High precision digital barometer

User manual

Revisions list

Issue	*Date*	*Description of changes*
Origin	11/10/2019	Rif. R10.8
1 (A)	26/02/2021	Added instructions to change the offset
2	03/11/2023	Modified power supply; made minor changes
3	29/11/2024	Updated Modbus map, 7-pin cable wire colours and technical specifications; made minor changes

About this manual

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Summary

1 Introduction

DQA251 is a very high accurate digital barometer developed for specific applications. It provides a reliable measure of absolute pressure in a wide range of applications through dedicated electronic with Linux on board.
It is available with a lot of digital outputs as LAN Ethernet, ModBus, RS485, RS232 for an easy interface with a high number of devices i.e. PCs in control rooms and so on. Other protocols are available on request (SDI12, NMEA etc).
A lot of calculated measures are available as QNH, QFE, QFF, calculated according to WMO CIMO/ET – Stand-1/Doc.10 (20.XI.2012).
The numerical value of all measures is available on the local display and in remote but are also available on the web pages inside the instrument together to graphical representation. It has also a large memory inside which permit to store up one-three year of data for post collecting.

DQA251 is available with one-two or three pressure transduced for an improving of the resulted measure.
A special calibration procedure with three dimensional algorithms, permits to have high accuracy on a wide range of temperature.

DQA251 permits to read immediately its measures in many ways, on display, on web pages, on RS232 (autosending each 1 second), on RS485 ModBus, on TCP-IP ModBus, via socket or collect data via FTP. The stored data are available in ASCII file format or CSV.

DQA251 uses an absolute pressure transducer (from 1 to three) with a capacitive principle, automatically compensated in temperature trough a complex 3D algorithm into a climatic chamber. High frequency measures, in different condition of pressure and temperature, permit to create a three-dimensional plane in which each point represent the real pressure, and each point is automatically compensated. This is made for each transducer in each barometer.

DQA251 is able to calculate the QNH and QFF using a standard temperature value (15°C) or with real external temperature, coming from an air temperature sensor connected directly to the barometer (option on request).

1.1 Characteristic applications

- Industrial and environmental monitoring
- Aviation with calculated measure of QNH, QFE, QFF according to WMO: CIMO/ET – Stand-1/Doc.10 (20.XI.2012)
- Easy to interface and collect data also via web pages
- Easy to mount with specific accessories for poles, din rail etc
- IP68 connectors in an IP67 enclosure
- Different type of digital outputs available
- Low power consumption
- Possibility to use standard temperature for Q code calculation or with external air temperature from sensor

1.2 Contents of the package

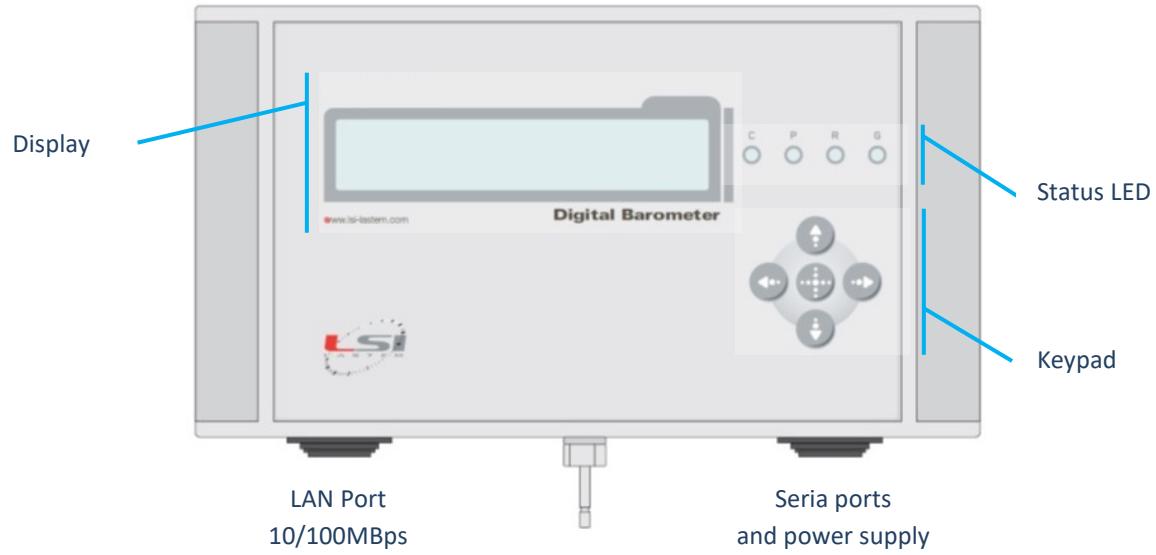
Before the installation check that the contents of the package correspond to the following:

- N° 1 DQA251 complete with two IP68 resin connectors, on at 4 wires and one at 7 wires
- N° 1 crossed RJ45 Ethernet cable with IP68 connector (LAN cross cable)
- N° 1 cable with free wires with IP68 connector
- Calibration report with annual validity from the first active configuration.

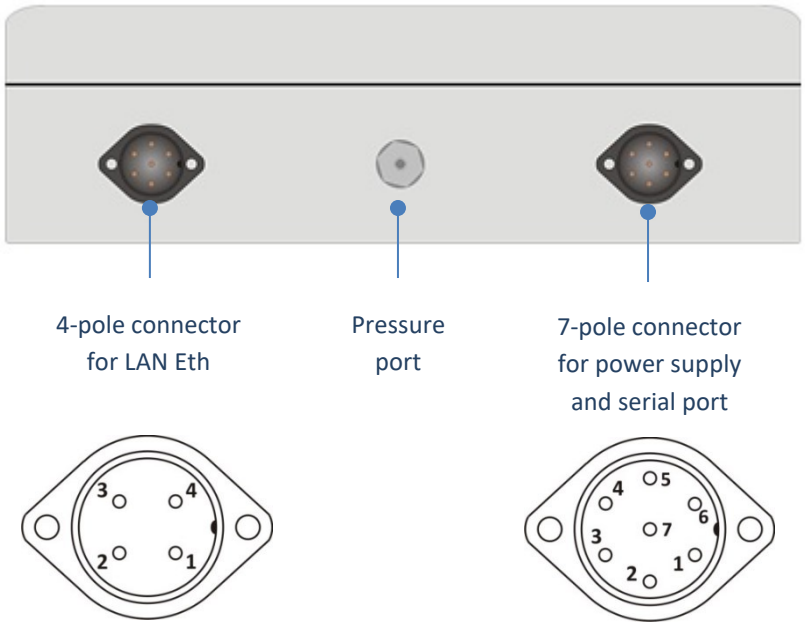
The Barometer is supplied calibrated, tested, and configured for a continuous transmission on RS232.

2 Instrument description

Front view



Front panel

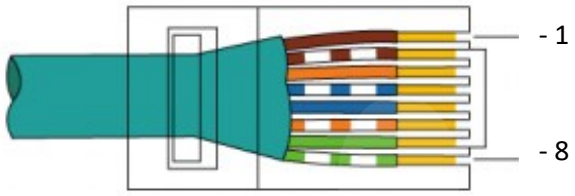


4-pole connector		
Pin No.	**Nome**	**Corrispondenza cavo LAN**
1	**TD+**	White/green
2	**TD-**	Green
3	**RD+**	White/Orange
4	**RD-**	Orange

7-pole connector		
Pin No.	**Name**	**Color**
1	SDI12 (optional)	Yellow
2	RS485 (A)	White
3	RS485 (B)	Green
4	GND	Grey/Orange
5	+12 V DC	Red
6	RS232 Tx	Blue
7	RS232 Rx	Brown

How to use LAN cable with 4 pole connector (supplied)

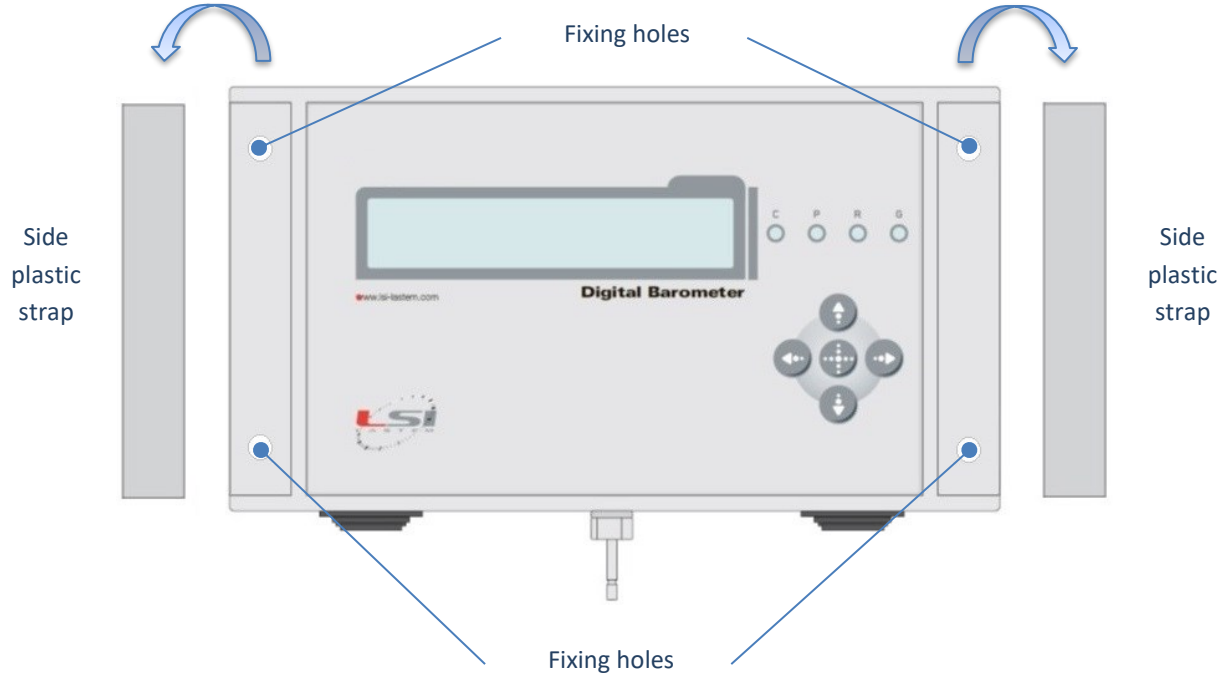
RJ45 connector (PC side)



IP68 connector (sensor side)

2.1 Installation

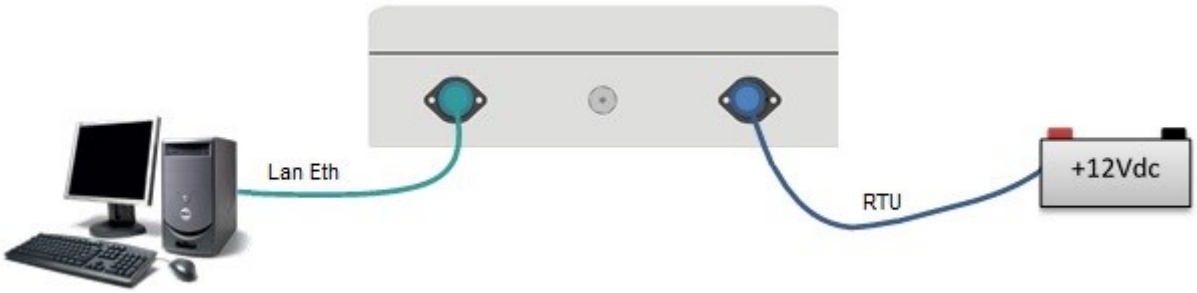
Per installare correttamente il sensore su di un supporto, rimuovere le bandelle plastiche laterali a destra e sinistra del pannello frontale, a questo punto è possibile vedere i fori attraverso i quali fissare lo strumento.



