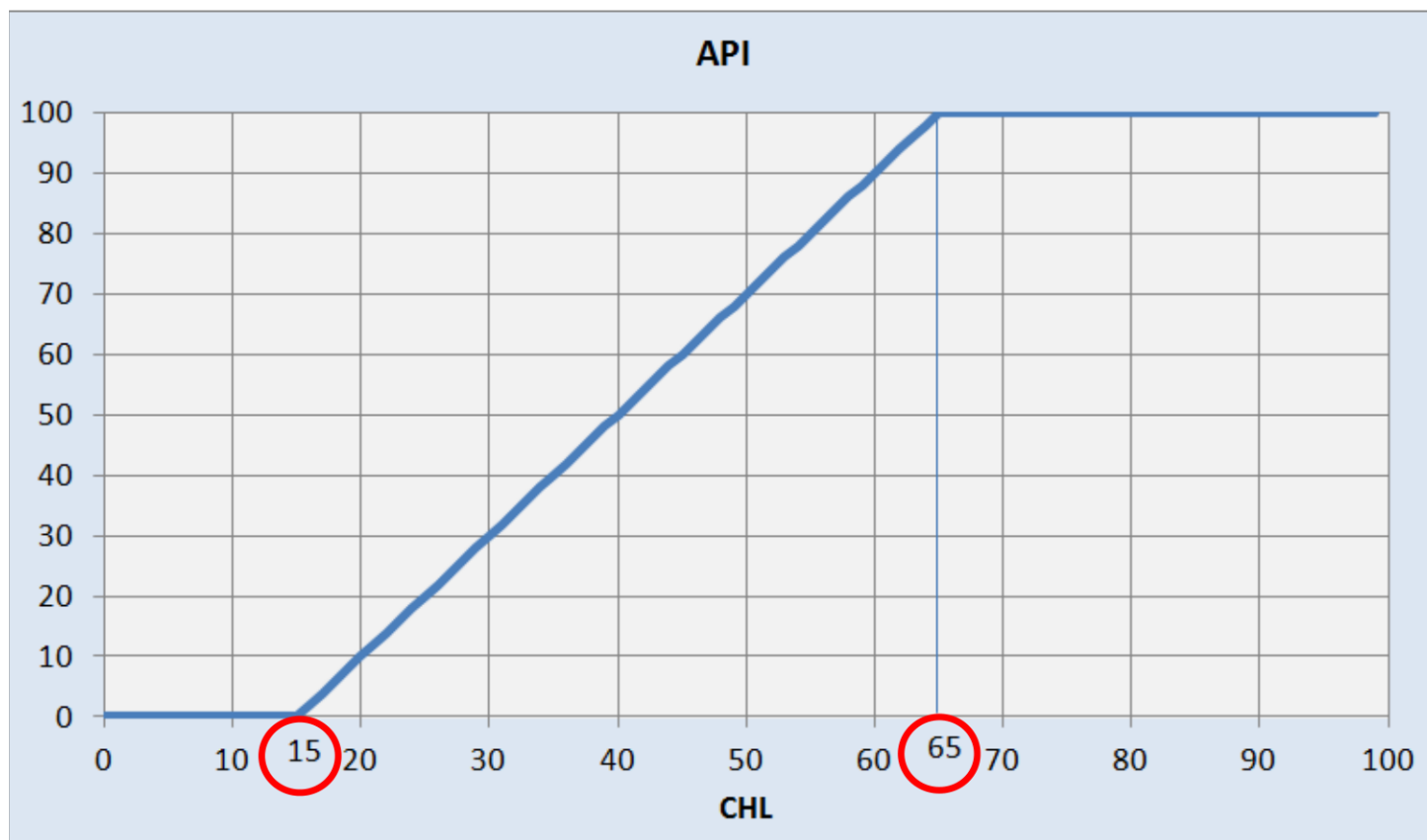
- To the right of the second line of the LCD screen, the value of the measure is displayed (C= 44.1)



