MeteoAG wireless agricultural sensor node

**Compatible with most existing agricultural sensors,
giving you the freedom to measure anywhere with proven agricultural sensors.**

Supports most agricultural and hydrology sensors

Solar powered, wireless data robust & impact resistant

Part of the MeteoHelix agro-weather station sets

Simple to install

Connect the sensors, turn the selector switch to your sensor type, and enjoy your data without worrying about individual configurations.

Maintenance free

With its long battery life and oversize solar pannel, you can be sure that your data will keep flowing even under a thick coating of dirt.

Solar powered and long-battery life

8+ month battery life and toughness to survive in all measurement environments including long winters and summer droughts.

Easy sensor & soil calibration

Data traceability is assured by the application of soil calibration equations, sensor calibrations, and settings on a timeline in the allMeteo® web portal which keeps track of all your actions, changes and relevant documentation.

View, access & export live data in real time

allMeteo® web portal enables easy regional view of your data including data export, API data access and real-time view. It also offers the ability to manage your fleet of sensors & weather stations.

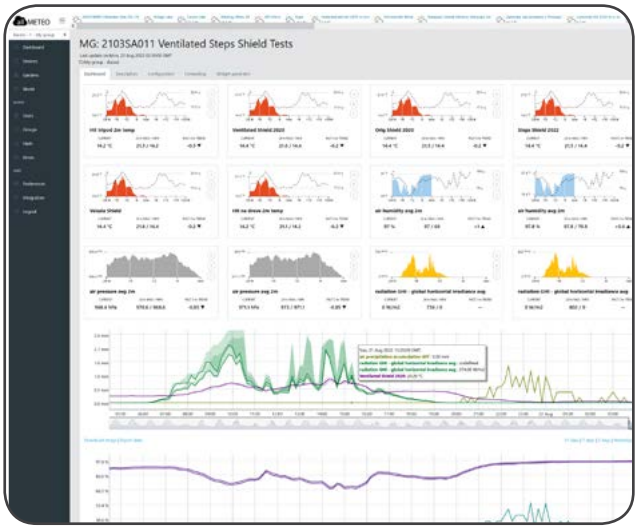
Experience has shown that only **simple-to-use** and simple-to-configure devices are practical in agriculture.

Modularity of BARANI DESIGN weather and agro sensors allows you to **install sensors where you need them** most, not limited by weather station placement.

Reuse your existing sensors and connect them to MeteoAG for ease of use and data reliability. Compatibility with your existing agricutural sensors is a key feature to retain data continuity for critical decition making.

Seven sensor inputs with up to 17 different sensor types in 3 groups give you the flexibility to measure in one location with multiple sensors and at multiple heights and ground depths.

Available in SigFox and LoRaWAN. NB-IoT coming soon.



allMeteo® portal for data display and configuration is included. MeteoSDI is plug-&-play and per request, it can interface with any other 3rd party cloud or software platform.

MeteoAG wireless agricultural multi-sensor node is designed primarily for soil moisture, soil temperature and soil water tension sensors. I supports leaf wetness sensors, snow temperature sensors, frost sensor sensors, heat flux sensors and more.

Currently supported sensors by the MeteoAG sensor node include the following sensors and types and customers may request addtional sensor options to be supported.

Sensor Type	Max number of sensors of this type	Max number of sensors of this type	Max number of sensors of this type
Soil Moisture sensors	up to 7x soil water tension: Watermark Irrometer 200SS	up to 7x soil volumetric water content (VWC): Meter 10HS	Reserved for future customer request
Temperature sensors	up to 7x temperature: ± 0.1°C thermistor (10K)		Reserved for future customer request
Leaf wetness & other sensors	up to 7x leaf wetness: Meter Phytos 31		Reserved for future customer request

ROBUST and easy to use for everyone

Electrical specifications of sensor		
Wireless communication	Available versions: Sigfox. (LoRaWAN, NB-IoT coming soon)	
Power & supply voltage	Built in solar panel with internal Li-Ion battery for 8+ months of operation without sun	
Power on/off	On/off switch located inside wireless module	
External connections	7 water tight IP67 cable glands (M12) compatible with sensor cable diameters Ø 3 - Ø 6.5 mm	
Environmental rating of sensor		
Operating temperature & humidity	-33 °C to +65 °C (Special versions from -40 °C to +65 °C are available for snow temperature sensor applications)	0 % to 100 % RH
IP – Protection rating	IP67W (DIN 40050) Watertight	
General specifications		
Dimensions	Length = 200 mm, Width = 200 mm, Height = 60 mm	
Weight (mass)	700 grams (including stainless steel mounts)	

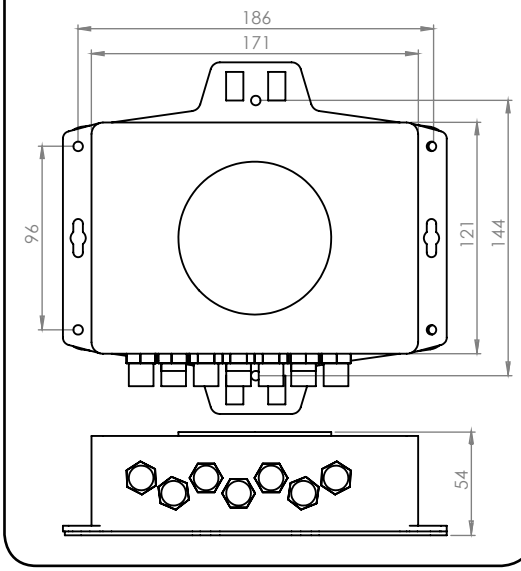
Benefits of MeteoAG Node with MeteoHelix® Weather Station

Total agro-meteorological solution takes advantage of the BARANI DESIGN agricultural sensor modularity to let you locate sensors where you need them, not limited by the location of your weather station.