Using its specific kit, is possible to install the instrument on a pole (PSK code) or in a Din rail (DRK code) or in a box.

NOTA: for connecting and supply the sensor is not necessary to open it.

2.2 First ignition



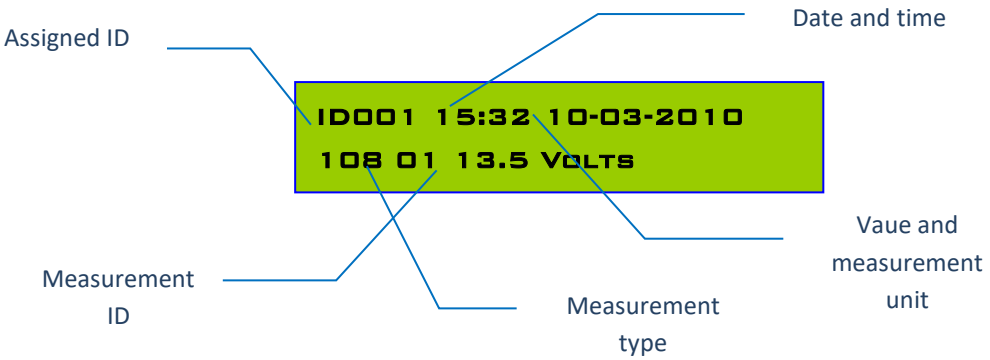
1. Connect the barometer to a power supply system (10.8 to 28 V DC) using the 7 pole connector and using a battery (12 V DC minimum 1 A/h), or a 220 V AC/12 V DC wall power supply. Just after the connection the barometer will start the boot procedure (no switch is necessary). Pay attention to the right position of +/-.
2. Connect the supplied LAN cable between a PC and the barometer. In this phase it is possible, through the sequence of the status LEDs, to verify the correct ignition of the machine. In particular:
   - When the power button is set to ON all the 4 status LEDs light up, remaining on for approximately 1 second.
   - Depending on the type of power supply (battery, or battery plus panel or battery + power supply) the LEDs A and B will light up, which remain lit to signal the presence of the power source. The C and D status LEDs are normally off, only flashing if there is an anomaly in the system start-up phase, signalling an operating system kernel anomaly.

Status Led		
Name	**Color**	**Function**
A	Green	Power on of Led (always on)
B	Red	Battery charge Led (only during charge time)
C	Yellow	Boot anomaly signalling Led
D	Yellow	Boot anomaly signalling Led

The ignition sequence is also shown on the display, where the machine start-up and diagnostics messages appear (see paragraph 5); of these the first one represents the serial number of the barometer.

The entire start-up sequence of the device takes approximately 90 seconds.

Once the start-up is complete, the device starts the standard acquisition cycle and the display of the instantaneous data in the display has the following form:



Le misure vengono visualizzate ciclicamente ad intervalli di circa 2 secondi, passando da una misurazione all'altra.

2.3 Connection to the PC

The barometer can be immediately connected to a computer, laptop or PDA, through the LAN network interface. It leaves the factory with a pre-set IP address, and subsequently modifiable, to which reference must be made for connection.

LAN interface			
IP:	**192.168.1.115**	Subnet mask:	**255.255.255.0**

To connect to the machine, it is necessary to use the supplied Ethernet cable or any cross (cross) type cable following the procedure below:

1. Switch device on.
2. Connect the cable to the LAN port of your computer.
3. Connect the other end of the cable to the device Ethernet port.
4. Turn on the computer and set an IP address of your network card congruent with that of the device, for example 192.168.1.10 and subnet mask 255.255.255.0.

At this point the connection between computer and **DQA251** is established and it is possible to access configuration pages or data visualization pages as explained in the next paragraphs.

3 Web interface

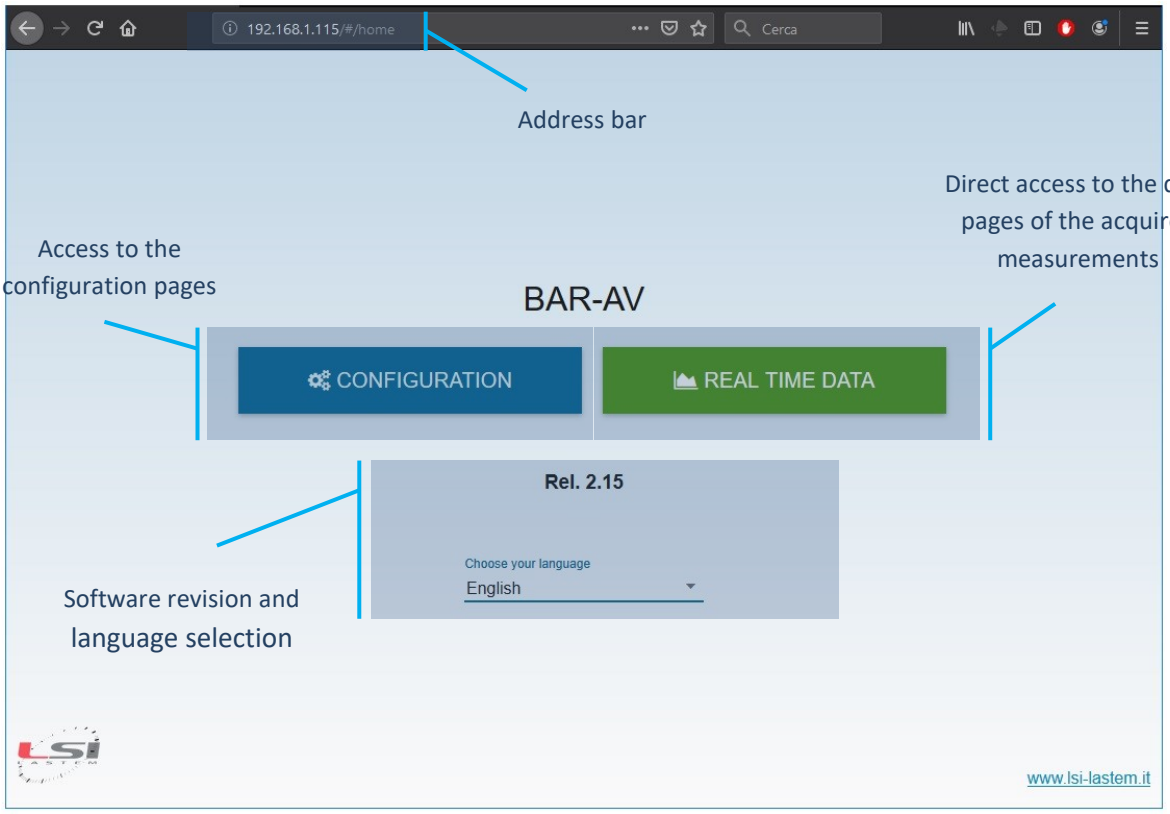
To access the configuration and/or display data page of the machine, it is sufficient, after establishing the connection as in the previous paragraph, to open one of the following Internet browsers for which the device is compatible:

- ✓ **Chrome** (from version 63.0.3239.132)
- ✓ **Firefox** (from version 57.0.4)
- ✓ **Edge** (from version 41.16)

The configuration procedure of a **DQA251** terminal only takes place through the use of web pages, while the display of data is also possible on the display.

For correct display of the pages, enable javascript scripts and the option to search the most recent versions of the stored pages in the tools or options menu of each browser

With the browser active, type in the address bar the IP of the barometer: http://192.168.1.115 (factory address) and wait for opening of the main page that allows the general user to choose between viewing the instantaneous data and configuring the device.

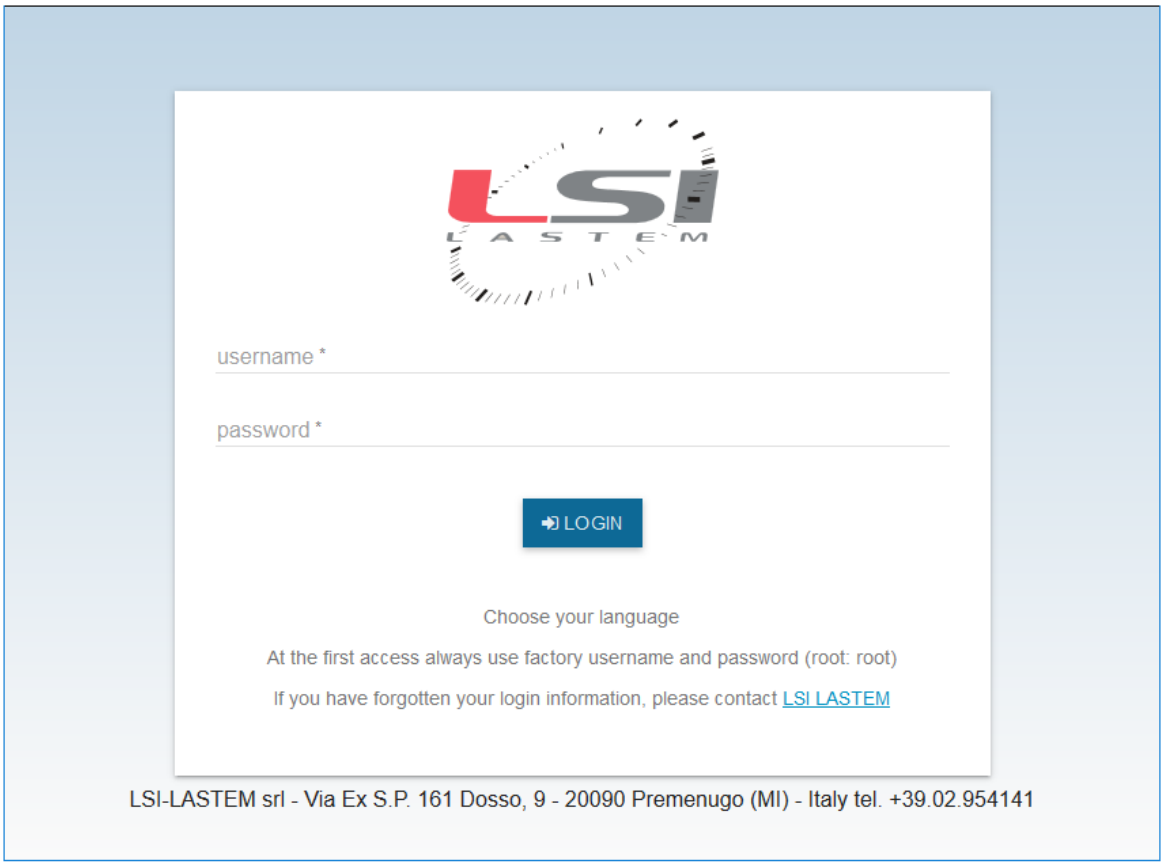


3.1 Authentication

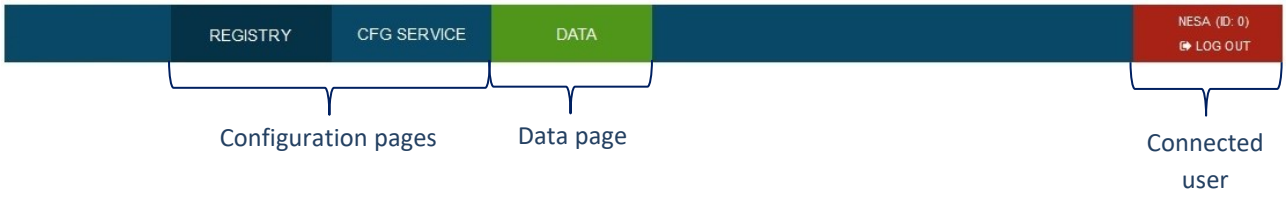
Access to any barometer resource always requires initial authentication.
From the factory the device always exits with a pre-enabled user. The factory credentials user are:

username: **root** password: **root**

At the pressing of one of the two keys CONFIGURATION REAL TIME DATA the authentication page opens, and you have access to the pages relating to the acquired data, or to the configuration ones.



