# METOS 5

## *Extended Manual*

Pessl Instruments GmbH

Version 2.3, 11-2025

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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 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 users 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 uses a mobile network for transmission of 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.

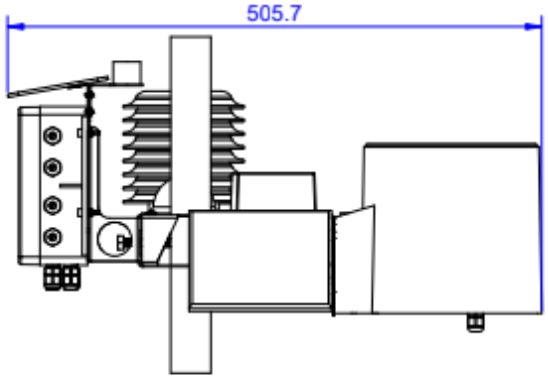
# 5. Technical Overview

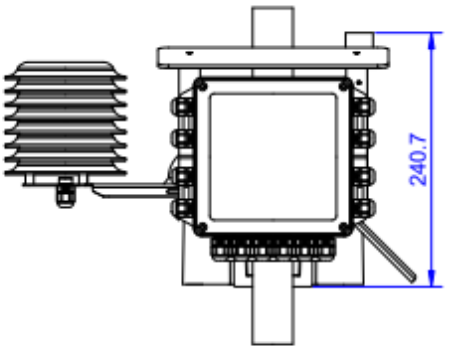
**Technical Specifications:**

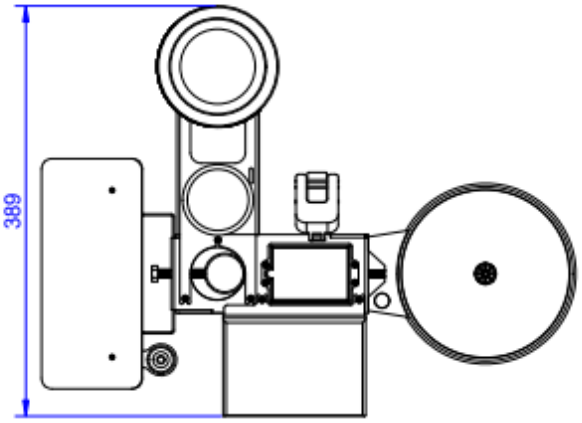
| | |
|---|---|
| Housing | ABS (Protection class IP67) |
| Connectivity | various, depending on the communication board |
| Battery | 6V 4.5A/20HR charging battery |
| Solar panel | 1.5 Watt solar panel |
| Dimensions (with rain gauge) | 50.6 cm L x 38.9 cm W x 22.6 cm H |
| Weight (with rain gauge)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

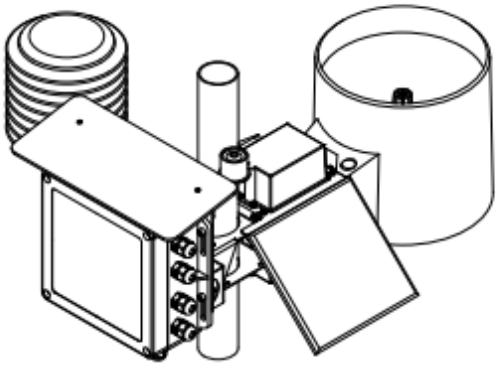
## 5.1 Housing

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



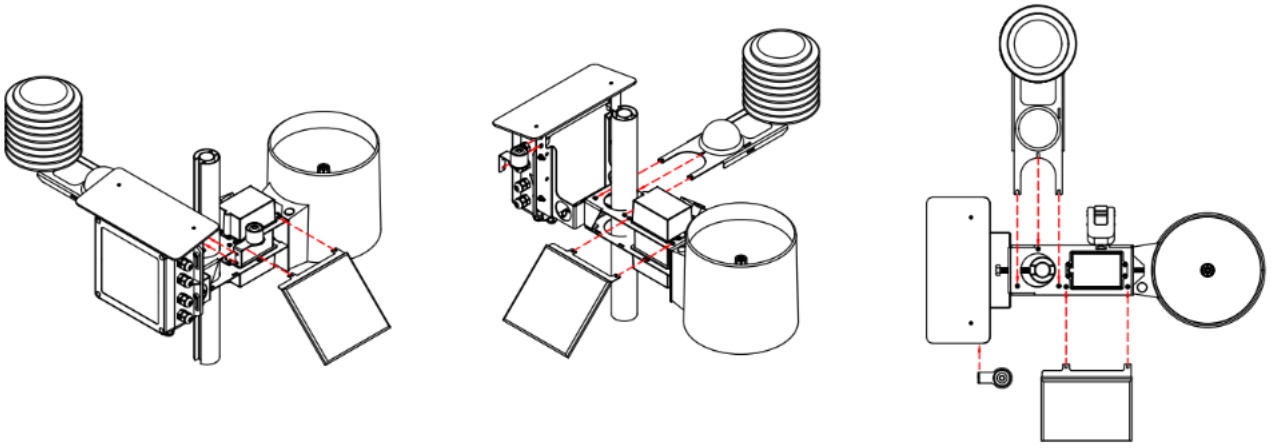



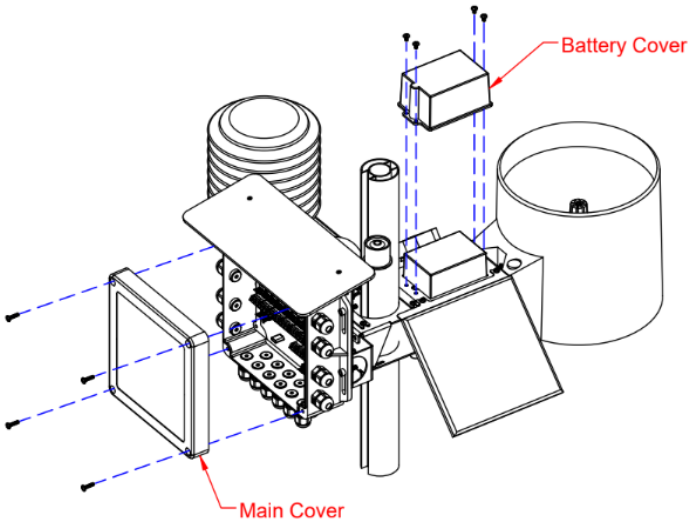



## 5.2 METOS 5 Assembly

Here, an exploded view of the full station.



## 5.3 Opening the housing and accessing the motherboard

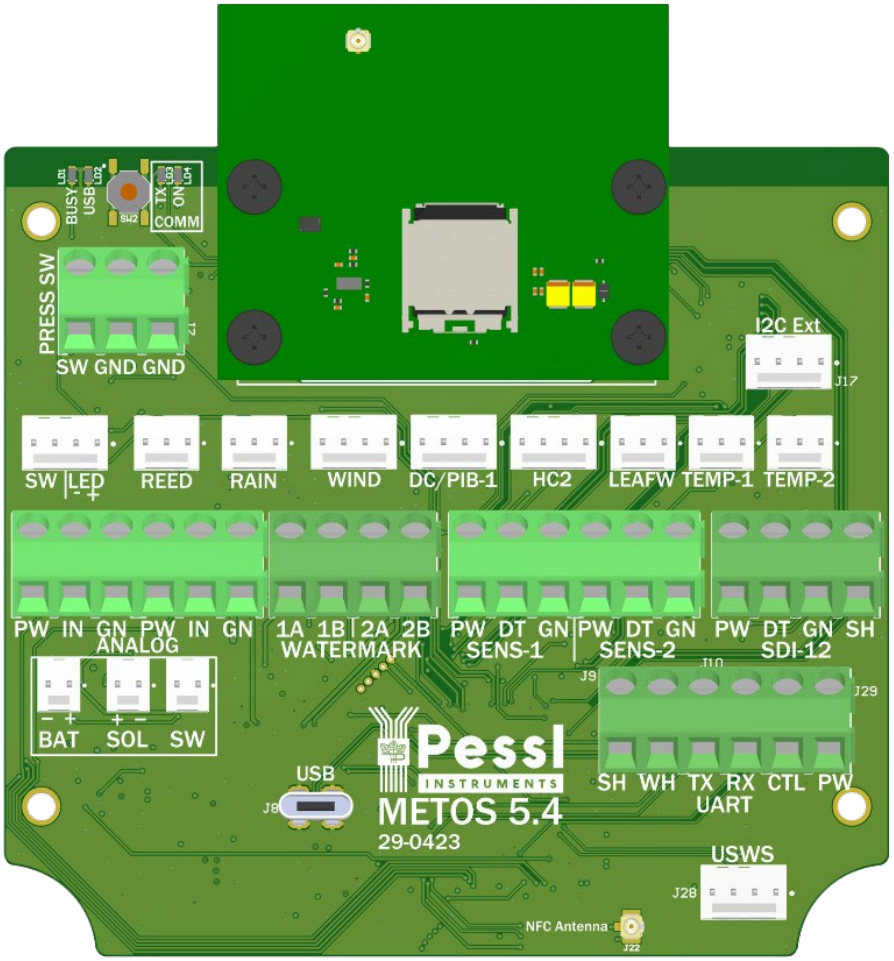



**Steps:**

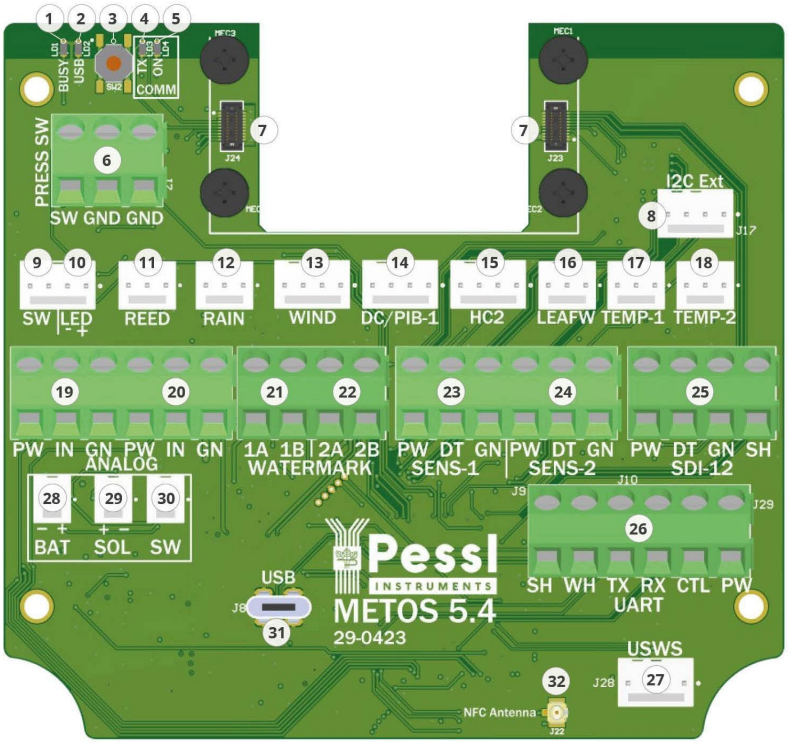
1. Open the four (4) screws of the main cover to have direct access to the motherboard, connected sensors, and other inputs.
2. Optionally, one can also open the four screws of the battery cover in case of a need to change the battery or check whether the cables are connected.

