



Environmental monitoring solutions



# Pluvi-ONE

## User manual



**Document**

Pluvi-ONE – User manual

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**Notes on this manual**

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## How to use this manual

Use the block diagram on the next page to browse within the different options and features.

To facilitate the reading of the manual using electronic devices such as PCs, tablets and smartphones, the references to the various chapters, indicated with the “§” character, to the tables, figures and summary, are hypertext links.

The symbology used is the following:



Warning

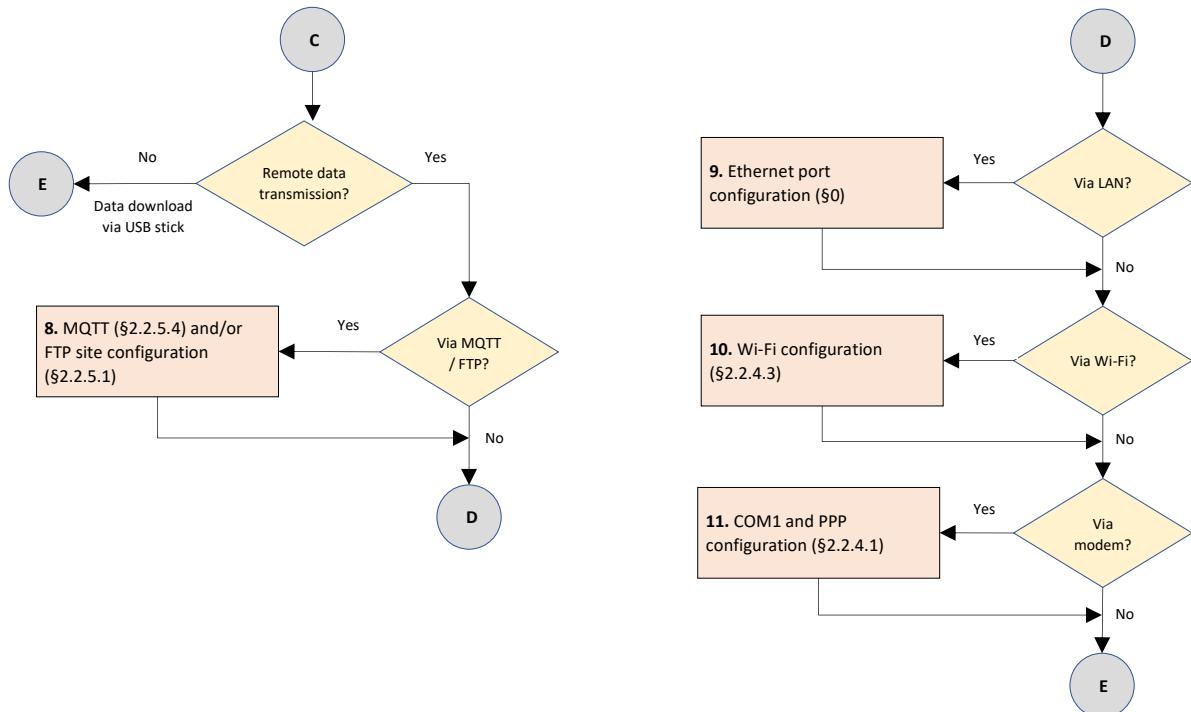
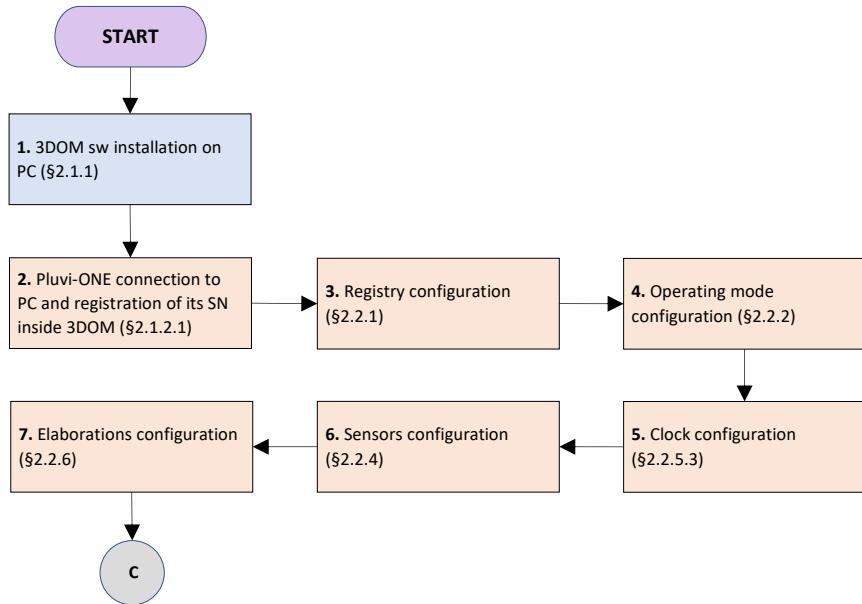


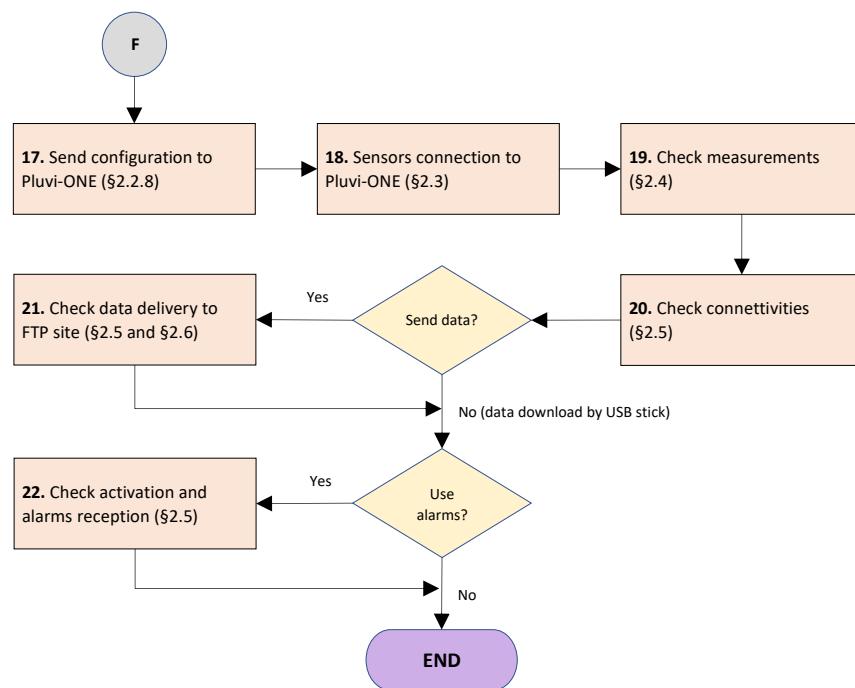
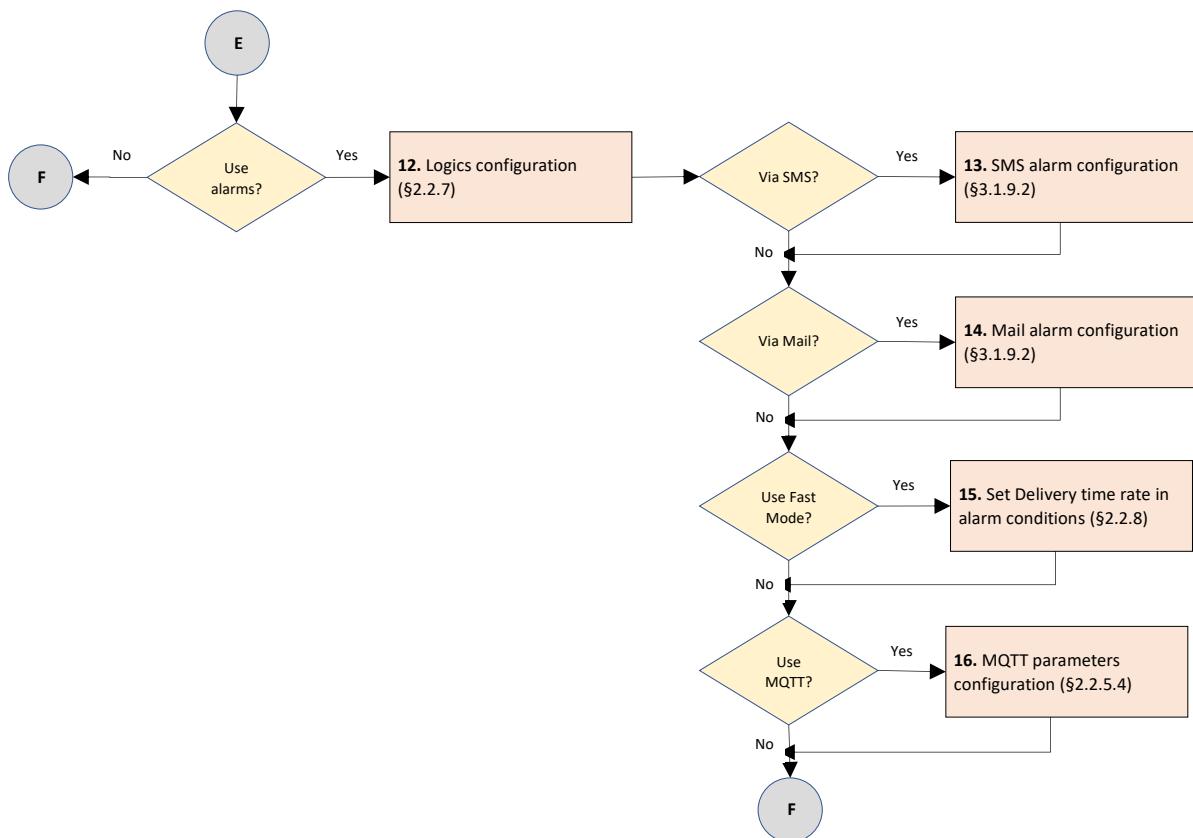
Additional information



Suggestions

## Flow scheme of the features





## Part 1

### 1.1 Introduction

Pluvi-ONE is an integrated system for monitoring rain and for issuing alarms. The basic system consists of a rain gauge, a data logger, a communication system and a power supply. The rain data produced are saved in its internal memory, or on a USB key, and sent via radio or via modem to appropriately configured remote systems. The alerts of the preset alarm conditions occur by sending an SMS or via the output implemented.

The system can be equipped with other sensors, such as the air temperature and humidity sensor, the sensor for measuring the water level or the sensor for measuring the distance of the storm front, using the available inputs.

Normally the *MW6501 – LSI LASTEM Products* USB stick is delivered with Pluvi-ONE unit. It contains 3DOM program for set up and management of Pluvi-ONE features. Anyway, it is possible to download 3DOM program by the [www.lsi-lastem.com](http://www.lsi-lastem.com) site. It is available in the *Software* page

## 1.2 Instrument description

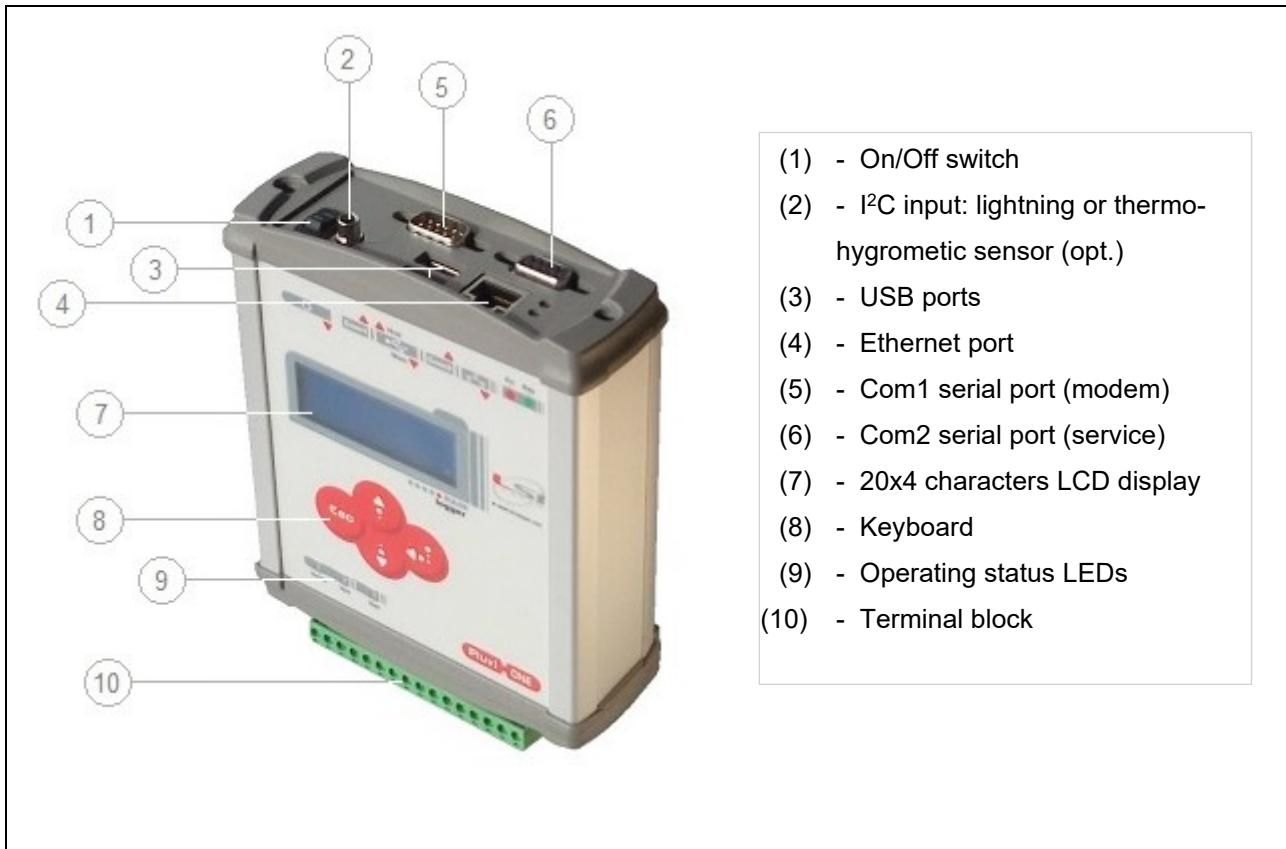


Fig. 1 – Instrument description.

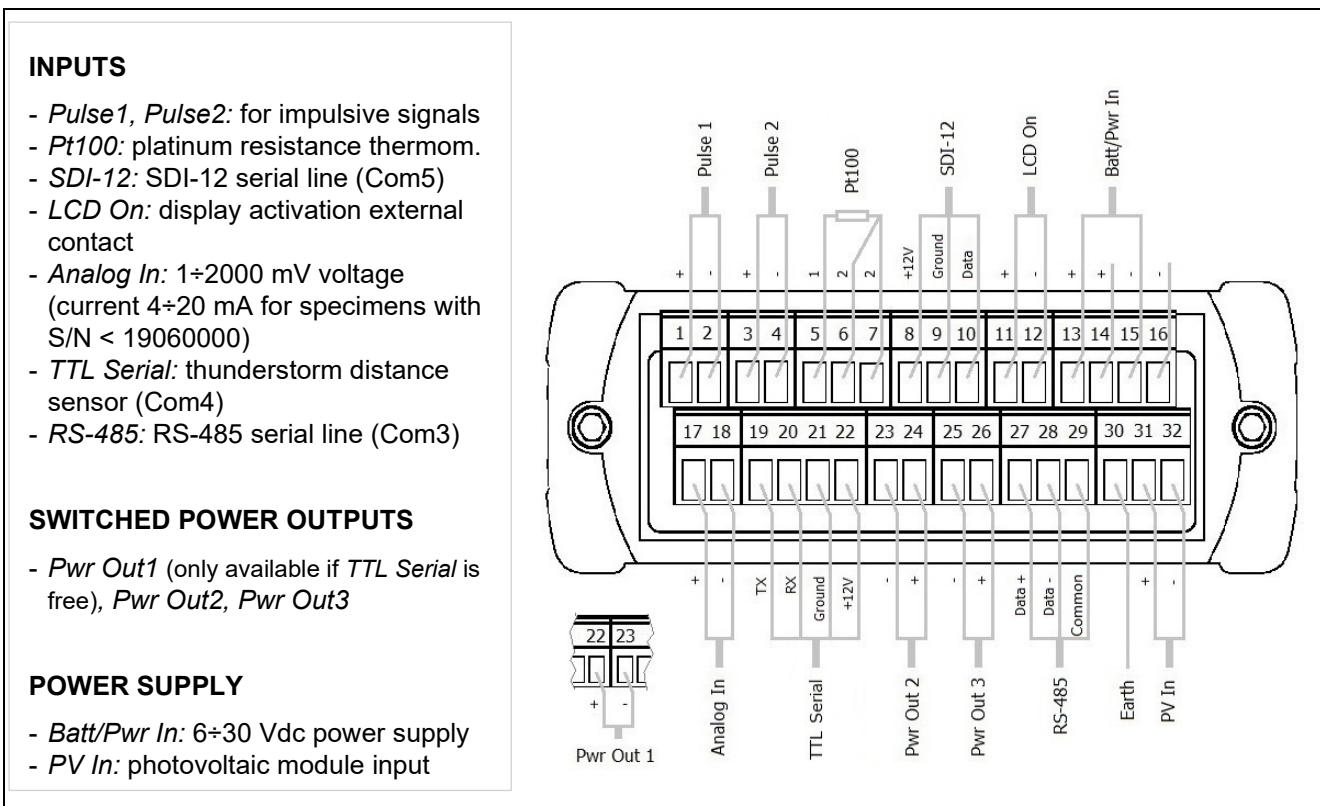


Fig. 2 – Terminal block.

## 1.3 Product setup and disposal

### 1.3.1 General safety standards

Read the following safety standards to avoid personal injuries and to prevent damages to this product or to the devices connected to it. Use this product strictly in the indicated way to avoid damages.

**Only the support staff is authorized to perform the setup and managing procedures.**

**Install the instrument in a clean, dry and safe place.** Humidity, dust and extreme temperatures tend to ruin or damage the instrument. In these particular environments, it's recommended to install the instrument in appropriate protective boxes.

**Power the instrument properly.** Observe the power voltage indicated for the instrument model owned.

**Connect the instrument properly.** Follow meticulously the wiring diagram provided with the equipment.

**Do not use the product if a malfunction presence is suspected.** If the existence of a malfunction is suspected, do not power the instrument and ask for assistance to the qualified support staff.

**Before any operation on electrical connections, power, sensors and communication devices:**

- **turn off the power**
- **discharge the accumulated electrostatic charges touching a conducting material or a grounded device**

**Do not start up the product if water or condensing humidity is present.**

**Do not start up the product in an explosive atmosphere.**

### 1.3.2 Mechanical installation and placing

Pluvi-ONE is usually used outdoor inside the appropriate protective boxes. However, indoor use is possible by fixing the instrument on DIN bar or to wall. For its functioning it requires the dedicated power supply or a photovoltaic module with the proper external battery. For the mechanical installation see the documentation provided with the equipment.

## 1.4 Disposal

This product is a high electronic content device. In accordance with environmental protection and recovery regulations, LSI LASTEM recommends treating the product as a waste of electrical and electronic equipment (RAEE). Its collection at the end of its life must be separated from other waste.

LSI LASTEM is responsible for the conformity of the production, sale and disposal chain of the product, ensuring the rights of the user. Improper disposal of this product will result in law penalties



## Part 2

### 2.1 Guide to first starting of Pluvi-ONE

Pluvi-ONE comes with a factory standard configuration. It is made to acquire the atmospheric pressure (the related sensor is built-in) and the battery level. Use the 3DOM software to change the factory configuration.

#### 2.1.1 3DOM software installation

3DOM is located on the USB pen driver - LSI LASTEM products (or on the website [www.lsi-lastem.com](http://www.lsi-lastem.com)).

Follow the instructions provided by the Setup program. If the used PC is the same PC used for the data management, it is recommended to install, at the same time, the other LSI LASTEM's programs with the related user licenses file.

