



METOS 5



Manual

Pessl Instruments, GmbH

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1. Overview

METOS 5 is a weather station that can utilize different connectivity options to deliver the measured sensor data to the FieldClimate Cloud. It is designed to support various different sensors for climate monitoring (rainfall, air temperature, relative humidity,...), soil characteristics (soil moisture, soil temperature and electrical conductivity, dielectric permittivity,...), water pressure, multisensory SDI12 probes, etc. Thus, everything that the standard user needs, with the possibility for further expansion. Modularity provides its user the chance to get exactly what they need to get more yield from their fields.

The sensor's data is consistently logged every 15 minutes and sent every 60 minutes to the FieldClimate Cloud and this can be changed to fit the specific monitoring needs of the end-user. Specific restrictions by different communication types apply and are described in section 6.3.

To mitigate connectivity issues in remote areas, the station saves data from the last few months in its internal storage. Once the connectivity with the FieldClimate Cloud is restored, the stored measurements are automatically retransmitted. All data is synchronized and securely stored on the FieldClimate platform, where it is fully integrated with additional Pessl Instruments services and available for further integration via the PI API. Some communication modules also support an external antenna for enhanced connectivity and a built-in GPS sensor for precise location tracking.

Website: <https://metos.global/en/metos5/>

2. Purpose

This technical manual provides comprehensive guidance for the METOS 5 product. It contains all vital information on how to handle the product with an emphasis on configuration and connectivity.

For a quick overview, please refer to the METOS 5 short manual.

3. Requirements

For setting up the parameters, updating the firmware, and observing the sensors and communication processes, one needs to connect the motherboard to the Windows OS PC using a type C USB cable. Alternatively, many settings can be done remotely via the FieldClimate Cloud device management.

For delivering the data to the FieldClimate Cloud, the appropriate communication board needs to be selected based on the requirements and availability of the mobile network at the place of the installation. In case the device will use a mobile network for transmission of the data, a micro-SIM card with an adequate data plan needs to be inserted into the dedicated SIM card slot which is located on the communication board.

The METOS 5 device is powered with a 6 V rechargeable battery and a 1,5 Watt solar panel.

4. METOS 5 Quick Start

To start up the METOS 5:

1. insert the SIM card
2. connect the power supply (battery and solar panel)
3. check data on the FieldClimate

All steps are described in detail in this document.

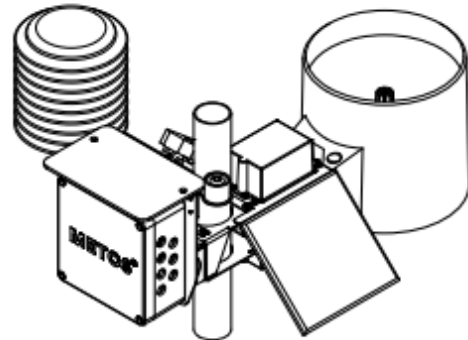
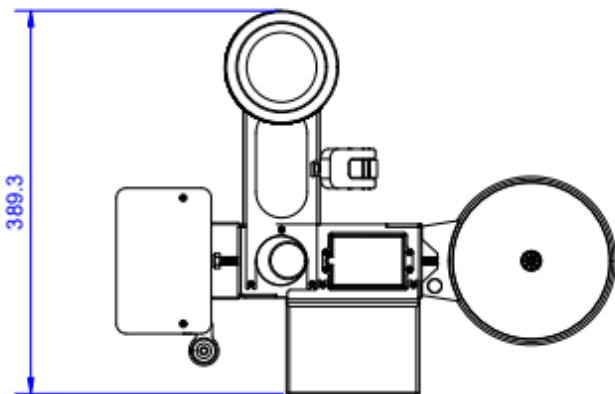
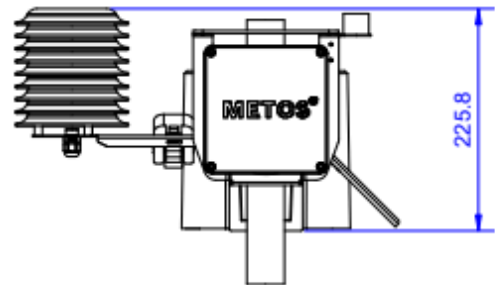
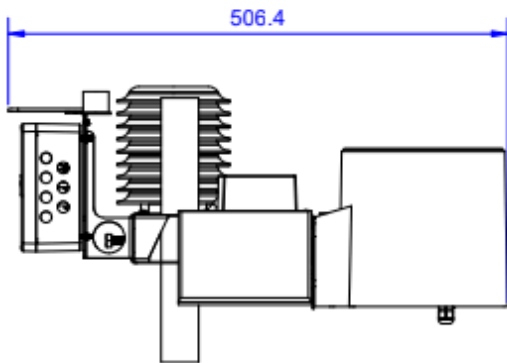
5. Technical Overview

Technical Specifications:

Housing	ABS (Protection class IP67)
Connectivity	various, depending on the communication board
Battery	6V 4.5A/20HR charging battery
Solar panel	1.5 Watt solar panel
Dimensions (with rain gauge)	50.6 cm L x 38.9 cm W x 22.6 cm H
Weight (with rain gauge)	2.7 kg

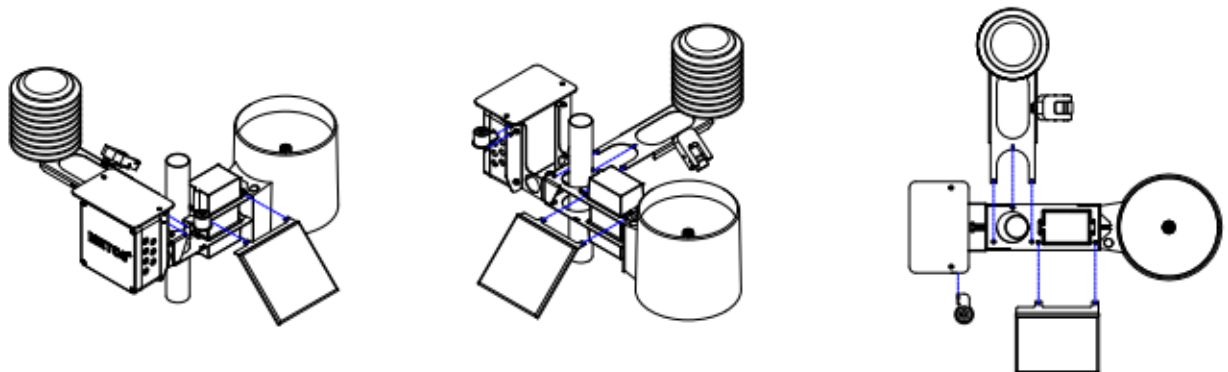
5.1 Housing

Below are pictures of various angles and dimensions of the METOS 5 product.

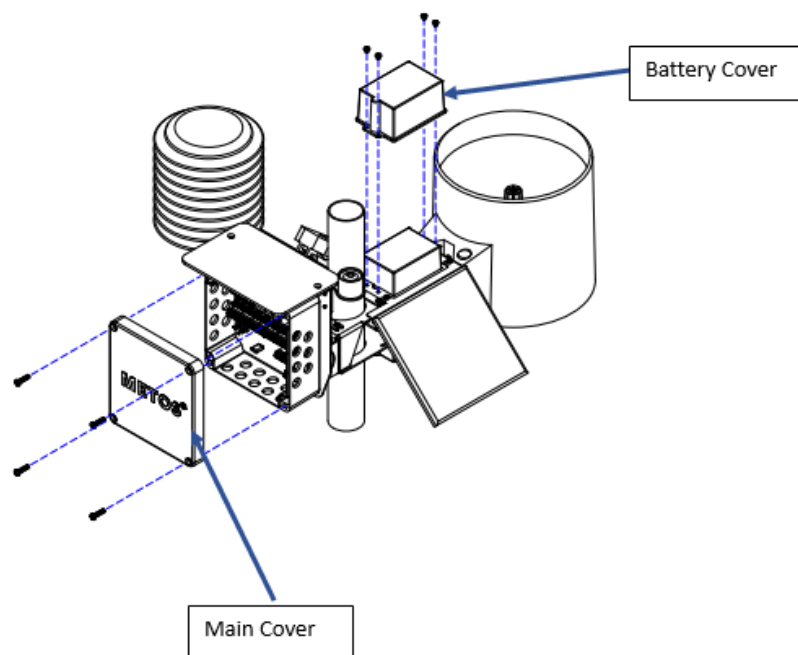


5.2 METOS5 Assembly

Here an exploded view of the full station.



5.3 Opening the housing and accessing the motherboard



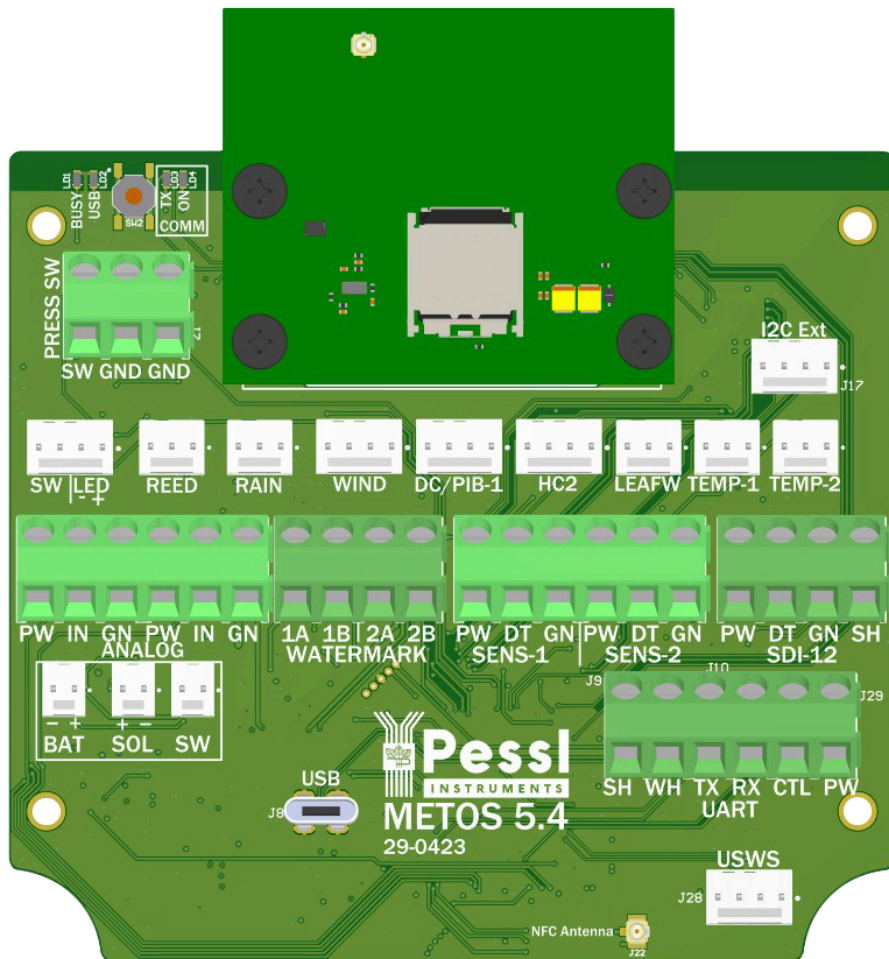
Steps:

1. Open the four (4) screws of the main cover to have direct access to the motherboard, connected sensors, and other inputs.
2. Optionally one can also open the four screws of the battery cover in case of a need to change the battery or check whether the cables are connected

