METOS®

µMETOS Blue

User Manual

A Product of

Pessl Instruments GmbH
Werksweg 107
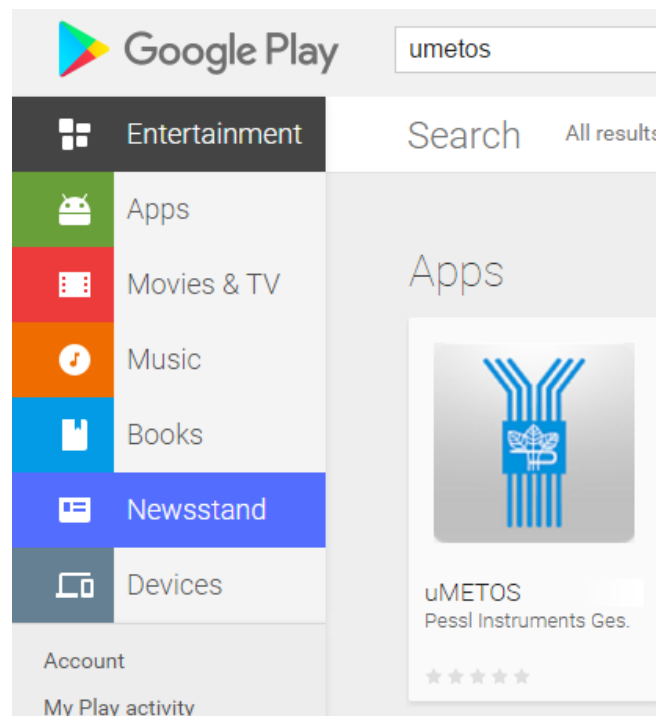8160 Weiz
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Welcome among µMETOS Blue users!

Thank you for choosing a µMETOS Blue for monitoring soil moisture or environmental data. The µMETOS Blue has been design to monitor data with limited sensor sets. µMETOS Blue measures, logs and sends the data to the Internet via your smart device. µMETOS Blue systems will be mainly used for:

- Soil Moisture Monitoring with Decagon ECH_2O sensors, watermark sensors.
- Irrigation monitoring with flowmeter and presostat
- Diseases forecast with the leaf wetness sensor, rain, air temperature and relative humidity
- MicroClimatic monitoring

Among the particular features on the µMETOS Blue we outline the following:

- Memory size 2MB for 2 to 5 years of weather data depending in amount of sensors and logging interval
- Uses a smart phone to upload data into FieldClimate.com platform
- Primary battery for 5 years of un interrupt logging
- Selectable logging interval

To use the µMETOS Blue you need a Smart Device with Android operating system, Bluetooth and Internet data connectivity. Download the APP at Google Play Store.