#### 2.1.2 Pluvi-ONE entry in 3DOM

At the first use it is necessary to insert Pluvi-ONE in the list of 3DOM instruments and import its factory configuration. This can be done by connecting to the data logger via Ethernet(4) or using a USB stick.

##### 2.1.2.1 Pluvi-ONE entry via Ethernet connection

The data logger can be connected to the PC directly or via a local network where the DHCP service is active (for more information contact your network administrator).

For the direct connection, proceed as follows:

1. Insert the LAN cable into your computer and Pluvi-ONE Ethernet ports(4).
2. Connect the 10÷30 Vdc power supply to the terminal (14+, 16-) in the terminal block(10).
3. Set the computer IP address in the 192.168.0.2÷192.168.0.254 range with 255.255.255.0 as the netmask.
4. Turn on Pluvi-ONE with the On/Off switch(1).



For connection via network, instead:

1. Insert the LAN cable into the Pluvi-ONE Ethernet (4) port and to the network socket.
2. Connect a 10÷30 Vdc power supply to the terminal (14+, 16-) of the terminal block (10).
3. Turn on Pluvi-ONE with the On/Off switch (1).
4. Using the keyboard (8), enable the acquisition of the IP address from DHCP (for the navigation menu see §4.1.5, while for the activation see §4.1.4.5.1).
5. Detect the new IP address (§4.1.4.5.1 Ethernet).



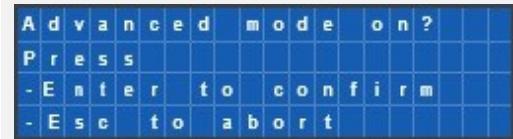
Once Pluvi-ONE is connected, proceed as follows:

1. Start 3DOM.
2. Select *Instrument->New...*
3. Select *Alpha-Log – Pluvi-ONE* and press **[Continue]**.
4. Enter Pluvi-ONE serial number and password indicated on the label in the back of the instrument and press **[Next]**.
5. In the **Communication Parameters** window, enter:
  - Connecting using SSH protocol.
  - IP address of the instrument: 192.168.0.1.
6. Press **[Save]**, then **[Next]**, **[Next]** and **[Finish]**.



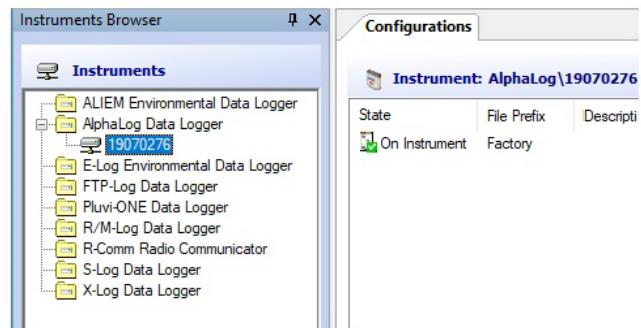
Pluvi-ONE enables the connection only when it is in advanced mode (default condition).

To check this condition, enter in the *SYSTEM->Advanced mode* using the instrument keyboard. The activation requires approximately one minute.



7. To download instrument configuration to PC, choose **[Yes]**, then **[Continue]**. After that, press **[Close]**, assign a name to the configuration (e.g. "Factory") and press **[Ok]**.

3DOM will update the *Instruments Browser* and *Configurations* with the serial number of the instrument and its configuration.



The IP address display mask requires an update time of up to 1 minute. Wait this time to allow the tool to update the mask with the actual IP address currently in use.

### 2.1.2.2 Pluvi-ONE entry via USB stick

For this operation you need a formatted FAT32 USB stick with at least 2 MB of space available. Proceed as follows:

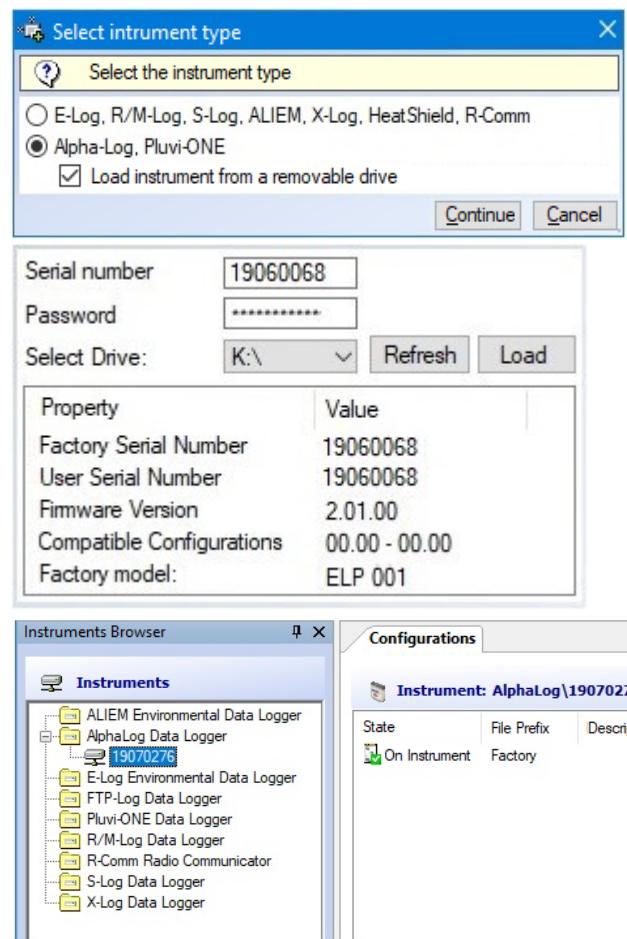
1. Turn on Pluvi-ONE with the On/Off switch **(1)**.
2. Using the keyboard **(8)**, enter the PEN DRIVE menu (§4.1.4.5.3). This function is accessible after about one minute since the instrument's ignition.
3. Insert the USB stick in one of Pluvi-ONE's USB ports **(8)**.

By reference to §4.1.4.5.3:

4. Choose *Upload config* and press , then confirm with . Once the file copy is finished, press 
5. Choose *Unmount* and press , then confirm with . At the end of the operation press , then pull out the USB stick.
6. Insert the USB stick in one of the PC's USB ports.

7. Start 3DOM.
8. Choose *Instrument->New...*
9. Choose *Alpha-Log – Pluvi-ONE*, enable the checkbox *Load instrument from a removable drive* and press **[Continue]**.
10. Enter the Pluvi-ONE serial number and password indicated on the label on the back of the instrument; select the unit associated with the stick and press **[Load]**. The program shows information about the instrument memorized in the flash drive.
11. Press **[Continue]** to accept the settings and import the configuration.
12. In the Configuration status window press **[Ok]**.
13. Name the configuration (e.g. "Factory") when prompted and press **[Ok]**.

3DOM will update the *Instruments list* and the *Configurations* with the serial of the instrument and its configuration.



## 2.2 Configuring Pluvi-ONE

In addition to the factory configuration, alternative configuration template models are available (*\$Pluvi-ONE configuration templates*). In both cases it is usually necessary to adapt these configurations according to the specific requirements. When completed, this new configuration will be sent to the instrument, which will start operating based on the options selected.

Edit the factory configuration model:

1. Select the serial number of the instrument in the *Instruments Browser* list.
2. Select the saved setting (e. g. "Factory"), choose *Configuration->Save as New Configuration...*, assign a name to the setting (e. g. "Custom") and press **[Ok]**.
3. Open the new configuration by selecting *Configuration->Edit...*

Edit one of the configuration template model:

1. Select the serial number of the instrument in the *Instruments Browser* list.
2. Select *Configuration->New...*, choose one of the available template model, assign a name to the setting (e. g. "Custom") and press **[Ok]**.



For further information see chapter *Operate with the configurations* of *3DOM – User manual*. The manual is available as 3DOM online help (*Help->User's manual*).

## 2.2.1 Set instrument code, name and geographical information

It is possible to set a customize serial number to Pluvi-ONE. When *Use a substitutive serial number*=YES, this number will be used on the data file instead of the factory serial number.

It is possible to set the Pluvi-ONE name and geographical information. Time zone is needed to assign the time stamp to the measurements.

Go to *Registry-> User and Site information*

For more information see §3.1.1.

Parameter	valore
<b>Factory Informations</b>	
Serial number	19070237
Firmware version	1.02.00
Model	ALP 001
Instrument configuration update	31/03/2020 07:30:13
Data configuration update	31/03/2020 07:30:13
<b>Device Identifier</b>	
Use an alternative serial code	No
Alternative serial code	
<b>Other Informations</b>	
User-defined name	
Site name	Settala
Longitude	9,3919
Latitude	45,4558
Altitude	108
Time Zone	+01:00

## 2.2.2 Setup of the operative mode based on the available energy

Set operating parameters to allow effective management of the available energy. Go to *System-> General settings*.

Set the *Operative mode*:

- *Always ON*: when main power supply is used.
- *Low Power*: when power from solar panel is used.

Parameter	Value
<b>General Settings</b>	
Operative mode	Always on
Power threshold low	11
Power threshold high	11.8
<b>Diagnostic</b>	
Rows of logs to send (0 - 1000)	0

Set two power thresholds:

- Power threshold high: below this value, Pluvi-ONE runs the measurements but stops the data communication procedure (Run limited).
- Power threshold low: below this value Pluvi-ONE stops even the data acquisition procedure (Low battery). On display the “Power low” information appears.

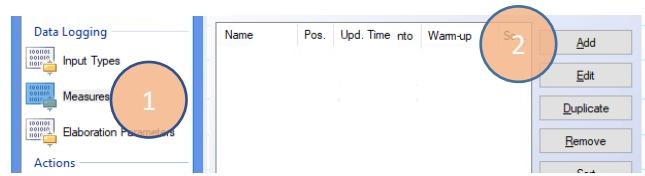


For more information, see §3.1.2

## 2.2.3 Sensors configuration

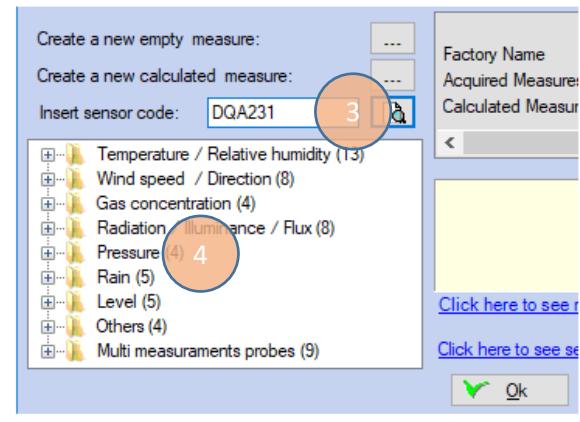
When one of configuration models suggested by 3DOM is used, remove the sensors not used and/or to add the ones missed. To add sensors, it is possible to search inside the 3DOM sensors library:

1. In the section *Data Logging*, select *Measures* (1).
2. Press **[Add]** (2).

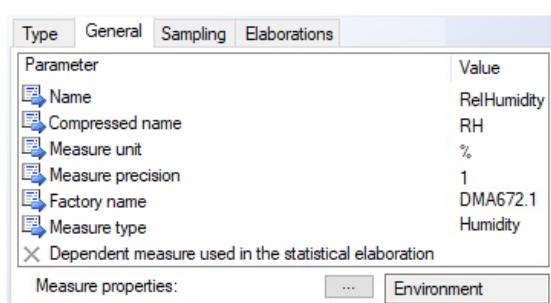
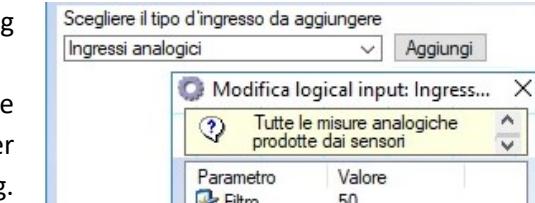


3. Enter the commercial code (e.g. DMA672.1) and launch the search (3), or select the code from its category (4) and press **[Ok]**.

If the sensor hasn't been found, see chapter §2.2.3.1.



4. Select *Add a new input type* (e.g. "DMA672.1: Analog input") and press **[Add]**.
5. Set/check that the parameters are appropriate for the selected type of sensor (e.g. DMA672.1 sensor: Filter value=50. The quantities measured by the sensor (e.g. DMA672.1: "RelHumidity" and "AirTemp") will appear.
6. Double click on the new measurement name and check parameters in the next labels are correct: *General, Sampling, Elaborations*
7. Repeat the operation for the next sensors.



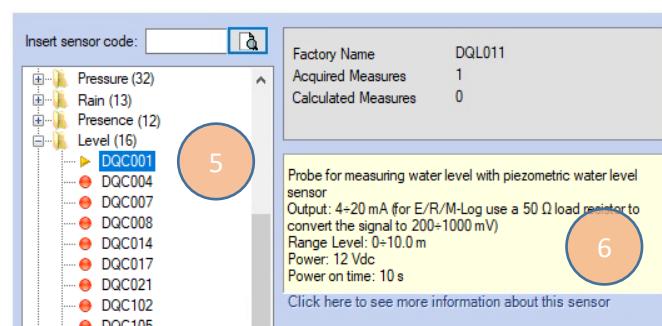
See also §3.1.5.

### 2.2.3.1 Configuring sensors not from the library

If the sensor is not in the library list, it is advisable to choose one from the list with similar characteristics and then change its properties or create a new one.

Starting from a similar sensor:

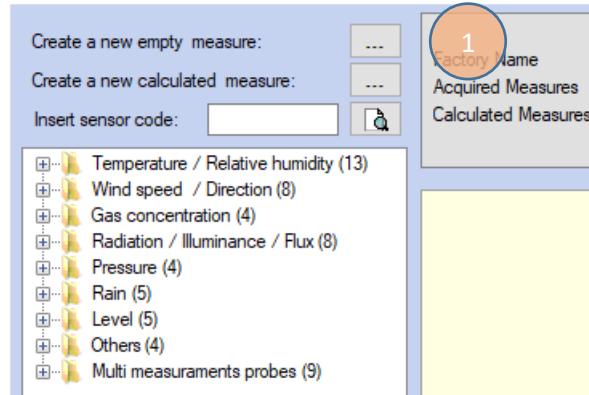
1. Select *Measures* in the *Data Logging* section and press **[Add]**.
2. Expand the category (e.g. "Level") and select the first sensor (5). The program will display its characteristics (6).
3. Scroll the list to find the most similar sensor.
4. Once the appropriate sensor has been identified, press **[Ok]**.



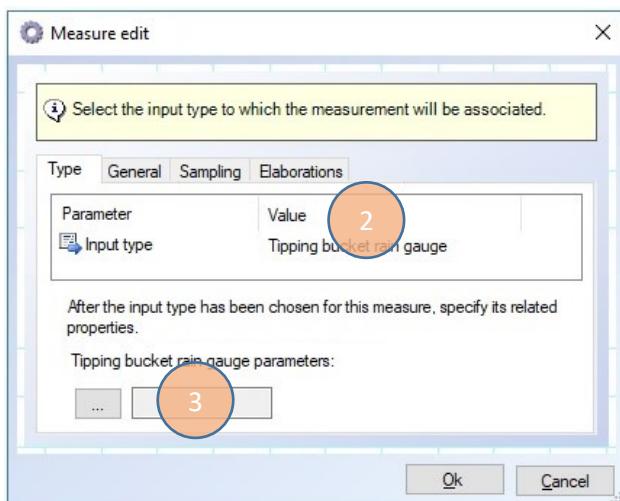
5. If requested, select *Add a new input type* (e.g. “Tipping bucket rain gauge”), press **[Add]** and check that the displayed parameters are adequate for the type of selected sensor.

Starting from new sensor (not from the sensors library):

1. Select *Measures* in the *Data Logging* section and press **[Add]**.
2. Press [...] (1) in *Create a new empty measure*.



3. Select *Input type* based on the sensor type (2).
4. Set the parameters (3).
5. Set the parameters of *General*, *Sampling* and *Elaborations* sheets.

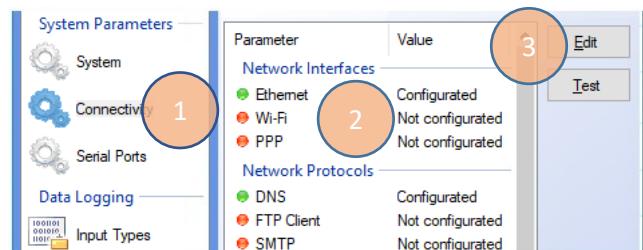


Configure all sensors, save the configuration and proceed to send it to the instrument.

## 2.2.4 Configuring Internet connectivity – network interfaces

Services such as sending data to a FTP server, sending e-mails, managing Pluvi-ONE configuration in remote mode as well as clock synchronization, require internet connection. If you wish to use such services, you should configure the network interface (LAN or WLAN) you need to use.

1. Select *Connectivity* (1) in the *System Parameters* section.
2. Select the item in *Network Interfaces* (2) to be set/changed.
3. Press **[Edit]** (3).
4. Enter all requested parameters.
5. Press **[Ok]**.



For further information, see §3.1.3.

As an example, below is a list of some interface configurations for Internet connection.

### 2.2.4.1 PPP interface (3G/4G modem)

3G/4G modem is connected to Pluvi-ONE COM1 serial port, where its power supply mode needs to be set (Dev: /dev/tty/SP3). *APN*, *User*, *Password* and *Context Dial* are those relating to the telephone provider used.

For further information, see §3.1.3.

Parameter	Value
Enable PPP connection	Si
Dev	/dev/ttySP3
APN	ibox.tim.it
User	
Password	
Context Dial	*99***1#

### 2.2.4.2 Ethernet interface

If the IP address is assigned by the server, set *Configuration* to *DHCP*. If, instead, it is a static address, set *Configuration* to *Static address* and specify *IP address*, *Subnet mask* and *Gateway*.

For further information, see §3.1.3.

Parameter	Value	Value
Set Ethernet settings	Yes	Yes
Configuration	Static address	DHCP
IP address	192.168.148.35	
Subnet mask	255.255.255.0	
Gateway	192.168.148.200	

Consult your network administrator for more details.

### 2.2.4.3 Wi-Fi interface

Set *SSID* and *Password*.

If the IP address is assigned by the server, you only need to set *Configuration* to *DHCP*. If on the contrary it is a static address, set *Configuration* to *Static address* and specify *IP address*, *Subnet mask* and *Gateway*.

For further information, see §3.1.3.

Parameter	Value	Value
Set Wi-Fi settings	Yes	Yes
SSID	meteo	meteo
Password	*****	*****
Configuration	Static address	DHCP
IP address	192.168.148.35	
Subnet mask	255.255.255.0	
Gateway	192.168.148.200	

Consult your network administrator for more details.



Password cannot be hidden in the configuration file.



Connect a Wi-Fi USB stick into one of the two USB ports(3) of the instrument to connect Pluvi-ONE to a WLAN network.



If an internet connection is required and there is no LAN or WLAN network available for Pluvi-ONE connection, use a 3G/4G modem equipped with appropriate SIM card (having activate data traffic, check the data volume) and configure PPP interface.



It is possible to specify one or more gateways for connecting Pluvi-ONE to the internet. The first used is the specific one of the used network interface, the others are defined as Preferential gateways. The insertion order defines its priority.

## 2.2.5 NFTP, MQTT, NTP protocols configuration

1. *System Parameters-Connectivity*(4).
2. *Network Protocol*(5) to be set up/changed (e.g. FTP).
3. Press **[Change]**(6).

Parameter	Value
PPP	Configured
DNS	Configured
FTP	Not configured
SMTP	Not configured
NTP	Configured
MQTT	Not configured
Modbus Slave	

In the next sections some examples are reported.

### 2.2.5.1 FTP protocol for data the configuration file management (Configuration Authority)

Set the FTP area from where Pluvi-ONE will download the configuration file:

1. Enter the identification *Name*(7) of FTP site and *URL*(8) in the specified format. The side panel shows an example of the FTP site named LSI-Lastem.
2. Press **[Test]**(10) to perform a connection test to the FTP site.
3. enable the *Configuration Authority* checkbox (9).
4. Press **[Ok]**(11).