Then the ENTER key can be pressed again to perform another measure or after 2 minutes of inactivity the meter will go into power off (stand-by)



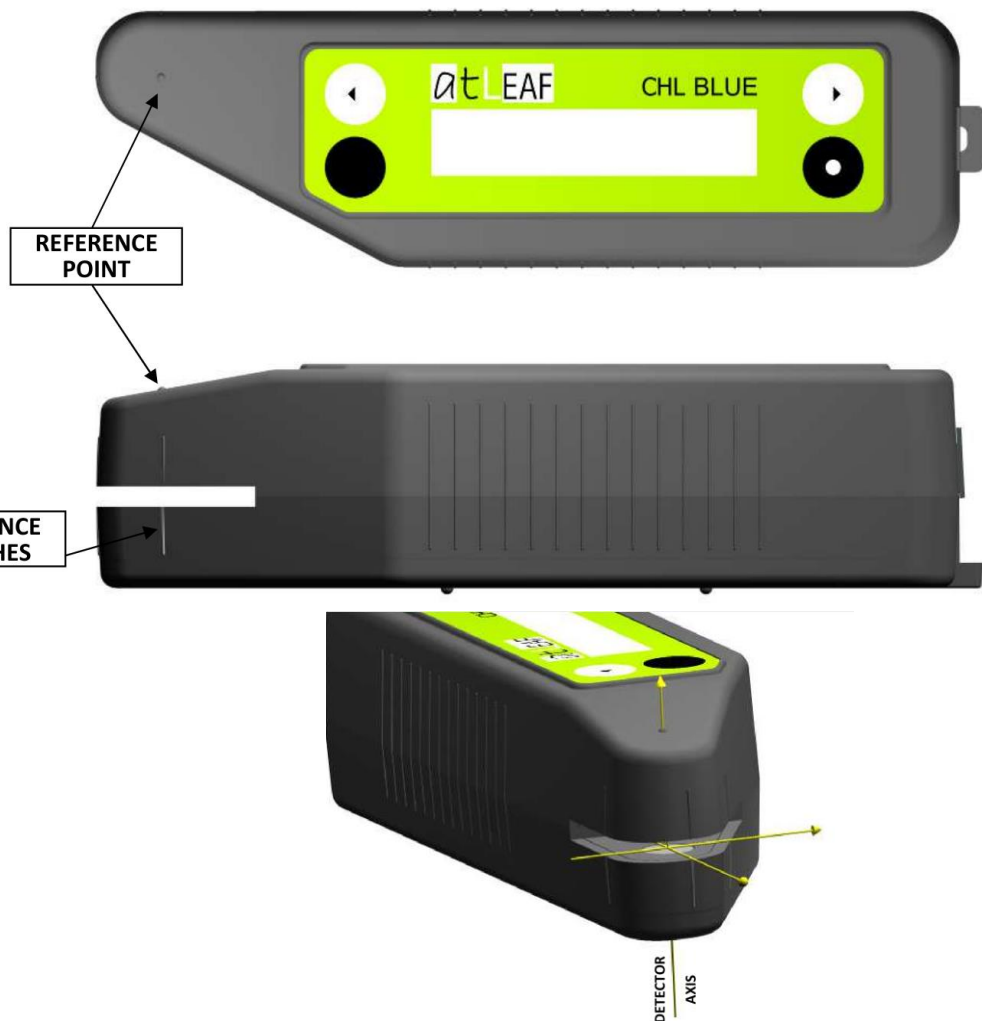
API atLEAF Performance Index



- API (atLEAF Performance Index) is a device related index that can summarize, in a simple and direct way, measurement meaning.
- For the atLEAF CHL BLUE device, the API index is calculated as the linear interpolation between an interval of measurement values, giving as result values from 0 to 100
- CHL values under 15 will result in an API=0 and CHL values greater than 65 will give API=100



