Alpha-Log

User manual

Document Alpha-Log – User manual

Pages 123

Revisions list

Issue	*Date*	*Description of changes*
Origin	11/05/2020	
0	07/07/2020	Integration INSTUM_03386 – Alpha-Log and Quick start
1	01/10/2020	Modification of the TTL input description of Fig. 2
2	04/12/2020	Instrument new functions description
3	05/05/2021	Description of use of USB stick
4	17/11/2021	Description of Input types
5	29/03/2022	Update based on Alpha-Log fw v. 2.06
6	04/07/2022	Added description of wind processing elements and the Declaration of conformity
7	23/03/2023	Update for introduction of model ALP003
8	19/06/2023	Added information on safety, handling, storage, packaging, preservation and delivery
9	26/01/2024	Added new calculated measures and new features
10	22/03/2024	Added information on SDI-12 protocol
11	19/09/2024	Added Alpha-Log consumption

Notes on this manual

The information included in this manual may be modified without notice. No part of this manual may be reproduced in any form or by any electronic or mechanical means, for any use, without LSI LASTEM's written permission.

LSI LASTEM reserves the right to intervene on the product, without the obligation to promptly update this document.

Table of contents

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:

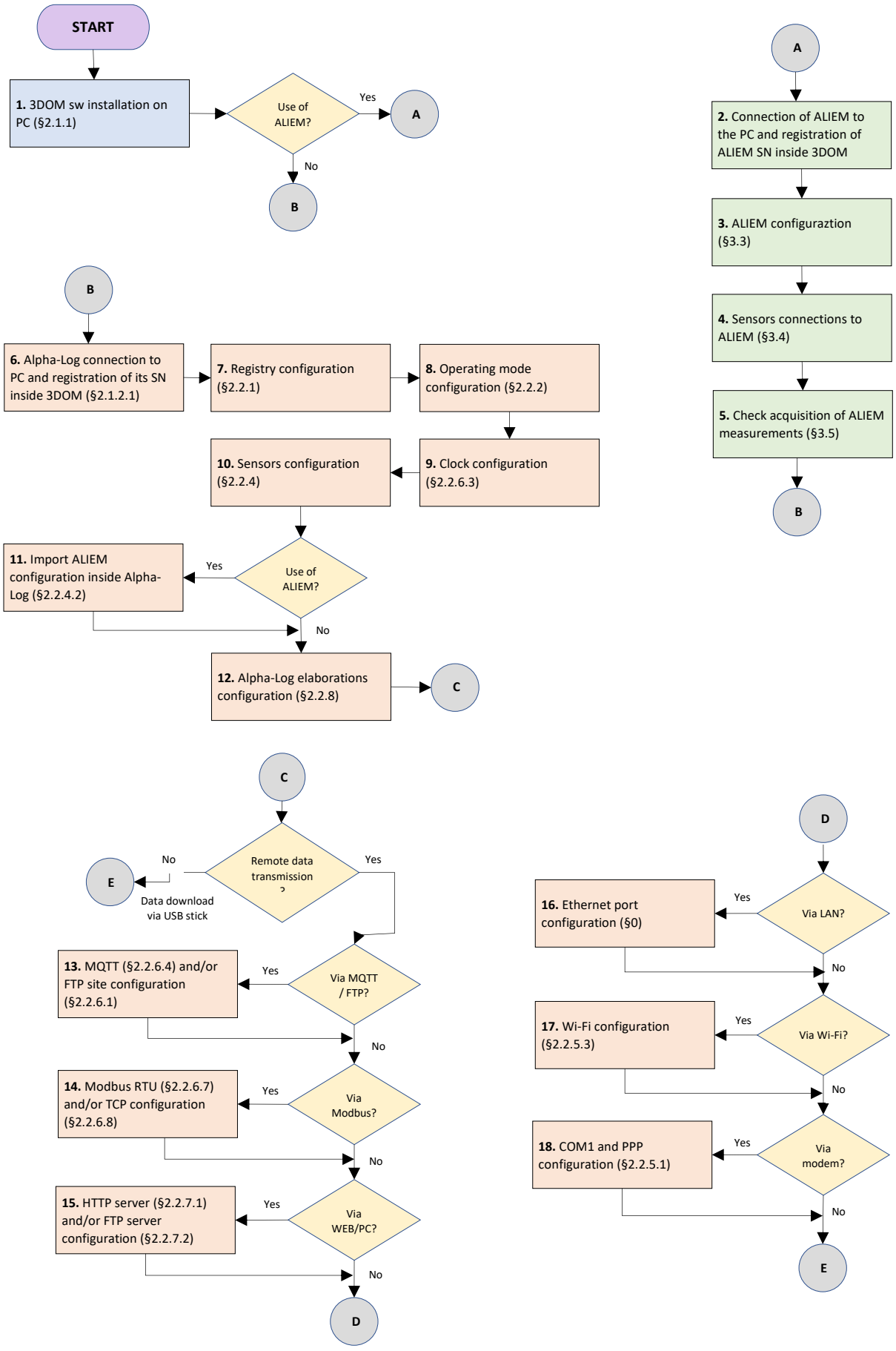

Warning

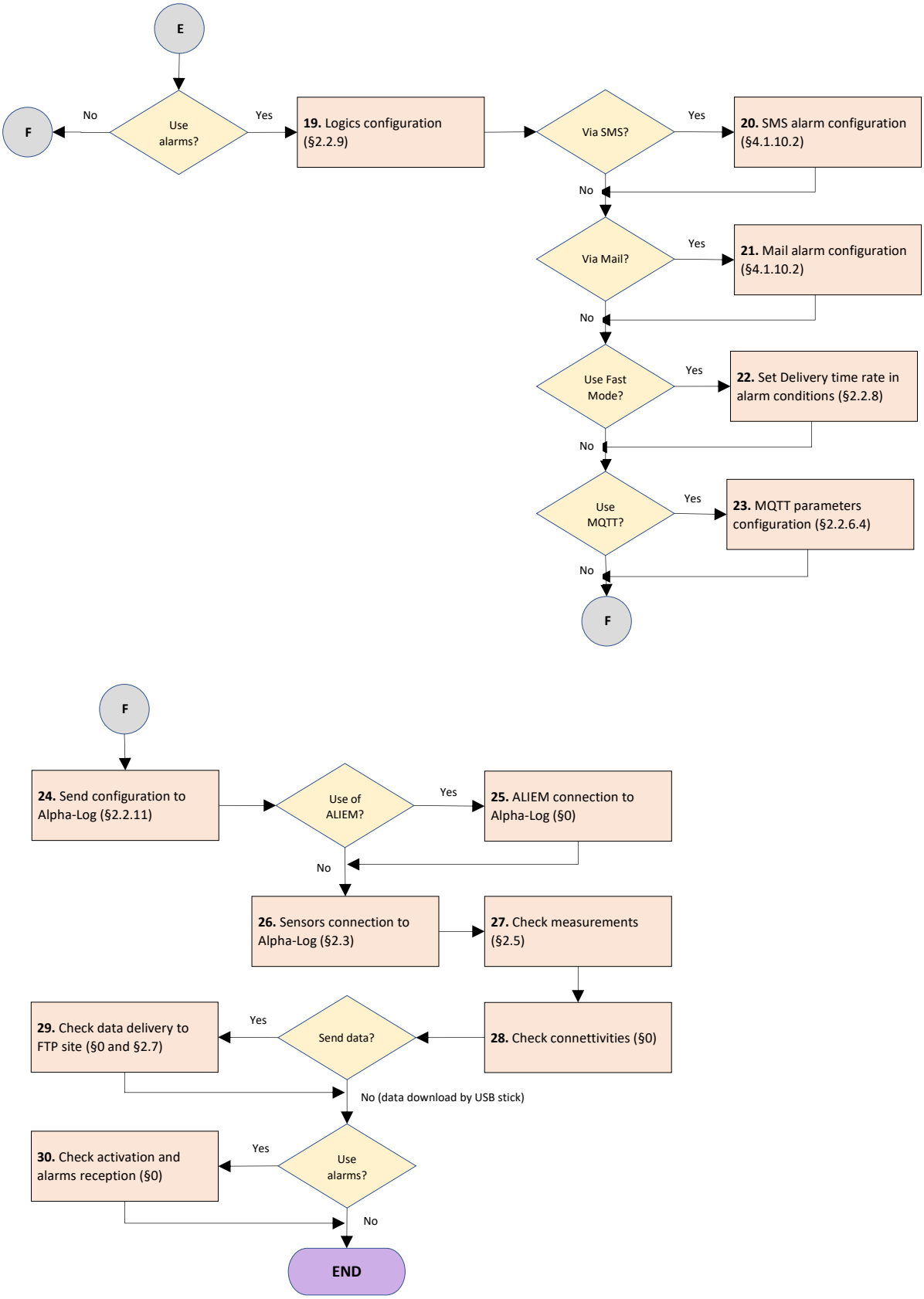

Additional information


Suggestions

For some specific topics tutorial videos are available.

Flow scheme of the features




E
F
No
Use alarms?
Yes
19. Logics configuration (§2.2.9)
Via SMS?
Yes
20. SMS alarm configuration (§4.1.10.2)
No
Via Mail?
Yes
21. Mail alarm configuration (§4.1.10.2)
No
Use Fast Mode?
Yes
22. Set Delivery time rate in alarm conditions (§2.2.8)
No
Use MQTT?
Yes
23. MQTT parameters configuration (§2.2.6.4)
No
F
F
24. Send configuration to Alpha-Log (§2.2.11)
Use of ALIEM?
Yes
25. ALIEM connection to Alpha-Log (§0)
No
26. Sensors connection to Alpha-Log (§2.3)
27. Check measurements (§2.5)
28. Check connettivities (§0)
Send data?
Yes
29. Check data delivery to FTP site (§0 and §2.7)
No (data download by USB stick)
Use alarms?
Yes
30. Check activation and alarms reception (§0)
No
END

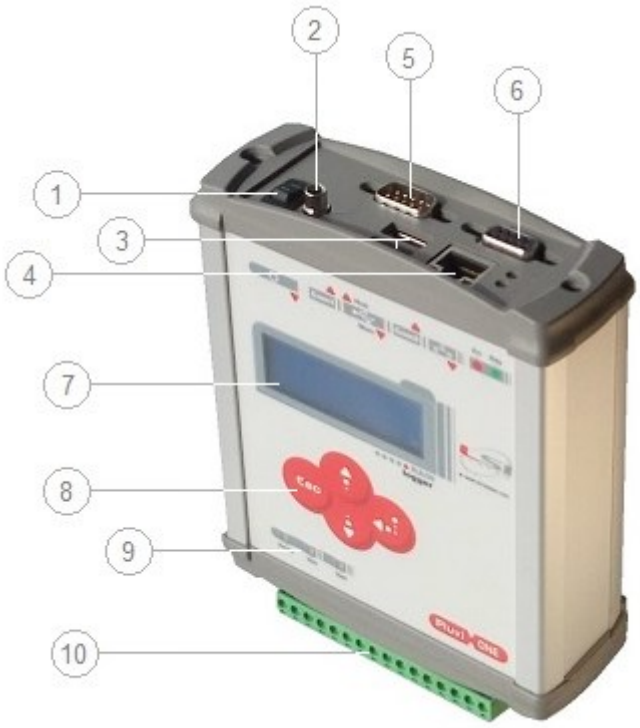
Part 1

1.1 Introduction

Alpha-Log is the latest born of the LSI LASTEM's data logger family. It contains the most efficient technical solutions assimilated in more than 40 years LSI LASTEM's experience regarding data acquisition systems. Alpha-Log was created with the objective of being an autonomous acquisition system, but also integrated into more complex systems. Based on a Linux architecture, it contains the power of this kind of operating system, but also an optimized hardware with extreme low consumption. Also, the usability and data management as well as the data output part has been designed having in mind the most modern needs.

If required, the *MW6501 – LSI LASTEM Products* USB stick is delivered with Alpha-Log unit. It contains 3DOM program for set up and management of Alpha-Log features. Anyway, it is possible to download 3DOM program by the www.lsi-lastem.com site. It is available in the *Software* page.

1.2 Instrument description



(1) - On/Off switch
(2) - I²C input
(3) - USB ports
(4) - Ethernet port
(5) - Com1 serial port (modem)
(6) - Com2 serial port (ALIEM)
(7) - 20x4 characters LCD display
(8) - Keyboard
(9) - Operating status LEDs
(10) - Terminal block

Fig. 1 – Instrument description.

INPUTS

- *Pulse/Freq/State1, Pulse/Freq/State2:* for impulsive, frequency and state signals
- *Pt100:* platinum resistance thermometer
- *SDI-12:* SDI-12 serial line (Com5)
- *LCD On:* display activation external contact
- *Analog In:* 1÷2000 mV voltage
- *TTL Serial:* DQA601.3 thunderstorm distance or DMA672.1 Temperature/RH% sensor (Com4)
- *RS-485:* RS-485 serial line (Com3)

SWITCHED POWER OUTPUTS

- *Pwr Out1* (only available if *TTL Serial* is free), *Pwr Out2, Pwr Out3*

POWER SUPPLY

- *Batt/Pwr In:* power supply 6÷30 Vdc
- *PV In:* photovoltaic module input

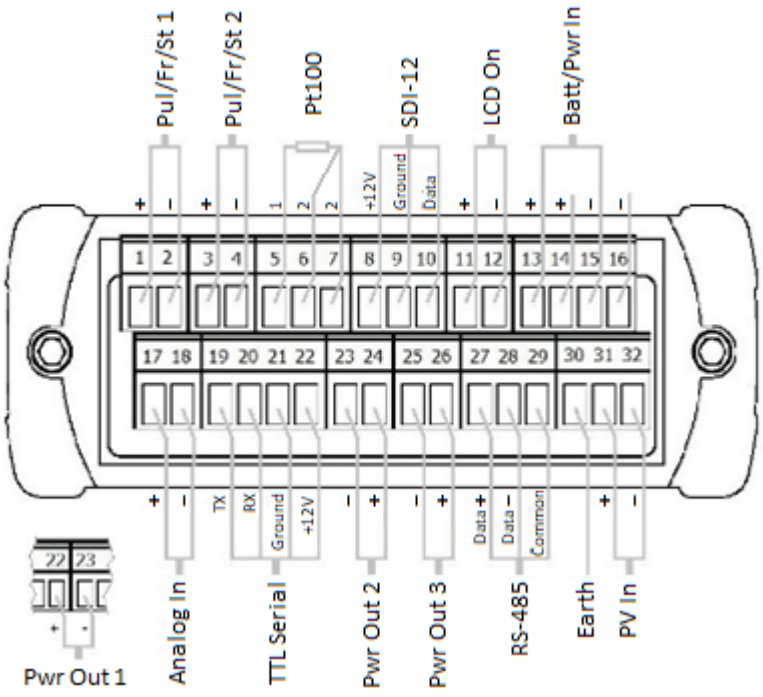


Fig. 2 – Terminal block.

1.3 Product setup

1.3.1 General safety rules

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.

For safety regulations please refer to manual INSTUM_05290.

1.3.2 Mechanical installation and placing

Alpha-Log 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 (the charge controller inside the data logger manages the recharging of the 12 V batteries only; the management of the 24 V batteries is optional and on request). For the mechanical installation see the documentation provided with the equipment.

Part 2

2.1 Guide to first starting of Alpha-Log

Alpha-Log 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.

Watch the following video tutorials related to the topics of this chapter.

#	Title	YouTube link	QR Code
1	3DOM: Installation from the LSI LASTEM web site	3DOM #1 - Installation from website - YouTube	
4	3DOM: Installation from LSI LASTEM's USB pen driver	3DOM #2 - Installation from USB pen drive - YouTube	
5	3DOM: How to change user's interface language	3DOM #3 - How to change user's interface language - YouTube	
2	3DOM: Powering the device	Alpha-Log #2 – Powering the device - YouTube	
3	3DOM: How to set Ethernet port to connect PC to Alpha-Log	Alpha-Log #3 – How to set the PC Ethernet port to connect PC to Alpha-Log - YouTube	
6	3DOM: Check the settings for the PC connection using Ethernet port	Alpha-Log #6 - Check the settings for the PC connection using Ethernet port - YouTube	
11	Alpha-Log: Adding new Alpha-Log inside 3 DOM	Alpha-Log #11 - Adding new Alpha-Log in 3DOM program - YouTube	
23	Alpha-Log: Connection to Ethernet LAN	Alpha-Log #23 - Connection to Ethernet LAN - YouTube	

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).

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 Alpha-Log entry in 3DOM

At the first use it is necessary to insert Alpha-Log in the list of 3DOM tools 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 Alpha-Log 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 Alpha-Log Ethernet ports **(4)**.
2. Connect the 12÷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 Alpha-Log with the On/Off switch **(1)**.

For connection via network, instead:

1. Insert the LAN cable into the Alpha-Log Ethernet **(4)** port and to the network socket.
2. Connect a 12÷30 Vdc power supply to the terminal (14+, 16-) of the terminal block **(10)**.
3. Turn on Alpha-Log 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 §5.1.5, while for the activation see §5.1.4.5.1).
5. Detect the new IP address (§5.1.4.5.1 Ethernet).

Once Alpha-Log is connected, proceed as follows:

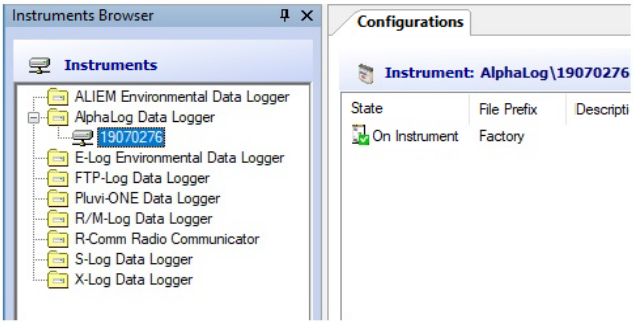
1. Start 3DOM.
2. Select *Instrument->New…*
3. Select *Alpha-Log – Pluvi-ONE* and press **[Continue]**.
4. Enter Alpha-Log serial number and password indicated on the label in the back of the instrument and press **[Next]**.
5. In the **Communication Parameters** window, enter:
   - Connecting using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

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

To check this condition, enter in the S*YSTEM->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 Alpha-Log entry via USB stick

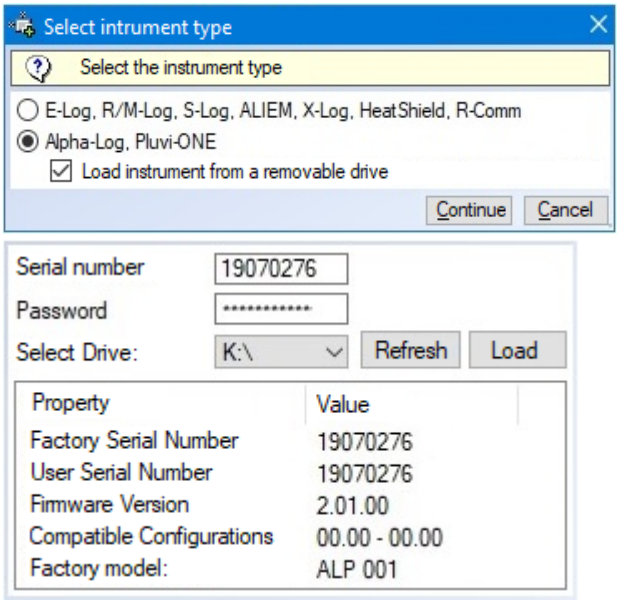
For this operation you need a formatted FAT32 USB stick with at least 2 MB of space available. Proceed as follows:

1. Turn on Alpha-Log with the On/Off switch **(1)**.
2. Using the keyboard **(8)**, enter the PEN DRIVE menu (§5.1.5). This function is accessible after about one minute since the instrument's ignition.
3. Insert the USB stick in one of Alpha-Log's USB ports **(8)**.

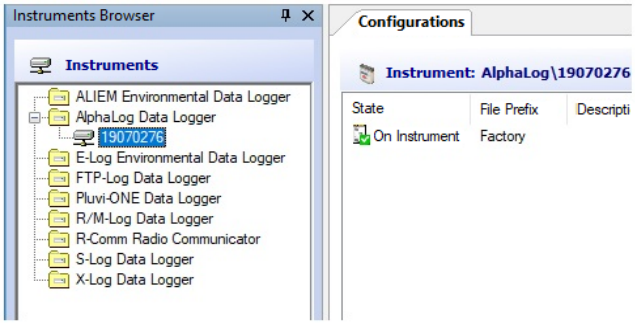
By reference to §5.1.4.5.3:

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 Alpha-Log 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 Alpha-Log

Watch the following video tutorials related to the topics of this chapter.

#	Title	YouTube link	QR Code
8	Alpha-Log: Sensors configuration starting from empty configuration	Alpha-Log #8 - Sensors configuration starting from empty configuration - YouTube	
16	Alpha-Log: Clock settings	Alpha-Log #16 - Clock settings - YouTube	
17	Alpha-Log: Radio Modem setup	Alpha-Log #17 - Radio modem setup - YouTube	
19	Alpha-Log: How to set data delivery to FTP servers	Alpha-Log #19 - How to set data delivery to FTP servers - YouTube	
4	Alpha-Log: Setting Alpha-Log as Modbus Slave device	Alpha-Log #4 - Setting Alpha-Log as Modbus slave device - YouTube	

If Alpha-Log is connected to ALIEM modules, start first the ALIEMs configuration (§3.3), then configure Alpha-Log unit by importing the measurements from ALIEM to Alpha-Log.

In addition to the factory configuration, alternative configuration template models are available (§*Alpha-Log 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 Alpha-Log. 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 Alpha-Log 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 §4.1.1.

Parameter	valore
Factory Informations	
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
Device Identifier	
Use an alternative serial code	No
Alternative serial code	
Other Informations	
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*.

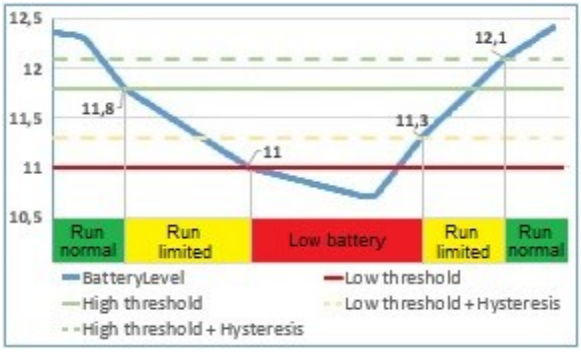
Set the *Operative mode:*

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

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

Set two power thresholds:

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



For more information, see §4.1.2

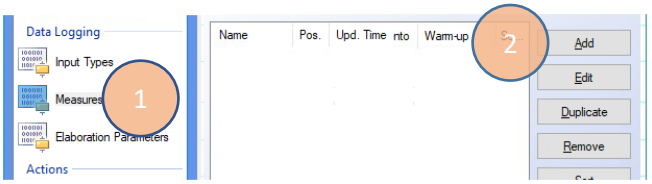
2.2.3 Setup of the log file rows concerning diagnostic information

Select *System->Diagnostic* to set the rows number of the log file which will include diagnostic information. This file becomes available when *FTP Authoriy* is set (§2.2.6.1).

2.2.4 Alpha-Log sensors configuration

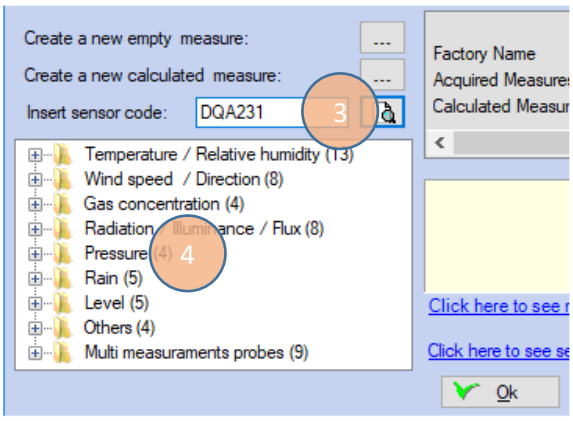
When one of configuration models suggested by 3DOM is used, remove the sensors not used and/or to add the ones missed. To add sensors, it is possible to search inside the 3DOM sensors library:

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

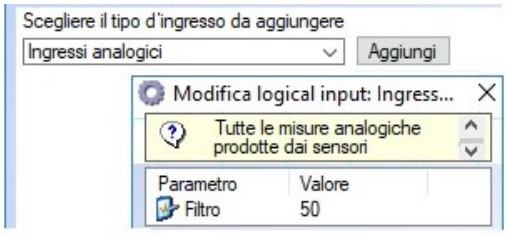


3. Enter the commercial code (e.g. DMA672.1) and launch the search (3), or select the code from its category (4) and press **[Ok]**.

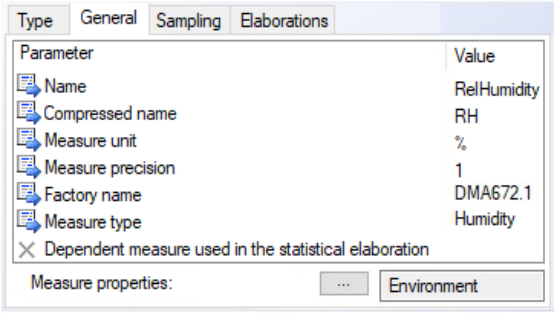
   If the sensor hasn't been found, see chapter §2.2.4.1.



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.



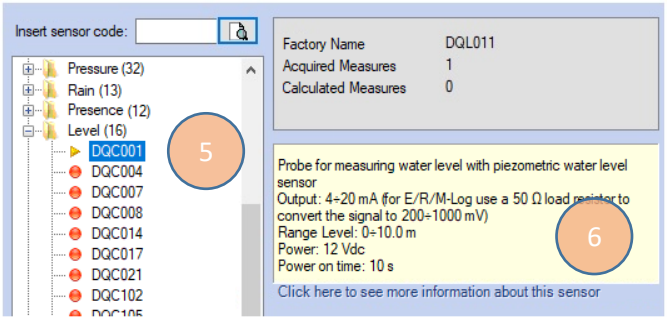
See also §4.1.6.

2.2.4.1 Configuring sensors is not available in the 3DOM sensors 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:

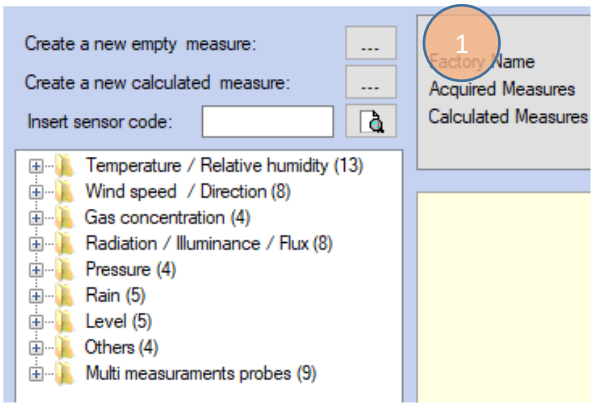
1. Select *Measures* in the *Data Logging* section and press **[Add]**.
2. Expand the category (e.g. "Level") and select the first sensor **(5)**. The program will display its characteristics **(6)**.
3. Scroll the list to find the most similar sensor.
4. Once the appropriate sensor has been identified,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



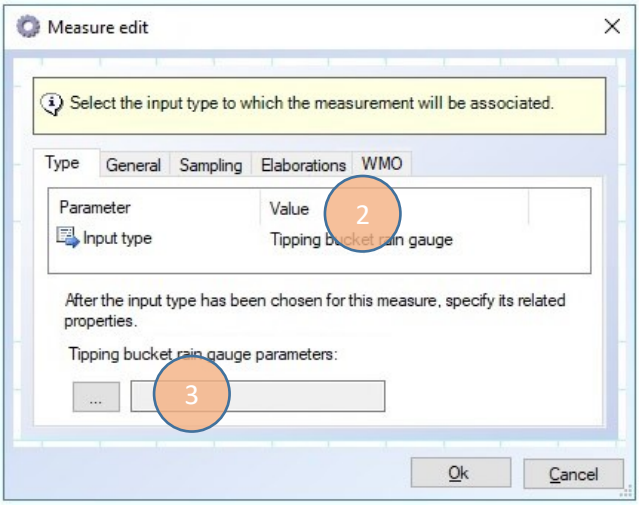
5. If requested, select *Add a new input type* (e.g. "Tipping bucket rain gauge"), press **[Add]** and check that the displayed parameters are adequate for the type of selected sensor.

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

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



3. Select *Input type* based on the sensor type **(2)**. For more information about the input types, see §4.1.5.
4. Set the parameters relating to the input type choosen **(3)**.
5. Set the parameters of *General*, *Sampling* and *Elaborations* sheets.
   For the RMAP protocol it is also necessary to set the parameters of the *WMO* tab.

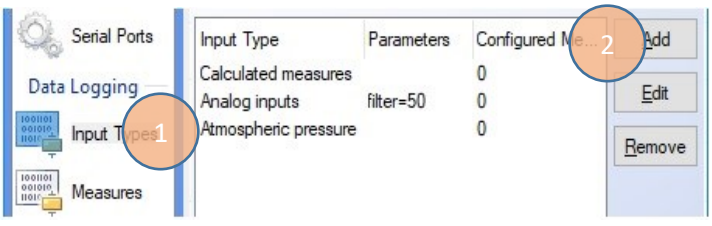


In the case of a new sensor (not available in the 3DOM sensor library) with Modbus RTU output is used:

- set input type by specifying the communication parameters
- set the measurements by specifying the Modbus parameters for data reading

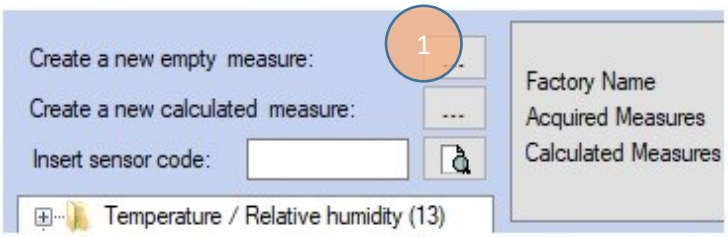
Set input type:

1. Select *Input Types* from *Data Logging* **(1)**.
2. Press **[Add]** **(2)**.
3. Select Modbus RTU Master, then press **[Add]**.
4. Set the required parameters (for more info §4.1.5.5).