6. METOS 5 Hardware Overview

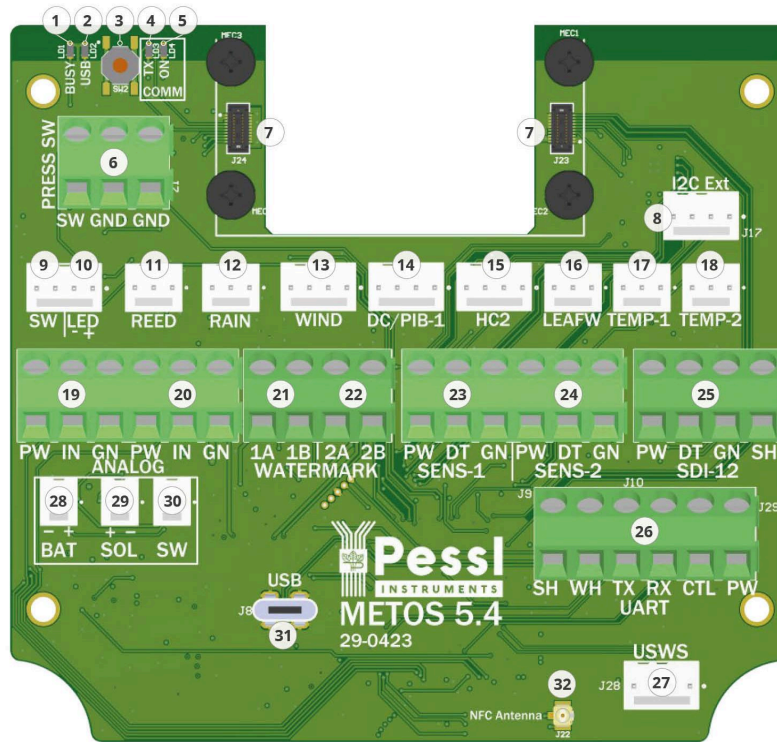


METOS 5 motherboard (version 5.4) with attached communication board:



6.1 METOS5 inputs and connectors

METOS 5 box inputs description:



The front side of the METOS 5 motherboard version 5.4 (29-0423) with labeled parts

METOS 5.4 main motherboard inputs description:

Number	Label	Description
1	BUSY	<p>Busy LED</p> <p>On: METOS 5 motherboard is performing some operation - the board is not in sleep mode. The operation can be anything that brings the board from sleep mode into normal mode.</p> <p>Off: METOS 5 motherboard is in sleep mode - the board is not performing any activity.</p>
2	USB	<p>USB LED</p> <p>On: When the USB connection between the METOS 5 motherboard and a PI is active.</p> <p>Off: When there is no USB-connected device to the USB port.</p>
3	SW2	<p>Connect Button</p> <p>Short press (from 1 to 3 seconds): initiates the communication process. METOS 5 tries to send stored sensor data to the FieldClimate.</p> <p>Long press (from 5 or more seconds): initiates the METOS 5 reset process. The board shuts down and restarts. Note: The external Button has the same functionality as the onboard connect button.</p>
4	TX	<p>TX LED</p> <p>On: When the Communication board starts the communication</p>

		<p>process with the server until the communication process ends. Off: When there is no communication process happening.</p> <p>2 short blinks when the communication process finished successfully. 5 long blinks when there was an issue with the communication process. For detailed issue recognition a terminal log is required.</p>
5	ON	<p>ON LED On: When the Communication board is turned on for some operation (Modem activity). Off: When the Communication board is turned off.</p>
6	PRESS SW	<p>Pressure switch sensor input By default, it supports the Pessl Instruments Pressure Switch sensor.</p>
7	J24 & J23	<p>Communication board connectors. This is where the communication board needs to be connected to, in addition the communication board should be firmly fixed to the METOS 5 motherboard with four additional screws.</p>
8	I2C Ext	<p>I2C Ext input By default, it supports the PI Air Temperature & Relative Humidity sensor.</p>
9 & 10	SW LED	<p>External Button with LED (optional) It provides the same functionality as the onboard Connect button (SW2).</p>
11	REED	<p>REED sensor input Default configuration: resettable (pulse counter) value, normally open, configured as: Pessl Instruments Water Counter Interface sensor Can be configured to act as an: a) how the values are stored: - accumulative sensor value or - resettable value b) normally open or normally closed device More on the possible configurations in section 9.</p>
12	RAIN	<p>RAIN sensor input Default configuration: accumulative value, normally closed, resolution: 0.2, configured as Pessl Instruments Rain Gauge More on the possible configurations in section 9.</p>
13	WIND	<p>WIND sensor input (Mechanical) By default, it supports the Pessl Instruments Wind Speed sensor.</p>
14	DC/PIB-1	<p>DC/PIB-1 sensor input (Duty Cycle & PI Bus sensors) Connected sensors are automatically recognised, it supports PI bus sensors and PI bus interfaces.</p>
15	HC2	<p>HC2 sensor input (Hygroclip) It supports the Hygroclip (Air temperature & Relative Humidity) sensor.</p>
16	LEAF	<p>LEAFW sensor input It supports the Pessl Instruments Leaf Wetness sensor.</p>
17	TEMP-1	<p>Temperature sensor input Default configuration: PI Air temperature sensor Configurable to: PI Soil temperature, PI Wet bulb, PI Dry bulb, Leaf temperature PT1000, Black body temperature PT1000, Water</p>

		temperature... More on the possible configurations in section 9.
18	TEMP-2	Temperature sensor input Default configuration: PI Soil temperature sensor Configurable to: PI Air temperature, PI Wet bulb, PI Dry bulb, Leaf temperature PT1000, Black body temperature PT1000, Water temperature... More on the possible configurations in section 9.
19	ANALOG	ANALOG sensor input 1 *currently not in use
20	ANALOG	ANALOG sensor input 2 *currently not in use
21	WATERMARK 1A 1B	WATERMARK sensor input 1 It supports the Irrrometer Watermark Soil Moisture sensor.
22	WATERMARK 2A 2B	WATERMARK sensor input 2 It supports the Irrrometer Watermark Soil Moisture sensor.
23	SENS-1	PI-Bus/Decagon/Meter group sensor input 1 Default configuration: PI Bus input. Configurable to: EC5, 10HS, MPS1, 5TE, 5TM and many other sensors. More on the possible configurations in section 9.
24	SENS-2	PI-Bus/Decagon/Meter group sensor input 2 Default configuration: PI Bus input. Configurable to: EC5, 10HS, MPS1, 5TE, 5TM and many other sensors. More on the possible configurations in section 9.
25	SDI-12	SDI-12 sensor input Supports one PI Profile Probes, Sentek Drill&Drop, and TriSCAN Probes. Two probes will be supported in future firmware updates.
26	UART	UART input (Generic bidirectional UART interface / PI-Bus sensor input) Default configuration: PI Bus input.
27	USWS	Ultrasonic wind sensor input It supports the Pessl Instruments Ultrasonic Wind sensor.
28	BAT	6V battery connector
29	SOL	Solar panel connector
30	SW*	ON/OFF switch
31	USB	USB interface
32	NFC Antenna	NFC antenna connector

* This is only available on METOS 5.4 (29-0423) motherboard.

6.2 METOS 5 communication boards

6.2.1 HL78xx v1.3 29-0418

Top:	Bottom:
<ol style="list-style-type: none"> 1. SIM card holder 2. Optional external antenna connector 	<ol style="list-style-type: none"> 3. Mobile network antenna 4. GPS antenna 5. Modem

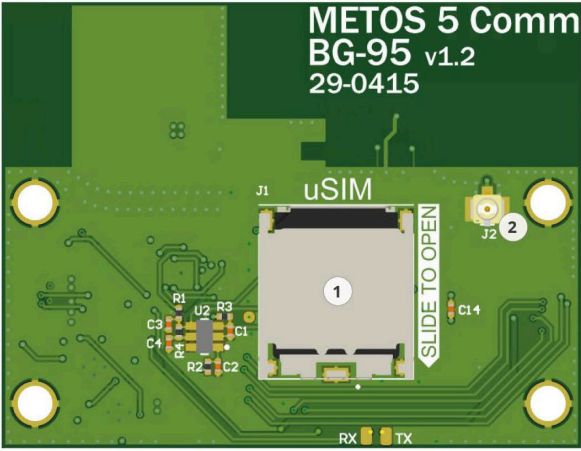
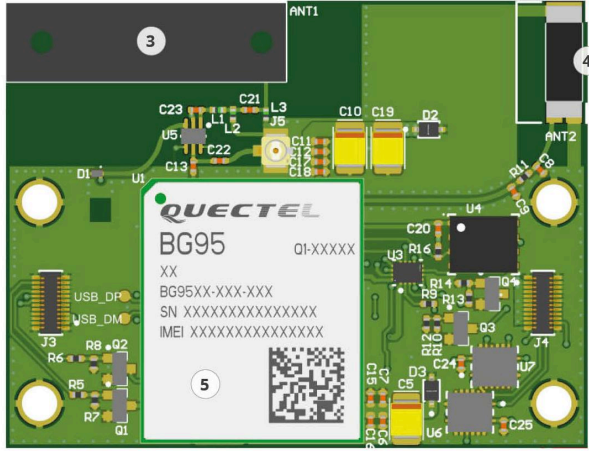
It comes in two variants, with Semtech HL7800 (<https://www.sierrawireless.com/iot-modules/lpwa-modules/hl7800/>) with NBloT and CatM1 mobile connectivity or with HL7802 (<https://www.sierrawireless.com/iot-modules/lpwa-modules/hl7802/>) with NBloT, CatM1 and 2G mobile connectivity.

6.2.2 EG912U v1.0 29-0421

Top:	Bottom:
<ol style="list-style-type: none"> 1. SIM card holder 2. Optional external antenna connector 	<ol style="list-style-type: none"> 3. Mobile network antenna 4. GPS antenna 5. Modem

It uses Quectel EG912U (<https://www.quectel.com/product/lte-eg912u-gl/>).

6.2.3 BG-95 v1.2 29-0415

Top:	Bottom:
	
<ol style="list-style-type: none"> 1. SIM card holder 2. Optional external antenna connector 	<ol style="list-style-type: none"> 3. Mobile network antenna 4. GPS antenna 5. Modem

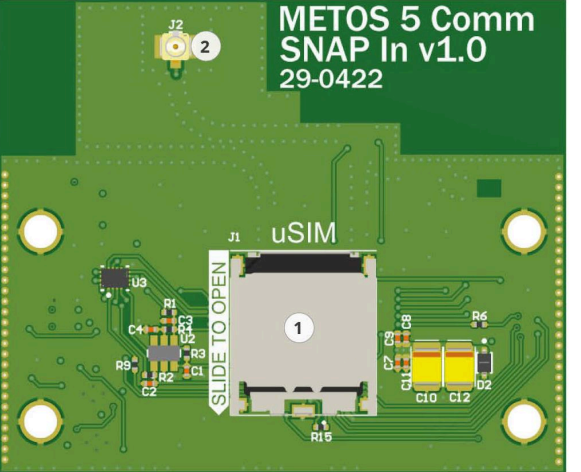
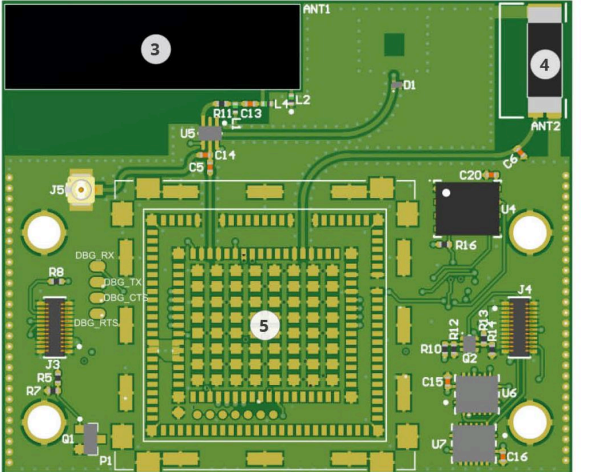
It uses Quectel BG95 modem

(<https://www.quectel.com/product/lpwa-bg95-cat-m1-cat-nb2-egprs-series/>)

6.2.4 SNAPIN v1.0 29-0422

SNAPIN v1.0 (29-0422) communication board supports these modems:

- Semtech HL7800
- Semtech HL7802

Top:	Bottom:
	
<ol style="list-style-type: none"> 1. SIM card holder 2. Optional external antenna connector 	<ol style="list-style-type: none"> 3. Mobile network antenna 4. GPS antenna 5. Modem

6.3 METOS 5 compatible communication boards

METOS 5 compatibility chart:

	Communication boards			
METOS 5 motherboard and Firmware	HL78xx v1.3 (29-0418)	EG912U v1.0 (29-0421)	SNAPIN v1.0 (29-0422)	BG-95 v1.2 (29-0415)
HW v5.2 (29-0414) & FW from v1.28	yes	no	no	no
HW v5.3 (29-0419) & FW from v1.29	yes	yes	yes	yes
HW v5.4 (29-0423) & FW from v1.29	yes	yes	yes	yes

METOS 5 communication boards mobile network connectivity options:

Communication board	2G/GSM	3G/UMTS	4G/LTE Cat1	LTE Cat M1	LTE Cat NB1	LTE Cat NB2
HL78xx v1.3 (29-0418) with HL7800 modem	no	no	no	yes	yes	no
HL78xx v1.3 (29-0418) with HL7802 modem	yes	no	no	yes	yes	no
EG912U v1.0 (29-0421) with Quectel EG912U modem	yes	no	yes	no	no	no
BG-95 v1.2 (29-0415) with Quectel BG95 modem	yes	no	no	yes	no	yes

The distributor and the client have to check, which communication type (2G, 3G, 4G, NBIoT, CatM1...) is available at the final installation location and this information needs to be included in the order of the METOS 5 weather station. The client or distributor should not need to know each communication board specifics or the modems used on those communication boards.