Picture 1: µMETOS Blue app on Google Play Store

A Product of

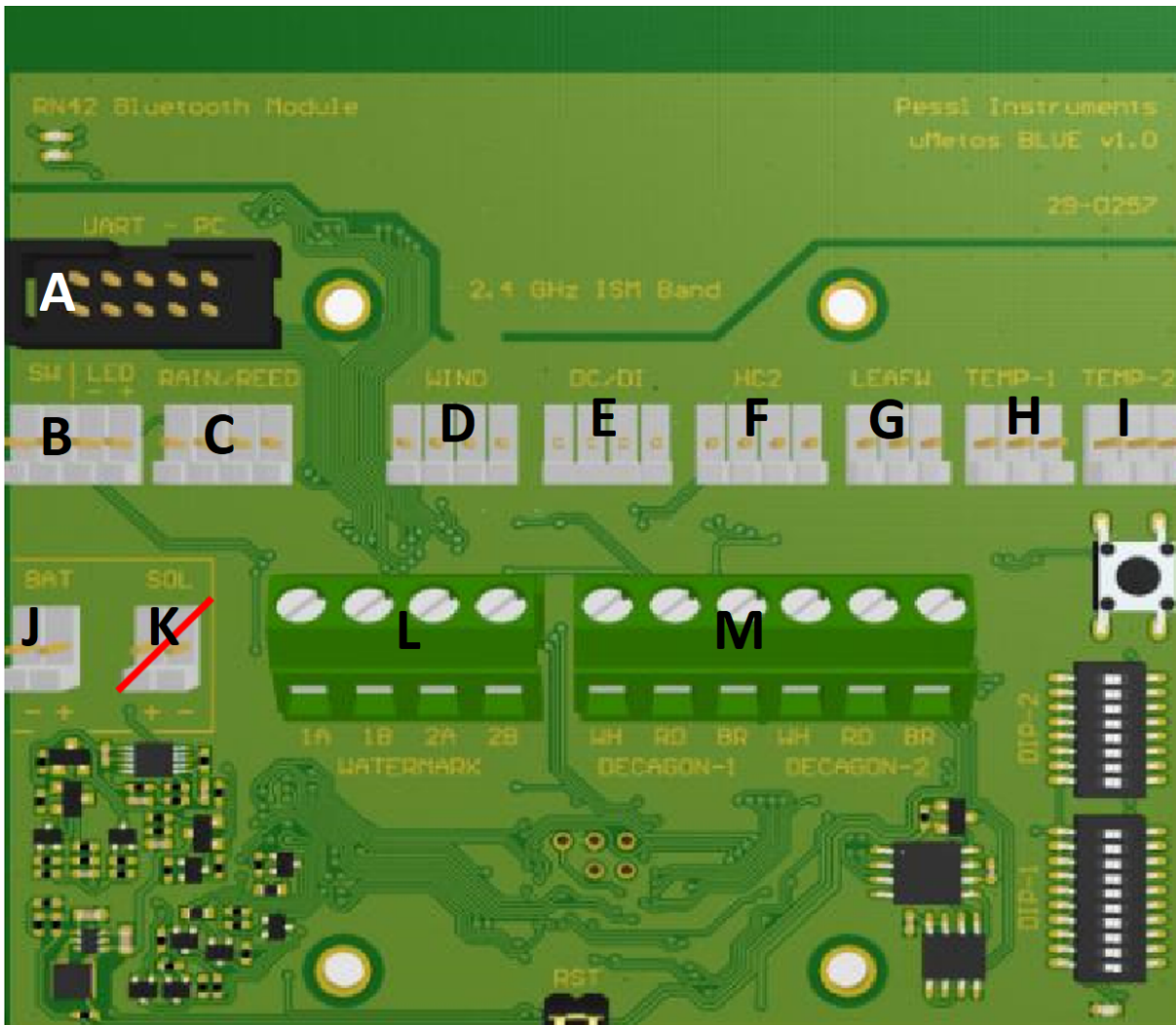Pessl Instruments GmbH
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Table of Content

1   Your µMETOS Blue

1.1   PCB layout

Picture 2: µMETOS Blue motherboard

A. Serial port connection socket to PC (via terminal. Baudrate: 38400 Data: 8 bit Parity: None Stop bit: 1 bit)
B. External comunication button with blue LED
C. Rain or flow counter (according to DIP- 2 configuratuin see below)
D. Wind Speed sensor
E. Duty Clicle sensor or Digital input (for Global radiation, wind direction, water level…)
F. Hygroclip sensor for air temerature and relative humidity
G. Leaf wetness sensor or presostat (according to DIP- 2 configuratuion see picture bélow)
H. Extra temperature sensor (air, wet or dry bulb. leaf, water…)
I. Extra temperature sensor (air, wet or dry bulb. leaf, water…)
J. Lithium primary battery for 5 years of power suply
K. Slolar panel connectot (for future use)
L. Conector for 2 watermark sensors
M. Conector for 2 decagon sensors (sensor selected according DIP-1 configuratuion see picture below)

DIP Switch 2

8	- C	} Resolution of Counter Sensor
7	- B	
6	- A	
5	- R	→ Type of Counting
4	- S	→ Type of Counter Sensor
3	- Not used!	
2	- Not used!	
1	- Not used!	

