iMETOS

Maintenance & troubleshooting

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iMETOS maintenance and troubleshooting

In this document, a detailed maintenance and troubleshooting section of all iMETOS (including iMETOS 1 and iMETOS 2) and ECO series is described. Proper maintenance of the iMetos components is essential to obtain accurate data. Equipment must be in good operating condition, which requires a program of regular inspection and maintenance. Routine and simple maintenance can be accomplished by the person in charge of the weather station. More difficult maintenance such as sensor calibration, sensor performance testing, and sensor component replacement, generally requires a skilled technician, or that the instrument be sent to Pessl Instruments. A station log should be maintained for each iMetos station that includes serial numbers, dates that the site was visited, and maintenance that was performed.

1. POWER SUPPLY

1.1. Maintenance

Keep the solar panel cleaned and make sure it charges in an efficient way the battery. Make sure that battery cable is well connected to its correspondent input on the board. When the solar panel of the iMETOS is exposed to the sun and gets enough sunlight it should constantly recharge the battery of the system. The lifespan of the battery is expected to be twelve years with sufficient recharging from the solar panel. Deep discharge shortens its lifetime. Battery should be replaced once it goes down to 5V. It is recommended to change the battery cable every 3 years in normal climate and every 2 year in maritime climate.

1.2 Troubleshooting

- Power supply breaks frequent: battery cable is damaged.
- Battery is not charged:
  - ◊ Station power consumption increased.
  - ◊ Check/look for damaged sensors, corrosion parts on pcb, station settings (logging of profile probes, transfer interval).
  - ◊ Not enough sunlight: change station settings (decrease n° of transfer intervals).
  - ◊ Broken wires of solar panel: exchange solar panel.
  - ◊ Solar panel partially broken: exchange solar panel.
- High fluctuation of battery voltage: battery lost capacity.
- Occasional drop of battery voltage: board seems to hang communication – change the main board.
- iMetos1: never charges, battery is connected to solar panel input – pcb has to be replaced
  - ◊ Completely broken of power supply – exchange fuse.
- iMetos2: at 6.85V the charging is suspended till it goes down to 6.3V.

2. COMMUNICATION

2.1 Troubleshooting

During installation

Once mounted the station, operator should never leave the site before checking the communication in spy mode and doing a SENSOR TEST. Here following a detailed description.

In the office

- Check for valid contract and validation of SIM card
  - ◊ Switch off the PIN query on the sim card. This can be done using directly the USB <=> PC connection via terminal menu: MAIN MENU > MODEM SETTINGS > UNLOCK SIM CARD.
  - ◊ Test SIM strength via Terminal menu / MODE / MODEM SETTINGS / SIGNAL QUALITY GRAPH. In alternative, test signal strenght with your phone.
  - ◊ Test in a old mobile phone if you come to the Internet with the Sim card.
  - ◊ If you come to the internet with your mobile phone but can not transfer the station please contact us creating a ticket.
- Check battery status
- Check for communication problems in the previous period (events). User can see this events in FieldClimate (Fieldclimate / Station settings / Information / Station events) or locally via USB connection. Please refer to appendix 2 for the complete list.

Having somebody in the field

- Open the station box and check for the LEDs, if no leds are blinking or they are permanent on, press connect button and look at the LEDs. If LEDs are not blinking or still blinking after 5 minutes, press RESET (pins for iMetos2 and ECO D2).

You are in the field

- Connect your PC to the station with USB cable without any jumper (spy mode). The communication process starts and it will take few minutes until data are transmitted successfully to the platform. When you see nothing press CONNECT, if still nothing happens press RESET (before pressing reset button, in TeraTerm press Alt+i). If communication fails, copy the whole content in a file .txt and send it to us attached to the ticket. Complete monitoring of the communication process should be done after every installation by connecting the PC to the iMETOS. Installer never should leave the site without performing sensor test and communication process log.
- When using faulty sensors or operating the station in an unexpected way, the sensors configuration and/or records could be damaged to a point that affects some functionalities of the station. To recover from that, it is recommended to **clear the sensors configuration** and to **erase the records** from the non volatile memory.