Modular agricultural weather station sets may include any or multiple of the following independently mounted wireless sensors:

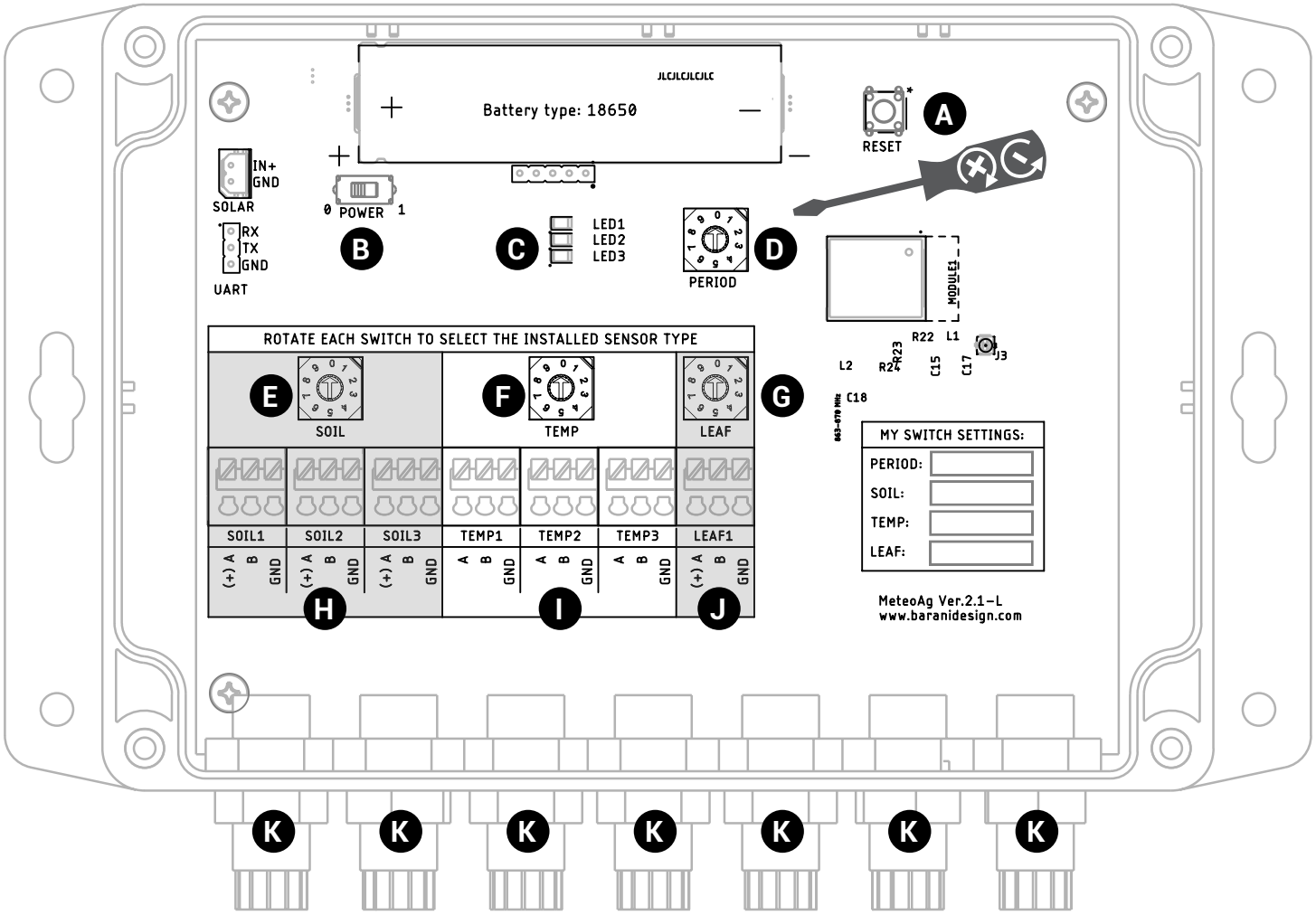
- MeteoAG sensor node with agricultural sensors
- MeteoHelix® weather station
- MeteoWind® wireless wind sensor
- SDI12-IoT sensor node with agricultural sensors
- MeteoRain® 200 rain gauge
- MeteoRain® IoT wireless rain gauge

MeteoAG IoT Node
Wireless agricultural sensor node



For SDI-12 agricultural sensors, the SDI12 IoT Node is available on special request

Reach your gold standard of measurement with BARANI DESIGN ISO:9001 quality



- **A** Reset push button
- **B** On/Off switch
- **C** Indicator lights: LED1 = XXXXXXX
- **D** Sending/measuring time interval selector:

Measure interval	Sending/Averaging/Logging interval			
	1 min	5 min	10 min	30 min
10 s	0	2	4 (default)	
1 min	1	3	5	7
10 min			6	8
30 min				9

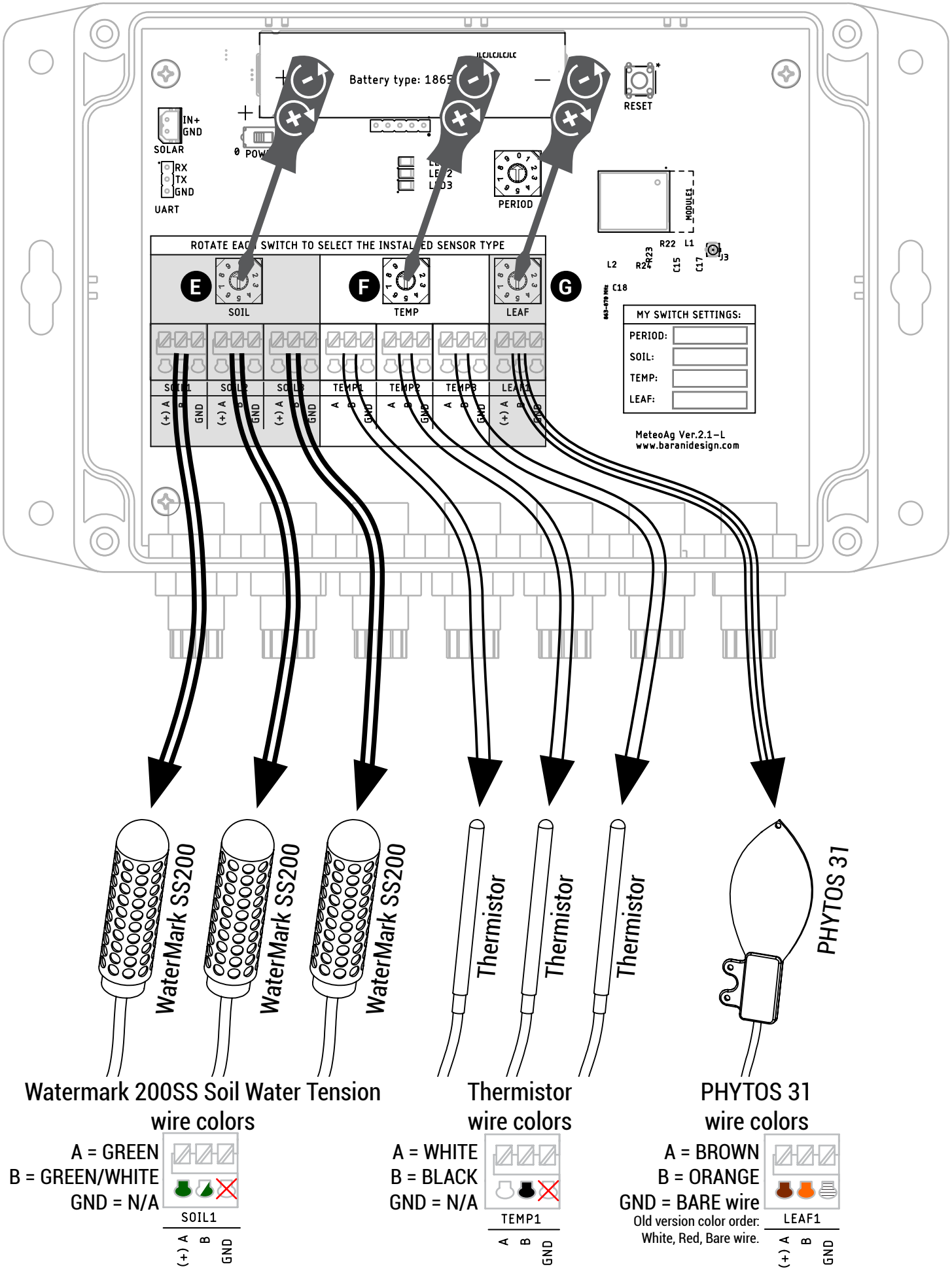
Default setting = 4. *Sigfox can only use 10 & 30 minute sending interval. 1-minute sending interval can only be used on the highest data rate with LoRaWAN.*