DIP Switch 1

10	- Not used!	
9	- F	} Soil Media
8	- E	
7	- D	
6	- C	} Decagon Sensor 2
5	- B	
4	- A	
3	- C	} Decagon Sensor 1
2	- B	
1	- A	
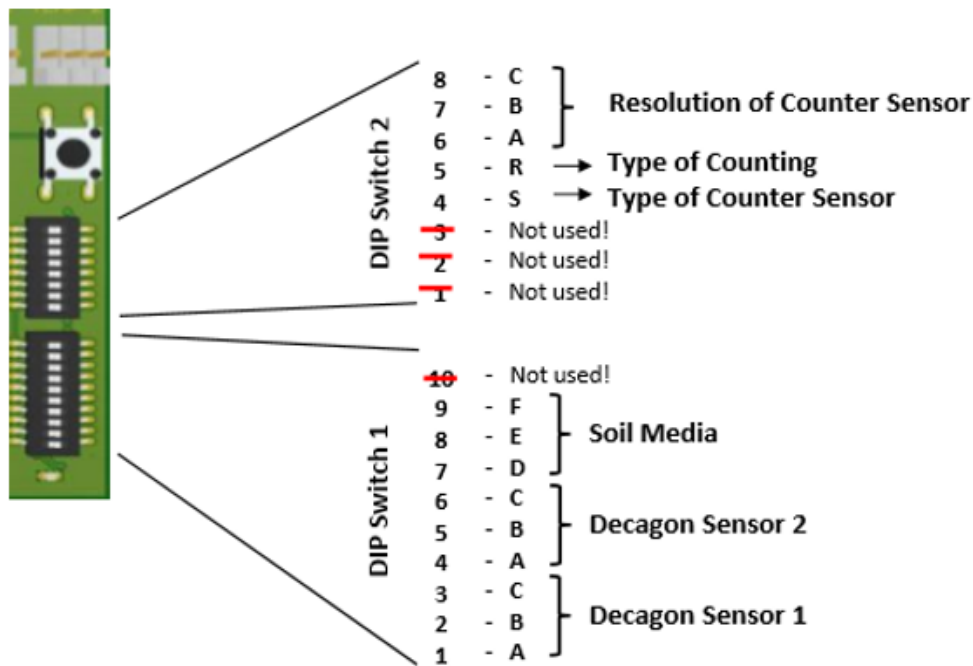
DIP SWITCH 1 - SOIL MEDIA OPTIONS FOR VWC CALIBRATION OF DECAGON SENSORS

D	E	F	Soil media	EC-5	10HS	LWS	MPS-1	MPS-2	MPS-6	5TE	5TM	GS3	GS1
0	0	0	Mineral soil*	X	X					X	X	X	X
0	0	1	Potting soil	X	N/A					X	X	X	X
0	1	0	Rockwool	X	N/A	Not used!	Not used!	Not used!	Not used!	X	X	N/A	N/A
0	1	1	Perlite	X	N/A					X	X	X	X
1	0	0	Peat	N/A	N/A					N/A	N/A	X	X
others			"reserved"	N/A	N/A					N/A	N/A	N/A	N/A

X - Available calibration.
N/A - Not available!
* - Default **mineral soil** calibration in case of EC-5, 10HS, 5TE, 5TM, GS3 or GS1 sensor, if selected "reserved" or N/A option.

DIP SWITCH 1 - DECAGON SENSOR OPTIONS

A	B	C	Decagon sensor
0	0	0	EC-5
0	0	1	10HS
0	1	0	LWS
0	1	1	MPS-1
1	0	0	MPS-2 / MPS-6 / 5TE / 5TM / GS3
1	0	1	GS1
1	1	0	"reserved"
1	1	1	"reserved"

DIP SWITCH 2 - RESOLUTION OF COUNTER SENSOR

A	B	C	Rain Gauge	/	Water Meter
0	0	0	0.1 mm		0.1 L
0	0	1	0.2 mm*		1 L*
0	1	0	0.5 mm		10 L
0	1	1	"reserved"		100 L
1	0	0	"reserved"		1000 L
1	0	1	"reserved"		"reserved"
1	1	0	"reserved"		"reserved"
1	1	1	"reserved"		"reserved"

* - Default resolution if selected "reserved" option .

Picture 3: DIP Switch details

DIP SWITCH 2 - TYPE OF COUNTING

R	Counter
0	Resettable counter
1	Non-resettable counter

DIP SWITCH 2 - TYPE OF COUNTER SENSOR

| S	Counter Sensor (RAIN/REED)
0	Rain Gauge (Precipitation)
1	Water Meter

1.1.1   Power supply

Primary Lithium battery

- Nominal Capacity :20AH
- Size :SIZE D
- Voltage :3.6V
- Weight :110

1.2   µMETOS Blue for soil moisture monitoring

If your µMETOS Blue was intended for soil moisture monitoring it comes with a set of soil moisture sensors connected to the main unit. The sensors connected to it can be EC 5, HS10, 5TE from Decagon Limited and/or Watermark sensors or vacuum tensiometers.

