SENSOTERRA

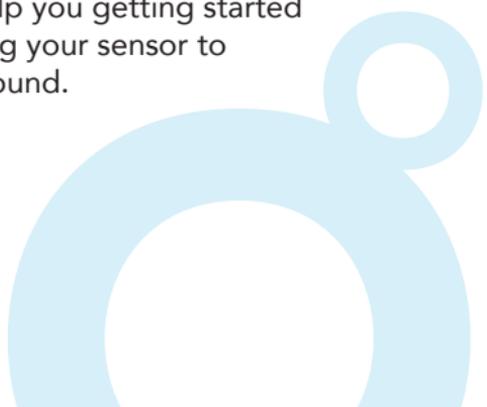*Grow more, waste less...*

Single-Depth

Soil moisture sensor

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USER GUIDE

Welcome

Welcome on board and thank you for joining us! In this guide we will help you getting started - from successfully installing your sensor to getting data out of the ground.

Contents

Overview

What's in the box

Single Depth sensor(s)

User manual

Quick installation guide

What to bring to the field:

Your smartphone
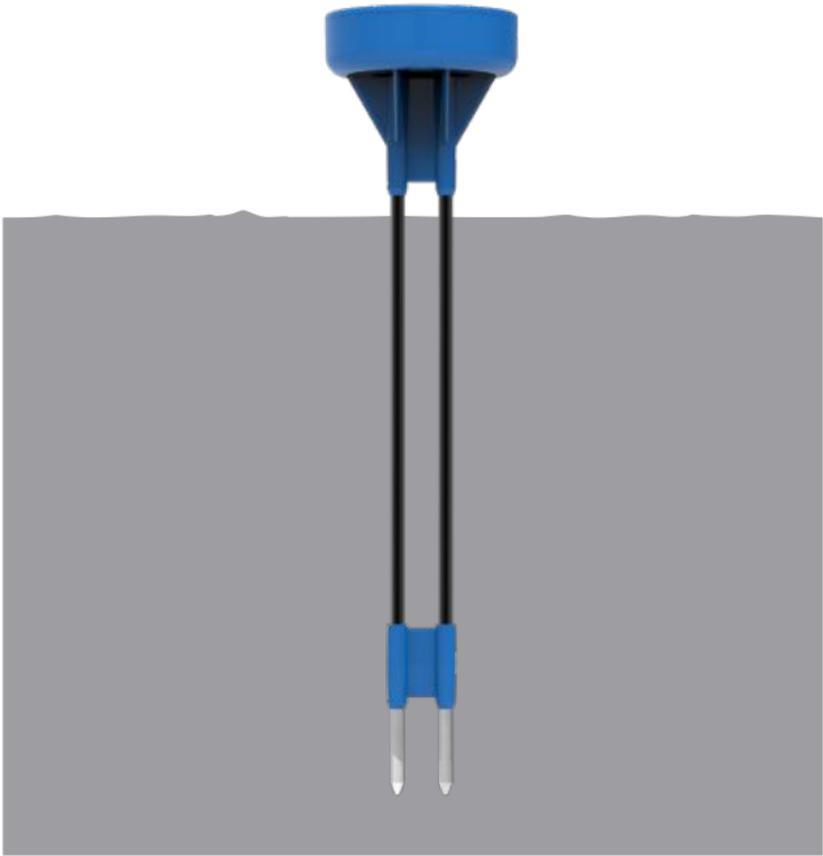with the Sensoterra
app installed

The quick
installation guide
you find in the box

Please read this entire installation manual booklet
before you go in to the field to install your sensors.

Proper installation

The sensor should be installed so that the blue head is sticking out of the soil.

Download the app
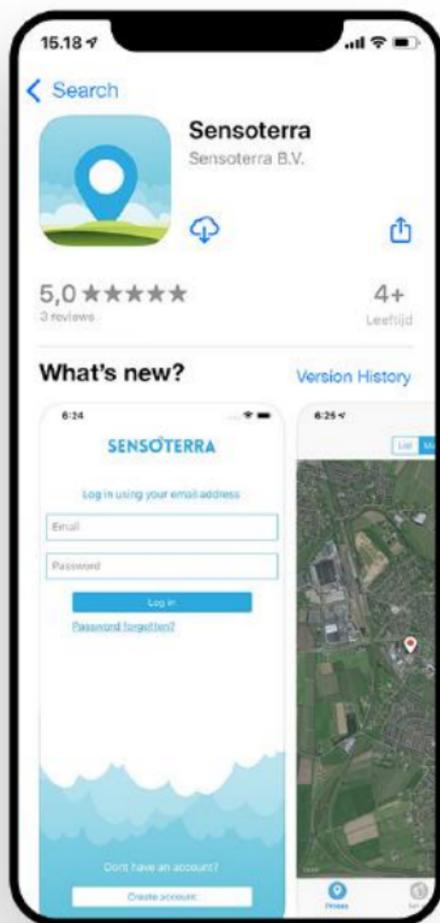
Download the Sensoterra app

Download and install the Sensoterra app from the App Store or Google Play on your smartphone. Create an account or log-in. You will need the app for registering sensors when you install them in the field.