3. RAIN GAUGE

3.1 Maintenance

New rain-gauge sensor funnel includes a plastic filter intended to reduce maintenance needs. It is possible that birds or insects construct nests inside the filter and the mechanism; if it rains and the data does not look consistent, check your Rain Gauge internally. To open it, just press the lateral walls and pull the metallic lid. Check also that the buckets are clean and can tip without impediment – it's not uncommon for spider webs, for example, to impair tipping and potentially to prevent tipping altogether – even a strand or two of spider silk is surprisingly strong. Judicious use of insecticides may be helpful in preventing recurrent problems with webs, insect nests etc.

In case of recurrent bird use the bird repellent system on the rain gauge or in case of insect infestation, a good practice is to spray some insecticide or pyrethrum, this will keep them away.

3.2 Troubleshooting

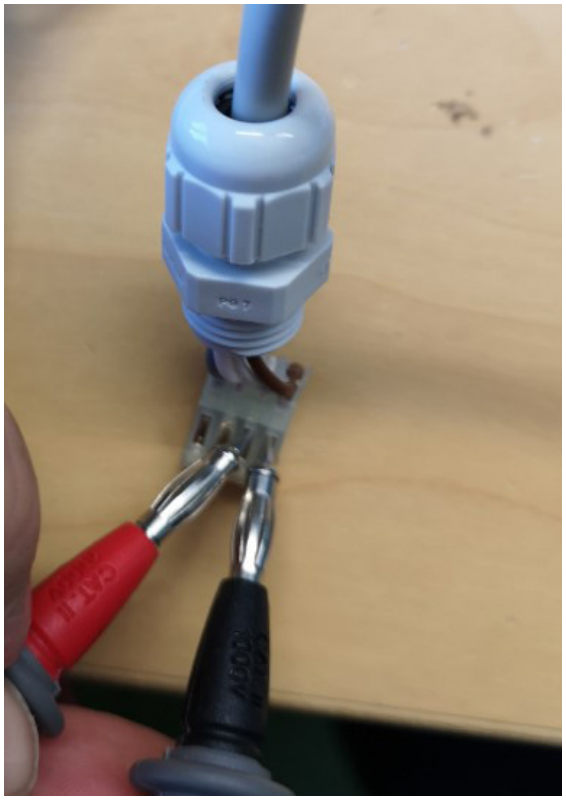
- Measurements are lower than expected: Cable with reed switch is pulled out.
- The bucket tips are monitored by means of a sealed reed switch. Make sure to insert the rain gauge cable into the black cover until it reached the top and that the reed relay faces the magnet.
- Values "0": Funnel blocked by leaves, insects inside the funnel.
- Measurements are higher than expected: heavy wind shakes the station, please fix it properly
- No data, no sensor recognition: Cable is cut
- Many separate in time 0.2mm readings: can be due to dew, condensation, insect.

Testing rain gauge

1. Use a 500 ml bottle:
test can be done by the client (than we can delete the data)
Take a 500 ml bottle of water, make a pinhole at the bottom and leave it on the rain gauge. Open a bit the tap of the bottle and the water will start to pore into the funnel slowly producing 125 tips at a rate of 25 mm. Note that bucket tips with 4 cc (ml) of water.
This calibration method gives high accuracy and repeatability because it is based on an average over more than 100 tips.
The error should be lower than 10%. To calculate the error:
Err= (Xreal-Xexp)/Xexp*100, where Xreal = measured value, Xexp = expected value
Based on the result from the bottle test, do one of the following test:

2. Connect PC to the station and do a SENSOR TEST. Each tip should show 0.2 mm.

3. If you have a voltage tester, do a test to see if the sensor works fine. Switch the tester to resistance (Ω). Black prone on brown pin and red on any of the white pins, tester should start beeping or showing 0 Ω (short circuit). Tip the buckets slowly by hand. As the buckets pass the midway position (magnet in front to the reed switch), voltage tester should stop beeping or resistance goes to infinite (open circuit). This means that the reed relay is positioned properly.