This sensors can be connected to the µMETOS Blue itself or - of it is needed because of the installation or because of the number of sensors – they can be connected to an extension box on a serial bus connection.
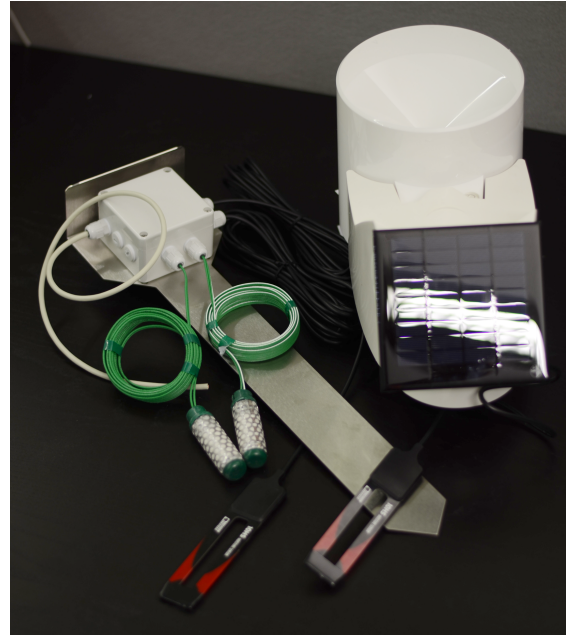
Picture 4: Logger with soil moisture sensors

1.3   µMETOS Blue for rain monitoring

If your µMETOS Blue is intended for rain monitoring it will have a rain gauge connected to its main body.

Picture 5: Logger with rain gauge

2 Start-up the µMETOS Blue

To start up the µMETOS Blue you will need an Android based smart phone with:

- Bluetooth
- Location
- Data access

The µMETOS Blue housing is closed with 6 M3 screws. To open them, you will need an Allen key of 2.5 mm. This is part of the delivery. For security issues in shipping the battery is unplugged so you will need to open it and connect the battery.

- Install https://play.google.com/store/search?q=umetos on your smart phone (see Picture 1)
- Open the case of your µMETOS Blue by releasing the 6 screws
- Plug the battery in it connector (see figure 2)
- Allow (if is not allowed the location service in your smart phone)
- Run your uMETOS APP on your smart device
- Press the connect button on the base of your µMETOS Blue

Note: the APP should launch the Bluetooth connectivity but in some cases the device may block this option. Please check that Bluetooth connectivity is active.