The web pages of **DQA251** have in common a simple and efficient menu divided into three coloured areas:



3.1.1 Viewing data in Real Time

If the authentication has been carried out by pressing the key DATI IN TEMPO REALE you are redirected directly to the page of instantaneous data acquired by the barometer. Otherwise you can always reach this page from any other point by clicking on the green button at the top of the menu.

The page opens on measurements in tabular format, whose fields and values are shown and updated in a few seconds. On the left there are 3 sections (MEASUREMENTS, GRAPHS and MAP) which correspond to similar manners of displaying information.

At the top of the page, common to each section, is some information of the barometer for its identification: the altitude, the ID, the date of the client computer connected to the barometer (User Data) and the date

and time of the measurement (to recognise any time zone). Also, through the indicated link, it is possible to **download the data in Excel format (.csv) of the current month or previous month** with respect to the barometer date.

The file that is downloaded is a **CSV** (**C**omma-**S**eparated **V**alues) file type, which can be opened with a spreadsheet, and whose name shows the following format:

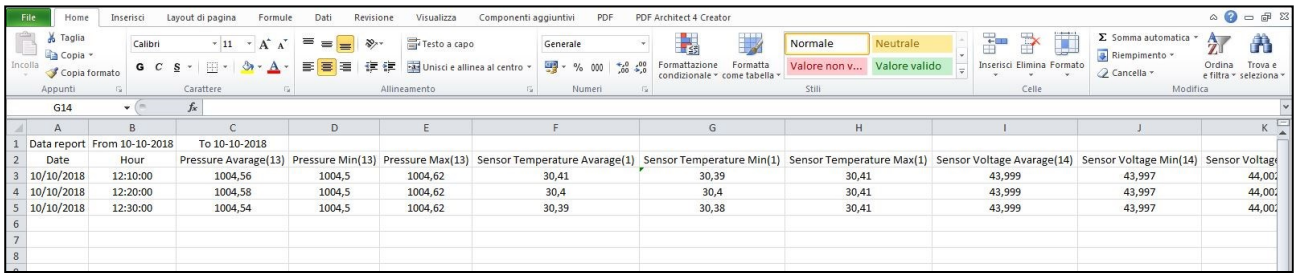
user_id – terminal_id-current_month.csv
user_id – terminal_id -previous_month.csv

where:

- *user_id* is the numerical identifier of the user who has logged in (always 0)
- *terminal_id* represents the numerical identifier associated with the machine in configuration
- *current* and *previous* are respectively the file of the current month and that of the previous month

For example, the file *0-101-current_month.csv* is the file containing the data of the current month of the barometer with ID 101.
Open in a spreadsheet, the file contains column labels to ascertain the date and time of storage (every row) and the measurement with relative processing associated with the data in the column.

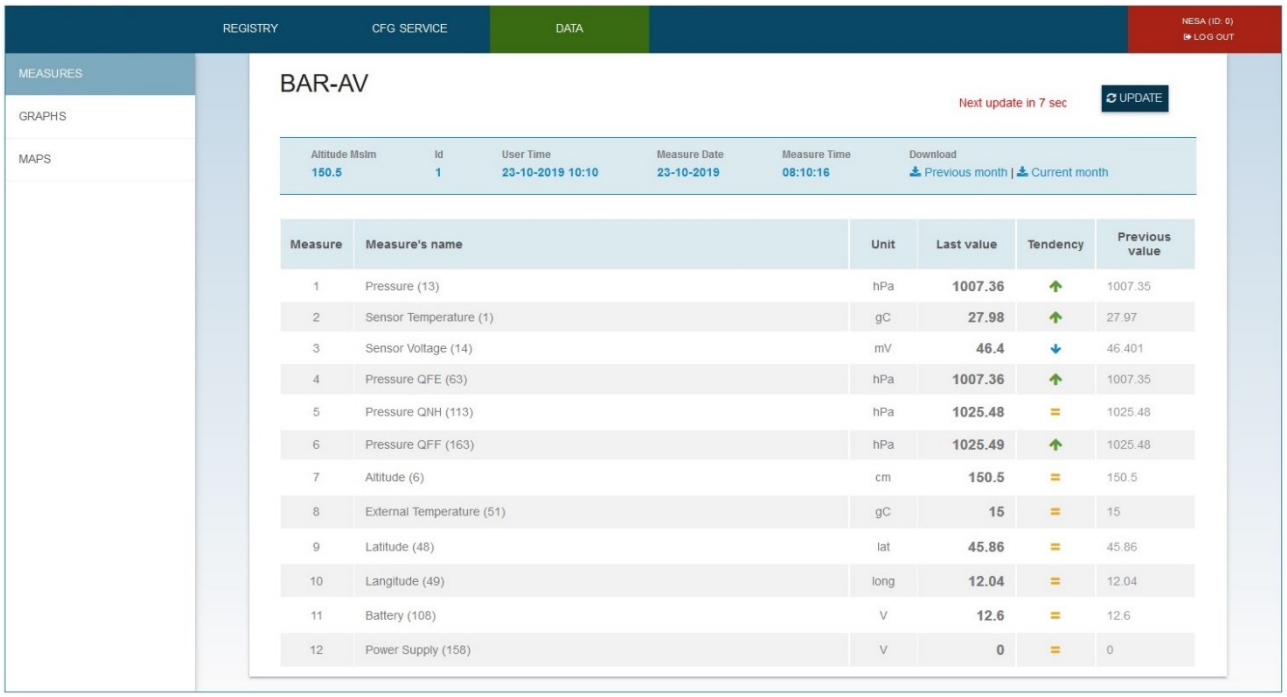
An example:



	A	B	C	D	E	F	G	H	I	J	K
1	Data report	From 10-10-2018	To 10-10-2018								
2	Date	Hour	Pressure Avarage(13)	Pressure Min(13)	Pressure Max(13)	Sensor Temperature Avarage(1)	Sensor Temperature Min(1)	Sensor Temperature Max(1)	Sensor Voltage Avarage(14)	Sensor Voltage Min(14)	Sensor Voltage
3	10/10/2018	12:10:00	1004,56	1004,5	1004,62	30,41	30,39	30,41	43,999	43,997	44,00
4	10/10/2018	12:20:00	1004,58	1004,5	1004,62	30,4	30,4	30,41	43,999	43,997	44,00
5	10/10/2018	12:30:00	1004,54	1004,5	1004,62	30,39	30,38	30,41	43,999	43,997	44,00
6											
7											
8											

MEASUREMENTS section

This section summarises in a user-friendly format all the information concerning the measurements acquired and available to the user who has logged in.



In the central part of the page is the information associated with the acquired measurements:

Measure	Measure's name	Unit	Last value	Tendency	Previous value
1	Pressure (13)	hPa	**1007.36**	↑	1007.35
2	Sensor Temperature (1)	gC	**27.98**	↑	27.97
3	Sensor Voltage (14)	mV	**46.4**	↓	46.401
4	Pressure QFE (63)	hPa	**1007.36**	↑	1007.35
5	Pressure QNH (113)	hPa	**1025.48**	=	1025.48
6	Pressure QFF (163)	hPa	**1025.49**	↑	1025.48

- ✓ **Measure** represents the sequence of measurements according to the saved configuration
- ✓ **Measure's name** name of the measurements according to the saved configuration with possible ID
- ✓ **Unit** engineering unit associated with the measurement according to the saved configuration
- ✓ **Last value** represents the last value acquired by the device
- ✓ **Tendency** changes in the last measurement compared to the previous value
- ✓ **Previous value** represents the value of the previous acquisition cycle of the device

The page values are updated automatically every 10 seconds or can be forced by pressing the button UPDATE or chosen on the upper right menu.

NOTE: *the instrument calculates the instantaneous value of a measurement (in real time) through a Gaussian average on a very high number of samples, in other words the data per second is not the result of an analog-ical/digital conversion of the electronics, albeit of the highest level, but the result of a weighted average over a Gaussian bell, of an average number of over 100 samples.*

Measures avilable

Measure	Measure's name (ID)	Unit
1	Pressure (13)	hPa
2	Sensor Temperature (1)*	gC
3	Sensor Voltage (14)	mV
4	Pressure QFE (63)	hPa
5	Pressure QNH (113)	hPa
6	Pressure QFF (163)	hPa
7	Altitude (6)	m
8	External Temperature (51)	gC
9	Latitude (48)	lat
10	Langitude (49)	long
11	Battery (108)	V
12	Power Supply (158)	V

**Temperature of the transducer*

Algorithms used for calculating QFE, QNH and QFF are formulas recommended to WMO (World meteorological Organization) and described to the document "CIMO/ET-Stand-1/Doc. 10 (20.XI.201)", and you can view it below:

Algorithm	Formula	Constants
QFE	$QFE = p_s * e^{\frac{H_s}{7996*+0.0086*H_s+29.33*t}}$	*p_s = Pressure sensor Value (hPa)* *H_s = Airport Elevation above pressure sensor (m)* *t = Air Temperature (°C)*
QNH	$QNH = QFE * e^{\frac{0.03146*H*\left(1-0.19025\ln\left(\frac{QFE}{1013.2315}\right)\right)}{288.2+0.00325*H}}$	*H = Airport (weather station) Elevation (m)*
QFF	$QFF = QFE * e^{\frac{H}{7996+0.0086*H+29.33*t}}$	*H = Airport (weather station) Elevation (m)* *t = Air Temperature (°C)*

GRAPHICS section

The graphs section allows representation with a powerful graphical engine of the values acquired according to one or more Cartesian diagrams based on time, auto-adaptive on the scale of the acquired values, and independent for each measurement.

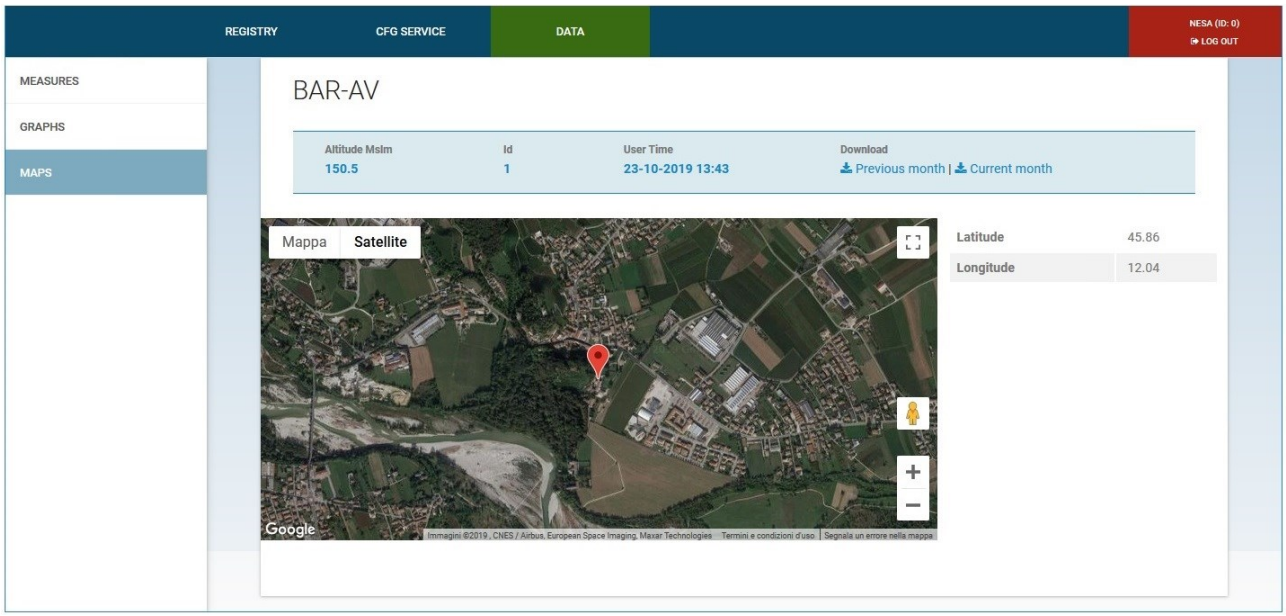
Each diagram is automatically populated in real time and cyclically over periods of 10 seconds, displaying the value acquired at the time instant with a dot. All measurements in the configuration are displayed in different colours.