METOS 5 sensor measurement and communication intervals for each communication type:

	Sensor measurement interval (default)	Sensor measurement interval (configurable to)	Sensor logging interval (default)	Sensor logging interval (configurable to)	Device communication interval (default)	Device communication interval (configurable to)
with cellular connectivity (minutes)	5	5 10 15 30 60	15	15 30 60	60	15 30 60
with LoRaWAN connectivity (minutes)	5	5	15	15	15	15
with WiFi connectivity (minutes)	5	5 10 15 30 60	15	15 30 60	15	15 30 60

6.4 METOS 5 internal memory

METOS 5 has an internal memory capacity of 8 MB. In the table below, we can see how many days certain METOS 5 product variants can store logged sensor data (numbers are representing the days).

METOS 5 Device variant		Base	Frost	90-USW	200	280-MWS	300-MWS	280-USW	300-USW
Logging interval	15 min	4792	2875	1597	2614	2279	2212	1487	1462
	30 min	9583	5750	3194	5227	4539	4423	2974	2924
	60 min	19166	11500	6389	10454	9079	8846	5948	5847

7. SIM card and power system

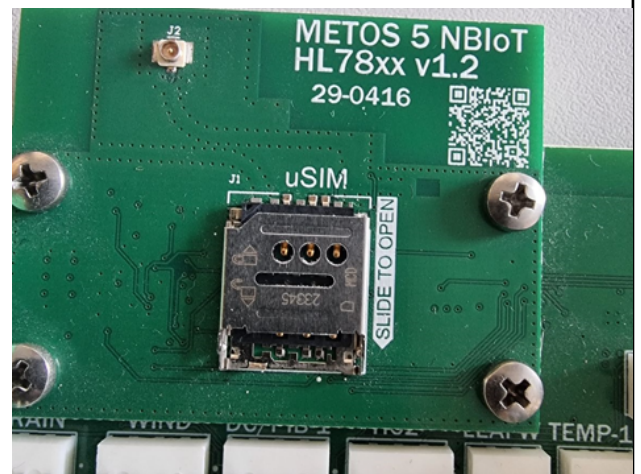
7.1 SIM card handling

METOS 5 communication boards for mobile networks use micro (3FF) SIM cards for mobile connectivity.

Inserting the SIM card:



1. Make sure that the battery and the solar panel are disconnected from the motherboard.



SIM card holder in a locked state

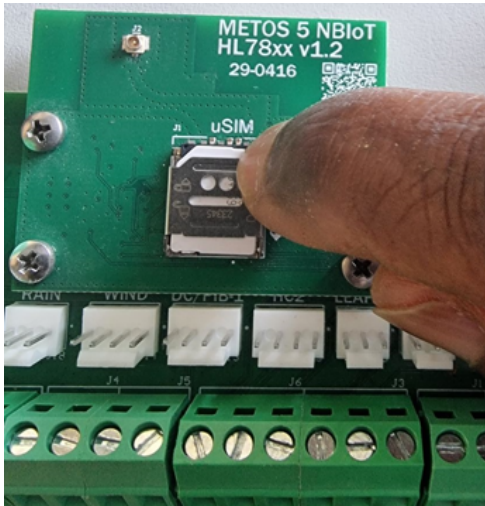
2. Gently slide the SIM card holder opposite the "uSIM" label to unlock the holder.



3. Gently lift the holder after the slide to open.



4. Insert the SIM card, and make sure the SIM card is oriented correctly.



5. Close the SIM card cover back to the position and gently press down the holder with the inserted SIM card.



6. Slide the holder back down into the lock position.

CAUTION: If too much force is applied on the SIM Card holder and it is not in a completely open state, the metallic pivots will be bent and the SIM card holder will no longer provide a good SIM card connection – subsequently the communication will fail and the daughter motherboard needs to be replaced in this scenario.

7.2 Powering up the motherboard

METOS5 weather station needs power from the 6V battery which is recharged from the solar panel.

Power-up sequence:

1. Connect the battery to the BAT connector, and make sure the polarity is correct, the negative (-) terminal is on the left (indicated by white cable in the picture below) and the positive (+) terminal is on the right (indicated by brown cable).
2. Connect the solar panel to the SOL labeled connector, make sure the polarity is correct, the negative (-) terminal is on the right (black cable), and the positive (+) terminal is on the left (red cable).

METOS motherboard version 5.3:

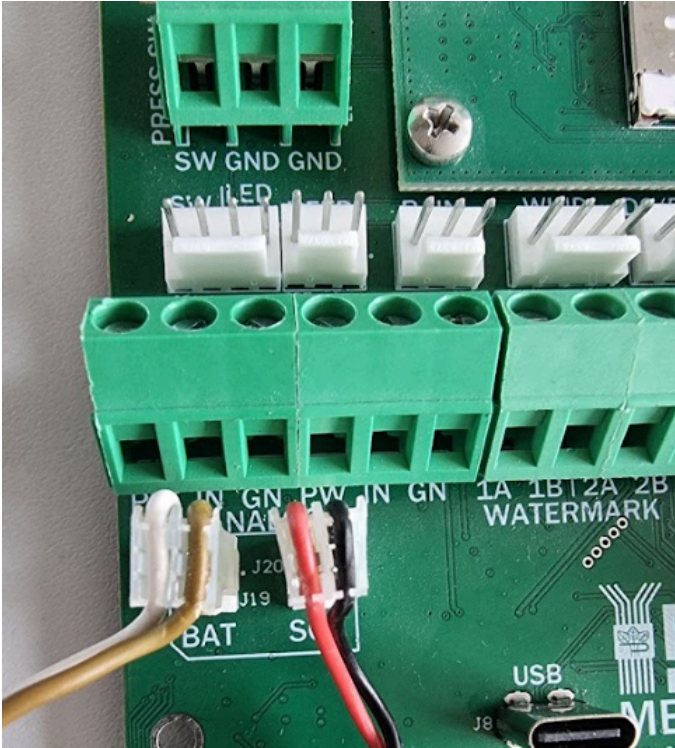
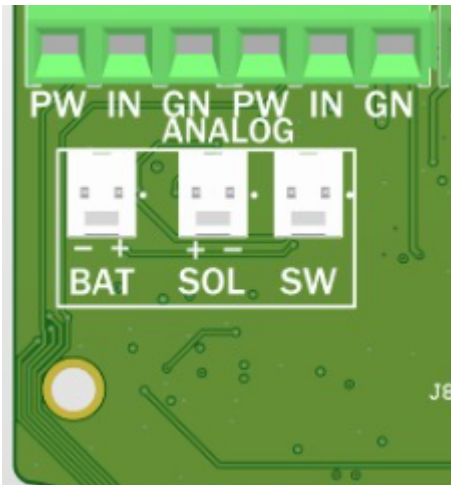


Image shows cables of connected battery (left) and solar panel (right)

METOS motherboard 5.4:



In addition to the BAT and SOL inputs on the METOS 5.3 version, the version METOS 5.4 also uses the standard ON/OFF switch, which needs to be connected to the SW input. Without the switch on ON position, the electronics are not powered with any power supply.

Common color scheme:

Battery cable:

WHITE cable is negative (-), connected to the - battery terminal
 BROWN cable is positive (+), connected to the + battery terminal

Solar panel cable:

RED cable is positive (+)
 BLACK cable is negative (-)

CAUTION: If the wrong power source is connected to the wrong power input on the motherboard or the polarity is reversed, the motherboard can have issues, possibly a burnout. In such a case, the motherboard needs to be replaced.

7.3 METOS 5 Power Requirements

The METOS 5 product operates in three distinct power stages, each determined by specific battery voltage thresholds:

Stage	Minimum voltage	Sensor measurements	Data transmissions	Note
1. Default mode	> 6 V	✓	✓	default (normal) operating mode where the device measures and logs sensors data and transmits the logs to the FieldClimate cloud
2. Measure mode	5.8 V – 6 V	✓	✗	device only measures and logs sensor data. it does not have enough power to execute data transmission
3. Sleep mode	< 5.8 V	✗	✗	device does not have enough power to measure the sensors or to do the data transmissions

METOS 5 automatically handles the various battery voltage thresholds. When the battery voltage is not sufficient, it goes from high to low power mode (1 to 3) and when the battery is sufficiently charged, again, it transitions from low (3) to default (1) power mode.

When the METOS 5 is in Measure mode (2), it stores the measured data in the internal memory. After the station has sufficient power for transmission, it transmits all old stored data from the internal memory to the FieldClimate cloud.

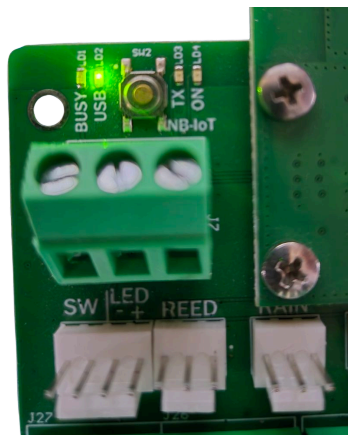
The usual battery voltage with a solar panel ranges between 6.2 to 6.6 V.

8. Connecting the METOS 5 to the PC

Below are the Steps involved in connecting the METOS 5 to the PC:

1. The power (battery and the solar panel) should be connected to the motherboard
2. The type C USB cable should then be connected to the motherboard and USB port of a computer
3. When booting up for the first time, the ON and TX LED lights will turn on briefly, and then the USB LED light also turns on. The busy LED light will also turn on and off intermittently. After successfully booting up, all LED lights except the USB LED shall be on.

After the USB cable is connected, the USB LED status will turn on with a green color.



Picture of the green LED when the USB is connected.



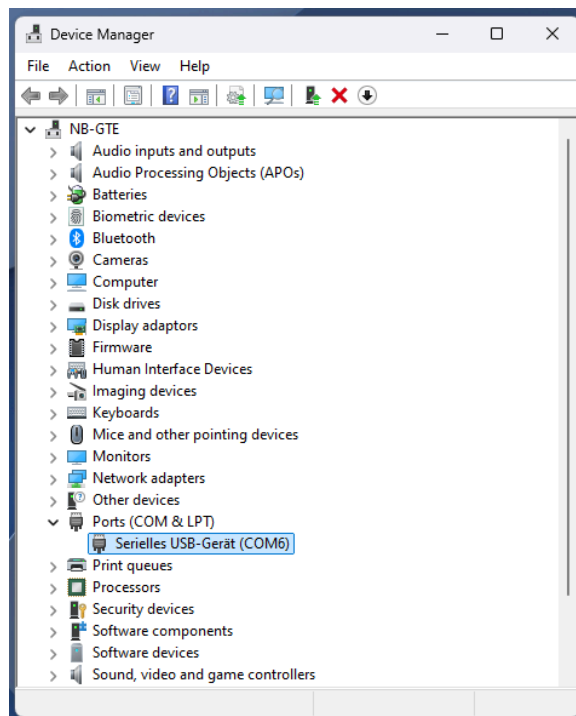
Connected power, inserted SIM card, and connected USB cable.

8.1 Opening the COM port and accessing the main menu via the PI Service Terminal

After the motherboard is connected to the PC, it will automatically recognize the device and install the appropriate USB drivers. If drivers are not recognized, the Windows OS needs to be updated.