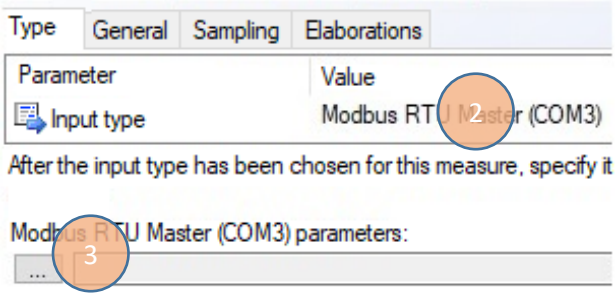


Set the measurements:

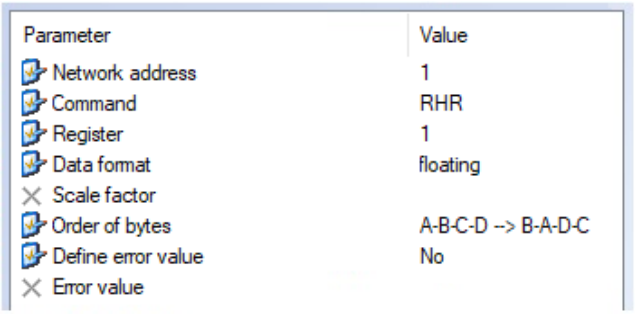
1. Select *Measure* from *Data Logging* section, then press **[Add]**.
2. Press **[…]**(1)*Create a new empty measure*.



3. In the Input Parameters Editing window set the Modbus RTU input type(2) just inserted, then press **[…]**(3).



4. Enter the Modbus parameters related to the sensor measurement.



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

2.2.4.2 Importing measurements from ALIEM module

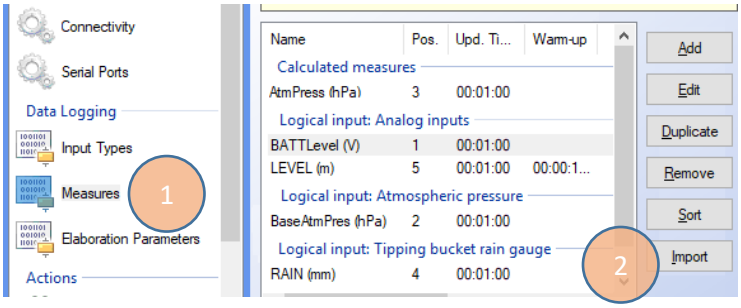
Watch the following video tutorials related to the topics of this chapter.

#	Title	YouTube link	QR code
14	Alpha-Log – ALIEM: How to import an existing ALIEM configuration, inside an Alpha-Log pre-set configuration	Alpha-Log #14 - How to import an existing ALIEM configuration inside Alpha-Log preset configuration - YouTube	

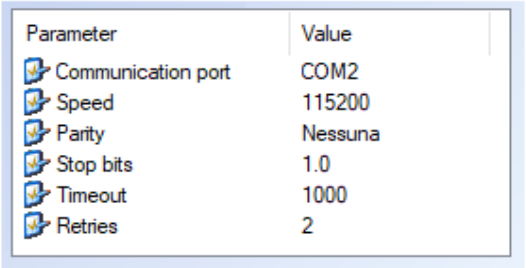
Alpha-Log can acquire the measurements coming from the ALIEM module connected to its RS-232-Com2(6) or RS-485-Com3 port(10). Configuration of each ALIEM module must be imported inside the Alpha-Log configuration. During this procedure the acquisition and elaboration rates are defined for each quantity. Here the instructions in case ALIEM (model MDMMB1110) is connected to Alpha-Log RS-232 Com2.

This operation should be performed after completing the inputs configuration of ALIEM module (see §3.3).

1. Select *Measures* (1) in the *Data Logging* section and press **[Import]** (2).

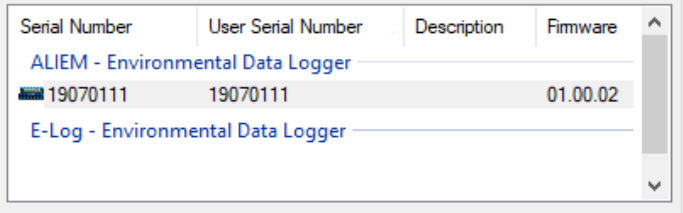


2. From the windows Press **[Add]**.
3. Select *Modbus RTU Master* and press **[Add]**.
4. Set parameters as shown in the figure and press **[Ok]**.



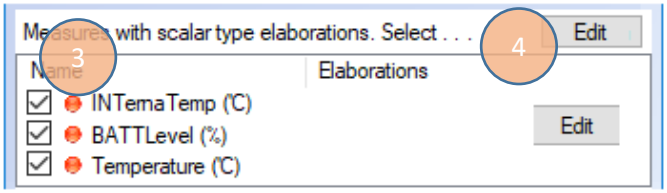
For more information see §4.1.4.

5. In the following window, select ALIEM serial number (e.g. “19070111”) and press **[Next]**.
6. Select the configuration to be imported from ALIEM (e.g. “Custom”), press **[Next]** and then **[Finish]**.



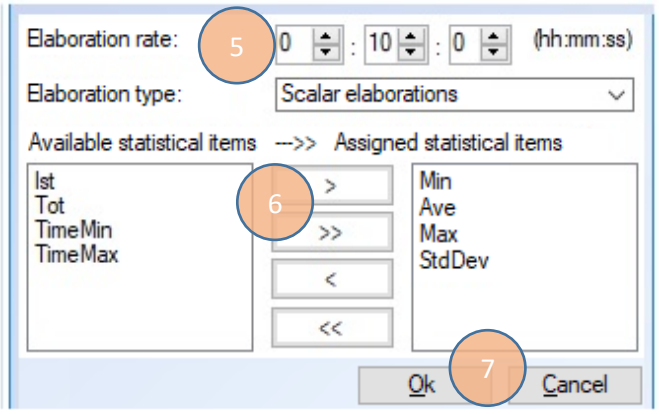
The **Set elaborations** window will appear. Measurements are divided based on the elaboration type: scalar, vector, and total. The following will describe the operations using scalar type elaborations; repeat the procedure with other typologies, if any.

7. In the *Set elaborations for imported measures* window, deselect the measurements you don’t want to change (3) and press **[Edit]** (4).



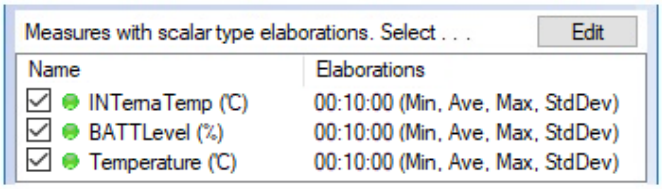
The **Set elaborations** window displays the existing elaboration rates. If no rate is shown or if the rate displayed is not the desired one, press **[Add]**, or select the displayed rate and press **[Enable/Edit]**.

8. In the **Edit Elaboration Rate** window:
   - Set the *Elaboration rate* (5) (e.g. 10 minutes).
   - Enter the *Statistical items* using the navigation keys (6) (the example in the figure shows the items *Minimum*, *Average*, *Maximum* and *Standard Deviation*).
9. Press **[Ok]** (7).



10. Press **[Ok]** in the **Set Elaborations** window.

The **Set elaborations for imported measures** window will be updated with the selected elaborations.



For each channel it is possible to set many elaboration rates.
Example Temperature channel: Min/Ave/Max every 10 min, 1 hr, 24 hrs.

Press **[Ok]** once completed the selection of the measurements to be imported.

The new measurements will be added to the *Measurements* panel.

Name	Pos.	Upd. Ti...	War...	Source Mea...	Elaboration Rates	Used by Logics	Factory Code
Calculated measures							
AtmPres (hPa)	2	00:01:00		BaseAtmPres	00:10:00 (Inst)	No	_InsidePress
Logical input: Analog inputs							
BATTLevel (V)	3	00:01:00			00:10:00 (Inst)	No	_BatteryLevel
Logical input: Atmospheric pressure							
BaseAtmPres (hPa)	1	00:01:00				No	_InsidePress
Logical input: Tipping bucket rain gauge							
RAIN (mm)	4	00:01:00			00:10:00 (Tot)	No	DQA231
Logical input: Modbus RTU Master (COM2)							
INTemaTemp (°C)	5	00:01:00			00:10:00 (Min, Ave, Max, StdDev)	No	_InsideTemp
BATTLevel (%)	6	00:01:00			00:10:00 (Min, Ave, Max, StdDev)	No	_BatteryLevel
Temperature (°C)	7	00:01:00			00:10:00 (Min, Ave, Max, StdDev)	No	DLE041

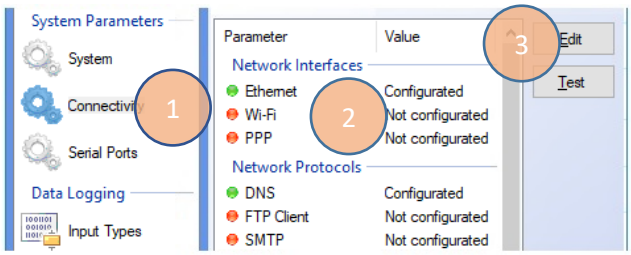
For more information on the procedure for importing the ALIEM configuration into Alpha-Log, refer to the chapter *Alpha-Log import measures* of *3DOM - User manual*.

Once completed the configuration of all probes/channel, it is possible to list them as wished. In the next step will be to configure the instrument connectivity.

2.2.5 Configuring Internet connectivity – network interfaces

Services such as sending data to an FTP server, sending e-mails, managing Alpha-Log 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 §4.1.3.

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

2.2.5.1 PPP interface (3/4G modem)

3G/4G modem is connected to Alpha-Log COM1 serial port, where its power supply mode needs to be set *Dev* to */dev/ttySP3* (*/dev/ttyS1* in case of ALP003). *APN*, *User*, *Password* and *Context Dial* are those relating to the telephone provider used.

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

For further information, see §4.1.3.

2.2.5.2 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 §4.1.3.

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

Value
Yes
DHCP

Consult your network administrator for more details.

2.2.5.3 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 §4.1.3.

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

Value
Yes
meteo
****
DHCP

Consult your network administrator for more details.

Password cannot be hidden in the configuration file.

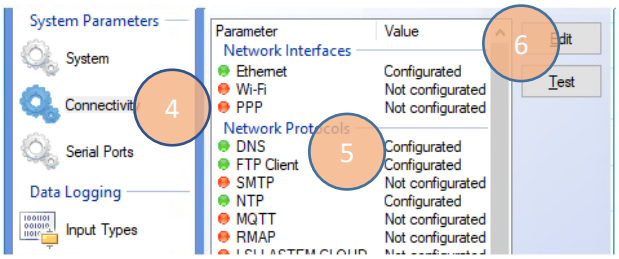
Connect a Wi-Fi USB stick into one of the two USB ports (3) of the instrument to connect Alpha-Log to a WLAN network.

If an Internet connection is required and there is no LAN or WLAN network available for Alpha-Log 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 Alpha-Log 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.

2.2.6 NFTP, MQTT, NTP, Modbus protocols configuration

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



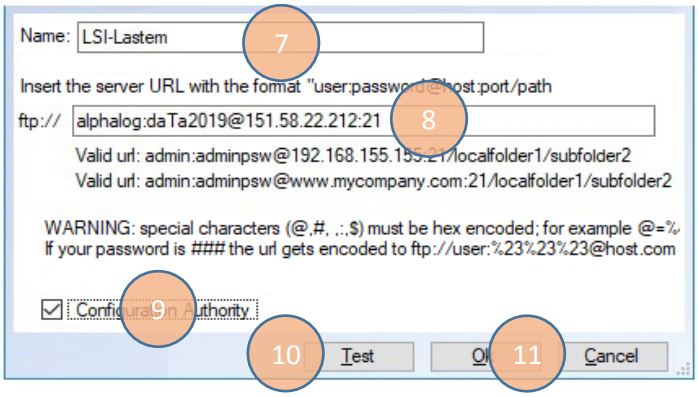
Alpha-Log supports Modbus RTU and TCP protocol. Read *INSTUM_03762* user's manual for more information.

In the next sections some examples are reported.

2.2.6.1 FTP protocol for data the configuration file management (Configuration Au-thority)

Set the FTP area from where Alpha-Log 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, Alpha-Log 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 Alpha-Log 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*.

LSI LASTEM offers its customers an FTP service. For more information contact the commercial service by writing to info@lsi-lastem.com.

2.2.6.2 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.

2.2.6.3 NTP protocol for watch synchronization via Internet

When Alpha-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 §4.1.3.

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

2.2.6.4 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 §4.2.9.

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.

LSI LASTEM offers its customers a MQTT service. For more information contact the commercial service by writing to info@lsi-lastem.com.

2.2.6.5 RMAP protocol

Example of parameters to send data via RMAP protocol.

The protocol requires that each measurement is configured with the WMO parameters (§2.2.4.1).

Parameter	Valore
Abilita il protocollo RMAP	Si
Host	151.58.120.25
Porta	21
Utente	
Password	

The password is visible in the configuration file.

2.2.6.6 LSI LASTEM CLOUD protocol

Configuration example for sending data to the LSI LASTEM cloud.
Then proceed with the assignment of the identification keys of each configured measure.
For more information refer to the CLOUD_04842 manual.

Parametro	Valore
Abilita l'invio dei dati al CLOUD di LSI LASTEM	Si
Selezionare la base di elaborazione	00:10:00
Invio dei dati elaborati	Si
Invio dei dati istantanei	

LSI LASTEM provides upon request the *Cloud Service* data recording and processing system. For more information contact the commercial service by writing to info@lsi-lastem.com.

2.2.6.7 Modbus RTU Slave protocol

Example of parameters to send data via Modbus RTU protocol using the COM3 RS-485 port**(10)**.

For more information, read ISTUM_03762 user's manual.

Parameter	Value
Default	
Communication port	COM3
Speed	38400
Parity	Even
Stop bits	1.0
Address	1
Order of bytes	Little Endian
Error on integer values	65535
Error on floating point values	-999999

2.2.6.8 Modbus TCP Slave protocol

Example of parameters to send data via Modbus TCP protocol using a network connection.
For more information, read INSTUM_03763 user's manual.

Parameter	Value
Enable Modbus Slave TCP	Yes
Port	502
Order of bytes	Big Endian
Update Rate (s)	10

2.2.7 HTTP and FTP server configuration

2.2.7.1 HTTP server

Alpha-Log has an internal http web server. Using an Internet browser, it will possible to access to the http pages made by the data logger. Pages are used for data display, diagnostic information and data download from the memory (§4.2.10).

Example of HTTP server configuration.

Parameter	Value
Enable internal server	Yes
Port	80
User	ALuser
Password	ALpwd123

The password is visible in the configuration file.

2.2.7.2 *FTP server*

Alpha-Log has an internal FTP server. Using an FTP client, it is possible to send files and to access to the internal file system.

Example of FTP server configuration.

Parameter	Value
Enable internal server	Yes
Port	21
User	ALuser
Password	ALpwd123

The password is visible in the configuration file.

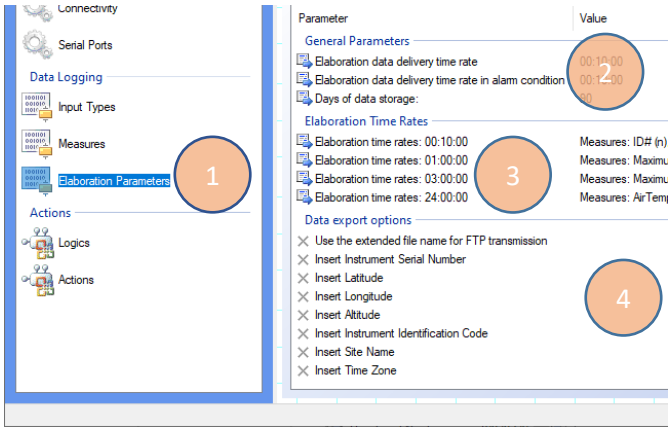
For security reasons and intrinsic "weakness" of the FTP protocol, it is better to use the SFTP, which allow to access to the whole Alpha-Log file system.

2.2.8 Data delivery to FTP and MQTT server or USB memory

Typically, Alpha-Log 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 §4.1.7.

2.2.9 Data validation

It is possible to configure validation criteria on the elaborations produced. Specifically, the following controls (henceforth referred to as validators) can be set up:

- *Less than*: value below a set threshold.
- *Greater than*: value above a set threshold.
- *Delta Max Min less than*: difference between the values of the *max* and *min* elements of the elaboration below a set threshold.
- *Delta Max Min greater than*: difference between the values of the *max* and *min* elements of the elaboration above a set threshold.

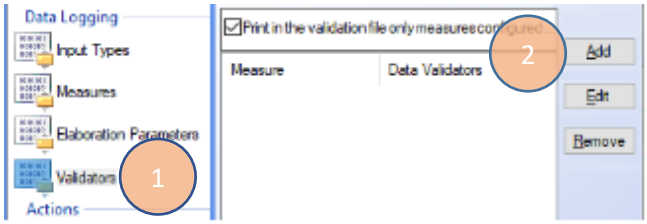
These are the ways in which validators can be used:

- One or more validators can be associated with each elaboration.
- The same validator cannot be associated with an elaboration more than once.
- The values available to be applied to an elaboration depend on the type of elaboration the measurement produces. In particular, the following list applies:
  - *Less than / Greater than*: applicable to the *min*, *ave*, *max*, *devst*, *tot*, *ist* elements of the elaboration.
  - *Delta Max Min less than / Delta Max Min greater than*: applicable only if the *min* and *max* elements of the elaboration are present at the same time.

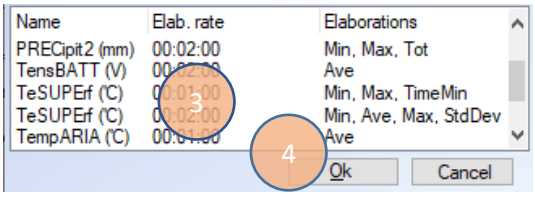
The use of validators causes duplication of the data files generated by Alpha-Log. In this regard, see §4.2.6.

To configure validators, proceed as follows:

1. Select *Validation*(1).
2. Press **[Add]**(2).

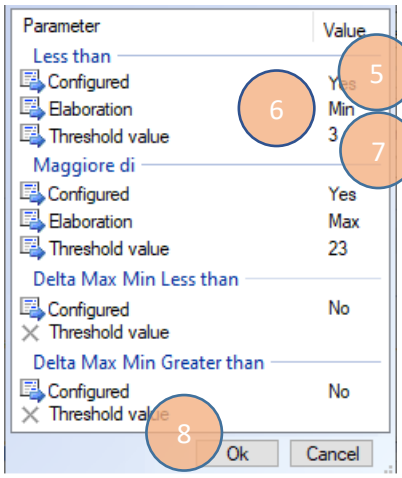


3. Select the measure with the elaboration to be validated (3) (the measure appears multiple times if it has multiple elaboration rate).
4. Press **[Ok]**(4).

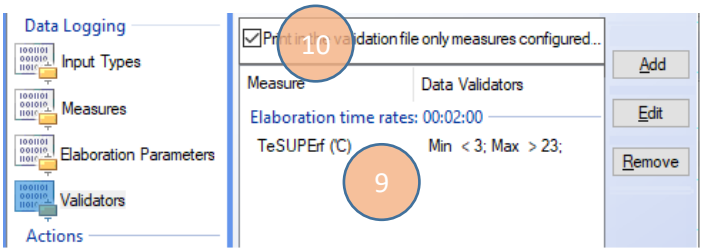


For each validator to be configured:

5. Set the parameter Configured(5) to Yes.
6. Select Elaboration(6).
7. Enter the Threshold value(7).
8. Press **[Ok]**(8).



The added validator will be displayed in the Data Validators section(9).



9. Enable or disable the *Print in the validation file only measures configured with at least one validator*(10) option as needed.

2.2.10 Configuring logics, actuators and alarms

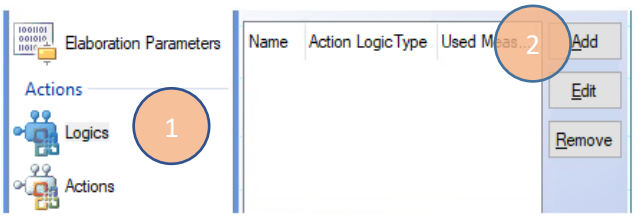
Watch the following video tutorials related to the topics of this chapter.

#	Title	YouTube link	QR code
18	Alpha-Log: How to set logics and actions	Alpha-Log #18 - How to set logics and actions - YouTube	

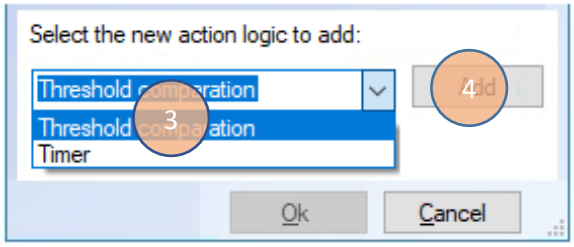
It is possible to set logics that, upon their occurrence (true / false), will activate an action as: triggering local electrical outputs and messages (SMS, e-mail, MQTT). Alpha-Log is equipped with 3 actuated electrical outputs for triggering external devices such as sensors, modems or alarm devices. 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:

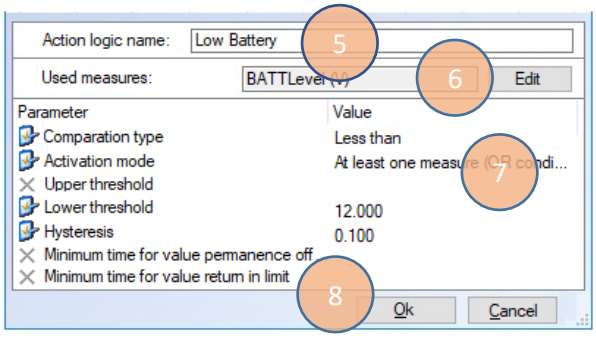
1. *Logics-Actions* (1).
2. Press **[Add]** (2).



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

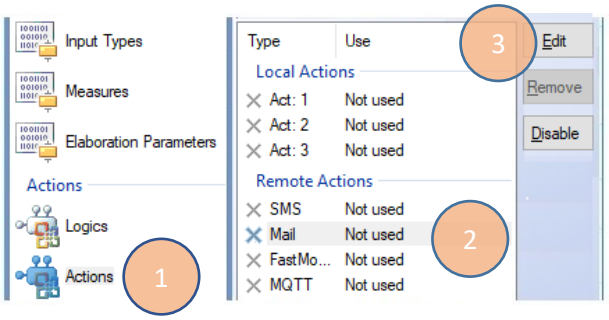


5. Assign a name to the logics (5). This name will be reported on the sms or e-mail messages.
6. Press **[Edit]** (6) and select the measurement associated to these logics.
7. Set all the requested parameters (7).
8. Press **[Ok]** (8).

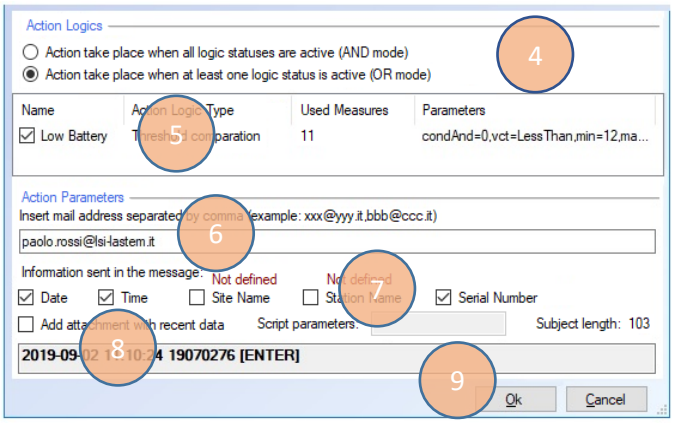


Joint the new logic to a specific action:

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 §4.1.9.

Alpha-Log DLALA0100 requires a minimum power supply of 12 Vdc to supply 10.5 Vdc to the actuated outputs.
Alpha-Log DLALA0100.1 and DLALB0100 supplies the actuated outputs with a voltage approximately 0.3 Vdc lower than the power supply on terminals 13 +, 14 + and 15-, 16-.

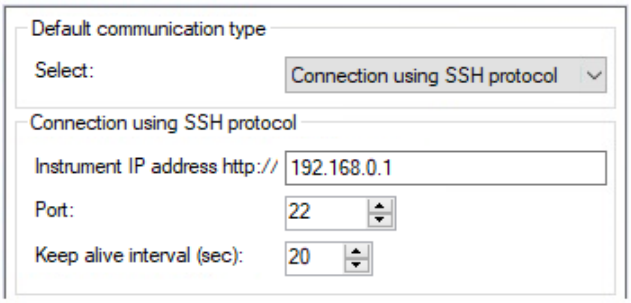
2.2.11 Saving and uploading configuration file to Alpha-Log

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

To send the configuration via SSH (Alpha-Log 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 §4.1.11.1.
For sending the configuration via USB stick or FTP server, see §4.1.11.2 and §4.1.11.3 respectively.

2.3 Connecting probes to Alpha-Log

The probes must be physically connected to Alpha-Log 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 Alpha-Log and ALIEM module. See the instructions of chapter §1.3

2.4 Connecting ALIEM to Alpha-Log

Watch the following video tutorials related to the topics of this chapter.

#	Title	YouTube link	QR code
15	Alpha-Log – ALIEM: ALIEM module to Alpha-Log data logger, physical connection and checks	Alpha-Log #15 - ALIEM module to Alpha-Log data logger, physical connection and checks - YouTube	

MDMMB1110 ALIEM module can be connected to the Alpha-Log Com2-RS-232**(6)**, while one or more MDMMB1110.1 ALIEM can be connected to Alpha-Log on the Com3-RS-485 port**(10)**. In the first case, the connection is made via the ELA105 cable and the DEA606 null modem adapter supplied; in the second, if there are more than one ALIEMs, one or more RS-485 HUBs must be used.

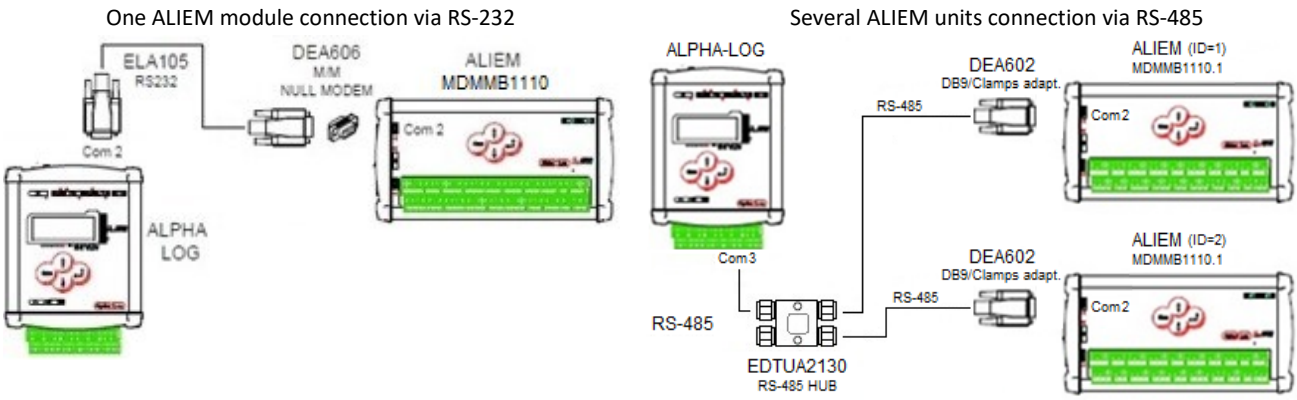


Fig. 3 – Alpha-Log – ALIEM connection diagram.

Alpha Log can manage on its RS-485 bus simultaneously other Modbus RTU slave devices, such as AIO sensors.

ALIEM can be powered directly from Alpha-Log as follows:

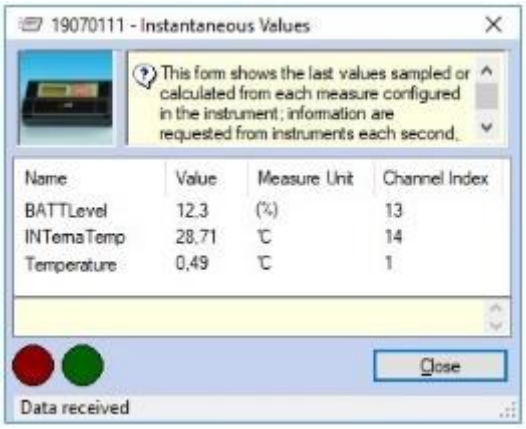
ALIEM terminal board			Terminal board Alpha-Log	
64	-Vdc Power	⟷	15 (or 16)	-Vdc Power
65	+Vdc Power	⟷	13 (or 14)	+Vdc Power
66	GND	⟷	30	GND

For installation, follow the instructions given in chapter §1.3.

2.5 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 Alpha-Log is connected to the PC via the Ethernet or Wi-Fi port. If not, check the instantaneous values directly on the data logger display (§5.1.4.1).

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

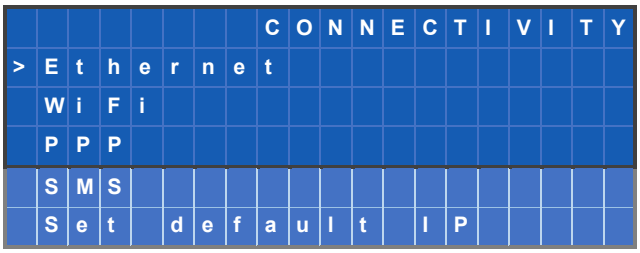


Values will change with a rate based on *Update time rate* set in the *Sampling* section of the specific measurement.
To stop the communication press **[Close]**.

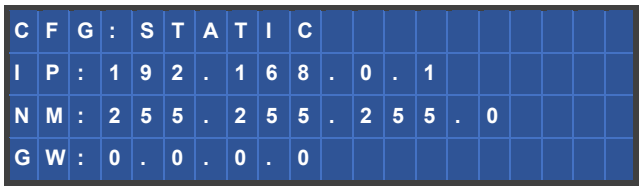
2.6 Checking operation

After physically connecting all the probes and after checking the proper acquisition of the measurements, it is possible to check the Alpha-Log 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.)