# 6. METOS 5 Hardware Overview

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



## 6.1 METOS 5 inputs and connectors




*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 | **Busy LED**<br>**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.<br>**Off**: METOS 5 motherboard is in sleep mode - the board is not performing any activity. |
| 2 | USB | **USB LED**<br>**On**: When the USB connection between the METOS 5 motherboard and a PC is active.<br>**Off**: When there is no USB device connected to the USB port. |
| 3 | SW2 | **Connect Button**<br>**Short press (from 1 to 3 seconds):** initiates the communication process. METOS 5 tries to send stored sensor data to the FieldClimate.<br>**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. |
| 4 | TX | **TX LED**<br>**On**: When the Communication board starts the communication process with the server until the communication process ends.<br>**Off**: When there is no communication process happening, 2 short blinks when the communication process is finished successfully.<br>5 long blinks when there was an issue with the communication process. |

| | | |
|---|---|---|
| | | For detailed issue recognition, a terminal log is required. |
| 5 | ON | **ON LED**<br>**On**: When the Communication board is turned on for some operation (Modem activity).<br>**Off**: When the Communication board is turned off. |
| 6 | PRESS SW | **Pressure switch sensor input**<br>By default, it supports the Pessl Instruments Pressure Switch sensor.<br><br>Communication protocol: A/D input<br>Power voltage: 3.3 V, max 120 mA<br>I/O Specifications: 0 V - 3.0 V |
| 7 | J24 & J23 | **Communication board connectors.**<br>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. |
| 8 | I2C Ext | **I2C Ext input**<br>By default, it supports the PI Air Temperature & Relative Humidity sensor. |
| 9 & 10 | SW\|LED | External Button with LED (optional)<br>It provides the same functionality as the onboard Connect button (SW2). |
| 11 | REED | **REED sensor input**<br>Default configuration: resettable (pulse counter) value, normally open, configured as: Pessl Instruments Water Counter Interface sensor<br>Can be configured to act as:<br>a) how the values are stored:<br>- accumulative sensor value or<br>- resettable value<br>b) normally open or normally closed device<br>More on the possible configurations in section 9.<br><br>Communication protocol: Reed relay/switch input<br>Power voltage: /<br>I/O Specifications: Reed relay/switch input |
| 12 | RAIN | **RAIN sensor input**<br>Default configuration: accumulative value, normally closed, resolution: 0.2, configured as Pessl Instruments Rain Gauge<br>More on the possible configurations in section 9.<br><br>Communication protocol: Reed relay/switch input<br>Power voltage: /<br>I/O Specifications: Reed relay/switch input |
| 13 | WIND | **WIND sensor input (Mechanical)**<br>By default, it supports the Pessl Instruments Wind Speed sensor.<br><br>Communication protocol: /<br>Power voltage: /<br>I/O Specifications: AC signal (max. 3V amplitude) |
| 14 | DC/PIB-1 | **DC/PIB-1 sensor input (Duty Cycle & PI Bus sensors)**<br>Connected sensors are automatically recognized, it supports PI bus sensors and PI bus interfaces.<br><br>Communication protocol: Duty cycle input, PI-Bus input<br>Power voltage: Variable up to 6 V (5.4 V by default), max 200 mA |

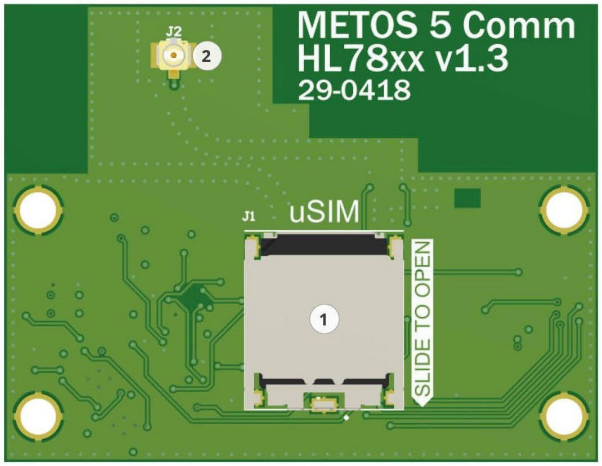
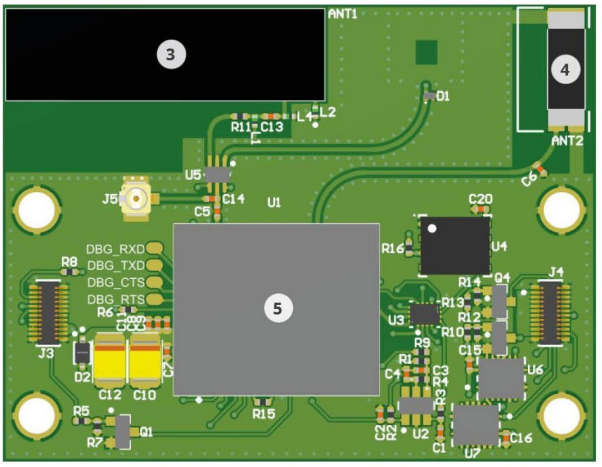
| | | |
|---|---|---|
| | | I/O Specifications: Low voltage: 0 V - 0.6 V, High voltage: 2.5 V - 3.3 V |
| 15 | HC2 | **HC2 sensor input (Hygroclip)**<br>It supports the Hygroclip (Air temperature & Relative Humidity) sensor.<br><br>Communication protocol: UART-RX<br>Power voltage: 3.3 V, max 120 mA<br>I/O Specifications: Low voltage: 0 V - 0.6 V, High voltage: 2.5 V - 3.3 V |
| 16 | LEAF | **LEAFW sensor input**<br>It supports the Pessl Instruments Leaf Wetness sensor.<br><br>Communication protocol: A/D input<br>Power voltage: 3.3 V, max 120 mA<br>I/O Specifications: 0 V - 3.0 V |
| 17 | TEMP-1 | **Temperature sensor input**<br>Default configuration: PI Air temperature sensor<br>Configurable to: PI Soil temperature, PI Wet bulb, PI Dry bulb, Leaf temperature PT1000, Black body temperature PT1000, Water temperature...<br>More on the possible configurations in section 9.<br><br>Communication protocol: One-wire half-duplex serial communication<br>Power voltage: 3.3 V, max 120 mA<br>I/O Specifications: 0 V - 3.3 V |
| 18 | TEMP-2 | **Temperature sensor input**<br>Default configuration: PI Soil temperature sensor<br>Configurable to: PI Air temperature, PI Wet bulb, PI Dry bulb, Leaf temperature PT1000, Black body temperature PT1000, Water temperature...<br>More on the possible configurations in section 9.<br><br>Communication protocol: One-wire half-duplex serial communication<br>Power voltage: 3.3 V, max 120 mA<br>I/O Specifications: 0 V - 3.3 V |
| 19 | ANALOG-1 | **ANALOG sensor input 1**<br>**Attention: on this Input, the GN needs to be connected to the GN of ANALOG-2 (Appendix E)**<br><br>Communication protocol: General analog input<br>Power voltage: Variable up to 6 V (5.4 V by default), max 200 mA<br>I/O Specifications: 0 V - 3.3 V |
| 20 | ANALOG-2 | **ANALOG sensor input 2**<br><br>Communication protocol: General analog input<br>Power voltage: Variable up to 6 V (5.4 V by default), max 200 mA<br>I/O Specifications: 0 V - 3.3 V |
| 21 | WATERMARK 1A 1B | **WATERMARK sensor input 1**<br>It supports the Irrometer Watermark Soil Moisture sensor.<br><br>Communication protocol: Resistance measurement<br>Power voltage: 3.3 V |