4. LEAF WETNESS SENSOR

4.1 Maintenance

The sensing element (paper) should be checked periodically/every 3 months depending on the rain frequency. If this sensing element (paper) is dirty, soiled by bird droppings, coated by spray materials (copper fungicide, etc.), physically damaged, or worn out, it should be replaced. The sensing element will eventually dissolve after long exposure. As replacement, you can use an other filter paper, if it is thin you should put it in 2 pcs of paper. Filter size is 18 x 25 mm.

The sensor works by measuring the conductivity in a filter paper. The filter paper is held by two stainless steel electrodes in a transparent holder. The use of transparent Lucite plastic as a holder reduces the warm up of the sensor when it is exposed to direct sunlight.

Note: *do not clip the leave into the sensor the filter paper is simulating the green tissue of the leave.*

Installation tip: To avoid premature ageing of the cable, check that the 5m cable is fixed and that is not affected by wind.

Life expectancy: Over ten years in very hummed micro-climates (worst case). Check it every 4 years.

4.2 Troubleshooting

- It always shows wet or dry data: cable is cut.
- Leaf wetness period shorter than expected: no filter or pure rain.

5. TEMPERATURE AND RELATIVE HUMIDTY SENSOR

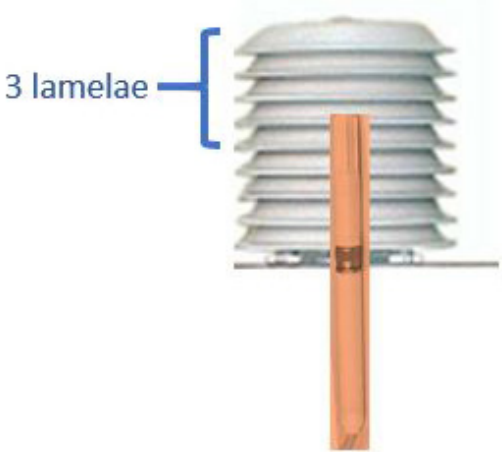
5.1 Maintenance

The temperature sensors of iMETOS are free of any maintenance as long as they are used in a proper way and the cables are not damaged. Long-term stability is better than 1 %RH per year. Depending on the conditions of measurement, the filter should be checked from time to time. Corroded, discolored or clogged filters should be replaced. Applications where the probe is exposed to contaminants may require more frequent verifications. The relative humidity sensor is affected by pollution in dependence of the severity of the pollution. It is recommended to recalibrate the sensor based on the type of application, in particular:

- In scientific research studies every 2-3 years.
- In agricultural application, every 5-8 years. Keep the readings checked, under frequent copper sprays it may give inaccurate high readings after some years of use.

In this case the sensor has to be changed for a new calibrated one. Recalibration can be done through Pessl Instruments and it means to receive a new calibrated sensor head and to send back the replaced one. Before request for calibration please check, if the filter covering the sensor element is clean. If it is dirty at your glance, a new filter can be ordered (order no. A660622).

Radiation shield: (aka: convection cup) must be cleaned at the beginning of the season. At least three lamellae (plates) must cover the top of the sensor.



5.2 Troubleshooting

- RH always 100% (long periods): replace the filter or clean the filter, replacement filter available with ord. no. A660622. It can also be checked by looking at the leaf wetness data.
- RH drops down to 0%: sensor is damaged by condensated water: replace the head of the sensor.
- iMetos 3.3 no data of Temperature, RH, dew point and Serial Number: cable is damaged, change the cable and check the sensor.
- Head/Sensor replacement of old HC: If it has a metal ring between sensor and cable you can change just the head. If it is plastic than it is the HC1 and you have to change the sensor and the cable. If it is an iMetos1, you need a new HC + cable + voltage converter. iMetos 3.3 works only with HC2.

6. SOIL TEMPERATURE SENSOR

6.1 Maintenance

The soil temperature sensor does not need any maintenance. If it fails it is nearly always due to damaged wires.