Click on the left upper angle (see figure below A)
Select Add/Manage (see figure below B)
Peering process will start: when requested, introduce peer default code: 1234
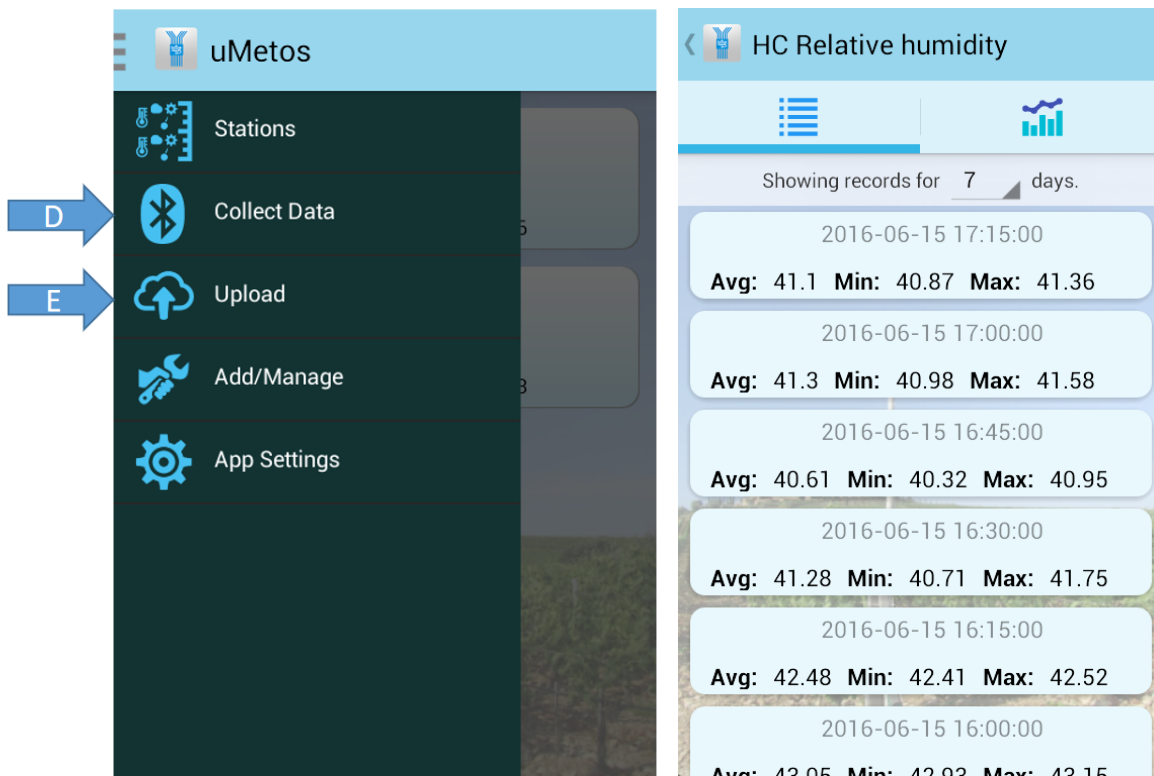Launch measurement by clicking on the wrench icon (C)
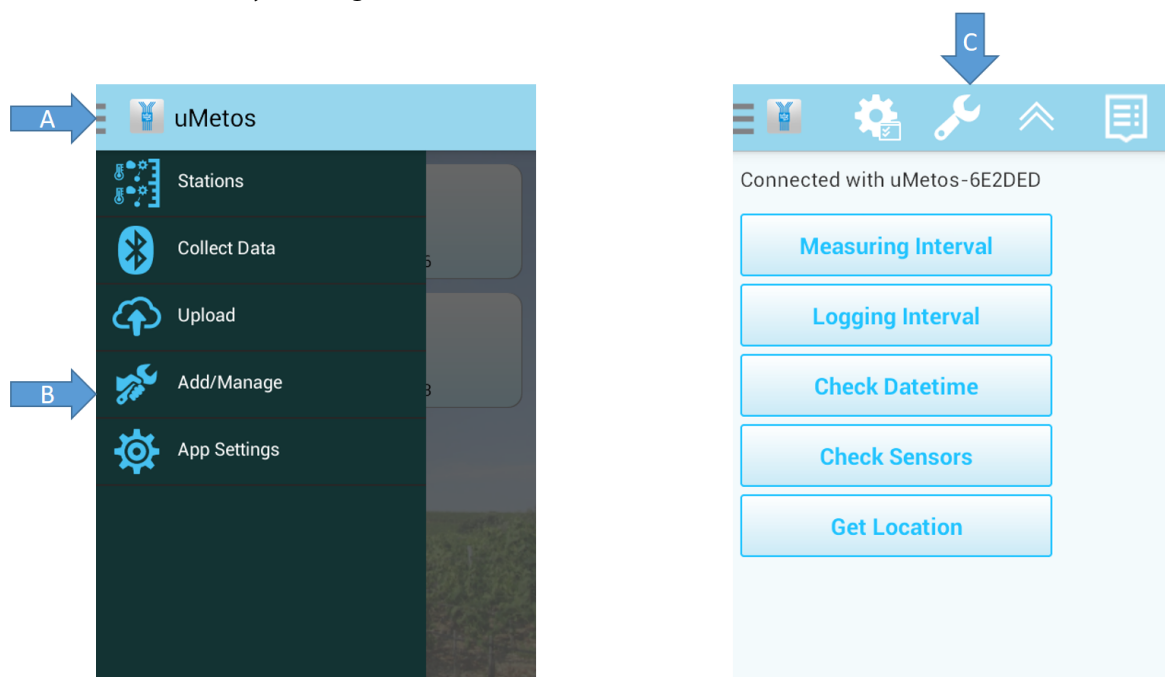
3 Collecting Data and Uploading it to FieldClimate

Next time you visit the station you can:

- Collect the data (D)
- Upload it to FieldClimate (E)
- Also you can see the data in the screen of your portable

3.1   Use your µMETOS Blue

FieldClimate.Com is the web service you are intended to use your µMETOS Blue with. It allows you to see the data in graphs or tables. It provides interfaces for automated downloads and it provides a powerful decision support system for plant protection and irrigation management.

3.2   Register yourself as a user on FieldClimate.Com

To use the services on FieldClimate.Com you have to register as a user. Click the link in the circle (picture on the left).

The registration screen, which comes up now, asks you for a username and a password. You will also have to provide email address, postal address and some information about the company.
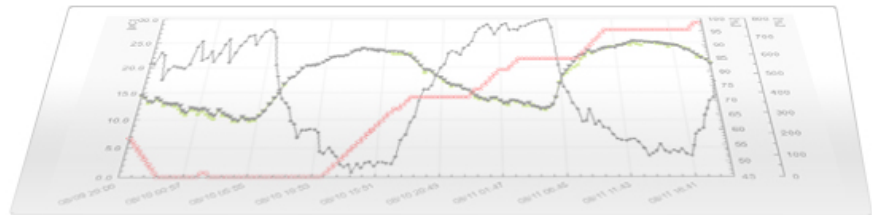Please note you will have to enter the real email address. Account confirmation email with activation link will be sent to your inbox to finish registration of your new account.