| | | |
|---|---|---|
| | | I/O Specifications: from 0 to 60 kOhm |
| 22 | WATERMARK 2A 2B | **WATERMARK sensor input 2**<br>It supports the Irrometer Watermark Soil Moisture sensor.<br><br>Communication protocol: Resistance measurement<br>Power voltage: 3.3 V<br>I/O Specifications: from 0 to 60 kOhm |
| 23 | SENS-1 | **PI-Bus/Decagon/Meter group sensor input 1**<br>Default configuration: PI Bus input.<br>Configurable to: EC5, 10HS, MPS1, 5TE, 5TM and many other sensors.<br>More on the possible configurations in section 9.<br><br>Communication protocol: Configurable general sensor inputs (analog sensor, Decagon/METER Group sensor, PI-Bus sensor)<br>Power voltage: Variable up to 6V (5.4V by default), max 200 mA<br>I/O Specifications: Analog (sensor) input: 0 V - 3.0 V, Digital (sensor) input: Low voltage: 0 V - 0.5 V High voltage: 2.5 V - 3.3 V |
| 24 | SENS-2 | **PI-Bus/Decagon/Meter group sensor input 2**<br>Default configuration: PI Bus input.<br>Configurable to: EC5, 10HS, MPS1, 5TE, 5TM and many other sensors.<br>More on the possible configurations in section 9.<br><br>Communication protocol: Configurable general sensor inputs (analog sensor, Decagon/METER Group sensor, PI-Bus sensor)<br>Power voltage: Variable up to 6V (5.4V by default), max 200 mA<br>I/O Specifications: Analog (sensor) input: 0 V - 3.0 V, Digital (sensor) input: Low voltage: 0 V - 0.5 V High voltage: 2.5 V - 3.3 V |
| 25 | SDI-12 | **SDI-12 sensor input**<br>Supports one PI Profile Probes, Sentek Drill&Drop, and TriSCAN Probes. Two probes will be supported in future firmware updates.<br><br>Communication protocol: SDI-12 asynchronous serial communication protocol<br>Power voltage: 12V, max 850 mA<br>I/O Specifications: Marking: 0 V - 1.0 V, Spacing: 3.5 V - 5.5 V |
| 26 | UART | **UART input (Generic bidirectional UART interface / PI-Bus sensor input)**<br>Default configuration: PI Bus input.<br><br>Communication protocol: Full-duplex UART<br>Power voltage: Variable up to 6 V (5.4 V by default), max 200 mA<br>I/O Specifications: Low voltage: 0 V - 0.6 V, High voltage: 2.5 V - 3.3 V |
| 27 | USWS | Ultrasonic wind sensor input<br>It supports the Pessl Instruments Ultrasonic Wind sensor.<br><br>Communication protocol: Full-duplex UART, PI-Bus input<br>Power voltage: 3.3V, max 120 mA<br>I/O Specifications: Low voltage: 0 V - 0.6 V, High voltage: 2.5 V - 3.3 V |
| 28 | BAT | 6 V battery connector |
| 29 | SOL | Solar panel connector |

| | | |
|---|---|---|
| 30 | SW | ON/OFF switch |
| 31 | USB | USB-C 2.0 interface |
| 32 | NFC Antenna | NFC antenna connector |

## 6.2 METOS 5 communication boards

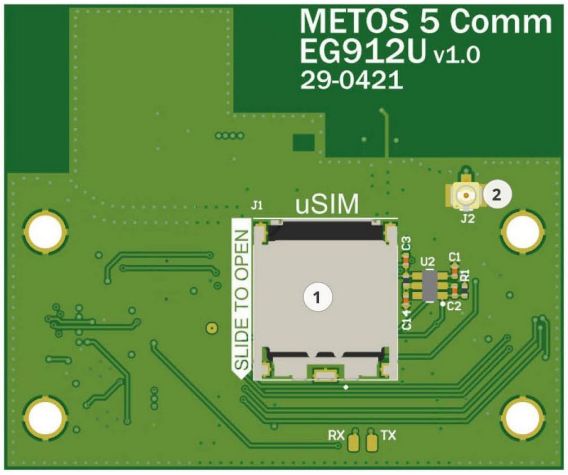
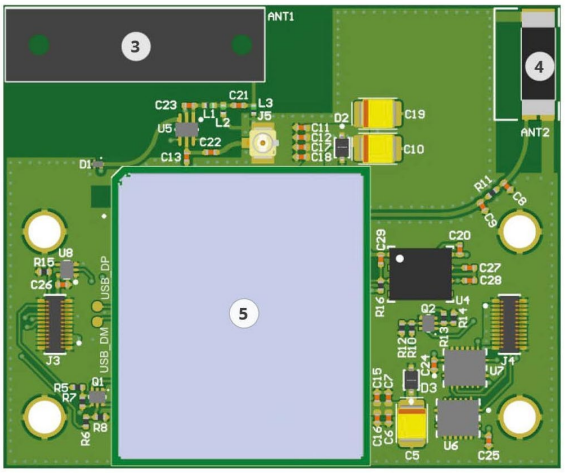
### 6.2.1 Semtech (Sierra Wireless) HL78xx v1.3 29-0418

| Top: | Bottom: |
|---|---|
|  |  |
| 1. SIM card holder<br>2. Optional external antenna connector | 3. Mobile network antenna<br>4. GPS antenna<br>5. Modem |

It comes in two variants:

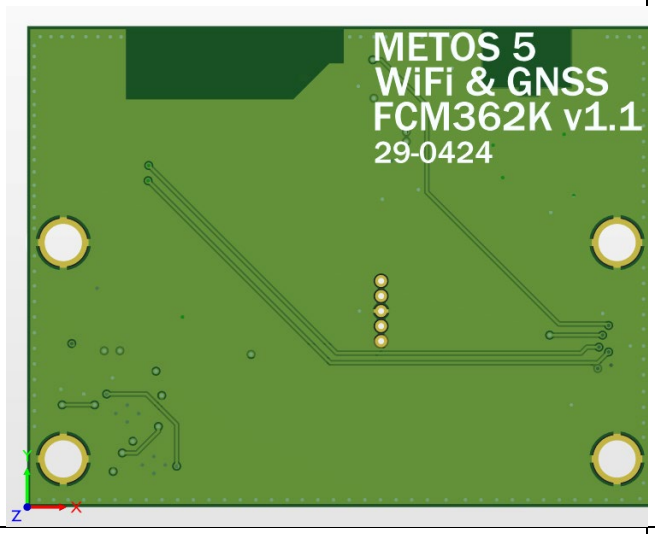
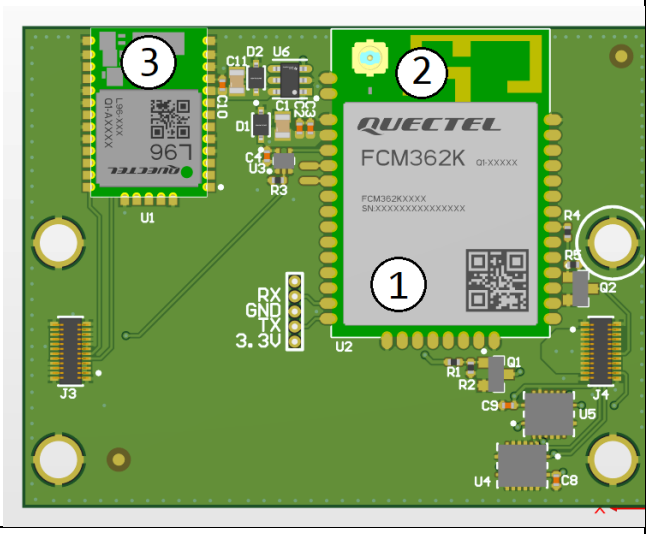
- with Semtech HL7800 modem - for NBIoT and CatM1 mobile connectivity
- with Semtech HL7802 Modem - for NBIoT, CatM1 and 2G mobile connectivity.

### 6.2.2 Quectel EG912U v1.0 29-0421

| Top: | Bottom: |
|---|---|
|  |  |
| 1. SIM card holder<br>2. Optional external antenna connector | 3. Mobile network antenna<br>4. GPS antenna<br>5. Modem |

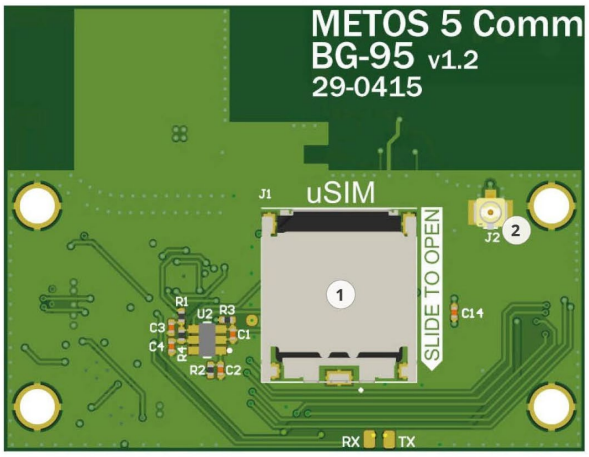
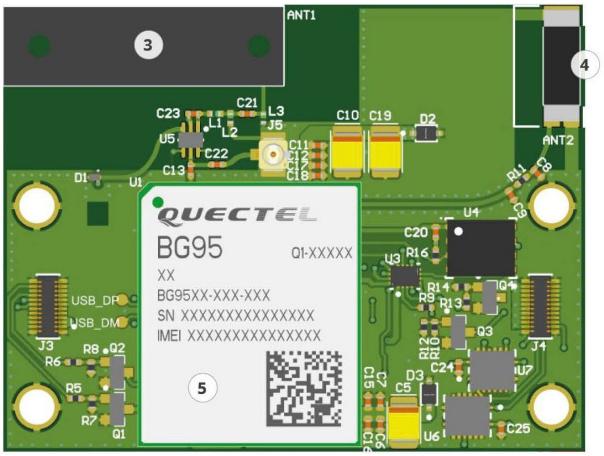
It uses a Quectel EG912U modem.

### 6.2.3 WiFi – FCM362K 29-0424

| Top: | Bottom: |
|---|---|
|  |  |
| | 1. Quectel FCM362K WiFi module<br>2. WIFI External antenna connector<br>3. Quectel L96 GNSS module |

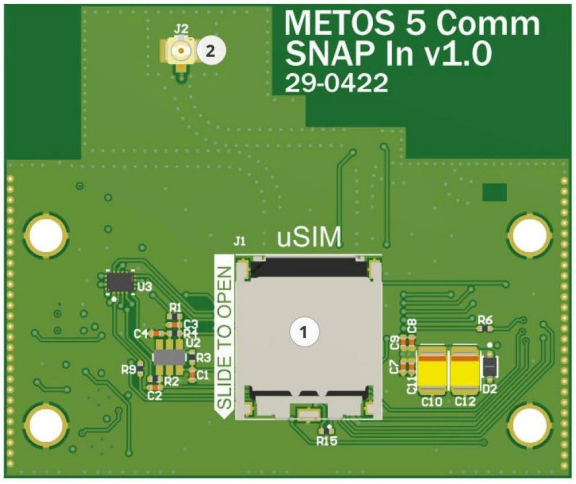
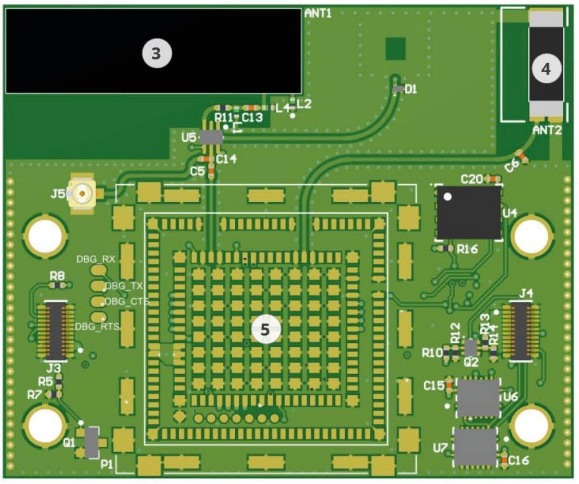
You can find out how to set up the WiFi daughterboard here.