6.2 Troubleshooting

- Sensor shows values out of range: water entered in the sensor – sensor should be replaced.
- Gap of data: cable might be damaged, this increases power consumption and it can lead to misfunction on the station – unplug the sensor and replace it.

7. GLOBAL RADIATION SENSOR

7.1 Maintenance

The global radiation sensor should be maintained cleaned. A visible check at the plastic cover is recommended at the beginning of the season.

7.2 Troubleshooting

- Values out of range (higher/lower than expected): check sensor status, cleaning, orientation.
- Values different to 0 at night: water enters in the sensor, exchange the sensor.
- No values: cable cut.

8. WIND SPEED AND DIRECTION SENSOR

PI Wind Speed Sensor (IM512CD)

Maintenance

The wind sensor should be examined whether the wind wheel is low-friction. Check for easy-going and the sound. If it is not the case, send the sensor for service to us. If the wind wheel is damaged please order a new one.

Troubleshooting

- Heavily increment of values – replace the main board.
- Check for induction (cable rounded around the pole): cable should be positioned along the pole, but not wrapped around it.
- Station gets frequent reset – power cable or pcb are damaged.

- Reduced values – mechanical problem of the sensor.
- No value: cable is damaged.

PI Wind Direction (IM511CDI)

Troubleshooting
- No values: internal battery should be replaced/cable is damaged.

RM Young (05103L)

Troubleshooting
- No values: internal battery should be replaced, lifetime of the battery is highly influenced by the frequency of heavy wind.

Ultrasonic Atmos 22/D2

Troubleshooting
- No values: check that interface board is properly mounted.

PI Ultrasonic (PI-USWM)

Maintenance
Clean the outer surfaces of the sensor with wet map water or neutral soap once per season and every time it receives significant amounts of dust or phytosanitary spray.

Troubleshooting
If the sensor requires a software update (all units before DEC 2019), this request will be attended by Pessl Instruments after-sales service.

9. PI-Bus

Troubleshooting
- No data at all: cable cut/old, different sensor timing, water entered in the box.
- No sensor data: sensor cable cut, water entered in the sensor.

10. RADIONODE TROUBLESHOOTING

10.1 Reset the WSN

- Reset the RF AP board: by power up push the button and hold the button at least 2 seconds. The all 3 LED diodes will be flashing for 2 seconds. All configuration and link settings of the wireless system will be erased in RF AP board.

- Reset the RF SD board: by power up push the button and hold the button at least 2 seconds. The LED diode will be flashing for 2 seconds. All configuration and link settings of the wireless system will be erased in RF SD board.

Notes:
- If there was executed reset on AP board, there is no possible to communicate anymore. The solution is doing the device pairing again with all RF sensor devices.
- If there was executed reset only on SD board (not on AP board), there is possible to re-pair RF SD again.

10.2 Connection Recovery During Running

- If the connection between RF AP and RF SD is lost for any reason:
  - ◊ RF AP is automatically searching the RF SD for 24 hours
  - ◊ RF SD is automatically searching the WSN for 24 hours
- If the connection of RF AP is being lost for more than 24 hours:
  - ◊ Activate the WSN searching the lost RF SDs for next 24 hours by pressing the button of RF AP.
- If the connection of RF SD is being lost for more than 24 hours:
  - ◊ Activate the WSN searching for next 1 hour by pressing the external button of RF SD.

10.3 Connection Recovery After Power On

If the WSN was established (RF AP and RF SDs have been paired). When the RF AP or RF SD board are powered off, all their configuration and link settings are kept and restored when power on again. There is not necessary to do the device pairing again.

- The RF AP searches the paired RF SD boards for 24 hours automatically (Right after the start-up initialization of RF AP from iMetos station. This initialization process can take the time of a few minutes).
- The RF SD searches the WSN (the RF AP) for 1 hour automatically (After power on).

10.4 Terminal menu info about AP board

On the Terminal window press the following buttons to get the following information.