If *Configuration Authority* is enabled, each time the configuration is saved using 3DOM, it is also sent to the same FTP area. In concurrence with every data transfer via FTP, Pluvi-ONE monitors the FTP area that has been set up as *Configuration Authority* and, if it detects the presence of a new configuration file, this is automatically uploaded; then Pluvi-ONE will start operating in accordance with the new configuration.



Password cannot be hidden in the configuration file.



It is possible to specify several FTP areas for data delivery, but only one area can be appointed as *Configuration Authority*.

### 2.2.5.2 SMTP protocol for e-mail messages

Here an example of configuration for sending e-mails.

Consult your network administrator for more details

Parameter	Value
Enable SMTP service	Yes
Server	mail.lsi-lastem.it
Port	25
Security using TLS	Si
Security using STARTTLS	No
User	AlphaLog276@lsi-lastem.it
Password	*****



The password is visible in the configuration file.

### 2.2.5.3 NTP protocol for watch synchronization via internet

When Apha-Log is connected to Internet, its internal watch will be synchronized using the time given by the following NTP sites.

The time used keeps into consideration the time zone as set in the *Registry*.

For more information, see §3.1.3.

Parameter	Value
↳ NTP Server	0.pool.ntp.org
↳ NTP Server	1.pool.ntp.org
↳ NTP Server	it.pool.ntp.org

### 2.2.5.4 MQTT protocol

Example of configuration for sending MQTT messages. The time rate for the elaboration data depends by the value set in *Elaboration Parameters-Elaboration data delivery time rate*.

For more information see §3.2.6.

Parameter	Value
↳ Enable MQTT protocol	Yes
↳ Broker	151.58.122.27
↳ Port	1883
↳ User	
↳ Password	
↳ Publish instantaneous values	Yes
↳ Inst. values publishing time rate	10
↳ Publish elaboration values	Yes
↳ Publish diagnostic information	No
↳ Publish alarms	No



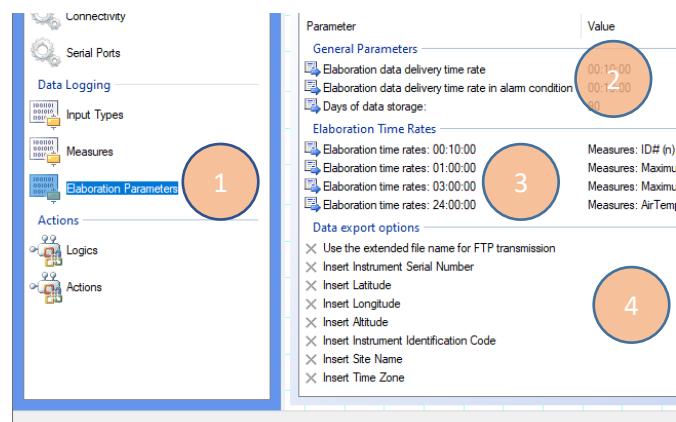
The password is visible in the configuration file.

## 2.2.6 Data delivery to FTP and MQTT server or USB memory

Typically, Pluvi-ONE send data in the form of ASCII file to one FTP area inside a server

From *Elaboration Parameters*(1).

- *General Parameter*(2). Set the rate of data delivery to FTP server or USB memory, in normal situation and in case of alarm event
- *Elaboration Time rates* (3). Summarize the delivery rate for each measurement



*Data export options* (4) set the list of information to be added to the ASCII file delivered to FTP or MQTT server.

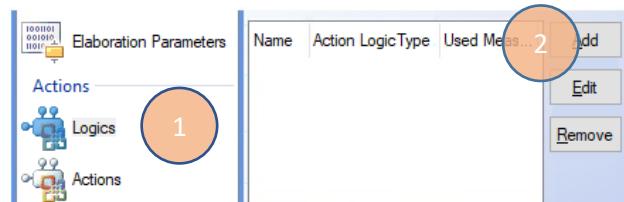
For more information, see §3.1.6.

## 2.2.7 Configuring logics, actuators and alarms

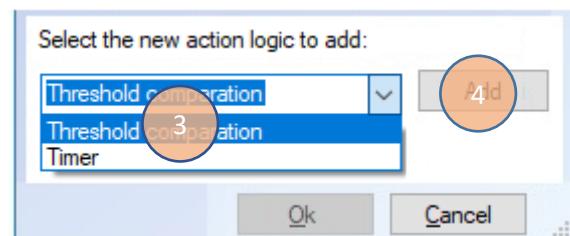
It is possible to set logics that, upon their occurrence (true / false), will activate an action as: triggering local electrical outputs and messages (SMS, Email, MQTT). Pluvi-ONE is equipped with 3 actuated electrical outputs for triggering external devices such as sensors, modems or alarm devices. Additionally, it can also send e-mails, SMS, and MQTT messages. All these actions take place when some specific (logic) conditions occur. If the used configuration is made starting from one of the 3DOM models, in *Actions-Logics* you will find same sample logics already. It is possible to modify them or add new ones.

Add actuation logics:

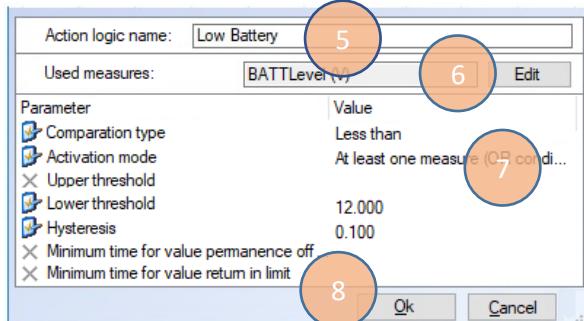
1. *Logics-Actions*(1).
2. Press **[Add](2)**.



3. Select the desired type of logics (3) (e.g. "Threshold comparison").
4. Press **[Add](4)**.

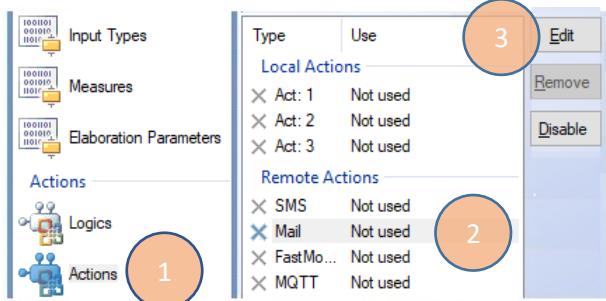


5. Assign a name to the logics (5). This name will be reported on the sms or Email messages
6. Press **[Edit](6)** and select the measurement associated to this logics.
7. Set all the requested parameters (7).
8. Press **[Ok](8)**.



Joint the new logic to a specific action:

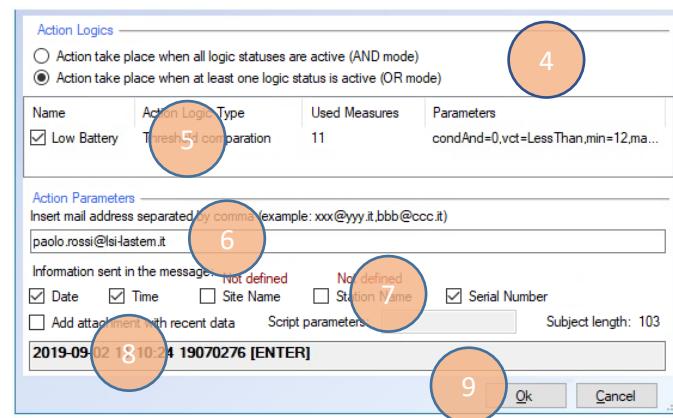
1. *Actions-(1)*.
2. Select one *Local action* (switched power output)
3. Select one *Remote action* (2).
4. Press **[Edit](3)**.



5. Select the mode of activation: AND/OR(4).
6. Select one or more logic statuses involved in this action (5).
7. Enter the remaining parameters.

In the example on the right, parameters refer to e-mails. In particular: recipient's e-mail address (6), elements (7) to enter in the e-mail. The program shows a preview of the selected items (8).

8. Press [Ok](9).



FastMode and MQTT modes setup required the selection of the logic name only.

For further information, see §3.1.8

## 2.2.8 Saving and uploading configuration file to Pluvi-ONE

Press [Save] in the *Toolbar* and press [Ok]. If a check of the connectivity parameters is required (the PC must be connected to the internet), press [Yes] and then [Continue].

3DOM will ask if it is needed to send the configuration to the instrument. If yes, press [Yes] and confirm with [Ok], or [No] to send it later.



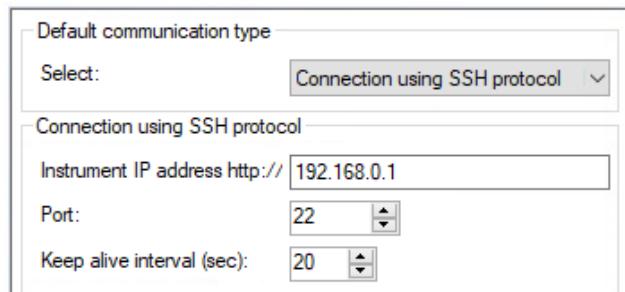
During the configuration saving process, 3DOM verifies that it does not contain errors or inappropriate choices. Whenever these are still acceptable / tolerable by the system, the program generates a warning message, however it will be possible to save the configuration.

In case of critical errors 3DOM does not allow configuration saving and indicates the corrective action to be taken to proceed. In case of important changes, the program asks for confirmation of the choices made.

While uploading and saving the configuration in Pluvi-ONE, 3DOM shows a percentage progress bar. In the event that an unexpected event (e.g. communication interruption) disturbs this phase, Pluvi-ONE detects the irregularity and restarts itself with the last valid configuration.

To send the configuration via SSH (Pluvi-ONE is connected to the PC directly via Ethernet or Wi-Fi):

1. Select the serial number of the instrument and the required configuration from the list *Instruments*.
2. *Configuration->Upload...*, then [Ok].
3. Press [Edit], select *Connecting using SSH protocol*.
4. Set the parameters shown on the side panel and press [Save] to start operation.
5. Press [Continue].
6. Once the operation has been completed, press [Close].



For more information, see §3.1.10.1.

For sending the configuration via USB stick or FTP server, see §3.1.10.2 and §3.1.10.3 respectively.

## 2.3 Connecting probes to Pluvi-ONE

The probes must be physically connected to Pluvi-ONE according to configurations. It is recommended to create the *Configuration Report* to identify the physical inputs that are assigned to the programmed probes.

For the generation of the Configuration report, refer to the chapter *Configuration Report of 3DOM – User manual*.



Switch off the instrument to connect the probes to the terminal board(10) of Pluvi-ONE and ALIEM module. See the instructions of chapter §1.3

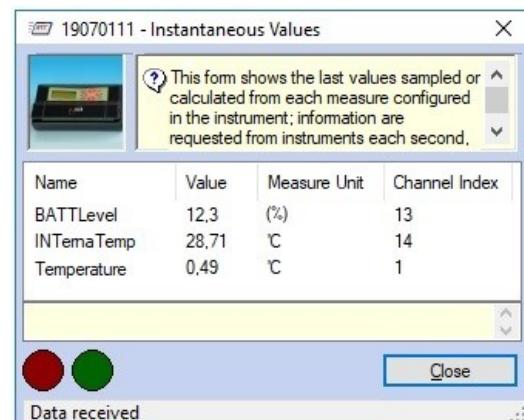
## 2.4 Check measures acquisition

Once the physical connection of the probes has been completed, the instantaneous values can be displayed on 3DOM. The use of the software requires that Pluvi-ONE is connected to the PC via the Ethernet or Wi-Fi port. If not, check the instantaneous values directly on the data logger display (§4.1.4.1).

1. Make sure the PC is connected to the Pluvi-ONE Ethernet port(4) (§2.1.2.1).
2. Turn on AlPluvi-ONE using the On/Off switch(1).
3. Startup 3DOM.
4. Select Pluvi-ONE serial number.
5. Select *Communication->Instantaneous values...*

Values will change with a rate based on *Update time rate* set in the *Sampling* section of the specific measurement.

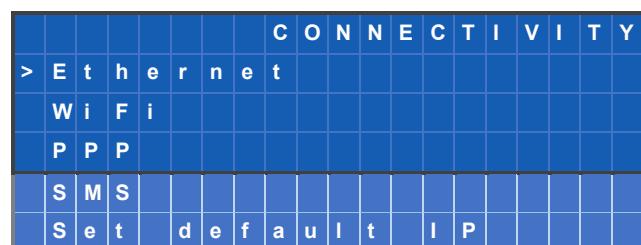
To stop the communication press **[Close]**.



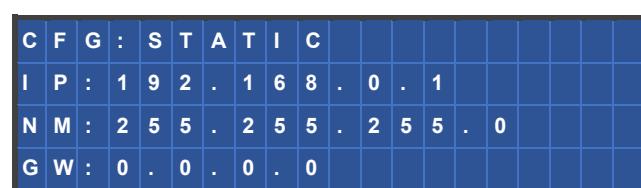
## 2.5 Checking operation

After physically connecting all the probes and after checking the proper acquisition of the measurements, it is possible to check the Pluvi-ONE connectivity parameters.

From *Connectivity* menu, accessible from *Advanced Features* menu, it is possible to check the connectivity parameters (data transfer to FTP site, e-mail sending, SMS sending, etc.)



Example of Ethernet port setting.

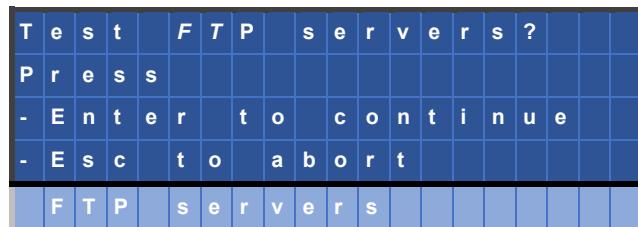




If modem is used, check connectivity using the PPP menu where it is checked if the radio modem has received an IP from the mobile network, this confirms the internet connectivity of the instrument.

If FTP sites have been configured, perform a connection test.

From *FTP servers* menu, accessible from *Advanced Features* menu, it is possible to see the list of configured FTP sites and perform a connection test.



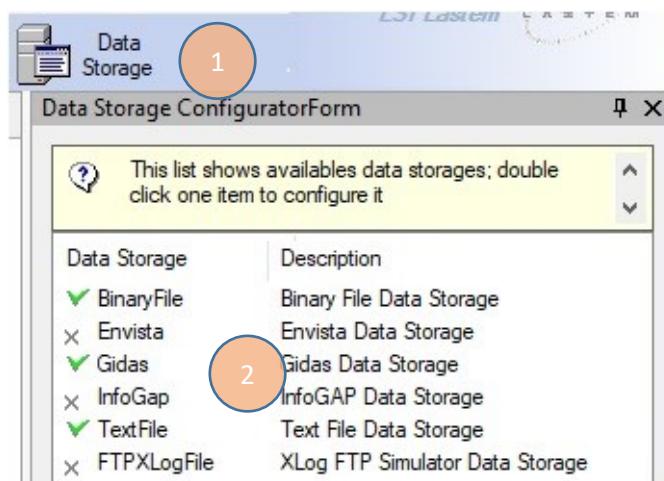
If logic and consequent action has been configured, try to trigger the activation condition. For example, if a logic has been configured to send an email in case of rain more than 2 mm, pour water on the rain gauge until it exceeds 2 mm, subsequently check if email is received at the indicated address.

## 2.6 Check data reception to PC using 3DOM program

Using 3DOM, it is possible to receive the data elaborations to the PC. Depending on the type of network interface configured (§2.2.4) and the type of protocol implemented (§2.2.5), it is possible to choose between a direct connection from the data logger, from an FTP site or from a local or network folder.

Set the data storage format you want to receive. This setting will also be kept for next uses.

1. From the Instruments Browser select the instrument serial number.
2. Select **[Data Storage](1)** from the 3DOM tool bar.
3. Double click to select the data format required **(2)**. The green mark advise that the selection has been activated.

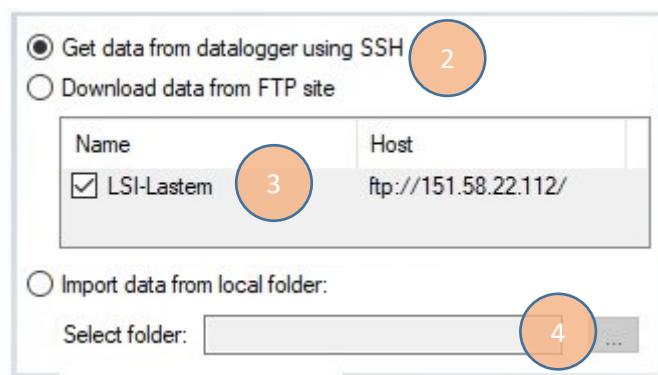


For data download:

1. Select **[Elab. Values](1)** from the tool bar.

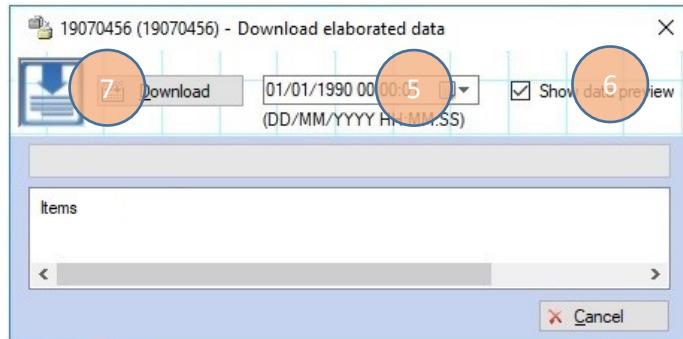


2. Select the data download modality (2).
  - From FTP site: select the FTP address from the proposed list (3).
  - From local (network) folder: select the local folder (or network folder) [...] (4).



3. Select the day/time since the data are required (5).
4. Select if data preview is required (6).
5. Select [Download] (7) to start receiving data.

Duration of the process depends by the data volume Pluvi-ONE.



Verify that the processed data received on the PC have the type and rate required. In case of errors, change the configuration.

## Part 3 - Insights

### 3.1 Insights the Pluvi-ONE configuration

#### 3.1.1 Registry information

The registry information identifies Pluvi-ONE. An example is shown in Fig. 3.

Parameter	valore
<b>Factory Informations</b>	
Serial number	19070237
Firmware version	1.02.00
Model	ALP 001
Instrument configuration update	31/03/2020 07:30:13
Data configuration update	31/03/2020 07:30:13
<b>Device Identifier</b>	
Use an alternative serial code	No
Alternative serial code	
<b>Other Informations</b>	
User-defined name	
Site name	Settala
Longitude	9,3919
Latitude	45,4558
Altitude	108
Time Zone	+01:00

Fig. 3 – Registry information

The *Factory information* are not editable. These are:

- *Serial number*: is the serial number of the instrument. It's the name of the folder where the data files are stored or part of the data files name if *Use an alternative serial code* is set to *No*.
- *Firmware version*: the current firmware version installed on the instrument.
- *Model*: identifies the instrument model.
- *Instrument configuration update*: the exact date and time the instrument was configured.
- *Data configuration update*: the exact date and time the instrument received data.

The parameters in *Device Identifier* are editable. These are:

- *Use an alternative serial code*: if set on *Yes*, Pluvi-ONE uses *Alternative serial code* instead of *Serial number*.
- *Alternative serial code*: the serial number that the instrument will adopt instead of the factory one.

In *Other Information* there are additional information that helps to identify the instrument. They are:

- *User-defined name*: the name used to easily detect the instrument among others.
- *Site name*: the location where the instrument is installed.
- *Longitude/Latitude*: identify the installation site (expressed in decimal degrees).
- *Altitude*: the installation site altitude.
- *Time Zone*: the time zone, compared to NTP time, used by the instrument to synchronize its internal clock.

### 3.1.2 Operating mode based on energy availability

The operative modes define Pluvi-ONE's behaviour based on the available power.

System Parameters->System.

Parameter	Value
<b>General Settings</b>	
Operative mode	Always on
Power threshold low	11
Power threshold high	11.8
<b>Diagnostic</b>	
Rows of logs to send (0 - 1000)	0

Fig. 4 – System parameters

Pluvi-ONE's operative modes are based on three parameters: *Operative mode*, *Power threshold low* and *Power threshold high*. In 3DOM, these can be found in *General Settings*.