On the right the identification label of the measurement is always present.

NOTE: *Even if not present in the configuration, are always shown both in the Measurements section and in the Graphics section, two measurements called "Voltage" (in Volt) and "Power" (in Volt), which represent the two additional analogue channels of the device, used in a native way for measurement of the primary power value, typically the battery, and the secondary one, typically the photovoltaic panel or a direct voltage power supply or other source.*

MAP section

The Map section allows geo locating of the barometer. It uses the GPS Latitude and Longitude coordinates entered during configuration or acquired from a GPS antenna connected to the same device.
The map representation passes through a connection to the Google Maps® site and through a library of tools made available for this purpose. Obviously, the map only appears when the device is connected to the network.



On the right are the coordinates in **WGS84 GD decimal format.**

3.1.2 Configuration

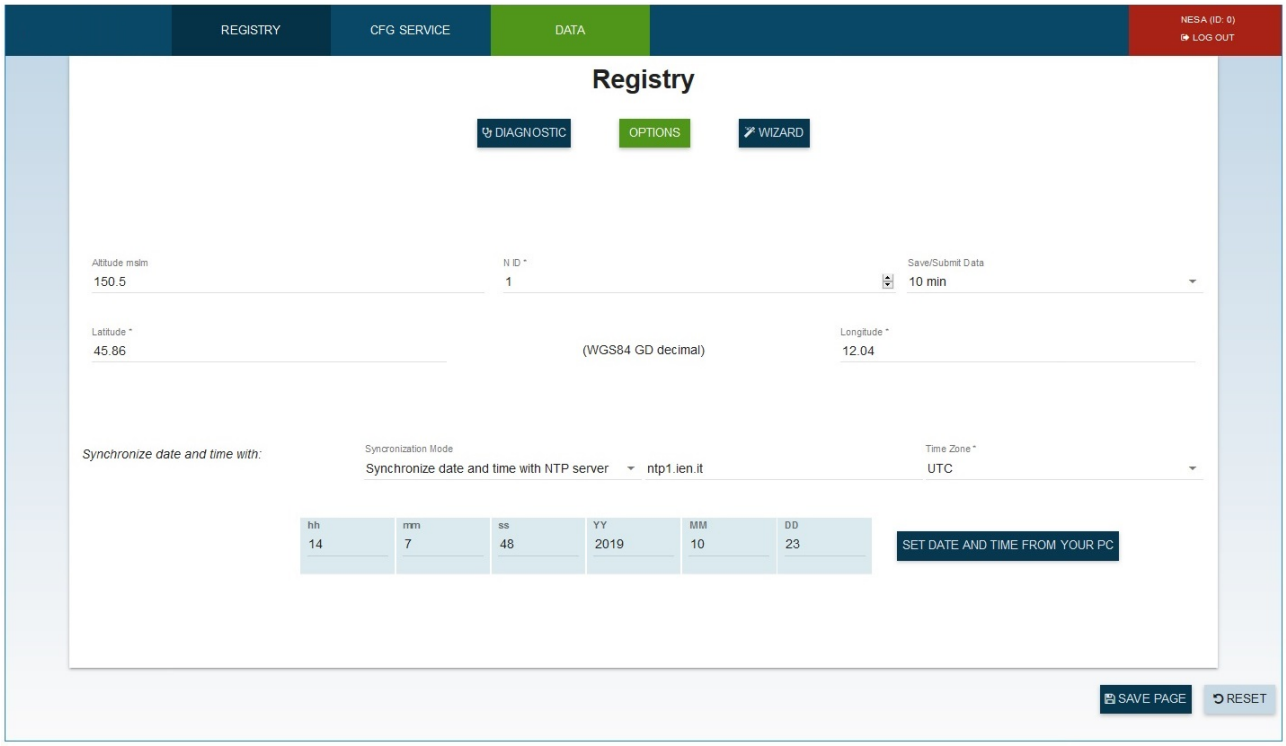
If the authentication has been carried out by pressing the key 

you will be redirected to the first page (REGISTRY) to start the configuration sequence of the barometer.

All configuration pages are similar and characterised by a pair of buttons in the bottom right:

The "Save Page" key allows the saving of any changes made to the individual page, automatically generating the new configuration without restarting the device.
The "Reset" key allows resetting of the valuesof each field of the page.

3.1.3 Registry page



This page contains all the *information that characterises the instrument* (it can be different for each user).
In the **upper part** we have:

- ✓ Altitudine mslm — sensor elevation on medium ground level (AGL)
- ✓ ID N° — numeric identification of the instrument (max 6 digits)
- ✓ Save/Submit Data — saving and/or sending of the file (data, images, etc.), from 1 to 1440 minutes
- ✓ Latitude — in WGS84 GD decimal
- ✓ Longitude — in WGS84 GD decimal

At the **bottom** of the page are the *clock settings* inside the device, i.e. date and time, time zone and, if provided by the connection to the network or to an external device, the type of synchronisation to be applied, with indication of the NTP server on which to engage.

The clock synchronisation possibilities are as follows:

- ✓ None: the barometer keeps the internal date and time since the last adjustment made.
- ✓ Synchronise date and time with NTP server: it is necessary to insert the address in an NTP server
- ✓ Set date and time from GPS (if present): the type of GPS used, must be chosen from a drop-down list
- ✓ Set date and time from SATELLITE (if present): select the type of satellite used from a drop-down list
- ✓ Set date and time: by synchronising them from PC. In this case and **only in this case**, the device will restart automatically.

Once you have entered the information of interest for this page, confirm it by pressing SAVE PAGE or cancel it with the button RESET otherwise, changing the page it will be lost.

There are also two buttons on the page: DIAGNOSTIC WIZARD

Pressing the "*Diagnostics*" key a procedure is launched in the device which allows extraction of a text file representing the functional diagnosis of the barometer operating system. It contains some important information that allows understanding of the operating status, including the amount of total memory, the memory used and the available memory, both program memory and data memory.
It also contains a list of all active processes, to immediately identify a blocked or shutdown process.

An example of how this file can appear:

```
Filesystem                Size      Used Available Use% Mounted on
ubi0_0                   53.9M     33.8M     17.3M  66% /
devtmpfs                 57.1M      4.0K     57.1M   0% /dev
tmpfs                    16.0M    360.0K     15.6M   2% /var/volatile
tmpfs                    57.1M         0     57.1M   0% /dev/shm
tmpfs                    10.0M     32.0K     10.0M   0% /home/httpd/sito
ubi0:nesa                49.2M      6.8M     39.8M  15% /mnt/nand
PID USER VSZ COMMAND
13355 daemon 83036 /usr/sbin/httpd
13597 daemon 80988 /usr/sbin/httpd
13587 daemon 80988 /usr/sbin/httpd
```

The system file also identifies the memories available for each user and is a file that can be transmitted remotely by setting in the device, among the types of data sent, also the system file.

For the "Wizard" button it is not active in this version of **DQA251**.

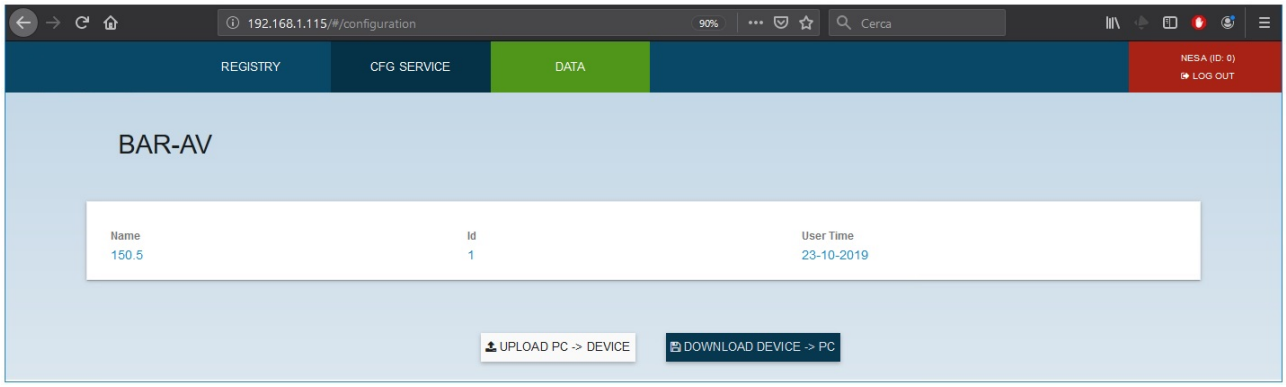
Options section

The *Options* menu contains information on the *IP address* of the barometer, of the *Subnet Mask* and allows entering of a possible *Gateway* (if any) for exit of the network communication packets.

All modifications become operative by pressing the SAVE PAGE key button.

3.1.4 CFG-SERVICE page

This is the page allows to download or upload a configuration from/into instrument.



At the top of the page are the configuration *Name* , device *Identification*, and creation *date*.
The configuration of a machine is easily replicable on other barometers of the same series. It is in fact possible to download the configuration (DOWNLOAD DEVICE -> PC) or load an existing one from a PC or from an external device (UPLOAD PC -> DEVICE) .

Saving or loading a configuration means updating the files of the machine that supervise its operation. To facilitate and accelerate the transfer, during the loading (or unloading) phase, the configuration files are compressed into a single file (with ***nsa*** extension) that represents a complete "snapshot" of the status of the barometer at that moment. In the same way, loading a configuration means loading a single file, which will then be decompressed and interpreted by the process that takes care of the machine set-up.

The loading and unloading times may take some time depending on the browser used.

The configuration files downloaded are normally named ***evolution.nand.nsa***.

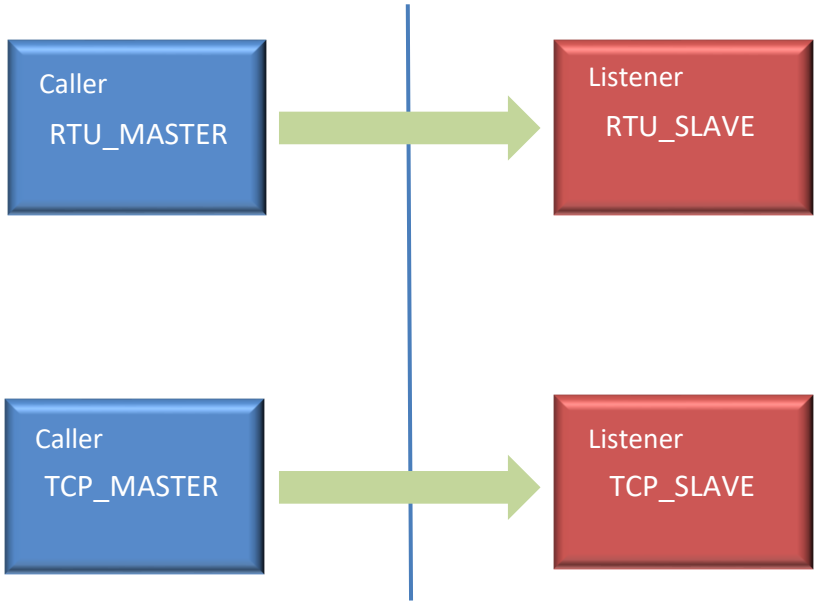
NOTE: *Warning: the management of a download through a browser is highly dependent on the browser used and the settings on the browser used. Using for example Google Chrome the file is present in the Download folder of the PC used for the connection.*

4 Communication process

The **DQA251** has different modes of transferring information with external devices, using the physical lines of LAN and serial communication (RS232 and RS485).
All the communication processes are completely independent (thread) modules and share the memory area containing the data collected by the logger process.