### 6.2.4 BG-95 v1.2 29-0415

| Top: | Bottom: |
|---|---|
|  |  |
| 1. SIM card holder<br>2. Optional external antenna connector | 3. Mobile network antenna<br>4. GPS antenna<br>5. Modem |

It uses a Quectel BG95 modem.

### 6.2.5 SNAPIN v1.0 29-0422

| Top: | Bottom: |
|---|---|
|  |  |
| 1. SIM card holder<br>2. Optional external antenna connector | 3. Mobile network antenna<br>4. GPS antenna<br>5. Modem |

This communication board supports Semtech HL7800 and Semtech HL7802 modems.

## 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)** | **WiFi-FCM362K (29-0424)** |
| **HW v5.2 (29-0414) & FW from v1.28** | ✓ | ✗ | ✗ | ✗ | ✗ |
| **HW v5.3 (29-0419) & FW from v1.29** | ✓ | ✓ | ✓ | ✓ | ✓* |
| **HW v5.4 (29-0423) & FW from v1.29** | ✓ | ✓ | ✓ | ✓ | ✓* |
| ***Note:** FW v2.04 or higher is needed to support WiFi modem!!!* | | | | | |

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** | ✗ | ✗ | ✗ | ✓ | ✓ | ✗ |
| **HL78xx v1.3 (29-0418) with HL7802 modem** | ✓ | ✗ | ✗ | ✓ | ✓ | ✗ |
| **EG912U v1.0 (29-0421) with Quectel EG912U modem** | ✓ | ✗ | ✓ | ✗ | ✗ | ✗ |
| **BG-95 v1.2 (29-0415) with Quectel BG95 modem** | ✓ | ✗ | ✗ | ✓ | ✗ | ✓ |

*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 does not need to know each communication board's 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<br>10<br>15<br>30<br>60 | 15 | 15<br>30<br>60 | 60 | 15<br>30<br>60 |
| **with LoRaWAN connectivity (minutes)** | 5 | 5 | 15 | 15 | 15 | 15 |
| **with WiFi connectivity (minutes)** | 5 | 5<br>10<br>15<br>30<br>60 | 15 | 15<br>30<br>60 | 15 | 15<br>30<br>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 represent 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 and power system

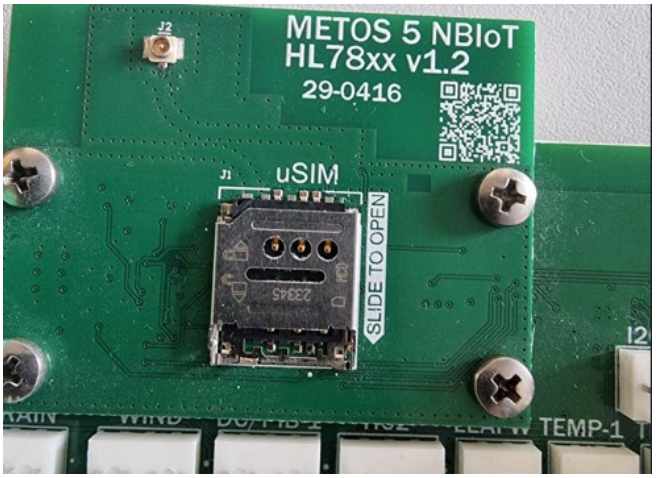
## 7.1 SIM card / eSIM

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

### Handling uSIM:

**Inserting the SIM card:**

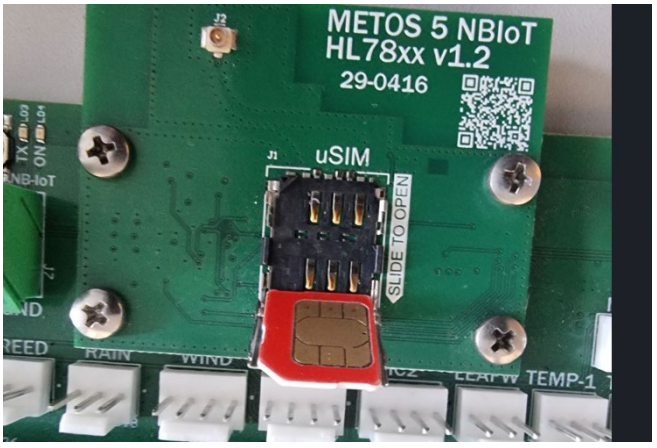
1. Make sure that the battery and the solar panel are disconnected from the motherboard.



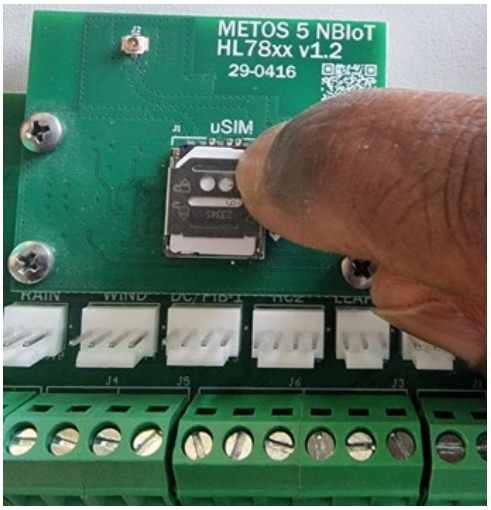

*(SIM card holder in locked state)*

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 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.

### Handling eSIM:

**Attention:** BG955A modem **does not** support eSIM !!!

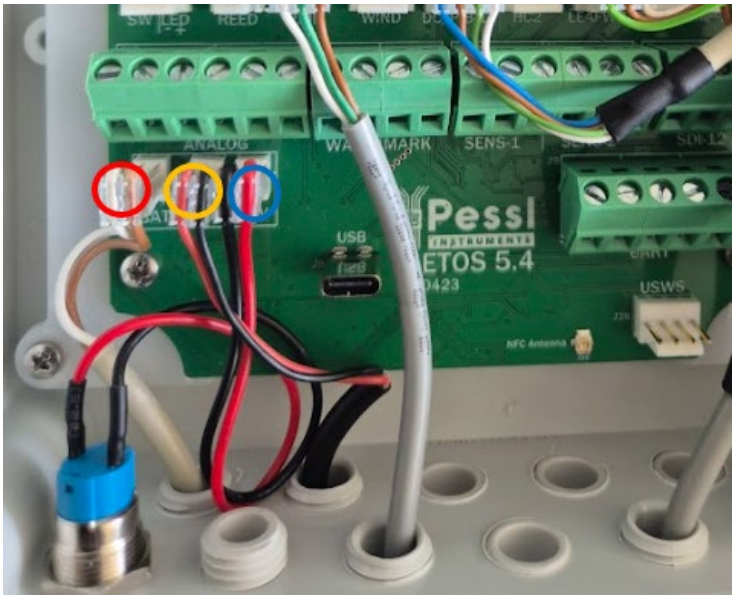
The eSIM (electronic SIM-card) is a microchip soldered on the back of the Daughterboard and requires a Firmware **of version 2.06 or higher**. Refer to paragraph 9.4 option E - SIM SELECTION for further details.

## 7.2 Powering up the motherboard

METOS 5 weather station needs power from the 6V battery which is recharged from the solar panel.

**Power-up sequence:**

1. The station comes with a battery already connected to the BATT labelled connector on the pcb, a solar panel connected to the SOL input, and a switch connected to the SW input as depicted in the image below.

| | |
|---|---|
|  | • Red-circle: Battery<br>• Yellow-circle: Solar panel<br>• Blue-circle: Latching switch button |

2. If situations occur where the battery and/or the solar panel are NOT connected, then they need to be connected to the respective inputs. One must ensure that the polarity is correct. In the case of the battery, the negative (-) terminal is on the left (indicated by white cable in the picture above) and the positive (+) terminal is on the right (indicated by brown cable). The solar panel input has the negative (-) terminal on the right (black cable), and the positive (+) terminal is on the left (red cable).