Choosing your location
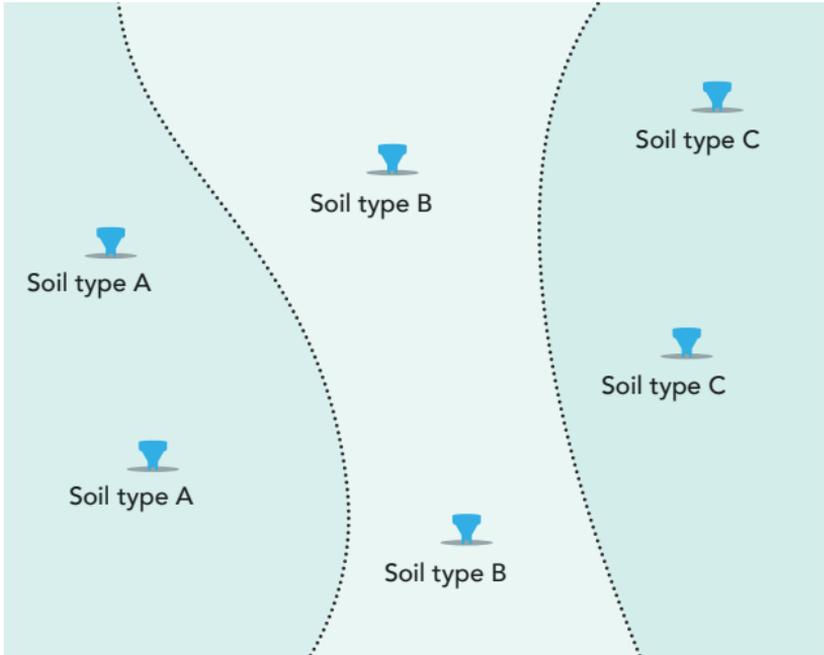
Example of a field with soil variety

The field you like to monitor can consist of geographic features like slopes, valleys and changing soil types. These features might influence the soil moisture levels throughout the field. Consider placing sensors in different places to get a broad overview of the field you monitor.

Ensuring good connectivity

Sensoterra sensors communicate over the LoRa network. This means the data is first sent from the sensor to a gateway, which then forwards the data to the cloud via an internet connection. In some countries and areas, telecom providers have gateways available for your sensor to connect to.

If you are installing your own gateway, the basic rule is to **find free line of sight** from the sensor antenna to the gateway antenna.

Objects like houses, barns, big trees, big vehicles in the line between sensor and gateway could obstruct the signal. Try to get the gateway antenna up as high as possible to get a look over the fields and think about the location of the objects when choosing the locations of the sensors.
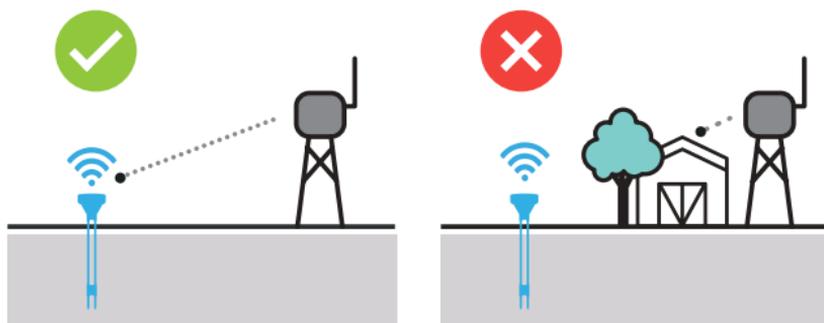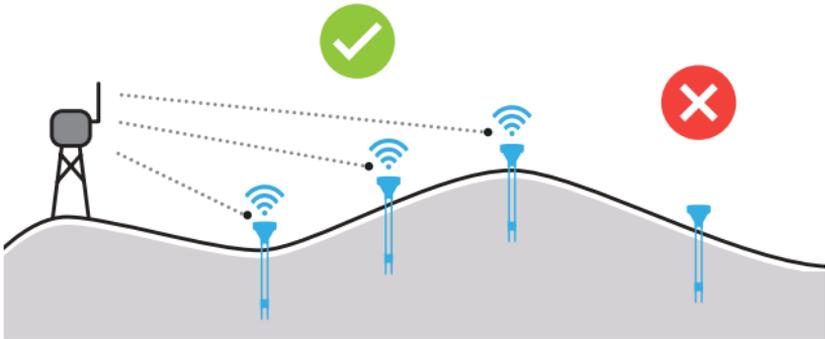
Terrain