4.1 Modbus

The Modbus protocol is a standard protocol for communication between devices, which in **DQA251** uses both the RS232/RS485 serial port for data transfer (Modbus RTU - Remote Terminal Unit), and the network port (Modbus TCP - Transmission Control Protocol) For details of the structure, refer to the abundant literature present that describes the protocol in detail; this paragraph will provide all the information related to the interface mode and the structure of the months records available from the device.
It's a communication protocol with a **Master / Slave** structure, where Master means the calling device ("caller"), and for Slave we mean the listening device ("listener") that makes the data available.
In the Modbus communication module of **DQA251** the Slave communication tasks are always active, on the serial communication lines or on the Ethernet line (**modbus RTU and modbus TCP-IP**).



4.1.1 "Listener" mode - Slave

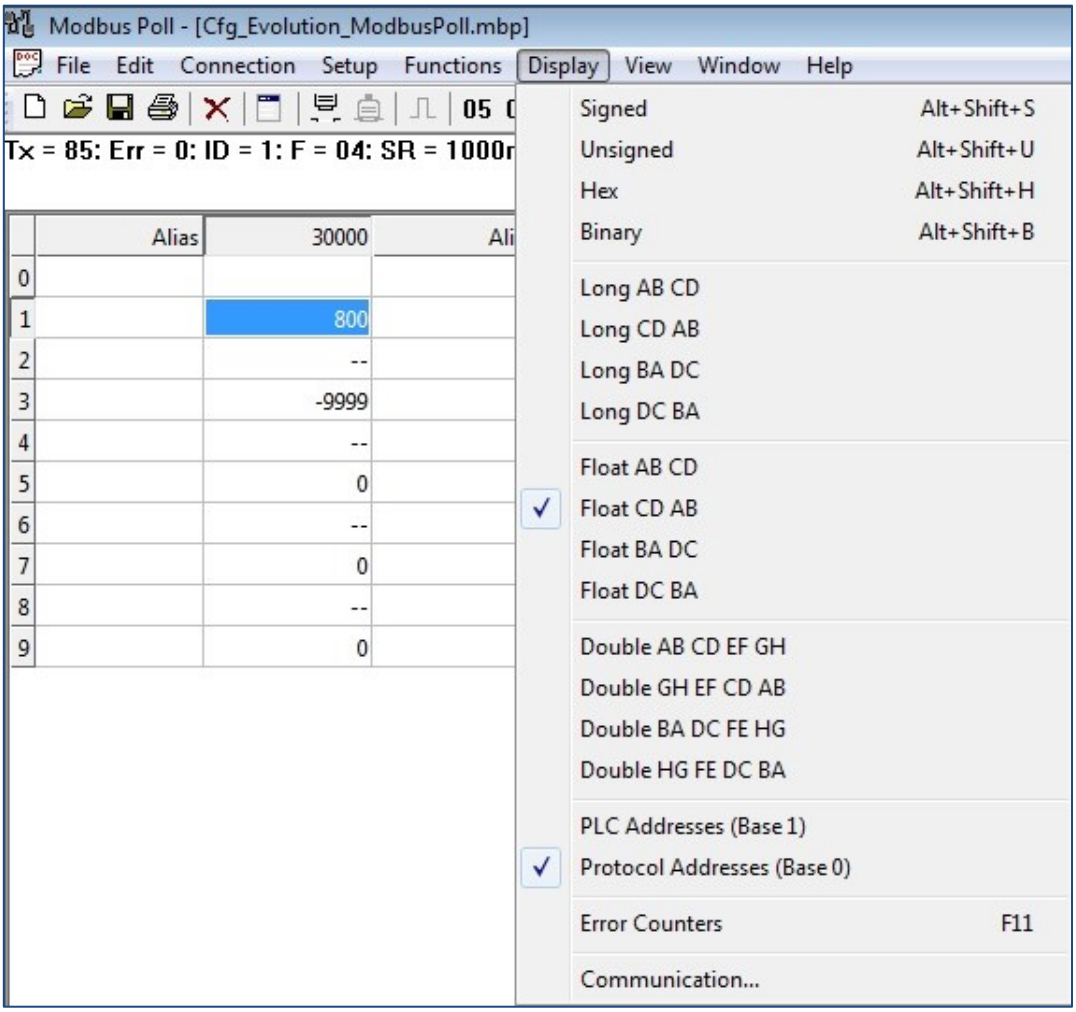
In Modbus Slave mode, the **DQA251** establishes communication with a Master of the network in which it is inserted, receives the request message and transmits the response. The information that is made available is all the measurements configured and acquired by the device, in instant data, with the update frequency defined in the configuration. Its order is the same as that is defined in the configuration.
The measured values are read by using the **04h (Read Input Register)** function defined by the standard starting from address **30001h**.
Up to a maximum of 1000 16-bit registers are made available starting from address 0x30001.
The measurements acquired by the device are always in the 4-byte *floating point* format in *little endian* coding (also known as float reverse mode), so the maximum exportable measurements via ModBus is **500** because two ModBus registers are required to contain the measurement.
The exported value is always in engineering units, as defined in the configuration.
As an example, for the barometer ModBus map is as follows:

Address	Measurement	M. U.	Format
0x30001	Pressure	hPa	Float reverse 32 bit
0x30002			
0x30003	Sensor Temperature	°C	Float reverse 32 bit
0x30004			
0x30005	Transducer voltage	mV	Float reverse 32 bit
0x30006			
0x30007	Pressure QFE	hPa	Float reverse 32 bit
0x30008			
0x30009	Pressure QNH	hPa	Float reverse 32 bit
0x30010			
0x30011	Pressure QFF	hPa	Float reverse 32 bit
0x30012			
0x30013	Altitude	m	Float reverse 32 bit
0x30014			
0x30015	External temperature	°C	Float reverse 32 bit
0x30016			
0x30017	Latitude	lat	Float reverse 32 bit
0x30018			
0x30019	Longitude	long	Float reverse 32 bit
0x30020			
0x30021	Battery voltage	V	Float reverse 32 bit
0x30022			
0x30023	Power supply voltage	V	Float reverse 32 bit
0x30024			

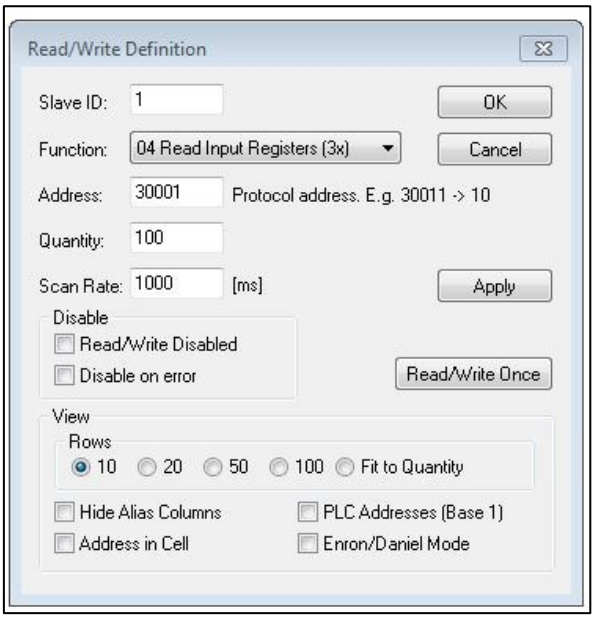
The battery voltage and supply voltage measurements are always present.

4.1.2 TCP Slave

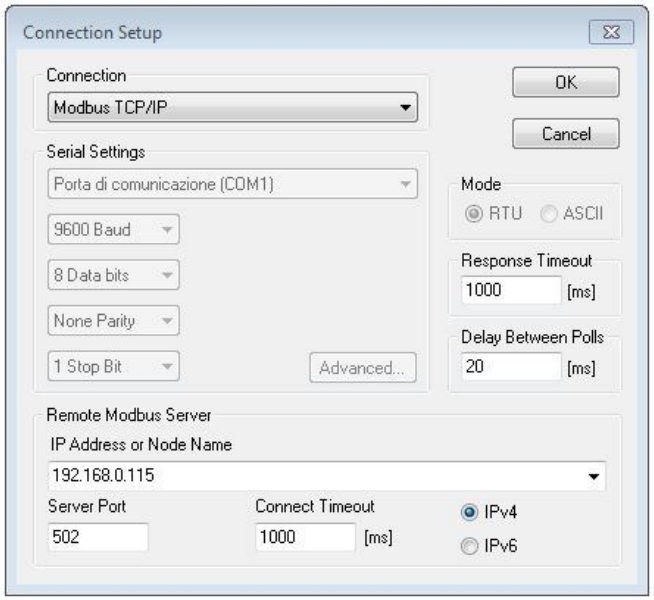
In Modbus TCP slave mode, the call from the master is on a LAN cable and must be addressed to the IP address of the barometer, on **port 502**. The call function is **04h** (Read Input Register) starting from address **0x30001** in READ mode.
The number of registers to be read, up to a maximum of **500**, must be included in the call.
As an example of a device that connects via Modbus TCP, we report the configuration of a common software, called Modbus Poll, configured to connect to on **DQA251** via Modbus TCP and to read its registers.
The following image shows the type of data representation, inverse *floating point*, and the registers that contain the measurement. In the example is the measurement in register 30001 (the first in configuration) with a value equal to 800.



The following image shows the call function, the number of registers read and the address of the initial register.



The last part of the setting concerns the interface mode, Modbus TCP, the address to be called and the port.



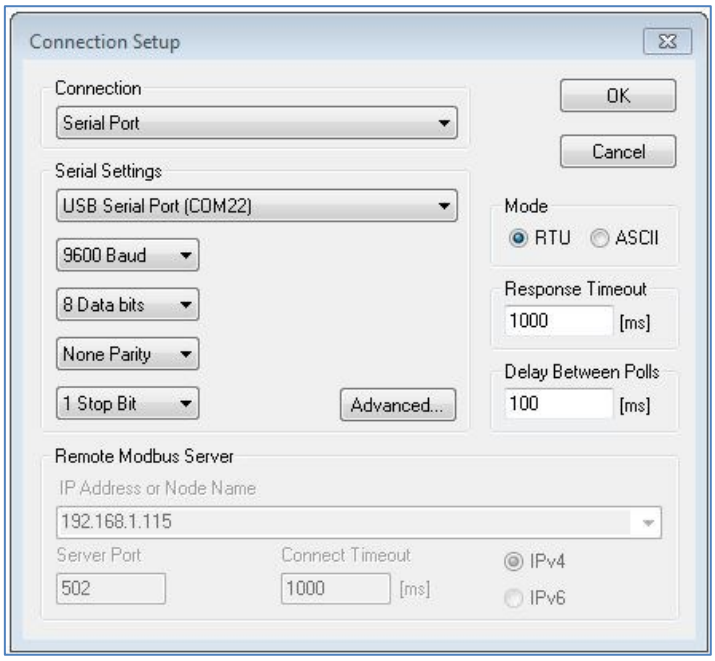
4.1.3 RTU Slave

In Modbus RTU slave mode, the call from the master is on a serial cable (RS 232 or RS485) and must be addressed to the ID of the barometer, which coincides with the ID of the terminal.
The serial connection must have the following characteristics:

Speed:	**9600 baud**
Bit number:	**8**
Parity:	**None**
Stop bit:	**1**

The call function is **04h** (Read Input Register) starting from address **0x30001** in READ mode.

