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English

Operating manual

Barometric Data Logger

HD3114B

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Members of GHM GROUP:

GREISINGER
HONSBERG
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IMTRON
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1 INTRODUCTION

HD3114B is a pressure, temperature and humidity data logger with a large (43 x 58 mm) color graphic LCD display.

The instrument has a built-in precision barometric sensor for the measurement of the atmospheric pressure and the calculation of the following barometric and altimetric derived parameters: **barometric tendency and trend**, **altitude**, **QNH** (atmospheric pressure at mean sea level calculated considering the international standard atmosphere - ISA), **QFE** (atmospheric pressure at ground level) and **QFF** (atmospheric pressure at mean sea level calculated considering the real temperature). The instrument can display the internal temperature of the barometric sensor.

The input for SICRAM probes (intelligent and interchangeable probes capable to store calibration data into memory) allows connecting:

- 4-wire Pt100 temperature probes.
- Temperature and relative humidity combined probes.
- TP704/TP705 absolute/relative/differential probes with PP471 module.

The type of SICRAM probe connected is automatically recognized by the instrument. The probes are supplied factory- calibrated and are interchangeable.

By connecting a combined relative-humidity and temperature probe, the instrument calculates the derived humidity quantities: dew-point temperature, wet-bulb temperature, absolute humidity, mixing ratio, partial vapor pressure, saturated steam pressure, enthalpy. The DI (Discomfort Index) and the NET (Net Effective Temperature) indexes are calculated as well.

The display can show up to 24 quantities, three of which can be displayed simultaneously in numeric format. A real-time measured quantity graph is shown in the display.

The measuring unit can be selected according to the measured physical quantity.

Data logging function with data storage in CSV format directly into the SD-type Memory Card, for a long logging time (for example, with a 4 GB SD-type card, the logging lasts several months even when recording several quantities with the minimum logging interval of 1 second). User-configurable storage interval. Manual or programmed logging start/stop. Logging date/time storage of each sample (automatically creates measurement reports in PDF format in the memory card). Manual RECORD function (acquires the current measurement by simply pressing a button) or automatic RECORD function (acquires the current measurement once per second) for the calculation of minimum, mean and maximum values of the measured quantities.

HOLD function (holds current measurements on the display) and REL function (difference with regard to a stored value).

Functions reserved through user password. USB port with mini-USB connector for PC connection, for configuration and download of the acquired data. The **DeltaLog9** application software is downloadable from Delta OHM website.

It is provided with MSD (Mass Storage Device) mode, in which the instrument is seen by the PC as a SD card reader, thus allowing direct access to the memory card for displaying, copying or deleting the logging files.

Serial output for the print of the displayed measurements on a RS232C input printer. The Baud Rate can be set from 1200 to 115200.

Lithium ion rechargeable battery. Automatic switch-off (may be disabled) after user-configurable downtime (2, 5, 10, 15, 20 or 30 minutes) for preserving the battery life. External power supply through USB input (with mini-USB connector) by connecting a 5 Vdc power supply unit or a PC USB port (500 mA at least). With an external power supply unit connected, the battery is recharged and the automatic switch-off is automatically disabled.