Terrain that is hilly creates signal shadows over the field. Placing the gateway at the highest point of the hills could reduce the signal shadows. The sensors should be placed on the side of the hill that is facing the gateway. Buildings and large structures can also obstruct the signal. Avoid placing them in the signal shadow or place your gateway elsewhere.
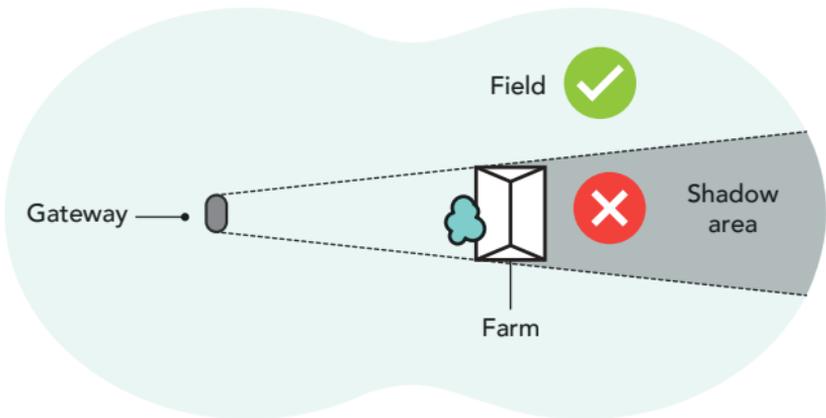
Crops that limit the signal

Crops could create a very dense canopy containing a lot of water, which might limit the signal. If the sensor struggles to connect, try moving it slightly away from the crop so the sensor gets free access to the open sky.

Installation depth

In areas with poor connectivity, it can help adding a little more space between the sensor head and the ground. Always make sure the sensor is stable in the soil and not wiggling around.

Poor connectivity   Recommended   Improved connectivity   Too high
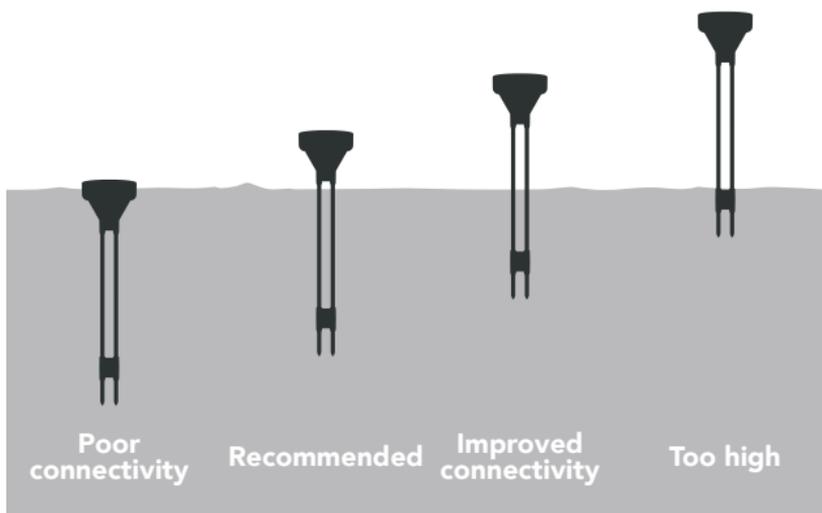
Choosing soil type

When installing the sensor in the app there is an option to pick soil type. It is important to choose the closest soil type available. This will improve the accuracy of the measurement from the sensor. Sensoterra calibrates the sensor measurements for many different soil types to make the data you view in the app, web monitor and the push notifications you set up more useful.
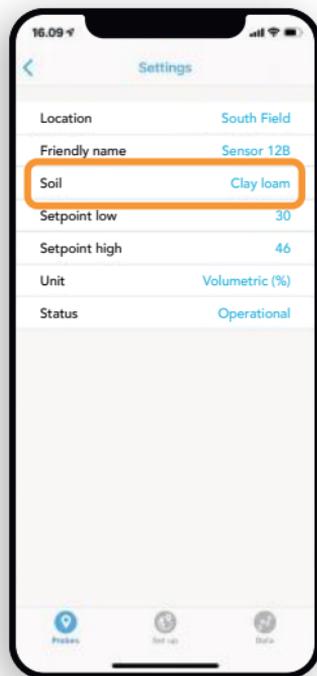
→ **For more information visit the soil calibration section on www.sensoterra.com**