‘**2**’, —› ‘**W**’, “WIRELESS SYSTEM” —›
‘**I**’, “INFORMATION ABOUT WIRELESS”
‘**S**’, “SETUP AP BOARD”
‘**T**’, “SPY WIRELESS SYSTEM”
‘**B**’, “BRIDGE OF SYSTEM”

- ‘**I**’ – Prints info about the AP board and radio nodes (if there is any radio node connected to it).
- ‘**S**’ – Sets timestamp and serial number in the AP board (this may be used after resetting the AP board, but usually after a station reset it does this automatically).
- ‘**T**’ – Keeps printing what the AP board is doing. Each 5 minutes it should print some activity, and if there are radio nodes connected prints also what the radio nodes are sending to the AP board (because in this

mode there are a lot more of data to transmit this may occur sometimes in UART Overflow error, this error is informed in the screen, but it is not a real failure of the system).

- '**B**' – The user can send and read commands from the AP board manually, following the "AT Communication Protocol of RF AP".

11. STATION NOT SENDING DATA – USE TERMINAL MODE

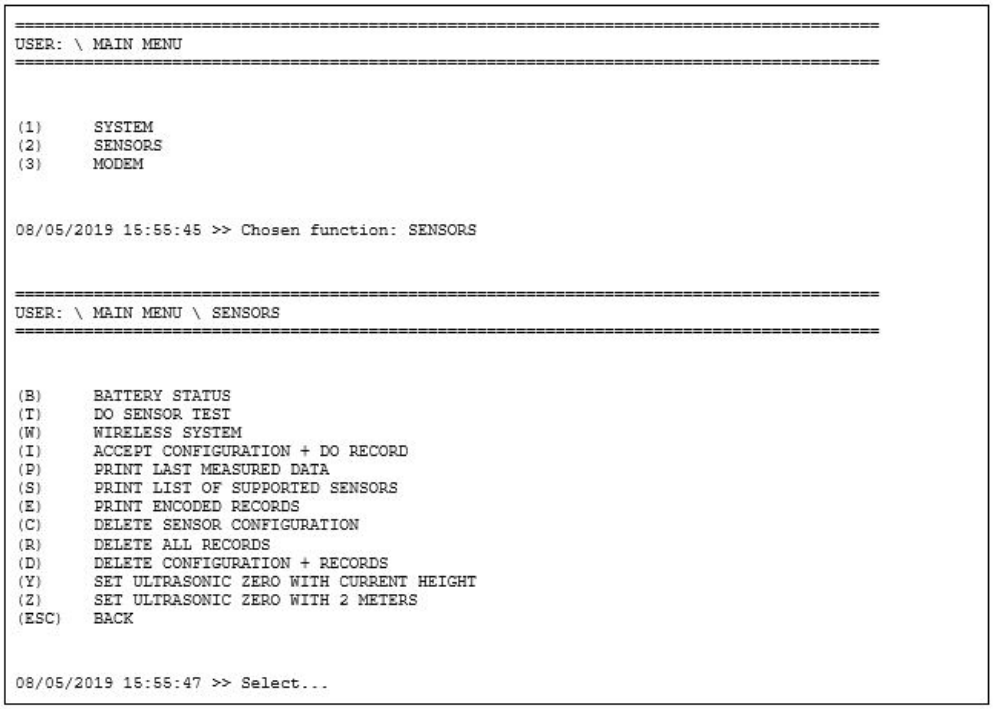
If station is communicating with the server but you don't see any data in Fieldclimate, make sure logging interval is set properly or the flash memory may be full.

11.1 How to get the data already stored in the station through TeraTerm

Sometimes it is wanted to clear the station's memory for a fresh start of the system. When this is the case, but it is also wanted to have all the data already stored in the station uploaded, it is possible to do it manually with the help of TeraTerm.