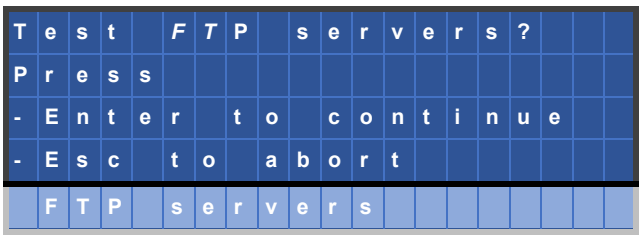
Example of Ethernet port setting.



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.



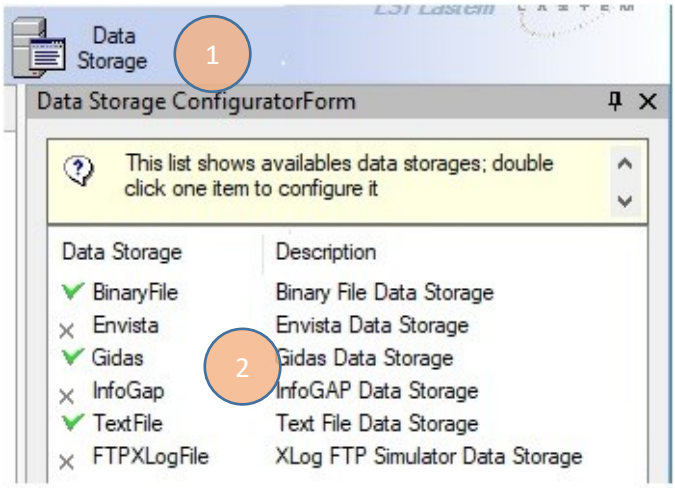
If logic and consequent action has been configured, try to trigger the activation condition. For example, if a logic has been configured to send an e-mail in case of rain more than 2 mm, pour water on the rain gauge until it exceeds 2 mm, subsequently check if e-mail is received at the indicated address.

2.7 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 (§2.2.5) and the type of protocol implemented (§2.2.6), it is possible to choose between a direct connection from the data logger, from an FTP site or from a local or network folder.

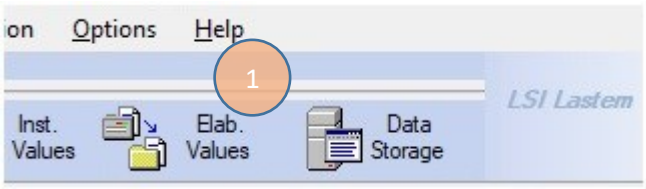
Set the data storage format you want to receive. This setting will also be kept for next uses.

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.

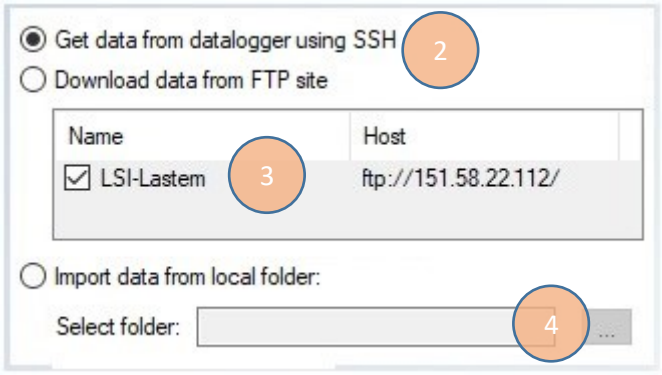


For data download:

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

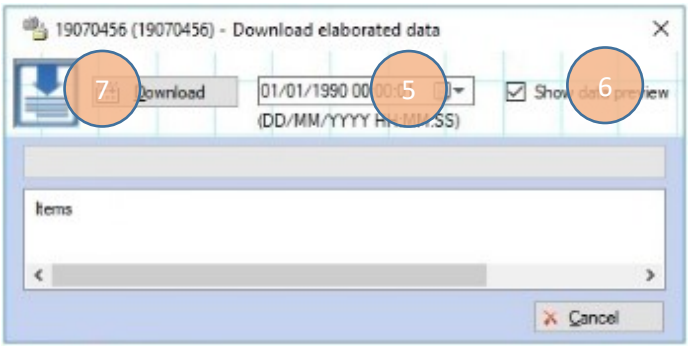


2. Select the data download modality (2).
   - From FTP site: select the FTP address from the proposed list (3).
   - From local (network) folder: select the local folder (or network folder) **[…]** (4).



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 Alpha-Log.



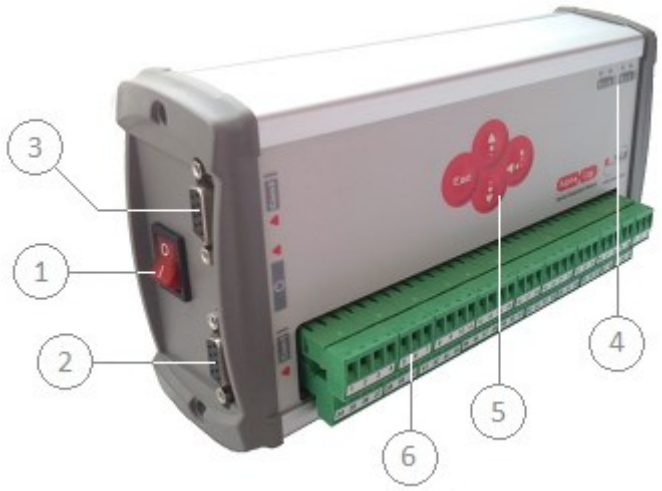
Verify that the processed data received on the PC have the type and rate required. In case of errors, change the configuration.

Part 3

3.1 ALIEM (Alpha-Log Input Extension Module)

ALIEM is a module used to extend the number of sensors managed by Alpha-log. It measures the instant values from the sensors connected (it does not perform any statistical processing) and makes them available to Alpha-Log through the Modbus RTU protocol on the RS-232 port **(3)**.

ALIEM looks like in Fig. 4.



(1) - On/Off switch

(2) - Com1 serial port (PC)

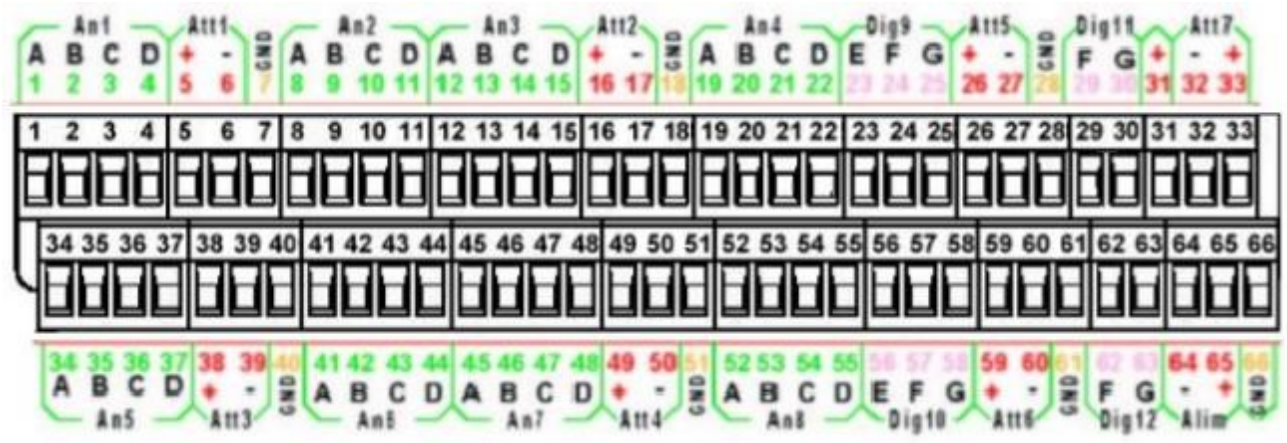
(3) - Com2 serial port (Alpha-Log)

(4) - Operating status LEDs

(5) - Keyboard

(6) – Terminal board

Fig. 4 – ALIEM description.



Analogue input	Terminal board				GND	Actuator		
	A	B	C	D		Number	+V	0 V
An1	1	2	3	4	7	Act1	5	6
An2	8	9	10	11				
An3	12	13	14	15	18	Act2	16	17
An4	19	20	21	22				
An5	34	35	36	37	40	Act3	38	39
An6	41	42	43	44				
An7	45	46	47	48	51	Act4	49	50
An8	52	53	54	55				
Digital input	**Terminal board**				**GND**	**Actuator**		
	E	**F**	**G**			**Number**	**+V**	**0V**
Dig9	23	24	25		28	Act5	26	27
Dig10	56	57	58					
Dig11	-	29	30		61	Act6	59	60
Dig12	-	62	63					
					28	Act7	33	32

Fig. 5 – ALIEM terminal board.

3.2 Guide to first starting of ALIEM

ALIEM comes with a factory configuration: set to acquire the internal temperature measurement (the related sensor is built-in) and the battery level. Use the 3DOM software to modify the configuration according to your needs (see §2.1.1).

Watch the following video tutorials related to the topics of this chapter.

#	Title	YouTube link	QR code
10	Alpha-Log – ALIEM: Powering ALIEM	Alpha-Log #10 - Powering ALIEM - YouTube	
7	Alpha-Log – ALIEM: ALIEM connection to PC by RS-232 and USB adapter and how to place new Instrument in 3DOM program	Alpha-Log #7 - ALIEM connection to PC and new instrument in 3DOM program - YouTube	
9	Alpha-Log – ALIEM: New configuration file in ALIEM module using 3 DOM	Alpha-Log #9 - ALIEM sensors configuration starting from empty configuration - YouTube	
12	Alpha-Log – ALIEM: Upload configuration from 3DOM program to ALIEM module	Alpha-Log #12 - Upload configuration from 3DOM program to ALIEM module - YouTube	
13	Alpha-Log – ALIEM: Save ALIEM configurations as template and upload it to another ALIEM unit	Alpha-Log #13 - Save ALIEM configuration as template and upload it to another ALIEM unit - YouTube	

3.2.1 Connection to PC

To connect ALIEM to PC:

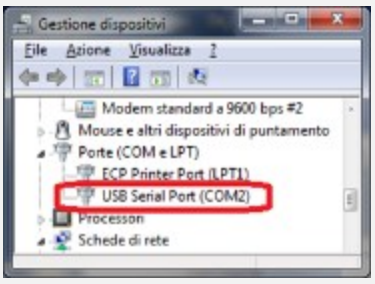
1. Insert the ELA105 serial cable to the ALIEM Com1**(2)** and to the RS-232 serial port of your PC. If the PC does not have a RS-232 serial port, use the USB/RS-232 adapter provided. In this case, allow the installation of the device driver.
2. Connect the 12 Vdc power supply to the terminal (64-, 65+) in the terminal block **(6)**.
3. Turn on ALIEM with the On/Off switch **(1)**.

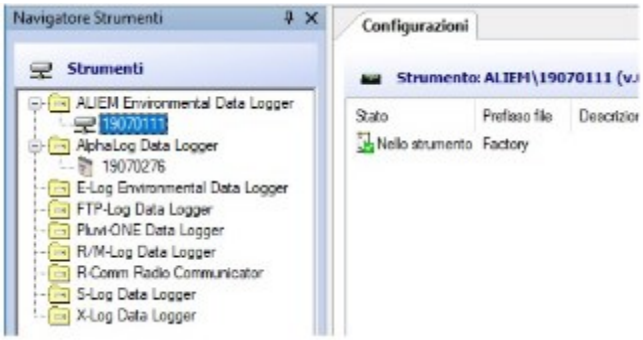
In order to be configured, ALIEM must be inserted in 3DOM as a new Instrument.

1. Start 3DOM.
2. Select *Instrument->New…*
3. Select *E-Log – R/M-Log, S-Log, ALIEM…* and press **[Continue]** and then **[Next]**.
4. In the **Communication parameters** window, set:
   - Connection type: Serial.
   - Serial port: the number of PC port to which it is connected (e.g. COM1).
   - Bit rate (bps): 9600.
5. Press **[Save]**, then **[Next]** to connect to the instrument. Press **[Next]** and then **[Finish]** to continue.
6. Select **[Yes]**, then **[Continue]** to download the configuration. At the end, press **[Close]**, assign a name to the configuration (e.g. "Factory") and press **[Ok]**.

3DOM will update the *Instruments Browser* and the *Configurations* with the instrument's serial number and the configuration just downloaded.

In MS Windows, to check the PC serial port where the USB adapter is connected, select *System* in the *Control Panel* and select *Hardware setup*. Expand the Ports list *(COM and LPT).* Identify the port number called USB Serial Port. In the case more than one USB port is listed, disconnect and reconnect the adapter and check with port will disappear and reappear. Set the same COM number in the 3DOM.





3.3 Configuring ALIEM

ALIEM is provided with a factory configuration. Moreover, some configuration models are available (§*Alpha-Log configuration templates*). In both cases it is required to start from one of these configuration models and to adapt it 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.

ALIEM configuration is performed independently from Alpha-Log configuration. Only at the end, the ALIEM configuration is "imported" into an existing Alpha-Log configuration. The ALIEM configuration process can only be performed via PC directly connected to ALIEM. While Alpha-Log is reachable and remotely configurable, an ALIEM module, even if connected to Alpha-Log, cannot be reached if not disconnected from Alpha-Log and connected to a PC.

Edit the factory configuration model:

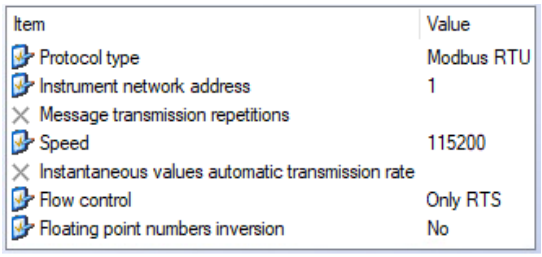
1. Select the serial number of the instrument in the *Instruments Browser* list.
2. Select the saved setting (e. g. "Factory"), choose *Configuration->Save as New Configuration…,* assign a name to the setting (e. g. "Custom") and press **[Ok]**.
3. Open the configuration by selecting *Configuration->Edit…*

Edit one of the configuration model:

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

In the **Configuration Editor** window select *Serial Communication port 2* and set:

- Protocol type: *Modbus RTU*.
- Instrument network address: *1* (if several ALIEM devices are used on the same bus, set a value able to identify univocally the instrument).
- Speed: *115200*.



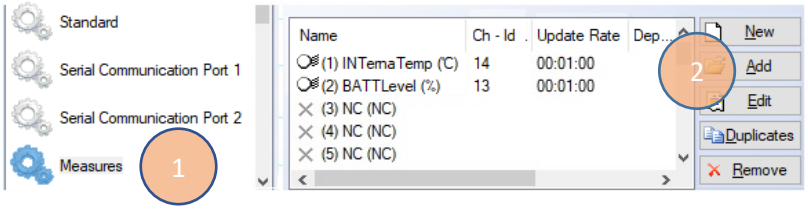
For further information see chapter *Operate with the configurations* of *3DOM – User manual*.

Proceed with the sensors configuration.

3.3.1 Configuring ALIEM sensors

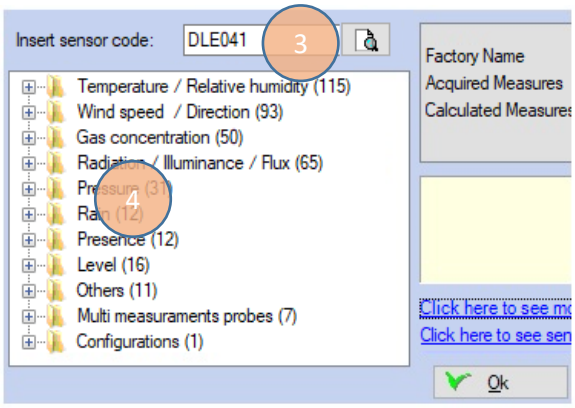
3DOM is provided with a library of LSI LASTEM sensors. Each sensor of the library is already appropriately set to be sampled by ALIEM. Follow the steps below to check if the sensors are available in the library:

1. In *General Parameters* section, select *Measure* **(1)**.
2. Press **[Add]** **(2)**.

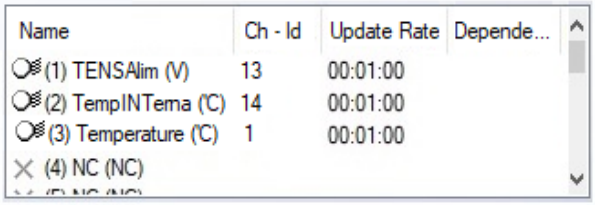


3. Enter the sensor's commercial code (e.g. DLE041) and perform search **(3)**, or select it from its own category **(4)** and press **[Ok]**.

   If the sensor has not been found, see chapter §3.3.2.



4. Press **[Ok]** to confirm the measurements.
   The new measurements will be added to the *Measures List Panel* of 3DOM (e.g. the Temperature measurement has been added to DLE041 sensor).



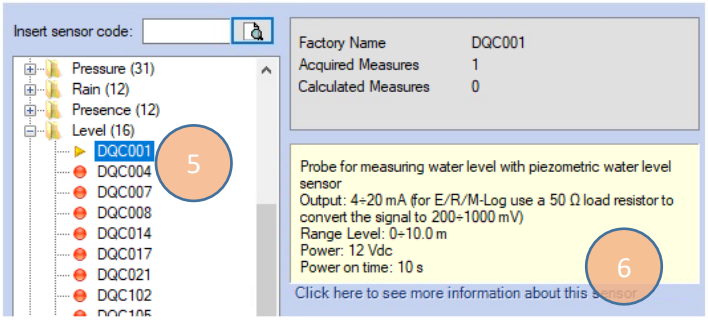
   For measurements' customization, see chapter §3.3.2.
5. Repeat the same procedure for the remaining sensors.

At the end of the procedure, save and send the configuration to the instrument.

3.3.2 Configuring ALIEM sensors not from the 3DOM sensor library

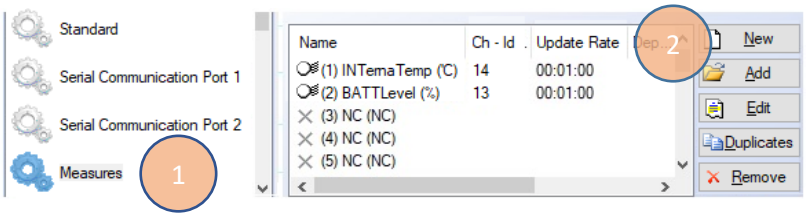
If the sensor is not in the library list, it is advisable to choose one from the list with similar characteristics and then change its properties or create a new one.

1. Press **[Add]** from *Measure List Panel*.
2. Expand the sensor's category (e.g. "Level") and select the first sensor **(5)**. The program will display its features **(6)**.
3. Scroll the list until you find the most similar sensor.
4. Once identified, press **[Ok]** to confirm measurements.

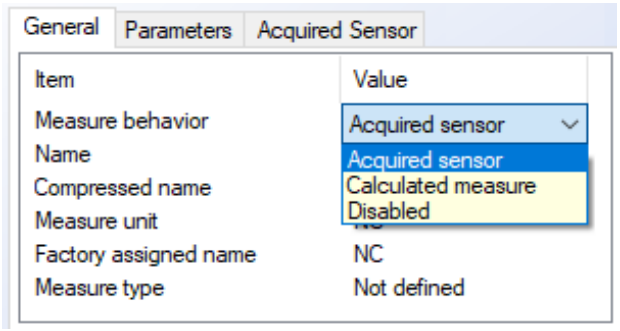


Starting from new sensor (not from the sensors library):

1. From section *General Parameters*, select *Measures* **(1)**.
2. Press **[New]** **(2)**.



3. As *Measure behaviour* select *Acquired sensor.*
4. Set the remaining items of the *General* tab.
5. Set the items of *Parameters* and *Acquired sensor* tabs.



ALIEM module is not producing any statistical elaboration. All elaborations are made by Alpha-Log using the row data received by ALIEM module (§2.2.4.2).

3.3.3 Saving and uploading configuration to ALIEM

1. In the 3DOM's *Toolbar*, press **[Save]** to save the configuration; confirm Measures Order and then *Configuration State* by pressing **[Ok]**.
2. Press the name of the newly created configuration with the right key of your mouse and select *Upload...* to send it to ALIEM.
3. After sending the configuration, press **[Close]** in the **Communication** window.

3.4 Connecting the probes to ALIEM

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

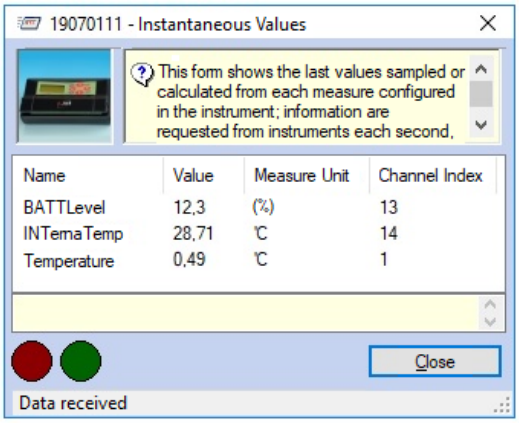
For the generation of the Configuration report, refer to the chapter *Configuration Report* of *3DOM – User manual*.

Switch off the instrument to connect the probes to the ALIEM terminal board **(6)**.
For installation, follow the instructions given in chapter §1.3.

3.5 Checking ALIEM measurements acquisition on 3DOM

Once the physical connection of the probes has been completed, instant values can be viewed on 3DOM:

1. Make sure that your PC is connected to ALIEM Com1 serial port **(2)**.
2. Turn on ALIEM by means of the On/Off switch **(1)**.
3. Start 3DOM.
4. Select ALIEM serial number.
5. Select *Communication->Instantaneous values...*



The values are updated according to the *Update rate* parameter set in the *Acquired Sensor* tab of the respective measurement.
Press **[Close]** to stop communication.

The good operation of the ALIEM unit as a Modbus Slave, can be checked by connecting directly to the Com2 serial port of the data logger using a PC on which a Modbus RTU Master application is installed. The MDMMB1110.1 model has an RS-485 serial output, therefore, if the PC does not have a serial port of the same type, you must have an RS-232 / RS-485 converter.

Part 4 - Insights

4.1 Insights the Alpha-Log configuration

4.1.1 Registry information

The registry information identifies Alpha-Log. An example is shown in Fig. 6.

Parameter	valore
Factory Informations	
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
Device Identifier	
Use an alternative serial code	No
Alternative serial code	
Other Informations	
User-defined name	
Site name	Settala
Longitude	9,3919
Latitude	45,4558
Altitude	108
Time Zone	+01:00

Fig. 6 – Registry information.

The *Factory information* cannot be changed. They 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*, Alpha-Log 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). The indication of the N (north) / S (south) and E (east) / W (west) hemispheres is replaced by the sign: negative values for latitudes in the southern hemisphere and longitudes west of the fundamental meridian. Some examples of coordinates:
  - Milan Cathedral (lat: 45° 28' 38.28" N, long: 9° 10' 53.40" E): 45.477300, 9.181500
  - Opera House Sydney (lat: 33° 51' 23.8" S, long: 151° 12' 54.8" E): 33.856611, 151.215222

- Machu Picchu Perù (lat: 13° 9' 29" S, long: 72° 31' 53" W): - 13.158056, -72.531389
- Statue of Liberty New York (lat: 40° 41’ 21.15” N, long: 74° 02’ 39.93” W):40.689208, -74.044425

- *Altitude*: the installation site altitude.
- *Time Zone*: the time zone, compared to NTP time, used by the instrument to synchronize its internal clock.

4.1.2 Operating mode based on energy availability

Watch the following video tutorials related to the topics of this chapter.

#	Title	YouTube link	QR code
20	Alpha-Log: Setup power operative modes	Alpha-Log #20 - Setup power operative modes - YouTube	

The operative modes define Alpha-Log’s behavior based on the available power.
System Parameters->System.

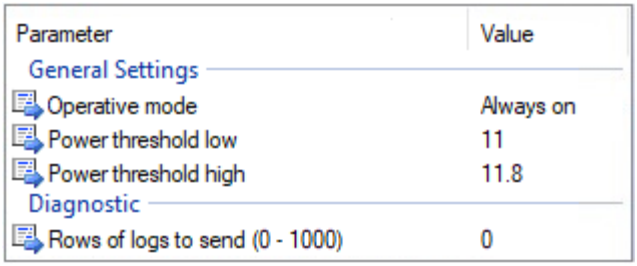


Fig. 7 – System parameters.

Alpha-Log’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 Alpha-Log’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 acquirement 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 acquirement 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. 8 shows Alpha-Log'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.

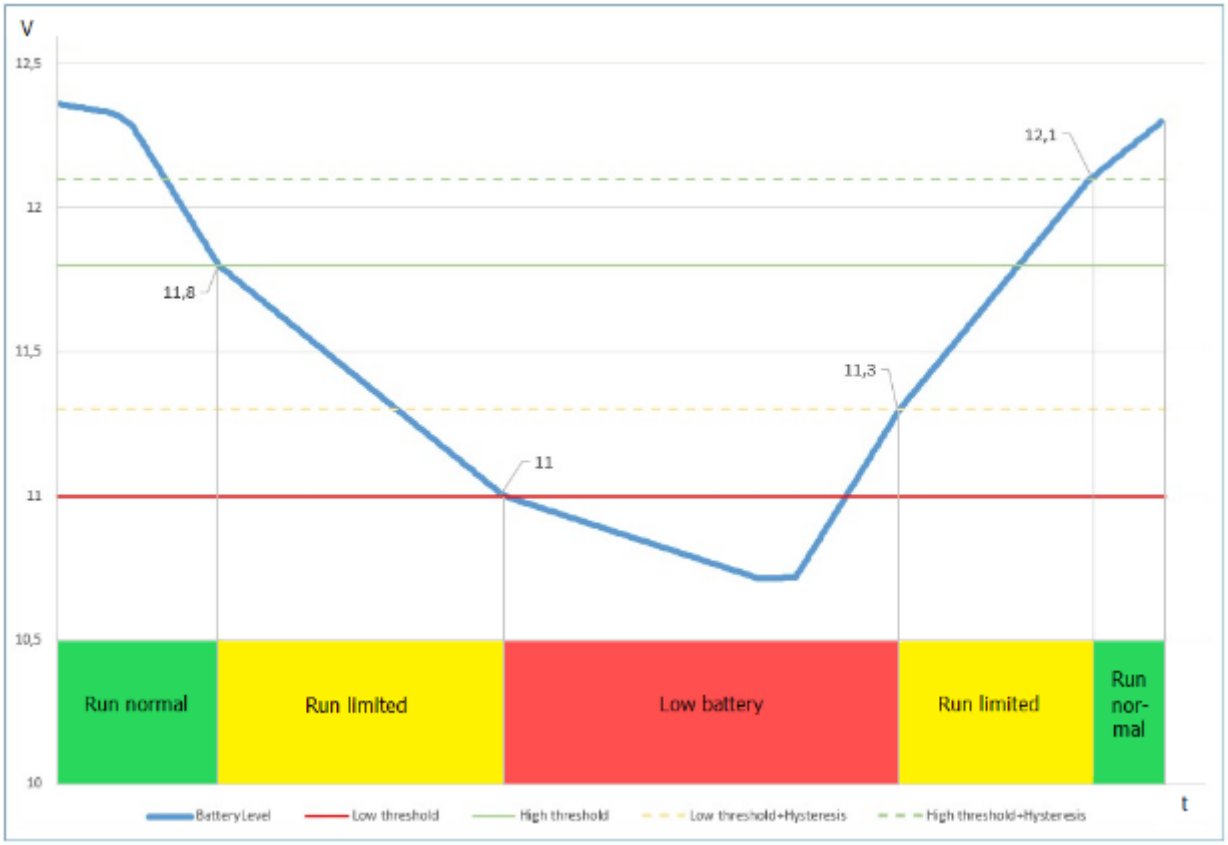


Fig. 8 – Alpha-Log's operating status.

4.1.3 Connectivity

The communication between Alpha-Log 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 Alpha-Log 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 DCHP 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 setttings	Yes	Yes
Configuration	Static address	DHCP
IP address	192.168.148.35	
Subnet mask	255.255.255.0	
Gateway	192.168.148.200	

Fig. 9 – 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 setttings	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. 10 – 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 (§4.1.4). 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. 11 – PPP configuration for a TIM SIM example.

If Alpha-Log 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 Alpha-Log 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.

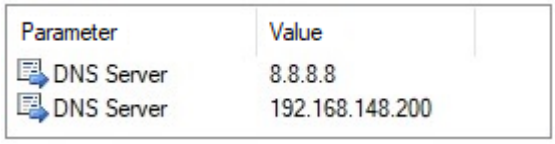


Fig. 12 – DNS server configuration example.

NTP

NTP (*Network Time Protocol*) is a protocol used for synchronizing the Alpha-log clock using the time obtained through an Internet server. The configured servers are those of the "NTP POOL PROJECT" 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.*

Fig. 13 – NTP server configuration example.

For further information about the Alpha-Log clock please refer to §4.2.2.

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.

4.1.4 Serial ports

Alpha-Log provides four serial ports for the communication with external devices: two RS-232 (Com1 and Com2), one RS-485 (Com3) 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).
- Com3**(10)** (Fig. 2): for the connection to Modbus RTU devices with RS-485 output. Devices with RS-232 output (including ALIEM) can be connected to this port through the dedicated RS-232/RS-485 serial converter.
- 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. D*efault value: not used*.
- Speed: is the speed Alpha-Log communicates with the modem. Select the same communication speed set in the modem. D*efault value: 38400 bps*.
- Parity: parameter used in the communication. It's the same one set in the modem. D*efault value: none*.
- Stop Bit: parameter used in the communication. It's the same one set in the modem. D*efault 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 Alpha-Log and is turned off when transmission is finalized. 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). D*efault value: not used*.