3. **Press the switch button** located at the bottom left of the weather station to power on the device. The device will connect to a network at the deployed location and transmit data to our FieldClimate. Check after a few minutes for data on the FieldClimate to ensure the device is powered on and transmitting data as expected. This button can also be used to power off the station.

| Switch OFF (Default Mode, station not powered on)<br>***Image shows Protruded Switch Button*** | Switch ON (Station is powered on by pressing the switch button)<br>***Image shows Pressed-In Switch Button*** |
| --- | --- |
| | |

Protruded Switch button - OFF

Pressed-In Switch button - ON

**METOS motherboard version 5.3:**

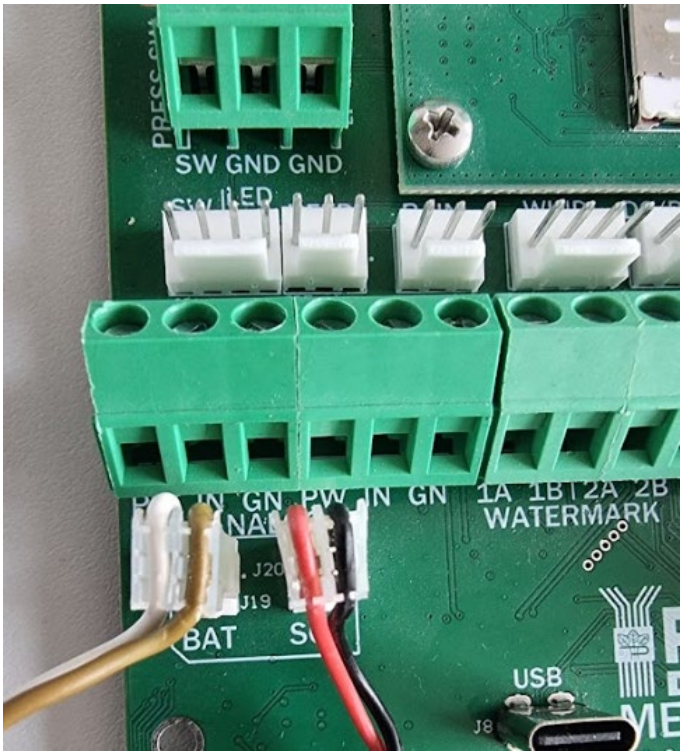
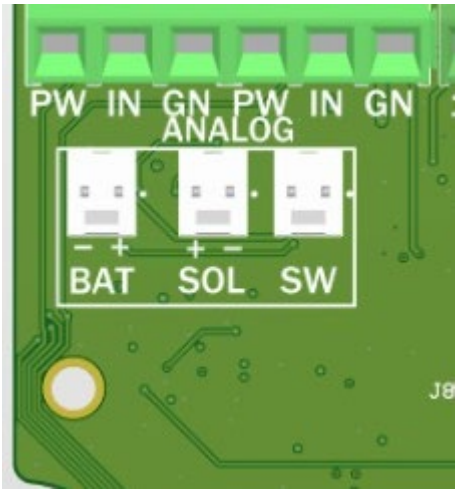



*Image shows cables of connected battery (left) and solar panel (right)*

**METOS motherboard 5.4:**




In addition to the BAT and SOL inputs on the METOS 5.3 version, the METOS 5.4 version also uses the standard ON/OFF switch, which needs to be connected to the SW input. Without the switch on the 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. Measurement 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.

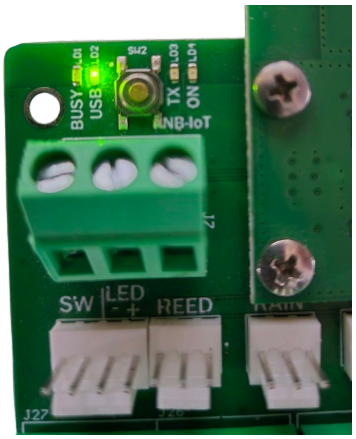
The usual battery voltage with a solar panel range between 6.2 to 6.6 V.

# 8. Connecting the METOS 5 to the PC

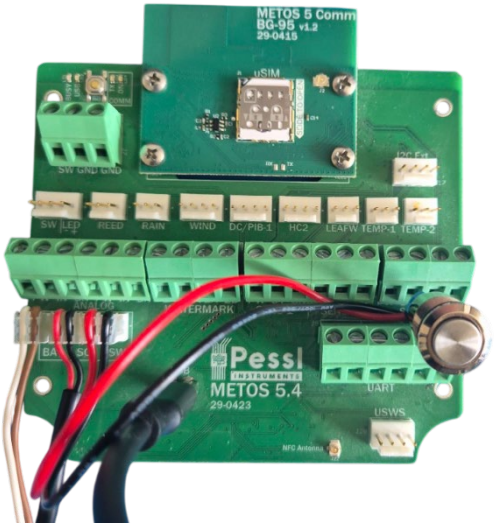
Below are the steps for connecting the METOS 5 to the PC:

1. The power (battery and the solar panel) and the switch button should be connected to the motherboard.
2. Press on the switch button to power on the PCB
3. The type C USB cable should then be connected to the motherboard and a USB port of a computer
4. 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, connected switch, inserted SIM card, and connected USB cable.*

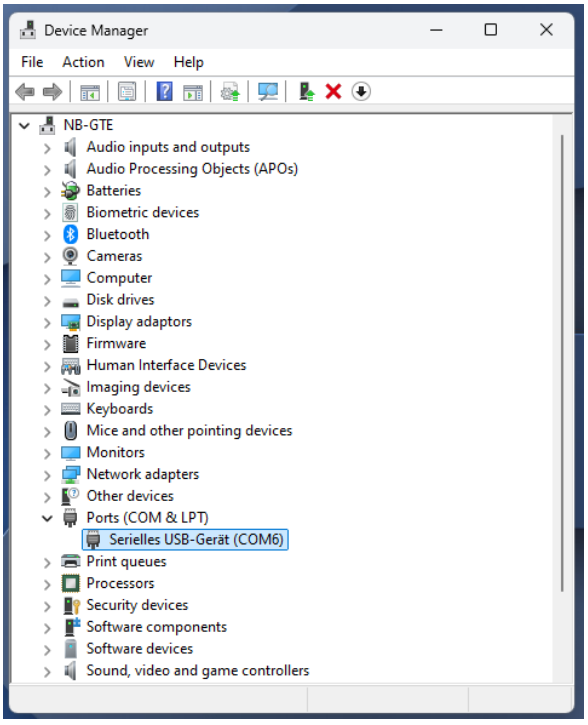
METOS 5 uses USB C version 2.0 for communication and is handled by the STM STM32L476 microcontroller. In case of USB driver issues, we suggest the client refers to https://www.st.com/en/development-tools/stsw-stm32102.html.

## 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 the Device Manager and check which USB COM port is assigned to the METOS 5. In this example, we can see the Windows OS assigned COM6 to the device:



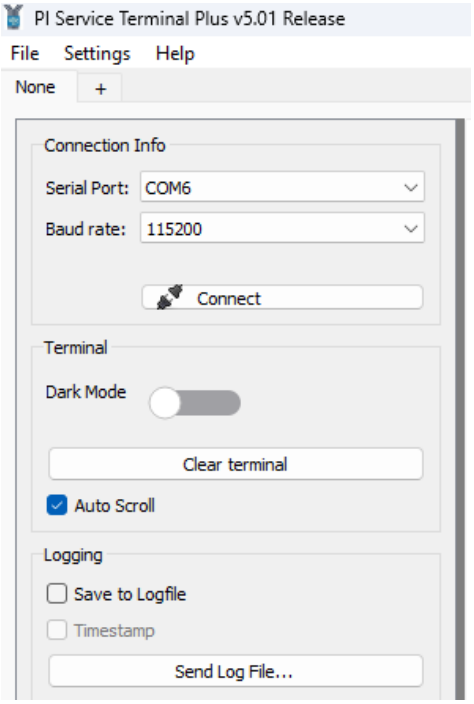

*Checking the assigned COM port in the Device manager*

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.

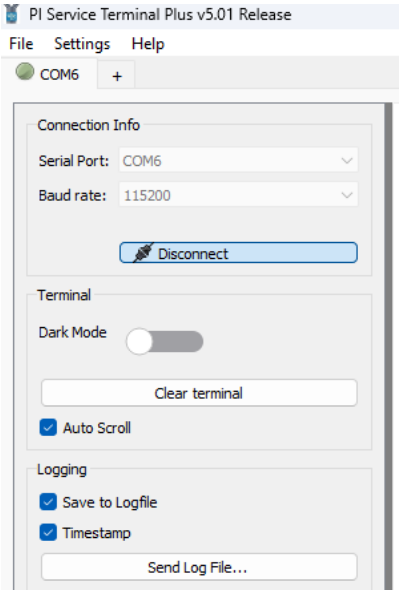
**Steps:**

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 (COM port 6 automatically detected by the PI Service Terminal in this case)




3. Click on the connected button to connect your METOS 5 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 2.06.

## 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 assess 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:          v5.04
Hardware ID:               29-0423
Device ID:                 80
Device type:               Metos 5
Firmware version:          v2.06
Firmware revision date:    2025-11-20 13:28:00
Device description:        Metos v5.0 LTEIoT Station
Serial Number:             0501xxxx
Current date and time:     2020-01-01 00:01:29
Status of measurement:     running
Next alarm time:           00:05:00
Frost monitoring:          Disabled
Measure interval [sec.]:   300
Logging interval [sec.]:   600
Transmission int. [sec.]:  1200
Max. number of data pckts: All
GNSS Data:                 None
Modem stack version:       v1.22
Modem stack revision date: 2025-02-19 14:40:00
USB stack version:         v1.00
USB stack revision date:   2023-03-03 10:00:00
Bootloader version:        v1.04
Bootloader revision date:  2025-03-10 16:30:00
Bootloader description:    BOOT_STM32L476ZG
```

**Option 2 - Print the last raw data of data memory**

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

```
Ord.Nm.  RECORD HEADER                          RAW SENSOR DATA VALUES
-------  -------------------------------------  ---------------------->
0000001  14 64 01 2025-10-16 04:30:00 00000001  184B 0000
0000002  14 3F 01 2025-10-16 04:40:00 00000000  1861 0000
```

**Option 3 - Print all raw data of data memory**

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

```
Ord.Nm.  RECORD HEADER                          RAW SENSOR DATA VALUES
-------  -------------------------------------  ---------------------->
0000001  14 FD 01 2025-10-15 11:10:00 00004800  18AD 0000
0000002  14 85 01 2025-10-15 11:10:00 00000000  189D 0000
0000003  14 5F 01 2025-10-15 11:20:00 00000000  1877 0000
0000004  14 64 01 2025-10-16 04:30:00 00000001  184B 0000
0000005  14 3F 01 2025-10-16 04:40:00 00000000  1861 0000
```

**Option 4 - Print sensors configuration set**

Press key **4** to see the configuration sensor 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
```

**Option 5 - Sensor testing**

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

```
    Input  S.Code      Full Name Of Sensor       Short     Value        Unit     Notes
   ------- ------ ------------------------------ ----- ------------- ---------- ------->
   BAT     0x0007 Battery voltage                BATTR          6154 mV
   SOL     0x001E Solar Panel                    SOLPN          5845 mV
```