To do that, please follow the steps:

1. With the USB cable connected, jumper on J1 and the terminal application running, navigate to the menu **(2) SENSORS**.
2. Now, in the **SENSORS** menu, select the option **(E) PRINT ENCODED RECORDS**.



```
================================================================================
USER: \ MAIN MENU \ SENSORS
================================================================================


(B)     BATTERY STATUS
(T)     DO SENSOR TEST
(W)     WIRELESS SYSTEM
(I)     ACCEPT CONFIGURATION + DO RECORD
(P)     PRINT LAST MEASURED DATA
(S)     PRINT LIST OF SUPPORTED SENSORS
(E)     PRINT ENCODED RECORDS
(G)     PRINT ENCODED RECORDS FROM TIME
(H)     PRINT RECORDS IN HEXADECIMAL
(C)     DELETE SENSOR CONFIGURATION
(R)     DELETE ALL RECORDS
(D)     DELETE CONFIGURATION + RECORDS
(U)     SETUP INPUTS TIMING
(Y)     SET ULTRASONIC ZERO WITH CURRENT HEIGHT
(Z)     SET ULTRASONIC ZERO WITH 2 METERS
(ESC)   BACK

29/05/2019 12:35:41 >> Chosen function: PRINT ENCODED RECORDS

paX/AQAAAAD/////HAEAACLV61wbAAAB5zYDax4ABAACCMoaBwAHAAIIsBkAAAsABgf5APkA+QD8AREACwikiAAg+gESAAYHgqqCCoIK+wETAAIHtw+3D7cPFQAUACYDegB6ABkA
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gz4LCEjoAQAEjoQ+CQgBBY6FPgkEAAaOhj4JCAQHjoc+DQPLywiOiD4JCAAJjok+CQgFCo6KPgkIAaWl/wECAAAAHAEAAFQDAADa4utcGwAAATsiAzkeAAQAAgi3GgcABwACCLkZ
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Bo6GPgkIBAeOhz4NA8zMCI6IPgkIAAmOiT4JCAUHjoc+CQgBpaX/AQMAAAA4AgAAcAQAAlbm61wbAABBe2cDUR4ABAACCMYaBwHAAIInBkAAAsABgfOAPQA9AD8AREkCwikIAAg
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GwAjAAYHCgMCAxMD8QECAAYH7vDrAPAAAZOg
```
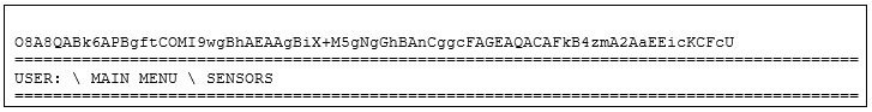

And so on until the menu appears again:

3. Copy all of this, save it with the serial number of the station and send it to us (support@metos.at). We will



```
O8A8QABk6APBgftCOMI9wgBhAEAAgBiX+M5gNgGhBAnCggcFAGEAQACAFkB4zmA2AaEEicKCFcU
================================================================================
USER: \ MAIN MENU \ SENSORS
================================================================================
```

upload this later directly to our server.

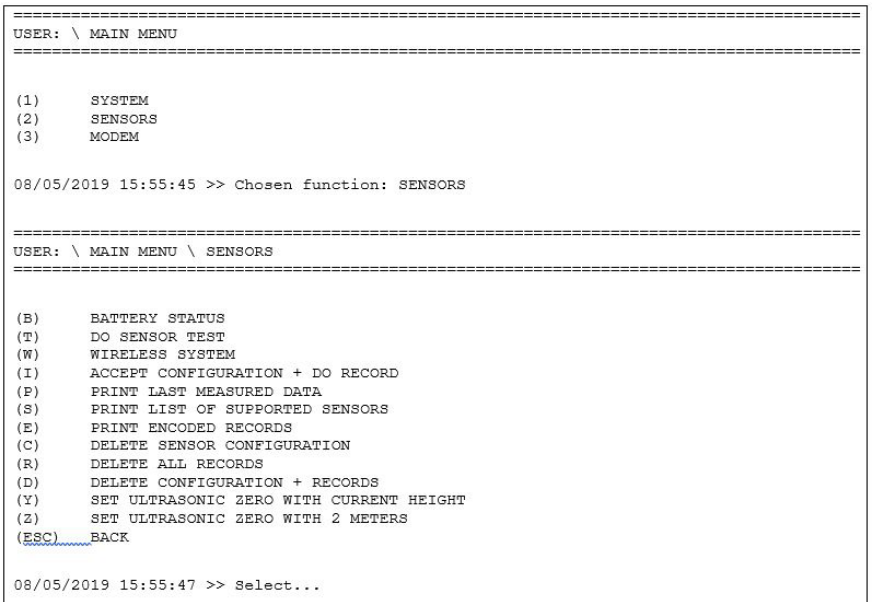
After this is done, it is time to clear the sensor configuration and records following the next document **Erasing sensor configuration and records**.