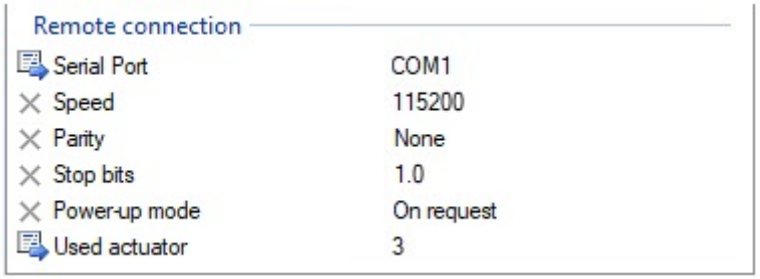


Fig. 14 – Remote port configuration example (modem).

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 Alpha-Log'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.

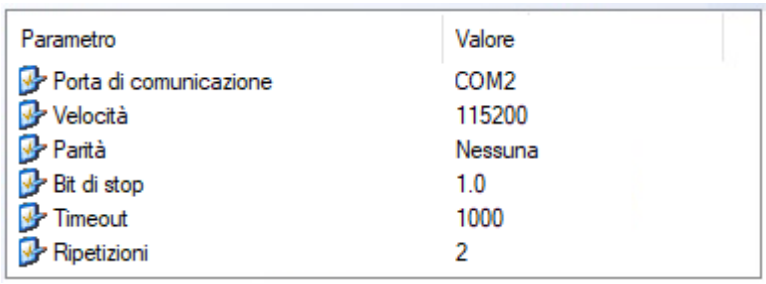


Fig. 15 – Com2 port configuration for Modbus RTU example.

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.

4.1.5 Input types

Each measurement is associated to a type of physical input used by the sensor connected directly to Alpha-Log. Sensors connected to ALIEM module are not following this logic.

Input types:

- Analog inputs
- Tipping bucket rain gauge
- Lightning Sensor
- Thermo-hygrometer RTR
- Modbus RTU Master
- SDI-12
- Atmospheric pressure
- Thermo-hygrometer SNS
- Boschung
- Temperature TI
- Frequency/Pulse inputs
- Logical State
- Calculated measures

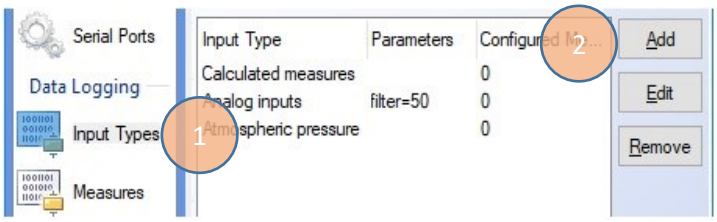
By default, the factory input types are only the following:

- Calculated measures
- Analog inputs
- Atmospheric pressure

Other input types are needed if new added sensors will use different Input type from those already existing.

If a new sensor is selected from the 3DOM sensors library, its input type is automatically set. Otherwise, proceed as follows:

1. Select *Input Types* from *Data Logging* section (1).
2. Press **[Add]** (2).
3. Select the type of input suitable for the sensor output, then press **[Add]**.
4. Set the required parameters.



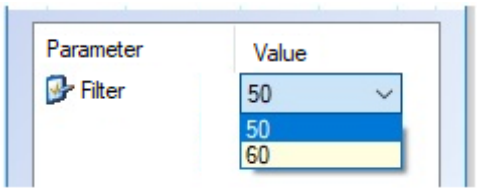
4.1.5.1 Analog inputs

Analog inputs type is used to acquire sensors with voltage output, as

- battery voltage
- *Analog In* input on the data logger terminal block (§Fig. 2).

This input is used by sensors with voltage output up to 2000 mV. In case of sensors having current output (0/4 ÷ 20 mA), it is possible to convert the signal into voltage, applying a 100 Ω resistor between terminals 17-18.

For this type of input Alpha-Log uses a filter to reduce the noise produced by the mains power supply. During setup, it is possible to choose the frequency of the mains voltage used (50/60 Hz).



4.1.5.2 Tipping bucket rain gauge

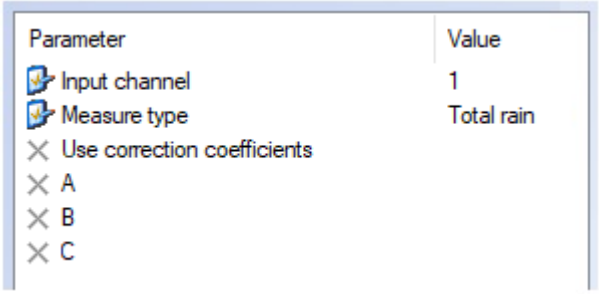
The *Tipping bucket rain gauge* is used by Alpha-Log for the acquisition of rain gauges. This type is associated with the *Pulse/Freq/State1* and *Pulse/Freq/State2* inputs of the data logger (§Fig. 2).

Set the following:

- *Mode*: indicates rain gauge type used in *Pulse/Freq/State1* and *Pulse/Freq/State2* inputs:
  - *Indipendent*: one reed relay. In this case it is possible to connect two rain gauges, one for each input.
  - *Central double reed*: if the rain gauge has two reed relays placed in a central position.
  - *Lateral double reed*: if the rain gauge has two reed relays placed in a lateral position.
- *Resolution channel 1 (mm)*: it indicates the amount of rain generated by each pulse in channel 1. Depending on the resolution of the sensor, set 0.1, 0.2 or 0.5.

- *Resolution channel 2 (mm)*: it indicates the amount of rain generated by each pulse in channel 2. Depending by the resolution of the sensor, set 0.1, 0.2 or 0.5.
- *End rain detection time (minutes)*: it indicates the time between one pulse and the next to interrupt the rain intensity calculation. It is possible to set any time from 3 to 2880 minutes. The default value is 30 minutes.

Other parameters related to the rain measurement using tipping bucket rain gauges, are also needed:



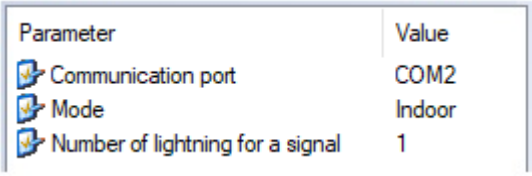
That are:

- *Input channel*: it specifies which is the input channel where the rain gauge is connected.
- *Measure type*: it is the type of measure associated with the rain gauge. It could be:
  - *Rain intensity*: expressed in mm/h, it is the intensity of rain calculation based on the frequency of the pulses. Each impulse is given by each movement of the spoon across the magnetic.
  - *Total rain*: it is the rainfall recorded within the sampling rate (§2.2.4).
  - *Tip interval*: it is the time elapsed between the last two pulses detected.
  - *Rain intensity (class A)*: expressed in mm/h, it is the intensity of rain. The Class A is more accurate since the correction coefficients are used in the calculation.
- *Use correction coefficients:* if set to Yes, it enables the coefficients A, B and C for the type of measure Rain intensity.
- *A, B, C:* they are the correction coefficients for the calculation of the rain intensity measurement. The coefficients are reported in the calibration certificate of the Class A rain gauge.

4.1.5.3 Lightning Sensor

The *Lightning Sensor* type is used for the acquisition of the LSI LASTEM DQA601.1 lightning sensor. It is associated to:

- *COM2*(4): DQA601.1 (RS-232 port)
- *COM4* (§Fig. 2): DQA601.3 (UART port). Always in COM4.



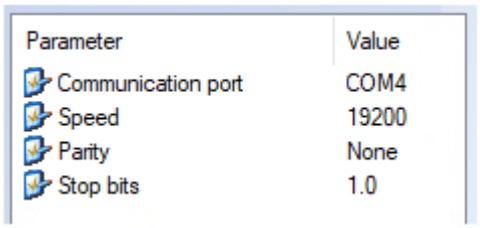
Parameters to be set:

- *Communication port*: it is the serial port where the sensor is connected.

- *Mode*: it indicates whether the sensor is installed indoors or outdoors. It minimizes the detection of false events.
- *Number of lightning for a signal*: it is the number of electrical discharges required to calculate the distance of the storm front; values greater than 1 allow the lightning sensor to ignore any discharges generated by electrical equipment sporadically and in short time, and therefore avoid false signals. Allowed values are: 1 (default), 5, 9 and 16.

4.1.5.4 Thermo-hygrometer RTR

The *Thermo-hygrometer RTR* type is used by Alpha-Log for the acquisition of the LSI LASTEM DMA672.3 and DMA672.4 thermohygrometric sensors. It is associated with the COM4 port (§Fig. 2).



The parameters relating to the Thermo-hygrometer type are the following:

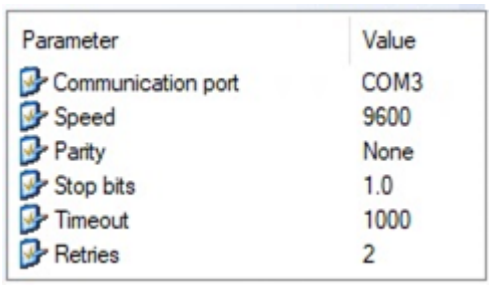
- *Communication port*: it is the serial port where the sensor is connected. It is not possible to choose a different port than COM4.
- *Speed*: it is serial port communication speed, 19200 bps by default.
- *Parity*: it is the parity used in communication with the sensor, None by default.
- *Stop bits*: it is a parameter used in communication with the sensor, 1 by default.

4.1.5.5 Modbus RTU Master

Watch the following video tutorials related to the topics of this chapter.

#	Title	YouTube link	Codice QR
21	Alpha-Log: Connecting Modbus RTU sensors	Alpha-Log #21 - Connecting Modbus-RTU sensors - YouTube	

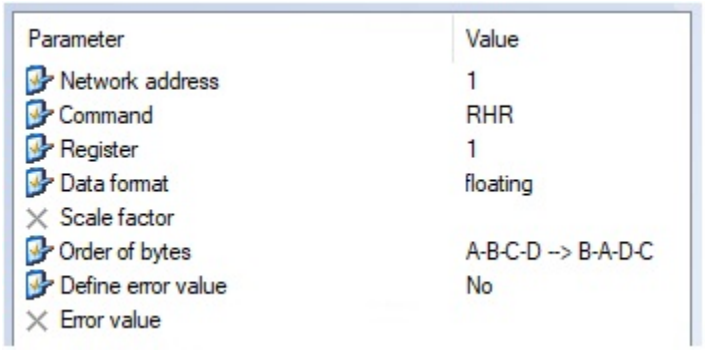
The *Modbus RTU Master* type is used by Alpha-Log for the acquisition of sensors with Modbus RTU protocol. It is associated with the *COM2*(4) and *COM3* ports (§Fig. 2) of the data logger.



Modbus RTU Master parameters are the following:

- *Communication port*: it is the serial port used for connection to one or more slave sensors.
- *Speed*: it is the serial port communication speed (must be same speed set on the slave sensor). Default= 9600 bps.
- *Parity*: it is the parity used in communication. Default= None.
- *Stop bits*: it is a communication parameter. Default= 1.
- *Timeout*: it is the protocol waiting time after sending a request. Default= 1000 ms.
- *Retries*: it is the number of attempts to send the request after a timeout without reply. Default= 2.

During the configuration, the Modbus RTU parameters for reading the data must also be specified. Refer to the sensor documentation for this.



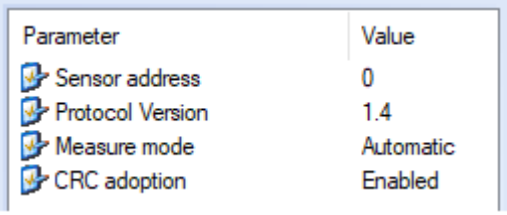
The Modbus RTU parameters are as follows:

- *Network address*: it is the sensor address.
- *Command*: it is the data request command to the sensor. It can be *Read Holding Register* or *Read Input Register* according to the sensor specifications.
- *Register*: it is the register containing the data to be read. The first register starts from the address 0x0000.
- *Data format*: it is the format of the data produced by the sensor. Alpha-Log supports the following formats:
  - *Floating*: two 16-bit floating point registers. The byte ordering is defined by the *Order of bytes* parameter.
  - *Integer16*: 16-bit unsigned register.
  - *Integer 16s*: 16-bit signed register.
  - *Integer32*: two consecutive unsigned 16-bit registers.
  - *Integer32s*: two consecutive 16-bit signed registers.
- *Scale factor*: for the integer data format, 16 or 32 bits, with or without sign, it is possible to specify the division factor of the data to obtain a floating value.
- *Order of bytes*: in case the sensor has floating type data format, it is possible to define the ordering of the 4 bytes ABCD that make up the data:
  - *ABCD*: default endian.
  - *DCBA*: little endian.
  - *BADC*: big endian.
  - *CDAB*: reverse endian.
- *Define error value*: if set to Yes, it enables the parameter *Error value*.
- *Error value*: is the value that the measure assumes in the event of an error. The default value is -99999.

4.1.5.6 SDI 12

Alpha-Log works with all versions of the SDI 12 protocol. At present, the latest version released is 1.4 (Jan 2019). The *High Volume* and *Metadata* commands, introduced in version 1.4, are not currently supported.

The *SDI 12* type is used by Alpha-Log for the acquisition of sensors supporting SDI 12 protocol.
It is associated with the *COM5* port (§Fig. 2) of the data logger.



The parameters to be set are as follows:

- *Sensor address*: is the address that identifies the sensor in the SDI 12 bus.
- *Protocol Version*: is the SDI 12 protocol version of the sensor. Refer to the sensor manual.
- *Measure mode*: defines the measurement mode of the sensor. It can take the following values:
  - *Automatic*: selects the most efficient measure mode according to the selected protocol version. **It is not certain that the specific sensor supports the automatically selected mode. If you do not know which modes are supported, it is preferable to select the *Measure* mode**.
  - *Measure*: set *Measure* as measure mode. It is the least efficient mode, but its operation is guaranteed for any SDI 12 sensor and any protocol version.
  - *Concurrent*: set *Concurrent* as measure mode. This is the most efficient mode when using sensor with a response time of several seconds.
  - *Continuous*: set *Continuous* as measure mode. This is the most efficient mode when using sensors with a response time of a few seconds.
- *CRC adoption*: is the CRC control code used in communication with the sensor. It can take the following values:
  - *Automatic*: enables CRC calculation if the selected protocol version allows it.
  - *Enabled*: communication uses the CRC code.
  - *Disabled*: communication does not use the CRC code.

4.1.5.7 Atmospheric pressure

The *Atmospheric Pressure* type is used by Alpha-Log to acquire the pressure value by the sensor mounted inside. In the factory setup this measurement is preset.

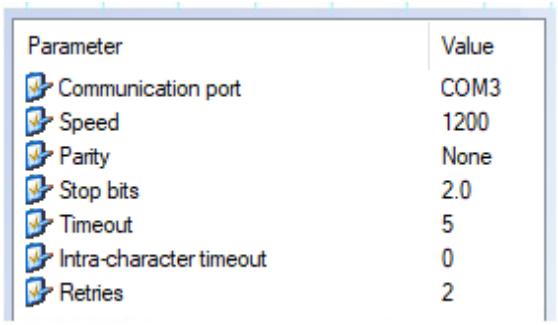
4.1.5.8 Thermo-hygrometer SNS

The *Thermo-hygrometer SNS* type is used by Alpha-Log for the acquisition of the LSI LASTEM PRTHA0700 sensor.
It is associated with the I^2C input**(2)** of the data logger.

This type of input does not require the setting of other parameters.

4.1.5.9 Boschung

The *Boschung* type is used by Alpha-Log for the acquisition of LSI LASTEM sensors with Boschung protocol. It is associated with the *COM2*(4) and *COM3* ports (§Fig. 2) of the data logger.



The parameters relating to the *Boschung* type are the following:

- *Communication port*: it is the serial port where the sensor is connected.
- *Speed*: it is the communication speed of the serial port. Default value 1200 bps.
- *Parity*: it is the parity used in communication with the sensor. Default value None.
- *Stop bits*: it is a parameter used in communication with the sensor. Default value 1.
- *Timeout*: it is the protocol wait time after sending a request. Default value is 5 ms.
- *Intra-character timeout*: it is the intra-character delay used in the data request message sent to the sensor. Default value 0.
- *Retries*: it is the number of attempts to send the request after a timeout without reply. Default value 2.

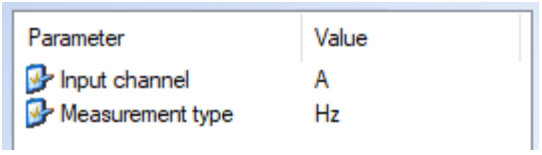
4.1.5.10 Temperature TI

The *Temperature TI* type is used by Alpha-Log for the acquisition of LSI LASTEM digital temperature sensors. It is associated with the I^2C input(2) of the data logger.

This type of input does not require the setting of other parameters.

4.1.5.11 Frequency/Pulse inputs

This inputs type is used by Alpha-Log for the acquisition of sensors measurements with frequency and pulse outputs such as, for example, the LSI LASTEM taco-anemometers.
This type is associated with the *Pulse/Freq/State1* and *Pulse/Freq/State2* inputs of the data logger (§Fig. 2).



Parameters to be set when configuring the measure:

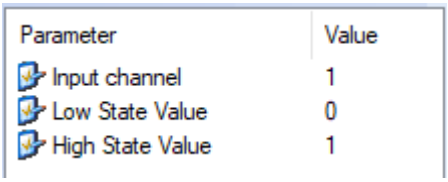
- *Input channel*: A for input *Pulse/Freq/State1*, B for input *Pulse/Freq/State2*.
- *Measurement type*:
  - *Hz*: for frequency measurement.
  - *Total*: for the totalization of the pulses.

4.1.5.12 Logical state

Alpha-Log allows you to configure Logical State type measurements.
The logical state determines the measurement value based on the electrical condition of the input; the measurement value can take on three different logical states based on the following conditions:

- *Error*: initial condition present until the occurrence of the first sampling after instrument start-up. Internally it takes the value of -99999.0
- *Inactive*: specific value assigned to the electrical signal condition at VSS value (ground, 0 V).
- *Active*: specific value assigned to the electrical signal condition at VDD value (3.3 V).

The following parameters must be set up when configuring the measure:



- *Input channel*: enter 1 for Pulse/Freq/State1 input, 2 for Pulse/Freq/State2 input.
- *Low State Value*: is the value assumed by the measure when the electrical signal of the specified input channel is less than 1.1 V DC.
- *High State Value*: is the value assumed by the measure when the electrical signal of the specified input channel is greater than 2.2 V DC.

A specific input channel cannot be configured if already used by one of the following inputs: *Frequency/Pulse input* or *Tipping bucket rain gauge*.

4.1.5.13 Calculated measures

The *Calculated measures* type is used by Alpha-Log to handle quantities whose value is determined, generally, from other measurements through the application of mathematical formulas or algorithms of various kinds (§4.2.3).
This type of input is always present in the data logger and cannot be removed.

4.1.6 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*).

4.1.7 Elaboration parameters

Alpha-Log 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 behaviour is not due to lack of memory, it has been introduced to limit the number of files stored into 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 Alpha-log together with the data elaboration of its measurements.

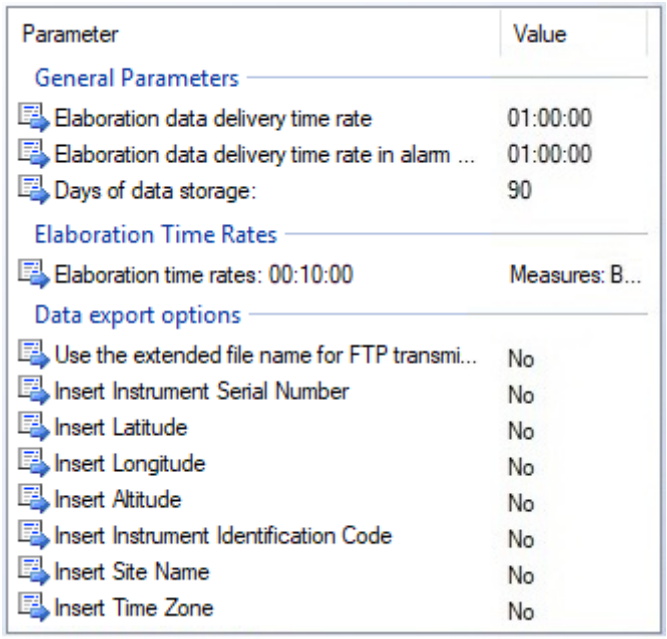


Fig. 16 – Elaboration parameters configuration example.

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

4.1.8 Using the USB memory stick

It is possible to use a USB stick as addition to the internal memory of the Alpha-Log 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 multiple partitions. The capacity must not exceed 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 Alpha-Log is more reliable than FAT32 used for the stick.

4.1.8.1 Use as an external memory

To use the USB key as external memory, insert it into one of the Alpha-Log 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 (§5.1.4.5.2). The information is updated at the expiry of the *Elaboration data delivery rate* (§4.1.7).

The text files (* .txt) of the processed data are stored in aggregate form in the file named files.tar in the path

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

from the moment the key is inserted until it is disconnected. To use this type of file in a Windows environment, we recommend using a special utility program, such as 7Zip (www.7-zip.org).

For more information on the files generated by Alpha-Log see §4.2.5.

4.1.8.2 Use as file exchange device

Using the USB stick, it is possible to upload the Alpha-Log configuration file or to download the data files from the memory. These operations are accessible from the PEN DRIVE menu (§5.1.4.5.3).

On the inquiry to upload the files with the data processed on the stick (*Upload data* function), the data logger creates the folder of the type *export_YYYY-MM-DD hh.mm.ss* in the path

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

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 Alpha-Log see §4.2.5.

4.1.9 Logics

Alpha-Log offers three 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*.

4.1.9.1 Threshold comparison logic

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

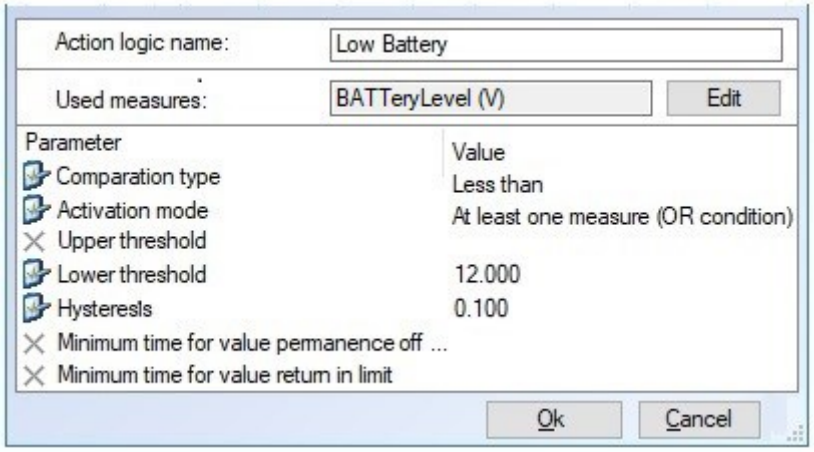


Fig. 17 – Example of Threshold comparation logic.

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:* **[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 deactivated 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 deactivated 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 deactivated 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.

4.1.9.2 Timer logic

Fig. 18 it is an example of *Timer* logic.

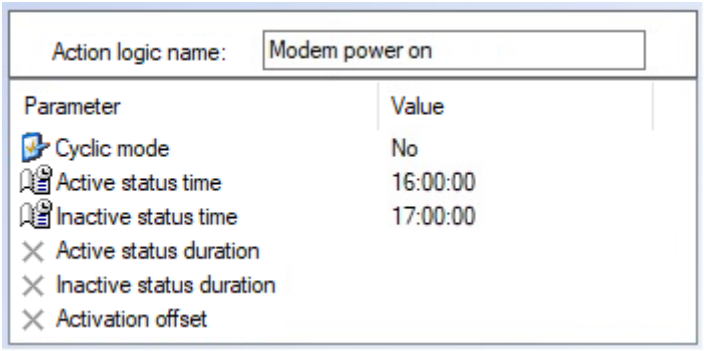


Fig. 18 – Example of *Timer* logic.

It is possible to configure the following:

- *Name of the logic:* it is the name whom it will be reported on the messages SMS, Mail and MQTT.
- *Cyclic mode:*
  - *No*: it indicates that the logic is active every day within the period of time from *Active status time* to *Inactive status time*.
  - *Yes:* it indicates that the logic switches on and off cyclically for the time periods specified in *Active status duration* and *Inactive status duration* respectively. It is possible to specify an activation delay by setting the *Activation offset* parameter.

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.

4.1.10 Actuators and alarms

Each logic can be assigned to an actuator (Switched power supply output) or to an action (SMS, e-mail, MQTT), or to both.

4.1.10.1 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.

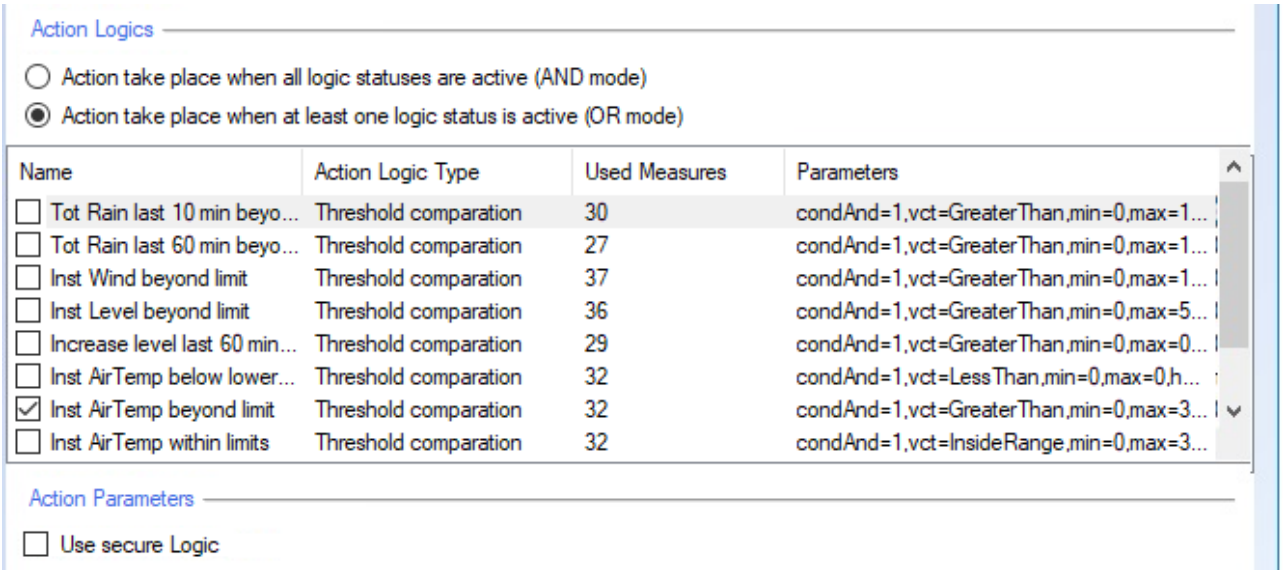


Fig. 19 – Example of logic assigned to a switched power supply output.

4.1.10.2 Logic assigned to an action

Each logic can be jointed to the following actions:

- *SMS*: when the logic status occurs, Alpha-Log sends one SMS message to up to 5 users. The function is active only if the data logger works in low consumption mode (§4.1.2) and if a 3G / 4G modem is connected.
- *e-mail*: when the logic status occurs, Alpha-Log sends the message via e-mail to the specified addresses. The maximum length of the addresses list cannot exceed 128 characters.
- *FastMode*: when the logic status occurs, Alpha-Log exits from any low-power mode and start sending data using the value reported in *General parameters-> Elaboration data delivery rate in alarm condition* (§4.1.7).
- *MQTT*: when the logic status occurs, Alpha-Log sends MQTT messages.
- *WakeUp*: when the logic status occurs, Alpha-Log exits from the low consumption mode and becomes accessible from the outside, via its network interfaces (§2.2.5).

Inside SMS and e-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.

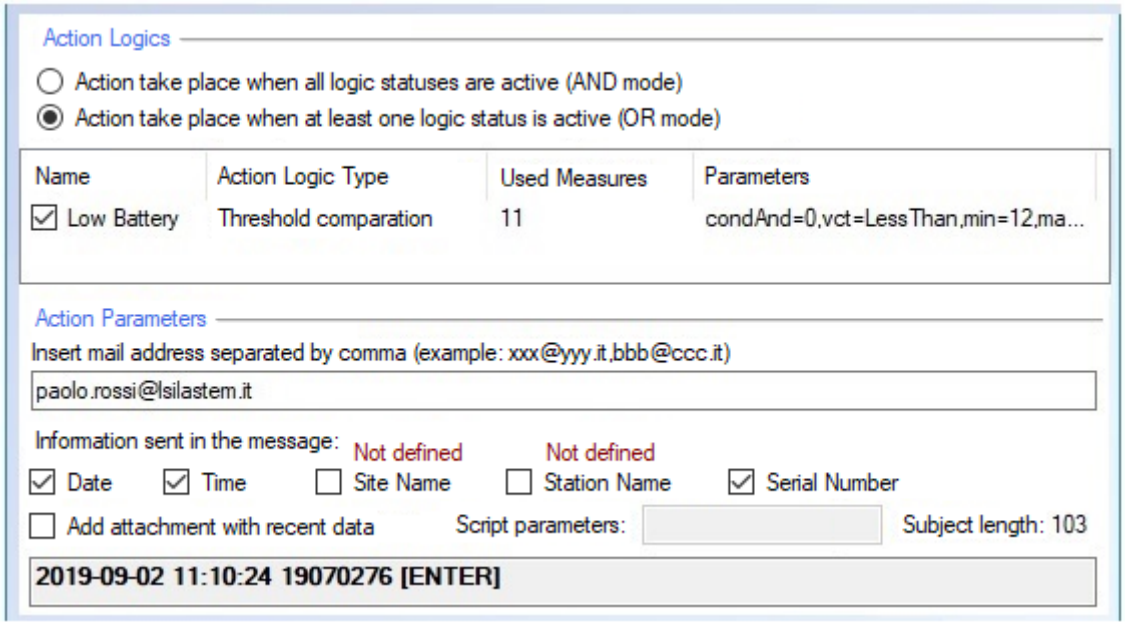


Fig. 20 – Example of Mail action assigned to a logic called "Low Battery".

4.1.11 Uploading configuration file to Alpha-Log

Watch the following video tutorials related to the topics of this chapter.

#	Title	YouTube link	QR Code
22	Alpha-Log: Uploading configuration	Alpha-Log #22 - Uploading configuration - YouTube	

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.