- **E** Soil moisture sensor group selector
- **F** Temperature sensor group selector
- **G** Leaf wetness sensor
- **H** Soil sensor group 3x wire terminals
- **I** Temperature sensor group 3x wire terminals
- **J** Leaf wetness sensor 1x wire terminal
- **K** Cable glands: Ø 3 - 6.5 mm (Ø ⅛ - ¼") cable

Configuration procedure

User can install various sensors and turning the associated rotary switch to the proper sensor type position. **All sensors in a group must be of the same type.**

Rotary Switch	Rotary switch setting	Meas. method:
E Soil moisture sensor group	0 = WaterMark SS200 (kPa)	0-3 VDC, Vcc=3V
	1 = 10HS (VWC in %)	0-3 VDC, Vcc=3V
	2 = EC-5	0-3 VDC, Vcc=3V
	3-5 = reserved for future use	
	6 = PHYTOS 31 leaf wetness	0-3 VDC, Vcc=3V
	7 = Copy setting from Temperature sensor group	
F Temperature sensor group	0 =	
	1 = 10K NTC Thermistor (°C)	0-3 VDC, Vcc=3V
	2 = 10HS (VWC in %)	0-3 VDC, Vcc=3V
	3-6 = reserved for future use	
	7 = Copy setting from Soil sensor group	
G Leaf wetness sensor group	0 = PHYTOS 31 leaf wetness	0-3 VDC, Vcc=3V
	1 = 10HS	0-3 VDC, Vcc=3V
	2 =	
	3 = 10K NTC Thermistor (°C)	0-3 VDC, Vcc=3V
	4-5 = reserved for future use	
	6 = HFP01SC soil heat flux	0-3 VDC, Vcc=3V
	7 = Copy setting from Temperature sensor group	