11.2 Erasing sensor configuration and records

When using faulty sensors or operating the station in an unexpected way, the sensors configuration and/or records could be damaged to a point that affects some functionalities of the station. To recover from that, it is recommended to clear the sensors configuration and to erase the records from the non volatile memory.

To do that, please follow the steps:

1. With the USB cable connected, jumper on J1 and the terminal application running, navigate to the menu **(2) SENSORS**.
2. Now, in the **SENSORS** menu, select the option **(D) DELETE CONFIGURATION + RECORDS**.



```
================================================================================
USER: \ MAIN MENU
================================================================================


(1)     SYSTEM
(2)     SENSORS
(3)     MODEM

08/05/2019 15:55:45 >> Chosen function: SENSORS


================================================================================
USER: \ MAIN MENU \ SENSORS
================================================================================


(B)     BATTERY STATUS
(T)     DO SENSOR TEST
(W)     WIRELESS SYSTEM
(I)     ACCEPT CONFIGURATION + DO RECORD
(P)     PRINT LAST MEASURED DATA
(S)     PRINT LIST OF SUPPORTED SENSORS
(E)     PRINT ENCODED RECORDS
(C)     DELETE SENSOR CONFIGURATION
(R)     DELETE ALL RECORDS
(D)     DELETE CONFIGURATION + RECORDS
(Y)     SET ULTRASONIC ZERO WITH CURRENT HEIGHT
(Z)     SET ULTRASONIC ZERO WITH 2 METERS
(ESC)   BACK

08/05/2019 15:55:47 >> Select...
```

3. Now press Y to confirm the operation, and wait some time until the operation is finished (the gray text is

```
================================================================================
USER: \ MAIN MENU \ SENSORS \ DELETE CONFIGURATION + RECORDS
================================================================================


        Do You want to reset database and put it to default (Y/N)? >
```

coppied from the last step).

4. When it is finished, the menu entries should be shown again (the gray text is coppied from the last step)

```
================================================================================
USER: \ MAIN MENU \ SENSORS \ DELETE CONFIGURATION + RECORDS
================================================================================


        Do You want to reset database and put it to default (Y/N)? > YES


        Database operation accepted
        Operation can take up to 5 minutes
        PLEASE WAIT until yellow led turns off
```

```
================================================================================
USER: \ MAIN MENU \ SENSORS \ DELETE CONFIGURATION + RECORDS
================================================================================


        Do You want to reset database and put it to default (Y/N)? > YES


        Database operation accepted
        Operation can take up to 5 minutes
        PLEASE WAIT until yellow led turns off


================================================================================
USER: \ MAIN MENU \ SENSORS
================================================================================


(B)     BATTERY STATUS
(T)     DO SENSOR TEST
(W)     WIRELESS SYSTEM
(I)     ACCEPT CONFIGURATION + DO RECORD
(P)     PRINT LAST MEASURED DATA
(S)     PRINT LIST OF SUPPORTED SENSORS
(E)     PRINT ENCODED RECORDS
(C)     DELETE SENSOR CONFIGURATION
(R)     DELETE ALL RECORDS
(D)     DELETE CONFIGURATION + RECORDS
(Y)     SET ULTRASONIC ZERO WITH CURRENT HEIGHT
(Z)     SET ULTRASONIC ZERO WITH 2 METERS
(ESC)   BACK

08/05/2019 16:01:50 >> Select...
```

5. Done, now the jumper may be removed and the station reset

11.3 Remote reset

In order to erase the memory and sensor configuration you can send a station reset via SMS.