The number of registers to be read, up to a maximum of **500**, must be included in the call.
Similarly, to what is described for Modbus TCP mode, the Modbus Poll call software configuration is absolutely the same, with the exception of the connection part, which is now serial, and must be filled in by inserting the previously mentioned connection parameters, as described in the image below.

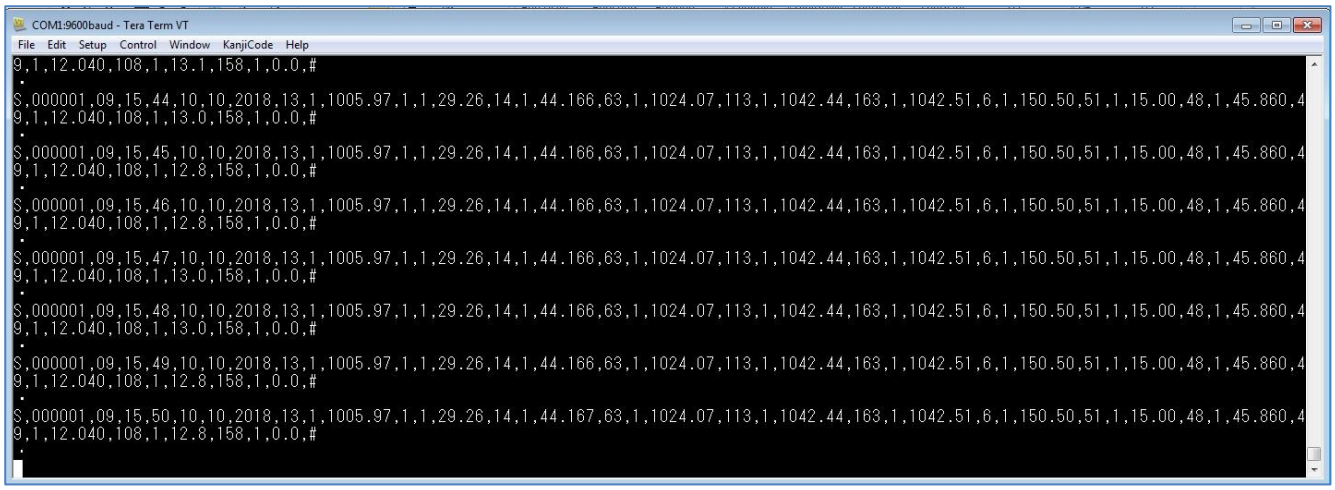


4.2 RS232

The **DQA251** is able to stream, via RS232, the data record every second.
If you would like to use this communication way you have to connect an RS232 cable and a listener with the following characteristics:

Speed:	**9600 baud**
Bit number:	**8**
Parity:	**None**
Stop bit:	**1**

As an example of a device that connects to **DQA251** via serial line, we report the output of a common software, called *Tera Term VT*:



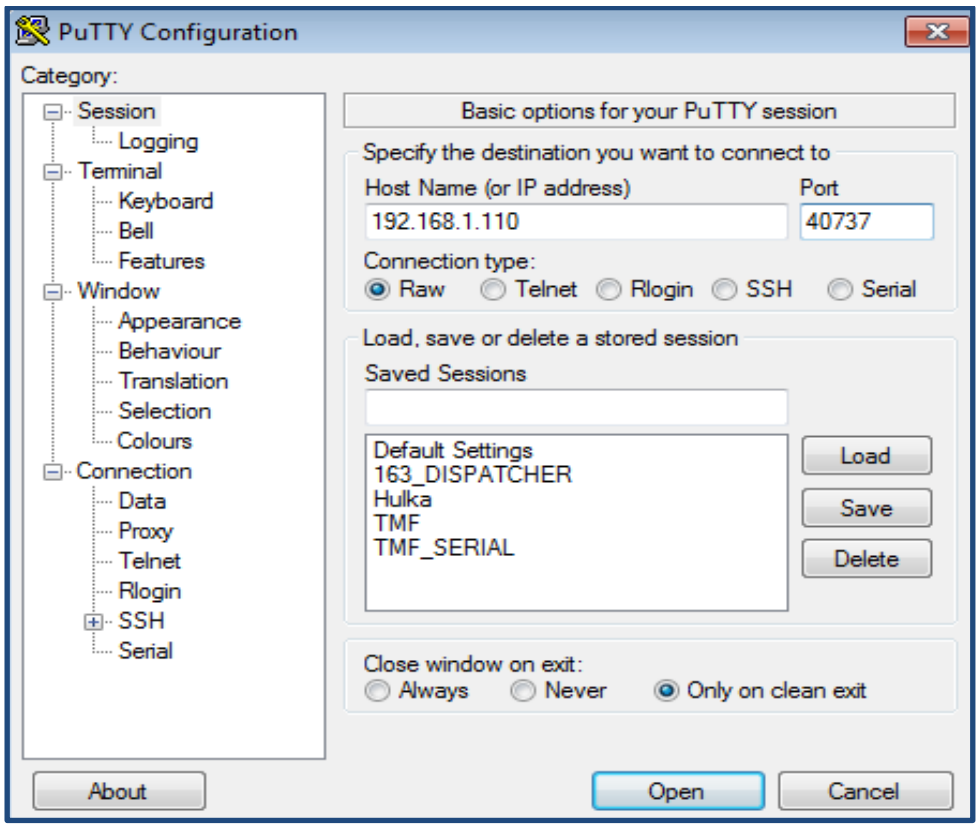
4.3 Socket

A socket, in the modern operating systems, indicates a software abstraction designed to use standard and shared libraries for transmitting and receiving data through one ethernet port. It is a particular software object through which two processes residing on two different machines, connected to the same network, can read and write the data to be transmitted or received.

On the **DQA251** there is always the possibility of a connection via **TCP/IP socket** listening on port 40737, with the possibility of:

- Access in reading/writing to the memory locations of the machine
- Reading files contained within the device
- Sending files to the device

Data is read by the use of cells (or memory locations), or MEM, within which the logger process stores data of the type float 32. The memory locations currently available are 10000 for each user, corresponding to a maximum of 100 measurements per user.
The first measurement occupies the leases from 1 to 100, the second one leases from 101 to 200 and so on.
The socket connection can be tested using the *putty* freeware software configuring with a raw connection as shown in the figure:



4.3.1 List of available commands

Multiple reading of data with or without value range

R|102|202|301:303 [CR]

responce: W|102|0|202|1|301|0|302|1002.2|303|1002.0 [CR]

responds with the required values (locations 102, 202, 301 to 303) separated by pipes

Multiple writing with and without range

W|402|1|502|0|601:603|3 [CR]

writes the memory locations 402, 502 and from 601 to 603

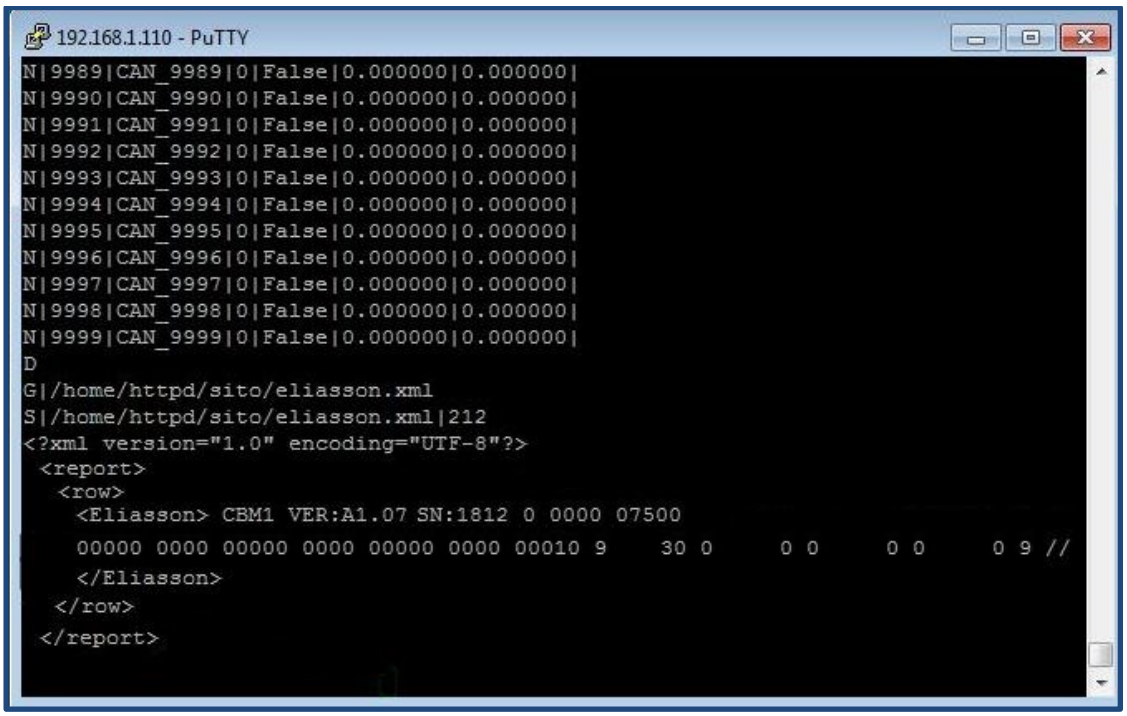
File reading

G|filename [CR]

E.g.:

G|home/httpd/sito/dati.xml [CR]

response: S|filename|len|[CR] + [stream del file]



The response presents the name of the file followed by its length, and on a stream the content.

File writing:

S|filename|len|[CR] + [len dati binari]

E.g.:

S|home/httpd/sito/test.txt|9|[CR]

Test file

Inside the folder /home/httpd/site/ there is now a file called test.txt whose content is the "Test file" string.

4.4 FTP (File Transfer Protocol)

File Transfer Protocol (FTP) (file transfer protocol) is a protocol for the transmission of data between host based on TCP and with architecture, type **client/server**.
The protocol uses separate TCP connections to transfer data, to monitor transfers, and requires client authentication by username and password, although the server can be configured for anonymous connections with dummy credentials. The data that FTP transmits both these credentials and any other communication are clear**.**
On the On the **DQA251** device there are both functions, **server** and **client**.

4.4.1 Server FTP

FTP uses two separate connections to handle commands and data. The FTP server remains in listening on the **port 21** of TCP to which the client connects. The connection by the client determines the initialisation of the command channel through which the client and server exchange commands and responses. The actual exchange of data (such as a file) requires the opening of the data channel, which can be of two types: active or passive.
The mode implemented on the machine's FTP server is passive.
In a passive data channel, the server opens a usually random port (above 1023); through the command channel it makes known the number of this port to the client and waits for it to connect. For this purpose, the PASV or EPSV commands can be used, depending on the network protocol used (usually IPv4 o IPv6).
An FTP server offers several functions that allow the client to interact with its file-system and the files that populate it, including:

- Download/upload di file.
- It resumes interrupted transfers
- Removal and renaming of files.
- Creation of directories.
- Navigation between directories.

The data connection from an FTP client to the FTP server of the machine takes place through the root user, so there is therefore full access to the partition of the machine that contains the operating system with administrator privileges. This means that any modification made to the files of this partition, if incorrect, can affect the operation of the logger.
It is advisable not to delete or modify files during a connection to the ftp server if not fully aware of the effects of the changes.
For file upload transfer, especially if using a client on Windows machine, it is always advisable to run it by activating, before transferring, the *binary* directive.
To use the possibility of the FTP server of the machine, the user administrator password must be requested from LSI LASTEM.