Optional step:

One can open up the Device Manager and check which USB COM port is assigned to the METOS5. In this example, we can see the Windows OS assigned COM6 to the device:

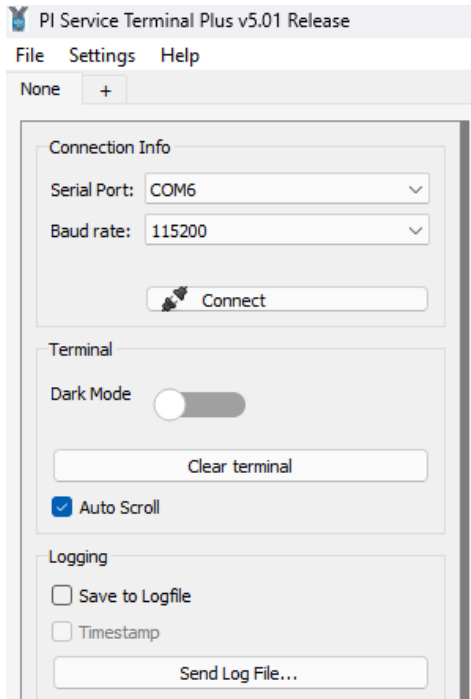


Checking the assigned COM port in the Device manager

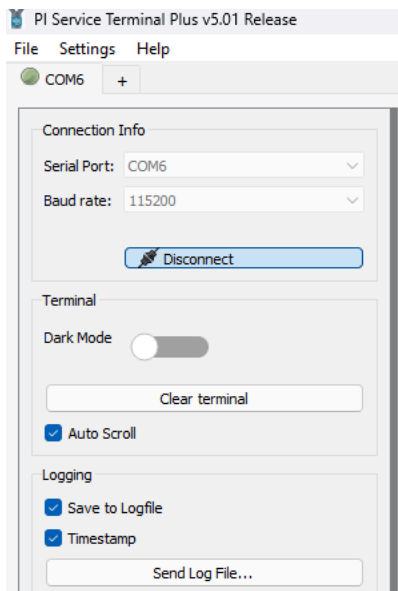
For accessing the settings, and logs... on the METOS 5 weather station, it is recommended to use the PI Service Terminal Plus app. This can be downloaded from here: <https://cloud.metos.at/index.php/s/PYsNGLkHZnRQRtc>

Steps:

1. Run the PI Terminal App after extracting it into a folder. The terminal App shall automatically detect the appropriate COM port.
2. Select Serial and appropriate COM port 6 automatically detected by the PI Service Terminal.



3. Click on the connected button to connect your METOS5 device to the terminal



4. For any debugging, logging, etc. a log file is automatically created when the 'Connect' button is clicked. (This is confirmed by the 'save to Logfile' and 'Timestamp' checkboxes). All the messages that appear in the Terminal shall then be written into the generated log file. The location of the log file is shown on the status bar of the Terminal application.

9. METOS 5 Menus and Configuration

The menu structure is susceptible to slight changes depending on firmware versions. These changes, however, shall have no major effect on the core functionalities of the METOS 5 station. This manual is based on firmware version 1.28.

9.1 Menu Overview

Press key **H** to see the main menu.

```
MAIN MENU:

 1 - Print system info
 2 - Print last raw data of data memory
 3 - Print all raw data of data memory
 4 - Print sensors configuration set
 5 - Sensor testing
 6 - Print all control registers of data memory
 7 - Print DataFlash memory organization
 8 - Make a new sensors configuration set
 9 - Print the list of supported sensors
 A - System setup
 C - Sensor settings
 D - Delete all stored data
 S - SDI12 bridge mode
 L - Print modem info
 P - Setup modem parameters
 M - Modem bridge mode
 T - Test (force) data transmission
 G - Get new GNSS position
 Z - FW Upgrade
```

The main menu gives a general overview of all options available to the user. A number or alphabet ascribed to each menu item can be used to access the appropriate menu using the computer keyboard.

Option 1 - Print system info:

Press key **1** to see the system info.

```

METOS 5 - System info:

Hardware version:      v5.00
Hardware ID:          29-0414
Device ID:            80
Device type:          Metos 5
Firmware version:     v1.28
Firmware revision date: 2024-10-17 12:07:00
Device description:   Metos v5.0 LTEIoT Station
Serial Number:        05014113
Current date and time: 2023-01-01 00:01:42
Status of measurement: running
Next alarm time:      00:05:00
Measure interval [sec.]: 300
Logging interval [sec.]: 900
Transmission int. [sec.]: 1800
Max. number of data pkts: All
GNSS Data:            None
Modem stack version:  v1.20
Modem stack revision date: 2024-03-05 14:40:00
USB stack version:    v1.00
USB stack revision date: 2022-08-17 10:00:00
Bootloader version:   v1.04
Bootloader revision date: 2024-05-15 12:00:00
Bootloader description: BOOT_STM32F103ZG
Press H for help.
  
```

Option 2 - Print the last raw data of data memory

Press key **2** to see the last raw data.

```

Last raw data records from DataFlash memory:

Ord.Nm. RECORD HEADER          RAW SENSOR DATA VALUES
----->
0000001 18 1A 01 2024-11-04 13:15:00 00000000 1915 0000 0000 0000
Press H for help.
  
```

Option 3 - Print all raw data of data memory

Press key **3** to see all raw data.

```

All raw data records from DataFlash memory:

Ord.Nm. RECORD HEADER          RAW SENSOR DATA VALUES
----->
0000001 24 2C 01 2024-10-23 09:15:00 00004801 190F 0000 0000 0002 0888 0885
08BB 01CD 01CB 01D0
0000002 24 45 01 2024-10-23 09:30:00 00000000 1913 0000 0000 0000 088E 0889
0891 01CB 01C5 01D1
0000003 24 0C 01 2024-10-23 09:45:00 00000000 1911 0000 0000 0000 088A 0887
08BD 01D9 01CC 01E2
Press H for help.
  
```

Option 4 - Print sensors configuration set

Press key **4** to see the configuration sensor set.

```
Sensors configuration set:
Chan. S.Code      Full Name      Short  Unit  Size NEG LST SUM AVG MIN MAX TIM USE AXL
-----
  1 0x0007 Battery voltage  BATTR  mV   2    X
  2 0x001E Solar Panel   SOLPN  mV   2    X
 10 0x0005 Wind speed   WNDSP  m/s  2          X      X
Press H for help.
```

Option 5 - Sensor testing

Press key **5** to measure all connected sensors and see sensor data.

```
Sensor testing:
Input S.Code      Full Name Of Sensor  Short  Value  Unit  Notes
-----
BAT   0x0007 Battery voltage  BATTR  6528 mV
SOL   0x001E Solar Panel   SOLPN  6613 mV
WIND  0x0005 Wind speed   WNDSP  0.0 m/s
Note: Press 8 to save a new sensor configuration set.
Done.
Press H for help.
```

Option 6 - Print all control registers of data memory

Press key **6** to see all control registers.

```
Control registers of data memory:
The number of all records = 0
The number of last records = 0
Pointer to initial record = 0
Pointer to starting record = 0
Pointer to next record = 0
Pointer of Memory Ctrl. = 0
Force data saving = false
Size of SD record = 24
Max. number of rec. ptrs = 344994
Max. number of SD rec. = 344992
Number of SD values = 4
Number of 1k records = 0
Press H for help.
```


Option 7 - Print DataFlash memory organization

Press key **7** to see the station data flash (memory) status.

```
DataFlash memory organization:

DataFlash memory size   = 8388608
Record Ctrl Reg. adr.   = 4096
Sensor Config. Set adr. = 4116
Sensor Config. Set size = 1604
SD Record memory adr.   = 8704
SD Record memory size   = 8279904
Events Rec. memory adr. = 8288608
Events Rec. memory size = 100000
SD Record (max. size)   = 784
Press H for help.
```

Option 8 - Make a new sensor configuration set

Press key **8** to detect and store all connected sensors to the motherboard. You need to confirm the new configuration by pressing key Y.

```
Do you really want to make a new sensors configuration set? [Y - Yes / N - No]
New sensors configuration set:
AWS sensor config... (wait a few seconds)... 100% restored!
Done.
Press H for help.
```

Option 9 - Print the list of supported sensors

Press key **9** to print the list of all supported sensors that can be connected to the METOS5 motherboard. Refer to [Appendix D](#) for the detailed list.

Option A - System setup

Press key **A** to enter the system setup menu. Further explained in paragraph 9.2 on page 29.

```
SYSTEM SETUP MENU:  
  
1 - Setup the measure/logging/transmission intervals  -> 300/900/1800 sec.  
2 - Setup the system date and time                   -> 2023-01-01 00:08:08  
3 - Setup the max. number of data logged packets     -> All  
  
Press ESC to return to MAIN MENU.
```

Option C - Sensor settings

Press key **C** for the sensor settings menu. Refer to paragraph 9.3 for a detailed explanation on page 31.

```
SENSOR SETTINGS:  
  
1 - Sensor type on RAIN           -> Rain Gauge  
2 - Sensor resolution on RAIN     -> 0.2 mm  
3 - Sensor type on REED           -> Rain Gauge  
4 - Sensor resolution on REED     -> 0.2 mm  
5 - Sensor type on SENS-1         -> PI-BUS  
6 - Sensor type on SENS-2         -> PI-BUS  
7 - Soil media type               -> Mineral soil  
8 - Pulse length test (on RAIN input)  
  
Press ESC to return to MAIN MENU.
```

Option D - Delete all stored data

Press key **D** for an option to delete all stored data from memory. One is prompted to confirm this irreversible action by pressing key Y or to cancel this action by pressing key N.

```
Do you really want to delete all stored data? [Y - Yes / N - No]  
Done.  
Press H for help.
```

Option S - SDI12 bridge mode

Press key **S** when you want to enter direct bridge mode to the connected SDI12 sensor to execute any manual SDI12 command directly on the sensor.

```
SDI12 interface - Bridge Mode.  
Bridge mode opened (ESC - close):  
Command:
```

Option L - Print modem info

Press key **L** to see modem, SIM card, communication, and server info.

```
LTEIoT module - System info:  
  
Server Remote Address:    80.122.185.10  
Server Remote Port:      44441  
APN name:                 None  
APN login:                None  
APN password:            None  
Registration timeout:     240 sec.  
Operator selection:       Automatic  
Preferred RAT (Network):  AUTO RAT  
  
Modem Manufacturer:      Sierra Wireless  
Modem Model:              HL7802  
Modem SW Version:        HL7802.4.7.1  
Modem Revision ID:       HL7802.4.7.1.0  
Modem Serial Number:     52210231460310  
IMEI:                     359459092884092  
SIM Card ID (ICCID):     SIM not inserted!  
CAT-M1 LTE bands config: Unknown  
NBI-IoT LTE bands config: Unknown  
  
Last connection status:  
  
Signal Strength:          Waiting for next connection...  
Signal Quality:           Waiting for next connection...  
Network type:             None  
Transfer Protocol:        TCP  
Server upload errors:    0/20  
Press H for help.
```

Option P - Setup modem parameters

Press key **P** to set up any modem connectivity parameters. Further explained in [paragraph 10.4](#).

```
SETUP THE MODEM PARAMETERS:

*   DEFAULT REMOTE ADDRESS      -> 80.122.185.10
*   DEFAULT REMOTE PORT        -> 44441
1 - CUSTOM REMOTE ADDRESS      -> None
2 - CUSTOM REMOTE PORT        -> None
3 - APN NAME                   -> None
4 - APN LOGIN                  -> None
5 - APN PASSWORD               -> None
6 - REGISTRATION TIMEOUT       -> 240 sec.
7 - OPERATOR SELECTION         -> Automatic
8 - PREFERRED RAT (NETWORK)    -> AUTO RAT
9 - TRANSFER PROTOCOL          -> TCP
A - Antenna SelectionOnboard Antenna
S - Network scan
D - Set the default parameters
F - Modem FOTA
U - Modem FW Upgrade

Press ESC to return to MAIN MENU.
```

Option M - NBIoT modem bridge mode

Press key **M** to enter direct bridge mode to the HL7802 modem in order to execute any supported AT command directly on the modem.

```
LTEIoT module - Bridge Mode.

LTE IoT module power: ACTIVE
LTE IoT module booting...
LTE IoT module check UART communication... done.

Bridge mode opened (ESC - close):
```

Option T - Test (force) data transmission

Press key **T** to start the communication process. An example of successful communication can be found in Appendix A.