It's possible to set the regular mode (*Operative mode*) or the low power mode. The first one is to prefer when there are no power issues (the power grid is available), while the second one is preferable when the data logger is powered by a battery and photovoltaic panel combo.

In the regular mode, the instrument set up its internal components to be always on, so that they are always ready to communicate with the external devices, at the expense of a higher power consumption.

In the low power mode, instead, the instrument works with the minimum power usage. The internal components are switched on only when necessary (e.g. for sending data to the FTP site), at the expense of the communication with the external devices.

When Pluvi-ONE's power voltage is higher than the set high threshold, the data logger works in the selected operative mode (data logger status = Run normal).

If the power voltage is lower than the high threshold but higher than the low threshold, the data transmission activities will be stopped. The measurements acquisition and the elaborations creation will continue regularly. If used, the modem will be turned off and the instrument will switch to the low power operative mode (data logger status = Run limited).

If the power drops under the low threshold, the measurements acquisition and the elaborations creation will be stopped too. Instead of showing the measurements values, "Power low" will be shown on the display (data logger status = Low battery).

The data logger will restore the partial functioning of the instrument when the low threshold is exceeded; when the high threshold is exceeded, it will restore the complete functioning instead.

A power voltage check is done every minute, regardless of whether the battery voltage measurement is configured or not. To change data logger status while the battery is charging, it's required a battery voltage value higher than 0,3 V, since the activation of the actuators that are configured to turn the sensors or the modem on could cause a sudden voltage drop, due to the power absorption.

Fig. 5 shows Pluvi-ONE's operating status depending on the detected battery value, considering the default low and high thresholds, which are 11 V and 11,8 V respectively.

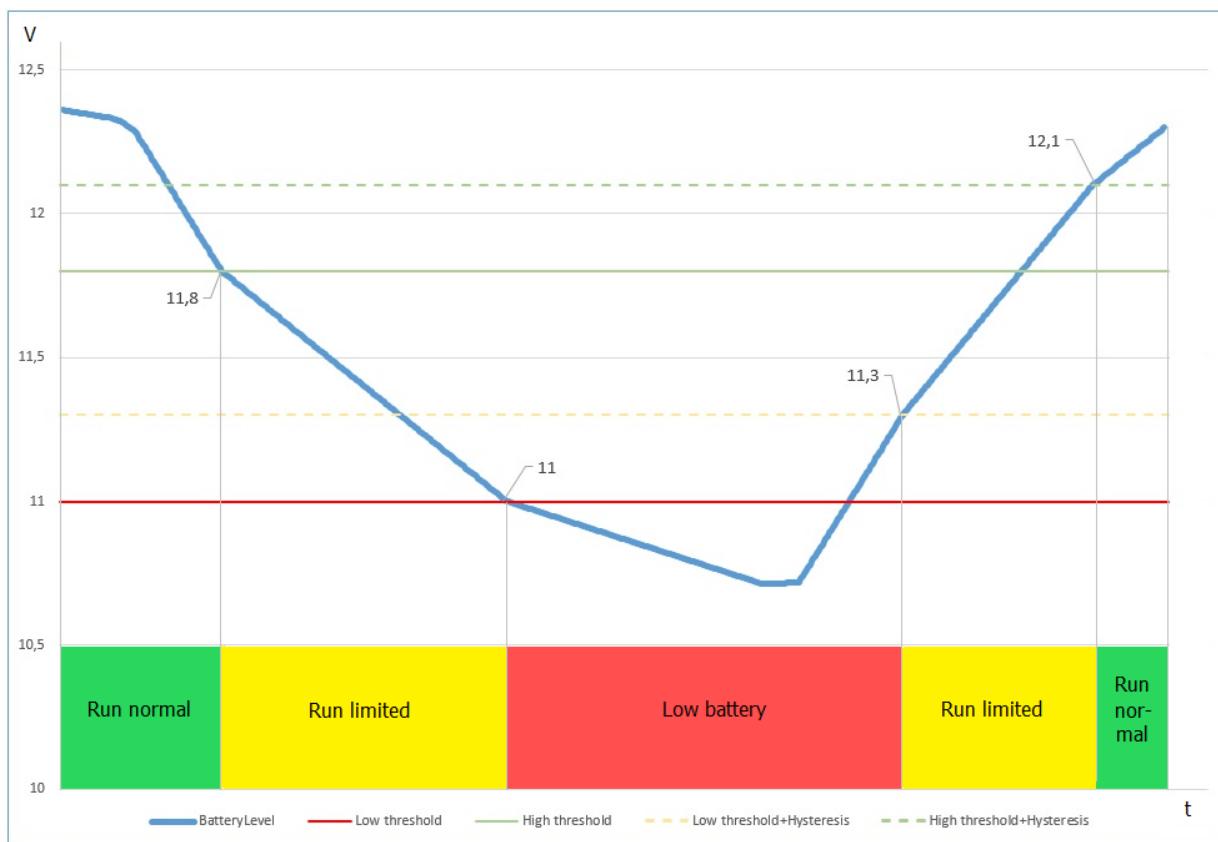


Fig. 5 – Pluvi-ONE's operating status.

### 3.1.3 Connectivity

The communication between Pluvi-ONE and the external devices works through different network protocols. It's therefore necessary to configure the network connection in accordance with the protocol intended to be used. 3DOM allows the user to configure the following network connections:

**Ethernet** If configured, it permits SSH connection through a PC. SSH is a protocol that allows two systems (in our case Pluvi-ONE and PC) connected through the same network, to communicate each other. The IP address can be static or dynamic. The static IP address is an address that is definitively assigned to the instrument, unless the user decides to change it. The dynamic IP address, on the other hand, this is an address that is assigned by the DHCP server when the communication devices of the data logger are turned on. It may change from time to time, depending on the availability of the DHCP server. To use the DHCP function, the instrument must be connected to the network.

In case data logger must be often interrogated by the PC, as for example if the instrument has WEB server mode activated, prefer static IP address.

*Default value: IP: 192.168.0.1, Subnet mask: 255.255.255.0.*

Parameter	Value	Value
Set Ethernet settings	Yes	Yes
Configuration	Static address	DHCP
IP address	192.168.148.35	
Subnet mask	255.255.255.0	
Gateway	192.168.148.200	

Fig. 6 – Ethernet configuration example

**Wi-Fi** It can be used instead of the Ethernet connection if a Wi-Fi USB pen drive is available. The connection to the network is made by specifying the name (SSID) and the password of the Access Point. The assignment of the IP address takes place as for Ethernet connectivity.

**ATTENTION!** Password is stored not encrypted inside the configuration file.

*Default value: not configured.*

Parameter	Value	Value
Set Wi-Fi settings	Yes	Yes
SSID	meteo	meteo
Password	*****	*****
Configuration	Static address	DHCP
IP address	192.168.148.35	
Subnet mask	255.255.255.0	
Gateway	192.168.148.200	

Fig. 7 – Wi-Fi configuration example

**PPP** To be configured in case of 3G/4G modem use. Same features as the Ethernet connectivity. The modem must be configured on the COM1 (5) serial port (§3.1.4). Parameter *Dev* must be set to */dev/ttySP3*. Other parameters are those related to the telephone operator.

**ATTENTION!** Password is stored not encrypted inside the configuration file.

*Default value: not configured.*

Parameter	Value
Enable PPP connection	Si
Dev	/dev/ttySP3
APN	ibox.tim.it
User	
Password	
Context Dial	*99***1#

Fig. 8 – PPP configuration for a TIM SIM example

If Pluvi-ONE has connected to more than one device for its internet connection, for example a 3G / 4G modem and satellite modem, the respective gateways (routes) for internet connection must be specified as *Preferred gateways*. The insertion order defines its priority.

The first gateway used is the specific one of the network interface in use. When Pluvi-ONE must make an internet connection, for example for sending data, it verifies the connection via the configured network interfaces. In the event of failure, the second gateways in the list are taken into consideration.

Here are some insights on the supported protocols:

- DNS** Each device connected to the network is identified by an IP address. For convenience, each device can be assigned to one name in order to identify it more easily in the network. Name resolution (conversion from name to IP address) is performed by a DNS server of the network. If the FTP, SMTP, NTP and MQTT protocols use names instead of IP addresses, it is necessary to set the IP address of the DNS server.  
*Default value: 8.8.8.8.*

Parameter	Value
DNS Server	8.8.8.8
DNS Server	192.168.148.200

Fig. 9 – DNS server configuration example

- NTP** The Network Time Protocol (NTP) is a protocol used for synchronizing the Pluvi-ONE clock using the time obtained through an Internet server. The configured servers are those of the "NTP POOL PROJECT" [pool.ntp.org](http://pool.ntp.org) (0.pool.ntp.org, 1.pool.ntp.org, etc.) It is preferable to use the specific servers of the area where the data logger is installed (e.g. for Italy it.pool.ntp.org) because they are easier to reach.  
*Default value: 0.pool.ntp.org and 1.pool.ntp.org.*

Parameter	Value
NTP Server	0.pool.ntp.org
NTP Server	1.pool.ntp.org
NTP Server	it.pool.ntp.org

Fig. 10 – Esempio di configurazione server NTP.

After setting the parameters relating to the interface and the network protocols, press the [Test] button to check if what has been entered is correct. The test is necessary if FTP sites have been configured since 3DOM creates the structure for the processed data and any configuration files.

### 3.1.4 Serial ports

Pluvi-ONE provides three serial ports for the communication with external devices: two RS-232 (Com1 and Com2) and one TTL (Com4), to be used as follows:

- Com1(5): for the connection to 3G/4G modem only.
- Com2(6): for the connection to Modbus RTU devices with RS-232 output (e.g. the *ALIEM Input extension module*) and to the PC (reserved to LSI LASTEM staff).
- Com4(10) (Fig. 2): for the connection some of LSI LASTEM's serial sensors.

They shall be set compatible with the devices in use.

To configure the serial ports for the modem and the PC, select *Serial ports* of 3DOM's *System parameters* section.

For the connection to the modem, configure *Remote connection*, by specifying:

- Serial port: is the serial port to connect the modem to. Select COM1. *Default value: not used*.
- Speed: is the speed Pluvi-ONE communicates with the modem. Select the same communication speed set in the modem. *Default value: 38400 bps*.
- Parity: parameter used in the communication. It's the same one set in the modem. *Default value: none*.
- Stop Bit: parameter used in the communication. It's the same one set in the modem. *Default value: 1*.
- Switch-on mode: expresses the mode the modem is turned on. It's possible to choose between three different types:
  - On request: modem is turned on only in case of new data or alarms transmission by Pluvi-ONE and is turned off when transmission is finalised. It is to be preferred in case of low power functioning.
  - Based on logic: modem is turned on according to a programmed logic (for example, from 1 PM to 4 PM every day). It is to be preferred in case of low power functioning in special conditions.
  - External power supply: modem's switch-on does not depend on the data logger.
- Used actuator: set the number of the actuated output corresponding to the terminal block' socket where powering wires of the modem are connected. Output is typically PwrOut3 (§Fig. 2). *Default value: not used*.

Remote connection	
Serial Port	COM1
Speed	115200
Parity	None
Stop bits	1.0
Power-up mode	On request
Used actuator	3

Fig. 11 – Remote port configuration example (modem).

To access the configuration of serial port Com2 or Com3 connected to a Modbus RTU device (e.g. ALIEM), select *Input types* from the *Measurements acquisition* section, then select and open the MODBUS RTU Master type. If it's not present, add it with the dedicated button.

- *Communication port*: is Pluvi-ONE's port where the Modbus RTU device is connected. Com2 (6) if connection is RS-232 type; Com3 (§Fig. 2) if it's RS-485 type.
- *Speed, Parity and Stop Bit*: must be the same set in the Modbus RTU device.
- *Timeout*: is the waiting time expressed in ms for receiving the response to a command sent.
- *Repetitions*: is the number of repetitions of the command after a timeout.

Parametro	Valore
Porta di comunicazione	COM2
Velocità	115200
Parità	Nessuna
Bit di stop	1.0
Timeout	1000
Ripetizioni	2

Fig. 12 – Com2 port configuration for Modbus RTU example.

Configuration parameters related to the Com4 also can be found in *Input types*, in the *Measurements acquisition* section. Select and open the interested type (e.g. *RTR Thermo Hygrometer*). If it's not present, add it with the dedicated button. Parameters are the same of the Modbus RTU Master type.

### 3.1.5 Measurements

For further information about the measurements and the input types see the *3DOM – User manual*. The manual is available as 3DOM online help (*Help->User's manual*).

### 3.1.6 Elaboration parameters

Pluvi-ONE manages the measures elaborations as defined in the elaboration parameters. In the normal operative condition, the instrument saves data files in its internal memory and sends them to the FTP and MQTT sites (if they are configured) with the time rate expressed in the *Elaboration data delivery time rate* parameter. In case of alarm, *Elaboration data delivery time rate in alarm condition* parameter will be considered.

Data files remain in memory for the period of time specified in *Days of data storage*; after this period the files are deleted; this is not because of the size of the memory, but because to limit the number of files inside the instrument's data folders and consequently to optimize the data downloading process. It is possible to change this value, but it will be better to monitor the data logger memory while it is running and evaluate in this way if the number of days set is adequate. The memory display function, is available from the local display; it can be used for this purpose, but requires local access to the instrument, it cannot be performed remotely. The advice is to run the tool for a few days and evaluate the daily consumption by making the proper proportions.

The parameters in the *Data Export Options* report which other parameters are to be sent by Pluvi-ONE together with the data elaboration of its measurements.

Parameter	Value
<b>General Parameters</b>	
Elaboration data delivery time rate	01:00:00
Elaboration data delivery time rate in alarm ...	01:00:00
Days of data storage:	90
<b>Elaboration Time Rates</b>	
Elaboration time rates: 00:10:00	Measures: B...
<b>Data export options</b>	
Use the extended file name for FTP transmi...	No
Insert Instrument Serial Number	No
Insert Latitude	No
Insert Longitude	No
Insert Altitude	No
Insert Instrument Identification Code	No
Insert Site Name	No
Insert Time Zone	No

Fig. 13 – Elaboration parameters configuration example.

See *Pluvi-ONE instrument configuration* chapter from *3DOM's user manual* for more information.

### 3.1.7 Using the USB memory stick

It is possible to use a USB stick as addition to the internal memory of the Pluvi-ONE or as a device for files exchanging from data logger to PC or the other way round.

The memory stick must be formatted with the FAT32 file system and must not have a capacity greater than 32 GB.



Although memory extension via USB stick is supported, long term uses are not recommended for several reasons. The most important reason is due to the operating temperature limits of these devices. You should be sure that your memory stick has an industrial protection grade (as the LSI LASTEM XLA010 memory stick). Most of the sticks are tested to operate in environments with moderate environmental temperatures (typically 10 ÷ 30 °C) therefore their use is limited in high and/or Low temperature operational conditions. Also, another reason concerns the type of file system used: UBIFS used internally by Pluvi-ONE is more reliable than FAT32 used for the stick.

#### 3.1.7.1 Use as an external memory

To use the USB key as external memory, insert it into one of the Pluvi-ONE USB ports(3). The data logger will automatically recognize it. Through the MEMORY menu it is possible to view the capacity and the space used (§4.1.4.5.2). The information is updated at the expiry of the *Elaboration data delivery rate* (§3.1.6).

From the moment the key is inserted until it is disconnected, the text files (\*.txt) of the processed data are stored in the path

<serial>/data (where <serial> is the serial or user number of the Pluvi-ONE - for more info §2.2.1)

From version 2.03.00 of Pluvi-ONE, the processed data files are stored in aggregate form in the file named *files.tar*. To use this type of file in a Windows environment, we recommend using a special utility program, such as 7Zip ([www.7-zip.org](http://www.7-zip.org)).



For more information on the files generated by Pluvi-ONE see §3.2.5.

### 3.1.7.2 *Uso come dispositivo di scambio file*

Using the USB stick, it is possible to upload the Pluvi-ONE configuration file or to download the data files from the memory. These operations are accessible from the PEN DRIVE menu (§4.1.4.5.3).

On the inquiry to upload the files with the data processed on the stick (*Upload data* function), the data logger copies the files in the path

*<serial>/data* (where *<serial>* is the serial or user number of the Pluvi-ONE - for more info §2.2.1)

From version 2.03.00 of Pluvi-ONE, the files are copied in the folder of the type *export\_YYYY-MM-DD hh.mm.ss*, containing the following files:

- *config.json*: the current configuration, available at the time of the export procedure
- *HDR\*.txt*: zero or more header files, one for each processing time base created in the current configuration
- *data.tar.gz*: compressed file containing all the files saved up to now inside the device, referring not only to the actual configuration but also to old configurations (the file nomenclature specifies the configuration that generated it)



For more information on the files generated by Pluvi-ONE see §3.2.5.

## 3.1.8 Logics

Pluvi-ONE offers 3 implemented electric outputs to power external devices such as sensors and modem or to activate alarm devices. It can also send mails, SMS and MQTT messages when certain conditions that are defined in the actuation logics are verified.

Two types of logic can be defined: *Threshold comparison* and *Timer*.

### 3.1.8.1 *Threshold comparison logic*

The picture below shows one example of *Threshold comparation* logic.

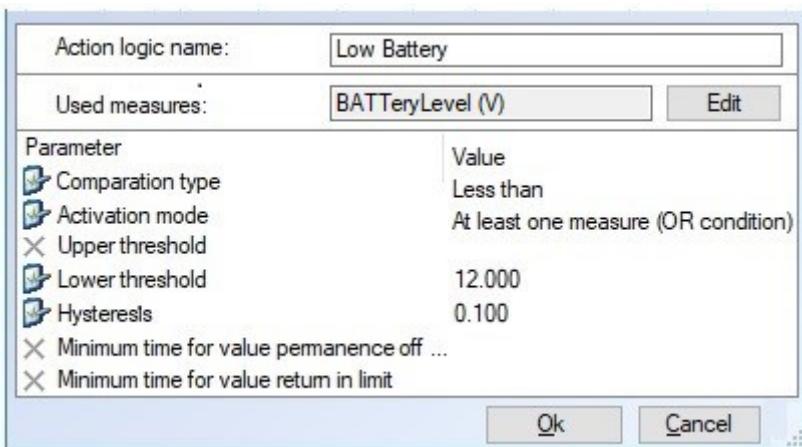


Fig. 14 – Example of Threshold comparation logic.

It is possible to configure the following:

- *Name of the logic*: this is the name whom it will be reported on the messages SMS, Mail and MQTT.
- *Used measurements*: press [**Edit**] to select one or more measurements jointed to this logic.
- *Types of compare*:
  - *Less then*: this logic is activated when the measurement value is less than the *lower threshold* (less the *hysteresis* value) and it will be deactivates when the measurement value is greater than the *lower threshold* (plus the *hysteresis* value). Example: threshold = 4.0 and hysteresis = 0.2. The logic is activated with a value less than 3.8 and deactivated with a value greater than 4.2.
  - *More than*: this logic is activated when the measurement value is more than the *upper threshold* (plus the *hysteresis* value) and it will be deactivates when the measurement value is less than the *upper threshold* (less the *hysteresis* value). Example: threshold = 4.0 and hysteresis = 0.2. The logic is activated when the value is more than 4.2 and deactivated when the value is less than 3.8
  - *Within*: this logic is activated when the measurement value is greater than the lower threshold (plus the *hysteresis* value) and lower than the upper threshold (less the *hysteresis* value) and deactivates when the measurement value is lower than the lower threshold (less the *hysteresis* value) and higher than the upper threshold (plus the *hysteresis* value). Example: threshold = 4.0 and hysteresis = 0.2. The logic is activated when the value is within 3.8 and 4.2 and it is deactivated when outside.
  - *Outside*: this logic is the opposite of the *Within* logic. Example: threshold = 4.0, hysteresis= 0.2. Logic is active when the values is less than 3.8 and more than 4.2 and then it is deactivated when inside.
- *Activation modality*:
  - *Single measure*: this logic is activated considering the measurement selected in *Used measures*.
  - *At least one measurement (OR condition)*: this logic is activated considering at least one of the measurements selected in *Used measures*.
  - *All measures (AND condition)*: this logic is activated considering the whole set of measurements selected in *Used measures*.
- *Upper threshold*: it is the value of the upper threshold; it is not available when the *Less than* logic has been chosen.