1

Preparation

Use the soil triangle to determine which calibration is closest to your soil type:
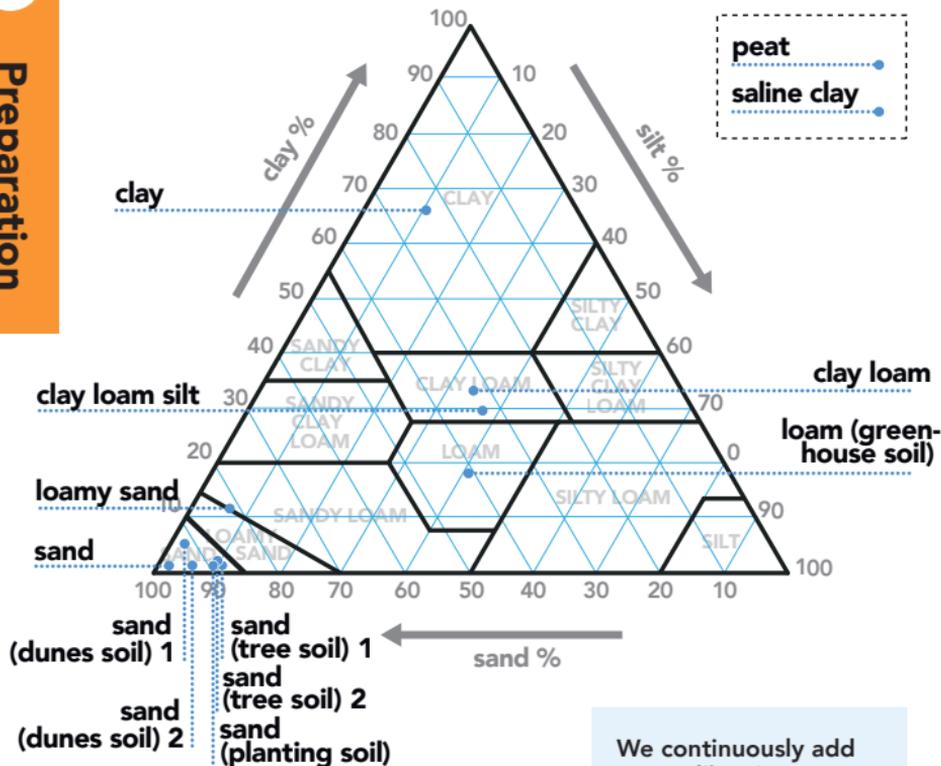
The sensor will work in all soil types, but if the calibrated soil is very different from your own, your data might be offset.

We continuously add new calibrations, please visit our soil calibration section for the latest information:

Choosing unit of measure

The Sensoterra app and monitor can show data in two ways: **Volumetric Moisture Content** and **Sensoterra Index.**

Volumetric Moisture Content (%)

The volumetric soil moisture content of the soil is expressed in the app as Volumetric (%). It is simply the ratio of water volume to soil volume. The volumetric soil moisture percentages allow for careful management of soil moisture levels in your soil.

KEY:

Too dry

Healthy

Too wet

Saturation point*

Solid soil fraction

PEAT — 22%, 63%, 83%

SAND — 2%, 10%, 40%

CLAY — 28%, 53%, 55%
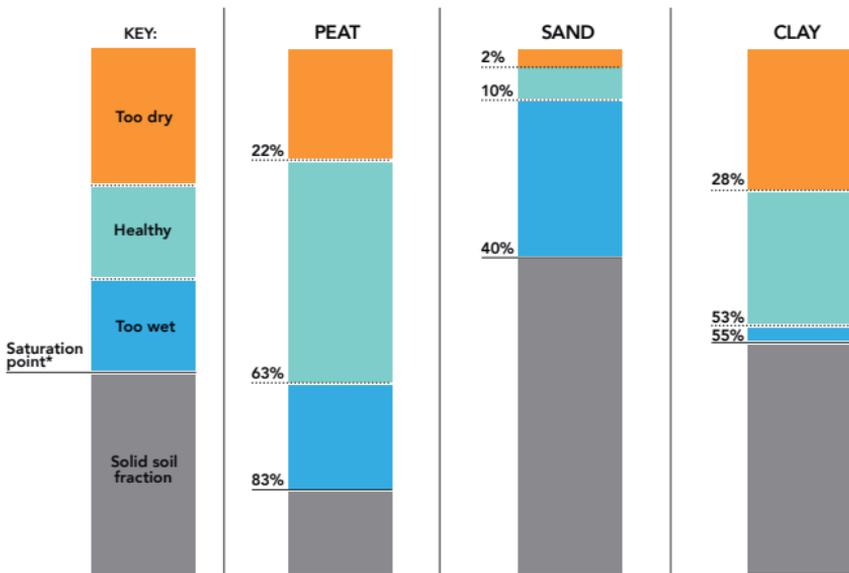
* Saturation point = maximum volume of water that the soil can hold

Sensoterra Index (SI)

Sensoterra Index scale is based on pF data and focuses on the 'Too Dry', 'Too Wet', and the 'Plant available water" (or Healthy) zones and spreads the three zones over a 0 to 10 scale. The 0 and 10 values represent oven-dry soil and complete saturation of the soil, respectively.

The Sensoterra Index is a simplified soil moisture score that allows you to determine soil health at a glance, as well as making it easy comparing data from sensors in different soils.

pF7	0	**Oven dry soil (pF7)**
Too Dry	1	
	2	
	3	**Permanent wilting point ±2 (pF4.2)**
pF4	3.3	**Wilting point (pF2.5–pF3)**
Limiting	4	The point at which plants begin to wilt permanently through drought
Healthy	5	
pF2.5	6	
Productive		
pF2	6.6	**Field capacity (pF2)**
	7	The maximum amount of water the soil can hold
Too Wet	8	
	9	
pF0	10	**Complete saturation (pF0)**
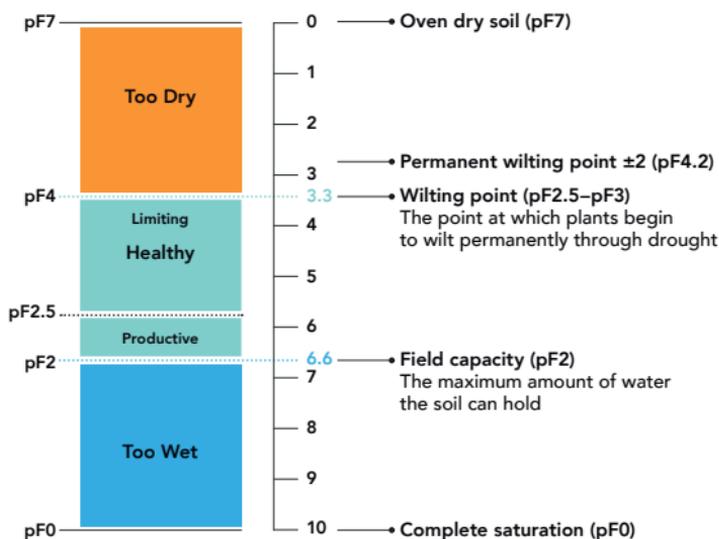
For more info on units of measurements, visit:
support.sensoterra.com