During initial communication (when the station is joining the CatM1 or NBIoT mobile network for the first time), the registration can take up to 4 minutes. The average time necessary for first-time registration is around 1.5 minutes. All next communications are usually done between 2 to 10 seconds.

Option G - Get a new GNSS position

Press key **G** to get a new GPS position. This option enables GNSS and can take up to 3 minutes. See the output in Appendix B.

Option Z - FW Upgrade

Press key **Z** in either PI Service Terminal or PI FW Uploader app manually reset the board into the bootloader mode. This option is mainly used to manually update the firmware of the motherboard.

9.2 System Setup (Sub-Menus of option 'A' from Main Menu)

```
SYSTEM SETUP MENU:

1 - Setup the measure/logging/transmission intervals  -> 300/900/1800 sec.
2 - Setup the system date and time                    -> 2023-01-01 00:22:25
3 - Setup the max. number of data logged packets      -> All

Press ESC to return to MAIN MENU.
```

In this scenario, the METOS 5 is set up to perform sensor measurements every 300 seconds (5 minutes), store the measured data logs in 900 seconds (15 minutes), and it transmit the stored data every 1800 seconds (every 30 minutes).

Option 1 - Setup the measure/logging/transmission intervals

We can change the measurement, logging, and transmission interval values.

In the given example below, we set the measurement interval to 15 minutes, the logging interval to 15 minutes, and the transmission interval to 1 hour.

```
Set up the measure/logging interval:

Enter NEW MEASURE INTERVAL (300 sec.) [in seconds] (from 60 to 43200) = 900

Enter NEW LOGGING INTERVAL (900 sec.) [in seconds] (from 60 to 43200) = 900

Enter NEW TRANSMISSION INTERVAL (1800 sec.) [in seconds] (from 300 to 43200) = 3600

The new intervals changed!
Current status of intervals:
Measure interval [sec.]:      900
Logging interval [sec.]:      900
Transmission interval [sec.]: 3600
Press H for help.
Press ESC to return to MAIN MENU.
```

The same settings can be changed on the weather station configuration page in FieldClimate and they will be transmitted and applied on the station at the next successful transmission.

Warning! These settings have an effect on the battery and transmission data size.

The more frequent the measurements and the transmissions, the more battery power the device will need. The METOS 5 supports very frequent transmissions due to its rechargeable battery.

The same is true for the data transmissions. More frequent measurements and logging intervals will require more data to be transferred to the FieldClimate cloud. Make sure you have a suitable data plan with the SIM card provider.

Option 2 - Setup the system date and time

There is no need to set up the system date and time as the values are synced automatically with each data transmission with FieldClimate cloud.

Option 3 - Set up the max. number of data-logged packets

Use this option when you want to send all logged data packets. It is not needed as the weather station automatically sends all the necessary packets.

```
Set up the max. number of data logged packets:

Current the max. number of packets: All
Do you want to send ALL logged data packets? [Y/N]
New max. number of data packets: All
Done.

Press H for help.
Press ESC to return to MAIN MENU.
```

9.3 Sensors Configuration (Sub-Menus of Option 'C' From Main Menu)

METOS 5 weather station supports defining the connected sensors on the RAIN, REED, SENS-1, and SENS-2 inputs. It is mandatory to select the correct sensors from these menus in order for the station to recognize the sensors correctly, depending on the input the sensor is connected to.

These are the default settings that are used on the METOS 5 station:

```
SENSOR SETTINGS:

1 - Sensor type on RAIN      -> Rain Gauge
2 - Sensor resolution on RAIN -> 0.2 mm
3 - Sensor type on REED     -> Rain Gauge
4 - Sensor resolution on REED -> 0.2 mm
5 - Sensor type on SENS-1   -> PI-BUS
6 - Sensor type on SENS-2   -> PI-BUS
7 - Soil media type        -> Mineral soil
8 - Pulse length test (on RAIN input)

Press ESC to return to MAIN MENU.
```

Option 1 - Sensor type on RAIN

```
Current sensor type on RAIN: Rain Gauge

0 - Rain Gauge
1 - Water Meter (Resettable)
2 - Water Meter (Accumulative)
Select new option: 0

New selected sensor type on RAIN: Rain Gauge
Done.

Press H for help.
Press ESC to return to MAIN MENU.
```

When a water meter sensor is connected to the RAIN input, it is suggested that the 'option 1' Water Meter (Resettable) value is selected.

Option 2 - Sensor resolution on RAIN

```
Current sensor resolution on RAIN: 0.2 mm

0   - 0.1 mm
1   - 0.2 mm
2   - 0.5 mm
Select new option: 1

New selected sensor resolution on RAIN: 0.2 mm
Done.

Press H for help.
Press ESC to return to MAIN MENU.
```

The default rain gauge tipping mechanism detects 0.2mm of rain for every tip. In case you use some other rain gauge sensor, you can select between options 0.1, 0.2, and 0.5 mm of rain for each pulse from the sensor.

Option 3 - Sensor type on REED

Same as option 1 (sensor type on rain input)

Option 4 - Sensor resolution on REED

Same as option 2 (sensor resolution on rain)

Option 5 - Sensor type on SENS-1

```
Current sensor type on SENS-1: PI-BUS

0   - PI-BUS
1   - Decagon/METER EC5
2   - Decagon/METER 10HS
3   - Decagon LEAF WETNESS
4   - METER PHYTOS 31
5   - Decagon MPS1
6   - Decagon MPS2
7   - Decagon MPS6
8   - METER TEROS 12
9   - Decagon/METER 5TE
10  - Decagon/METER 5TM
11  - Decagon/METER GS3
12  - Decagon/METER ES-2 (F)
13  - Decagon/METER GS1
14  - METER CTD-10/HYDROS 21
15  - PI54D
16  - METER TEROS 21
17  - Generic analog voltage
18  - Analog water pressure
19  - Analog tensiometer
20  - Analog irrigation
21  - Analog water level
22  - Analog dendrometer
Select new option: 0

New selected sensor type on SENS-1: PI-BUS
Done.

Press H for help.
Press ESC to return to MAIN MENU.
```

SENS-1 input on the METOS 5 board supports multiple different sensors. In the menu, the user needs to select the appropriate sensor that is connected to the SENS-1 input otherwise the METOS 5 will use the default value of the PIBUS sensor. For instance, if a PI54D sensor is connected but option 15 is not selected (15 – PI54D) for this input, the METOS 5 will not recognize the connected sensor properly and the user will not get any values from this sensor on the FieldClimate platform.

After you insert the desired option press Enter key to confirm the input.

Option 6 - Sensor type on SENS-2

Same as Option 5 – Sensor type on SENS-1 but in this case the setting determines which sensor is connected to the SENS-2 input.

Option 7 - Soil media type

This option is only needed when a soil monitoring sensor is connected to either or both of the SENS-1 and/or SENS-2 inputs.

The default soil media type is set to 0 – Mineral soil as this option is used in the majority of cases. The user can select a different soil media type from this menu.

```
Current soil media type: Mineral soil

0 - Mineral soil
1 - Potting soil
2 - Rockwool soil
3 - Perlite soil
4 - Peat soil
Select new option: 0

New selected soil media type: Mineral soil
Done.

Press H for help.
Press ESC to return to MAIN MENU
```

After the desired option is selected, one needs to press the Enter key to confirm.

Option 8 - Pulse length test (on RAIN input)

This option is to test the pulse length of a rain gauge sensor connected to the RAIN input. Carefully moving the tipping spoon of the rain gauge to the left and right generates the corresponding pulse length measurements. The acceptable minimum pulse length is 35 ms.

```
PULSE LENGTH TESTING ON RAIN INPUT
(ESC - Cancel, Min. pulse length = 35 ms)

Nm = 1      Pulse length = 45 ms   Raw register: 2
Nm = 2      Pulse length = 53 ms   Raw register: 4
Nm = 3      Pulse length = 50 ms   Raw register: 6
Nm = 4      Pulse length = 64 ms   Raw register: 8
Nm = 5      Pulse length = 59 ms   Raw register: 10
```

9.4 Modem Configuration (Sub-Menus of Option 'P' From Main Menu)

```
SETUP THE MODEM PARAMETERS:  
  
*   DEFAULT REMOTE ADDRESS      -> 80.122.185.10  
*   DEFAULT REMOTE PORT        -> 44441  
1 - CUSTOM REMOTE ADDRESS      -> None  
2 - CUSTOM REMOTE PORT        -> None  
3 - APN NAME                   -> None  
4 - APN LOGIN                  -> None  
5 - APN PASSWORD               -> None  
6 - REGISTRATION TIMEOUT       -> 240 sec.  
7 - OPERATOR SELECTION         -> Automatic  
8 - PREFERRED RAT (NETWORK)    -> AUTO RAT  
9 - TRANSFER PROTOCOL          -> TCP  
A - Antenna SelectionOnboard Antenna  
S - Network scan  
D - Set the default parameters  
F - Modem FOTA  
U - Modem FW Upgrade  
  
Press ESC to return to MAIN MENU.
```

There is a default Remote Address (80.122.185.10) and Remote Port (44441) used by the station to send data. These default settings indicated by asterisk (*) can be changed using options 1 and 2 respectively.

Option 1 - CUSTOM REMOTE ADDRESS

Option to enter the new custom remote address that shall be used by the station to send data.

Option 2 - CUSTOM REMOTE PORT

Option to enter a new custom port to be used in data transmission by the station.

Option 3 - APN NAME

When the SIM card requires an APN Name to be set, the user needs to set the appropriate APN value here.

Option 4 - APN LOGIN

When the SIM card requires an APN username to be set, the user needs to set the appropriate APN username value here.

Option 5 – APN PASSWORD

When the SIM card requires an APN password to be set, the user needs to set the appropriate APN password value here.

Option 6 - REGISTRATION TIMEOUT

This is the maximum registration timeout where the weather station is trying to attach to the mobile network. The initial communication usually takes around 1.5 minutes on average but can take up to 4 minutes. All next communications are usually done in between 2 to 10 seconds. Setting the value higher to 240 seconds is not recommended.

Option 7 - OPERATOR SELECTION

```
Current operator selection: Automatic
Do you want to select an operator manually? [Y/N]
Enter new numeric network name (MCC+MNC):
```

When the automatic mode is not sufficient, the user can insert a specific MCC and MNC mobile network operator code. After you enter the MCC and MNC value press Enter to confirm or press Esc to cancel and exit this menu.

Option 8 - PREFERRED RAT (Network)

```
Current preferred RAT (Network): AUTO RAT SELECTION
Select new RAT (Network) or escape [ESC]:
1 - Preferred NB-IoT
2 - Preferred CAT-M1
3 - Preferred 2G/GSM
4 - AUTO RAT SELECTION
5 - Only NB-IoT
6 - Only CAT-M1
7 - Only 2G/GSM
```

Users can select from the seven available Radio Access Technologies (RAT) options to optimize connectivity.

- When a preferred RAT option is selected (Options 1-3), the station will prioritize the selected RAT during network registration. If registration fails using the preferred RAT, the station will automatically attempt to connect with the other remaining available RATs.

- AUTO RAT SELECTION (Option 4): If this option is selected, the station defaults to the NB-IoT for initial network registration. If NB-IoT is unavailable, it will sequentially attempt to connect using other RATs, CAT-M1, and 2G/GSM in that order.
- There is also an option to exclusively select only a particular RAT to use (Options 5-7). In this case, only that RAT shall be used during network registration. If the registration fails, the station shall not attempt any other RATs but will retry with the selected RAT at a later time.

Option 9 - TRANSFER PROTOCOL

```
Current Transfer Protocol: TCP
Select new one or escape [ESC]:
1 - UDP
2 - TCP
```

Users also have the option to select any of the 2 transfer protocols to manage data transmission over the network.

User Data Protocol (UDP) and Transmission Control Protocol (TCP).

TCP provides reliable, ordered, and error-checked data transmission, while UDP prioritizes speed and efficiency by omitting reliability checks.