- *Lower threshold*: it is the value of the lower threshold; it is not available when the *More than* logic has been chosen.
- *Hysteresis*: it is a value that, depending on the type of comparison chosen, it is added or subtracted from the threshold values, this will avoid continuous activation/deactivation of the logic, when the measurement values are floating around the threshold.
- *Minimum residence time outside*: it is applied to a single measurement. It determines how long the measurement must remain outside the limit for the logic activation.
- *Minimum time of return within the limit*: it is applied to a single measurement. It determines how long the measurement must remain inside the limit for the logic deactivation.

### 3.1.8.2 Timer logic

Fig. 15 it is an example of *Timer logic*.

Action logic name:	Modem power on
Parameter	Value
 Cyclic mode	No
 Active status time	16:00:00
 Inactive status time	17:00:00
 Active status duration	
 Inactive status duration	
 Activation offset	

Fig. 15 – Example of *Timer logic*.

It is possible to configure the following:

- *Name of the logic*: this is the name whom it will be reported on the messages SMS, Mail and MQTT.
- *Cyclic mode*:
  - *No*: this will indicate that the logic is active every day within the period of time from *Active status time* to *Inactive status time*.
  - *Yes*: this will indicate that the logic is active during the period of time given by the *Active status duration* and will be deactivated during the period of time given by the *Inactive status duration* with a delay given by the *Activation offset*.

Note that this logic can be combined with other logics in AND mode to allow, for example, the activation of alarms or switched power outputs only at specific times of the day.

### 3.1.9 Actuators and allarms

Each logic can be assigned to an actuator (Switched power supply output) or to an action (SMS, Email, MQTT), or to both of them.

#### 3.1.9.1 Logic assigned to a power supply output (actuator)

Logics assigned to power supply output (actuator) are based on the instantaneous value of the measurements, both acquired and calculated. One or more logics can be combined, to switch on the chosen actuator, in two different ways:

- AND: actuator is active when all the logics status assigned are on.
- OR: actuator is active when at least one logic status assigned is on.

The actuator assigned to a logic can work in low power mode (off when the logic status assigned is off, on when the status turns to on), or in safety mode (on when the logic status assigned is off, off when the status turns to on). The following table summarizes its meaning:

Operational mode of the output	Logic status	Power supply output
Low power	Not active	Off
	Active	On
Safety	Not active	On
	Active	Off

In case of any error condition of one or more measurements, due for example to sensor breakage, out of scale acquisition or disconnected cable, it does not change the current state of the actuator driven by the measurement assigned to this logic.

Action Logics

Action take place when all logic statuses are active (AND mode)  
 Action take place when at least one logic status is active (OR mode)

Name	Action Logic Type	Used Measures	Parameters
<input type="checkbox"/> Tot Rain last 10 min beyo...	Threshold comparation	30	condAnd=1,vct=GreaterThan,min=0,max=1...
<input type="checkbox"/> Tot Rain last 60 min beyo...	Threshold comparation	27	condAnd=1,vct=GreaterThan,min=0,max=1...
<input type="checkbox"/> Inst Wind beyond limit	Threshold comparation	37	condAnd=1,vct=GreaterThan,min=0,max=1...
<input type="checkbox"/> Inst Level beyond limit	Threshold comparation	36	condAnd=1,vct=GreaterThan,min=0,max=5...
<input type="checkbox"/> Increase level last 60 min...	Threshold comparation	29	condAnd=1,vct=GreaterThan,min=0,max=0...
<input type="checkbox"/> Inst AirTemp below lower...	Threshold comparation	32	condAnd=1,vct=Less Than,min=0,max=0,h...
<input checked="" type="checkbox"/> Inst AirTemp beyond limit	Threshold comparation	32	condAnd=1,vct=GreaterThan,min=0,max=3...
<input type="checkbox"/> Inst AirTemp within limits	Threshold comparation	32	condAnd=1,vct=InsideRange,min=0,max=3...

Action Parameters

Use secure Logic

Fig. 16 – Example of logic assigned to a switched power supply output

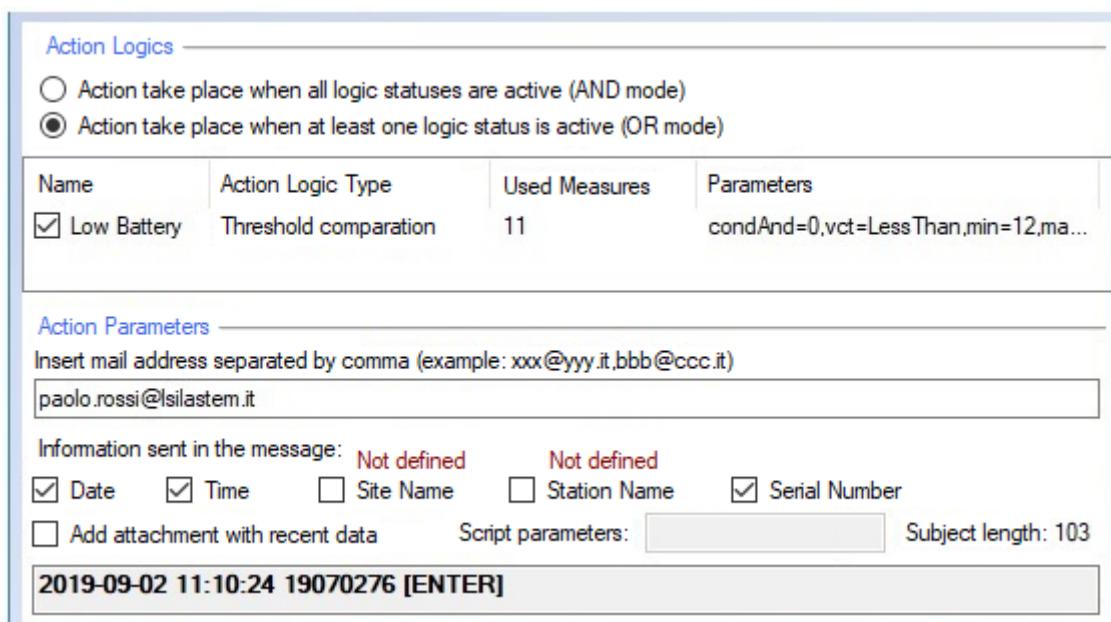
### 3.1.9.2 Logic assigned to an action

Each logic can be jointed to the following actions:

- *SMS*: when the logic status occurs, Pluvi-ONE sends one SMS message to up to 5 users. The function is active only if the data logger works in low consumption mode (§3.1.2) and if a 3G / 4G modem is connected.
- *Mail*: when the logic status occurs, Pluvi-ONE sends the message via email to the specified addresses. The maximum length of the addresses list cannot exceed 128 characters.
- *FastMode*: when the logic status occurs, Pluvi-ONE exits from any low-power mode and start sending data using the value reported in *General parameters-> Elaboration data delivery rate in alarm condition* (§3.1.6).
- *MQTT*: when the logic status occurs, Pluvi-ONE sends MQTT messages.
- *WakeUp*: when the logic status occurs, Pluvi-ONE exits from the low consumption mode and becomes accessible from the outside, via its network interfaces (§2.2.4).

Inside *SMS* and *Mail* messages it is possible report some related information as: Logic name, *Date/Time* of the data generating alarm condition, *Site name*, *Station name* and *Serial number*.

It is possible to attach in the *Mail* message a file reporting the last measurements.



Name	Action Logic Type	Used Measures	Parameters
Low Battery	Threshold comparation	11	condAnd=0,vct=LessThan,min=12,ma...

Fig. 17 – Example of Mail action assigned to a logic called “Low Battery”.

### 3.1.10 Uploading configuration file to Pluvi-ONE

Delivery of the configuration file can be obtained in three different ways: direct SSH connection via Ethernet or Wi-Fi, using USB pen drive, or using a FTP server set for this purpose.



If the operative mode has been changed from Always on a Low power after the configuration transmission and the consequent reboot of the instrument, it is necessary to turn off and on Pluvi-ONE, otherwise it won't go to low power mode.

#### 3.1.10.1 Sending via SSH connection

Pluvi-ONE supports SSH. SSH (Secure Shell) is an encrypted protocol that allows the user to safely access the devices connected into the same network.

In the guided transmission procedure of 3DOM's configuration, set following parameters up:

- Default communication type: *Connection using SSH protocol*
- Instrument IP address (the current one of Pluvi-ONE)
- Port

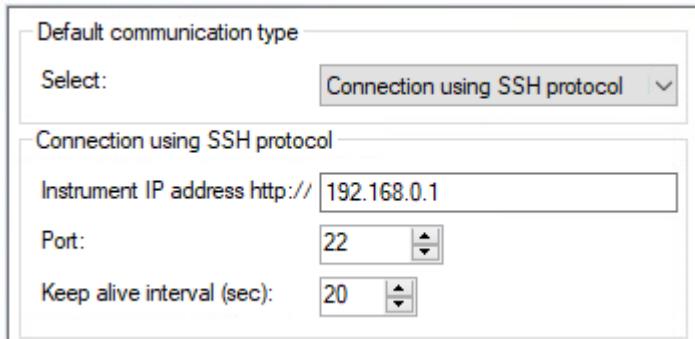


Fig. 18 – SSH connection to Pluvi-ONE with factory IP address example

To know the Pluvi-ONE's IP address, see §4.1.4.5.1. If the instrument does not have an IP address or it isn't in the same network as the PC, it is possible to send the configuration through a USB pen drive or check the mode through FTP server.

#### 3.1.10.2 Sending via USB pen drive

If Pluvi-ONE isn't connected to a network or to the internet, using a USB pen drive to update the instrument may be useful. In this case, proceed as follows:

1. Insert the USB pen drive into the PC.
2. In 3DOM's transmission procedure, select *Save on a local USB pen drive*.
3. Safely eject the USB pen drive from the PC and insert it in one of Pluvi-ONE's USB ports(3).
4. Using the instrument buttons, enter *Pen drive* from the *ADVANCED FEATURES* menu.
5. Select *Download config* and follow the instructions displayed.
6. Select *Unmount* and follow the instructions displayed to remove the USB pen drive.

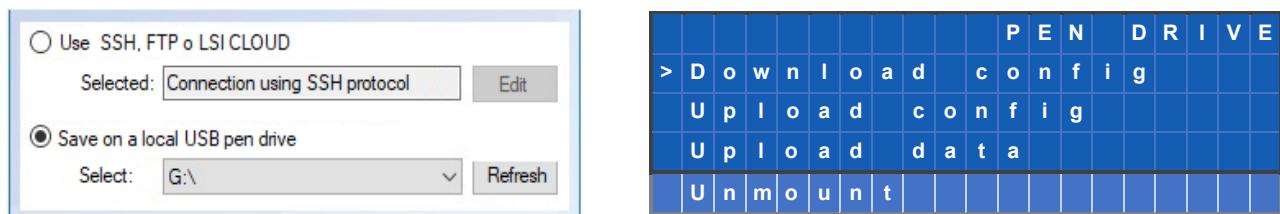


Fig. 19 – Configuration file transmission on a USB pen drive identified on the G:\ unit example.

*ADVANCED FEATURES* functions are active only if *Advanced mode* (§4.1.4.3) is enabled.

### 3.1.10.3 Sending via *FTP server*

Pluvi-ONE supports FTP protocol for the file transmission in client/server mode. This type of transmission assumes the FTP server to already be configured properly. The FTP server indicated in the configuration must have a checkmark on *Configuration Authorities* option.

In the guided transmission procedure of 3DOM's configuration, set the following parameters up:

- Default communication type: *FTP server with configuration authority*.
- User name.
- Password.
- Server IP address.
- Port.
- Destination directory.

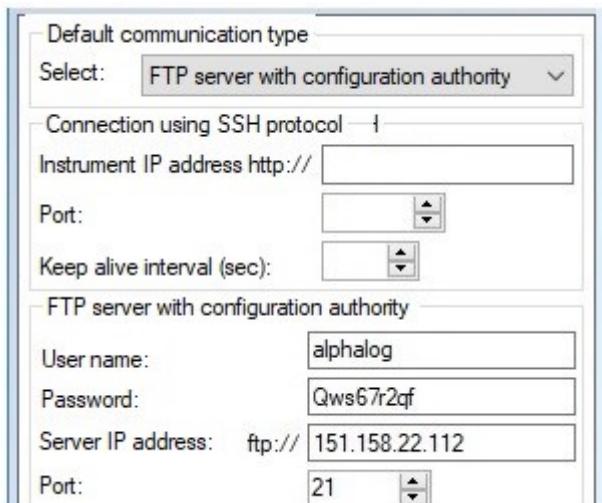


Fig. 20 – FTP connection example

Pluvi-ONE will update the configuration at the end of *Elaboration data delivery time rate*.

## 3.2 Insights the Pluvi-ONE functionalities

### 3.2.1 Communication protocols

Pluvi-ONE is provided with proprietary protocol SAP (*Simple ASCII Protocol*). It provides configuration and transfer service of the acquired and processed data to the instrument, and the control commands of the devices connected to it. Communication works through Com2 port(6). Communication parameters are editable by 3DOM and default ones are: Speed: 115220 bps, Parity: None, Stop bits: 1, Flow control: None.

Pluvi-ONE implements part of Modbus TCP protocol, both Master and Slave. See manual *INSTUM\_03762* for more information on Modbus Slave.

### 3.2.2 Internal clock/calendar

Pluvi-ONE is equipped with an internal clock with backup battery. This clock is used for elaborations, alarms and system events dating and for the scheduling of other activities such as the processed files transmission on one or more FTP servers, the measures acquisition, the actuators activation, etc. Therefore, keeping the clock synced is important.

Pluvi-ONE synchronizes the clock in the following circumstances:

- When it receives the configuration by SSH connection from the PC. In this case the data logger lines up with the PC clock. Refresh is immediate.
- If at least one NTP server is specified in its configuration. An internet connection is required. The check and the possible alignment take place every 10 hours.



Starting from version 2.01 of Pluvi-ONE, it is also possible to change the system time through the special command available with SSH connection (for example through the program *PutTY*). It requires the IP address of the data logger as a parameter. Log in as *root* and enter the password indicated on the back label of the instrument, then enter the command:

```
/usr/local/bin/sbctimesync "yyyy-MM-ddThh:mm:ss".
```

### 3.2.3 Calculated quantities

The instrument can calculate several quantities, obtained by relying on one or more primary and constant quantities and standard quantities collected from an internal library. For example, it's possible to determine the dew point temperature by setting temperature and relative humidity of the air as the primary quantities. It's also possible to obtain a measure with the moving average of wind's velocity calculated on a chosen period.

Measures' sampling sequence can be configured through 3DOM. Thus, measures are acquired and showed on the instrument display in the chosen order.

Measures with elaboration element *Total* are reset on the display at the end of acquisition rate.

### 3.2.3.1 Dew point temperature

The calculation of the dew point temperature is based on *UNI EN ISO 7726*. It requires measurements of temperature and relative humidity of the air.

Select calculation type: **Dew point temperature**

ⓘ Returns the temperature [°C] of the dew point given air temperature (Ta, °C) and relative humidity (RH, %). Formulation: UNI EN ISO7726.

	Parameter	Source Measure	Value	Trigger
	Ta	Temperature (°C)	▼	<input checked="" type="checkbox"/>
ⓘ	Rh	RelHumidity (%)	▼	<input checked="" type="checkbox"/>

Fig. 21 – Example of calculated measurement configuration of type "Dew point temperature"

### 3.2.3.2 Barometric pressure at sea level (QNH)

QNH is the value of the pressure reported at sea level from the one measured at a certain location, considering the standard atmosphere. Since the standard formula has not yet been officially defined, Pluvi-ONE proposes the choice of three different types of calculation:

- QNH – WMO Table
- QNH – ISA
- QNH – ICAO

The formula of type QNH - WMO Table corresponds to:

$$QNH = A + B * QFE$$

where *A* and *B* are standard parameters based on the measurement point elevation and defined by WMO via Table 3.10 (ref. "International Meteorological Tables - WMO No. 188 TP. 94 - 1966") and *QFE* is the value of relative true atmospheric pressure (measured) to the measuring point itself.

**Table 3.10 Altimeter setting (QNH) computation factors**  
*Facteurs pour le calcul du calage de l'altimètre (QNH)*

Geopotential géopotentiel m'	<i>A</i>	<i>B</i>	Geopotential géopotentiel m'	<i>A</i>	<i>B</i>
0	0	1.000 00	2 000	45.71	1.217 12
50	1.14	1.004 81	2 050	46.86	1.223 23
100	2.29	1.009 66	2 100	48.00	1.229 41
150	3.43	1.014 53	2 150	49.14	1.235 63
200	4.57	1.019 43	2 200	50.28	1.241 88
250	5.71	1.024 37	2 250	51.43	1.248 18
300	6.86	1.029 32	2 300	52.57	1.254 51
350	8.00	1.034 31	2 350	53.71	1.260 88
400	9.14	1.039 33	2 400	54.86	1.267 28
450	10.29	1.044 38	2 450	56.00	1.273 73
500	11.43	1.049 45	2 500	57.14	1.280 24
550	12.57	1.054 57	2 550	58.28	1.286 78
600	13.71	1.059 71	2 600	59.43	1.293 33
650	14.86	1.064 89	2 650	60.57	1.299 95
700	16.00	1.070 09	2 700	61.71	1.306 61
750	17.14	1.075 32	2 750	62.86	1.313 31
800	18.29	1.080 58	2 800	64.00	1.320 05
850	19.43	1.085 88	2 850	65.14	1.326 84
900	20.57	1.091 22	2 900	66.28	1.333 67
950	21.71	1.096 58	2 950	67.43	1.340 56
1 000	22.86	1.101 98	3 000	68.57	1.347 46
1 050	24.00	1.107 40	3 050	69.71	1.354 41
1 100	25.14	1.112 86	3 100	70.86	1.361 42
1 150	26.28	1.118 37	3 150	72.00	1.368 47
1 200	27.43	1.123 89	3 200	73.14	1.375 56
1 250	28.57	1.129 45	3 250	74.28	1.382 71
1 300	29.71	1.135 04	3 300	75.43	1.389 88
1 350	30.86	1.140 67	3 350	76.57	1.397 11
1 400	32.00	1.146 33	3 400	77.71	1.404 40
1 450	33.14	1.152 04	3 450	78.85	1.411 74
1 500	34.28	1.157 78	3 500	80.00	1.419 09
1 550	35.43	1.163 54	3 550	81.14	1.426 51
1 600	36.57	1.169 35	3 600	82.28	1.433 98
1 650	37.71	1.175 19	3 650	83.43	1.441 51
1 700	38.86	1.181 06	3 700	84.57	1.449 07
1 750	40.00	1.186 98	3 750	85.71	1.456 68
1 800	41.14	1.192 93	3 800	86.85	1.464 34
1 850	42.28	1.198 92	3 850	88.00	1.472 04
1 900	43.43	1.204 94	3 900	89.14	1.479 81
1 950	44.57	1.211 00	3 950	90.28	1.487 63
			4 000	91.43	1.495 49

Fig. 22 – Table 3.10 reported in “International Meteorological Tables – WMO No. 188 TP. 94 - 1966”

Select calculation type: **QNH -WMO Table**

Return the QNH using the WMO table 3.10 given Atmospheric pressure at site elevation (Pa,hPa), coefficient A for the algorithm, coefficient B for the algorithm.

Parameter	Source Measure	Value	Trigger
Pa	AtmPress (hPa)		<input checked="" type="checkbox"/>
Coefficient A		2.29	<input type="checkbox"/>
.. ↗ ⓘ Coefficient B		1.00966	<input checked="" type="checkbox"/>

Fig. 23 - Example of calculated measurement configuration of type "QNH - WMO Table"

The type QNH - ISA, instead, uses the formula ISA nr. 7 indicated in "CIMO/ET-Stand-1/Doc. 10 (20.XI.2012)" (§ Fig. 24).