Volumetric Moisture Content (%) Example:

This example shows two graphs expressing Volumetric %. It looks like the sandy soil is very dry (around 5%) compared to the planting soil (around 25%):

Sensoterra Index (SI) Example:

Below is the sama data expressed with Sensoterra Index. It now becomes clear, that relative to the soil type, both soils are mostly in their healthy zones with SI values above 3.3:

Registering the sensor
QR code

To register your sensor, first select a suitable location in the field where you want to install your sensor. Once you are there, open the app and select **"add a new device"**. The GPS location of your phone will be stored so you can easily find the sensor again. Follow the guidelines in the app.

Activating the sensor
Flip it!

Wake the sensor by flipping the sensor upside down for 2 seconds. Normally, the sensor makes a measurement once every hour. By flipping it upside down, the sensor tried to get a connection faster.

2
seconds
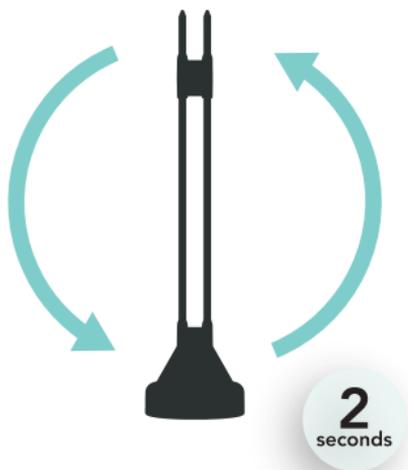
After 1 hour check the Sensoterra app or the web monitor for soilmoisture data. In certain cases, it may take up to 48 hours for the first data point to appear in the Sensoterra app or monitor site. This process is to ensure the best possible connection on the LoRa network.
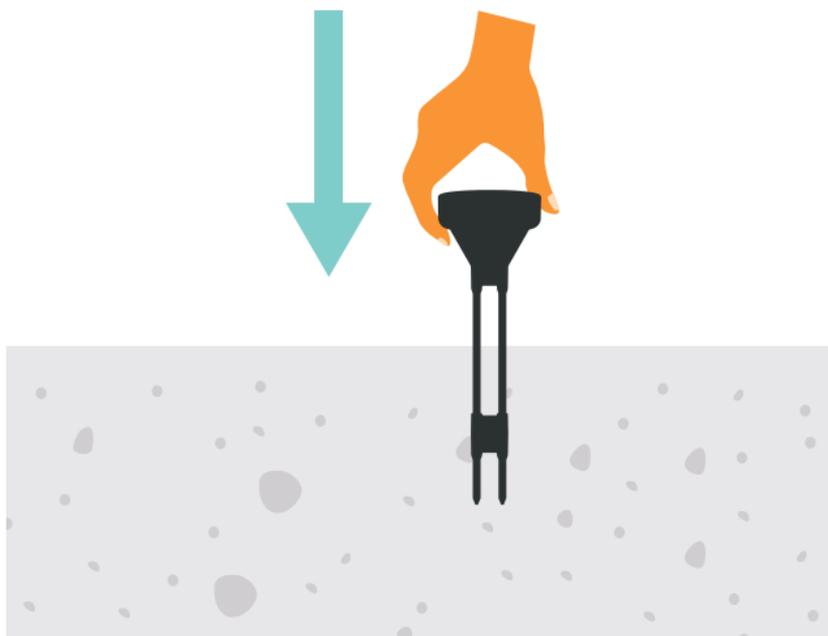
Installing the sensor
Soft soil

The blank metal pins on the sensor stem are the measurements points. These need to be in full contact with the soil for a good measurement. Install the sensor in the soil. If the soil is soft, you can push the sensor fully into the ground.

Installing the sensor
Hard soil

If the soil is too hard for you to push the sensor all the way, use a rubber hammer until only the sensor head is sticking out of the soil. Make sure you hit the sensor in the center of the head. Do not use a steel hammer!

Be careful, if the soil is too hard (dried out) or rocky, hammering can damage the sensor. Don't use too much force. If the top layer is too hard, remove the first centimeters/inches until you reach more moist, softer soil and install the sensor as described.