Notes:

- You need the phone number associated to the SIM card in the iMETOS 3.3
- Alternatively, to send the SMS to the SIM card at the iMETOS 3.3 you can use a SIM card which already has the configuration SMS locally stored.
- After sending the SMS described below in this section press the connect button in the iMETOS so it checks for received SMS, otherwise it will be checked at midnight.

The following string will be sent:

Code: ! serial_number 2 UID_station !

serial_number is the serial number of the station

UID_station is the Unique identification number of the station

You can get the UID_number by connecting the iMETOS to the PC via USB cable and asking for a quick report.

This command does a factory reset (exception: the APN table is kept).

11.4 Sensor test and send data manually

To log manually data connect your PC to the station with USB cable with jumper in J1.

- Select 2) SENSORS —› T) DO SENSOR TEST
- Select I) ACCEPT CONFIGURATION + DO RECORD. The measure is taken and logged in the data logger.

```
System Initialization, Please Wait...

================================================================================
USER: \ MAIN MENU
================================================================================

(1)     SYSTEM
(2)     SENSORS
(3)     MODEM SETTINGS

07/05/2019 02:52:03 >> Chosen function: SENSORS

================================================================================
USER: \ MAIN MENU \ SENSORS
================================================================================

(B)     BATTERY STATUS
(T)     DO SENSOR TEST
(W)     WIRELESS SYSTEM
(I)     ACCEPT CONFIGURATION + DO RECORD
(P)     PRINT LAST MEASURED DATA
(S)     PRINT LIST OF SUPPORTED SENSORS
(E)     PRINT ENCODED RECORDS
(C)     DELETE SENSOR CONFIGURATION
(R)     DELETE ALL RECORDS
(D)     DELETE CONFIGURATION + RECORDS
(A)     FAST DELETE CONFIGURATION + RECORDS
(Y)     SET ULTRASONIC ZERO WITH CURRENT HEIGHT
(Z)     SET ULTRASONIC ZERO WITH 2 METERS
(ESC)   BACK

07/05/2019 02:52:13 >> Select...

16/07/2019 02:45:47 >> Chosen function: ACCEPT CONFIGURATION + DO RECORD

================================================================================
USER: \ MAIN MENU \ SENSORS \ ACCEPT CONFIGURATION + DO RECORD
================================================================================

(0)     MAIN + DUTY + HC2 SENSORS
(1)     CHAIN AT INPUT 1
(2)     CHAIN AT INPUT 2
(3)     CHAIN AT INPUT 3
(4)     CHAIN AT INPUT 4
(5)     DEDICATED CHAIN
(6)     EXTENDED INPUT A
(7)     EXTENDED INPUT B
(8)     WIRELESS CHAIN
(A)     ALL SENSORS
(ESC)   BACK

16/07/2019 02:45:48 >> Chosen function: ALL SENSORS

================================================================================
USER: \ MAIN MENU \ SENSORS \ ACCEPT CONFIGURATION + DO RECORD \ ALL SENSORS
================================================================================

        Data was stored into Record
```

- Press CONNECT button, the communication will start and data measured will be transmitted to Fieldcli-

mate. Alternatively, you can do it via Terminal 3) MODEM —› 3) SEND STATION DATA.

```
================================================================================
USER: \ MAIN MENU
================================================================================

(1)     SYSTEM
(2)     SENSORS
(3)     MODEM

16/07/2019 04:34:09 >> Chosen function: MODEM

================================================================================
USER: \ MAIN MENU \ MODEM
================================================================================

(1)     MODEM SETTINGS
(3)     SEND STATION DATA
(4)     GET GPS
(5)     GET CONF SMS
(6)     Download FW
(7)     Download APN list
(ESC)   BACK

16/07/2019 04:34:37 >> Chosen function: SEND STATION DATA

================================================================================
USER: \ MAIN MENU \ MODEM \ SEND STATION DATA
================================================================================

>
> Starting modem process
>
>
>> Turning modem on
>
```