Inserting the leaf correctly



WRONG
leaf is behind window



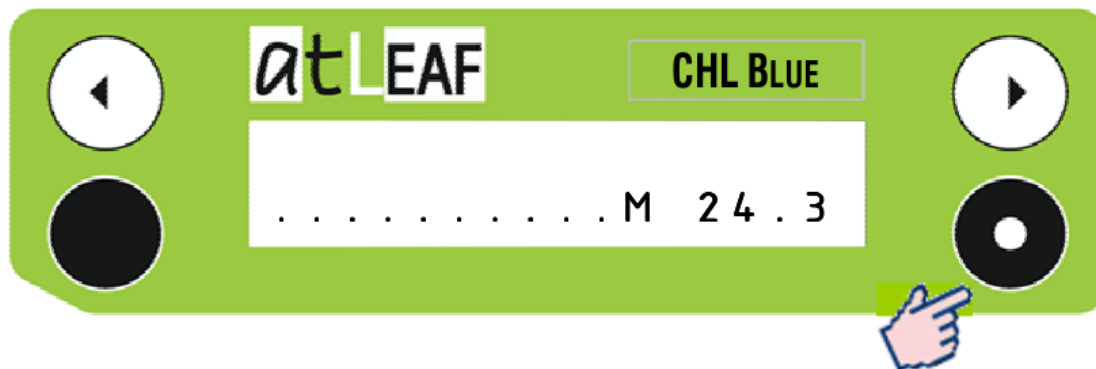
WRONG
leaf is in front of window



CORRECT
leaf is aligned with
reference notches

The position of the detector is indicated by the reference point on top and notches on the sides.

Taking continuous readings along a leaf



Repeated acquisitions

- By pressing and holding down the **ENTER** key, the device will continue to perform successive measurements while automatically calculating the mean value. During the repeated acquisitions "M" is displayed followed by the measure value. Up to 200 successive measurements can be made for calculating the average. Upon releasing the **ENTER** key, the calculated mean value is displayed and stored.



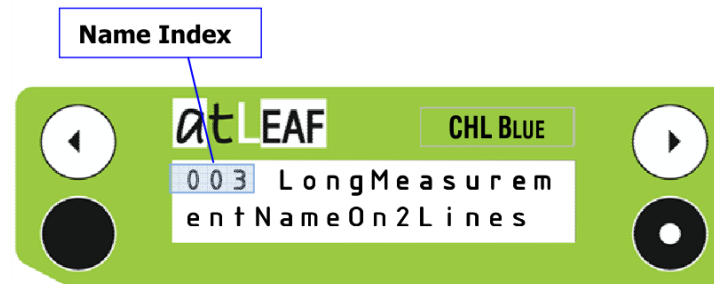
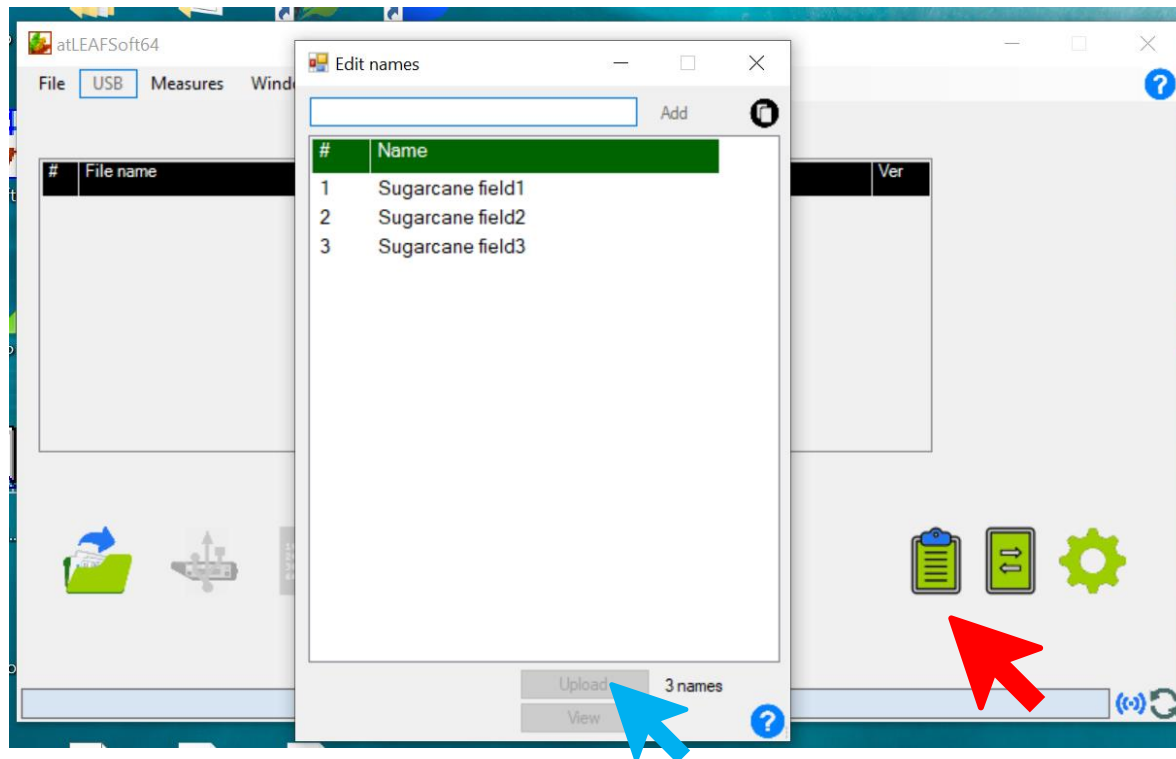
See video
<https://youtu.be/MkJIUkD908E?si=Yra8qBcFn2fEuphq>