With suitable basic values the equation becomes the International Standard Atmosphere (ISA) up to 11 km.

$$7. \quad QNH = QFE \left\{ 1 - \frac{\gamma H}{T_0 \left[ \frac{QFE}{P_0} \right] \frac{R_d \gamma}{g}} \right\}^{-\frac{g}{R_d \gamma}}$$

$R_d$  = specific gas constant of dry air (287.04 J/kg/K Rindert 1978)  
 $T_0 \equiv 288.15$  K (+15°C)  
 $p_0 \equiv 1013.25$  hPa  
 $g \equiv 9.80665$  m/s<sup>2</sup> (standard gravity)  
 $\gamma \equiv -0.0065$  K/m  
H = airport elevation in m  
The elevation should be replaced with the geopotential height (gpm) but the difference can normally be neglected. See the section on [gravity](#).  
New estimates of R ( $\approx 8.314\,472 \pm 0.000\,015$  J/mol/K according to CODATA 2006),  $m_d$  ( $\approx 28.9644$  g/mol) and  $m_v$  ( $\approx 18.016$  g/mol) are hinted by Richard Shelquist at <http://wahiduddin.net>. This gives  $R_d \approx 287.05$  J/kg/K that is used by some sources. U.S. Standard Atmosphere 1976 uses R = 8.31432 J/mol/K and  $m_d = 28.9644$  g/mol.

Fig. 24 – Reference to equation No. 7 given in "CIMO/ET-Stand-1/Doc. 10 (20.XI.2012)"

Select calculation type: **QNH - ISA**

Return the QNH using the ISA equation nr. 7 given Atmospheric pressure at site elevation (Pa,hPa), elevation of the site where QNH is measured [m].

Parameter	Source Measure	Value	Trigger
Pa	AtmPress (hPa)		<input checked="" type="checkbox"/>
► ⓘ Site Elevation		109	<input type="checkbox"/>

Fig. 25 - Example of calculated measurement configuration of type "QNH - ISA"

Lastly, the type QNH - ICAO uses the formula defined by ICAO, indicated as nr. 28 and 29 in ICAO Doc 7488 and 9837, which allows to achieve results very close to the standard ISA formula (error less than 0.02 hpa up to 2000 m).

ICAO describes how to calculate QNH in ICAO Doc 7488 (generally) and ICAO Doc 9837 (for automatic stations. The calculation is made in the same two steps as DNMI use: first the elevation in ISA that has pressure QFE (formula 28), then QNH (formula 29).

$$28. \quad H_{ISA} = 44330.77 - 11880.32 * QFE^{0.190263}$$

$$29. \quad QNH = 1013.25 * \left( 1 - 0.0065 * \frac{H_{ISA} - H}{288.15} \right)^{5.25588}$$

Fig. 26 – ICAO equations 28 and 29 reference

Select calculation type: **QNH - ICAO**

ⓘ Return the QNH using the ICAO equations nr. 28/29 given Atmospheric pressure at site elevation (Pa,hPa), elevation of the site where QNH is measured [m].

Parameter	Source Measure	Value	Trigger
Pa	AtmPress (hPa)		<input checked="" type="checkbox"/>
► ⓘ Site Elevation		109	<input type="checkbox"/>

Fig. 27 - Example of calculated measurement configuration of type "QNH - ICAO"

### 3.2.4 Elaborations

For each acquired or calculated measure, it's possible to obtain the statistic elaborations with time basis from 1 second to 24 hours. It's possible to choose one or more of the statistic elements mentioned in the list:

Item	Description
Ist	Is the last acquired value
Min	Is the lower value among those acquired within the time basis
Med	Is the average value calculated with the values acquired within the time basis
Max	Is the higher value among those acquired within the time basis
DevSt	Is the standard deviation calculated with the values acquired within the time basis
Tot	Is the total obtained by adding all the values acquired within the time basis
TimeMin	Is like Min with the addition of the point in time when it happened
TimeMax	Is like Max with the addition of the point in time when it happened

Each measure can have different time basis.

### 3.2.5 Processed data files

Data processed by Pluvi-ONE (§4.2.4), are included in text files (\*.txt). Each file is identified by its name. Default name is composed as follows:

*Name:* CyyyyMMddhhmmss-Bnn-EyyyyMMddhhmmss.txt

*Example:* C20171020081421-B00-E20171020124100.txt

The name includes the following information:

CyyyyMMddhhmmss	Configuration file date/time (in the example: 20/10/2017 8:14:21)
Bnn	Pointer of the elaboration base (in the example: 00)
EyyyyMMddhhmmss	Date/time of the elaboration reported in the first line of the file (in the example: 20/10/2017 12:41:00).

If parameter *Use the extended file name for FTP transmission* is enabled in 3DOM's *Elaboration Parameters* (§3.1.6), the instrument will save files with the extended name.

*Extended name:* Mxxxxxxxx-CyyyyMMddhhmmss-Bnn-EyyyyMMddhhmmss- LyyyyMMddhhmmss.txt

*Example:* M17110023-C20171020081421-B00-E20171020124100- L20171020125000.txt

Comparing the default name, the additional information are the following:

Mxxxxxxxx	Pluvi-ONE serial number (in the example: 17110023)
LyyyyMMddhhmmss	Date/time of the elaboration contained in the file's last line (in the example: 20/10/2017 12:50:00)

To understand the processed data file, it's necessary to refer to the information contained in the corresponding header file. Pluvi-ONE generates one file for each elaboration.

File name is composed as follows:

*Format: HDR\_CyyyyMMddhhmmss-Bnn.txt*

*Example: HDR\_C20171020081421-B00.txt*

The name includes the following information:

<i>HDR</i>	Identifies the file as a header file
<i>CyyyyMMddhhmmss</i>	Configuration file date/time (in the example: 20/10/2017 8:14:21)
<i>Bnn</i>	Pointer of the elaboration base (in the example: 00)

For example, file *HDR\_C20171020081421-B00.txt* allows the user to define the data contained in file *C20171020081421-B00-E\*.txt*.

All files are stored in the folder named with Pluvi-ONE's serial number. If serial number is not defined by the user, the number used will be the number defined by the factory (§3.1.1).

Below is an example of files processed by Pluvi-ONE S/N 17110023.

<i>17110023</i>
<i>HDR_C20171020081421-B00.txt</i>
<i>HDR_C20171020081421-B01.txt</i>
<i>C20171020081421-B00-E20171020121100.txt</i>
<i>C20171020081421-B00-E20171020122100.txt</i>
<i>C20171020081421-B00-E20171020123100.txt</i>
<i>C20171020081421-B00-E20171020124100.txt</i>
<i>C20171020081421-B00-E20171020125100.txt</i>
<i>C20171020081421-B01-E20171020122500.txt</i>
<i>C20171020081421-B01-E20171020123500.txt</i>
<i>C20171020081421-B01-E20171020124500.txt</i>

Fig. 28 – Files processed by Pluvi-ONE example

### 3.2.5.1 Header files

To define the processed data files, it's necessary to rely on the information contained in the corresponding header file. Pluvi-ONE generates one for each elaboration base.

The header file is composed by sections ELAB, HEADER and MEASURES and it's structured as follows:

```
[ELAB]
ssss,oo,zzzz

[HEADER]
Datetime; Serial; Latitude; Longitude; Altitude; UserSerial; SiteName; TimeZone; Name_ElElab_1_(UM)_m_1; ...;
Name_ElElab_n_(UM)_m_1; ...; Name_ElElab_1_(UM)_m_n; ...; Name_ElElab_n_(UM)_m_n;

[MEASURES]
Serial
Latitude
Longitude
Altitude
UserSerial
SiteName
TimeZone;
Name_m_1; UM_m_1; ID_m_1; Prop_m_1; ListaElemElab_m_1
...
Name_m_n; UM_m_n; ID_m_n; Prop_m_n; ListaElemElab_m_n
```

ELAB includes the information on elaboration rates:

- *ssss*: is the number of seconds of the elaboration rate
- *oo*: is rate's offset
- *zzzz*: is the time zone compared to UTC expressed in seconds

HEADER includes column headers of the processed data:

- *Datetime*: is the date the item refers to
- *Serial*: is the instrument S/N
- *Latitude*: is the latitude of the site where the instrument is installed
- *Longitude*: is the longitude of the site where the instrument is installed
- *Altitude*: is the altitude of the site where the instrument is installed
- *UserSerial*: is the S/N defined by the user to identify the instrument
- *SiteName*: is the name of the site where the instrument is installed
- *TimeZone*: is the instrument time zone
- For each measure:
  - *Name*: is the measurement name
  - *ElElab (UM)*: is the items list of the elaboration, followed by the measurement unit

MEASURES includes the information on measures, one measure on a single row:

- *Serial, Latitude, Longitude, Altitude, UserSerial, SiteName, TimeZone*: as described in HEADER
- *Name\_m\_x*: is the measure name
- *UM\_m\_x*: is the measurement unit
- *ID\_m\_x*: is the measure ID
- *Propr\_m\_x*: are the measure properties configurated in 3DOM
- *ListaElemElab\_m\_x*: are the elaboration items (*null* means no elaboration)



Parameters *Serial, Latitude, Longitude, Altitude, UserSerial, SiteName* e *TimeZone* are shown in files only if enabled in 3DOM's *Elaboration Parameters*, in the *Data export options* section (§3.1.6).

After every configuration change, if the new configuration is compatible with the old one, the instrument generates other header files.

Below is an example of header files where metadata appear too.

```
[ELAB]
60,0,7200

[HEADER]
Datetime; Serial; Latitude; Longitude; Altitude; UserSerial; SiteName; TimeZone; Temperature Ave ('C);

[MEASURES]
Serial
Latitude
Longitude
Altitude
UserSerial
SiteName
TimeZone
Temperature; 'C; 1; 85; Ave
```

Fig. 29 – Header file example

### 3.2.5.2 Processed data files

Data files are generated by Pluvi-ONE according to the *Elaboration data delivery time* parameter, specified in 3DOM's *Elaboration Parameters* (§3.1.6). Default value is 1 hour.

Each data file includes the date the item refers to, followed by the items as described in the header file's HEADER section.

```
Datetime; Serial; Latitude; Longitude; Altitude; UserSerial; SiteName; TimeZone; Name_ElElab_1_(UM)_m_1; ...;
Name_ElElab_n_(UM)_m_1; ...; Name_ElElab_1_(UM)_m_n; ...; Name_ElElab_n_(UM)_m_n;
...
Datetime; Serial; Latitude; Longitude; Altitude; UserSerial; SiteName; TimeZone; Name_ElElab_1_(UM)_m_1; ...;
Name_ElElab_n_(UM)_m_1; ...; Name_ElElab_1_(UM)_m_n; ...; Name_ElElab_n_(UM)_m_n;
```

In more detail:

- *Datetime* is in yyyy-MM-ddThh:mm:ss format
- *Serial*, *Latitude*, *Longitude*, *Altitude*, *UserSerial*, *SiteName*, *TimeZone* are those described in HEADER (§3.2.5.1)
- Semicolon (";") is the column separator
- Full stop (".") is the decimal separator

Below is an example of header files reporting metadata too:

```
2017-10-20T12:11:00; 17110023; 45.4558; 9.3919; 108; 17110023; Settala; 3600; 25.00
2017-10-20T12:12:00; 17110023; 45.4558; 9.3919; 108; 17110023; Settala; 3600; 25.00
2017-10-20T12:13:00; 17110023; 45.4558; 9.3919; 108; 17110023; Settala; 3600; 24.90
2017-10-20T12:14:00; 17110023; 45.4558; 9.3919; 108; 17110023; Settala; 3600; 24.98
2017-10-20T12:15:00; 17110023; 45.4558; 9.3919; 108; 17110023; Settala; 3600; 24.82
2017-10-20T12:16:00; 17110023; 45.4558; 9.3919; 108; 17110023; Settala; 3600; 24.87
2017-10-20T12:17:00; 17110023; 45.4558; 9.3919; 108; 17110023; Settala; 3600; 24.76
2017-10-20T12:18:00; 17110023; 45.4558; 9.3919; 108; 17110023; Settala; 3600; 24.89
2017-10-20T12:19:00; 17110023; 45.4558; 9.3919; 108; 17110023; Settala; 3600; 24.99
2017-10-20T12:20:00; 17110023; 45.4558; 9.3919; 108; 17110023; Settala; 3600; 24.86
```

Fig. 30 – Processed data files example

Referring to the HEADER section in Fig. 29, the meaning of each value is obtained:

Datetime	Serial	Latitude	Longitude	Altitude	UserSerial	SiteName	TimeZone	Temperature Ave ('C)
2017-10-20 T12:11:00	17110023	45.4558	9.3919	108	17110023	Settala	3600	25.00

### 3.2.6 MQTT

MQTT is a standard messaging ISO protocol studied for conditions where a low power consumption is required, and bandwidth is limited.

Protocol implements a mechanism of publication and subscription for messages exchange through a message broker. Sender publishes the messages about a certain topic on the message broker. The recipient interested in receiving those messages subscribes to the topics they're interested to. Every time a new message is published on that topic, the message broker delivers it to all the recipients.

To enable MQTT on Pluvi-ONE use the program 3DOM.

First, configure the protocol in the *Connectivity* section (§3.1.3). In addition to the broker parameters, activate the publication of the desired messages (instant values, processed values, diagnostic data, alarms). Then, enable the additional information that will be included in the messages (instrument S/N, latitude, longitude, altitude, etc.) in the *Elaboration Parameters* (§3.1.6).

Possible topics to subscribe to are the following:

Argomento (topic)	Descrizione
device/<model>/<serial>/metrics/inst	Instant values
device/<model>/<serial>/metrics/elabs	Processed data
device/<model>/<serial>/config/metrics	Header files
device/<model>/<serial>/diagnostic	Diagnostic data (not implemented yet)
device/<model>/<serial>/metrics/alarm	Alarms
device/<model>/<serial>/config/file	Configuration

where:

- <model> is the instrument code (ELP001 or ELP002, §5.1.1).
- <serial> is the instrument serial number (§5.1.1). If 3DOM's parameters *Alternative serial code* and *Use an alternative serial code* del *Registry* are set, serial number is set by the user (§3.1.1).

Messages are published with the following logics:

- *Instant values*: based on MQTT parameter *Inst. values publishing time rate* (§2.2.5.4).
- *Processed data*: based on the *Elaboration data delivery time rate* parameter (§3.1.6).
- *Header files*: sent before each dispatch of n consecutive *Processed data* messages.
- *Diagnostic data*: topic to be implemented.
- *Alarms*: based on the occurrence of an event.
- *Configuration*: when a new configuration is applied to the instrument.

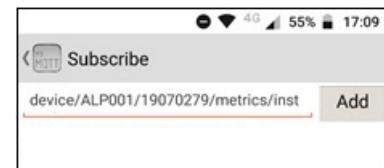
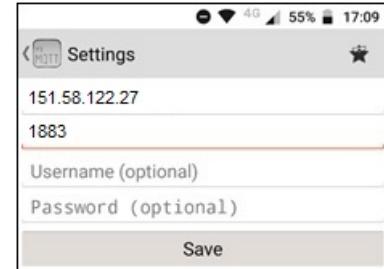
### 3.2.6.1 How to receive data on a smartphone

On the market are available several apps to receive an MQTT broker's topics. Below is an example with the app MyMQTT for Android.

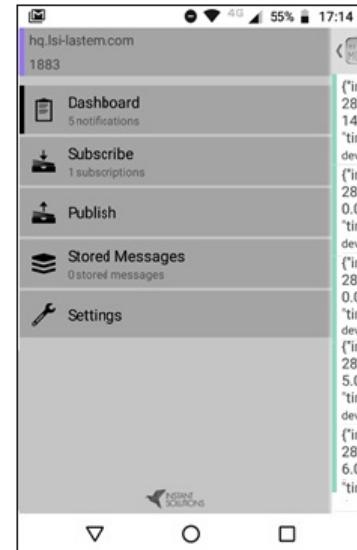
MyMQTT is downloadable on <https://play.google.com/store/apps/details?id=at.tripwire.mqtt.client&hl=en>.

On the first start the app warns the user that there are no notifications (*No notifications found... Add a new topic!*). Press on the message.

1. Press **[Connect]**.
2. Enter *Broker URL* and *Port* (ad es. 151.58.122.27 e 1883, §2.2.5.4).
3. Press **[Save]**.
4. Press **[Settings]**.
5. Press **[Subscribe]**.
6. Enter *Topic* (e.g. for instant values: *device/ELP001/19070279/metrics/inst*).
7. Press **[Add]**.

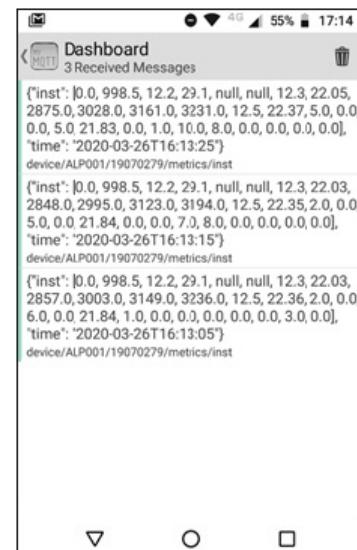


Here is the screen with the main menu, where the notifications of incoming messages (data) appear.



Here the MyMQTT dashboard, where the user can see data coming (instant values).

The values update depends on MQTT's parameter *Inst. values publishing time rate* (§2.2.5.4).



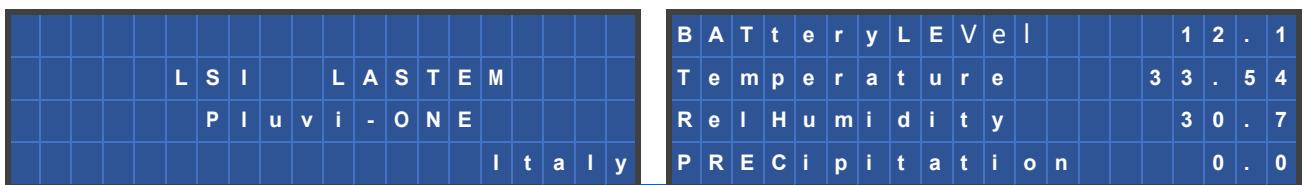
## Part 4

### 4.1 Keys, Menu and LEDs

#### 4.1.1 Start-up/Shutdown

System On/Off is controlled by the On/Off switch (5).

On the start-up, the instrument shows product information and, after a few seconds, the measures list in expanded form (measure's complete name and acquired value). Each sampled value is used to create statistics elaborations.



LSI	LASTEM	BATTERY LEVEL	12.1
Pluvi-ONE		Temperature	33.54
	Italy	Rel. Humidity	30.7
		Precipitation	0.0

If the low power mode is on, the data logger turns the display off approximately after one minute.

#### 4.1.2 Use of the keyboard

The keyboard consists in four buttons: two of them are directional and the other two are functional.

The main functions of each button are summarised below, based on the instrument state.

During menu display:

-   Scroll menu items up and down.
-  Enters menu item pointed by cursor “>”.
-  Changes the setting where the choice is via menu and goes back to the previous menu.
-  Exit the displayed menu and goes back to the previous menu.

During measures display:

-   Scroll measures up and down.
-  Switches to menu.
-  Stops measures scrolling and switches between the two forms of measure display.

During actuators display:

-   Change the state value pointed by the cursor.
-  Goes back to menu.
-  Moves cursor on the next actuator.

In other screenshots:



- In *Serial lines* (§4.1.4.2) screenshot, change the serial port number.
  - In *Events* screenshot, move to the previous or the next event.

If display is off (low power mode):



Turns the display on.

I display is on (normal mode):



If being hold for some seconds, turns the display off.

### 4.1.3 Operating status LEDs

On Pluvi-ONE's front panel are 3 LEDs that indicates the instrument operative status: Rx/Tx, Wrk, Batt.

Rx/Tx

This LED, green, lights up when communication activity is ongoing on any serial port.