Watermark 200SS Soil Water Tension wire colors

A = GREEN
B = GREEN/WHITE
GND = N/A

SOIL1
(+) A | B | GND

Thermistor wire colors

A = WHITE
B = BLACK
GND = N/A

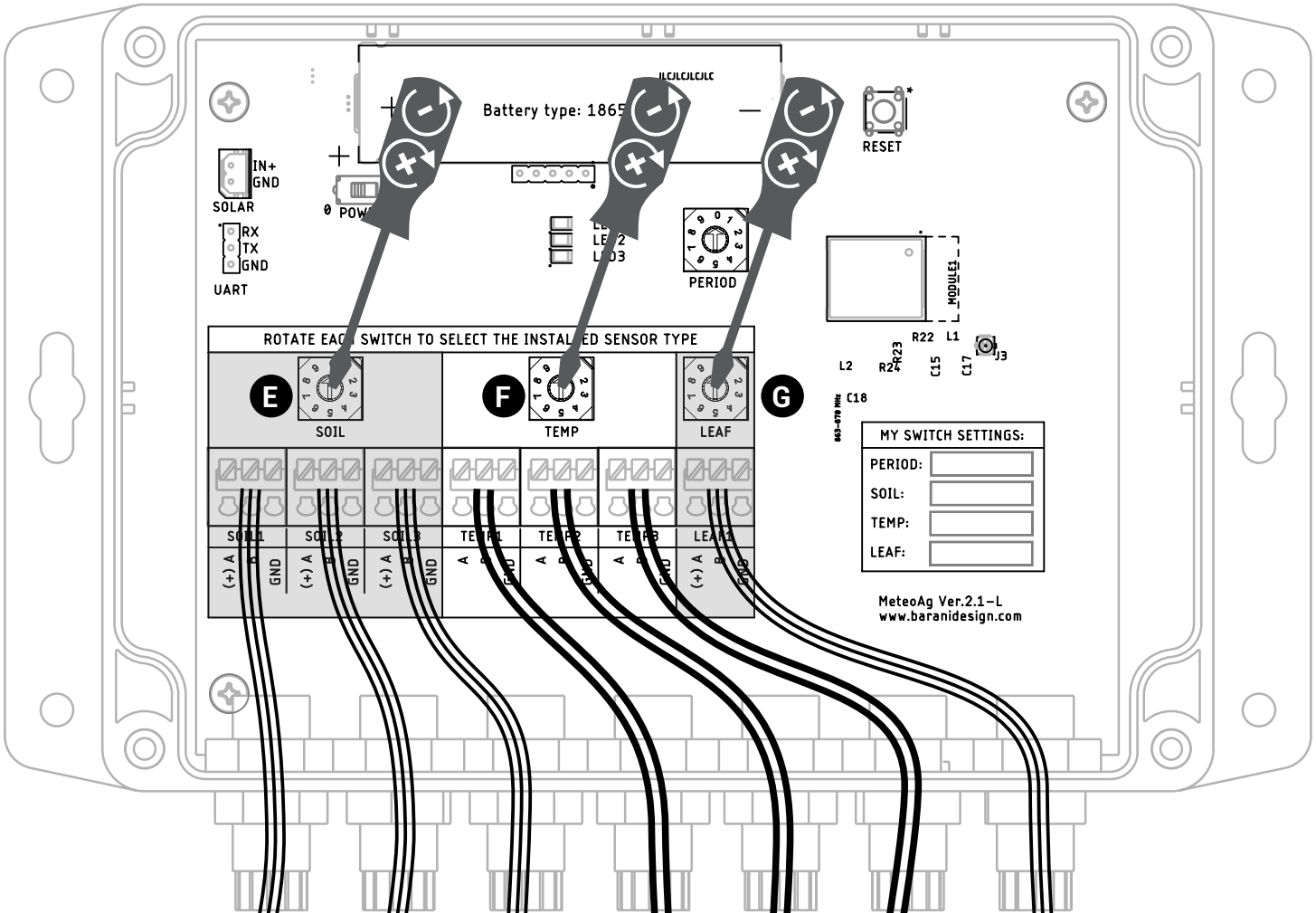
TEMP1
A | B | GND

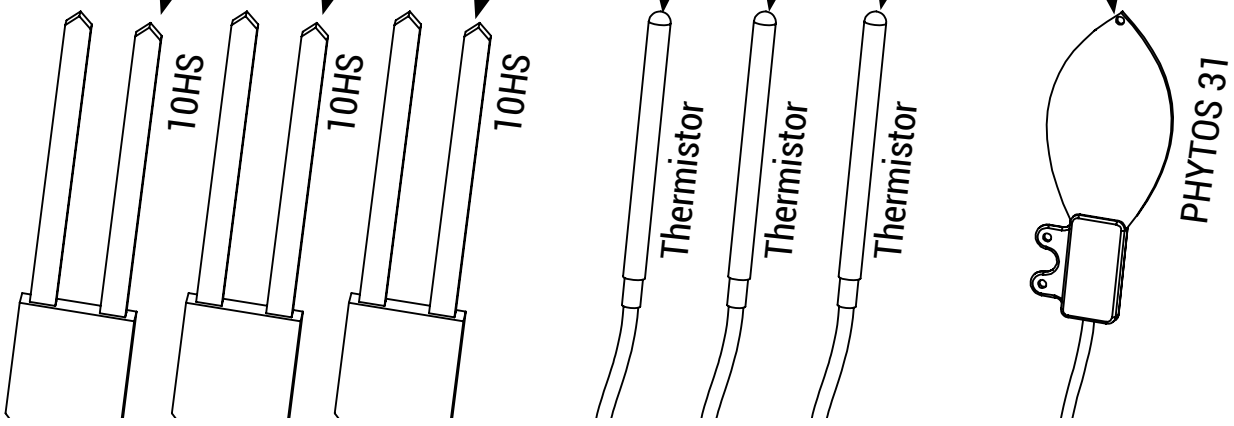
PHYTOS 31 wire colors

A = BROWN
B = ORANGE
GND = BARE wire

Old version color order:
White, Red, Bare wire.

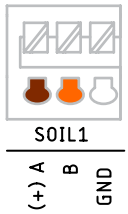
LEAF1
(+) A | B | GND





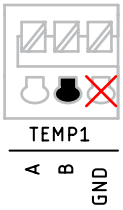
10HS Volumetric Water Content (VWC) wire colors

A = BROWN
B = ORANGE
GND = WHITE
Old version color order: White, Red, Bare.



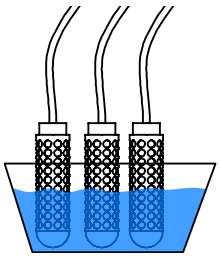
Thermistor wire colors

A = WHITE
B = BLACK
GND = N/A



PHYTOS 31 wire colors

A = BROWN
B = ORANGE
GND = BARE wire
Old version color order: White, Red, Bare wire.



Hydrate the 200SS water tension sensor before installation

Always install soaking wet soil water tension sensors and only after performing the sensor conditioning procedure which follows. Do not install dry sensors! After installation, connect them to the MeteoAG wireless IoT sensor node.

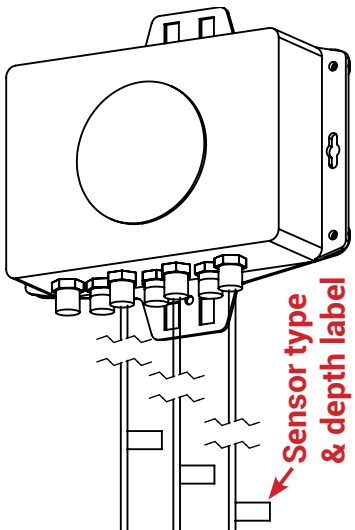
Soil water tension sensors are constructed of an open-cell porous substrate (similar to an open-cell foam, but rigid) whose pores are initially filled with air. For the sensor to function correctly and accurately, the air must be replaced by water, not to offset the soil water tension (pressure) readings. Replacing all of the air molecules with water takes some time inside the dense inner labyrinth of thousands of pores. The following hydration procedure will enable the Watermark sensors to show accurate soil water tension readings within one or two irrigation cycles, depending on the soil's wetness.

Soil water tension sensors need some time to reach an equilibrium with the surrounding soil moisture following an installation. This time can be minimized using the following procedure of hydrating the sensors over 2 days in multiple short cycles.

Sensor Hydration Before Installation (RECOMMENDED)

1. Wet the sensor the 1st time by **submerging less than halfway**, as show in the above illustration, for 30 minutes in the morning.
   - Fully submerging the sensor will trap air inside it and will require drying the sensor completely and restarting this procedure.
   - Submerging it only halfway lets air escape out of the pores above the water. It allows the capillary action to pull water into the inner pores. It is the fastest way to get the sensor prepared for installation.
2. Let it dry until the evening.
3. Wet the sensor a 2nd time by submerging less than halfway for 30 minutes that same evening.
4. Let it dry overnight.
5. Wet the sensor a 3rd time by submerging less than halfway for 30 minutes the next morning and let dry until the evening.
6. Finally, fully submerge the sensor over the 2nd night and install soaking wet in the 3rd morning.

Full sensor accuracy will be reached after 2 or more irrigation cycles, depending on the soil's wetness.