4.1.11.1 Sending via SSH connection

Alpha-Log 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)
- Port

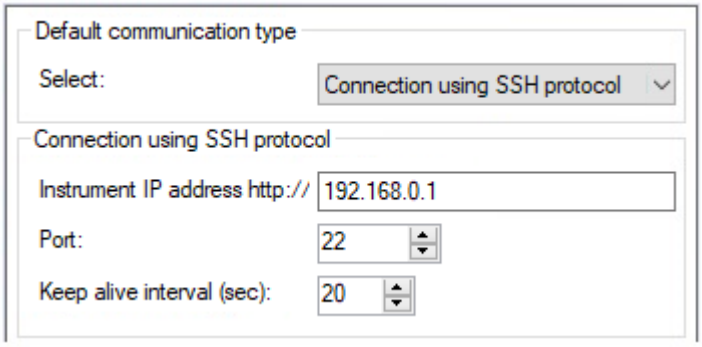


Fig. 21 – SSH connection to Alpha-Log with factory IP address example.

To know the Alpha-Log's IP address, see §5.1.4.5.1. 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.

4.1.11.2 Sending via USB pen drive

If Alpha-Log is not connected to a network or to the Internet, using a USB pen drive formatted with file system FAT32 that has at least 2 MB of free available space to update the instrument configuration 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 Alpha-Log'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.

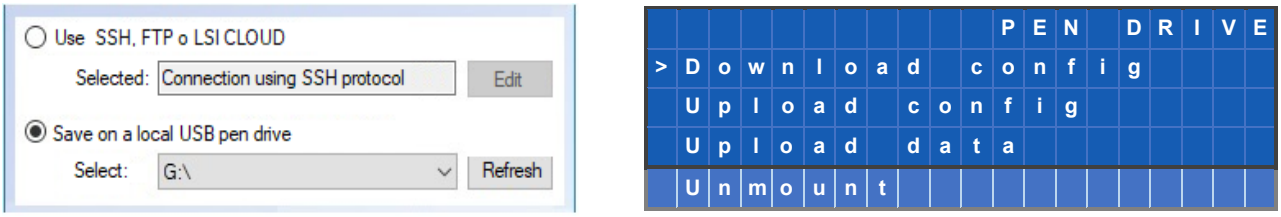


Fig. 22 – Configuration file transmission on a USB pen drive identified on the G:\ unit example.

ADVANCED FEATURES functions are active only if *Advanced mode* (§5.1.4.3) is enabled.

At the end of the configuration loading operation, the configuration file is removed from the USB stick.

4.1.11.3 Sending via FTP server

Alpha-Log 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*
- Username
- Password
- Server IP address
- Port
- Destination directory

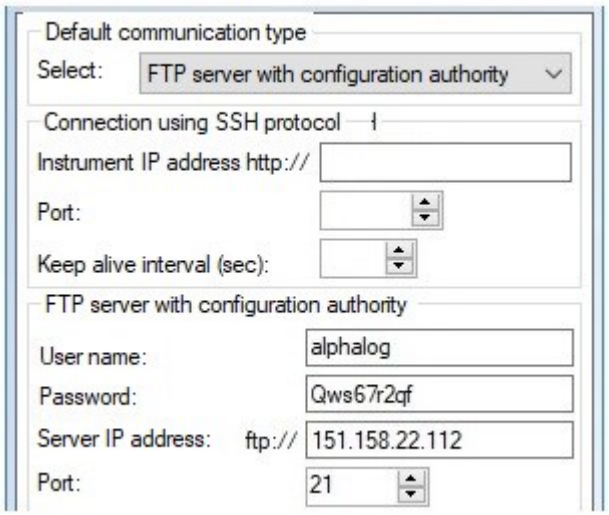


Fig. 23 – FTP connection example.

Alpha-Log will update the configuration at the end of *Elaboration data delivery time rate*.

4.2 Insights the Alpha-Log functionalities

4.2.1 Communication protocols

Alpha-Log 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 (default 115220 bps), Parity (default None), Stop bits (default 1), Flow control (default None).

Alpha-Log implements Boschung protocol (pavement sensor for road traffic applications) and part of industrial protocol Modbus RTU and Modbus TCP, both Master and Slave. See manual *INSTUM_03762* for more information on Modbus Slave.

4.2.2 Internal clock/calendar

Alpha-Log 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.

Alpha-Log 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. Update 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. This time, which cannot be modified, is a compromise between the need to update the time according to the accuracy of the internal clock and the energy and data traffic used for this operation.
- By command from the 3DOM software. The data logger instantly synchronizes with the PC clock in this case too.

Starting from version 2.01 of Alpha-Log, 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”.

4.2.3 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.

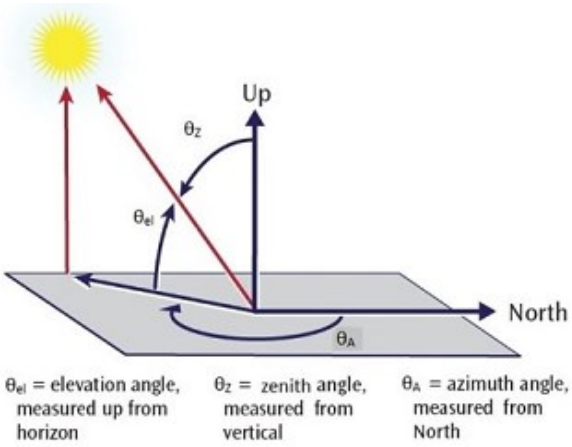
Only the most complex calculated measures are reported in this chapter.

4.2.3.1 Position (elevation) of the sun

The calculation of the position (elevation) of the sun is obtained by an adaptation of *SolarPosition* realized by Ken Willmott (*github.com/KenWillmott/SolarPosition*).

You can choose between two different types of calculated measurement:

- Position of the sun (elevation angle measured over the horizon)
- Sun azimuth (azimuth angle measured from North)



Both calculations require the Alpha-Log setting of the geographical position, provided by the *latitude* and *longitude* values. These values should however be entered during the stage of configuration of the calculated measure, although they may already have been specified in the registry information (§4.1.1). To trigger the calculation, it is also necessary to define a measure that has the desired acquisition rate.

In the Fig. 24 example the calculation is carried out in correspondence with the acquisition of the measure *BATTLevel*, normally activated every minute.

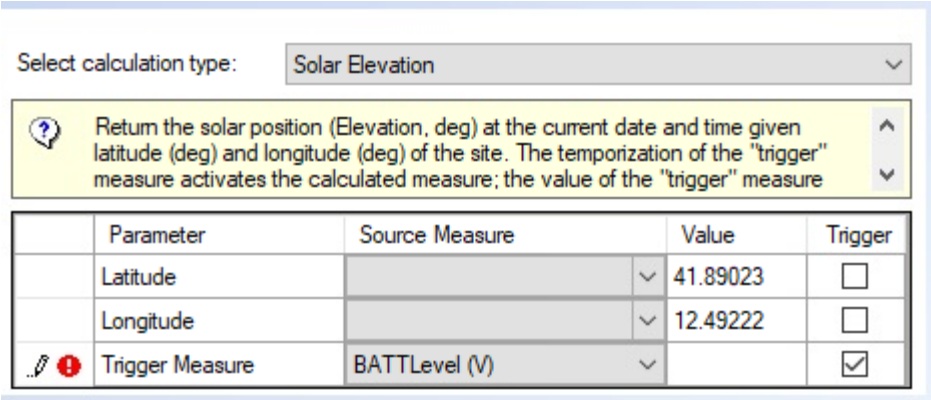


Fig. 24 – Example of calculated measurement configuration of type "Sun position".

4.2.3.2 *Diffused solar radiation*

The calculation is based on the fundamental equation expressed by the WMO guide nr. 8 that relates the global, direct and diffuse solar radiation. The formula given is 8.2:

$$I \cdot \cos \xi = G - D \qquad (8.2)$$

where I corresponds to direct solar radiation, ζ is the angle of solar elevation, so I cos(ζ) is the horizontal component of I, G is global solar radiation and D is diffuse solar radiation.
The calculation of diffuse radiation is then obtained by the formula:

$$D = G - I \cos \zeta$$

where G is the global radiation corresponding to the measurement obtained from a flat installed pyrometer, I is the direct radiation obtained from the heliometer (or another similar sensor), ζ obtained from the measurement calculated by Alpha-Log.

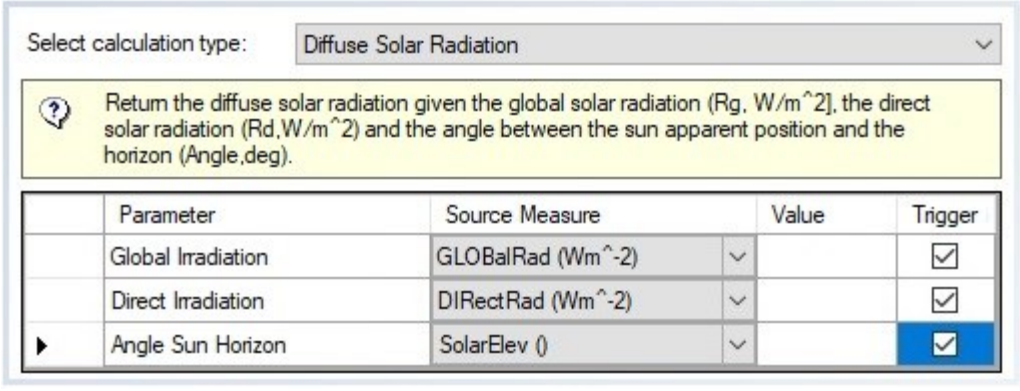


Fig. 25 – Example of calculated measurement configuration of type "Diffuse solar radiation".

4.2.3.3 *Duration of insolation (heliophania)*

You can choose between three different types of calculated measurement:

- Sun visibility (direct radiation)
- Sun Visibility (Step Algorithm)
- Sun visibility (Meteo France)

The first type refers to the standard method indicated by the WMO, which is based on the excess of the threshold of 120 W/m^2 of direct radiation.

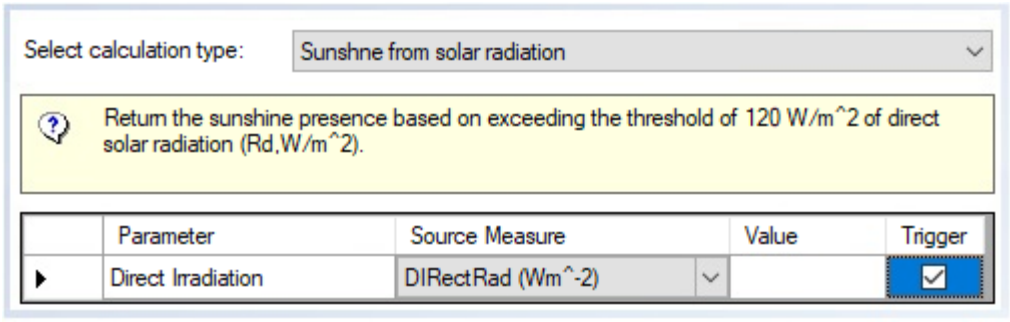


Fig. 26 – Example of calculated measurement configuration of type "Sun visibility (direct radiation)".

The other two types refer to the calculation methods set out in p. 4 of the document "*Sunshine duration – Vuerich.pdf*". In particular:

- *Step Algorithm* (SA)
- *Carpentras* AKA *Meteo-France Algorithm* (MFA)

The first method requires the measurement of global radiation (averaged over one minute) and the angle of elevation of the sun (§4.2.3.1).

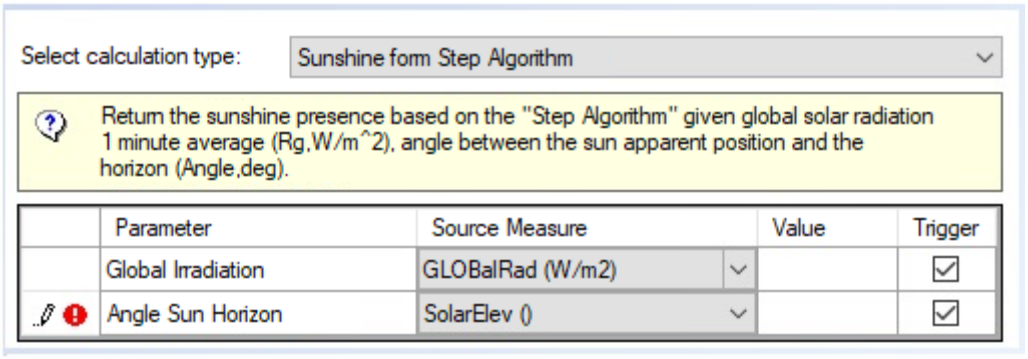


Fig. 27 – Example of calculated measurement configuration of type "Sun visibility (Step Algorithm)".

The second, like the first, requires the measurement of global radiation and the angle of elevation of the sun (§4.2.3.1) and the coefficients A and B, respectively set to the default values 0.73 and 0.06.

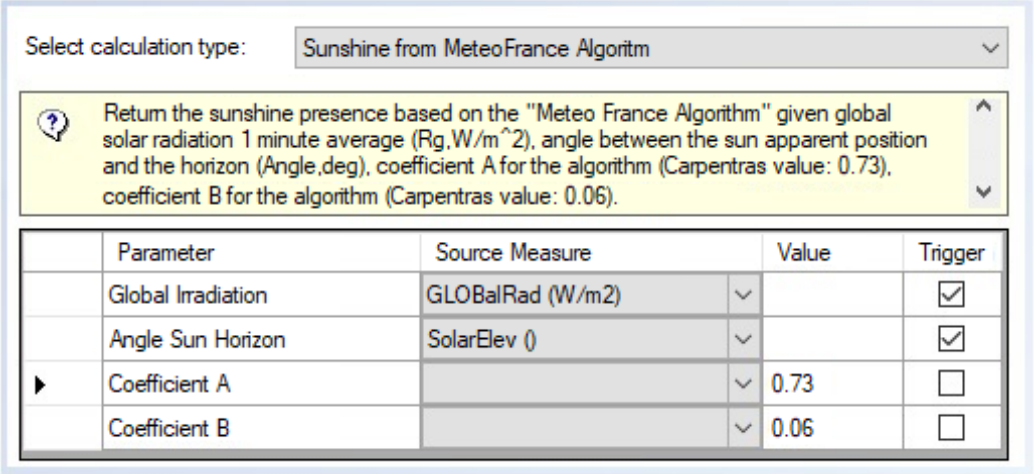


Fig. 28 - Example of calculated measurement configuration of type "Sun visibility (Meteo France)".

4.2.3.4 Penman-Monteith evapo-transpiration

The calculation of evapo-transpiration according to Penman-Monteith model is based on the original FAO document available at http://www.fao.org/3/X0490E/x0490e06.htm. The calculated index is named *ET0* and refers to a land area with grass having specific characteristics. In this way the calculation is independent of the type of crop present at the measuring site and provides comparable results to other sites with different types of cultivation.

The FAO document shall specify the use of the following measured quantities:

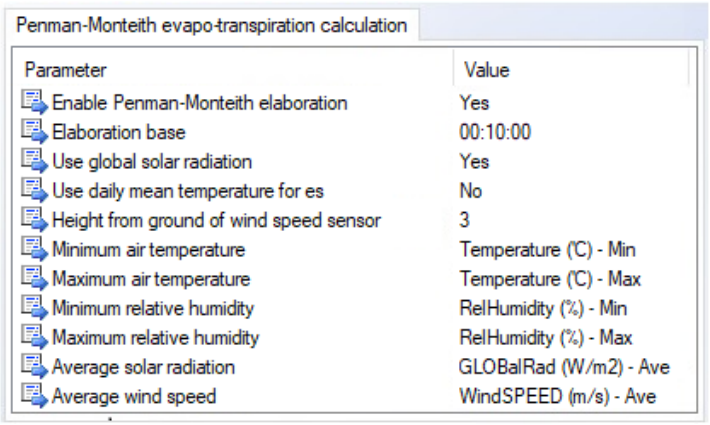
- Temperature
- Relative humidity
- Wind speed
- Net radiation

The net radiation data, if missing, can be estimated based on global radiation, temperature and humidity, calculation date/time (for solar position evaluation).
The calculation is performed on a daily basis, the type of calculation on a monthly basis is not supported (only one data per month). The daily activation of the calculation determines the extraction of the data of the previous day (as they are considered to be completely present). The data extracted are:

- Minimum and maximum temperature values.
- Minimum and maximum relative humidity values.
- Mean value of net or global radiation.
- Average value of wind speed.

To access the configuration:

1. From section *Extensions*, select *Calculation Modules.*
2. Select *Penman-Monteith evapo-transpiration calculation* and press **[Edit]**.
3. Set *Enable Penman-Monteith elaboration* to Yes. Then proceed to the compilation of the required fields according to the measures available on the data logger.



The elaboration results are stored in a specific file in ASCII text format (§4.2.7) and sent to remote reception systems, as already provided for statistical elaborated data normally produced by the data logger.

4.2.3.5 Pasquill-Gifford atmospheric stability class

The Pasquill-Gifford atmospheric stability classes are a method for classifying atmospheric stability. It is divided into six categories named with the letters from A to F in which the first indicates strong in-stability and the last more stability as indicated in the following table:

#	Stability class	Description
1	A	Strong unstability
2	B	Moderately unstability
3	C	Slightly unstability
4	D	Neutrality
5	E	Slightly stability
6	F + G	Moderately or strong stability

There are several methods for calculating the stability classes. Alpha-Log implements that based on global radiation and vertical temperature gradient. It is based on the following table:

Table 6-7
Key to Solar Radiation Delta-T (SRDT) Method for Estimating Pasquill-Gifford (P-G) Stability Categories

DAYTIME

	Solar Radiation (W/m^2)			
Wind Speed (m/s)	≥ 925	925 - 675	675 - 175	< 175
< 2	A	A	B	D
2 - 3	A	B	C	D
3 - 5	B	B	C	D
5 - 6	C	C	D	D
≥ 6	C	D	D	D

NIGHTTIME

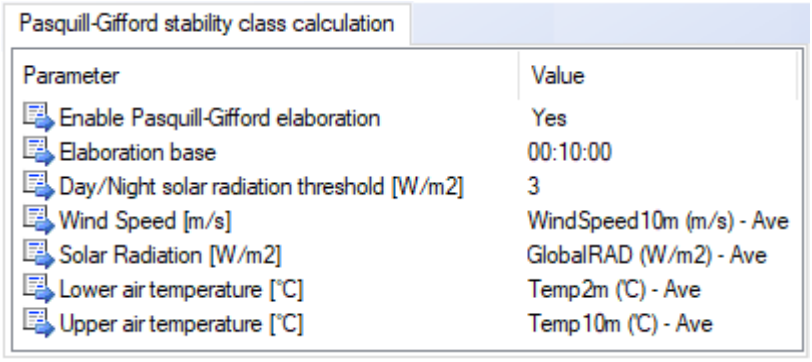
	Vertical Temperature Gradient	
Wind Speed (m/s)	< 0	≥ 0
< 2.0	E	F
2.0 - 2.5	D	E
≥ 2.5	D	D

speed is measured 10 meters above the ground.
The two temperatures are measured at a height of 2 and 10 meters.
Night and day are determined by the measurement of solar radiation. Below 3 W/m^2 is considered night, while above day.

For more information on Pasquill-Gifford stability classes, refer to *EPA - Method for Estimating Pasquill-Gifford (P-G) Stability Categories* (October 1993) and *Meteorological Moni-toring Guidance for Regulatory Modeling Applications* - EPA (February 2000).

To access the configuration:

1. From section *Estensions*, select *Calculation Modules.*
2. Select *Pasquill-Gifford stability class calculation* and press **[Edit]**.
3. Set *Enable Pasquill-Gifford elaboration* to Yes.



Then proceed to fill in the required fields based on the measurements available on the data logger.

The elaboration results are stored in a specific file in ASCII text format (§) and sent to remote reception systems, as already provided for the statistical elaborated data normally produced by the data logger.

4.2.3.6 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.

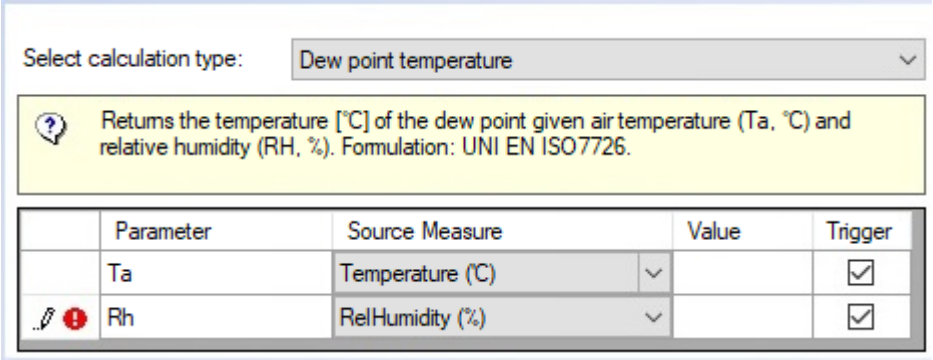


Fig. 29 – Example of calculated measurement configuration of type "Dew point temperature".

4.2.3.7 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, Alpha-Log 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′	*A*	*B*	Geopotential *géopotentiel* m′	*A*	*B*
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. 30 – Table 3.10 reported in "International Meteorological Tables – WMO No. 188 TP. 94 - 1966".

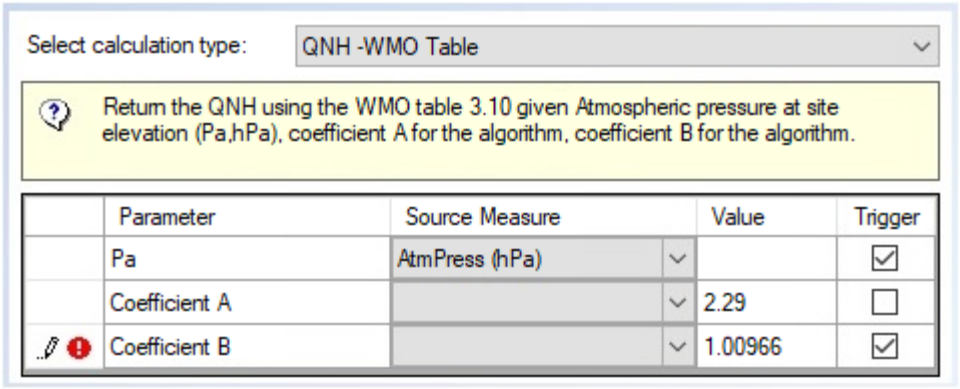


Fig. 31 - Example of calculated measurement configuration of type "QNH - WMO Table".

The type QNH - ISA, instead, uses the formula ISA nr. 7 indicated in "CIMO/ET-Stand-1/Doc. 10 (20.XI.2012)" (§ Fig. 32).

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

7. $$QNH = QFE\left\{1 - \frac{\gamma H}{T_0\left[\frac{QFE}{p_0}\right]^{\frac{R_d\gamma}{g}}}\right\}^{-\frac{g}{R_d\gamma}}$$

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/s² (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 (≈ 8.314 472±0.000 015 J/mol/K according to CODATA 2006), m_d (≈ 28.9644 g/mol) and m_v (≈ 18.016 g/mol) are hinted by Richard Shelquist at http://wahiduddin.net. This gives R_d ≈ 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. 32 – Reference to equation No. 7 given in "CIMO/ET-Stand-1/Doc. 10 (20.XI.2012)"

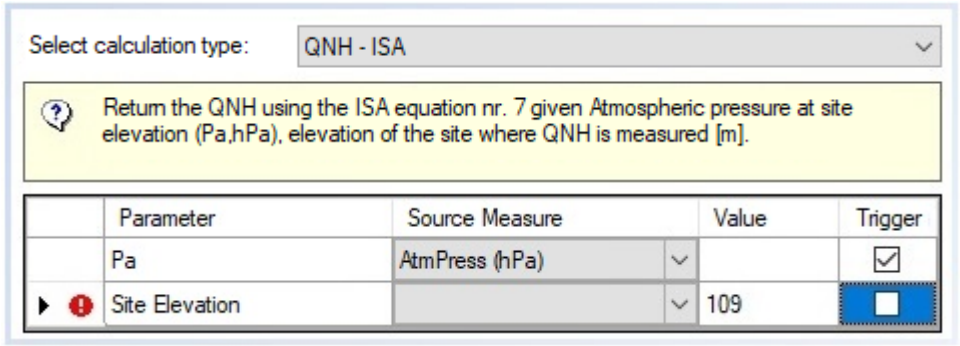


Fig. 33 - Example of calculated measurement configuration of type "QNH - ISA".

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

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

Fig. 34 – ICAO equations 28 and 29 reference.

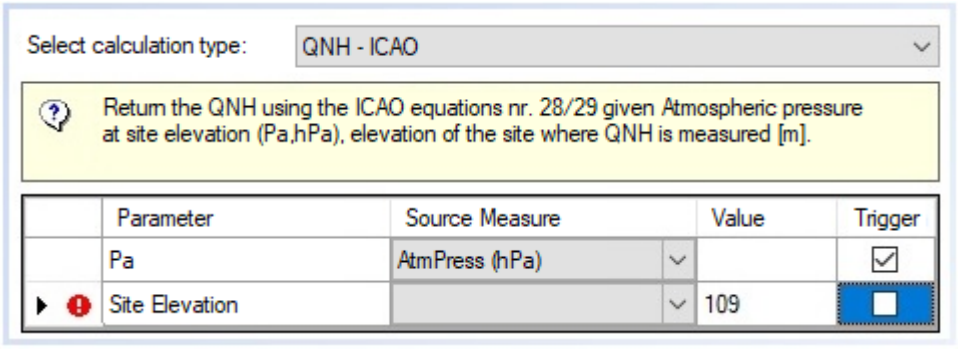


Fig. 35 - Example of calculated measurement configuration of type "QNH - ICAO".

4.2.3.8 *Wind component in aeronautics*

Alpha-Log calculates the transverse wind component, in the tail and in the bow depending on the angle of the landing strip relative to the North.
The formulas used are:

$$CW = ABS(V \times sin(D - D_r))$$
$$HW = V \times cos(D - D_r)$$
$$TW = V \times cos(180 + D - D_r)$$

where:

- *CW* = Cross Wind
- *HW* = Head Wind
- *TW* = Tail Wind
- *V* = Wind speed measured near the airstrip
- D = Wind direction measured near the airstrip
- D_r = Orientation direction of the landing strip with direction of travel relative to the indicated angle

Consider the following aspects:

- The direction measured by the anemometer is conventionally referred to the *origin* of the wind, while the direction of the aircraft is its *destination*.
- If *Head Wind* is greater than zero, it indicates presence of the wind component at the bow of the aircraft.
- If *Tail Wind* is greater than zero, it indicates the presence of the wind component at the tail of the aircraft.
- If *Cross Wind* is greater than zero, it indicates the presence of the transverse wind component on the aircraft.

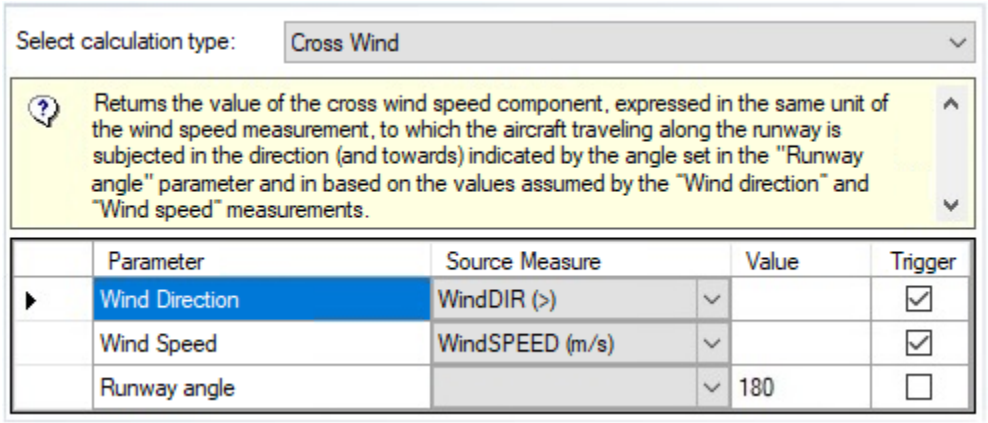


Fig. 36 – Example of calculated measurement configuration of type "Cross wind".

4.2.3.9 Mean radiant temperature

Calculation of the mean radiant temperature requires measurement of air temperature, globe temperature and air velocity.

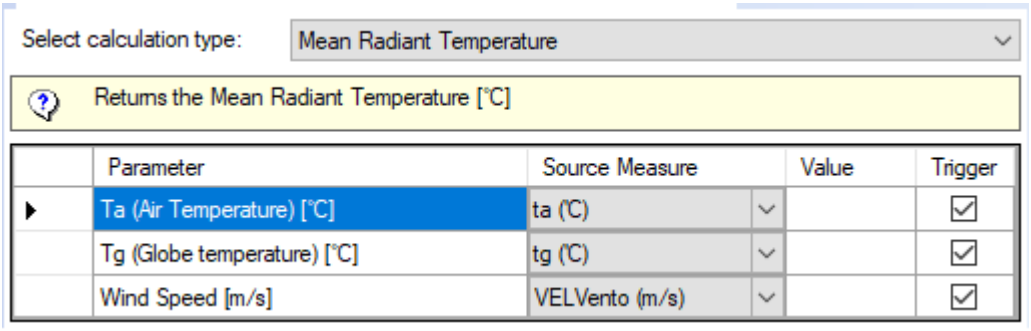


Fig. 37 – Example of calculated measurement configuration of type "Mean radiant temperature".

4.2.3.10 UTCI - Universal Thermal Climate Index

UTCI is an index for the assessment of thermal comfort/thermal discomfort conditions in outdoor environments. The calculation requires the measurement of air temperature, mean radiant temperature, relative humidity and air speed measured 10 m above the ground. The index is significant with measurement values within the following limits:

- Air temperature: -50 ÷ 50 °C
- Mean radiant temperature: -50 ÷ 50 °C
- Relative humidity: 0 ÷ 100%
- Air speed: 0.5 ÷ 17 m/s

By setting the parameter *Out of range parameter behaviour*, it is still possible to instruct Alpha-Log to perform the calculation while ignoring or limiting the values of out-of-limit measurements. In particular:

- 0: the calculation is performed by limiting the value of each measured quantity within the minimum and maximum values indicated above (e.g.: with an air temperature of 52 °C the calculation considers 50 °C, with an air speed of 0 m/s the calculation considers 0.5 m/s).
- 1: the calculation is carried out with dependent measurement values even beyond the limits indicated above. This choice may lead to results not expected within the validity limits of the formula, and should therefore be used carefully with this in mind.