Measurement Name

- ❑ Each measure in the device can be identified by a name of up to 32 characters.
- ❑ The names must be uploaded through a USB port from a text file on a PC, using the atLEAFSoft software (see here below) . Press mode until you get to mode 6 USB. Then connect to a PC running atLEAFSoft
- ❑ The names stored in the device can be seen and selected when in the Measure mode 1



1. Click on the icon indicated by the red arrow to open the names editor window
2. Insert the names
3. Upload the names to the device (blue arrow)

Name selection

- Press the **FORWARD** key to display the next stored name in the device's memory.
- Press the **BACKWARD** key to display the previous name.
- To quickly scroll through the recorded data, press the **FORWARD** or **BACKWARD** key without releasing it.
- If both the **FORWARD** and **BACKWARD** keys are pressed simultaneously, the device will go to "No name". Pressing the **FORWARD** key will display "No name".
- A plant name longer than 12 characters is displayed on two LCD lines



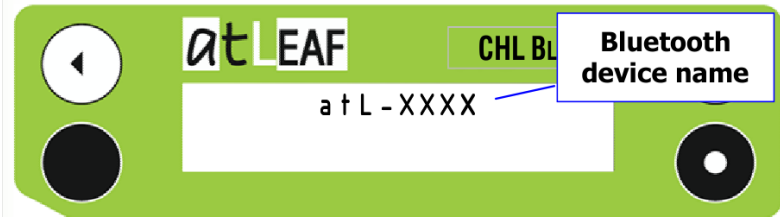
How do I set the time and date of the AtLEAF device?

The device time will be lost everytime you the instrument switches off, so you need to reset it every time before you take measurements. You can do it synchronizing the time from the smartphone app

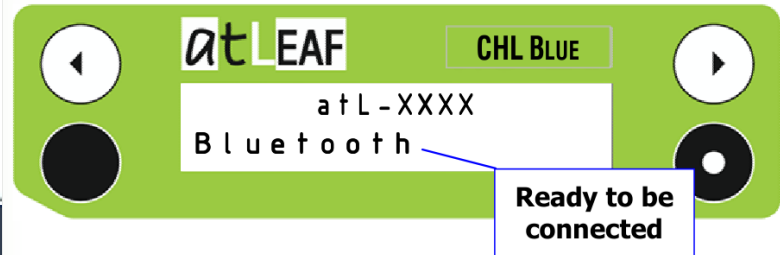
1. Press the mode key (bottom left) in the device until mode 7 Bluetooth appears



- Upon pressing the **ENTER** key, the device enters the *Bluetooth* mode.