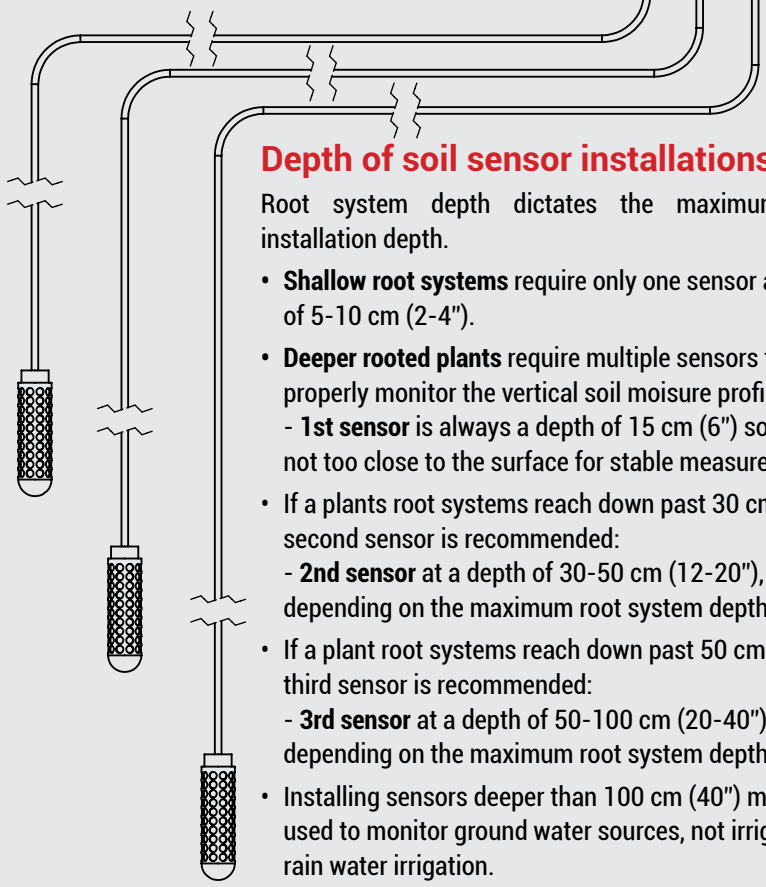


Location of soil moisture and soil water tension sensor installations

Root structure, depth profile and irrigation type and location are the main factors affecting where and how deep to install of soil moisture and soil water tension sensors.

Sensor location

- Sensors should be located within the wetted area of an irrigation system and within the plant root area.
- **Drip line:** Locate sensors about 15 cm (6") away from the dripper for response to water balance of the same day and 30 cm (12") away for response to water balance from roughly the previous week.
- **Micro-sprinkler**: Locate sensors about 2/3 distance away from the sprinkler head within within the wetted area.
- In the **North hemisphere**, install the sensors on the South-West (SW) side of the plant where the sun and heat of the day are more likely to keep soil temperatures higher and soilr drier.
- In the **South hemisphere**, for the same reasons, install sensors on the North-West (NW) side.

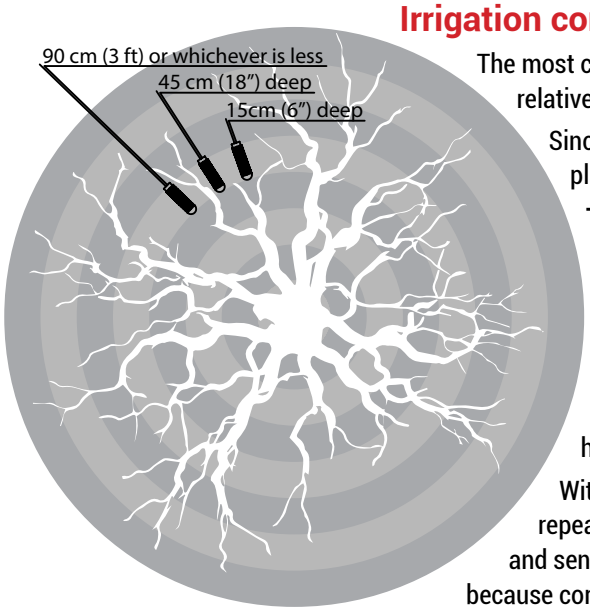


Depth of soil sensor installations

Root system depth dictates the maximum sensor installation depth.

- **Shallow root systems** require only one sensor at a depth of 5-10 cm (2-4").
- **Deeper rooted plants** require multiple sensors to properly monitor the vertical soil moisure profile:
  - **1st sensor** is always a depth of 15 cm (6") so that it is not too close to the surface for stable measurements.
- If a plants root systems reach down past 30 cm (12") a second sensor is recommended:
  - **2nd sensor** at a depth of 30-50 cm (12-20"), depending on the maximum root system depth
- If a plant root systems reach down past 50 cm (20") a third sensor is recommended:
  - **3rd sensor** at a depth of 50-100 cm (20-40"), depending on the maximum root system depth.
- Installing sensors deeper than 100 cm (40") may be used to monitor ground water sources, not irrigation and rain water irrigation.

Irrigation control sensor installation guide



The most critical factor governing soil moisture sensor accuracy is its location and depth relative to a plant's active root area and irrigation system location.

Since plant root system shape is governed by plant type, plant spacing, soil type, and planting pattern, a single rule for soil moisture sensor placement does not exist.

The maximum depth of a plant's active root zone will govern soil moisture sensor vertical spacing.

- We recommend placing soil moisture sensors at least 15 cm (6") below the surface for minimum measurement consistency.
- Active root zone depth governs placement of the deepest sensor.
- If the active root zone extends below 60 cm, we recommend a third sensor halfway between the shallow sensor and the deepest sensor.

With sensor depth, sensor response to surface irrigation slows, and conversely, repeatability of measurement improves. Without good repeatability of measurement and sensor response time, an automated irrigation system cannot function properly because correct irrigation decisions cannot be made based inconsistent or old data.

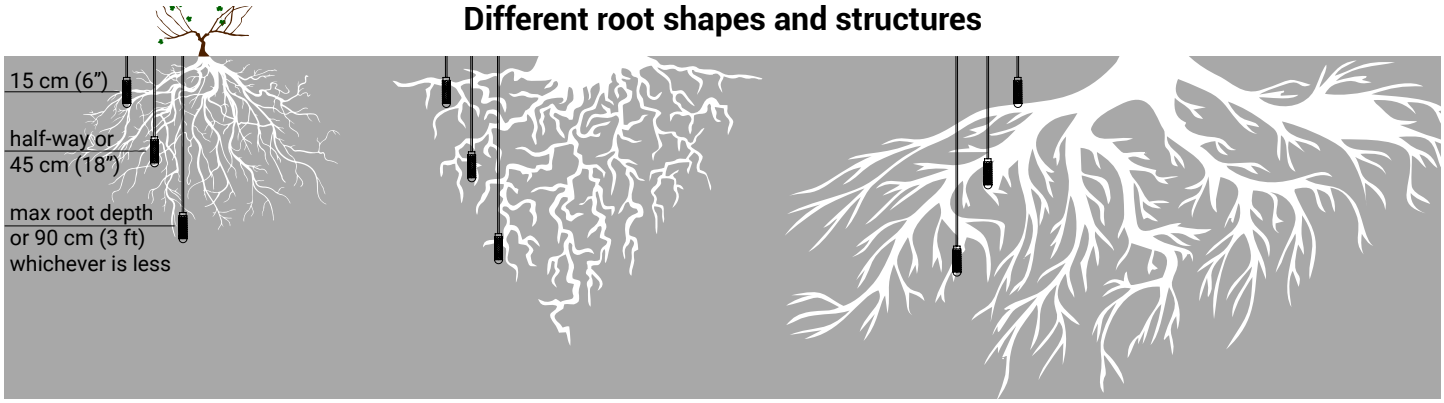
How sensor installation affects sensor accuracy and measurement repeatability