4.4.2 Client FTP

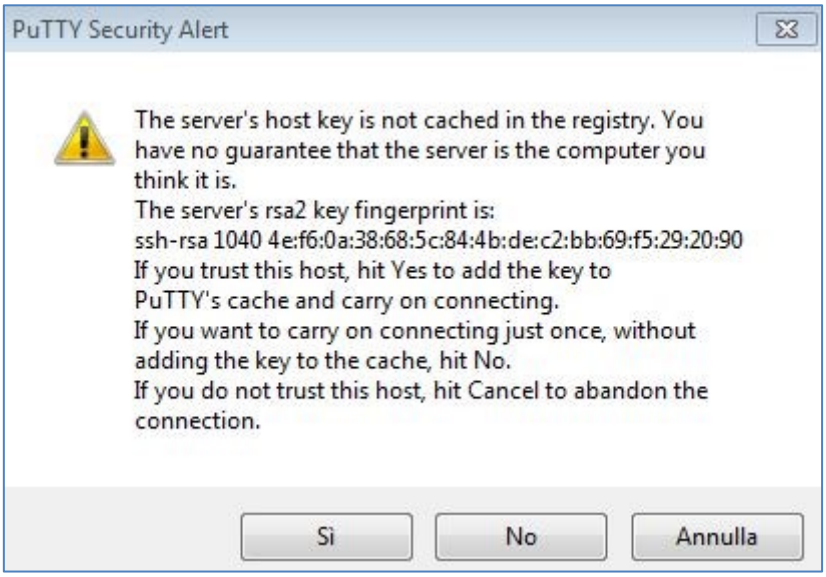
Using a terminal it is possible to use the functionality of FTP client, so it is possible to connect to an FTP server according to the methods and credentials of the server to connect to.

4.5 SSH (Secure Shell)

SSH (Secure SHell, shell secure) is a protocol that allows establishing of an encrypted remote session via command line interface with another one host present on the network. It is the protocol that replaced the similar, but non-secure, Telnet.
The SSH server of **DQA251** works on **port 22.**
An SSH authentication process between a client and a server goes through these steps:

Negotiation of algorithms
Algorithm negotiation is one of the first steps in establishing an SSH connection. In order to determine which algorithms to use in the SSH connection, the client and server must exchange the list of algorithms they support for the connection. The list contains all the available algorithms in order of preference; the preference and the available algorithms are determined by the configuration of the client and server software. Once the list exchange is over, the protocols available on both machines are chosen giving precedence to the higher algorithms in order of preference.

Key exchange
After defining the algorithms to be used in the connection, one of the most important steps is taken in establishing the secure communication channel: the exchange of keys. Key negotiation takes place at the beginning of each connection.
In the current SSH clients, e.g. putty, when a client first connects to the **DQA251** SSH server, a message appears prompting saving of the key in order to avoid subsequent negotiations.



Server authentication
Server authentication is used to prevent a malicious user from "tampering" with the having obtained the user credentials. For this purpose, a pair of asymmetric keys is generated for each server. The private key remains on the server. The public key must be known by the client, the client can obtain the key of a server by receiving it directly from the server during the first connection.
Authentication takes place during the exchange of keys, the server creates an encrypted message with its private key and sends it to the client, the client decrypts it with the server's public key verifying the identity

of the server. If the message is decrypted correctly the client proceeds with establishment of the connection, otherwise it interrupts the procedure. As only the server should be aware of the private key, the client is able to determine the identity of the server it is communicating with.

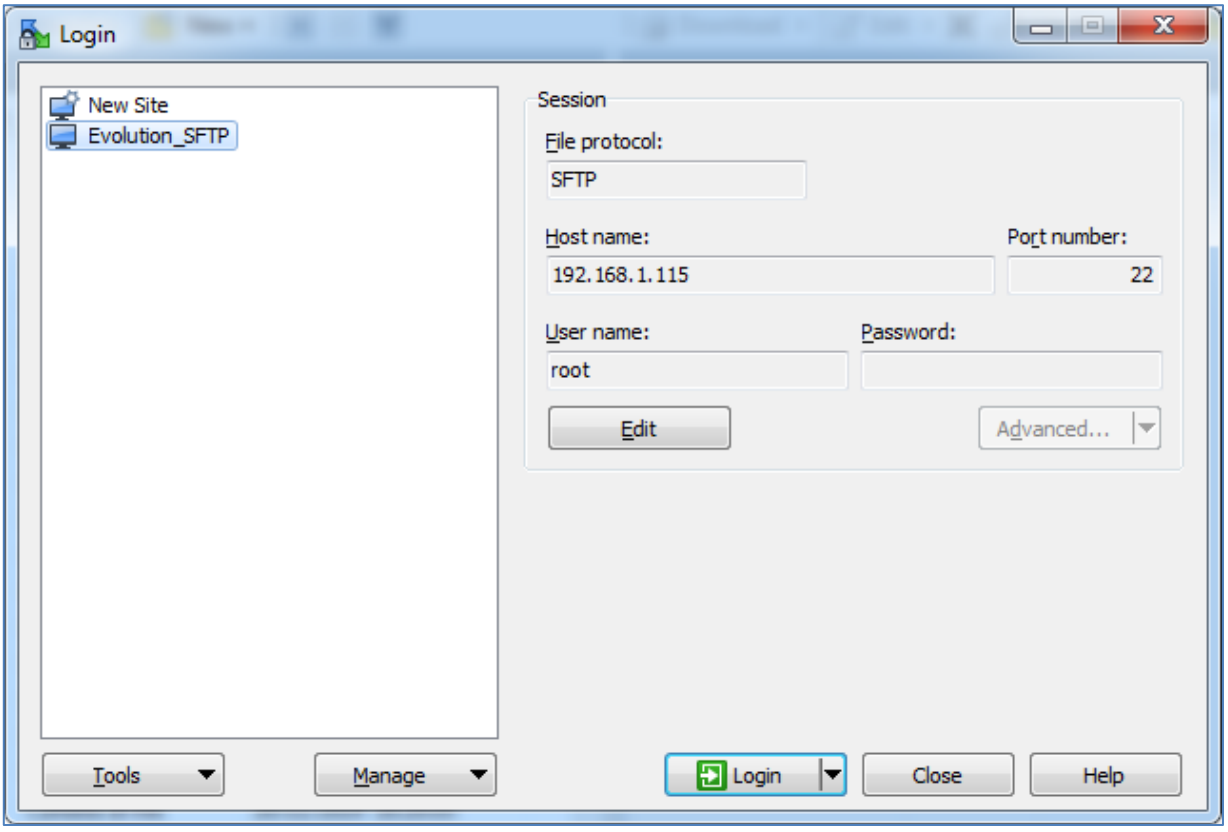
Connection encryption

Having defined a secret key known exclusively by the client and the server, it is possible to use a symmetric cryptographic protocol to encrypt the communication between client and server.
A symmetric cryptographic algorithm allows the use of a single key to encrypt and decrypt information. In a symmetric key algorithm, the shared key must be defined before initialisation of the connection using a method of communication of the secure key that is performed using the Diffie-Hellman algorithm in the SSH. Symmetric key algorithms guarantee a high standard of security and a low cost in terms of computing power (unlike asymmetric key algorithms such as the RSA algorithm).

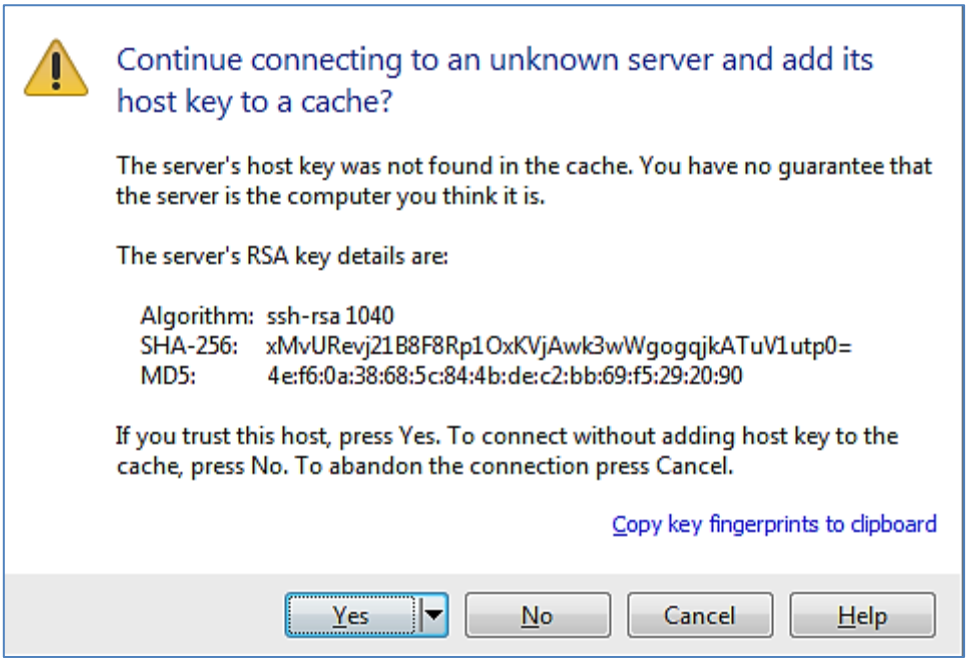
The user with whom a client can connect is the administrator user of the Linux system; the password of the administrator user must be requested to LSI LASTEM.

4.6 SFTP (Secure File Transfer Protocol)

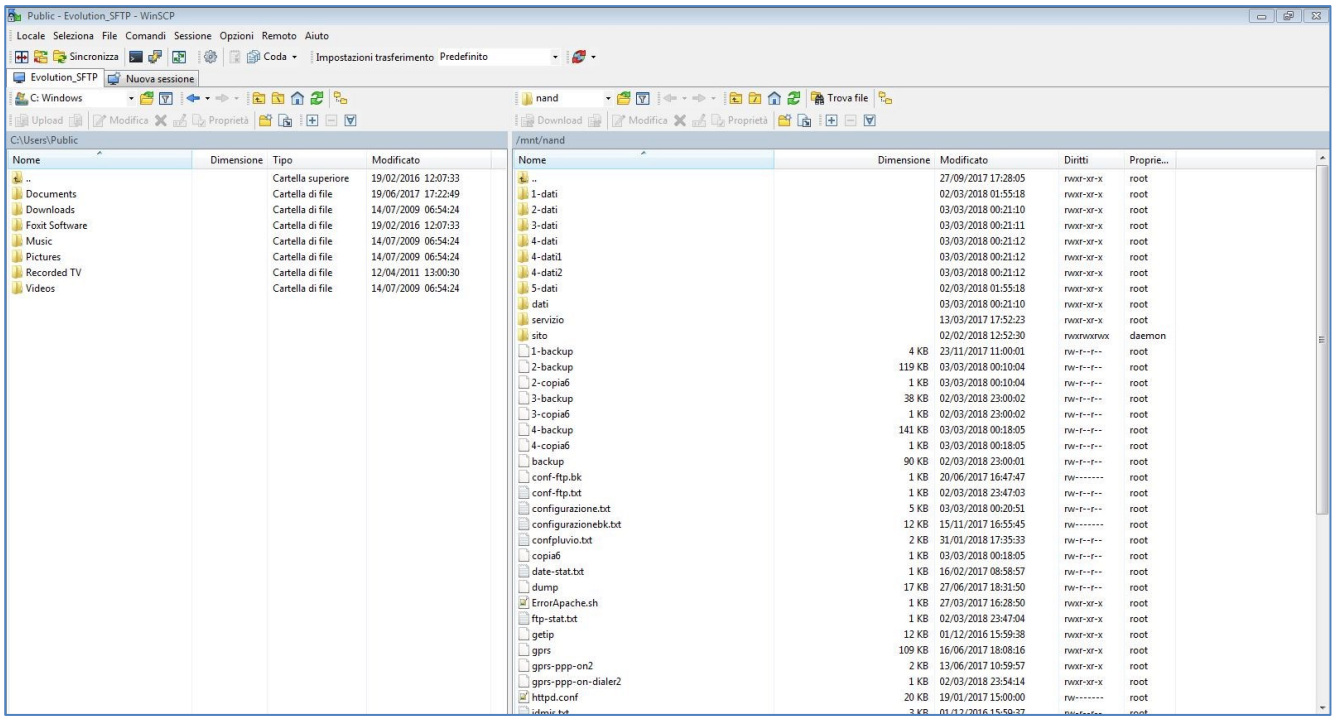
The **SSH File Transfer Protocol** (or SFTP) is a network protocol that involves data transfer using the SSH protocol, so it is considered a secure file transfer.
In the implemented version it allows data transfer using the standard port 22.
To connect to the barometer server, it is possible to use any client that supports the protocol, such as the **WinSCP** client freeware, described below.