Wrk

This LED, green, lights up to indicate any measurement activity of signals connected to the instrument; it also briefly lights up if an event is registered by a possible connected pluviometer.

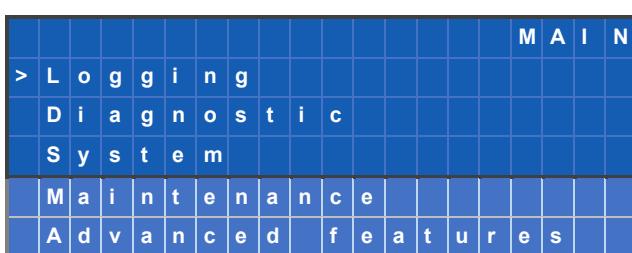
Batt

This LED is red and has the following meanings:

- **Steady on:** voltage is present from FV module and battery is not charged or it's disconnected.
  - **Flashing:** voltage is present from FV module and battery is connected and charged.
  - **Off:** voltage is not present from FV module or battery charged.

#### 4.1.4 Menu navigation

From MAIN menu, the user can access Pluvi-ONE's several submenus



#### 4.1.4.1 Logging



## > Last measures

In this screenshot are shown, one per line, the configured measures with their last acquired or calculated value. If measures are more than four, they will scroll vertically on the display.

In the expanded form, the screenshot shows the complete name of the measure and its value.

<i>n</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>																								
<i>n</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>																								
<i>n</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>																								
<i>n</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>																								
Mask														B	A	T	t	e	r	y	L	E	V	e	l	1	2	.	1	
														T	e	m	p	er	u	t	u	r	e	3	3	.	5	4		
														R	e	l	H	u	m	i	d	i	y	3	0	.	7			
														A	t	m	P	r	ess	u	re	s	u	re	1	0	0	1	.	8

Mask

## Example

where:

- *nnnnnnnnnnnnnnn*: is the name of the measure in expanded format.
  - *ddddd*: is the measure's value; *Err* means the measure is in error.

In the compressed form, it shows the short name of the measure, its value and the measurement unit.

<i>n</i>	<i>d</i>	<i>u</i>	<i>u</i>	<i>u</i>	<i>u</i>		<b>B</b>	<b>A</b>	<b>T</b>	<b>L</b>	<b>E</b>	<b>V</b>	<b>1</b>	<b>2</b>	<b>.</b>	<b>1</b>		<b>V</b>																	
<i>n</i>	<i>d</i>	<i>u</i>	<i>u</i>	<i>u</i>	<i>u</i>		<b>T</b>						<b>3</b>	<b>3</b>	<b>.</b>	<b>5</b>	<b>4</b>	<b>C</b>																	
<i>n</i>	<i>d</i>	<i>u</i>	<i>u</i>	<i>u</i>	<i>u</i>		<b>R</b>	<b>H</b>					<b>3</b>	<b>0</b>	<b>.</b>	<b>7</b>		<b>%</b>																	
<i>n</i>	<i>d</i>	<i>u</i>	<i>u</i>	<i>u</i>	<i>u</i>		<b>A</b>	<b>P</b>					<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>.</b>	<b>8</b>	<b>h</b>	<b>P</b>	<b>A</b>														

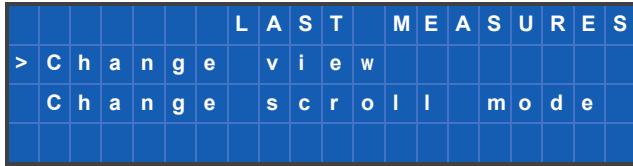
## Mask

## Example

where:

- *nnnnnnnn*: is the name of the measure in reduced format.
  - *dddddd*: is the measure's value; *Err* means the measure is in error.
  - *uuuu*: is the measurement unit.

Through *LAST MEASURES* submenu's functions, accessible by the button , it's possible to switch between the two forms and stop the automatic scroll of the measures.



## > Events

This screenshot shows the circular list of the last 10 events occurred since Pluvi-ONE's power-up.

## Mask

2 8 / 0 6 / 1 8 1 2 : 4 9 : 5 7  
( L ) L e v e l O N : L e v 6 . 3 m

### Example

where:

- *dd/MM/yy hh:mm:ss*: is the date and time an event occurred.
  - *x*: A=action, L=logic.
  - *tttttttttttt...: is the event's description text.*

Indication (L) means that a logic set during configuration occurred, while (A) shows the corresponding action. A logic example could be "(L) Level ON: Lev 6.3 m" and the corresponding action: "(A) SMS ON".

## > Errors

Errors screenshot shows the circular list of the last 10 errors occurred since Pluvi-ONE's power-up. Information shown are the same as the events' ones.

A system error example could be “Level sensor error”, which means the level sensor is in error.

#### 4.1.4.2 Diagnostic

Pluvi-ONE's functioning information are reported on some diagnostic screenshots, accessible from the *DIAGNOSTIC* menu.

D I A G N O S T I C	
> S	S e r i a l   l i n e s
S	S t a t u s
A	A c t u a t o r s

## > Serial lines

In this screenshot are reported the statistic information on the serial ports' functioning.

Use buttons   to move respectively to the next or the previous serial port.

## Mask

### Example

where:

- *n*: is the instrument's serial port number.
  - *aaaaaaaaaa*: is the number of received bytes.
  - *cccccccccc*: is the number of transmitted bytes.
  - *bbbbbbbb*: is the number of received messages.
  - *dddddddd*: is the number of submitted messages.

## > Status

This screenshot shows Pluvi-ONE's operative status.

D T d d / M M / y y h h : m m : s s  
R E S E T d d / M M / y y h h : m m  
S T A T U S : t t t t t t t t t t t t

## Mask

D	T	1	8	/	0	1	/	1	8		1	6	:	2	3	:	4	5
R	E	S	E	T	2	3	/	1	1	/	1	7		1	4	:	5	2
S	T	A	T	U	S	:		r	u	n		n	o	r	m	a	l	

## Example

where:

- *dd/MM/yy hh:mm:ss*: is the current date/time.
  - *dd/MM/yy hh:mm*: is the last reboot date/time.
  - *ttttttttttt*: is the current operative status (*run normal*, *run limited*, *low battery*).

## > Actuators

This screenshot shows the three actuators status and the battery voltage. To change the actuators status, use the buttons as explained in §4.1.2.

A C T U A T O R S									
S t a t u s :	x	x	x						
O u t p u t :	1	^	3						
P o w e r		n :	d	d	-	d	d	V	

## Mask

		A C T U A T O R S						
S t a t u s :		0 1 0						
O u t p u t :		^ 2 3						
P o w e r		1 2 - 8 5 V						

### Example

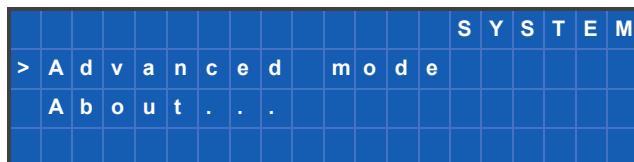
where:

- **x:** is the single actuation value (0=exit disabled, 1=exit enabled; if *safety logic* is set, values will be inverted: 0=exit enabled, 1=exit disabled).
  - **^:** is the cursor.
  - **dd.dd:** is the battery voltage.

#### 4.1.4.3 System

SYSTEM menu includes the command to enable Pluvi-ONE's specific functions that are disabled if low power mode is activated. It's also possible to display the instrument's identification data.

The menu shows up as follows:



##### > Advanced mode

By accessing the item *Advanced mode* from the SYSTEM menu, it will be shown the activation screenshot ("Advanced mode on?") of specific functions viewable in the ADVANCED FEATURES menu. If those features were already activated, the deactivation screenshot ("Advanced mode off?") will be shown.



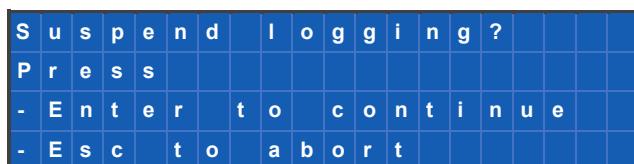
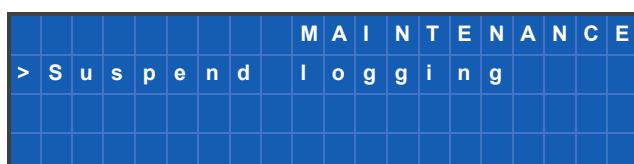
If the operation is not allowed in that moment, instrument will show the message "Denied now". In this case, try again after a few minutes.

##### > About...

The item *About...* shows instrument's identification information (§5.1.1).

#### 4.1.4.4 Maintenance

The MAINTENANCE menu includes the command to suspend measures memorization. This feature may be useful during maintenance operations, in order to avoid wrong data recordings. Pluvi-ONE doesn't send data during this time and elaborations made in this period of interruption may be in error.



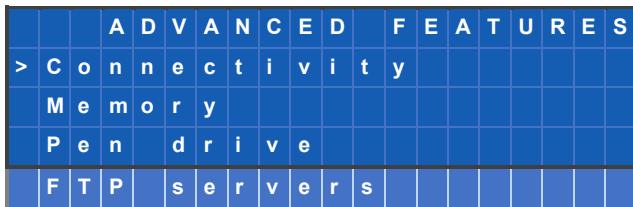
The feature automatically deactivates after 30 minutes. Upon deactivation, all activities resume regularly.

#### 4.1.4.5 Advanced features

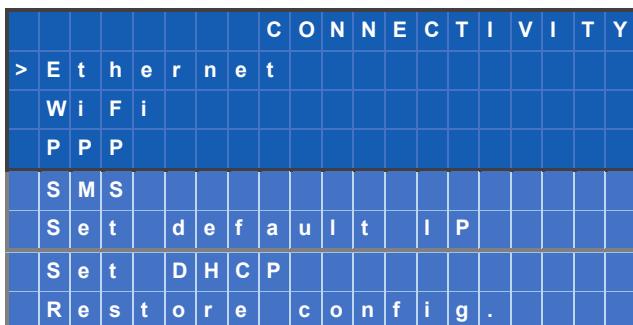
This menu functions are viewable only if they have been activated in the SYSTEM menu.



After the few minutes necessary to the installation, menu shows up as follows:



##### 4.1.4.5.1 Connectivity



###### > Ethernet

In this screenshot are shown Ethernet port's information that identify Pluvi-ONE in a computer network.

C	F	G : t	t	t	t	t						
I	P :	i	i	i	.	i	i	i	.	i	i	i
N	M :	n	n	n	.	n	n	n	.	n	n	n
G	W :	g	g	g	.	g	g	g	.	g	g	g

Mask

C	F	G : S	T	A	T	I	C					
I	P :	1	9	2	.	1	6	8	.	0	.	1
N	M :	2	5	5	.	2	5	5	.	2	5	5
G	W :	0	.	0	.	0	.	0	.	0	.	0

Example

where:

- *ttttt*: is the type of IP address (Static or DHCP).
- *iii.iii.iii.iii*: is the IP address.
- *NM*: is the subnet screenshot.
- *GW*: is the gateway.

The information update may take up to a minute or more, especially after using the "Set default IP" and "Set DHCP IP" functions to change the address.

> WiFi

Information shown in this screenshot are the same as the Ethernet port ones.

This type of connection requires the use of a Wi-Fi USB pen drive.

> PPP

If Pluvi-ONE is configured to work with a modem, the IP address will be provided by SIM's mobile phone operator.

## Mask

I	P	:	3	2	.	1	2	2	.	1	8	.	1	4	5
N	M	:	2	5	5	.	2	5	5	.	2	5	5	.	0
D	e	v	:												
A	P	N	:	i	b	o	x	.	t	i	m	.	i	t	

### Example

where:

- *iii.iii.iii.iii*: is the IP address.
  - *NM*: is the subnet screenshot.
  - *Dev*: is the device attached to the modem (/dev/tty/SP3).
  - *APN*: is the name of mobile phone operator's access point (Access Point Name) for the internet connection.

> SMS

In this screenshot are listed the telephone numbers of the SMS message addressers

## > Set default IP

Through this screenshot it's possible to restore the default IP address.

```
Set default IP?  
Press  
- Enter to continue  
- Esc to abort
```

## > Set DHCP IP

**DHCP (Dynamic Host Configuration Protocol)** is a service implemented on a network device (typically a PC server or a router) that has the task of automatically and dynamically assigning addresses to devices connected to the same network configured to automatically get an IP address.

If Pluvi-ONE is connected to the network, it is possible to have its IP address assigned by the DHCP service through this mask.

S	e	t		D	H	C	P	?
P	r	e	s	s				
-	E	n	t	e	r		t	o
-	E	s	c	t	o		a	b
						c	o	n
						t	i	n
						u	e	

### > Restore config

Using this mask you can restore the IP address specified in the configuration sent with the software 3DOM.

```
Restore configuration?
Press
- Enter to continue
- Esc to abort
```

#### 4.1.4.5.2 Memory

Pluvi-ONE is equipped with an internal memory where data and programs are stored. It's possible to extend memory capacity by inserting a USB pen drive in one of the two available ports.

The *MEMORY* menu allows the user to access the two types of memory, showing capacity and occupied space.

```
MEMORY
> Internal
      External
```

### > Internal

Shows the instrument internal memory's information.

```
Max : m . m GB
Cur : c . c GB
To Send : x
```

Mask

```
Max : 1 . 8 GB
Cur : 1 . 5 GB
To Send : 0
```

Example

where:

- *m.m*: is the memory capacity.
- *c.c*: is the occupied space.
- *x*: is the size of the data to be sent.

## > External

Shows information regarding external memory, if used (USB pen drive).

Max : mm GB  
Cur : cc GB

Mask

Max : 15 GB  
Cur : 50 MB

Example

where:

- mm: is the external memory capacity.
- cc: is the occupied space.

### 4.1.4.5.3 Pen drive

Pluvi-ONE's configuration and processed data can be saved on a USB pen drive. Using pen drive, it's also possible to change instrument's configuration.

See §3.2.5 for more information on files generated by Pluvi-ONE.

P E N D R I V E  
> D o w n l o a d c o n f i g  
U p l o a d c o n f i g  
U p l o a d d a t a  
U n m o u n t

## > Download of the configuration file

In this screenshot it's possible to change Pluvi-ONE's configuration, uploading it from the USB pen drive.

L o a d c o n f f r o m U S B ?  
P r e s s  
- E n t e r t o c o n t i n u e  
- E s c t o a b o r t

U p d a t i n g  
c o n f i g u r a t i o n  
P l e a s e w a i t . . .

Wait a few minutes for the instrument to reboot with the new settings.

## > Upload configuration file

In this screenshot it's possible to save Pluvi-ONE's current configuration on the USB pen drive.

S e n d c o n f t o U S B ?  
P r e s s  
- E n t e r t o c o n t i n u e  
- E s c t o a b o r t

W a i t o p e r a t i o n s . . .  
S e n d C o n f T o U S B 1 0 0 %  
- - - - C O M P L E T E D - - -  
P u s h E s c t o c o n t i n u e

### > Upload data files

In this screenshot it's possible to send the processed data saved in Pluvi-ONE memory to the USB pen drive.

Send data to USB?  
Press  
- Enter to continue  
- Esc to abort

Wait operations...  
Send Data To USB 100%  
---- COMPLETED ----  
Push Esc to continue

### > Unmount

USB pen drive must be unmounted before to extract it from Pluvi-ONE, as it is using PCs.

Unmount USB?  
Press  
- Enter to continue  
- Esc to abort

Wait operations...  
Unmount USB 100%  
---- COMPLETED ----  
Push Esc to continue

#### 4.1.4.5.4 FTP servers

The FTP SERVERS menu shows configured FTP servers and allows the user to run connection tests.

FTP SERVERS  
> List  
Test

### > List

Shows the names of the configured FTP servers.

### > Test

Runs a test to check if the FTP servers configured are available.

Test FTP servers?  
Press  
- Enter to continue  
- Esc to abort

Wait operations...  
Test FTP Servers 100%  
---- COMPLETED ----  
Push Esc to continue

## 4.1.5 Navigation menu structure

### MAIN

- Logging
  - o Last measures
  - o Events
  - o Errors
- Diagnostic
  - o Serial lines
  - o Status
  - o Actuators
- System
  - o Advanced mode
  - o About...
- Maintenance
  - o Suspend logging
- Advanced features
  - o Connectivity
    - Ethernet
    - WiFi
    - PPP
    - SMS
    - Set default IP
    - Set DHCP
    - Restore config
  - o Memory
    - Internal
    - External
  - o Pen drive
    - Download config
    - Upload config
    - Upload data
    - Unmount
  - o FTP servers
    - List
    - Test

## Part 5

### 5.1 Diagnostics

#### 5.1.1 Product identification

Pluvi-ONE's serial number and firmware version can be found in *ABOUT...* from the *SYSTEM* menu.

	L	S	I		L	A	S	T	E	M					
P	I	u	v	i	-	O	N	E		E	L	P	0	0	1
S	N	1	2	3	4	5	6	7	8						
F	W	1	.	0	0	.	0	0							

Other identification data are listed on the label placed on the back of the instrument.



#### 5.1.2 Troubleshooting

Below are listed the most common problems found using Pluvi-ONE.

##### ❖ Pluvi-ONE won't turn on

1. Make sure the On/Off button (1) is placed on On. If LED Rdy, green, is on, it means the instrument is powered up.
2. If powered by power supply or 230/12 V inverter:
  - a. Make sure the power supply is connected to the *Batt/Pwr In* input (10) of Pluvi-ONE's terminal block (§1.2).
  - b. Check the power supply system output voltage by using a Voltmeter. Even though the instrument turns on with only 6 V, it's recommended to have a voltage of at least 12 V, especially if the switched power outputs for the sensors powering are being used.
3. If powered by a battery and photovoltaic panel:
  - a. Make sure the battery is connected to the *Batt/Pwr In* input and the photovoltaic module to the *PV In* input (10) of Pluvi-ONE's terminal block (§1.2).
  - b. Check the battery power by determining its voltage with a Voltmeter. Refer to the specifics of the battery in use. If the battery is damaged, replace it. If it's just low, proceed to the next point.
  - c. Check the voltage generated by the photovoltaic panel by using a Voltmeter. Voltage must be at least 17 V for Pluvi-ONE to charge the battery.
4. If the previous points didn't resolve the problem, there might be a hardware failure in Pluvi-ONE.

#### ❖ Pluvi-ONE's display is off

1. Make sure Pluvi-ONE is turned on (*Pluvi-ONE won't turn on point*).
2. Pluvi-ONE might have entered low power mode. To turn the display on press Pluvi-ONE's keyboard button **ESC (7)** (§1.2).
3. Turn Pluvi-ONE off and on. If the display won't turn on, there could be a hardware failure in Pluvi-ONE.

#### ❖ PC won't communicate with Pluvi-ONE

1. Ensure Pluvi-ONE is turned on (*Pluvi-ONE won't turn on point*).
2. Ensure advanced mode is on (§4.1.4.3).
3. Ensure the IP address indicated in 3DOM's communication parameters is Pluvi-ONE's one. To know Pluvi-ONE's IP address, see §4.1.4.5.1.
4. Check PC's IP address: it must be in the range of Pluvi-ONE's one. For example, if Pluvi-ONE has IP address 192.168.0.1, the PC one shall be between 192.168.0.2÷192.168.0.254. Ensure both have set the same subnet. For more information on the PC's IP address change, consult the network administrator or the documentation provided with the PC.
5. If the communication takes place via Ethernet port:
  - a. If communication is direct, ensure the LAN cable is connected to PC and Pluvi-ONE's Ethernet port, whilst if the connection takes place in a network, ensure both LAN cable ends are connected to a network socket. Ensure the two LEDs on Pluvi-ONE's Ethernet port (also the PC one), one green and one yellow, are lit. If they aren't, Pluvi-ONE won't "feel" the network signal. The cable might be fault or the socket it is connected to might not be connected to the network. In the first case, replace the cable; in the second case, consult the network administrator.
6. If the connection takes place via a Wi-Fi USB pen drive:
  - a. Check the suitability of the used Wi-Fi USB pen drive. Pluvi-ONE supports keys compatible with Linux kernels 2.6.35.3 or previous.
  - b. Ensure the Wi-Fi connection parameters (§3.1.3– Wi-Fi) are correct. To request the parameters, consult the network administrator.
7. If the previous points didn't resolve the problem, there might be a hardware failure in Pluvi-ONE. Configuration's loading or downloading can also take place via USB pen drive (§3.1.10.2).