- The device Bluetooth name appears on the top row.



- As soon as the *Bluetooth* text appears on the second row the device is ready to be connected with the mobile.

2. Set the smartphone in Bluetooth mode and connect with the device
3. Open the AtLEAF app
4. Click on the Bluetooth button (**red arrow**)
5. Click on **Connect device**
6. Click on **Set Device Time**



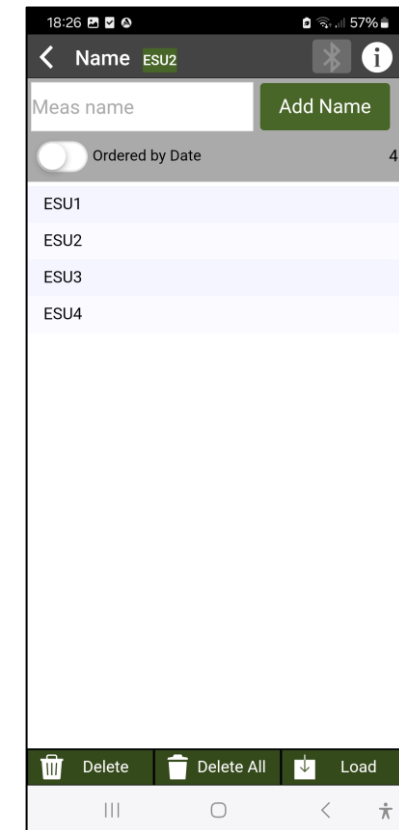
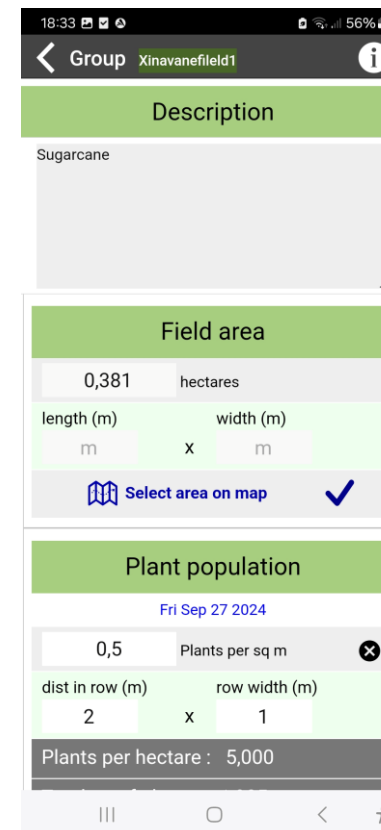


Setting up groups and names on the atLEAF app

Using the atLEAF app you can set Groups and names for measurements and then take measurements directly from the app.



1. In the AtLEAF app tap on the **Manage Measures** button (red arrow)
2. Tap on **Measure groups** and add the names of the fields in which you are going to take samples
3. Keep pressed on the group name to add information
4. Go back and tap on **Measure names** and add the names of the sampling points in which you are going to take samples