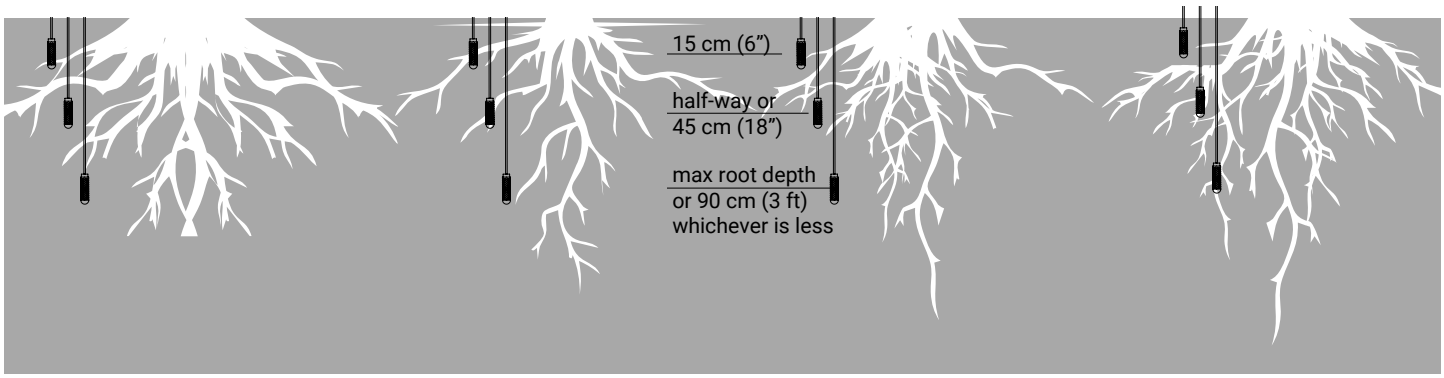
Sensor installation without disrupting the surrounding soil structure is vital to each moisture sensor's accuracy and for good repeatability of measurement. Because air gaps and disruptions in soil structure around the sensor alter soil water retention capacity and drainage, they will negatively affect measurement accuracy and repeatability. Measurements from improperly installed sensors will not reflect real soil moisture, will be of little value, and cannot be relied on for irrigation decision making.

How root system shape affects sensor placement

Always install soil sensors to copy the shape of the active zone of the root system structure. For most root systems, the deepest soil moisture sensor should be placed closest to the plant center. Idealy, sensors at different depths should be placed the same radial distance away from plant center but most importantly with respect to irrigation system type and location.