#### ❖ Measurement in Error status

1. If the measure is acquired (analogic/digital sensor connected to Pluvi-ONE's the terminal block (10) or I<sup>2</sup>C input (2)):
  - a. Ensure Pluvi-ONE had enough time to acquire the measure. In this regard, see the measure's *Update time rate* parameter of the *Sampling* tab (§0).
  - b. Ensure the measure is properly configured (linearization, scale, ecc.) and the associated input type is the appropriate one for the sensor in use. See the measure's parameters of the *Type* and *Update time rate* tabs (§0).
  - c. Ensure the sensor that generate the measure is connected to Pluvi-ONE according to the provided documentation. Pluvi-ONE's input shall be the one indicated in the measure configuration (§0).

- d. the sensor is powered by an Pluvi-ONE's actuated output, ensure that the sensor powering mode and the actuator's number are correct. If powering mode is set on *Pre-feeding time*, ensure that the set time matches the sensor's specifics. 3DOM's parameters to be checked are: *Sensor feeding mode*, *Power output* and *Pre-feeding time* of the concerned measure *Sampling* tab (§0).
2. If the measure is acquired via serial line (sensor connected to Pluvi-ONE's port Com3 (10) and/or Com2 (6)):
  - a. Ensure the sensor (or ALIEM) generating the measurement is powered and connected as described in the wiring diagram.
  - b. Ensure the communication parameters of Pluvi-ONE's serial port (see 3DOM's *Input Types*) are configurated correctly in the sensor (or ALIEM).
  - c. Ensure Modbus parameters for the measure reading are correct. See measure's *Modbus RTU Master Parameters* of the *Type* tab on 3DOM.
  - d. It might be useful to check the functioning of the sensor connecting it to the PC, on which is installed a program that allows communication with Modbus RTU devices.
3. If the measure is calculated:
  - a. At least one main measure is in error. Determine the cause.
  - b. Check the measure configuration. See the measure's parameters from the *Type* and *Sampling* tabs (§0).

#### ❖ Pluvi-ONE won't update the configuration via FTP

1. Ensure the site that the configuration was sent on has the checkmark near the *Configuration Authority* parameter (§2.2.5.1).
2. Ensure Pluvi-ONE is connected to the internet by running a connection test (§2.5). In case of failure, check the FTP protocol's connectivity parameters set with 3DOM (§2.2.5.1). If they are correct, run a connection test directly from the program. If this test fails as well, contact the FTP server's provider.

#### ❖ Pluvi-ONE won't send the data files to the FTP server and/or MQTT messages

1. Ensure Pluvi-ONE is in *Run normal* status, which is the normal operative status (§4.1.4.2, menu item: *Status*).
2. Ensure Pluvi-ONE had enough time to generate the elaborations. See parameter *Time* rate of the *Elaborations* tab (§0).
3. Ensure Pluvi-ONE had enough time to save/send the processed files. See *Elaboration data delivery time rate* and *Elaboration data delivery time rate in alarm condition* (§3.1.6).
4. For the FTP server:
  - a. Ensure Pluvi-ONE is connected to the internet by running a connection test (§4.1.4.5.4). In case of failure, check the FTP protocol's connectivity parameters set with 3DOM (§3.1.3). If they are correct, run a connection test directly from the program. If this test fails as well, contact FTP server's provider.
5. For MQTT:
  - a. Ensure Pluvi-ONE is configurated to connect to the internet. See the configurated network interfaces (§3.1.3).
  - b. Check MQTT protocol's connectivity parameters and the publishing options (§). If they are correct, contact MQTT service's provider.
6. If the problem is not solved immediately, please remember that the files with the processed data can be downloaded on a USB pen drive connected to the data logger (§4.1.4.5.3).

❖ **Pluvi-ONE won't send emails in case of alarm**

1. Ensure Pluvi-ONE is configured to connect to the internet. See the configured network interfaces (§3.1.3).
2. Ensure the SMTP server settings are correct (§3.1.3, SMTP) and that the specified account may be used for that purpose. For security reasons, some email services, such as Google Mail, do not allow its use until you have activated the two-step verification and created the password for the app (the data logger), directly from your account.
3. Check the parameters entered in the logic associated with the email transmission (§3.1.8). The conditions of activation of the email transmission may not occur.
4. Ensure the entered mails are correct and active (§3.1.8).

❖ **Pluvi-ONE won't send SMS in case of alarm**

1. Ensure the PPP interface settings are those required by the telephone operator of the SIM in use (§2.2.43.1.3, PPP).
2. Check the parameters entered in the logic associated with the SMS transmission (§3.1.8). The conditions of activation of the SMS transmission may not occur.
3. Ensure the entered recipient's telephone number is correct and active (§3.1.8).
4. Ensure the SIM is active and has enough credit to send messages.
5. Check the modem connection to Pluvi-ONE, as well as its power supply.

❖ **Pluvi-ONE won't send MQTT messages in case of alarm**

1. Ensure Pluvi-ONE is configured to connect to the internet. See the configured network interfaces (§3.1.3).
2. Ensure the MQTT server settings are correct and the *Publish alarms* parameter is activated (§3.1.3, MQTT).
3. Check the parameters entered in the logic associated with the MQTT messages transmission (§3.1.8). The conditions of activation of the MQTT messages transmission may not occur.

❖ **Missing data in the data files**

A lack of data generally depends on a power issue. Pluvi-ONE's status screenshot provides information about the last reset, the operating mode and the power supply voltage (§4.1.4.2, Status). If data logger is in the "Run limited" status (*Low power mode*), it will not send data (§3.1.2).

1. If Pluvi-ONE is powered by a power supply and does not have a battery:
  - a. Check the wires that connect Pluvi-ONE to the power supply. One of these might be loose.
  - b. Check the continuity of the electrical system that the equipment is connected to. In case of occasional lack of power, it's suggested the use of a backup battery.
2. If Pluvi-ONE is powered by a power supply and has a battery:
  - a. Perform the previous point inspections.
  - b. Check the battery status. If it's damaged, replace it. If it's low, charge it.
3. If Pluvi-ONE is powered by battery and photovoltaic panel:
  - a. Check the wires that connect Pluvi-ONE to the battery and the photovoltaic panel. One of them might be loose.
  - b. Check the battery status. If it's damaged, replace it. If it's low, check panel's efficiency. Pluvi-ONE charges the battery only if the panel provides at least a 17 V voltage.

## 5.2 Maintenance

Pluvi-ONE doesn't need special maintenance if installed as described in §1.3.

However, it's recommended to performs a periodic inspection of the entire system (Pluvi-ONE and the sensors connected), in order to detect and fix possible measurement errors.

## 5.3 Contacting LSI LASTEM

LSI LASTEM offers its assistance service at [support@lsi-lastem.com](mailto:support@lsi-lastem.com), or filling out the *Request for technical assistance module*, downloadable from [www.lsi-lastem.com](http://www.lsi-lastem.com).

See the following addresses for more information:

- Telephone number: +39 02 95.414.1 (switchboard)
- Address: Via ex S.P. 161 – Dosso n. 9 – 20049 Settala (MI)
- Website: [www.lsi-lastem.com](http://www.lsi-lastem.com)
- Commercial service: [info@lsi-lastem.com](mailto:info@lsi-lastem.com)
- Post-sale service: [support@lsi-lastem.com](mailto:support@lsi-lastem.com)

## Pluvi-ONE configuration templates

### Type 1 configuration: Rain

Sensor	Quantity
DQA230.1	Rain
-	Pressure (internal)
-	Temperature (internal)

Sensor code	Measure (UM)	Acq. rate hh:mm:ss	Elaborations (rata hh:mm – tipo)	Pluvi-ONE input
DQA230.1	RAIN (mm)	00:01:00	00:01 – Tot 00:10 – Tot 01:00 – Tot 24:00 – Tot Last 10 min – Mobile tot Last 60 min – Mobile tot	Pulse1
-	AtmPres (hPa)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd 24:00 - Min, Med, Max, DevStd	On board
-	INSideTemp (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	On board

### Type 2 configuration: Rain (Class A)

Sensor	Quantity
DQA230	Rain
-	Pressure (internal)
-	Temperature (internal)

Sensor code	Measure (UM)	Acq. rate hh:mm:ss	Elaborations (rata hh:mm – tipo)	Pluvi-ONE input
DQA230	RAIN (mm)	00:01:00	00:01 – Tot 00:10 – Tot 01:00 – Tot 24:00 – Tot Last 10 min – Mobile tot Last 60 min – Mobile tot	Pulse1
-	AtmPres (hPa)	00:01:00	00:10 - Min, Ave, Max, DevStd 01:00 - Min, Ave, Max, DevStd 24:00 - Min, Ave, Max, DevStd	On board
-	INSideTemp (°C)	00:01:00	00:10 - Min, Ave, Max, DevStd 01:00 - Min, Ave, Max, DevStd	On board

### Type 3 configuration: Rain + level

Sensor	Quantity
DQA230.1	Rain
DMA672.3	Temperature+RH%
DLE041	Soil temperature
DQC001.15	Level
-	Pressure (internal)
-	Temperature (internal)Temperature (internal)

Sensor code	Measure (UM)	Acq. rate hh:mm:ss	Elaborations (rata hh:mm – tipo)	Pluvi-ONE input
DQA230.1	RAIN (mm)	00:01:00	00:01 – Tot 00:10 – Tot 01:00 – Tot 24:00 – Tot Last 10 min – Mobile tot Last 60 min – Mobile tot	Pulse1
DMA672.3	Temperature (°C)	00:01:00	00:01 - Ave 00:10 - Min, Ave, Max, DevStd 01:00 - Min, Ave, Max, DevStd 24:00 - Min, Ave, Max, DevStd	TTL Serial
	RelHumidity (%)	00:01:00	00:01 - Ave 00:10 - Min, Ave, Max, DevStd 01:00 - Min, Ave, Max, DevStd 24:00 - Min, Ave, Max, DevStd	
DLE041	SoilTemp (°C)	00:01:00	00:01 - Ave 00:10 - Min, Ave, Max, DevStd 01:00 - Min, Ave, Max, DevStd 24:00 - Min, Ave, Max, DevStd Ultimi 60 min – Mobile min Ultimi 60 min – Mobile max increase	Pt100
DQC001.15	Level (m)	00:01:00	00:01 - Ave 00:10 - Min, Ave, Max, DevStd 01:00 - Min, Ave, Max, DevStd 24:00 - Min, Ave, Max, DevStd Ultimi 60 min – Mobile min Ultimi 60 min – Mobile max increase	Analog in
-	AtmPres (hPa)	00:01:00	00:10 - Min, Ave, Max, DevStd 01:00 - Min, Ave, Max, DevStd 24:00 - Min, Ave, Max, DevStd	On board
-	INSideTemp (°C)	00:01:00	00:10 - Min, Ave, Max, DevStd 01:00 - Min, Ave, Max, DevStd	On board

## Common settings

### Registry

Parameter	Value
Use an alternative serial code	No
User-defined name	
Site name	
Longitude	0.0
Latitude	0.0
Altitude	0
Time zone	00:00

### System

Parameter	Value
Operative mode	Always on
Power threshold low	11
Power threshold high	11.8
Rows of logs to send (0 – 1000)	0

### Connectivity

Network interfaces	Value
Ethernet	Static address, IP address: 192.168.0.1, Subnet mask: 255.255.255.0
Wi-Fi	Not configured
PPP	Not configured

Network protocols	Value
DNS	8.8.8.8
FTP Client	Not configured
SMTP	Not configured
NTP	0.pool.ntp.org, 1.pool.ntp.org, it.pool.ntp.org
MQTT	Not configured

### Elaboration Parameters

Parameter	Value
Elaboration data delivery time rate (hh:mm:ss)	01:00:00
Elaboration data delivery time rate in alarm condition (hh:mm:ss)	00:10:00
Days of data storage	90

## Logics

Name	Measure (reference value)	Description
Tot Rain last 10 min beyond limit	RAIN (Last 10 min – Mobile tot)	Logic is activated when the precipitation detected in the last 10 minutes is higher than 16 mm
Tot Rain last 60 min beyond limit	RAIN (Last 60 min – Mobile tot)	Logic is activated when the precipitation detected in the last 60 minutes is higher than 16 mm
Wind Inst beyond limit	WindSPEED (Inst)	Logic is activated when the last reading of the wind speed is higher than 10 m/s
Inst Level beyond limit	LEVEL (Inst)	Logic is activated when the last reading of the level is higher than 5 m
Increase level last 60 min beyond limit	LEVEL (Last 60 min – Mobile max increase)	Logic is activated when the level detected in the last 60 minutes increased by 10 cm
AirTemp Inst below lower limit	Temperature (Inst)	Logic is activated when the last reading of the air temperature is lower than 0 °C
AirTemp Inst beyond limit	Temperature (Inst)	Logic is activated when the last reading of the air temperature is lower than 35 °C
AirTemp Inst within limits	Temperature (Inst)	Logic is activated when the last reading of the air temperature ranges from 0 °C to 35 °C
AirTemp Inst out of limits	Temperature (Inst)	Logic is activated when the last reading of the air temperature is lower than 0 °C or higher than 35 °C

# Technical specifications

## Pluvi-ONE models

Codice	ELP001 - ELP001.1
Description	Pluvi-ONE data logger
Inputs type	Terminal block
Analogic inputs	1 (1 ÷ 2000 mV DC)
Digital inputs	2
RS232 ports	2
USB ports	2
RS485 port	NO
SDI-12 port	NO
Integrated barometric sensor	YES
Integrated temperature sensor	YES
On/off outputs	YES
Backlit display	YES
Threaded slot for tripod fixing	NO
Internal battery	NO (requires external battery)
Connector for power supply / battery charger	NO
Included accessories	Ethernet cable, DIN-bar mounting

## Technical characteristics

Inputs pulses (rain gauge)	Inputs number	2
	Inputs mode	Redundancy mode: <ul style="list-style-type: none"> <li>• 2 two pluviometers single reed relays</li> <li>• 1 double reed relay pluviometer</li> </ul>
	Powering	Limited to 1 mA per reed relay
	Input type	Open collector with 3.3 V pullup resistance (positive input)
	Max input frequency	480 KHz
	Linearization	YES (with intensity correction formula for Class A pluviometers - UNI11452-2012)
	Protections	<ul style="list-style-type: none"> <li>• From reed relay rebounds</li> <li>• From over-tension (&gt; 5V)</li> <li>• 400 W peak pulse power capability at 10/1000 <math>\mu</math>s waveform. Repetition rate (duty cycle): 0.01 %</li> <li>• IEC-61000-4-2 ESD 30 kV (air), 30 kV (contact)</li> <li>• ESD protection of data lines in accordance with IEC 61000-4-2</li> <li>• EFT protection of data lines in accordance with IEC 61000-4-4</li> </ul>

<b>Input (temperature RH% sensor)</b>	Input	UART-TTL (DMA672.1 sensor, DMA672.4 sensor when ELUxxx box is used)
	Range	Temperature: -40 ÷ 70 °C RH%: 0 ÷ 100 % Dew Point: -40 ÷ 70 °C
	Resolution	Temperature: 0.1 °C RH%: 0 ÷ 100 % Dew Point: 0.1 °C

<b>Input Pt100 (temperature sensor)</b>	Input	Pt100 (3 wires)
	Range	-40 ÷ 70 °C
	Resolution	0.1 °C
	Accuracy	±0.25 °C

<b>Input Voltage</b>	Range	1 ÷ 2000 mV
	Resolution	NA
	Accuracy	NA

<b>Internal measurement (absolute pressure)</b>	Range	500 ÷ 1100 hPa
	Resolution	Typically 0.084 hPa
	Accuracy	±0.3 hPa (-20 ÷ 85 °C)
	Long term stability	±1 hPa/year

<b>Internal measure (power supply)</b>	Mode	Battery or power supply level
	Type	Voltage

<b>RS485 Input/output</b>	Inputs number	1
	Mode	Connection to sensors (Modbus RTU - Master protocol)
	Powering	Isolated 3 kVdc

<b>RS232 input/output</b>	Inputs number	1
	Mode	Connection to communication devices (modem 3G/4G)

<b>USB input/output</b>	Ports number	2
	Type	Host, type A connector
	Mode	<ul style="list-style-type: none"> <li>• External memory pen-driver connection</li> <li>• Wi-Fi antenna connection (optional)</li> </ul>

<b>Switched power supply outputs</b>	Output number	3 (programmable triggering)
	Type	Solid state for output V Out = V In
	Maximum current	1.1 A for each actuator
	Mode	<ul style="list-style-type: none"> <li>External sensors powering</li> <li>Communication systems power supply</li> <li>Alarm</li> <li>Timer (date/time or cycles)</li> </ul>
	Protections	400 W peak pulse at 10/1000 µs waveform Repetition rate (duty cycle): 0.01 %.

<b>Memory</b>	Type	Three levels of memorization for more reliability: <ul style="list-style-type: none"> <li>8/16 MB on Flash chip for LSI LASTEM file system</li> <li>400 MB data on Flash chip with UBIFS file system</li> <li>Up to 32 GB data on USB memory with FAT32 file system</li> </ul>
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<b>User interface</b>	Display	57x19 mm, 4 lines x 20 char
	Keyboard	4 buttons
	LED	Diagnostic about: <ul style="list-style-type: none"> <li>Data transmission activity</li> <li>System status</li> <li>Battery charge status</li> <li>Internal Linux computer status (ready/error)</li> </ul>

<b>Clock</b>	Accuracy	30 seconds/month
	Synchronization	Automatic, da Internet time (NTP)

<b>ADC</b>	Resolution	12 bits oversampled up to 14 bit; 16 bits optional
	Filter	Noise filtering 50/60 Hz

<b>Data transmission</b>	Modem	External 3G/4G modems (connection to RS232 port)
	Router	3G-4G/External radio (connection to Ethernet port)
	Wi-Fi	External antenna (connection to USB port)

<b>Watchdog</b>	Type	Dual/redundant watchdog system
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<b>Linux computer</b>	Type	Linux based on computer with open and user extendable architecture
	Processor	32 Bit
	ADC converter	16 bit
	Powering mode	<ul style="list-style-type: none"> <li>Always ON (always connected to the Internet)</li> <li>Automatic ON (awake for data transmission only, best energy performance)</li> </ul>
	Linux kernel	V. 2.6.35, Debian Wheezy distribution
	Ethernet	Ethernet 10/100 Mbps
	USB port	2 connector, Host, Type-A
	Memory	2 GB Flash with UBIFS file system
	RAM	128 MB

<b>Power supply</b>	Voltage	DC 6 ÷ 30 V
	Inputs	<ul style="list-style-type: none"> <li>Separated by powering 6 ÷ 30 Vdc:</li> <li>From solar panel (17 Vmin); maximum input current 5 A; charge voltage 13.8 V</li> <li>From battery /power grid; maximum current 5 A</li> </ul>
	Peak pulse power capacity	400 W peak pulse at 10/1000 µs waveform Repetition rate (duty cycle): 0.01 %
	Battery charger	17 V
	Protections	<ul style="list-style-type: none"> <li>IEC-61000-4-2 ESD 30 kV (air), 30 kV (contact)</li> <li>Protection against self-restorable PTC fuses overcurrent</li> <li>Reverse polarity protection</li> <li>Power input overvoltage protection over 33 V</li> <li>400 W peak pulse power capacity with 10/1000 µs waveform.</li> </ul>

<b>Environmental limits</b>	Operative temperature	-30 ÷ 60 °C
	Operative humidity	10 ÷ 99 % RH, not condensation (conformal coating option)
	Storage temperature	-40 ÷ 80 °C

<b>Physical parameters</b>	Weight	600 g
	Dimensions	160x125x50 mm
	Mounting	DIN mounting rail 35 mm

<b>EMC</b>	Protections	EN61326-1 2013
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