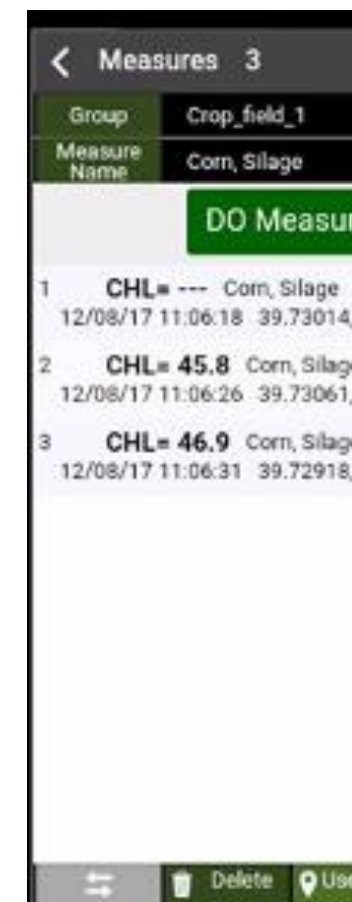
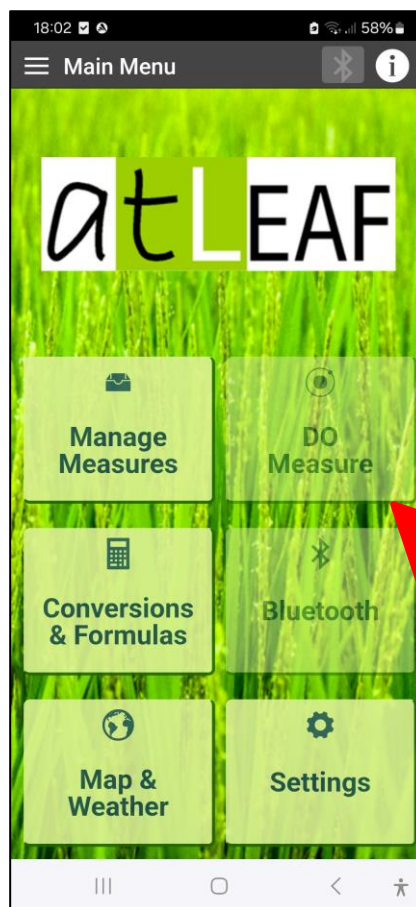




Taking measurements from the atLEAF app

Taking measurements from the app is advised because only in this way will the GPS coordinates be associated with the measurements.