Option A - Antenna Selection

There is a default onboard antenna to enhance the signal for connectivity. In areas where there are connectivity challenges, an external antenna can be used. In this instance, option 2 should be selected.

```
Current Antenna Selected: Onboard Antenna
Select new one or escape [ESC]:
1 - Onboard Antenna
2 - External Antenna
```

Option S - Network scan

This option scans for all available networks in the area of deployment of the METOS 5 product. It can take up to 2 minutes. This gives the user vital information about available networks that can be used for connectivity.

```
Modem is starting...
LTE IoT module check UART communication... done.
Modem initialization process... done.
Network scan is running (wait up to 2 minutes)... done.
Nm. of found operators: 2
1. operator: Status      -> Network available
             Operator name -> AI
             MCC+MNC     -> 23201
             Access technology -> E-UTRAN
2. operator: Status      -> Unknown network
             Operator name -> Magenta-T-
             MCC+MNC     -> 23203
             Access technology -> E-UTRAN
Modem is turning off... done.

Press H for help.
Press ESC to return to MAIN MENU.
```

Option D - Set the default parameters

This option clears all user input configuration and sets the values back to default mode:

```
Do you want to set the default parameters? [Y - Yes / N - No]
Done.

Press H for help.
Press ESC to return to MAIN MENU.
```

Option F - Modem FOTA

Option to update the modem firmware remotely. Some modes (NBloT) are currently not supported. For further inquiries and clarification, please contact support.

Option U - Modem FW Upgrade

Updating the HL78xx modem with a step-by-step guide in the terminal. Normally, the devices are shipped with updated modem firmware. One should use this option only when instructed by the support team.

```
MODEM FW UPDATE MODE

Modem booting up... waiting
LTE IoT module check UART communication... .. done.
1. Disconnect COM port in Terminal Application.
2. Open the Sierra Updater Application and proceed with the instructions.
   (Select UART port, enter COM port number and baud rate 115200)
3. Wait until the Sierra Updater Application finish the process.
4. The process ends when its request to press ENTER.
5. Once the process is finished reboot the board.
!!! CAUTION: DON'T INTERRUPT FW UPLOADING PROCESS. AN INTERRUPTION CAN CAUSE FW CORRUPTION !!!
```

9.5 METOS 5 Communication Check

Option L – Print NBIoT info in the main menu will show you all communication parameters used for connectivity and it will print out the modem info and SIM card info.

```
LTEIoT module - System info:

Server Remote Address: 80.122.185.10
Server Remote Port: 44441
APN name: None
APN login: None
APN password: None
Registration timeout: 240 sec.
Operator selection: Automatic
Preferred RAT (Network): NB-IoT

Modem Manufacturer: Sierra Wireless
Modem Model: HL7802
Modem SW Version: HL7802.4.7.1
Modem Revision ID: HL7802.4.7.1.0
Modem Serial Number: 52210231460310
IMEI: 359459092884092
SIM Card ID (ICCID): 89882806660010805192
IMSI: 901405101080519
SIM MCC: 901
SIM MNC: 40
CAT-M1 LTE bands config: 0000000000000A0A188E -> LTE Bands: 2, 3, 4, 8, 12, 13, 18, 20, 26, 28
NBI-IoT LTE bands config: 0000000000000080084 -> LTE Bands: 3, 8, 20

Last connection status:

Signal Strength: 42 %
Signal Quality: 86 %
Network type: roaming
Network name: 1nce.net
Current MCC: 232
Current MNC: 03
Current RAT: NB-IoT
Active LTE Band: 8
Registration time: 1 sec.
Transfer Protocol: TCP
Server upload errors: 0/20
Press H for help.
```

The last connection status tells us the signal strength (42%) of the NBIoT (Radio Access Technology: NB1) connectivity, that the sim card is in the roaming network, it uses a network with the name “1nce.net” and it took 1 second for the last registration time to the network.

An example of a full successful communication is in Appendix A: Example of successful communication.

An example of failed communication is in Appendix C.

10. Supported Sensors

A list of supported sensors can be found in [Appendix D](#) of this document.

Option 9 - PRINT THE LIST OF SUPPORTED SENSORS (Option from Main menu)

Alternatively, one can connect the METOS 5 to a computer and access the menu of the list of supported sensors by using option 9.

MAIN MENU:

```

1 - Print system info
2 - Print last raw data of data memory
3 - Print all raw data of data memory
4 - Print sensors configuration set
5 - Sensor testing
6 - Print all control registers of data memory
7 - Print DataFlash memory organization
8 - Make a new sensors configuration set
9 - Print the list of supported sensors
A - System setup
C - Sensor settings
D - Delete all stored data
S - SDI12 bridge mode
L - Print modem info
P - Setup modem parameters
M - Modem bridge mode
T - Test (force) data transmission
G - Get new GNSS position
Z - FW Upgrade

```

The list of supported sensors:

Nm.	S.Code	Group	Full Name	Short	Unit	Size	NEG	LST	SUM	AVG	MIN	MAX	TIM	USE	AXL
1	0x0000	0x01	Air temperature	AIRTM	C	2	X			X	X	X			
2	0x0010	0x03	Soil temperature	SOILT	C	2	X			X	X	X			

This option shall populate the list of all supported sensors on the terminal.

11. METOS 5 Firmware

The latest production firmware for the METOS 5 can be found here:

<https://support.metos.at/en/support/solutions/articles/15000018473-latest-firmware-fw-all-stations>

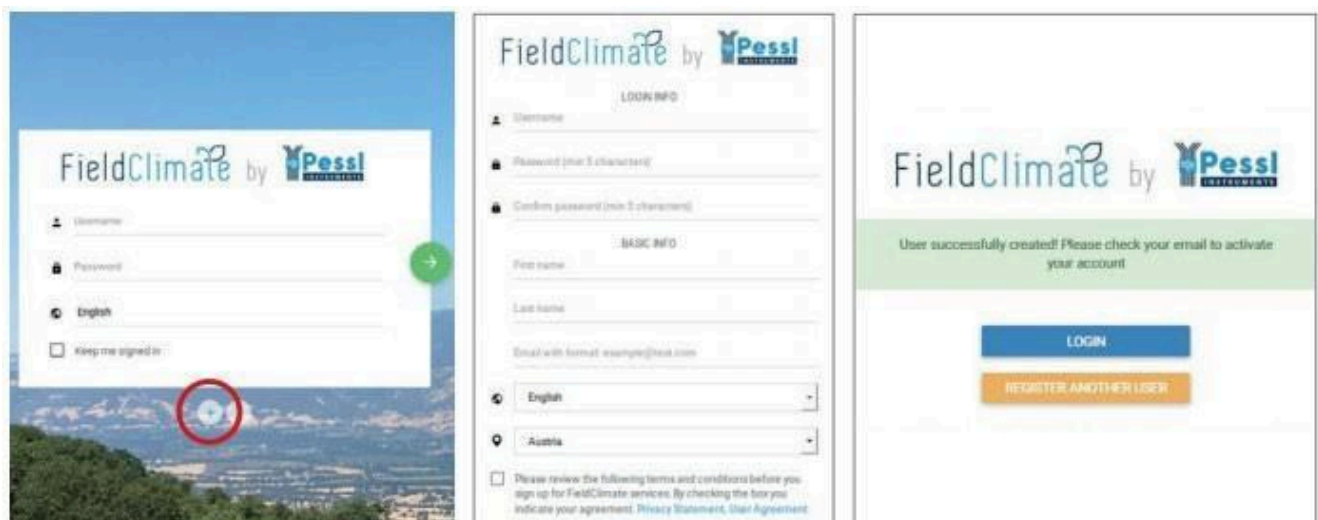
This link is always synchronized with the latest official stable released firmware versions. Users are thereby strongly advised to always use the latest when flashing new firmware onto the METOS 5 motherboard.

12. FieldClimate

12.1. Register on the FieldClimate

To start using services provided by Pessl Instrument, one needs to register the device on the FieldClimate platform, which grants one access to the data in graphs and tables. FieldClimate also provides a powerful decision support system for growing one's crops (plant protection, irrigation, sowing, harvesting, fertilizing).

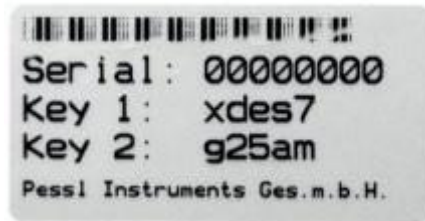
Register as a new user at <http://fieldclimate.com/>



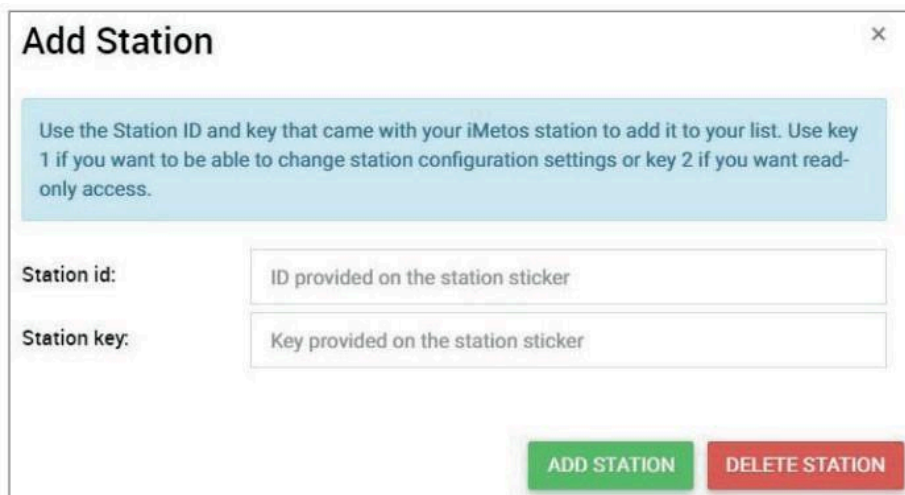
1. Go to ng.fieldclimate.com/ and click the button **+**.
2. Insert your personal data & e-mail.
3. Check your e-mail and click on the link to activate the user account you created.

12.2. Add your METOS 5 device to your FieldClimate profile

Now you can log in to FieldClimate.com. To add your METOS 5 device, click on the icon on the top right corner User Menu > Add/Remove station. It will ask you for the Station Serial number (SN) and the station key. Now the silver sticker (in the figure) that came with your METOS 5 has to be used. Key 1 gives you full (admin) access and enables you to change all the settings and set up the METOS 5. With Key 2 the user is not allowed to change the station parameters but can access all the data.



Example of the label on the METOS 5 device



Add Station ×

Use the Station ID and key that came with your iMetos station to add it to your list. Use key 1 if you want to be able to change station configuration settings or key 2 if you want read-only access.

Station id:

Station key:

ADD STATION **DELETE STATION**

Screenshot of adding the device to your FieldClimate account

13. FieldClimate API

All the data that is available on the FieldClimate platform can be retrieved automatically via our FieldClimate API system. The latest documentation is here: <https://api.fieldclimate.com/v2/docs>.

14. FAQ

14.1. Modem responses for joining the mobile network

When the METOS5 tries to join the mobile network, it responds with one of these responses:

<stat>	Indicates the EPS registration status
0	Not registered; MT is currently not searching for an operator to register to
1	Registered, home network
2	Not registered but MT is currently trying to attach or searching for an operator to register to
3	Registration denied
4	Unknown (e.g. out of E-UTRAN coverage)
5	Registered, roaming
6	Registered for "SMS only", home network (not applicable)
7	Registered for "SMS only", roaming (not applicable)
8	Attached for emergency bearer services only
9	Registered for "CSFB not preferred", home network (not applicable)
10	Registered for "CSFB not preferred", roaming (not applicable)

Example 1:

```
AT+CEREG?
```

```
+CEREG: 0,3 OK
```

This means the station registration to the mobile network is denied. In this case, check the APN settings.

Example 2:

```
AT+CEREG?
```

```
+CEREG: 0,2 OK
```

This means the station is trying to find a network to register to.

Example 3:

AT+CEREG?

+CEREG: 0,1 OK

The station successfully joined the home mobile network.

Example 4:

AT+CEREG?

+CEREG: 0,5 OK

The station successfully joined the roaming mobile network.

14.2. No SIM Card Detected

Check if the SIM card is inserted properly in the SIM card holder and if the holder is locked in the position. Unlocked holders or damaged (bent) pivots can lead to bad SIM card contact with the motherboard and the communication will fail.

15. Support

For all support questions, please send an email to support@metos.at or contact your local key account manager or distributor.