Picture 6: FieldClimate Login Mask

3.3   Add the µMETOS Blue to your account

If you received the activation email and you activated the account, you will be able to enter FieldClimate.Com. Now the system welcomes you with the message that there is no µMETOS Blue connected to this new account. To change this, press the "Add New Station" link.
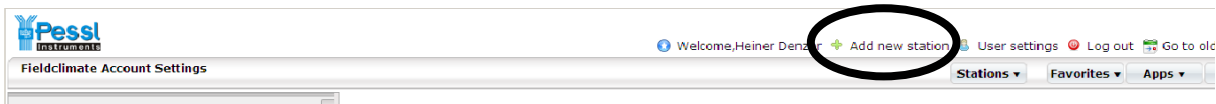
It will ask you for a serial number and a key. Now the little silver colored sticker which came with your µMETOS Blue has to be used. This sticker contains two keys. Key 1 gives the power to change all the settings on the µMETOS Blue whereas key 2 is only valid to access the data of the

Picture 7: Adding new station to FieldClimate

system. To be able to set up the µMETOS Blue please enter the key 1 here. If you entered the correct key your station list will be enlarged by this µMETOS Blue and it can be selected.

Picture 8: List of added stations

3.4   The µMETOS Menu

When you selected a µMETOS Blue and the site has reloaded, the menu visible on the left side of the screen is valid for the selected µMETOS Blue. The menu starts with the given name and serial number of the station. Pessl Instruments tried to structure the menu according to the frequency you will need the different entries. Therefore the menu starts with the links used for data presentation. It can be used to open graphs and tables of:

- **All sensors**
- **Disease** related **Climate** sensors
- Plant **Growing** related **Climate** sensors
- Sensors for **Frost and temperature monitoring**
- Sensors for **Soil and precipitation monitoring**

The menu entry "**Station Health**"shows battery voltage and solar panel voltage to inform about the charging situation. "**Settings**" are used to control the behaviour of the µMETOS in the field and on the Internet. "**Tools**" contains a set of helpful functions for data presentation and data use.

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3.5   Settings for your µMETOS Blue

The settings menu starts with the link "**Station info**" which displays information about the name, type and software of the µMETOS Blue. It shows you the GPS position that has been set for this station. It lists the duration of the data recorded on FieldClimate.Com for this station. From this screen you will be able to look for the statistics of the Internet connections done by the µMETOS Blue and some events logged by the device.

The link "**Names**" leads you to a screen where you can enter a given name for the station and for all sensors.
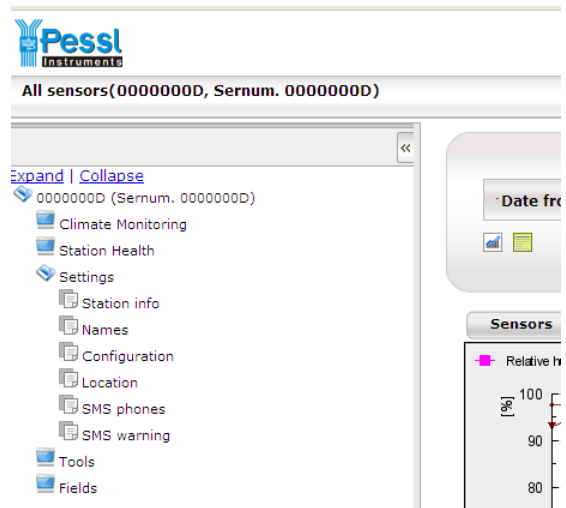
Picture 9: Settings menu in FieldClimate

3.6   Giving names to the µMETOS

Every µMETOS Blue is defined with a serial number. For most users it is more convenient to name it after the site it is installed. Tehrefore the names screen offers the possibility to enter a given name.
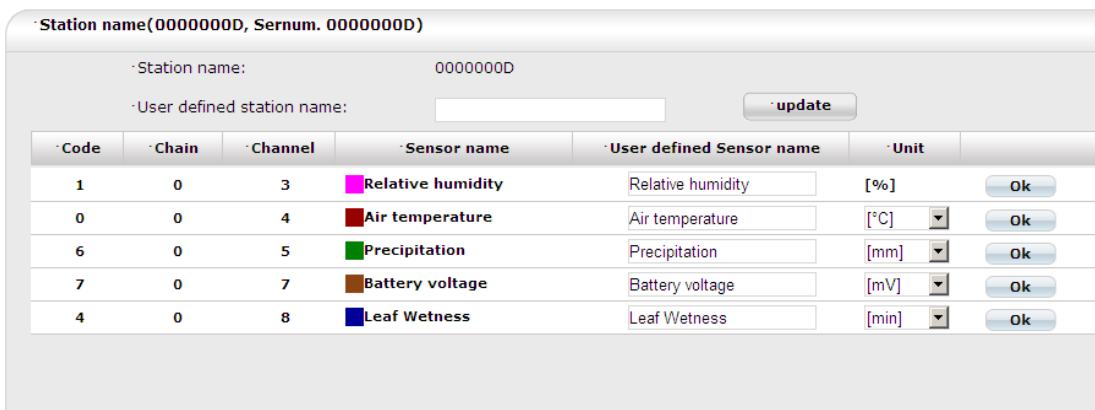
Picture 10: Renaming stations