**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  = 5
   The number of last records = 2
   Pointer to initial record  = 0
   Pointer to starting record = 3
   Pointer to next record     = 5
   Pointer of Memory Ctrl.    = 5
   Force data saving          = false
   Size of SD record          = 20
   Max. number of rec. ptrs   = 413993
   Max. number of SD rec.     = 413991
   Number of SD values        = 2
   Number of 1k records       = 0
```

### 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 = 3204
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
```

### 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)...  99% restored!
Done.
```

### 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 METOS 5 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

```
SYSTEM SETUP MENU:

  1 - Setup the measure/logging/transmission intervals   -> 300/600/1200 sec.
  2 - Setup the system date and time                     -> 2020-01-01 00:15:34
  3 - Setup the max. number of data logged packets       -> All
```

### Option C - Sensor settings

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

```
   SENSOR SETTINGS:

   1 - Sensor type on RAIN                      -> Rain Gauge
   2 - Sensor resolution on RAIN                -> 0.2 mm
   3 - Sensor type on REED                      -> Water Meter (Resettable)
   4 - Sensor resolution on REED                -> 1 L
   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/REED input)
   9 - USWS                                     -> DC/PI-BUS
   A - Sensor type on TEMP-1                     -> Air temperature
   B - Sensor type on TEMP-2                    -> Soil temperature
   C - SDI12 address configuration
   D - Sensor type on SENS-3                    -> PI-BUS
   E - Sensor type on SENS-4                    -> PI-BUS
   M - Setup frost monitoring (TEMP-1/TEMP-2)   -> Disabled
   N - Sensor calibration
   W - Setup Watermark                          -> Disabled
```

### 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:
Bridge mode closed.
```

**Option L - Print modem info**

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

```
   LTEIoT module - System info:

   Server Remote Address:     upload.fieldclimate.com
   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
   Antenna Selection:         Onboard Antenna

   Modem Manufacturer:        Quectel
   Modem Model:               BG955A-GL
   Modem SW Version:          BG955AGLAAR02A01_01.200.01.200
   Modem Revision ID:         BG955AGLAAR02A01
   Modem Serial Number:       D1Q23AD1A000033
   IMEI:                      8683480600xxxxx
   SIM Card ID (ICCID):       89882390000637xxxxxx
   IMSI:                      90128881094xxxx
   SIM MCC:                   901
   SIM MNC:                   28
   CAT-M1 LTE bands config:   0x2000000000f0e189f -> LTE Bands: 1, 2, 3, 4, 5, 8, 12, 13, 18, 19,
20, 25, 26, 27, 28, 66, 72
   NBI-IoT LTE bands config:  0x200000000090f189f -> LTE Bands: 1, 2, 3, 4, 5, 8, 12, 13, 17, 18,
19, 20, 25, 28, 66, 72

   Last connection status:

   Signal Strength:           45 %
   Signal Quality:            71 %
   Network type:              roaming
   Network name:              Magenta-T-
   Current MCC:               232
   Current MNC:               03
   Current RAT:               CAT-M1
   Active LTE Band:           8
   Registration time:         1 sec.
   Transfer Protocol:         TCP
   Server upload errors:      0/20
```

### Option P - Setup modem parameters

Press key **P** to set up any modem connectivity parameters. Further explained in paragraph 9.4.

```
     SETUP THE MODEM PARAMETERS:

   *   DEFAULT REMOTE ADDRESS        -> upload.fieldclimate.com
   *   DEFAULT REMOTE PORT           -> 44441
   1 - CUSTOM REMOTE ADDRESS         -> upload.fieldclimate.com
   2 - CUSTOM REMOTE PORT            -> 44441
   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 SELECTION             -> Onboard Antenna
   B - FAILOVER CONNECTION           -> Enabled
   C - TCP PAYLOAD SIZE LIMIT        -> 4200
   D - Set the default parameters
   E - SIM SELECTION                 -> uSIM (socket)
   F - Modem FOTA
   S - Network scan
   U - Modem FW Upgrade
```

### Option M - NBIoT modem bridge mode

Press key **M** to enter direct bridge mode to the modem that came with the station 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... QUECTEL_BG95 done.
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 to 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 every 900 seconds (15 minutes), and it transmits the stored data every 1800 seconds (30 minutes).

**Option 1 - Setup the measure/logging/transmission intervals**

The measurement, logging, and transmission interval values can be changed.

In the given example below, the measurement interval is set to 15 minutes, the logging interval to 15 minutes, and the transmission interval to 1 hour. Each setting is keyed and confirmed by pressing the ENTER key.

```
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.
```

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 influence the battery and transmission data size.

The more frequent 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 data measurements and logging. More frequent measurements and logging intervals will require more data to be transferred to the FieldClimate cloud. One must ensure 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**

This option can be used when one wants 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 settings (Sub-Menus of Option ‘C‘ from Main Menu)

METOS 5 weather station supports defining the connected sensors on the RAIN, REED, SENS-1 to SENS-2, USW and the Analog inputs. The Analog inputs are referred to as SENS-3 and SENS-4 in firmware. It is mandatory to select the correct sensors from these menus for the station to recognize the sensors correctly, depending on the input the sensor is connected to.

These are the default sensor settings 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                      -> Water Meter (Resettable)
4 - Sensor resolution on REED                -> 1 L
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/REED input)
9 - USWS                                     -> DC/PI-BUS
A - Sensor type on TEMP-1                    -> Air temperature
B - Sensor type on TEMP-2                    -> Soil temperature
C - SDI12 address configuration
D - Sensor type on SENS-3                    -> PI-BUS
E - Sensor type on SENS-4                    -> PI-BUS
M - Setup frost monitoring (TEMP-1/TEMP-2)   -> Disabled
N – Sensor calibration
W – Setup Watermark                          -> Disabled
```

**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. A selected option is confirmed with the ENTER key

**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 the case of usage of other rain gauge sensors, one can select between options 0.1, 0.2, and 0.5 mm of rain resolution for each pulse from the sensor. The ERNTER key is then used to confirm the selected resolution

**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 different sensors. In the menu, the user needs to select the appropriate connected sensor to the SENS-1 input, otherwise the METOS 5 device will use the default value of the PI-BUS sensor. For instance, if a PI54D sensor is connected but option 15 is not selected (15 – PI54D), the METOS 5 will not recognize the connected sensor properly and the user will not get any values from this sensor on the FieldClimate cloud. It would show – `(Unknown) PI-Bus Sensor`

After the appropriate connected sensor is selected, press **the Enter** key to confirm.

**Option 6 - Sensor type on SENS-2**

Same as Option 5 – Sensor type on SENS-1 but in this case the selection apply to the sensor 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 SENS-1 and/or SENS-2 inputs.

The default soil media type is set to 0 – Mineral soil as this option is used in most 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
```

**Option 9 – USWS**

Shows which protocol will be used for the USWS input. Default setting is – `0 – DC/PI-BUS which supports Mechanical Wind Direction sensor.`

```
Current sensor type on USWS: DC/PI-BUS

0    - DC/PI-BUS
1    - USW UART
2    - PI-BUS
Select new option:
```

Just press the key to the protocol you need and confirm it with the **ENTER** key.

**Option A - Sensor type on TEMP-1**

This option is to set the connected sensor to the needed sensor code connected to the TEMP-1 input. The ENTER key is used to confirm the selected option.

```
Current sensor type on TEMP-1: Air temperature
  0    - Air temperature
  1    - Soil temperature
  2    - Dry bulb temperature
  3    - Wet bulb temperature
  Select new option:
```

**Option B – Sensor type on TEMP-2**

Same as Option A – Sensor type on TEMP-1, but the select sensor corresponds to the sensor connected to the TEMP-2 input.

**Option C - SDI12 address configuration**

From FW v2.05 or higher, it is possible to connect up to three (3) SDI12 supported sensors e.g. Sentek, PI Profile Probe to the SDI-12 input.

The configuration manual to the link below refers.

-> Manual

Better still, the configuration manual can be accessed from our support homepage from this address.

*https://support.metos.at/en/support/solutions/articles/15000061569-metos-5-multiple-sdi12-probes-configuration*

**Option D – Sensor type on SENS-3 (ANALOG 1)**

Same as Option 5/6 but corresponds to sensors connected to the ANALOG 1 (left) input

**Attention**: refer to this manual on how to handle SENS-3 (ANALOG 1)
https://support.metos.at/en/support/solutions/articles/15000061567-metos-5-sens-3-input-configuration

**Option E – Sensor type on SENS-4 (ANALOG 2)**

Same as Option 5/6/D but again, this corresponds to sensors connected to ANALOG-2 (right) input

**Option M – Setup frost monitoring (TEMP-1/TEMP-2)**

If there is a Wet & Dry bulb temperature sensors connected to the TEMP-1 and TEMP-2 inputs, this option needs to be turned on to enable frost monitoring by pressing **1**. Confirm with the ENTER key.

```
  Current status of frost monitoring: Disabled
  0    - Disable
  1    - Enable
  Select new option:
```

**Option N – Sensor calibration**

It is now possible to calibrate the mechanical Wind direction sensor directly with the PI Service Terminal App. One must ensure that a wind direction sensor is connected to the USW input (refer to Option 9 under this sub menu 9.3)

```
SENSOR CALIBRATION:

1  - Wind direction sensor on USWS
Press ESC to return to MAIN MENU.

WIND DIRECTION SENSOR - MEASUREMENT & CALIBRATION

Press C    - to calibrate the North direction
Press ESC  - to exit calibration mode

Wind direction [degree] =  0
```

After pressing **"N",** one needs to select "**1"** to get to the Wind direction sensor – measurement and calibration sub menu.
PI Wind Direction sensors are already pre-calibrated to "North". If there is a need to recalibrate the sensors, one can find the manual here
One can also read live data of the value of the measured degree of the sensor from this menu, depicted by the last line in the above menu item (`Wind direction [degree]). In this case, the measured angle is 0 (North)`

**Option W – Setup Watermark**

It is possible to Enable/Disable the Watermark inputs with this option. These inputs are disabled by default. If required, one can re-enable the inputs by pressing the key **W** and then key **1.** The selected option is then confirmed with the ENTER key.

```
Current status of Watermark sensor: Disabled

0    - Disable
1    - Enable
Select new option: 1

Done: Enabled
```

## 9.4 Setup modem parameters (Sub-Menus of Option 'P' from Main Menu)

```
SETUP THE MODEM PARAMETERS:

*   DEFAULT REMOTE ADDRESS        -> upload.fieldclimate.com
*   DEFAULT REMOTE PORT           -> 44441
1 - CUSTOM REMOTE ADDRESS         -> upload.fieldclimate.com
2 - CUSTOM REMOTE PORT            -> 44441
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 SELECTION             -> Onboard Antenna
B - FAILOVER CONNECTION           -> Enabled
C - TCP PAYLOAD SIZE LIMIT        -> 4200
D - Set the default parameters
E - SIM SELECTION                 -> uSIM (socket)
F - Modem FOTA
S - Network scan
U - Modem FW Upgrade
```

There is a default Remote Address (upload.fieldclimate.com) and a Default 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.