- 2: in the case of measurements with an out-of-limit value, the calculated measurement assumes the error value -999999 ("err" on the instrument display).
- 3: in the case of measurements with an out-of-limit value, the calculated measurement takes the value -999997.

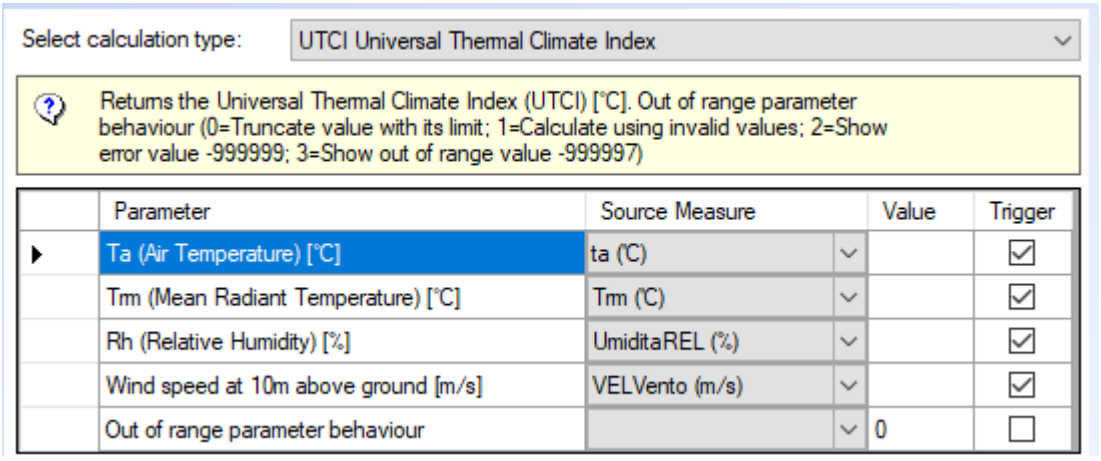


Fig. 38 – Example of calculated measurement configuration of type "UTCI" with forcing measurements out of limits.

4.2.3.11 Heat Index

Alpha-Log calculates the Heat Index defined by *NOAA* (National Oceanic and Atmospheric Administration); the calculation requires the measurement of air temperature and relative humidity.
The Heat Index is significant for air temperature values between 20 °C and 50 °C.

By setting the parameter *Out of range parameter behaviour*, it is still possible to instruct Alpha-Log to perform the calculation while ignoring or limiting the values of out-of-limit measurements. In particular:

- 0: the calculation is performed by limiting the value of each measured quantity within the minimum and maximum values indicated above (e.g.: with an air temperature of 52 °C the calculation considers 50 °C while with 18 °C it considers 20 °C).
- 1: the calculation is carried out with dependent measurement values even beyond the limits indicated above. This choice may lead to results not expected within the validity limits of the formula and should therefore be used carefully with this in mind.
- 2: in the case of measurements with an out-of-limit value, the calculated measurement assumes the error value -999999 ("err" on the instrument display).
- 3: in the case of measurements with an out-of-limit value, the calculated measurement takes the value -999997.

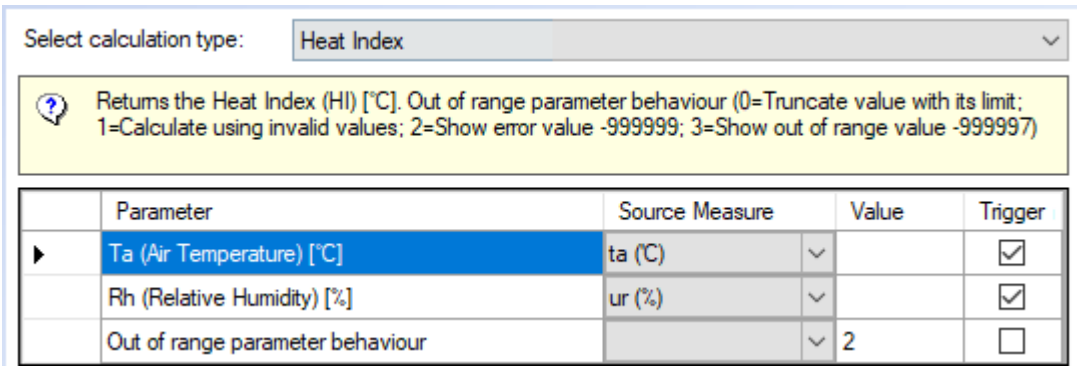


Fig. 39 – Example of calculated measurement configuration of type "Heat stress index" with error reporting In case of measurements out of limits.

4.2.3.12 WBGT - Heat stress index

Alpha-Log calculates the WBGT index according to ISO 7243. Four different types of calculation can be chosen:

- *WBGT*: indoor index (without solar load); requires the following measures:
  - Wet bulb temperature at natural ventilation.
  - Globe temperature.

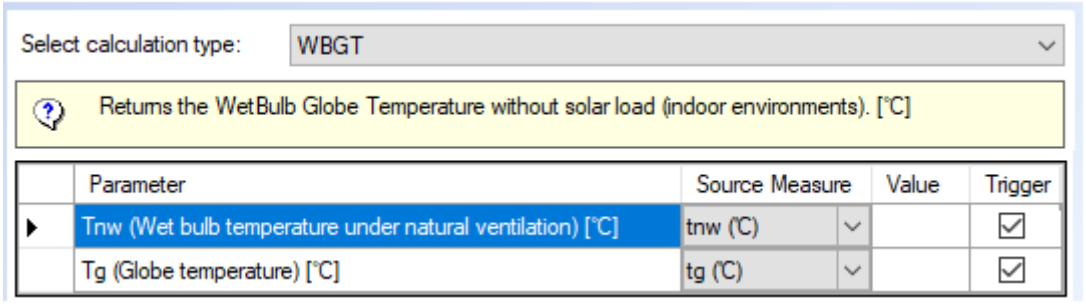


Fig. 40 – Example of calculated measurement configuration of type "WBGT".

- *WBGT with solar load*: outdoor index; requires the measure of:
  - Wet bulb temperature at natural ventilation.
  - Globe temperature.
  - Air temperature.

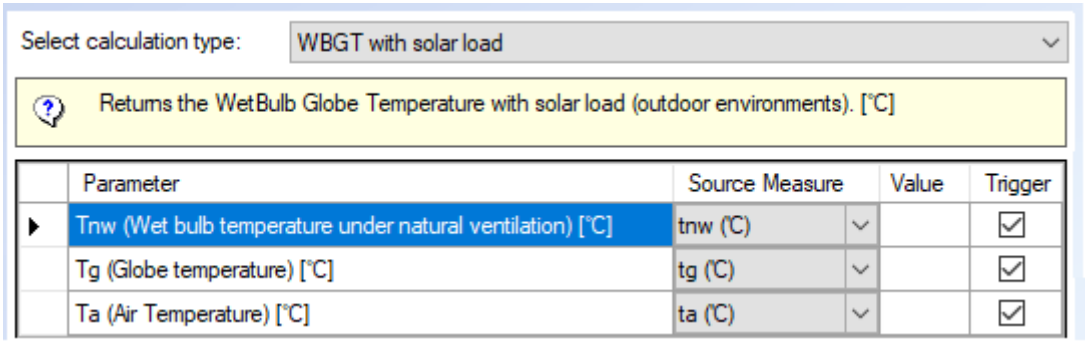


Fig. 41 – Example of calculated measurement configuration of type "WBGT with solar load".

- *WBGT effective*: index corrected for the effect of clothing; requires the following measures:
  - WBGT or WBGT with solar load.
  - CAV: Clothing Adjustment Value expressed in °C. By default the value is set to 0. The calculation does not include the additional value 1 corresponding to clothing insulation due to headgear.

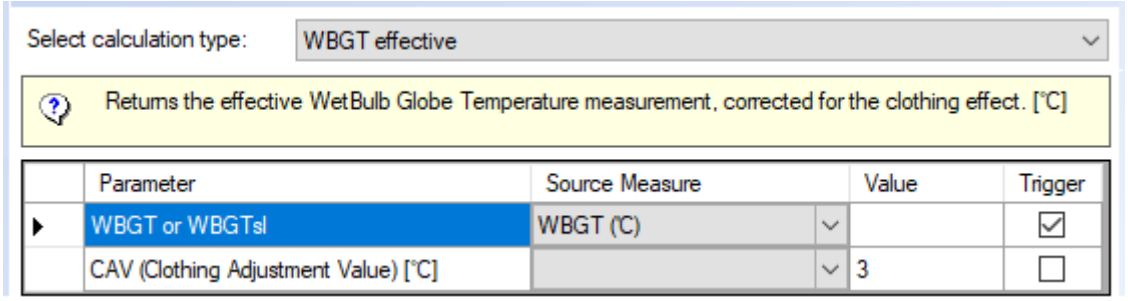


Fig. 42 – Example of calculated measurement configuration of type "WBGT effective"

- *WBGT reference*: the calculation requires the parameter the metabolic condition (Metabolic Rate) in watt and the indication of acclimatised (1) or non-acclimatised (0) subject.

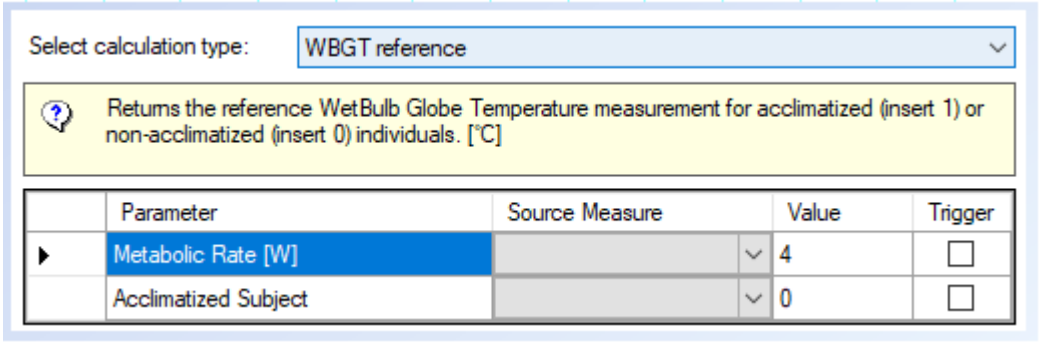


Fig. 43 – Example of calculated measurement configuration of type "WBGT reference" with non-acclimatised subject.

- *WBGT delta*: the calculation requires the calculated WBGT effective, the metabolic condition (*Metabolic Rate*) in watt and the indication of acclimatised (1) or non-acclimatised (0) subject.

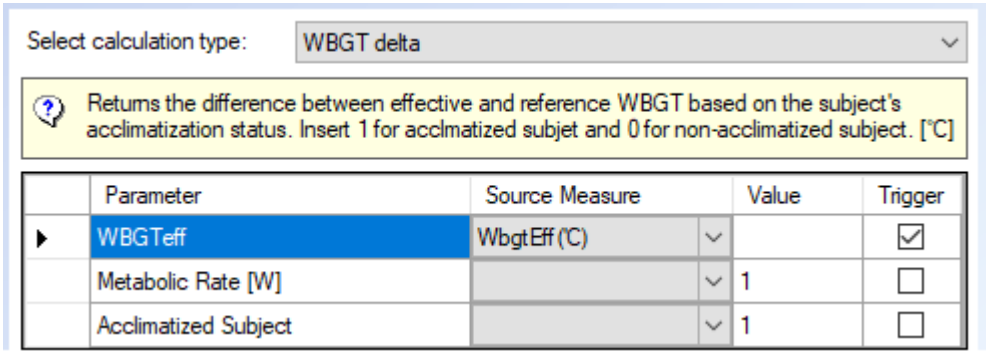


Fig. 44 – Example of calculated measurement configuration of type "WBGT delta" with acclimatized subject.

4.2.4 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

Furthermore, for anemometric measurements, it is possible to choose the following vector calculations:

(Prevailing) average direction

It is the vector angle value calculated as the vector sum of all wind components measured by the data logger within the selected statical time base, whose module is considered unitary. It provides the most frequent origin of the wind during the processing period, regardless of the wind intensity. The formula for calculating the Prevailing average direction is as follows:

$$PrevDir = gra\left(\text{atan2}\left(\Sigma Sin(rad(Dir)), \Sigma Cos(rad(Dir))\right)\right)$$

Resulting average direction

Vectorial angle value calculated as the vectorial sum of all wind speed and direction components measured by the data logger within the selected statistical time base. In other words, it provides the direction of origin of the wind based even on the individual wind intensities. Below is the formula for calculating the Resulting average direction.

$$RisDir = gra\left(\text{atan2}\left(\Sigma\left(Sin(rad(Dir)) \cdot Vel\right), \Sigma\left(Cos(rad(Dir)) \cdot Vel\right)\right)\right)$$

Resulting average speed

It corresponds to the value of the modulus of the vector calculated for the evaluation of RisDir, so it is the wind intensity resulting from the sum of each individual components. In other words, from the point of view of the displacement of the air masses, the same result would be obtained in real conditions, if the wind were blowing constantly with this intensity and from RisDir wind direction angle. Below is the formula for calculating the Resulting average speed.

$$RisVel = \frac{\sqrt{\left(\Sigma Sin(rad(Dir)) \cdot Vel\right)^2 + \left(\Sigma Cos(rad(Dir)) \cdot Vel\right)^2}}{n}$$

Direction's standard deviation (sigma theta)

It is the standard deviation of the wind direction. It indicates the fluctuations of wind direction across its average value. The formula for calculating the the Standard deviation of direction is as follows:

$$StDevDir = \text{gra}\left(\text{asin}\left(\sqrt{1 - \frac{\left(\Sigma Sin(rad(Dir))\right)^2 + \left(\Sigma Cos(rad(Dir))\right)^2}{n^2}}\right)\right)$$

Calm percentage

It indicates how many times, during the processing period, the wind intensity has remained below the relative threshold set in the data logger (default: 0.3 m/s), and therefore how many times the wind direction has been excluded from the calculations of the above indices, as they are not significant. In case of total absence of wind during the processing period, CalmPerc assumes the value 100, while both PrevDir and RisDir assume the conventional value 360 (wind angle to be considered "not significant"). The formula used to calculate the Calm percentage is as follows:

$$CalmPerc = \frac{\sum_{1}^{n} Calm}{n} * 100$$

Where:

Dir = instantaneous value of wind direction (0÷360°)
Vel = instantaneous value of wind velocity (m/s)
gra = conversion of an angle from radians to degrees
rad = conversion of an angle from degrees to radians
Calm = 0 in case of not calm wind velocity (< 0.3 m/s), otherwise 1
n = number of considered valid original data (no error)

Each measure can have different time basis.

If the *Penman-Monteith evapo-transpiration calculation* is enabled (§4.2.3.4), Alpha-log performs specific processing for this type of calculation whose results are saved in specific files (§4.2.7).

4.2.5 Processed data files

Watch the following video tutorials related to the topics of this chapter.

#	Title	YouTube link	QR code
19	Alpha-Log: How to set data delivery to FTP servers	Alpha-Log #19 - How to set data delivery to FTP servers - YouTube	

Data processed by Alpha-Log (§4.1.7, §4.2.4), are included in text files (*.txt). Each file is identified by its name. Default name is composed as follows:

Nome: *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* (§4.1.7), 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	Alpha-Log 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. Alpha-Log 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:

HDR	Identifies the file as a header file
CyyyyMMddhhmmss	Configuration file date/time (in the example: 20/10/2017 8:14:21)
Bnn	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 Alpha-Log's serial number. If serial number is not defined by the user, the number used will be the number defined by the factory (§4.1.1).

Below is an example of files processed by Alpha-Log S/N 17110023.

17110023
- *HDR_C20171020081421-B00.txt*
- *HDR_C20171020081421-B01.txt*
- *C20171020081421-B00-E20171020121100.txt*
- *C20171020081421-B00-E20171020122100.txt*
- *C20171020081421-B00-E20171020123100.txt*
- *C20171020081421-B00-E20171020124100.txt*
- *C20171020081421-B00-E20171020125100.txt*
- *C20171020081421-B01-E20171020122500.txt*
- *C20171020081421-B01-E20171020123500.txt*
- *C20171020081421-B01-E20171020124500.txt*

Fig. 45 – Files processed by Alpha-Log example.

4.2.5.1 Header files

To define the processed data files, it's necessary to rely on the information contained in the corresponding header file. Alpha-Log 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 (§4.1.7).

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. 46 – Header file example.

4.2.5.2 Processed data files

Data files are generated by Alpha-Log according to the *Elaboration data delivery time* parameter, specified in 3DOM's *Elaboration Parameters* (§4.1.7). 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; it considers the time zone.
- *Serial, Latitude, Longitude, Altitude, UserSerial, SiteName, TimeZone* are those described in HEADER (§4.2.5.1).
- 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. 47 – Processed data files example.

Referring to the HEADER section in Fig. 46, 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

4.2.6 Processed data files with validators

The presence of validators involves the duplication of the data files generated by Alpha-Log.
Data processed by Alpha-Log (§4.1.7, §4.2.4) are included in text files with the specific extension "*.ved*". Each file is identified by its name. Default name is composed as follows:

Name: *CyyyyMMddhhmmss-Bnn-EyyyyMMddhhmmss.ved*
Example: *C20171020081421-B00-E20171020124100.ved*

The name includes the following information:

CyyyyMMddhhmmss	Specific date/time for validation of the configuration file (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* (§4.1.7), the extended name will be generated following the same logic described for data files processed without validators (§4.2.5).

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

File name is composed as follows:

Format: *HDR_CyyyyMMddhhmmss-Bnn.ved*
Example: *HDR_C20171020081421-B00.ved*

The name includes the following information:

HDR	Identifies the file as a header file
CyyyyMMddhhmmss	Specific date/time for validation of the configuration file (in the example: 20/10/2017 8:14:21)
Bnn	Pointer of the elaboration base (in the example: 00)

For example, file *HDR_C20171020081421-B00.ved* allows the user to define the data contained in file *C20171020081421-B00-E*.ved*.

All files are stored in the folder named with Alpha-Log's serial number. If serial number is not defined by the user, the number used will be the number defined by the factory (§2.2.1).

Below is an example of files processed by Alpha-Log S/N 17110023.

17110023
HDR_C20171020081421-B00.ved
HDR_C20171020081421-B01.ved
C20171020081421-B00-E20171020121100.ved
C20171020081421-B00-E20171020122100.ved
C20171020081421-B00-E20171020123100.ved
C20171020081421-B00-E20171020124100.ved
C20171020081421-B00-E20171020125100.ved
C20171020081421-B01-E20171020122500.ved
C20171020081421-B01-E20171020123500.ved
C20171020081421-B01-E20171020124500.ved

Fig. 48 - Files with validators processed by Alpha-Log example.

4.2.6.1 Header files

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

The header files respect the same structures and rules described for elaborations without validation (§4.2.5.1).

4.2.6.2 Processed data files

Data files are generated by Alpha-Log according to the *Elaboration data delivery time* parameter, specified in 3DOM's *Elaboration Parameters* (§4.1.7). Default value is 1 hour.

Data files respect the same structures and rules described for elaborations without validation (§4.2.5.1).

4.2.7 Penman-Monteith evapo-transpiration elaborated data files

The result of evapo-transpiration calculations according to Penman-Monteith (§4.2.3.4) are contained in text files (*.txt) identified as follows:

Name: *penman_yyyy^{1}MM^{1}dd^{1}hh^{1}mm^{1}ss^1_yyyy^{2}MM^{2}dd^2*
Example: *penman_2020122000124_20201222.txt*

The name shall contain the following information:

penman	File identification prefix containing evapo-transpiration computations according to the Penman-Monteith algorithm
yyyy^{1}MM^{1}dd^{1}hh^{1}mm^{1}ss^1	File creation date/time (in the example: 20/12/2020 00:01:24)
yyyy^{2}MM^{2}dd^2	Date referenced by the data contained (in the example: 20/12/2020)

The file is created by Alpha-Log once a day as soon as all the data needed for the calculation is available. Normally this happens shortly after 0:00, or even later, depending on the operating conditions of the data logger (power mode, low battery, etc.).

The file contains two lines. The first line has a descriptive character; the second one has the actual values.

The information contained is:

- *PenmanValue:* Penman-Monteith index value (main result).
- *MinTair*: minimum air temperature value.
- *SiteElev*: elevation above sea level.
- *MaxTair*: maximum value of air temperature.
- *MinRH*: minimum relative humidity value.
- *UseTAvgForEA*: flag indicating whether the average temperature has been used for the calculation.
- *Id*: unique id of the calculation.
- *Timestamp*: date/time of data production.
- *UseGlobalRad*: flag indicating whether global radiation has been used.
- *MaxRH*: maximum relative humidity value.
- *Date*: indicates the day of the result.
- *AveWindSpeed*: mean wind speed value.
- *AveRad*: mean radiation value.

- *VairMeasHeight*: height of wind speed sensor.
- *SiteLat*: latitude used in the calculation.

Following is an example of a processed file:

```
PenmanValue,MinTair,SiteElev,MaxTair,MinRH,UseTAvgForEA,Id,Timestamp,UseGlobalRad,MaxRH,Date,AveWindSpeed,AveRad
,VairMeasHeight,SiteLat

28.43,27.52,200.0,34.09,12.1,False,32cbc12b-ca75-4e1b-a1d6-a29f4a0120c8,2020-12-29T10:15:25,False,12.1,2020-12-
23,0.207996254682,1012.72498127,2.0,45.376802
```

Fig. 49 – Example of elaborated Penman-Monteith evapo-transpiration file.

4.2.8 Pasquill-Gifford stability class elaborated data files

The result of Pasquill-Gifford stability class calculation (§4.2.3.5) are contained in text files (*.txt). The file naming is the same as the original files with the addition of ".SRDT." before the extension. Following an example of a processed:

Example 1: C20210527162230-B00- E20210528084000.SRDT.txt
Example 2: M21030052-C20210527162230-B00-E20210528084000-L20210528084000.SRDT.txt

For further information refer to §4.2.5.

The file, created by Alpha-Log as soon as all the data necessary for the calculation are available, is made up as follows:

- the number of lines corresponds to the file originally processed
- the first column contains the same processing date and time as the source file (it considers the time zone)
- the second column contains the numerical (non-literal) value of the calculated atmospheric stability class (§4.2.3.5)

Following is an example of a processed file:

```
2022-03-08T10:00:00;3
2022-03-08T10:10:00;3
2022-03-08T10:20:00;3
```

Fig. 50 – Example of elaborated Pasquill-Gifford stability class file.

4.2.9 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 Alpha-Log use the program 3DOM.
First, configure the protocol in the *Connectivity* section (§4.1.3). 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* (§4.1.7).

Possible topics to subscribe to are the following:

Argomento (topic)	**Descrizione**
device/<model>/<serial>/metrics/inst	Instant values
device/<model>/<serial>/metrics/elabs device/<model>/<serial>/config/metrics	Processed data 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 (ALP001 or ALP002, §6.1.1).
- <serial> is the instrument serial number (§6.1.1). If 3DOM's parameters *Alternative serial code* and *Use an alternative serial code* del *Registry* are set, serial number is set by the user (§4.1.1).

Messages are published with the following logics:

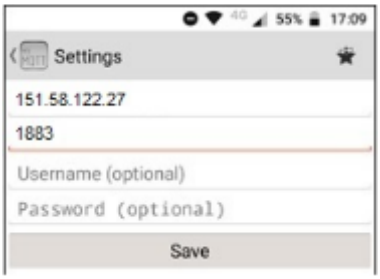
- *Instant values:* based on MQTT parameter *Inst. values publishing time rate* (§2.2.6.4).
- *Processed data:* based on the *Elaboration data delivery time rate* parameter (§4.1.7).
- *Header files*: sent before each dispatch of n consecutive *Processed data* messages.
- *Diagnostic data:* topic to be implemented.
- *Alarms:* based on the occurrence of an event.
- *Configuration:* when a new configuration is applied to the instrument.

4.2.9.1 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.

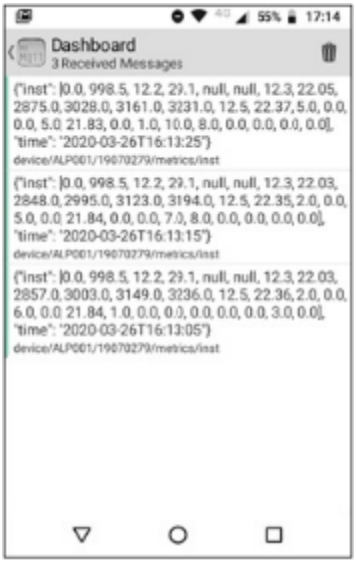
1. Press **[Connect]**.
2. Enter *Broker URL* and *Port* (ad es. 151.58.122.27 e 1883, §2.2.6.4).
3. Press **[Save]**.
4. Press **[Settings]**.



5. Press **[Subscribe]**.
6. Enter *Topic* (e.g. for instant values: *device/ALP001/19070279/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* (§2.2.6.4).



4.2.10 WEB server

Alpha-Log is equipped with an internal WEB server. Through an Internet browser, it's possible to connect to the data logger to visualize instant values, diagnostic information and the working state of the instrument. It's also possible to download the processed data files.
WEB server is not active by default. To activate it, follow the instructions reported at §2.2.7.1.

To connect to Alpha-Log, it is sufficient to set the data logger IP address (§2.2.5) in the address bar of the browser (e.g. http://192.168.0.1) and press Enter.

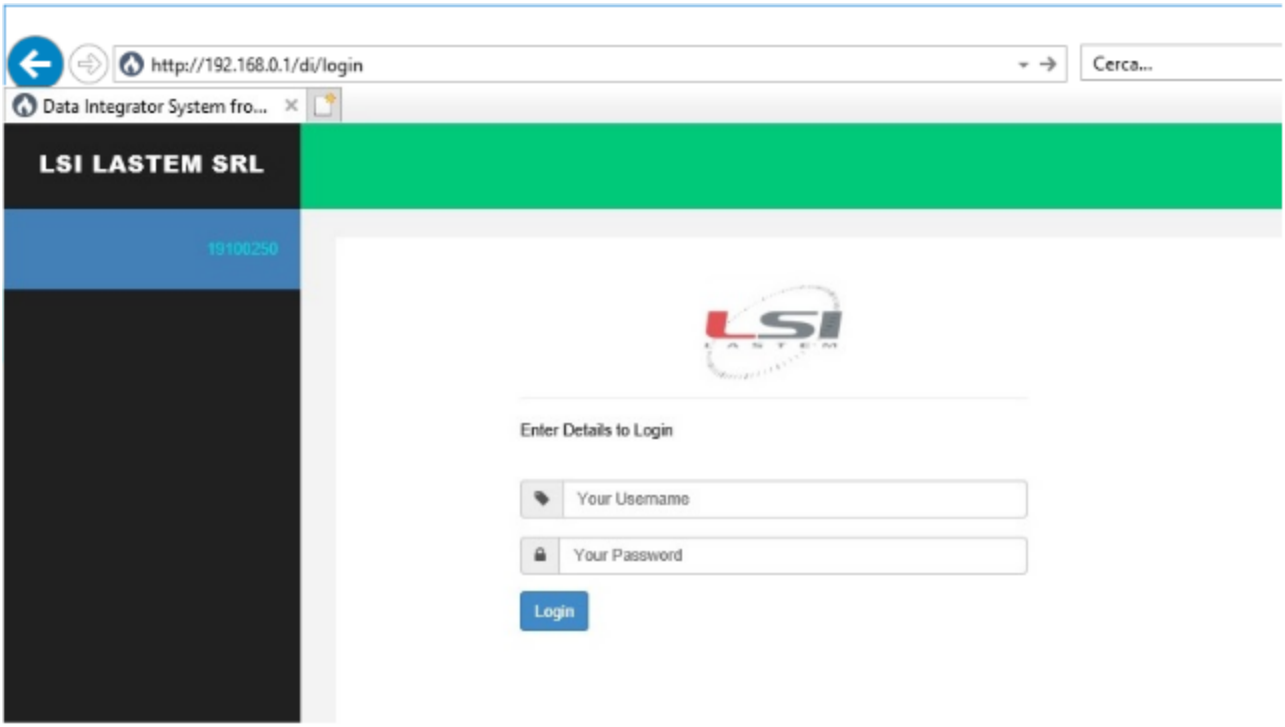


Fig. 51 – Login page.

Once *Username* and *Password* (specified in 3DOM §2.2.7.1) have been entered, user has access to the Dashboard, the main page. In the DASHBOARD are reported Alpha-Log's working state information.

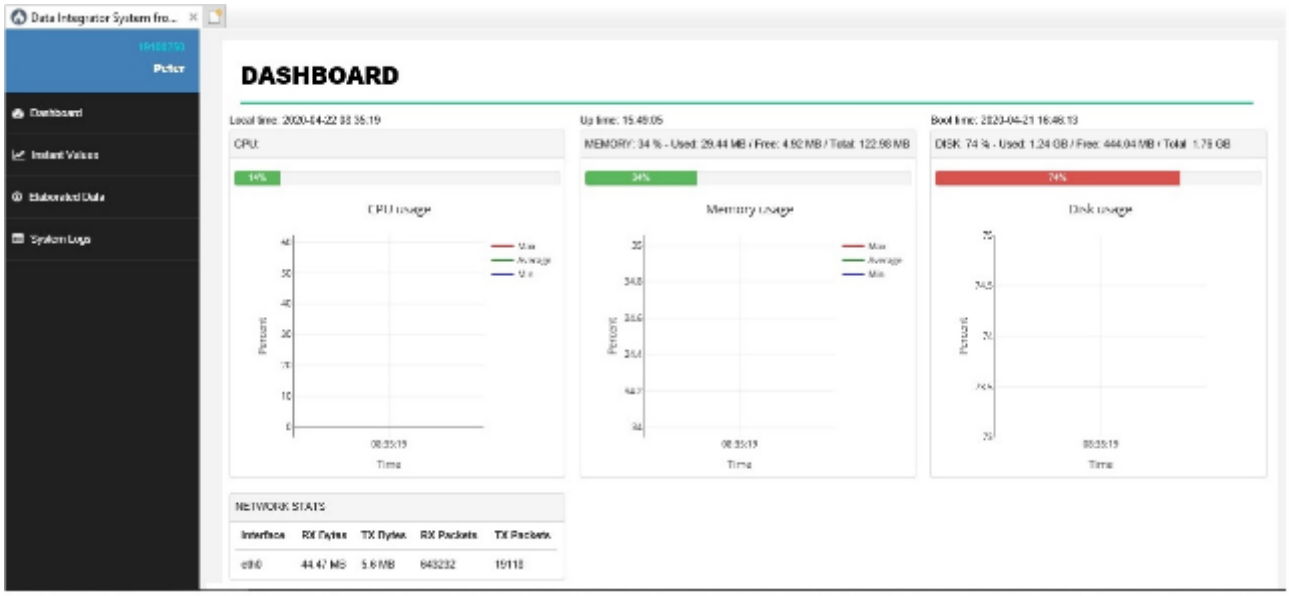


Fig. 52 – Main page where some information on Alpha-Log's functioning are displayed.