When contacting support, it is very helpful that you provide us with your description of the issue and the log from the PI Service Terminal which includes output from the Main menu options:

- 1 - Print system info
- 2 - Print the last raw data of data memory
- 3 - Print all raw data of data memory
- 4 - Print sensors configuration set
- 5 - Sensor testing
- 6 - Print all control registers of data memory
- 7 - Print DataFlash memory
- C - Sensor settings
- L - Print NBloT info
- P - Setup NBloT module parameters
- T - Test (force) data transmission

When remote support is needed, we can provide it via the TeamViewer app or Google Meet. In this case, you need to connect the station to the PC and have working access to the PI Service Terminal main menu.

Appendix A: Example of a Successful Communication

SENSOR DATA TRANSMISSION.	OK
LTE IoT module power: ACTIVE	
LTE IoT module booting...	AT+WDSI?
LTE IoT module check UART communication... done.	+WDSI: 0
AT	OK
OK	
ATE0	AT+IFC=2,2
OK	OK
AT+CFUN=1	ATS2=255
OK	OK
AT+CFUN?	ATI0
+CFUN: 1	HL7802
OK	OK
AT+KGPIOCFG=6,0,2	ATI8
OK	HL7802.4.7.1
	OK
AT+KGPIOCFG=14,0,2	ATI3
OK	HL7802.4.7.1.0
	OK
AT+KGPIO=6,1	AT+CGMI
OK	Sierra Wireless
	OK
AT+KGPIO=14,0	
OK	
<<< Onboard Antenna Enabled. >>>	AT+GSN
	359459092884092
	OK
AT+KSIMSEL?	
+KSIMSEL: 0,,1	
	AT+KGSN=3

+KGSN: 52210231460310

OK

AT+CCID

+CCID: 89882806660010805192

OK

AT+CIMI

901405101080519

OK

AT+KBNDCFG?

+KBNDCFG: 0,0000000000000A0A188E

+KBNDCFG: 1,0000000000000080084

+KBNDCFG: 2,0

OK

AT+KSELACQ?

+KSELACQ: 2,3,1

OK

<<< NB-IoT network selected >>>

AT+CGDCONT?

+CGDCONT: 1,"IP",,,0,0,0,0,0,,0,,,,,

+CGDCONT: 2,"IPV4V6",,,0,0,0,0,0,,0,,,,,

OK

AT+COPS?

+COPS: 0,0,"lnce.net",9

OK

AT+CEREG?

+CEREG: 0,5

OK

AT+CREG?

+CREG: 0,5

OK

<<< Registered in 1 second, roaming >>>

AT+KSRAT?

+KSRAT: 1

OK

<<< Current RAT mode: NB-IoT >>>

AT+CESQ

+CESQ: 99,99,255,255,29,40

OK

AT+COPS?

+COPS: 0,0,"lnce.net",9

OK

AT+COPS=3,2,"0"

OK

AT+COPS?

+COPS: 0,2,"23203",9

OK

AT+KBND?

+KBND: 1,00000000000000000080

OK

AT+CGDCONT?

+CGDCONT: 1,"IP",,,0,0,0,0,0,,0,,,,,

+CGDCONT: 2,"IPV4V6",,,0,0,0,0,0,,0,,,,,

OK

<pre> AT+CGPADDR=1 +CGPADDR: 1,"100.104.239.4" OK AT+KCNXCFG=1,"GPRS","" OK AT+KCNXUP=1 OK +KCNX_IND: 1,1,0 <<< Connected >>> AT+KTCPCFG=1,0,"80.122.185.10",44441,,0,1 +KTCPCFG: 1 OK AT+KTCPCNX=1 ERROR AT+KTCPCNX=1 OK +KTCP_IND: 1,1 <<< TCP session is set up and ready for operation >>> <<< UPLOAD PROCESS - TCP >>> <<< Payload limit = 4200 >>> AT+KTCPSND=1,484 CONNECT JKUBAwABE0EBBVAAfQBAoAABCotVgUkEBcABxIQBR ExbmNlLm51dAASAQAUAQAAABWgQwUAFgEe6AAfAwAi ASkIDTMlOTQ1OTA5Mjg4NDA5MgAqJBA1ADAQKyQQJQ AwEAOB251AAdOb251AAhOb251AAkBCkhMNzgwMgAL SEw3ODAyLjQuNy4xAAxITDc4MDIuNC43LjEuMAAOOD </pre>	<pre> 4MDY2NjAwMTA4MDUxOTIADzkWMTQwNTEwMTA4MDUxO QATaAAAXAAAAABgsARmEAxoIBxvwABw1MjIxMDIzMTQ 2MDMxMAAdMjktMDQxNAAGhQMhKAAjqBYkcBclACZTa WVycmEgV2lyZWxlclc3MAJzAwMDAwMDAwMDAwMDBBMEE xOdHfACgWMDAwMDAwMDAwMDAwMDA4MDA4NAAsAQ== CmYCAwEBE0EBBVAAJBA1ADAQEQAaaAcAAZsZHgAC6B kFAAoBAAEA --EOF--Pattern-- OK +KTCP_DATA: 1,48 +KTCP_ACK: 1,484,484 <<< Received data from server: 48 >>> AT+KTCPCRV=1,48 CONNECT O+cCAAETQQEFASQQJSYwEAWEAwIsAQMIbWbWAAiAAC AkEBA---EOF--Pattern-- OK <<< RESPONSE OK (SETTING PACKET) >>> <<< CHECK FOR NEW FIRMWARE AVAILABLE >>> Invalid Firmware Revision! <<< CLOSING MODE >>> AT+KTCPCLOSE=1,1 OK AT+KTCPDEL=1 OK AT+KCNXDOWN=1,1 OK +KCNX_IND: 1,3 </pre>
---	--

k4ODI

<<< Closed >>>

<<< Module Power OFF process >>>

AT

OK

AT+CPOF

OK

LTE IoT module power: SLEEP

NEW REMOTE SETTINGS FROM SERVER RESPONSE

Measure interval: 5 min. (accepted)

Logging interval: 15 min. (accepted)

Transmission interval: 30 min. (accepted)

Network registration timeout: 240 sec.
(accepted)

New timestamp: 2024-10-25 10:30:26
(accepted)

RTC upgraded.

Done.

End of AWS EVENT: 2024-10-25 10:30:26

SENSOR MEASUREMENT.

Done.

End of AWS EVENT: 2024-10-25 10:35:01

Appendix B: Example of a Failed Getting GPS Position

<pre> GET NEW GNSS DATA. LTE IoT module power: ACTIVE LTE IoT module booting... LTE IoT module check UART communication... done. AT OK AT+CFUN=0 OK AT+CFUN? +CFUN: 0 OK AT+GNSSNMEA=0,1000,0,3 OK AT+GNSSSTART=0 OK +GNSSEV: 0,1 +GNSSEV: 1,1 GNSS Enabled. +GNSSEV: 3,0 The Searching of a GNSS position is starting and takes time up to 3 minutes (ESC - stop). The Searching is in process. AT+GNSSNMEA=4 CONNECT PGSA,A,1,,,,,,,,,,,,,*1E \$PSGSA,1,,,,,,,,,,,,,0,,,,,0,00,3,0,B,, 0,0,0,0,0,0,0,0,0,0,0*0A \$GPGGA,000306.00,,,,,0,00,,,,,*4D \$GPGSA,A,1,,,,,,,,,,,,,*1E </pre>	<pre> \$PSGSA,1,,,,,,,,,,,,,0,,,,,0,00,3,0,B,, 0,0,0,0,0,0,0,0,0,0,0*0A OK Timeout! GNSS module has not received any valid data! <<< CLOSING MODE >>> AT+GNSSSTOP OK +GNSSEV: 2,1 GNSS Disabled. AT+CFUN=1 OK AT+CFUN? +CFUN: 1 OK Done. <<< Module Power OFF process >>> AT OK AT+CPOF OK LTE IoT module power: SLEEP Press H for help. </pre>
--	--

Appendix C: Example of an Unsuccessful Communication

<pre> FORCED DATA TRANSMISSION SENSOR MEASUREMENT. Cancelled (Not valid timestamp). SENSOR DATA LOGGING. Cancelled (Not valid timestamp). LTE IoT module power: ACTIVE LTE IoT module booting... LTE IoT module check UART communication... done. AT OK ATE0 OK AT+CFUN=1 OK AT+CFUN? +CFUN: 1 OK AT+KGPIOCFG=6,0,2 OK AT+KGPIOCFG=14,0,2 OK AT+KGPIO=6,1 OK AT+KGPIO=14,0 OK </pre>	<pre> <<< Onboard Antenna Enabled. >>> AT+KSIMSEL? +KSIMSEL: 0,,1 OK AT+WDSI? +WDSI: 0 OK AT+IFC=2,2 OK ATS2=255 OK ATIO HL7802 OK ATI8 HL7802.4.7.1 OK ATI3 HL7802.4.7.1.0 OK AT+CGMI Sierra Wireless OK AT+GSN </pre>
--	--

359459092884092	AT+COPS?
OK	+COPS: 0
	OK
AT+KGSN=3	AT+CEREG?
+KGSN: 52210231460310	+CEREG: 0,2
OK	OK
AT+CCID	AT+CREG?
+CCID: 89882806660010805192	+CREG: 0,0
OK	OK
AT+CIMI	AT+CEREG?
901405101080519	+CEREG: 0,2
OK	OK
AT+KBNDCFG?	AT+CEREG?
+KBNDCFG: 0,0000000000000A0A188E	+CEREG: 0,0
+KBNDCFG: 1,0000000000000080084	OK
+KBNDCFG: 2,0	AT+CEREG?
OK	+CEREG: 0,2
AT+KSELACQ?	OK
ERROR	AT+CEREG?
	+CEREG: 0,0
AT+KSELACQ?	OK
+KSELACQ: 1,3,2	AT+CEREG?
OK	+CEREG: 0,2
	OK
<<< CAT-M1 network selected >>>	AT+CEREG?
	+CEREG: 0,2
AT+CGDCONT?	OK
+CGDCONT: 1,"IP",,,0,0,0,0,0,,0,,,,,	AT+CEREG?
+CGDCONT: 2,"IPV4V6",,,0,0,0,0,0,,0,,,,,	+CEREG: 0,0
OK	OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,0
OK

<<< Registration failure ! >>>

<<< Module Power OFF process >>>

AT

OK

AT+CPOF

OK

LTE IoT module power: SLEEP

ERROR: LTEIoT communication failure!

Press H for help.

Appendix D: List of Supported Sensors

The list of supported sensors:

Nm.	S.Code	Group	Full Name	Short	Unit	Size	NEG	LST	SUM	AVG	MIN	MAX	TIM	USE	AXL
1	0x0000	0x01	Air temperature	AIRTM	C	2	X			X	X	X			
2	0x0010	0x03	Soil temperature	SOILT	C	2	X			X	X	X			
3	0x0300	0x05	Precipitation	PRECP	mm	2		X							
4	0x0004	0x0C	Leaf Wetness	LEAFW	Min	1								X	
5	0x0007	0x07	Battery voltage	BATTR	mV	2		X							
6	0x001E	0x2F	Solar Panel	SOLPN	mV	2		X							
7	0x002C	0x28	Water meter 1dL - Diff.	WMTRC	DL	4			X						
8	0x0005	0x06	Wind speed	WNDSP	m/s	2				X		X			
9	0x01FA	0x01	HC Air temperature	HC-TM	C	2	X			X	X	X			
10	0x01FB	0x02	HC Relative humidity	HC-RH	%	2				X	X	X			
11	0x0258	0x04	Solar radiation	SOLAR	W/m2	2				X					
12	0x007B	0x0B	Watermark	WMARK	cBar	1				X					
13	0x8703	0x19	EC-5 Water content	EC5	%	2	X			X					
14	0x5F01	0x19	10HS Water content	10HS	%	2	X			X					
15	0x5E07	0x0C	Decagon Leaf Wetness	DLWET	Min	2								X	
16	0x8732	0x2A	MPS-1 Water potential	MPSWP	kPa	2				X					
17	0x8781	0x19	GS1 Water content	GS1WC	%	2	X			X					
18	0x8741	0x2A	MPS-2 Water potential	MPSWP	kPa	2				X					
19	0x8742	0x03	MPS-2 Soil temperature	MPST	C	2	X			X	X	X			
20	0x8743	0x2A	MPS-6 Water potential	MPSWP	kPa	2				X					
21	0x8744	0x03	MPS-6 Soil temperature	MPST	C	2	X			X	X	X			
22	0x7811	0x2C	5TE Diel permittivity	5TED	-	2				X					
23	0x7812	0x2B	5TE El conductivity	5TEEC	mS/m	2				X					
24	0x7813	0x19	5TE Water content	5TEWC	%	2	X			X					
25	0x7814	0x03	5TE Soil temperature	5TET	C	2	X			X	X	X			
26	0x8762	0x2C	5TM/PI54D Diel permittivity	5TMD	-	2				X					
27	0x8764	0x19	5TM/PI54D Water content	5TMWC	%	2	X			X					
28	0x8765	0x03	5TM/PI54D Soil temperature	5TMT	C	2	X			X	X	X			
29	0x8773	0x2C	GS3 Diel permittivity	GS3D	-	2				X					
30	0x8774	0x2B	GS3 El conductivity	GS3EC	mS/m	2				X					
31	0x8775	0x19	GS3 Water content	GS3WC	%	2	X			X					