The default remote address is also used during Metos 5 firmware update over the air process.

**Option 1 - CUSTOM REMOTE ADDRESS**

Option to enter a 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 number 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**

This option is to set the appropriate APN password if required based on the station's SIM Card.

**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 between 2 to 10 seconds. Setting the value higher than 240 seconds is not recommended.

**Option 7 - OPERATOR SELECTION**

This is by default set to Automatic but grants the user the choice to manually select an operator by manually inputting the Mobile Country Code (MCC) plus the Mobile Network Code (MNC) if known.

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

After entering 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 later.

**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 after pressing A.

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

**Option B – FAILOVER CONNECTION**

This option is enabled by default, which results in the station switching to the default production server when communication to the local box fails repeatedly.

**Option C – TCP PAYLOAD SIZE LIMIT**

This option gives room to customize the payload size limit to upload to the server.

Unlike Metos 5 stations with either BG95A modules or WIFI (FCM32CK) modules which have a payload size limit of 1400 bytes, all other modules have payload sizes ranging from 1000 bytes to 4200 bytes. The **default** payload size for such modules is **4200 bytes.**

Frequent “NO_CARRIER” or “no server response” errors may indicate that the operator does not support a payload size of 4200. In such cases, reducing the payload size to 1400 bytes is recommended.

For additional help, please contact our support team via the Ticket system at [Support - METOS by Pessl Instruments]

**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 E – SIM SELECTION**

This section lets the user change the SIM type by selecting options 1 or 2 for uSIM or eSIM respectively.

```
Current SIM selected: uSIM (socket)
Select new one or escape [ESC]:
1 - uSIM (socket)
2 - eSIM

SIM Selected: uSIM (socket)
Done.

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

The default setting (option 1) is the uSIM (Universal Subscriber Identity Module) which requires a working SIM card inserted into the SIM Card slot. The eSIM is a digital embedded SIM on the Metos 5 station.

Not all Metos 5 stations support the eSIM. This should be clearly specified when placing an order for a Metos 5 station, whether an eSIM support variant is preferred.

**Option F - Modem FOTA**

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

**Option S - Network scan**

This option scans all available networks around the areas of deployment of the METOS 5 device. 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     -> A1
              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 U - Modem FW Upgrade**

This option is to update the HL78xx modem with a step-by-step guide in the terminal menu. 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 (Option from Main menu)**

This option will show all communication parameters used for connectivity, including the modem info and the SIM card info as well.

```
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:                      3594590928xxxxx
SIM Card ID (ICCID):       898828066600108xxxxx
IMSI:                      9014051010xxxxx
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:  00000000000000080084 -> 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)**

One can access the menu of the list of supported sensors by using option **9**.

```
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
```

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 therefore strongly advised to always use the latest when manually 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/

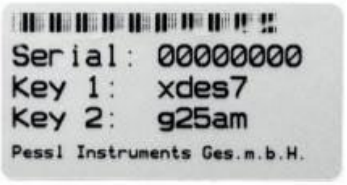
1. Go to *ng.fieldclimate.com/login* and click the button "+".

2. Insert your personal data & e-mail.

3. Check your e-mail and click on the link to activate the user account you created.

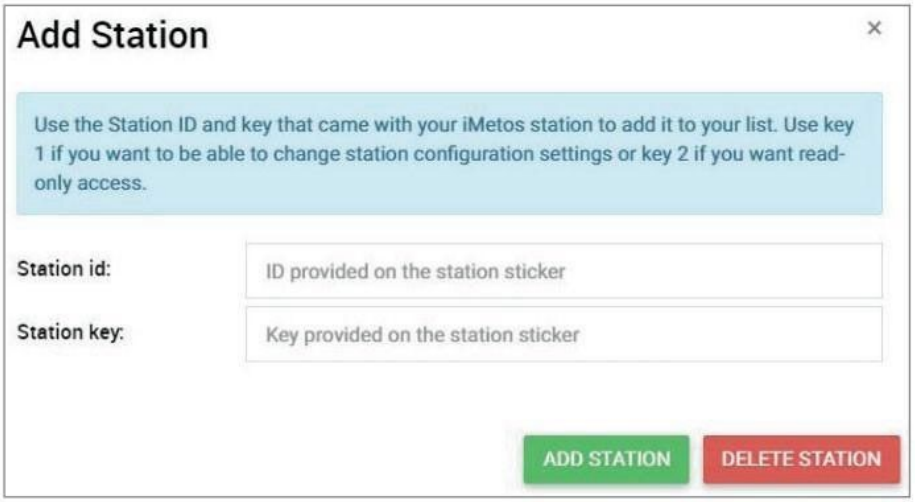
## 12.2. Add your METOS 5 device to your FieldClimate profile

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*

*The serial number label is placed on the main METOS 5 label.*




*Screenshot of adding the device to your FieldClimate account*

## 12.3. 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: API FC docs .

# 13. FAQ

## 13.1. Modem responses for joining the mobile network

When the METOS 5 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 on.

**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.

### 13.2. 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 communication will fail.

## 14. 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 NBIoT info

P - Setup NBIoT module parameters

T - Test (force) data transmission

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

# Appendix A: Example of a Successful Communication

```
SENSOR DATA TRANSMISSION.

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


<<< Onboard Antenna Enabled. >>>


AT+KSIMSEL?

+KSIMSEL: 0,,1

+KGSN: 52210231460310

OK


AT+WDSI?

+WDSI: 0

OK


AT+IFC=2,2

OK


ATS2=255

OK


ATI0

HL7802

OK


ATI8

HL7802.4.7.1

OK


ATI3

HL7802.4.7.1.0

OK


AT+CGMI

Sierra Wireless

OK


AT+GSN

359459092884092

OK


AT+KGSN=3
```

```
OK

AT+CCID
+CCID: 89882806660010805192
OK

AT+CIMI
901405101080519
OK

AT+KBNDCFG?
+KBNDCFG: 0,0000000000000A0A188E
+KBNDCFG: 1,00000000000000080084
+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,"1nce.net",9
OK

AT+CEREG?
+CEREG: 0,5
OK
AT+CGPADDR=1
```

```
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,"1nce.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
```

```
+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

JKUBAwABE0EBBVAAAfQBAoAABCotVgUkEBcABxIQBRE
xbmNlLm5ldAASAQAUAQAAABWgQwUAFgEe6AAfAwAiAS
kIDTM1OTQ1OTA5Mjg4NDA5MgAqJBAlADAQKyQQJQAwE
AZOb25lAAdOb25lAAhOb25lAAkBCkhMNzgwMgALSEw3
ODAyLjQuNy4xAAxITDc4MDIuNC43LjEuMAAOODk4ODI

<<< Closed >>>
```

```
4MDY2NjAwMTA4MDUxOTIADzkwMTQwNTEwMTA4MDUxOQ
ATaAAXAAAAABgsARmEAxoIBxvwABw1MjIxMDIzMTQ2M
DMxMAAdMjktMDQxNAAghQMhKAAjqBYkcBclACZTaWVy
cmEgV2lyZWxlc3MAJzAwMDAwMDAwMDAwMDBBMEExODh
FACgwMDAwMDAwMDAwMDA4MDA4NAAsAQ==

CmYCAwEBE0EBBVAAJBAlADAQEQAAAAcAAZsZHgAC6Bk
FAAoBAAEA



--EOF--Pattern--

OK

+KTCP_DATA: 1,48

+KTCP_ACK: 1,484,484


<<< Received data from server: 48 >>>


AT+KTCPRCV=1,48

CONNECT

O+cCAAETQQEFASQQJSYwEAWEAwIsAQMIBwbwAAiAACA
kEBA=--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
```

<<< 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

```
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*0A

$GPGGA,000306.00,,,,,0,00,,,,,,,*4D

$GPGSA,A,1,,,,,,,,,,,,,,*1E

$PSGSA,1,,,,,,,,,,,,,,,0,,,,0,00,3,0,B,,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.
```

# Appendix C: Example of an Unsuccessful Communication

```
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

359459092884092
OK
```

```
<<< Onboard Antenna Enabled. >>>

AT+KSIMSEL?
+KSIMSEL: 0,,1
OK

AT+WDSI?
+WDSI: 0
OK

AT+IFC=2,2
OK

ATS2=255
OK

ATI0
HL7802
OK

ATI8
HL7802.4.7.1
OK

ATI3
HL7802.4.7.1.0
OK

AT+CGMI
Sierra Wireless
OK

AT+GSN
AT+COPS?
+COPS: 0
```

```
AT+KGSN=3
+KGSN: 52210231460310
OK

AT+CCID
+CCID: 89882806660010805192
OK

AT+CIMI
901405101080519
OK

AT+KBNDCFG?
+KBNDCFG: 0,0000000000000A0A188E
+KBNDCFG: 1,00000000000000080084
+KBNDCFG: 2,0
OK

AT+KSELACQ?
ERROR

AT+KSELACQ?
+KSELACQ: 1,3,2
OK

<<< CAT-M1 network selected >>>

AT+CGDCONT?
+CGDCONT: 1,"IP",,,0,0,0,0,0,,0,,,,,
+CGDCONT: 2,"IPV4V6",,,0,0,0,0,0,,0,,,,,
OK

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

```
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK
AT+CREG?
+CREG: 0,0
OK
```

```
AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK
<<< Registration failure ! >>>