Different root shapes and structures

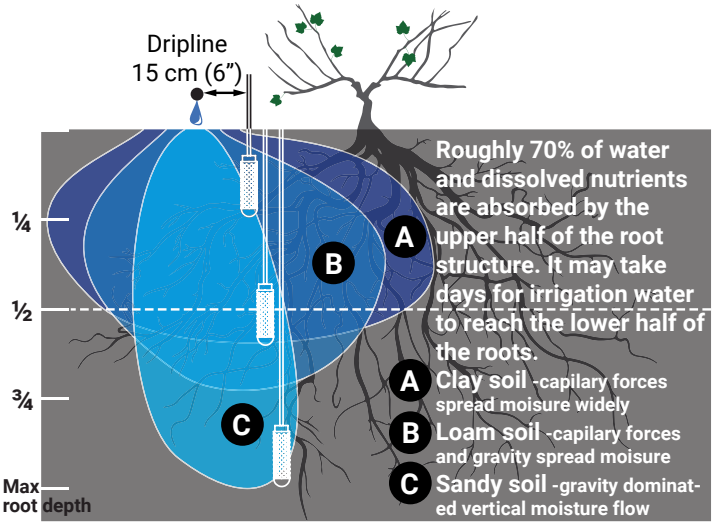


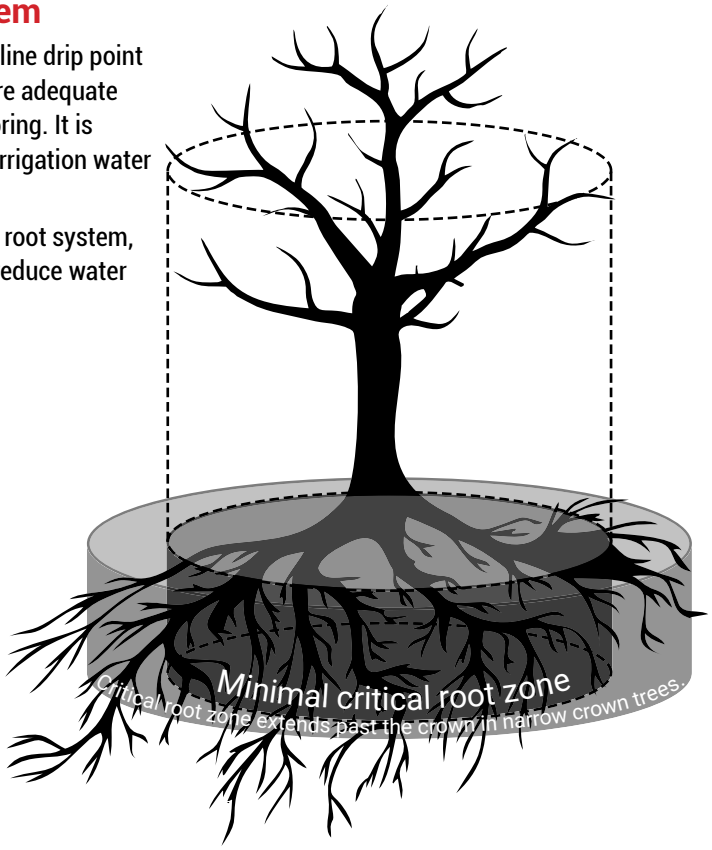


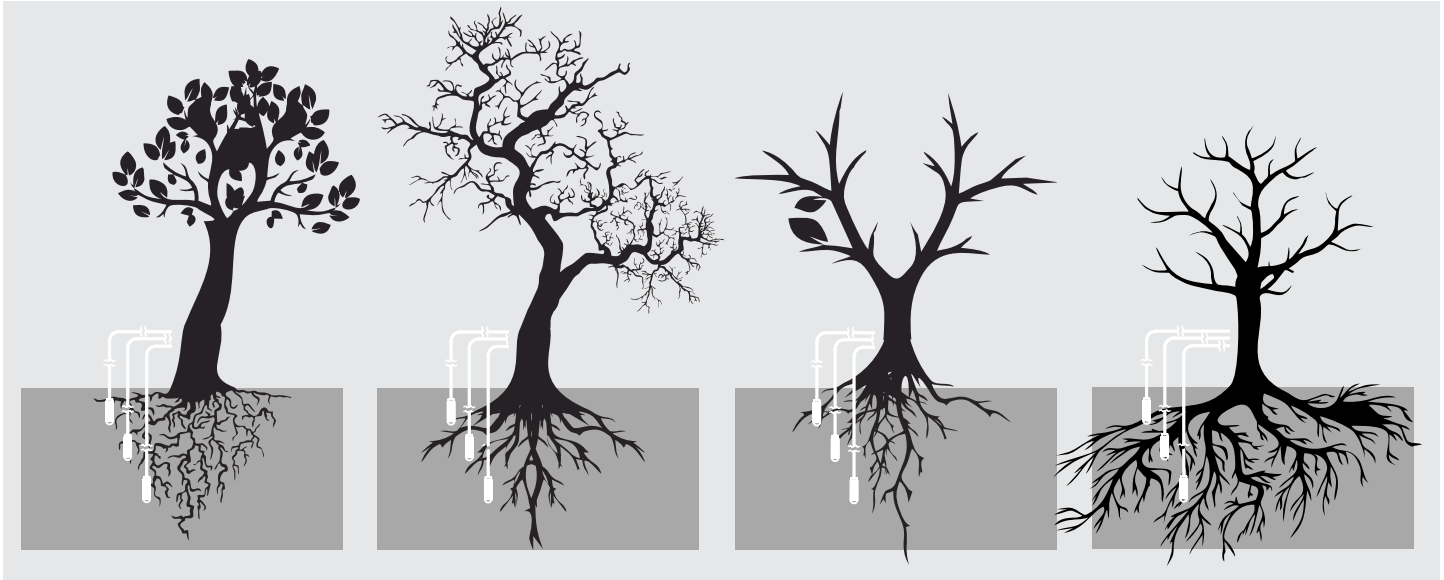
Plant water uptake distribution in the root system

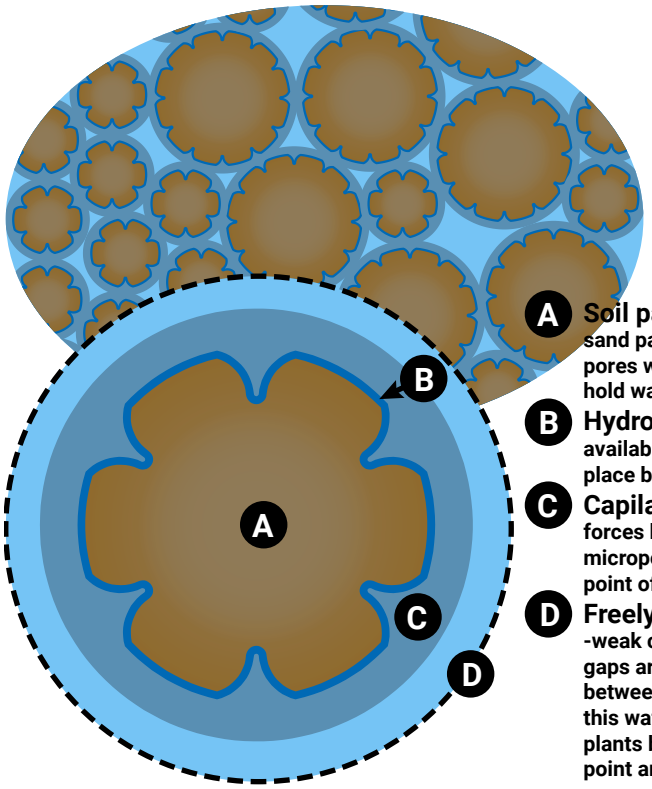
Placement of soil moisture sensors roughly 15 cm (6") away from dripline drip point and at depths discussed on the previous page will in most cases ensure adequate accuracy for irrigation control and accurate plant soil moisture monitoring. It is important to uderstand soil type and composition to understand how irrigation water will be distributed away from the drip point.

Since roughly 70% of irrigation water is absorbed in the top half of the root system, cover crops may be used to protects this top soil from erosion and to reduce water drainage on slopes with clay dominated soils.







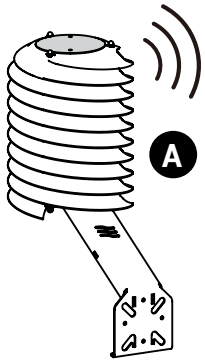


A **Soil particle** -clay, silt or sand particles have surface pores where capilary forces hold water

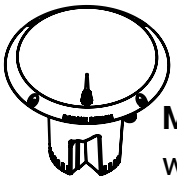
B **Hydroscopic water** -not available to plants and held in place by molecular forces

C **Capilary water** -capilary forces hold water tightly in micropores up to the wilting point of plants.

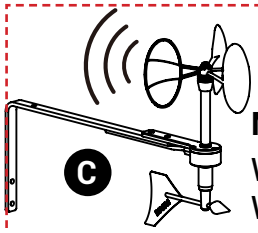
D **Freely available water** -weak capilary forces in large gaps around particles and between soil agregates make this water readily accessable to plants between field saturation point and field capacity.



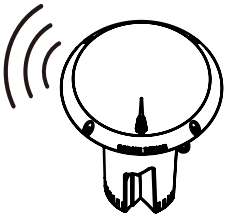
A **MeteoHelix**
Air temperature (2m)
Air humidity
Air pressure
Air Dew point
Air Frost point
Solar irradiation



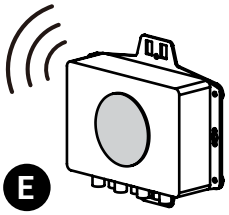
B **MeteoRain 200**
wired
Rain gauge



C **MeteoWind IoT**
Wind speed
Wind direction



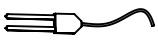
D **MeteoRain IoT**
wireless
Rain gauge



E **MeteoAG Sensor Node**
has 7-sensor inputs.
See page 3 for possible sensor combinations.