When you enter the name, the "**Update**" button has to be pressed to save this entry on the web server. In the sensors name menu the given name for the sensor can be entered and the colour for the sensor can be changed by clicking on the colour field. These settings have to be sent to the web server by pressing the "**OK**" button in the specific line.

The logging interval is set to 60 minutes by default. Shortening the logging interval will increase the power consumption. It can be set to multiples of 5 minutes, between 10 and 120 minutes. The time zone has to be set. The settings are send to the web server by pressing the "**Submit**" button.

3.7   Defining the µMETOS Location

The App on the smart device will associate the location to the µMETOSBlue automatically (from GPS, GSM tower proximity or Wi-Fi) once the location service is enabled.

4 Installing the µMETOS Blue

The µMETOS Blue is one plastic part that contains all the electronics, the battery and the antenna. If it is equipped with a rain gauge, it is just a little longer than without. The heaviest part is the battery which is why the clamp for the pole sits below it.

4.1 Mounting the µMETOS Blue on a pole

At the bottom of the unit there is a plastic ring with a metal clamp on. This fits on a 33 mm pole. Please hammer a pole of 1.2 to 2m straight into the ground and set the µMETOS Blue on it. Fix the screw on the clamp with a 10 mm spanner.

4.2 Soil Temperature

The soil temperature sensor should be buried in the soil. How deep it should be buried depends on the goal you want to achieve with the sensor. To have an impression of root growth and nitrogen mineralization in vines or apples in early spring it is best to bury it between 10 and 20 cm. If you want to assess the emergence possibilities of seeds it depends on the seeding depth of the seed. Using it in corn (maize) would mean to bury it at 5cm and using it for sugar beets would mean to bury it at 2 or 3 cm only.

5 Installing the soil moisture sensors

µMETOS Blue is designed to monitor soil moisture at the crop and to present this data on FieldClimate.Com. µMETOS might be used to monitor only one site or it can be used to monitor several sites in a short distance. These sites will be connected with cables.

µMETOS Blue supports different ways of soil moisture measurement. All these different sensors will need different electronics. For this purpose it will always consist of the main PCB (responsible for logging) and in minimum one second PCB (responsible for sensor evaluation). If it is made to monitor one spot this second and only sensor evaluation PCB will be in the same box than the main PCB. If it is used to monitor several sites with a cable connection, other sites will have their own sensor evaluation PCBs in own boxes.

All the PCBs for sensor evaluation do have a line going towards the µMETOS Blue and a line going towards the next PCB for sensor evaluation. Several of this sensor evaluation PCBs can be linked together in a chain. Nevertheless might it be needed to create a network where the sensing sites are going in two or 3 directions away from the µMETOS Blue. In this case the µMETOS Blue supports up to 3 sensor chains. For sensor chain 2 and 3 an extension PVB is needed.

5.1 Watermark Sensors

Watermark sensors measure water tension. These sensors measuring range is between 100 and 2000 mBar (10 to 250 kPa or cB). This sensor fits many horticultural crops, berries, stone fruits, vines and potatoes. Watermark sensors are easy to use and frost-proof.

Basically it is a gypsum block. The gypsum is embedded in a matrix material and gives a defined response in resistance on different water tension levels. We can measure the water tension on 3 to 5 cBar accuracy.

It showed that it works faster if it is wetted for 24 hours before installation. If you install it in the ground you will need a hole with the correct depth. Lay it horizontally on the ground and let the cable go

horizontally first to before you take it up to the top. This avoids water following the cable in the ground, thus reaching and wetting the sensor.

The watermark PCB can be equipped with an own soil temperature sensor. This sensor is used to do the temperature compensation of the water tension measurement. It allows you to to measure the soil temperature in specific blocks where you measure water tension. The irrigation might influence the soil temperature what can be important in asparagus for example.