By selecting the protocol, setting the name and port of the server to be called and obviously User Name and Password (to be requested to LSI LASTEM) it is possible to connect.
Being a secure connection, it is always advisable to save the key to be used for the connections:

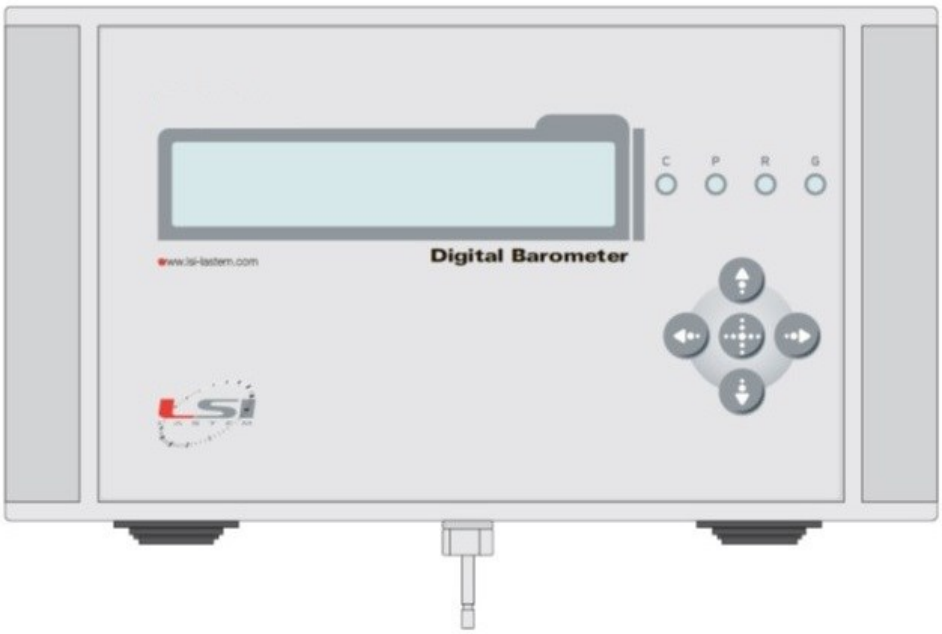


And at the end of the transaction the window that allows the exchange of files between the connected client and the SFTP server inside the barometer appears:



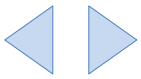
5 Using the keyboard

DQA251 is equipped with a functional five-key keyboard that allows you to act on some parameters of the system and navigate through the acquired measurements.

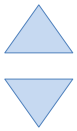


The keyboard consists of the following function keys:

allows you to confirm the selection or enter the sub-menus



allow navigation of measurements



allow vertical scrolling of measurements or of menu items

Display of measurements

Under normal operating conditions, the instrument presents on the first line of the display the ID associated with it (station ID), time and date, while, on the second line, it shows the measurements according to the configurations.

- By pressing the left /right arrows you can move to view the measurements of the specified user.
- By pressing the up/down arrow keys it is possible to move between any active users in the machine.

Setup

When the central button is pressed, the menu items relating to local configuration are enabled and available to the operator. Possible actions are:

`Date time setup`

Permits to modify time and data.
The menu shows sequentially all the date and time fields that can be modified using the up/down arrow keys and permit to confirm them using the center key.
At the end of the date/time change, the device restarts to apply the changes.

`Change Offset VAR-AV`

Permits to modify offset in a range of ±99 Pa (±0.99 hPa).
Selecting this function will appear the latest offset set in Pa. Press the arrow UP/DOWN to increase descrease the offset. Note that 1 Pa corresponds to 0.01 hPa, then you can adjust offset in a range ±0.99 hPa.
After selected new offset, press the central button to confirm and **wait at least 2 minutes**.

`Restore factory set`

It allows to restore the reconfiguration of the device to a default configuration stored in the factory during the production of the machine.
NOTE: *attention, in this case all the changes introduced by the user will be lost.*

`Exit`

Exit from the menu.

6 Diagnostic function

Following the switching on of the barometer as described in the paragraph **Errore. L'origine riferimento non è stata trovata.**, the following messages appear in the display order:

■■■■■■■■■■■■■■■■■■■■■■■■	: characters of the LCD test
`Waiting ... Fw Ver. 2.15`	: it shows the version of the firmware loaded in the first row

In the second line the messages appear in sequence:

`ip = 192.168.1.115`	: ip of the barometer
`Running . . . . . .`	: diagnostic message completed successfully
`Waiting for instantaneous data`	: waiting for the first acquired measurements

The bootstrap phase can exceed one minute.
If some checks are not successful, the machine stops and displays the last correct check made on the display.
Depending on the configuration, the configured measures will start cyclically alternating with the display.

7 Table of possible drawbacks

Problem	Possible causes	Solution
It does not come on	Power supply failure, low battery, incorrect power connection.	Check the wiring and the presence of at least 12V DC of power supply between the + Vbatt and Gnd terminals in the power connector.
It crashes during start-up in one of the tests	Internal hardware error.	Repeat the ignition of the machine. If the problem persists, contact the LSI LASTEM Technical Support.
The measurements appear on the display but there is no data	Wrong configuration or incorrect connection of the sensors	Check the configuration, check the correct insertion of the sensor connection connectors or check the wiring of the sensors. Check that the sensor is not damaged
Only some measurements appear on the display, but not all	Damaged sensors or plugs not properly inserted; incorrect configuration.	Check the sensors, their wiring and connection, then check the configuration.
it is not possible to connect to the control unit	Unsuitable network cable (not cross), incorrect configuration of the IP address class of your computer, presence of firewalls or other devices to block each connection.	Check the type of Ethernet cable and its correct insertion into the PC sockets and device. Check that the IP address of your computer is congruent with that of the barometer (default 192.168.1.115, subnet mask 255.255.255.0)
I always see the same data on the web page	Browser cache not updated	Clear the browser cache from the tools menu and set the search for the most updated pages every time the web page is opened.
The loaded configuration does not correspond to the one set	Browser cache not updated	Clear the browser cache from the tools menu and set the search for the most updated pages every time the web page is opened.
While the sensors are working, the asterisks "*" appear in the data trace	Possible error in the configuration to the minimum and maximum validation parameters. Sensor out of range or not working properly	Check the set values for the minimum and maximum of the measurement in the configuration of the device. Check that the sensor is working properly.

After switching on, the display remains off	Standby activated, display can be broken, hardware failure possible	Turn the machine off and on again or try connecting with the LAN cable to the web server. If necessary, contact LSI LASTEM Technical Support for repair.

8 Technical specifications

Range	500 ÷ 1200 hPa
Linearity / Hysteresis	< 0.1 hPa
Resolution	0.01 hPa
Accuracy at 20 °C	±0.15 hPa
Total extended accuracy	±0.20 hPa (-40 ÷ 60 °C)
Time constant	~ 2 s
Long term stability	< ±0.1 hPa/year
Working conditions	-40 ÷ 80 °C [0÷100 RH] (-20 ÷ 60 °C display)
Over pressure limit	3000 hPa
Housing	Enclosure in heavy duty metal painted, IP67
Data transfer	Modbus on RS485; Modbus on TCP-IP, LAN Eth; autosending on RS232, socket, FTP (SDI12 Optional)
Power Supply and consumption	10.8 ÷ 15 V DC, <0.9 W (~ 45 mA @ 12 V DC)
Protections	Polarity reverse and transient
Current Consumption	< 0.6 W (~ 45 mA @ 12 V DC)
Weight	~ 700 g

Technical data according to CIMO/ET-Stand-1/Doc.10 (20.XI.2012) WMO -2012.

9 Data record file

The **DQA251** series device stores or transmits a text file in **ASCII proprietary** format as standard. It is always possible to construct a customised format. Here we will explain the structure of the proprietary format which, in its minimal form, is as follows:

S, ID_SENS, TIME, DATE, ID_MIS1, Type_ELAB_MIS1, DATA, ID_MIS1, Type_ELAB_MIS2, DATA, … , ID_MIS1, Type_ELAB_MISn, DATA, … , ID_MISm, Type_ELAB_MISn, DATA, #

I vari campi del tracciato hanno le seguenti definizioni:

ID_SENS: it is a long integer and is unique

TIME: time of record in format hh, mm, ss

DATE: record date in the format dd, mm, yyyy

ID_MISm: ID of the mth measurement associated with the station/sensor

Example:
1 = Temperature
2 = Humidity
3 = Pressure
4 = Wind Direction
5 = Wind Speed
6 = ….

Type_ELAB_MISn: ID of the nth processing provided by the control unit associated with the mth measurement acquired

Example:
1 = Instant
2 = Medium
3 = Minimum
4 = Maximum
5 = Min. Minimum
6 = Min. Maximum
7 = ….

DATA: data associated with the nth processing provided by the control unit associated with the mth measurement acquired. The nature of the data and its formatting depend on the type of signal acquired. The record ends with #.

If there are **several records** in the same file, they are **stored on different lines**, so at the end of each line there are the characters CR (0xA) and LF (0xD).
If there are **several measurements of the same time**, the identifier of the second measurement is entered with an **offset of 50** (fifty) added to the identification of the previous one: for example, if there are three temperatures in a configuration, the first has identifier 1, the second will have identifier 51 and the third will have identifier 101.
In data storage, if the **measurement is outside the acquisition interval**, an ***** (**asterisk**) character will be inserted in the path instead of the data.

Example:

S,000001,00,05,00,12,03,2006,1,1,16.8,1,2,16.8,#
S,000001,00,10,00,12,03,2006,1,1,16.8,1,2,16.9,#

In the example above we can see that the file consists of two records at different times, coming from the TMF terminal n.000001: two pieces of temperature data were sent, the instantaneous and the medium one.

10 Disposal

This product is a device with high electronic content. In accordance with the standards of environmental protection and collection, LSI LASTEM recommends handling the product as waste of electrical and electronic equipment (RAEE). For this reason, at the end of its life, the instrument must be kept apart from other wastes

LSI LASTEM is liable for the compliance of the production, sales and disposal lines of this product, safeguarding the rights of the consumer. Unauthorized disposal of this product will be punished by the law.

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

11 How to contact LSI LASTEM

In case of problem contact the technical support of LSI LASTEM sending an e-mail to support@lsi-lastem.com, or compiling the technical support request module at www.lsi-lastem.com.

For further information refer to addresses and numbers below:

- Phone number +39 02 95.414.1
- Address: Via ex S.P. 161 – Dosso n. 9 - 20049 Settala Premenugo, Milano
- Web site: www.lsi-lastem.com
- Commercial service: info@lsi-lastem.com
- After-sales service: support@lsi-lastem.com, Repairs: riparazioni@lsi-lastem.com