If the soil is still too hard, create a hole which is a bit wider and deeper than the sensor. Mix the soil that comes out, put it back and compact it with the ball of your foot or your fist. Then install the sensor as described, by pushing or hammering. When following this procedure, the soil might need some time to 'reset' and regain the characteristics of the surrounding soil.

**Prefer a video?
Watch here:**

Good sensor placement

The connectivity of the sensor can be affected by the crop canopy. Ensure that the sensor gets a clear view of the sky. If connectivity worsens as the crop grows, try moving the sensor slightly further away from the canopy.
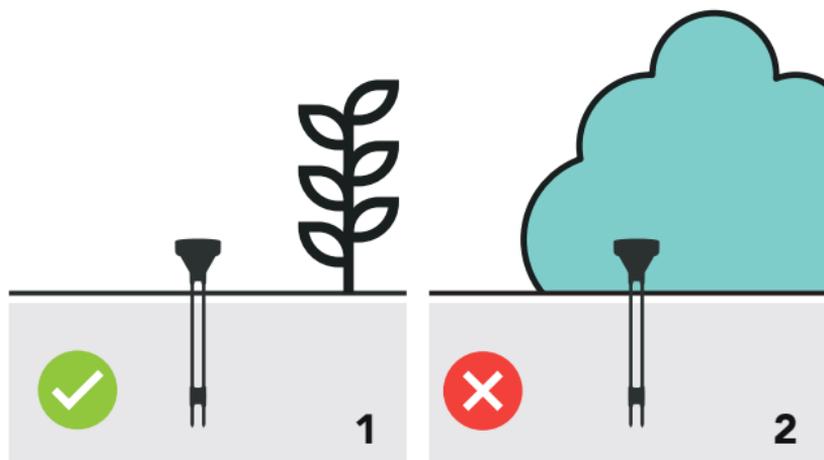
1. The sensor is next to the crop, but not fully covered by the canopy.

2. The sensor is placed right under a dense canopy.

Consistent soil readings

Soil moisture measurements can be affected by the characteristics of your field. This includes variation in soil composition, rocks, air gaps and root systems.

In a field of sensors, you may see slightly varying soil moisture measurements. This is normal behaviour and can be explained by the amount of rocks and roots in the ground and the soil variation across the field.

Imagine these examples: You have 5 sensors installed in the exact same soil type, but they all show different measurements. The soil itself will hold similar amounts of water, but the sensors will also include the surrounding rocks, roots or air in the measurement. Therefore you can expect the measurements to be slightly different.

PURE SOIL ROCKS ROOTS AIR (around pins) AIR (covering pins)
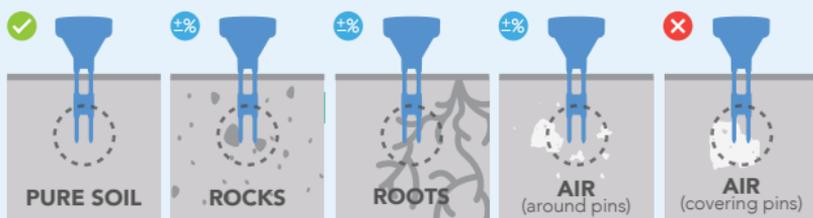
Tips:
- Always use a system of sensors and look at the moisture trends.
- If one sensor's data is very different, try re-installing it in a new spot.

Accessing the data

Once the sensor has connected to the network, you can access the data from either:

Sensoterra App on your smartphone

Web Monitor on your desktop or laptop

In your application (as an API)

API's collect the calibrated data and send it to the Sensoterra customer portal and to a third party ecosystem.

To view your data online, visit:
monitor.sensoterra.com

Understanding the data

See data from your field directly in the Sensoterra Monitor. Compare data across e.g. loctions or soil types.

3

Data

Data example:

The peaks show
irrigation and rainfalls.

Bars showing the moisture
status for all selected sensors.

Too wet and
too dry areas

Too wet

Friday, Jul 3, 9.00 AM
Sensor 1
38.3% (too wet) @30cm
Sensor 2
37% @30cm

Too dry

Dashed line showing
"Too dry"