5.2   ECH2O sensors

From the range of sensors produced by Decagon LTD we are supporting 2 capacitive soil moisture sensors EC5 and HS10 and the soil moisture and conductivity sensor TE5. EC5 is a 5 cm long sensor in the shape of a 2 legged fork. 10HS has the same shape but it is a 10 cm long and a little stronger than its smaller co product. In an ideal soil, it is possible to press these sensors into the ground. In this case you might dig a hole down to the maximum depth you like to burry the sensor and you insert the lowest sensor straight into ground and the other sensors will be pressed into the side walls of the hole.

As soon as you have structured organic matter or stones in the soil this way of installation is not possible. In this case you will have to dig a trench and to make smaller holes with the different depths you like to install the sensors. Take some of the soil of the different holes and mix it carefully with water to form a slurry a dry as possible. Insert this slurry into the hole and now you can insert the sensor vertically into this slurry. The cables can be buried in the trench.

The PCB supporting the ECH_2O sensors can take 3 sensors. It is possible to connect a wide range of different sensors to this PCB. Therefore a compound with 10 DIP switches is on this PCB. 9 of these switches are needed. The first 3 switches are for sensor 1, switches 4 to 6 are for sensor 2 and switches 7 to 9 are for sensor 3. If an EC5 is connected the switches have to be off, off, off. A HS 10 sensor needs the settings On, Off, Off. The TE5 sensor for soil moisture and conductivity needs the setting On, On, Off.

5.3   Joining Soil moisture and Water Tension

Soil moisture measured with capacitive sensors like EC5, HS10 or TE5 responds very well on irrigation, rain or water use by plants. Nevertheles it does not tell if the water is easy available for hardly held by the soil. Sensors giving water tension like tensiometers or watermark sensors are showing the plant availability of the water much better. These sensors are limited to show the dynamics of the soil water. To use the benefits of both systems Pessl Instruments has developed a PCB on which we can connect 2 watermark sensors, 2 ECH_2O probes and a soil temperature.

6 Installing new sensors on the µMETOS Blue

Each µMETOS Blue can be expanded to the maximum possible number of sensors. It is equipped with specific inputs for rain, and soil or air temperature. Along with this it has 3 digital inputs which can be used for a range of different soil moisture sensors and sensor chains.

7 Maintaining the µMETOS Blue

When the solar panel of the µMETOS is exposed to the sun and it gets enough sunlight, it should recharge the lead acid battery of the system constantly. With this the system should have enough power for years. The lifespan of the lead acid battery can be expected to be 5 to 6 years with sufficient reloading form the solar panel. Insufficient reloading will shorten the lifetime of the battery. In case of insufficient reloading of the battery the system will reduce the frequency of data upload to the amount that is needed to make sure that no data will be missing. With this, power use will be reduced and battery power will last longer.

The maintenance needed for the sensors depends on the different sensors. Temperature sensors will not need any maintenance for their lifetime whereas the rain gauge will only work properly when it is cleaned periodically.

7.1 Maintaining the rain gauge

The funnel of the rain gauge has several small holes to lead the water into the dipping bucket. These holes can be clogged with leaves. Please check the funnel periodically for leafs. The inner side of the rain gauge is a very attractive for several insects. Please check this especially at the end of summer where wasps tend to use the funnel.

The rain gauge can be recalibrated if needed. It should tip at 4ml filled into the double spoon. The tipping point can be selected by the white plastic screws below the spoon.
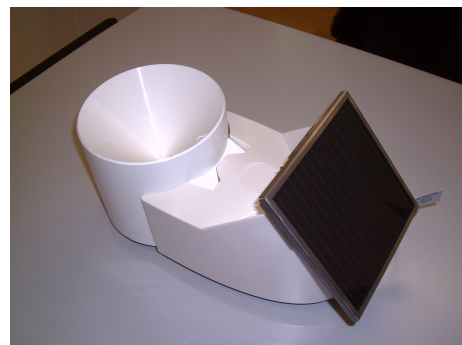
Picture 11: Unit with rain gauge

8 Uninstalling

µMETOS Blue is mainly used for soil moisture monitoring. If this is in a permanent crop, it can be out in the field for its lifetime. But it might be that the position should be changed or that the crop will not last as long. In this case the µMETOS Blue has to be uninstalled.

If you intend to do so, plan some time for it. If you would like to remove the soil moisture sensors and reuse them, you will have to dig carefully behind the cables. Make sure that you do not damage them.

If the µMETOS Blue should wait in a shed for the next season, please disconnect the battery before storing it. To do this, you have to open the housing with the six screws (with the 2.5 mm Allen key which came with it).

Picture 12: Rain gauge