In the INSTANT VALUES page are displayed the measures values in table and graphic form.

Fig. 53 – INSTANT VALUES page with the instant values visualization.

In the ELABORATED DATA page it's possible to download Alpha-Log's data (*.csv) by specifying the time period.

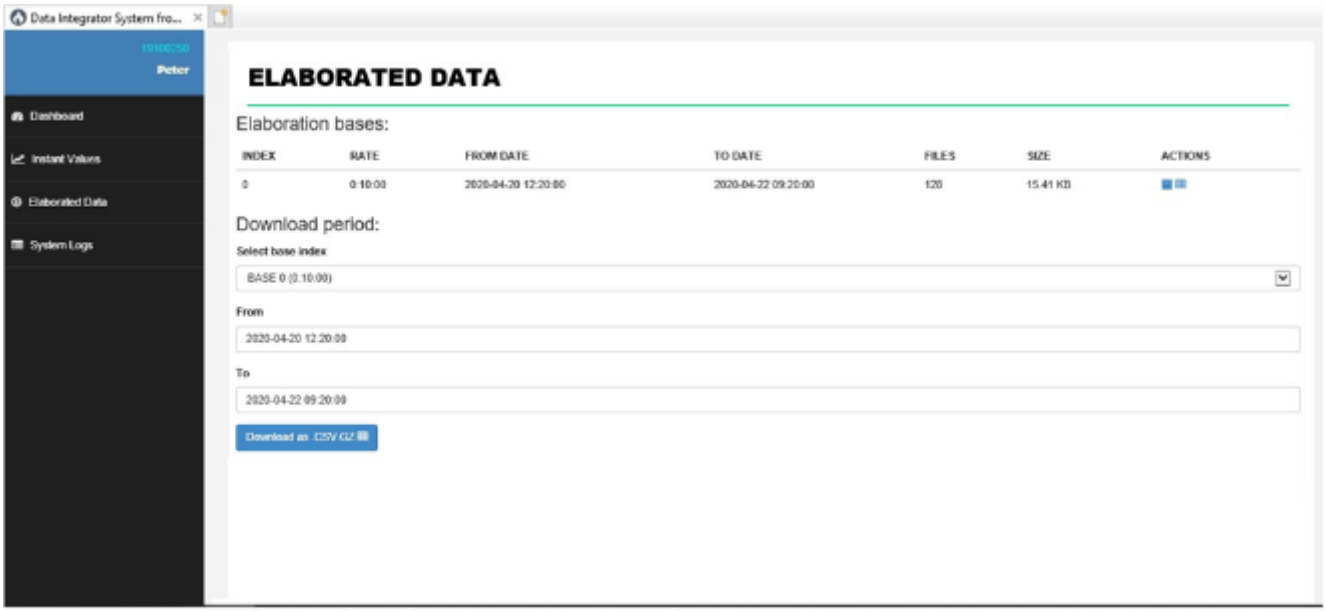


Fig. 54 – ELABORATED DATA page for the desired data extrapolation.

In the SYSTEMS LOGS page, it's possible to display the log files generated by Alpha-Log.

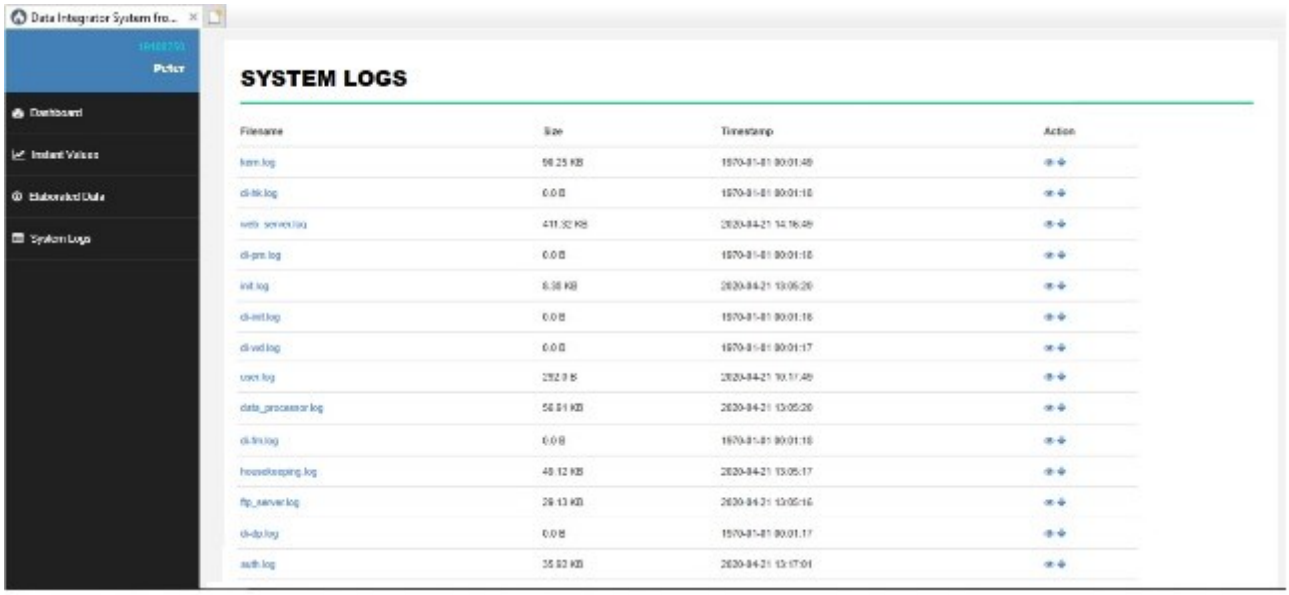


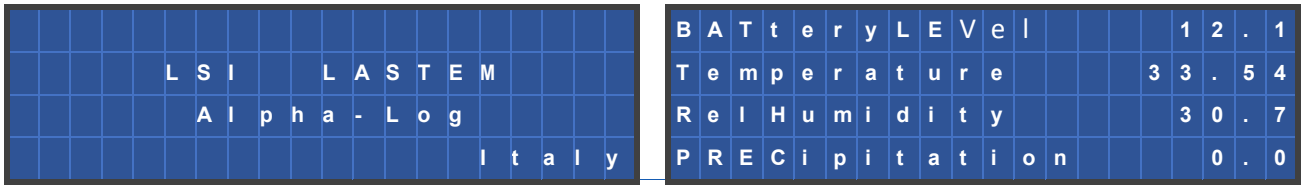
Fig. 55 – SYSTEM LOGS page for Alpha-Log's diagnostic.

Part 5

5.1 Keys, Menu and LEDs

5.1.1 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.



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

5.1.2 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* (§5.1.4.2) 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.

5.1.3 Operating status LEDs

On Alpha-Log'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.

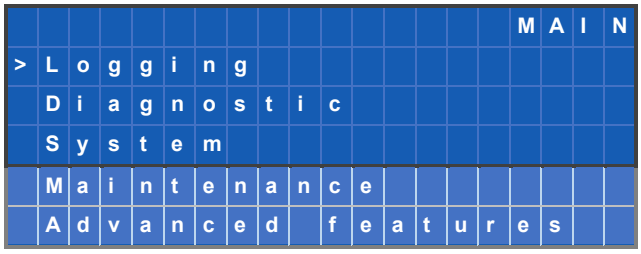
Batt

This LED is red and has the following meanings:

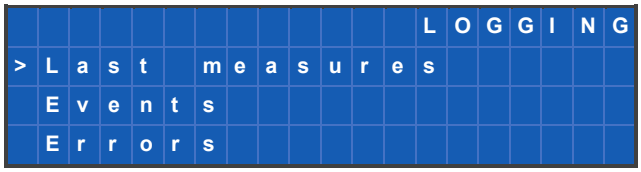
- *Steady on:* voltage is present from FV module and battery is not charged or it's disconnected.
- *Flashing*: voltage is present from FV module and battery is connected and charged.
- *Off*: voltage is not present from FV module or battery charged.

5.1.4 Menu navigation

From MAIN menu, the user can access Alpha-Log's several submenus.



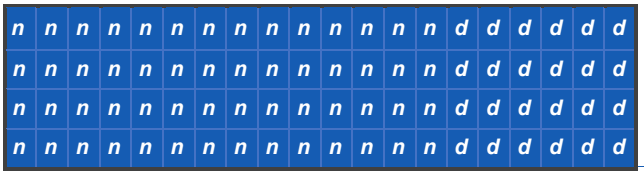
5.1.4.1 Logging



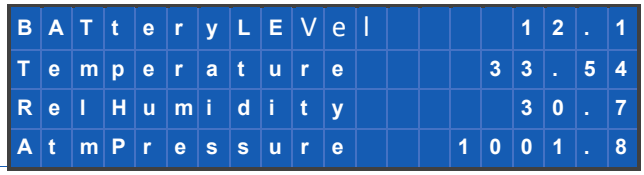
> Last measures

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.



Mask

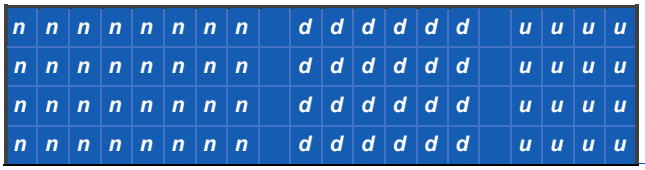


Example

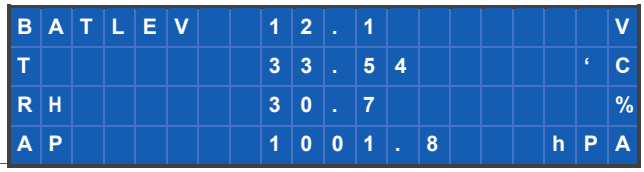
where:

- *nnnnnnnnnnnnnn*: is the name of the measure in expanded format.
- *dddddd*: 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.



Mask

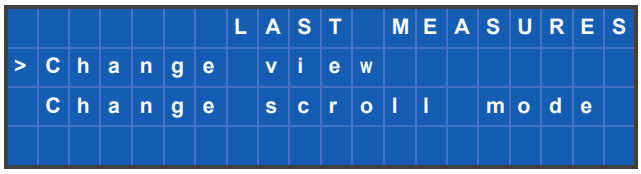


Example

where:

- *nnnnnnn*: 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 Alpha-Log's power-up.

dd/MM/yy hh:mm:ss
(x) ttttttttttttttttt
ttttttttttttttttttt
ttttttttttttttttttt

Mask

28/06/18 12:49:57
(L) Level ON: Lev 6.3 m

Example

where:

- *dd/MM/yy hh:mm:ss*: is the date and time an event occurred.
- *x*: A=action, L=logic.
- *ttttttttttttt…*: 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 Alpha-Log'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.

5.1.4.2 Diagnostic

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

DIAGNOSTIC
> Serial lines
Status
Actuators
Firmware

> 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.

The ALP003 model allows you to change the communication speed of the port by pressing the button 

COM n:						ssssss					
		BYTES					MSG				
RX	aaaaaaaaaa		bbbbbbb								
TX	ccccccccc		ddddddd								

Mask

COM2:					115200						
		BYTES					MSG				
RX		128360						3840			
TX		2647723	0					3841			

Example

where:

- *n*: is the instrument's serial port number
- *ssssss:* is the communication speed (9600, 19200, 38400, 57600, 115200 bps)
- *aaaaaaaaaa*: is the number of received bytes.
- *ccccccccc*: is the number of transmitted bytes.
- *bbbbbbb*: is the number of received messages.
- *ddddddd*: is the number of submitted messages.

> Status

This screenshot shows Alpha-Log's operative status. The displayed time considers the time zone.

DT dd/MM/yy hh:mm:ss											
RESET dd/MM/yy hh:mm											
STATUS: tttttttttttt											

Mask

DT 18/01/18 16:23:45											
RESET 23/11/17 14:52											
STATUS: run normal											

Example

where:

- *dd/MM/yy hh:mm:ss*: is the current date/time (it considers the time zone).
- *dd/MM/yy hh:mm*: is the last reboot date/time.
- *ttttttttttttt*: 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 §5.1.2.

ACTUATORS											
Status: xxx											
Output: 1^3											
Power In: dd.dd V											

Mask

ACTUATORS											
Status: 010											
Output: ^23											
Power In: 12.85 V											

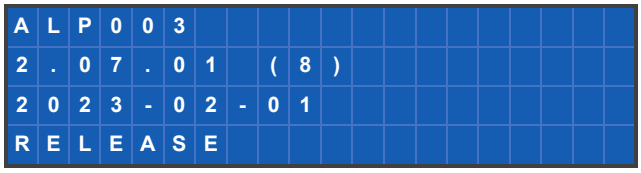
Example

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.

> Firmware

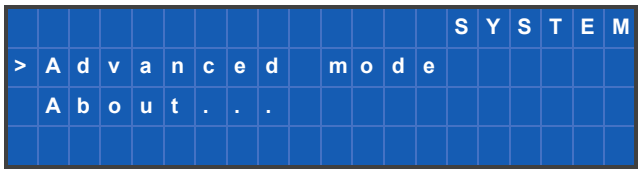
The mask displays the information relating to the Alpha-Log firmware.



5.1.4.3 System

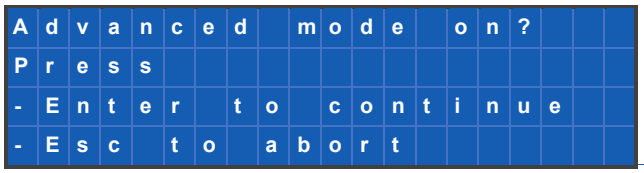
SYSTEM menu includes the command to enable Alpha-Log's specific functions that are disabled if low power mode is activated. It's also possible to display the instrument's identification data.

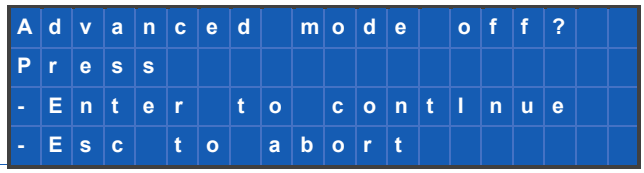
The menu shows up as follows:



> 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.





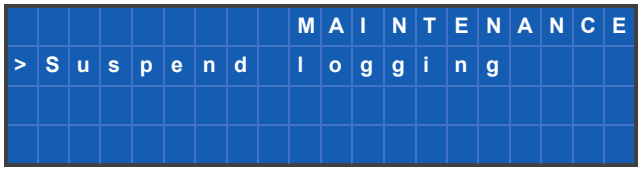
If the operation is not allowed in that moment, instrument will show the message "Denied now". In this case, try again after a few minutes.

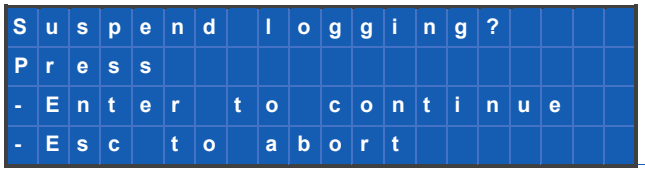
> About…

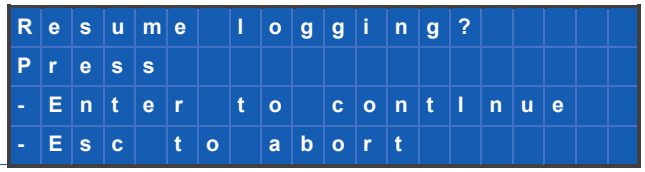
The item *About…* shows instrument's identification information (§6.1.1).

5.1.4.4 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. Alpha-Log doesn't send data during this time and elaborations made in this period of interruption may be in error.



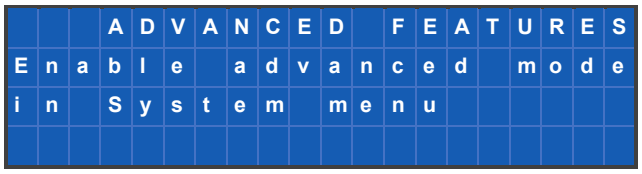




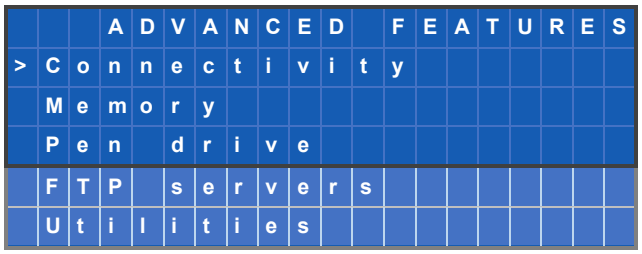
The feature automatically deactivates after 30 minutes. Upon deactivation, all activities resume regularly.

5.1.4.5 Advanced features

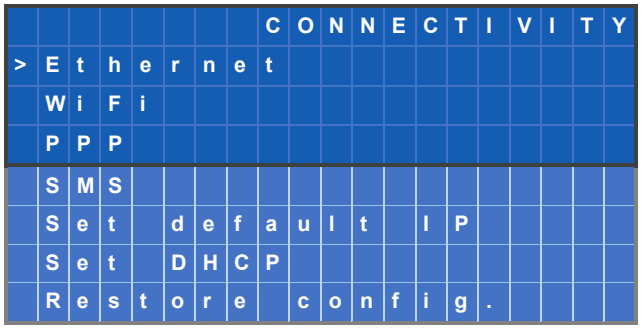
This menu functions are viewable only if they have been activated in the SYSTEM menu.



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

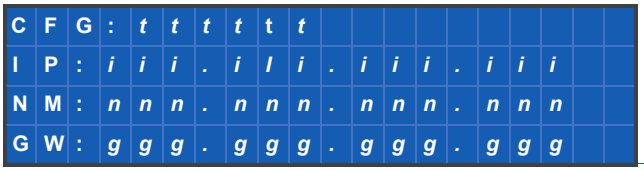


5.1.4.5.1 Connectivity

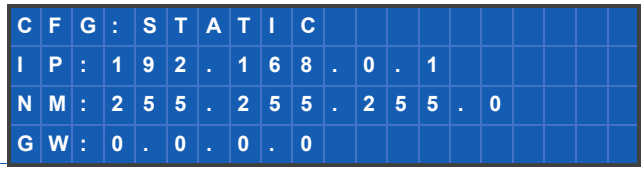


> Ethernet

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



Mask



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.

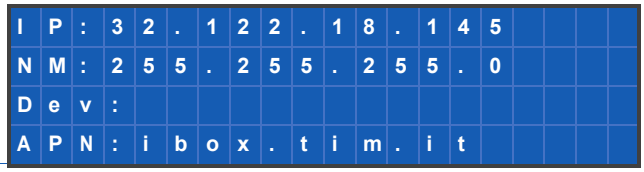
> WiFi

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

Mask



Example

where:

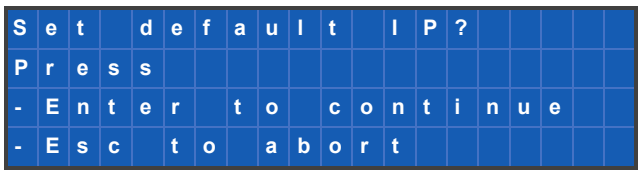
- *iii.iii.iii.iii*: is the IP address.
- *NM*: is the subnet screenshot.
- *Dev*: is the device attached to the modem (/dev/ttySP3 or /dev/ttyS1).
- *APN*: is the name of mobile phone operator's access point (Access Point Name) for the Internet connection.

> 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. It is retained even after a possible restart of the instrument.

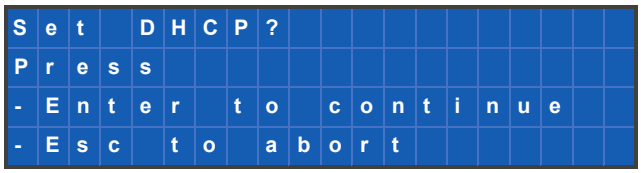


> Set DHCP IP

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.

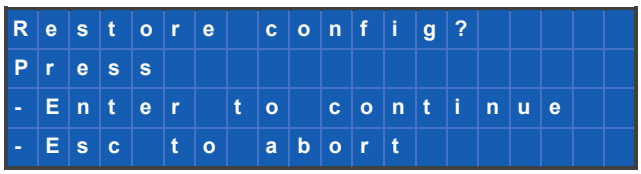
If Alpha-Log is connected to the network, it is possible to have its IP address assigned by the DHCP service through this mask.

The IP address is retained even after a possible restart of the instrument.



> Restore config

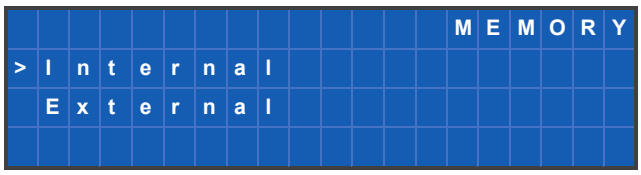
Using this mask you can restore the IP address specified in the configuration sent with the software 3DOM, after changing it manually with the *Set default IP* or *Set DHCP* commands.



5.1.4.5.2 Memory

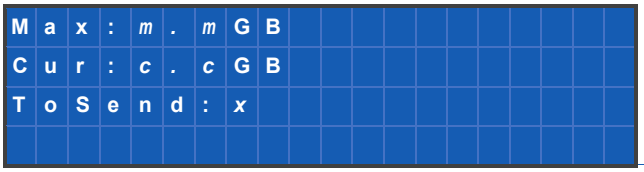
Alpha-Log is equipped with an internal memory where data and programs are stored. It's possible to extend memory capacity by inserting a USB pen drive in one of the two available ports.

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

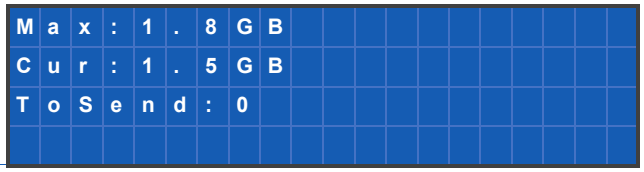


> Internal

Shows the instrument internal memory's information.



Mask



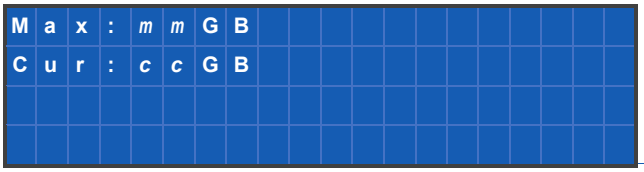
Example

where:

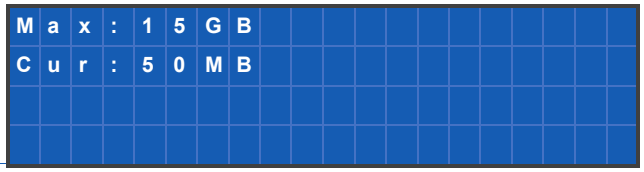
- *m.m*: is the memory capacity.
- *c.c*: is the occupied space.
- *x*: is the size of the data to be sent.

> External

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



Mask



Example

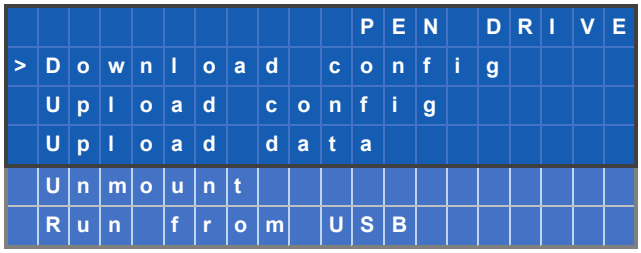
where:

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

5.1.4.5.3 Pen drive

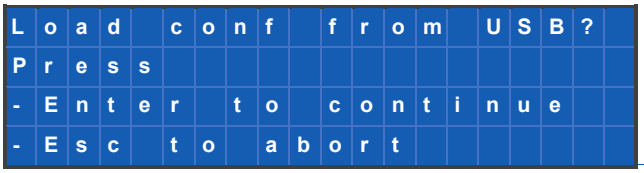
Alpha-Log's configuration and processed data can be saved on a USB pen drive. Using pen drive, it's also possible to change instrument's configuration and run scripts.

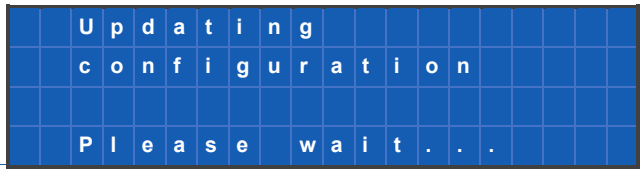
See §4.2.5.1 for more information on files generated by Alpha-Log.



> Download of the configuration file

In this screenshot it's possible to change Alpha-Log's configuration, downloading it from the USB pen drive.

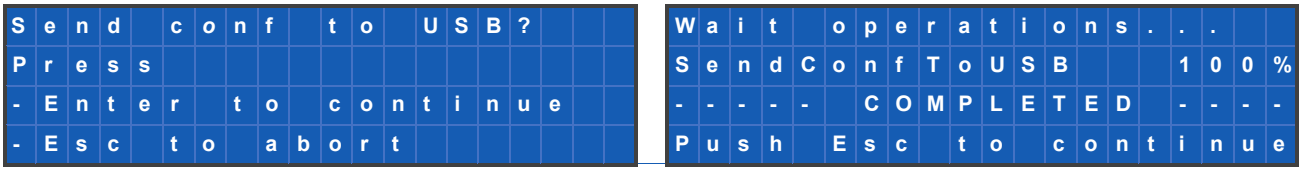




Wait a few minutes for the instrument to reboot with the new settings.

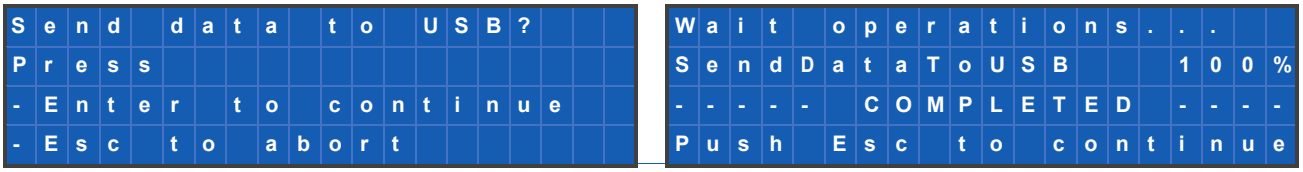
> Upload configuration file

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



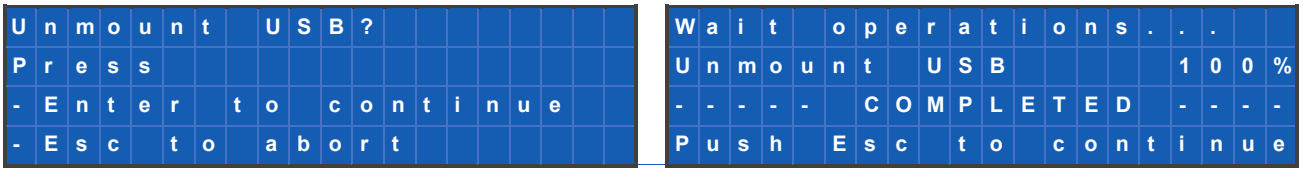
> Upload data files

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



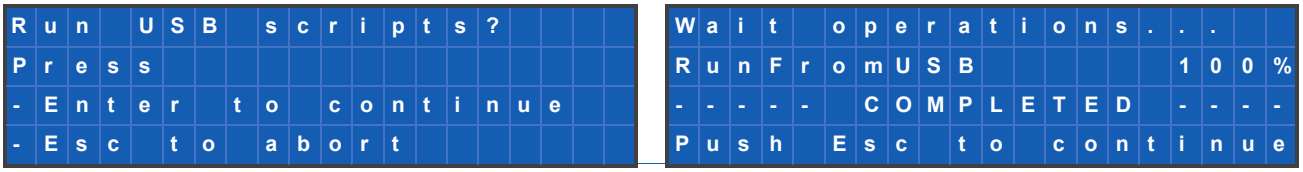
> Unmount

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



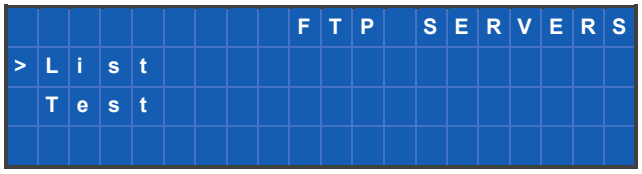
> Run from USB

Through this mask it is possible to execute the Alpha-Log programs contained in the USB pen drive.



5.1.4.5.4 FTP servers

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

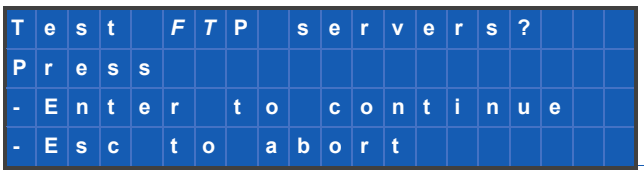


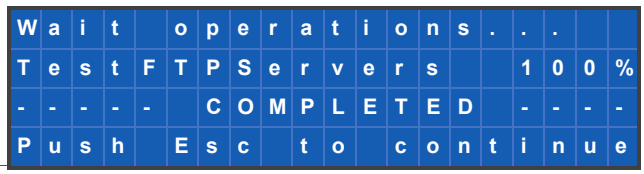
> List

Shows the names of the configured FTP servers.