Dashed line showing
"Too wet"
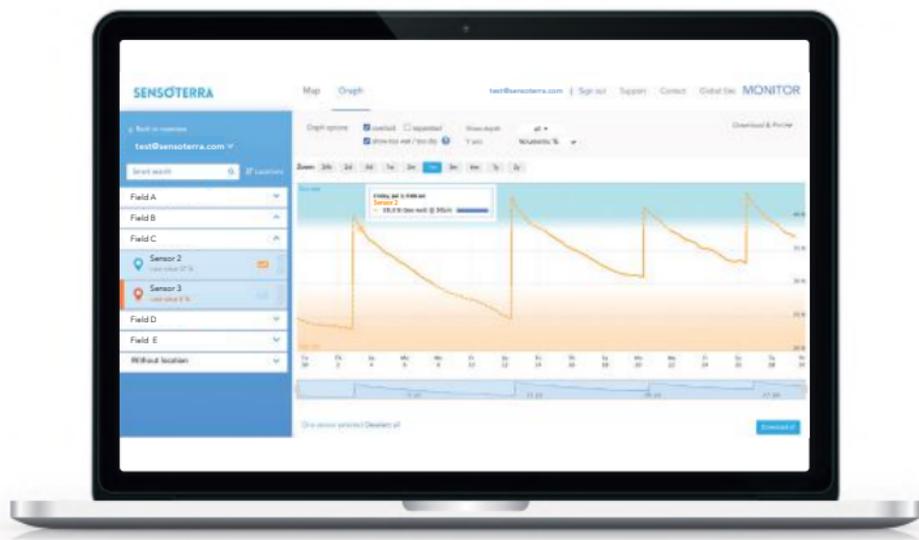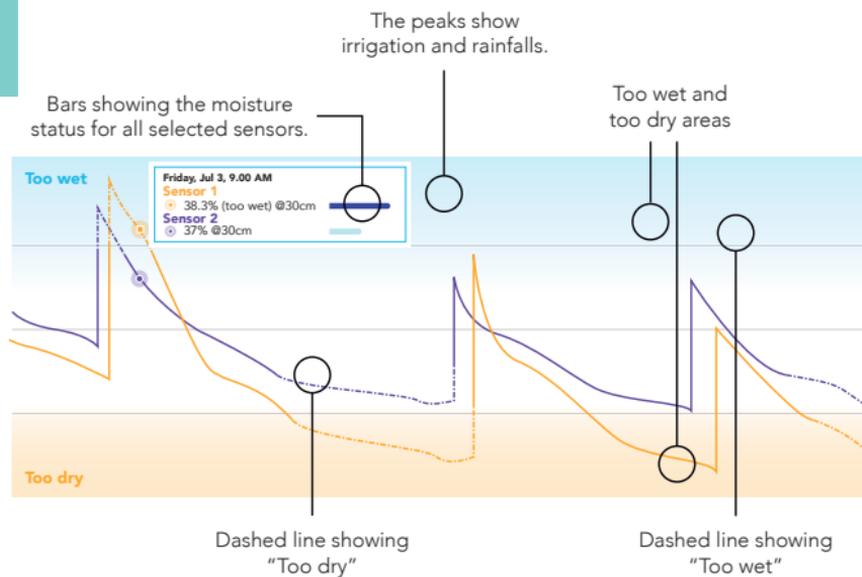
Adjusting setpoints

Use the setpoints in your sensor's settings to adjust upper and lower limits for too wet and too dry soils. Setpoints are different for all soil types. We have recommend ranges for all soil types.

Clay Loam

Setting	Value
Location	Tulip Field
Friendly name	Field 12B
Soil	Clay loam
Setpoint low	30
Setpoint high	46
Unit	Volumetric (%)
Status	Operational

30% — Too dry
46% — Healthy
52% — Too wet — **Saturation point***
Solid soil fraction
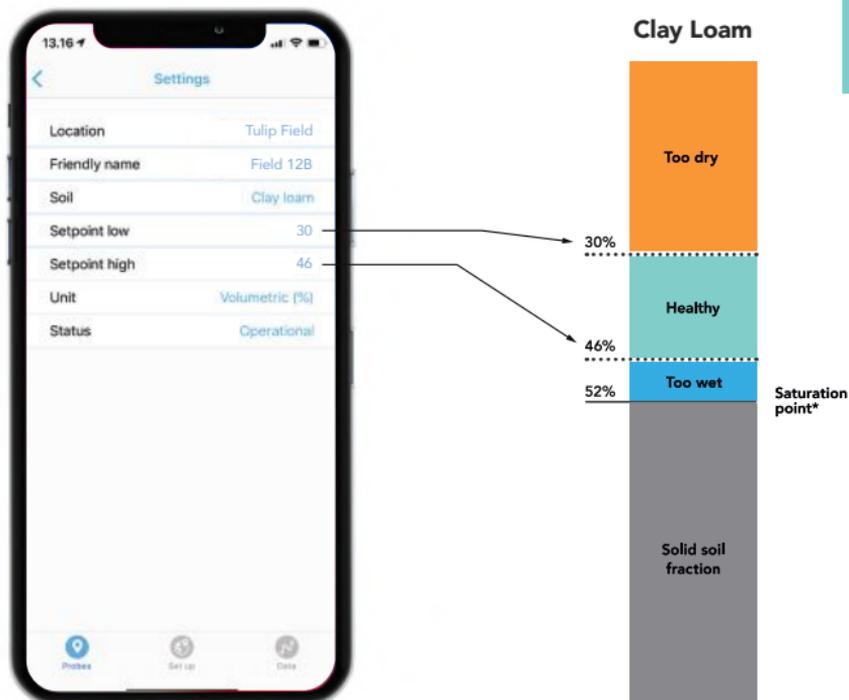
Check all our soil data sheets in the **soil calibration** section on **www.sensoterra.com**