F Soil temperature

G Soil moisture (%)



H Soil water tension

I Leaf wetness

J Air temperature

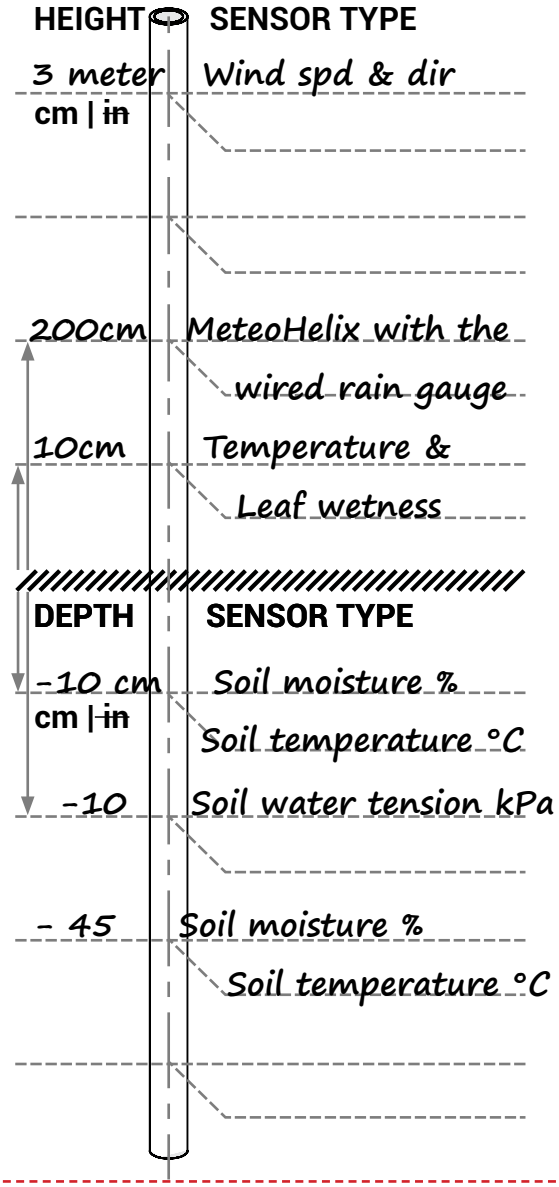
K Soil heat flux

EXAMPLE SENSOR LAYOUT DIAGRAM
Use the diagram on the next page to layout sensors for each installation

Name: *Peach orchard, location A,*

GPS: *45.15684* lat., *0.56465* long.

Elevation above sea level: *71* m ~~| ft.~~



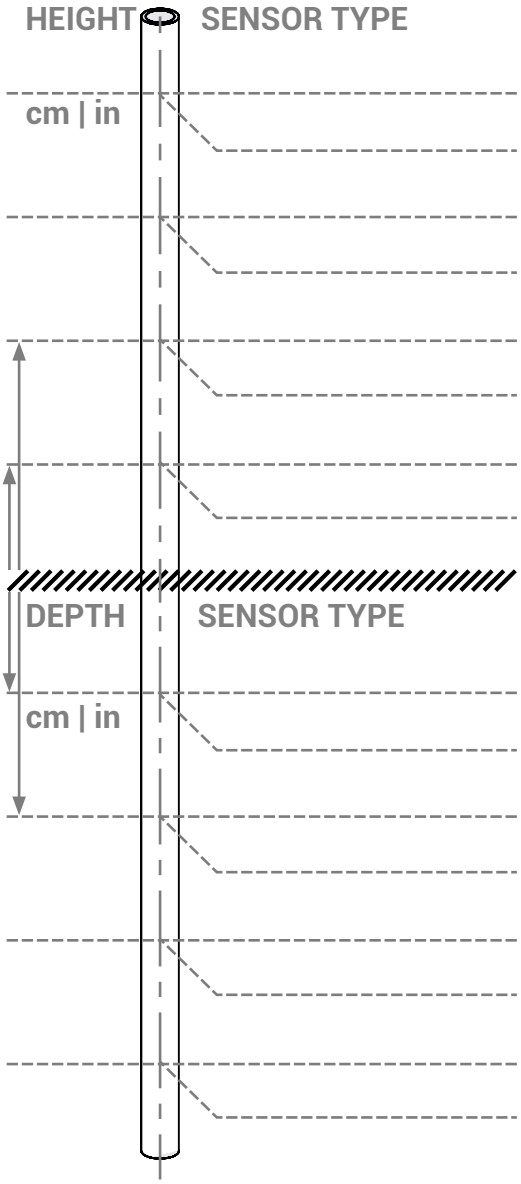
Customer name: **Tax / VAT ID:**

Billing address:

Name:

GPS:_____lat.,_____long.

Elevation above sea level:_____m | ft.

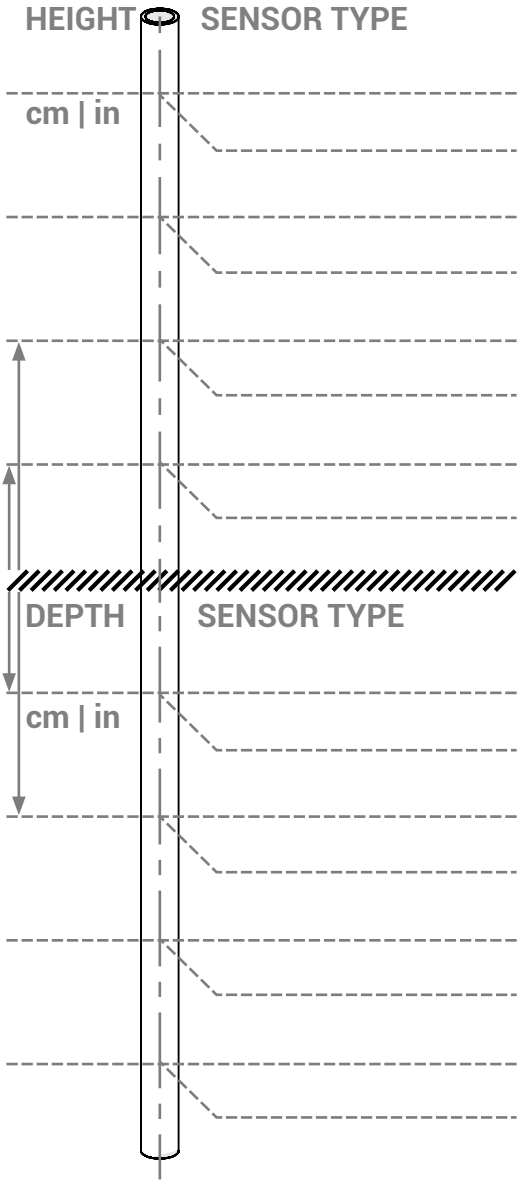


Notes & description (crop type):

Name:

GPS:_____lat.,_____long.

Elevation above sea level:_____m | ft.



Notes & description (crop type):