32	0x8772	0x03 GS3 Soil temperature	GS3T	C	2	X		X	X	X
33	0x6201	0x1C Water depth	DEPTH	mm	2			X	X	X
34	0x6202	0x0F Water temperature	WTEMP	C	2	X		X	X	X
35	0x602A	0x28 Water meter 1dL - Inc.	WMTRC	DL	4		X			
36	0x7201	0x0B Tensiometer	TENSM	mBar	2	X		X	X	X
37	0x41FF	0x0A Air pressure	AIRP	mBar	2			X	X	X
38	0x8411	0x3D Serial Number	SN	-	4		X			
39	0x4E01	0x19 Soil Moisture	SOILM	%	2			X		
40	0x4F04	0x21 Soil Salinity	SOILS	VIC	4			X		
41	0x6501	0x19 Aquacheck Soil Moisture	SOILM	%	2			X		
42	0x4301	0x03 Soil Temperature	SOILT	C	2	X		X	X	X
43	0x7301	0x0C Pressure switch	PRESS	min	1					X
44	0x6511	0x19 Dacom Soil Moisture	SOILM	%	2			X		
45	0x8001	0x31 PH	PH	-	2			X		
46	0x8002	0x2B Conductivity	COND	mS/m	4			X		
47	0x5D01	0x04 Active radiation (PAR)	PARQ	uMol/m2/s	2			X	X	X
48	0x4811	0x0A Air pressure	AIRP	mBar	4			X	X	X
49	0x4008	0x10 US Wind direction	WNDDR	Deg	2					X
50	0x4007	0x06 US Wind speed	WNDSF	m/s	2			X		X
51	0x4009	0x42 US Wind gust	WNDSG	m/s	2					X
52	0x01F1	0x01 HYT Air temperature	AIRTH	C	2	X		X	X	X
53	0x0301	0x02 HYT Relative humidity	RELHH	%	2			X	X	X
54	0x6301	0x28 Ext. water meter 1L - Inc.	WMCNT	L	4		X			
55	0x7210	0x0B Tensiometer	TENSM	mBar	2			X	X	X
56	0x8A01	0x0E IR Leaf Temperature	IRTMP	C	2	X		X	X	X
57	0x87B9	0x2B ES2 El. conductivity	ES2EC	mS/m	2			X		
58	0x87B8	0x0F ES2 Water temperature	ES2T	C	2	X		X	X	X
59	0x8779	0x2C TERSO-12 Diel permittivity	T12D	-	2			X		
60	0x877A	0x2B TERSO-12 El conductivity	T12EC	mS/m	2			X		
61	0x877B	0x19 TERSO-12 Water content	T12WC	%	2	X		X		
62	0x8778	0x03 TERSO-12 Soil temperature	T12T	C	2	X		X	X	X
63	0x8880	0x19 EnviroPro Soil Moisture	SOILM	%	2			X		
64	0x8881	0x2B EnviroPro Soil EC (Salinity)	SOILS	dS/m	2			X		
65	0x8882	0x03 EnviroPro Soil Temperature	SOILT	C	2	X		X	X	X
66	0x8860	0x19 Green Shield Soil Moisture	SOILM	%	2			X		
67	0x8861	0x03 Green Shield Soil Temperature	SOILT	C	2	X		X	X	X
68	0x4503	0x01 Asparagus Air Temperature	AIRTM	C	2	X		X	X	X
69	0x4504	0x03 Asparagus Soil Temperature	SOILT	C	2	X		X	X	X

70	0x87B3	0x1C CTD-10 Water depth	DEPTH	mm	2		X	X	X
71	0x87B2	0x2B CTD-10 El. Conductivity	COND	mS/m	4		X		
72	0x87B1	0x0F CTD-10 Water temperature	WTEMP	C	2	X	X	X	X
73	0x87D1	0x2A TEROS-21 Water potential	T21WP	kPa	2		X		
74	0x87D2	0x03 TEROS-21 Soil temperature	T21T	C	2	X	X	X	X
75	0x4501	0x03 Soil temperature	SOILT	C	2	X	X	X	X
76	0x9302	0x01 Air temperature PT1000	AIRTM	C	2	X	X	X	X
77	0x9303	0x08 Wet bulb temperature PT1000	WETBT	C	2	X	X	X	X
78	0x9304	0x09 Dry bulb temperature PT1000	DRYBT	C	2	X	X	X	X
79	0x9305	0x03 Soil temperature PT1000	SOILT	C	2	X	X	X	X
80	0x9306	0x0E Leaf temperature PT1000	LEAFT	C	2	X	X	X	X
81	0x9307	0x01 Black body temperature PT1000	BODYT	C	2	X	X	X	X
82	0x4901	0x1B Water pressure	WPRES	mBar	2		X	X	X
83	0x0091	0x4B Sunshine duration	SUNDR	Min	2				X
84	0x9801	0x45 Generic analog voltage	GAVOL	mV	4		X	X	X
85	0x4902	0x1B Analog water pressure	AWPRE	mBar	4	X	X	X	X
86	0x8890	0x19 PI-Profile Soil Moisture	SOILM	%	2		X		
87	0x8891	0x03 PI-Profile Soil Temperature	SOILT	C	2	X	X		
88	0x8892	0x4D PI-Profile Skin Temperature	SOSKT	C	2	X	X		
89	0x4903	0x0B Analog tensiometer	ATENS	cBar	2	X	X	X	X
90	0x4904	0x4E Analog irrigation	AIRRI	Bar	2	X	X	X	X
91	0x4905	0x1C Analog water level	AWLVL	cm	4	X	X	X	X
92	0x9901	0x4F SEN5x mass conc. of PM1.0	PM1_0	ug/m3	2		X	X	X
93	0x9902	0x4F SEN5x mass conc. of PM2.5	PM2_5	ug/m3	2		X	X	X
94	0x9903	0x4F SEN5x mass conc. of PM4	PM4	ug/m3	2		X	X	X
95	0x9904	0x4F SEN5x mass conc. of PM10	PM10	ug/m3	2		X	X	X
96	0x9905	0x02 SEN5x ambient rel. humidity	S5RH	%	2		X	X	X
97	0x9906	0x01 SEN5x ambient temperature	S5TM	C	2	X	X	X	X
98	0x9907	0x48 SEN5x VOC index	S5VOC	ppm	2		X	X	X
99	0x9908	0x48 SEN5x NOx index	S5NOX	ppm	2		X	X	X
100	0x8406	0x07 Sensor board battery voltage	SBATT	mV	2	X			
101	0x8407	0x2F Sensor board solar panel	SSOLP	mV	2	X			
102	0x4111	0x0B FloraPulse Tensiometer	FLPUT	Bar	2	X	X	X	X
103	0x8101	0x30 Dendrometer	DENDR	mm	2		X	X	X
104	0x6001	0x28 Water meter	WM10L	L	4	X			
105	0x6011	0x28 Water meter 0.1L	WM01L	L	4	X			
106	0x6302	0x07 Water meter battery	WMBAT	mV	2	X			
107	0x88A0	0x19 HydraScout Soil Moisture	SOILM	%	2		X		

108	0x88A1	0x03	HydraScout Soil Temperature	SOILT	C	2	X		X	X	X
109	0x400A	0x3D	US Wind speed - HW version	WNDHW	-	2		X			
110	0x400B	0x3D	US Wind speed - FW version	WNDFW	-	2		X			
111	0x400C	0x3D	US Wind speed - 32b ID (LSB)	WIDLs	-	4		X			
112	0x400D	0x3D	US Wind speed - 32b ID (MID)	WIDMI	-	4		X			
113	0x400E	0x3D	US Wind speed - 32b ID (MSB)	WIDMS	-	4		X			
114	0x4906	0x30	Analog dendrometer	ADIAM	mm	2			X	X	X
115	0x4C03	0x1E	Weight scale, high resolution	SCALE	g	4		X			
116	0x88B0	0x0F	NTU - Temperature	NTUTM	C	2	X		X	X	X
117	0x88B1	0x50	NTU - Nephelometric turbidity	NTUNT	NTU	4			X	X	X
118	0x88B2	0x50	NTU - TU turbidity	NTUTU	mg/L	4			X	X	X
119	0x9A01	0x51	Relative dissolved oxygen	RELDO	%	2			X		
120	0x9A02	0x0F	Temperature of DO sensor	DOTEM	C	2	X		X		
121	0x0036	0x41	Rain/reed pulse count	RRCNT	-	4			X		
122	0x0037	0x23	Rain/reed average pulse length	RRAVG	ms	4			X	X	X
123	0x0038	0x23	Rain/reed max pulse length	RRMAX	ms	4					X
124	0x0039	0x23	Rain/reed min pulse length	RRMIN	ms	4				X	
125	0x8412	0x3D	Sensor Model ID	SENSM	-	2		X			
126	0x8413	0x3D	Sensor FW Version	SENSV	-	2		X			

Press H for help.




List of supported sensors can change in different firmware versions. It is recommended to check the supported sensors directly via the terminal menu on the weather station.

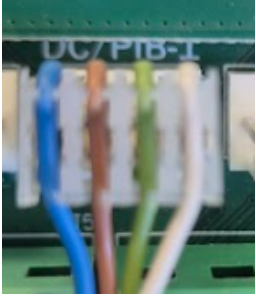




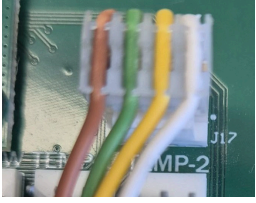
Appendix E: How to Connect Various Sensors to Various


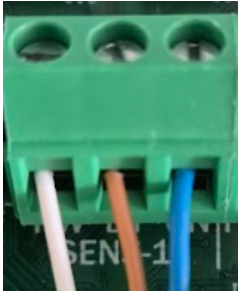
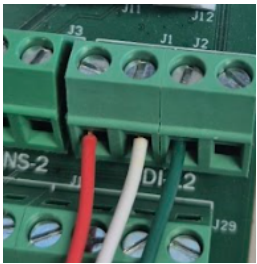
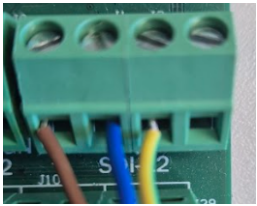
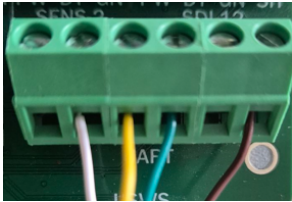
Inputs

The table below gives guidelines on how and where to connect some of the main sensors on the METOS 5 inputs. For detailed information on all the various sensors and the corresponding inputs contact our support.

NOTE: For the Rain input, one should pay attention to how the 4-pin rain sensor is connected to the RAIN input on the motherboard. Refer to the appropriate picture below.

Input / Label on the METOS 5 motherboard	Sensor	Optical Display
PRESS SW	Pressure Switch	
REED	Water meter counter sensors	
RAIN	Rain gauge	
WIND	Mechanical Wind Speed	

DC/PIB-1	Pyranometer	
HC2	Hygroclip	
LEAF	Leaf Wetness	
TEMP-1	Air Temperature	
TEMP-2	Soil Temperature	
I2C Ext	PI Air temp & Hum. sensor	
ANALOG 1&2	*currently not in use	

Watermark 1&2	Watermark	
SENS-1 or SENS-2	PI54D (29-0717)	
SDI-12	Sentek	
	PI Profile	
UART	Ultrasonic Wind	
USWS	Ultrasonic Wind	