Moving a sensor

Pulling the sensor out of the soil

To get the sensor out of the soil, gently pull the blue sensor head. Do not wiggle the sensor as this may cause damage.
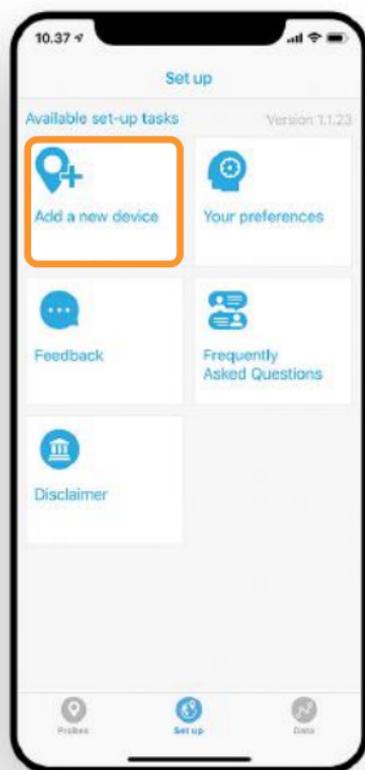
Installing the sensor in a new location

Go to the **Set up** tab in the Sensoterra App and click **Add a new device**

A sensor can get registered multiple times by the same user account.

Every time it is registered, you override previous settings like soil type, name, etc.

Moisture data is never overwritten and remains visible.

Storage and disposal

Handling

Operating and maintaining the sensor is safe and no personal protection equipment is needed. Maintenance may be carried out both by skilled and non-skilled persons.

Maintenance

The only recommended maintenance of the sensor is cleaning the sensor after use. The sensor can be cleaned with soap for a smooth surface. The measurement pins can be cleaned with an alcoholic cleaner.

Normal use

Remove the sensors prior to any mechanical harvesting. The default setting is for measurements once per hour. It is possible to increase the frequency, however this uses more battery and will decrease the expected life.

Storage

When not in use, remove the sensors from the ground and store them in a dry place. This is particularly important when your gateway is turned off. Do not leave the sensors in the soil with no LoRa coverage as they will continue to try to find a LoRa connection. This puts unnecessary strain on the battery and will reduce the battery life of the sensor. Storing the sensors in a cool (not freezing),

dry place puts them into stock mode and will prolong the battery life. Make sure that the bare metal ends are not in contact with each other.

Product life time

With proper use and care, the sensors should last 3 years.

Disposal

Dispose the sensor as an electronic product according to local regulation. The packaging can be recycled. Sort as cardboard in your local recycling station.

Warranty

The sensor comes with a 1 year warranty.

Note

Damage due to wrong installation is not covered by the warranty.

The materials are properly selected for outdoor use. There is always a change UV could change the color and this is not covered by the warranty.

Support

You can find more information on our dedicated support site where you can also reach out to our support team if you should have further questions.

For FAQs and more about using our sensors, please visit support.sensoterra.com

$C\,E$

Declaration of Conformity in accordance with the Radio and Telecommunications Terminal Equipment Act (FTEG) and Directives 2014/53/EU (RED) and 2011/65/EU (ROHS 2).

Manufacturer: Sensoterra International B.V.
declares that the Radio equipment: Single Depth Soil Moisture Sensor
Intended purpose: Telemetry/data transmission of soil moisture
Equipment class: 1

complies with the essential requirements of §3 and the other relevant provisions of the FTEG (Article 3 of the RED), when used for its intended purpose.

Protection requirements concerning electromagnetic compatibility §3(1)2, (Article 3(1)b)

Harmonised standards applied:

EN 300 220-1 V3.1.1
EN 300 220-2 V3.1.1
EN 301 489-1 V2.2.0
EN 301 489-3 V2.1.1 (2017-3)
EN 60950-1:2006+A11:2009+A12:2011+A1:2010+A2:2013
EN 62311-2008
EN 50581:2012 (ROHS)
IEC 62368-1:2014 (Second Edition), EN 62368-1:2014 + AC:2017 (Second Edition)

Address:	Place & date of issue:
Sensoterra International B.V.	Boskoop, 07-01-2021
Omloop 36, 2771 NL Boskoop	
The Netherlands	
	Name and signature:
Phone: +31(0)30-3035555	
E-mail: info@sensoterra.com	
	Ellery Rijkaart, Operational Director

Notes and warnings

For SD15NA, SD30NA, SD60NA, SD90NA

This equipment complies with FCC's radiation exposure limits set forth for an uncontrolled environment under the following conditions: 1) This equipment should be installed and operated such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and user's/nearby person's body at all times. 2)This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: 1) Re- orient or relocate the receiving antenna. 2) Increase the separation between the equipment and receiver. 3) Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. 4) Consult the dealer or an experienced radio/TV technician for help.

For SD15EU, SD30EU, SD60EU, SD90EU

Any change or modification of this equipment not expressly authorized by Sensoterra may cause interference and void the CE authorization to operate this equipment.

SENSOTERRA

Sensoterra, world leader in wireless soil moisture sensor solutions, provides data-driven solutions for optimizing land and freshwater resources for agriculture, horticulture, landscaping and nature restoration. Empowering better decision making for land management through smart soil moisture measurements. Sensoterra was founded in 2014 and is based in Amsterdam, the Netherlands. Today there are thousands of Sensoterra sensors in the ground, globally.

For further support visit **support.sensoterra.com**

www.sensoterra.com