<<< Module Power OFF process >>>

AT
OK
```

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

AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CREG?
+CREG: 0,0
OK
```

| | |
|---|---|
| AT+CPOF<br>OK<br><br>LTE IoT module power: SLEEP<br><br>ERROR: LTEIoT communication failure!<br>Press H for help. | |

# Appendix D: 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 | WNDSP | 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 | TEROS-12 Diel permittivity | T12D | - | 2 | | | X | | | | | |
| 60 | 0x877A | 0x2B | TEROS-12 El conductivity | T12EC | mS/m | 2 | | | X | | | | | |
| 61 | 0x877B | 0x19 | TEROS-12 Water content | T12WC | % | 2 | X | | X | | | | | |
| 62 | 0x8778 | 0x03 | TEROS-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 | | | | |

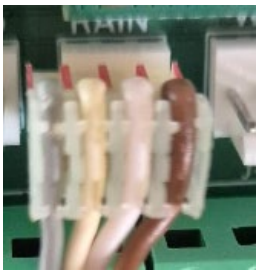
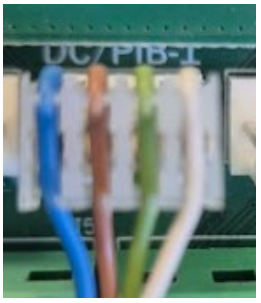
| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 108 | 0x88A1 | 0x03 | HydraScout Soil Temperature | SOILT | C | 2 | X | | | X | X | X | |
| 109 | 0x400A | 0x3D | US Wind speed - HW version | WNDHW | - | 2 | | X | | | | | |
| 110 | 0x400B | 0x3D | US Wind speed - 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 | | | | | |
| 127 | 0x4201 | 0x08 | Wet bulb temperature | WETBT | C | 2 | X | | | X | X | X | |
| 128 | 0x4701 | 0x09 | Dry bulb temperature | DRYBT | C | 2 | X | | | X | X | X | |
| 129 | 0x008F | 0x10 | Wind direction | WNDDR | Deg | 2 | | | | X | | | X |
| 130 | 0x9B02 | 0x57 | PI FylloClip capacitance | FCCAP | pF | 2 | | | | X | | | |
| 131 | 0x9B03 | 0x58 | PI FylloClip rel. irradiance | FCRIR | % VCC | 2 | | | | X | | | |

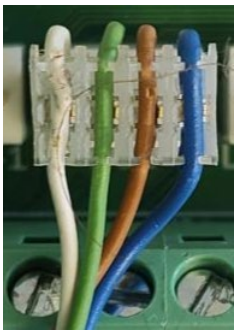
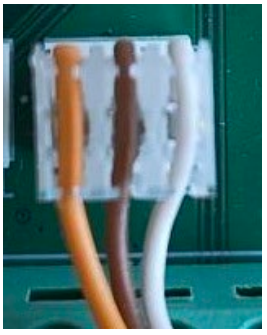
List of supported sensors can change in different firmware versions. It is recommended to check the supported sensors directly via the terminal menu on the weather station.

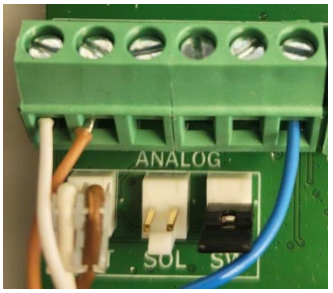
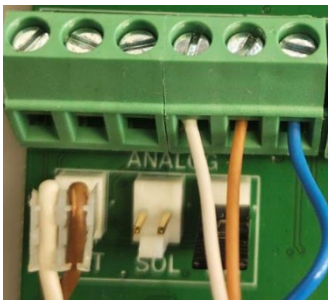
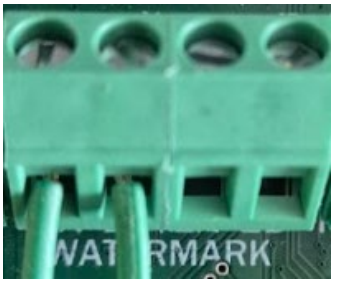
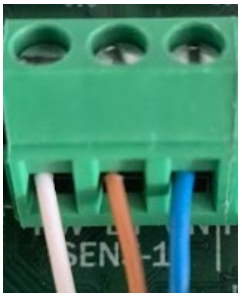
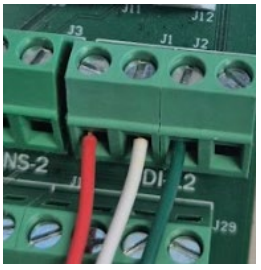
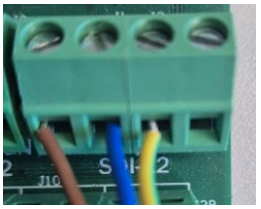
# Appendix E: How to Connect Various Sensors to Various Inputs

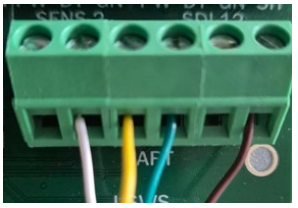
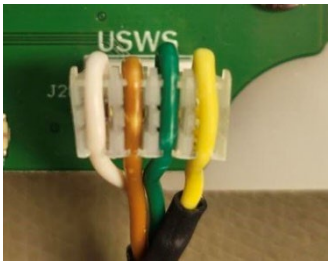
The table below gives guidelines on how and where to connect some of the main sensors on the METOS 5 inputs. For detailed information on all the various sensors and the corresponding inputs contact our support.

**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 | Supported Sensors | Default Sensor | Optical Display |
|---|---|---|---|
| PRESS SW | | Pressure Switch | |
| REED | Rain Gauge | Water meter counter sensors | |
| RAIN | REED sensors<br>Rain gauge | Rain gauge |  |
| WIND | Mechnical Wind speed sensor | Mechanical Wind Speed | |
| DC/PIB-1 | Pyranometer<br>PI-Bus Protocol sensors | Pyranometer |  |

| | | | |
|---|---|---|---|
| HC2 | - | Hygroclip |  |
| LEAFW | - | Leaf Wetness | |
| TEMP-1 | WM-Temp sensors | Air Temperature | |
| TEMP-2 | WM-Temp sensors | Soil Temperature |  |
| I2C Ext | - | PI Air Temp. & Hum. sensor | |

| | | | |
|---|---|---|---|
| ANALOG 1 | | PI54D (29-0717)<br><br>***Note:** The ground needs to be connected with GN from ANALOG-2<br>Additional manual if needed<br><br>*for HW v5.4 only |  |
| ANALOG 2 | | PI54D (29-0717) |  |
| Watermark 1&2 | - | Watermark |  |
| SENS-1 or SENS-2 | PI-Bus Protocol sensors | PI54D (29-0717) |  |
| SDI-12 | | Sentek |  |
| | | PI Profile |  |

| | | | |
|---|---|---|---|
| UART | Ultrasonic Wind sensor RS485 Protocol - interfaces/sensors | - |  |
| USWS | | Mech. Wind Direction/ PI BUS Protocol sensors |  |

# Appendix F: Technical specifications of the METOS 5.4 inputs

| INPUT LABEL | COMM. PROTOCOL | POWER VOLTAGE | INPUT/OUTPUT SPECIFICATION |
|---|---|---|---|
| PRESS SW | A/D input | | |
| REED | Reed relay/switch input | - | Reed relay/switch input |
| RAIN | Reed relay/switch input | - | Reed relay/switch input |
| WIND | - | - | A/C signal(max. 3V amplitude) |
| DC/PIB-1 | Duty cycle input<br>PI-Bus input | Variable up to 6V (5.4V by default)<br>Current: max 200 mA | Low voltage: 0 V - 0.6 V<br>High voltage: 2.5 V - 3.3 V |
| HC2 | UART-RX | 3.3V<br>Current: max 120 mA | Low voltage: 0 V - 0.6 V<br>High voltage: 2.5 V - 3.3 V |
| LEAFW | A/D input | 3.3V<br>Current: max 120 mA | 0V - 3.0V |
| TEMP-1<br>TEMP-2 | One-wire half-duplex serial communication | 3.3V<br>Current: max 120 mA | 0V or 3.3V |
| I2C Ext | I2C communication | 3.3V<br>Current: max 120 mA | Low voltage: 0 V - 0.6 V<br>High voltage: 2.5 V - 3.3 V |
| 2x ANALOG | General Analog inputs | Variable up to 6V (5.4V by default)<br>Current: max 200 mA | 0V - 3.0V |
| 2x WATERMARK | Resistance measurement | 3.3V | from 0 to 60 kOhm |
| SENS-1<br>SENS-2 | Configurable general sensor inputs (analog sensor, Decagon/METER Group sensor, PI-Bus sensor) | Variable up to 6V (5.4V by default)<br>Current: max 200 mA | Analog (sensor) input:<br>0V - 3.0V<br><br>Digital (sensor) input:<br>Low voltage: 0 V - 0.5 V<br>High voltage: 2.5 V - 3.3 V |
| SDI-12 | SDI-12 asynchronous serial communication protocol | 12V<br>Current: max 850 mA | Marking: 0 V - 1.0 V<br>Spacing: 3.5 V - 5.5 V |
| UART | Full-duplex UART | Variable up to 6V (5.4V by default)<br>Current: max 200 mA | Low voltage: 0 V - 0.6 V<br>High voltage: 2.5 V - 3.3 V |
| USW | Full-duplex UART<br>PI-Bus input | 3.3V<br>Current: max 120 mA | Low voltage: 0 V - 0.6 V<br>High voltage: 2.5 V - 3.3 V |

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**List of changes**

| Date | Revision Version | Changes |
|---|---|---|
| 02.2025 | 1 | First edition |
| 15.10.2025 | 2 | • Added WiFi daughterboard<br>• multiple SDI12 changes<br>• Analog inputs |
| 07.11.2025 | 2.1 | • New function: N – calibrate Sensor (Wind direction) added |
| 20.11.2025 | 2.2 | • Format adjustments<br>• E - SIM selection added<br>• W – Setup Watermark |
| 21.11.2025 | 2.3 | • eSIM added to 7.1 – SIM handling |
| 02.12.2025 | | • Review & editing of document |