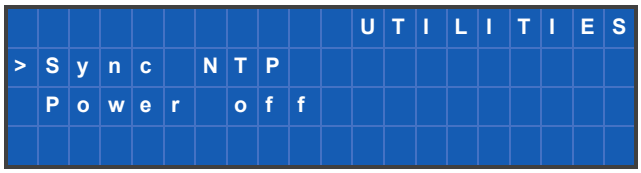
> Test

Runs a test to check if the FTP servers configured are available. Alpha-Log must be connected to the Internet.





5.1.4.5.5 Utilities

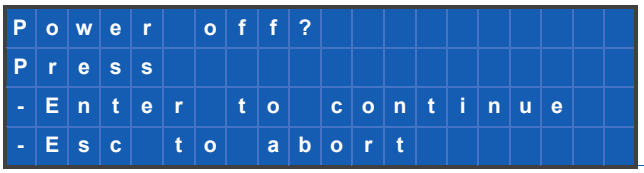


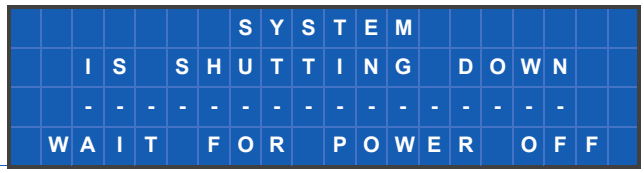
> Sync NTP

Performs clock synchronization with configured NTP sites. Alpha-Log must be connected to the Internet.

> Power off

Like any PC, also for Alpha-Log it is advisable to use the shutdown function instead of the On/Off switch. Although this practice is not strictly necessary, using it avoids the rare case of file system failure that can occur if a write operation is taking place in some critical file when the instrument is shut down by removing power. Loss of file system consistency causes the operating system to hang during its next boot.





To turn the instrument back on use the On/Off switch.

5.1.5 Navigation menu structure

MAIN

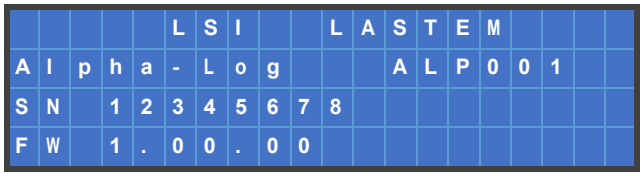
- Logging
  - Last measures
    - Change view
    - Change scroll mode
  - Events
  - Errors
- Diagnostic
  - Serial lines
  - Status
  - Actuators
  - Firmware
- System
  - Advanced mode
  - About…
- Maintenance
  - Suspend logging / Resume logging
- Advanced features
  - Connectivity
    - Ethernet
    - WiFi
    - PPP
    - SMS
    - Set default IP
    - Set DHCP
    - Restore config
  - Memory
    - Internal
    - External
  - Pen drive
    - Download config
    - Upload config
    - Upload data
    - Unmount
    - Run from USB
  - FTP servers
    - List
    - Test
  - Utilities
    - Sync NTP
    - Power off

Part 6

6.1 Diagnostics

6.1.1 Product identification

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



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

6.1.2 Troubleshooting

Below are listed the most common problems found using Alpha-Log.

❖ **Alpha-Log 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 Alpha-Log'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 Alpha-Log'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 Alpha-Log to charge the battery.
4. If the previous points didn't resolve the problem, there might be a hardware failure in Alpha-Log.

❖ **Alpha-Log's display is off**

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

❖ **PC won't communicate with Alpha-Log**

1. Ensure Alpha-Log is turned on (*Alpha-Log won't turn on* point).
2. Ensure advanced mode is on (§5.1.4.3).
3. Ensure the IP address indicated in 3DOM's communication parameters is Alpha-Log's one. To know Alpha-Log's IP address, see §5.1.4.5.1.
4. Check PC's IP address: it must be in the range of Alpha-Log's one. For example, if Alpha-Log 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 Alpha-Log'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 Alpha-Log's Ethernet port (also the PC one), one green and one yellow, are lit. If they aren't, Alpha-Log 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. Alpha-Log supports keys compatible with Linux kernels 2.6.35.3 or previous.
    b. Ensure the Wi-Fi connection parameters (§4.1.3– 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 Alpha-Log. Configuration's loading or downloading can also take place via USB pen drive (§4.1.11.2).

❖ **Measurement in Error status**

1. If the measure is acquired (analogic/digital sensor connected to Alpha-Log's the terminal block (10) or I^2C input (2)):
    a. Ensure Alpha-Log had enough time to acquire the measure. In this regard, see the measure's *Update time rate* parameter of the *Sampling* tab (§2.2.4).
    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 (§2.2.4).
    c. Ensure the sensor that generate the measure is connected to Alpha-Log according to the provided documentation. Alpha-Log's input shall be the one indicated in the measure configuration (§2.2.4).

d. the sensor is powered by an Alpha-Log'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 (§2.2.4).

2. If the measure is acquired via serial line (sensor connected to Alpha-Log'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 Alpha-Log'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.
   e. If the measurement is acquired by ALIEM and Alpha-Log has been reconfigured, turn off and power on ALIEM to reactivate its serial port.
   f. If the measure is acquired from Com2 serial port, to wich an E-Log data logger is connected, make sure that the acquisition rate on the Alpha-Log is less than or equal to 30 seconds since E-log, if not interrogated within this time, itt turns off its serial port.
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 (§2.2.4).

❖ **Alpha-Log 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 (§2.2.6.1).
2. Ensure Alpha-Log is connected to the Internet by running a connection test (§2.6). In case of failure, check the FTP protocol's connectivity parameters set with 3DOM (§2.2.6.1). If they are correct, run a connection test directly from the program. If this test fails as well, contact the FTP server's provider.

❖ **Alpha-Log won't send the data files to the FTP server and/or MQTT messsages**

1. Ensure Alpha-Log is in *Run normal* status, which is the normal operative status (§5.1.4.2, menu item: *Status*).
2. Ensure Alpha-Log had enough time to generate the elaborations. See parameter *Time* rate of the *Elaborations* tab (§2.2.4).
3. Ensure Alpha-Log had enough time to save/send the processed files. See *Elaboration data delivery time rate* and *Elaboration data delivery time rate in alarm condition* (§4.1.7).
4. For the FTP server:
   a. Ensure Alpha-Log is connected to the Internet by running a connection test (§0). In case of failure, check the FTP protocol's connectivity parameters set with 3DOM (§4.1.3). 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 Alpha-Log is configurated to connect to the Internet. See the configurated network interfaces (§4.1.3).

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 (§5.1.4.5.3).

❖ **Alpha-Log won't send e-mails in case of alarm**

1. Ensure Alpha-Log is configured to connect to the Internet. See the configured network interfaces (§4.1.3).
2. Ensure the SMTP server settings are correct (§4.1.3, SMTP) and that the specified account may be used for that purpose. For security reasons, some e-mail 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 e-mail transmission (§4.1.9). The conditions of activation of the e-mail transmission may not occur.
4. Ensure the entered mails are correct and active (§4.1.9).

❖ **Alpha-Log 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 (§4.1.3, PPP).
2. Check the parameters entered in the logic associated with the SMS transmission (§4.1.9). The conditions of activation of the SMS transmission may not occur.
3. Ensure the entered recipient's telephone number is correct and active (§4.1.9).
4. Ensure the SIM is active, enabled for message transmission and has enough credit.
5. Check the modem connection to Alpha-Log, as well as its power supply.

❖ **Alpha-Log won't send MQTT messages in case of alarm**

1. Ensure Alpha-Log is configured to connect to the Internet. See the configured network interfaces (§4.1.3).
2. Ensure the MQTT server settings are correct and the *Publish alarms* parameter is activated (§4.1.3, MQTT).
3. Check the parameters entered in the logic associated with the MQTT messages transmission (§4.1.9). 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. Alpha-Log's status screenshot provides information about the last reset, the operating mode and the power supply voltage (§5.1.4.2, Status). If data logger is in the "Run limited" status (*Low power* mode), it will not send data (§4.1.2).

1. If Alpha-Log is powered by a power supply and does not have a battery:
   a. Check the wires that connect Alpha-Log 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 Alpha-Log 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 Alpha-Log is powered by battery and photovoltaic panel:

a. Check the wires that connect Alpha-Log to the battery and the photovoltaic panel. On of them might be loose.
b. Check the battery status. If it's damaged, replace it. If it's low, check panel's efficiency. Alpha-Log charges the battery only if the panel provides at least a 17 V voltage.

6.2 Maintenance

Alpha-Log 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 (Alpha-Log and the sensors connected), in order to detect and fix possible measurement errors.

6.3 Handling

Avoid the introduction of electrostatic discharge (ESD). The product, or part of it, is fragile, avoid mechanical shocks, abrasions or scratches on the surface and display.

6.4 Storage, packaging, preservation, delivery

For storage, respect the humidity (10÷100% non-condensing) and temperature (-40÷80 °C) limits. Avoid direct sun exposure.
For delivery and storage, use the packaging supplied with the product.
For preservation, it is recommended to respect the environmental limits of humidity (15÷80% non-condensing) and temperature (-30÷60 °C). Alpha-Log has an internal Li 3V battery. The time limit is 10 years.
Upon receipt of the material, visually check the package for signs of crushing or perforation; in the presence of these signs, check the integrity of the product inside.

6.5 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.

Recycle or dispose of the packaging material according to local regulations.

6.6 Contacting LSI LASTEM

LSI LASTEM offers its assistance service at support@lsi-lastem.com, or filling out the *Request for technical assistance module*, downloadable from 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), Italy
- Website: www.lsi-lastem.com
- Commercial service: info@lsi-lastem.com
- Post-sale service: support@lsi-lastem.com

Alpha-Log configuration templates

Type 1 configuration: Alpha-Log + ALIEM

Alpha-Log	
Sensor	**Quantity**
DQA230.1	Rain
DMA672.1	Temperature+UR
DLE041	Ground temperature
DQA340	Water content
-	Pressure (internal)
-	Temperature (internal)
ALIEM	
Sensor	**Quantity**
DNA121	Wind Speed+Dir
DPA154	Global Rad.
DQC102	Evaporation
DLE124	Contact temperature
DQC001.15	Water level

Sensor code	Measure (UM)	Acq. rate hh:mm:ss	Elaborations (rata hh:mm – tipo)	Alpha-Log input
DQA230	RAIN (mm)	00:01:00	00:10 – Tot 01:00 – Tot 24:00 – Tot Last 10 min – Mobile tot Last 60 min – Mobile tot	Pul/Fr/St1
DMA672.3	Temperature (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd 24:00 - Min, Med, Max, DevStd	TTL Serial
	RelHumidity (%)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	
DLE041	Temperature (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd Last 60 min – Mobile med	Pt100
DQA340	VolMoisture (%)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	Analog In
	SOILTemp (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd Last 60 min – Mobile med	
-	AtmPres (hPa)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - 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

DNA121	WindSPEED (m/s)	00:00:02	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	Serial 2 (ALIEM)
	WindDIR (°N)	00:00:02	00:10 - DirPrev, DirRis, VelRis, DevStdDir, %Calm 01:00 - DirPrev, DirRis, VelRis, DevStdDir, %Calm	
DPA154	GLOBalRad (W/m^2)	00:00:10	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	
DQC102	EVAPLevel (mm)	00:00:10	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	
	EVAPoration (mm)	00:00:10	00:10 – Tot 01:00 – Tot	
DLE124	TeSURFace (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	
DQC001.15	LEVEL (m)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd Last 60 min – Mobile min Last 60 min –Mobile max increase	

Type 2 configuration: Alpha-Log + AIO (rain)

Alpha-Log	
Sensor	**Quantity**
DMA672.1	Temperature+UR%
DQC001.15	Water Level (Piezo)
DNB301	Wind Speed Wind Direction Temperature UR% Absolute pressure Rain
	Temperature (internal)

Sensor code	Measure (UM)	Acq. rate hh:mm:ss	Elaborations (rata hh:mm – tipo)	Alpha-Log input
DMA672.3	Temperature (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd 24:00 - Min, Med, Max, DevStd	TTL Serial
	RelHumidity (%)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	
DQC001.15	LEVEL (m)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd Last 60 min – Mobile min Last 60 min – Mobile max increase	Analog In

DNB301	WindSPEED (m/s)	00:00:01	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	Seriale 2
	WindDIR (°N)	00:00:01	00:10 - DirPrev, DirRis, VelRis, DevStdDir, %Calm 01:00 - DirPrev, DirRis, VelRis, DevStdDir, %Calm	
	AIRTemp (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd 24:00 - Min, Med, Max, DevStd	
	RELHumid (%)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	
	ATMPress (hPa)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	
	RAIN (mm)	00:01:00	00:10 – Tot 01:00 – Tot 24:00 – Tot Last 10 min – Mobile tot Last 60 min – Mobile tot	
-	INSideTemp (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	On board

Type 3 configuration: Alpha-Log + AIO (radiation)

Alpha-Log	
Sensor	**Quantity**
DQA230.1	Rain
DMA672.1	Temperature+UR%
DQC001.15	Water level
DNB302	Wind Speed Wind Direction Temperature UR% Atm. Pressure Global radiation
	Temperature (internal)

Sensor code	Measure (UM)	Acq. rate hh:mm:ss	Elaborations (rata hh:mm – tipo)	Alpha-Log input
DQA230.1	RAIN (mm)	00:01:00	00:10 – Tot 01:00 – Tot 24:00 – Tot Last 10 min – Mobile tot Last 60 min – Mobile tot	Pul/Fr/St1
DMA672.3	Temperature (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd 24:00 - Min, Med, Max, DevStd	TTL Serial
	RelHumidity (%)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	

DQC001.15	LEVEL (m)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd Ultimi 60 min – Mobile min Ultimi 60 min – Mobile max increase	Analog In
DNB302	WindSPEED (m/s)	00:00:01	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	Serial 2
	WindDIR (°N)	00:00:01	00:10 - DirPrev, DirRis, VelRis, DevStdDir, %Calm 01:00 - DirPrev, DirRis, VelRis, DevStdDir, %Calm	
	AIRTemp (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd 24:00 - Min, Med, Max, DevStd	
	RELHumid (%)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	
	ATMPress (hPa)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	
	GLOBalRad (W/m^2)	00:00:10	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	
-	INSideTemp (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	On board

Type 4 configuration: Alpha-Log + sonic anemometer

Alpha-Log	
Sensor	**Quantity**
DQA230.1	Rain
DMA672.1	Temperature+UR%
DPA863	Global Rad.
DNB305	Wind Speed+Dir
	Pressure
	Internal temperature

Sensor code	Measure (UM)	Acq. rate hh:mm:ss	Elaborations (rata hh:mm – tipo)	Alpha-Log input
DQA230.1	RAIN (mm)	00:01:00	00:10 – Tot 01:00 – Tot 24:00 – Tot Last 10 min – Mobile tot Last 60 min – Mobile tot	Pul/Fr/St1
DMA672.3	Temperature (°C)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd 24:00 - Min, Med, Max, DevStd	TTL Serial
	RelHumidity (%)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	
DPA863	GLOBalRad (W/m^2)	00:00:10	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	Analog In

DNB305	WindSPEED (m/s)	00:00:01	00:10 - Min, Med, Max, DevStd 01:00 - Min, Med, Max, DevStd	Serial 2
	WindDIR (°N)	00:00:01	00:10 - DirPrev, DirRis, VelRis, DevStdDir, %Calm 01:00 - DirPrev, DirRis, VelRis, DevStdDir, %Calm	
-	AtmPres (hPa)	00:01:00	00:10 - Min, Med, Max, DevStd 01:00 - 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

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

Input Types: Modbus RTU Master

Parameter	Value
Communication port	COM2
Speed	115200
Parity	None
Stop bits	1.0
Timeout	1000
Retries	2

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

Alpha-Log models

Code	DLALA0100/DLALA0100.1/DLALB0100	MDMMB1110/ MDMMB1110.1 (optional)
Description	Alpha-Log data logger	ALIEM-Inputs Extension Module
Analogic inputs	1 (1 ÷ 2000 mV dc)	8 differentials (16 single ended)
Digital inputs	2	4 (on/off or frequency/counter)
RS-232 ports	2	2 (1 for MDMMB1110.1)
USB ports	2	NO
RS-485 port	1	1 (only for MDMMB1110.1
SDI-12 port	1	NO
Integrated barometric sensor	YES	NO
Integrated temperature sensor	YES	YES
On/off outputs	YES	YES
Included accessories	Ethernet cable, DIN rod attachment	RS-232/USB adapter, RS-232 cable, DIN rod attachment
Power supply	6 ÷ 30 Vdc	8 ÷ 14 Vdc

Technical characteristics

	Type	Range	Resolution	Uncertainty (@ 25°C)
Analogic inputs on optional external module MDMMB1110 / MDMMB1010.1	Voltage	-300 ÷ 1200 mV	40 µV	±160 µV
		±78 mV	3 µV	±30 µV
		±39 mV	1,5 µV	±15 µV
	Pt100	-50 ÷ 70 °C	0,003 °C	±0.1 °C
		-50 ÷ 600 °C	0,011 °C	±0.3 °C
		0 ÷ 6000 Ω	0.1 Ω	±1.5 Ω
	Thermocouple	E-IPTS 68	< 0.1 °C	±0.6 °C
		J-IPTS 68	< 0.1 °C	±0.6 °C
		J – DIN	< 0.1 °C	±0.6 °C
		K-IPTS 68	< 0.1 °C	±0.5 °C
		S-IPTS 68	0.22 °C	±2.0 °C
		T-IPTS 68	< 0.1 °C	±0.5 °C
	Inputs number	8 differentials (16 single-ended)		
	ESD protections	±8 kV contact discharge IEC 1000–4-2		
	Max input signal	1.2 V		
	EMC	EN61326-1 2013		
	Temperature error (@-10 ÷ 30°C)	300 ÷ 1200 mV < ±0.01 % FSR, ±39 mV < ±0.01 % FSR, ±78 mV < ±0.01 % FSR		

Impulsive / frequency inputs on external optional module MDMMB1110 / MDMMB1110.1	Inputs number	4
	Function	4 frequency inputs/counters/On/off logic state (0 ÷ 3 Vdc): • 2 for optoelectronic sensors, max 10 kHz • 2 inputs max 1 kHz
	Uncertainty	3 Hz @ 5 kHz
	Protection	Transient voltage suppressor 600 W, <10 µs
Impulsive / frequency inputs	Inputs number	2
	Inputs mode	• 2 two pluviometers single reed relays • 1 double reed relay pluviometer • 2 frequency inputs from two optoelectronic anemometers • 1 relay reed from one rain gauge and 1 frequency input from optoelectronic anemometer
	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 for impulsive inputs • 10 kHz for frequency inputs
	Linearization	YES (with intensity correction formula for Class A pluviometers - UNI EN 17277:2020)
	Protections	Against reed relay pulses train Tension (> 5V) 400 W peak pulse power capability at 10/1000 µs waveform Repetition rate (duty cycle): 0.01 %. IEC-61000-4-2 ESD 30 kV (air), 30 kV (contact) ESD protections of IEC 61000-4-2 data line EFT protections of IEC 61000-4-4 data line

Input (relative humidity temperature sensor)	Input	UART-TTL (from sensor DMA672.1/.4)
	Range	Temperature: -40 ÷ 70 °C Relative Humidity: 0 ÷ 100 % Dew Point: -40 ÷ 70 °C
	Resolution	Temperature: 0.1 °C Relative Humidity: 0 ÷ 100 % Dew Point: 0.1 °C

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

Voltage input	Input	Voltage
	Range	1 ÷ 2000 mV
	Resolution	12 bit
	Accuracy	1.8 mV

Internal measure (barometric pressure)	Range	300 ÷ 1100 hPa
	Resolution	Typically 0.084 hPa
	Accuracy	±0.15 hPa (@25 °C, 750 hPa) ±0.25 hPa (@-20 ÷ 85 °C, 300 ÷ 1100 hPa)
	Long term stability	±1 hPa/year

Internal measure (power supply)	Mode	Battery level or powering
	Type	Voltage

SDI-12 input	Type	V1.1 compliant

	Protections	• Opto-isolated
		• Protection against self-restorable PTC fuses overcurrent
		• IEC-61000-4-2 ESD 30 kV (air), 30 kV (contact)
		• DATA-SDI12 line protection with gas suppressor and digital isolation:
		  ○ 1-2 kA of impulsive current capacity tested with an impulse of 8/20 µs as defined in IEC 61000-4-5
		  ○ Conform to ITU-T K12, IEC 1000-4-5
		  ○ Data lines isolated up to 4000 V peak and up to 2500 Vrms for one minute

RS-485 input/output	Inputs number	1
	Mode	• Connection to input terminal board (MDMMB1110.1) • Connection to sensors (Modbus RTU - Master protocol) • Connection to SCADA/PLC systems (Modbus RTU - Slave protocol)
	Powering	Isolated 3 kVdc

RS-232 input/output	Inputs number	2
	Mode	• Connection to input terminal block (MDMMB1110) • Connection to communication systems (2G/3G modem, radio) • Connection to SCADA/PLC systems (Modbus RTU - Slave protocol) • Connection (Com.2) to thunderstorm sensor (DQA601.1)

USB input/output	Ports number	2
	Type	Host, type A connector
	Mode	• External memory pen-driver connection • Wi-Fi antenna connection (optional)

Powered and actuated outputs	Outputs number	3 (programmable actuation)
	Type	High-side driver for output V out = V n
	Maximum current	1.1 A for each actuator
	Mode	• External sensors powering • Communication systems powering • Threshold exceeded alarm devices powering • Timer (date/time o cyclical)
	Protections	400 W peak pulse at 10/1000 µs waveform Repetition rate (duty cycle): 0.01 %.

Memory	Type (only for DLALB0100)	Two levels of memorization for more reliability: 1. 8 GB on micro-SD (5 GB available for data) with EXT4 file system 2. Up to 32 GB data on USB memory with FAT32 file system
	Type (only for DLALA0100)	Two levels of memorization for more reliability: 1. 400 MB data on Flash chip with UBIFS file system 2. Up to 32 GB data on USB memory with FAT32 file system

User interface	Display	57 x 19 mm, 4 lines x 20 char
	Keyboard	4 buttons
	LED	Diagnostic: • Data transmission activity • System status • Battery charge status • Computer status (OK/Error)

Clock	Accuracy	1 minute/month
	Synchronization	Automatic, da Internet time (NTP)

ADC	Resolution	12 bits oversampled up to 14 bit
	Filter	Noise filtering 50/60 Hz

Data transmission	Modem	External 3G/4G modems (connection to RS-232 port)
	Router	3G-4G/External radio (connection to Ethernet port)
	Wi-Fi	External antenna (connection to USB port)

Watchdog	Type	Redundant watchdog system

Linux computer	Type	Linux based on computer with open and user extendable architecture
	Processor	32 bit
	Powering mode	• Always ON (always connected to the Internet) • Automatic ON (activation triggered by data transmission, improving the energy consumption)
	Linux kernel	V. 5.15, Debian Distribution (for DLALB0100) V. 2.6.35, Debian Distribution (for DLALA0100)
	Ethernet	Ethernet 10/100 Mbps
	USB port	2 USB connectors, Host, Type-A
	Memory	See above sect. memory
	RAM	128 MB

Power supply	Voltage	6 ÷ 30 Vdc, max. consumption in operation: 170 mA @ 12 V
	Inputs	• Separated by powering 6 ÷ 30 Vdc: • From solar panel (17 Vmin); maximum input current 5 A; charge voltage 13.8 V • From battery /power grid; maximum current 5 A
	Voltage capacity pulse peak	400 W pulse dissipation's peak power capacity with 10/1000 waveform Repetition rate (duty cycle): 0.01 %
	Battery charger	17 V min
	Protections	• IEC-61000-4-2 ESD 30 kV (air), 30 kV (contact) • Protection against self-restorable PTC fuses overcurrent • Reverse polarity protection • Power input overvoltage protection over 33 V • 400 W pulse dissipation's peak power capacity with 10/1000 waveform.

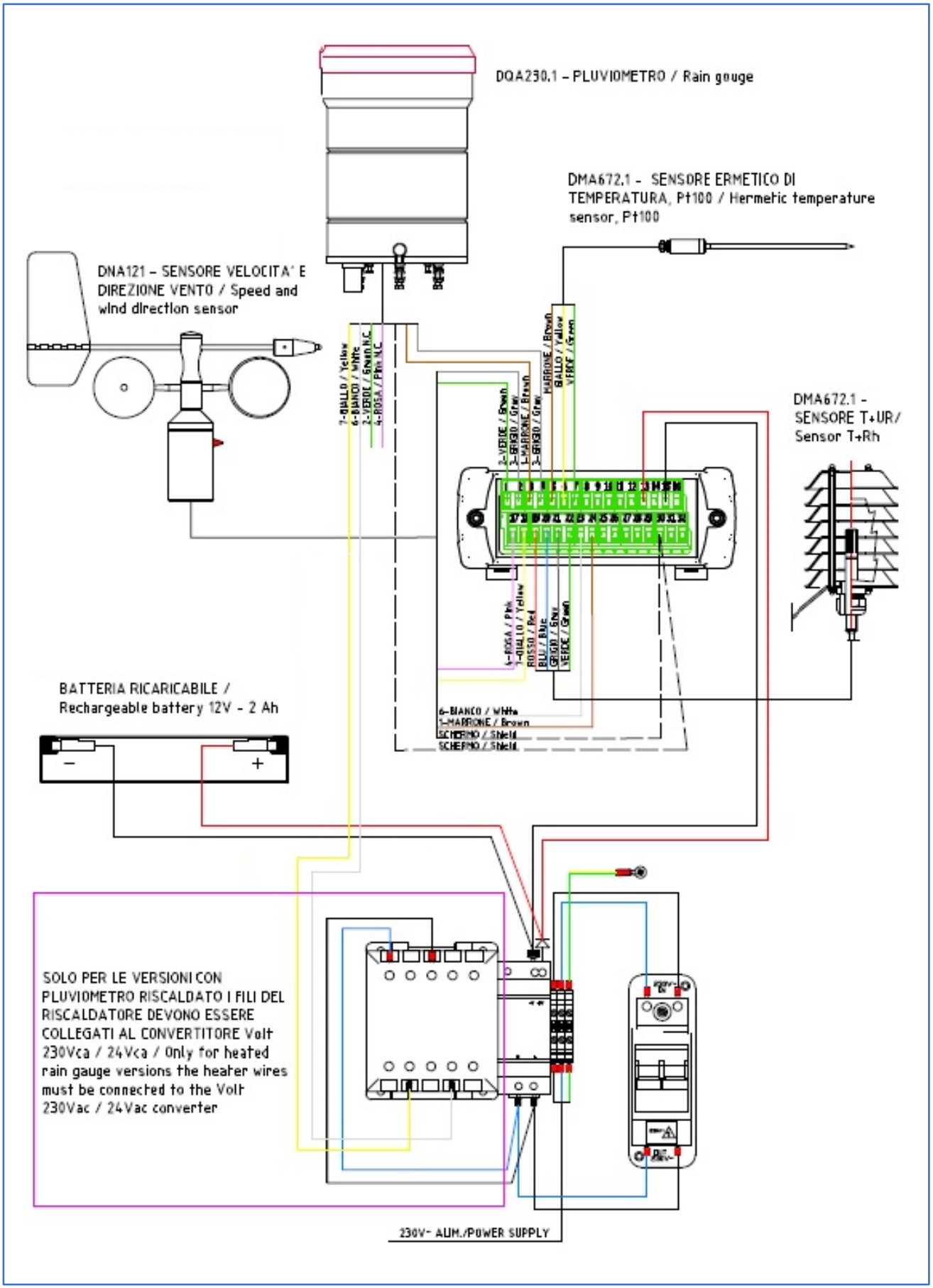
Environmental limits	Operative temperature	-30 ÷ 60 °C
	Operative humidity	10 ÷ 99 % RH, without condensation (*conformal coating* option)
	Storage temperature	-40 ÷ 80 °C

Physical parameters	Weight	600 g
	Dimensions	160 x 125 x 50 mm
	Mounting	On DIN rod 35 mm

EMC	Protections	EN61326-1 2013

RoHS	Compatibility	CEI EN 50581_01 2013

Generic connection scheme



Dichiarazione di conformità / Declaration of conformity

Oggetto / *Subject*

Codice prodotto / Product code: DLALA0100.1

Descrizione / *Description*

Datalogger ambientale / Environmental datalogger

Fabbricante / *Manufacturer*

LSI LASTEM Srl

Via ex S.P. 161 loc. Dosso 9

20049 Settala (MI) – Italy

Dichiarazione / *Declaration*

Dichiariamo che i prodotti oggetto di questo documento sono stati progettati in accordo e compatibilmente alle seguenti Direttive Europee e norme armonizzate / *We declare that the products covered by this document have been designed in compliance with the following European Directives and harmonized standards:*

2014/30/EU – Direttiva sulla compatibilità elettromagnetica EMC / *EMC electromagnetic compatibility directive.*

EN 61000-6-1: 2007, EN 61000-6-2: 2005– Norme generiche relative all'immunità elettromagnetica riferita ad ambienti residenziali ed industriali / Generic standards for electromagnetic immunity in residential and industrial environments.

EN 61000-6-3: 2007+A1:2011+AC:2012, EN 61000-6-4: 2007+A1:2011 – Norme generiche relative alle emissioni elettromagnetiche riferita ad ambienti residenziali ed industriali / Generic standards for electromagnetic emissions in residential and industrial environments.

2011/65/EU – Direttiva sulla restrizione dell'uso di determinate sostanze pericolose nelle apparecchiature elettriche ed elettroniche. (I nostri prodotti non contengono sostanze definite altamente preoccupanti come definito nell'Art. 33) / *The Restriction of Hazardous Substances Directive. (Our products don't contain the "substances" & "preparations" (Article 33) or release any substances.*

EN 61326-1:2013 – Apparecchi elettrici di misura, controllo e laboratorio – Prescrizioni di compatibilità elettromagnetica – Parte 1: Prescrizioni generali / *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements*

Il Legale Rappresentante / *Legal Representative*

Andrea Certo

15/01/2021