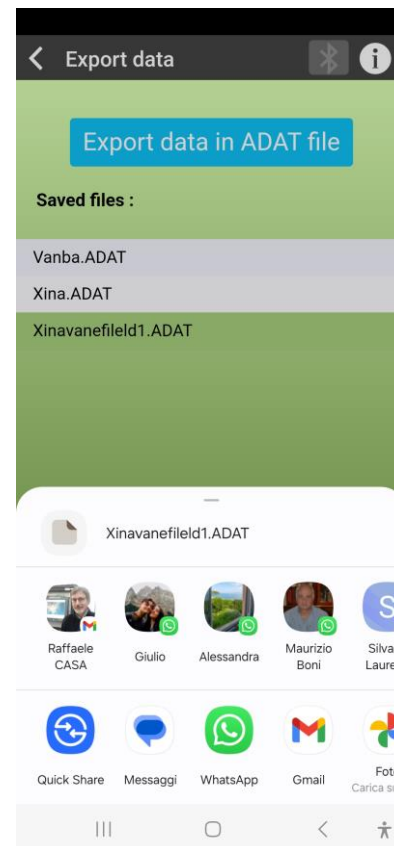
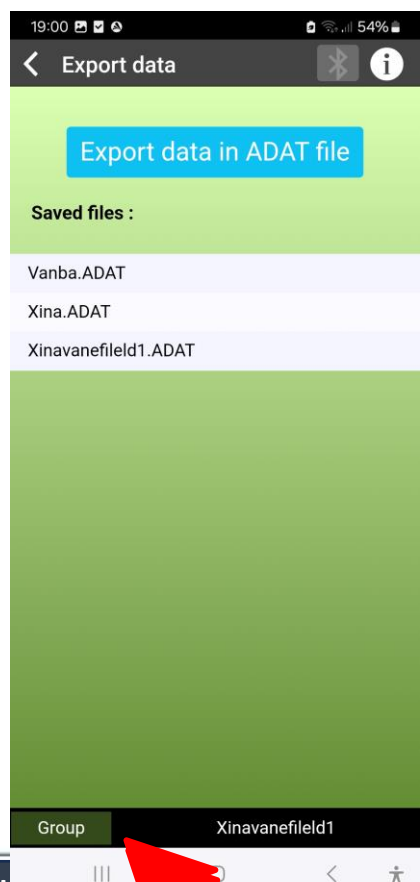
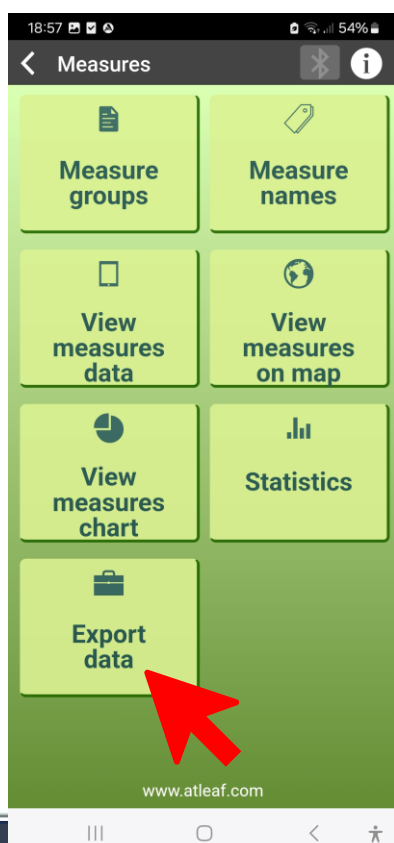
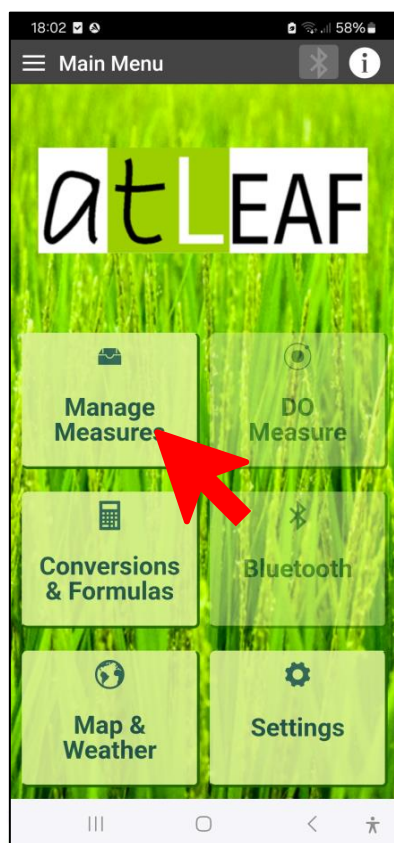
1. In the AtLEAF app tap on the **DO Measures** button (red arrow)
2. Tap on **Group** and select the names of the fields in which you are going to take samples
3. Tap on **Measure names** and select the names of the sampling points in which you are going to take samples
4. Position the leaf into the device and tap the **DO measurement** button





Exporting measurements from the atLEAF app

Measurements acquired from the app can be visualized in different forms (including on a map) and can be exported **ONLY** in the proprietary format *.ADAT that can only be opened using a licenced **atLEAFSoft PRO** software



1. In the AtLEAF app tap on the **Manage Measures** button
2. Tap on **Export data** and in the bottom of the screen tap on the group name and select the group for which you want to export data
3. Tap on the **Export data in ADAT file**
4. After the file is saved, it appears in the list and tapping on the name it can be shared (e.g. by e-mail)

Concluding remarks

With the atLEAF device it is possible to acquire measurements in different ways:

1. Directly from the device in the measurement mode. In this case it's important that the time and date of the device is first correctly set (using the app) since **no GPS data will be collected**. Once the data have been collected they can be transferred to the PC using the free AtLEAFSoft that can be downloaded from <https://download.atleaf.com/>
 - In this case you have to set the device in USB mode before connecting to the PC running AtLEAFSoft with an USB cable. By selecting the USB menu you can download the measurements stored in the device and **save them as CSV file**.
2. Taking measurements from the app as shown in previous slides. In this case the GPS position will also be recorded. The measurements can only be exported in the proprietary format *.ADAT that requires a licenced copy of **atLEAFSoft PRO** software to open.