2 DESCRIPTION

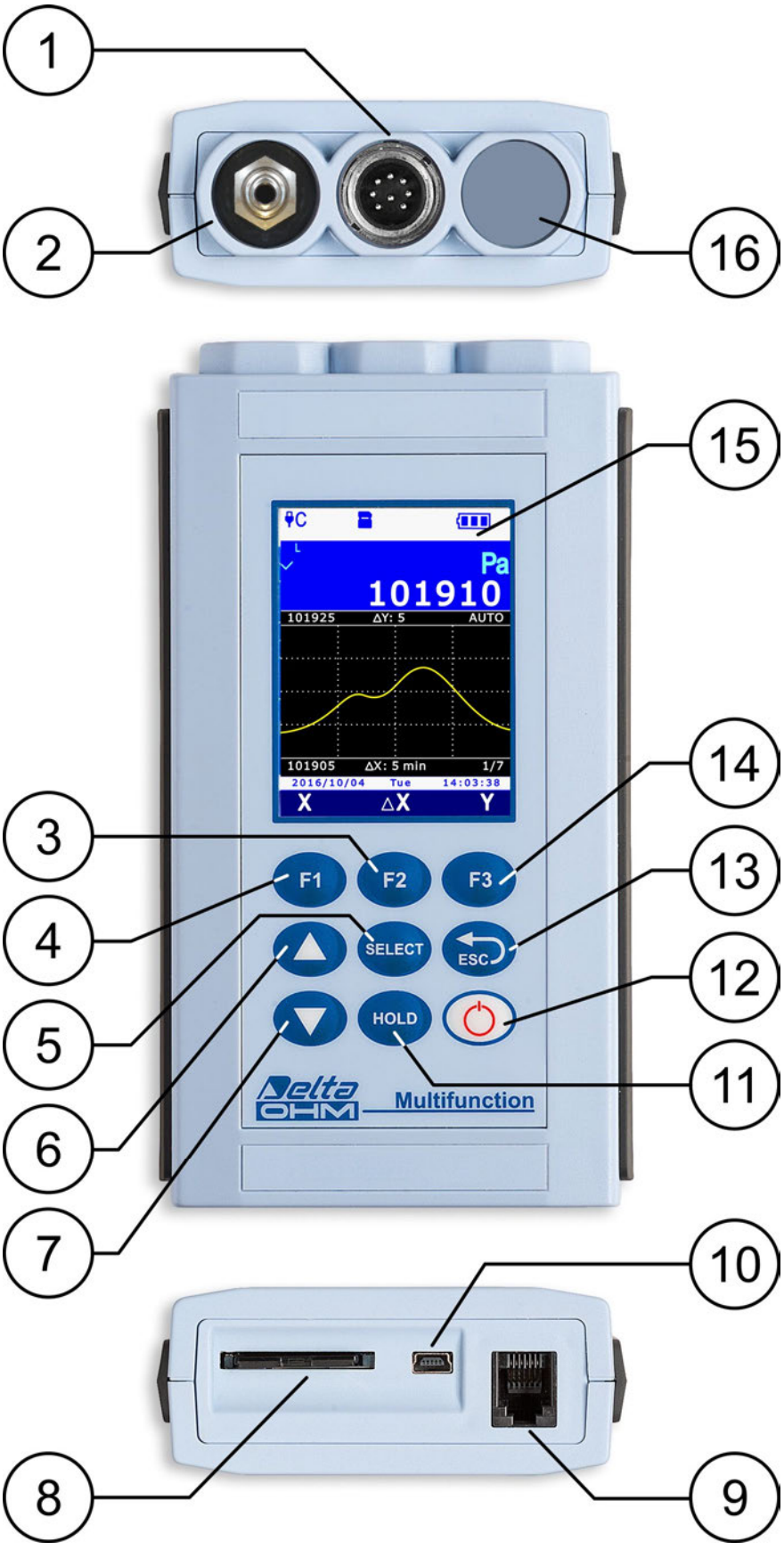


Fig. 2.1: instrument description

1. **Input B**, 8-pole DIN45326 connector.
2. **Input A**, barometric sensor.
3. **F2** function key: activates the central command in the command bar.
4. **F1** function key: activates the left command in the command bar.
5. **SELECT** key: scrolls cyclically forward the main commands in the command bar.
6. ▲ key: in "Measure" mode, selects cyclically one of the three measurements displayed; in the menu, it scrolls through the available options.
7. ▼ key: in "Measure" mode, scrolls cyclically downwards the measurements on the display (except the atmospheric pressure, which is always displayed in the first measurement line); in the menu, it scrolls through the available options.
8. **SD card** housing. To introduce the card, push it into the slot until it clicks into place, which ensures the correct insertion. To remove the card, push it until you hear the release click.

   CAUTION: to avoid data loss, do not remove the card if logging is active. Stop logging before removing the card.
9. RS232C serial output with RJ12 (6P6C) connector for connecting the printer.
10. USB port with mini-USB for connecting a PC or external power supply device.
11. **HOLD** key: holds the measurement to the current value.
12. **ON/OFF** key: turns the instrument on/off.
13. **ESC** key: in "Measure" mode, scrolls cyclically backward the main commands in the command bar; in the menu, it allows returning to the higher menu level; cancels the current operation without modifying the instrument parameters.
14. **F3** function key: activates the right command in the command bar.
15. Color graphic LCD display.
16. Unused input.

2.1 DISPLAY DESCRIPTION

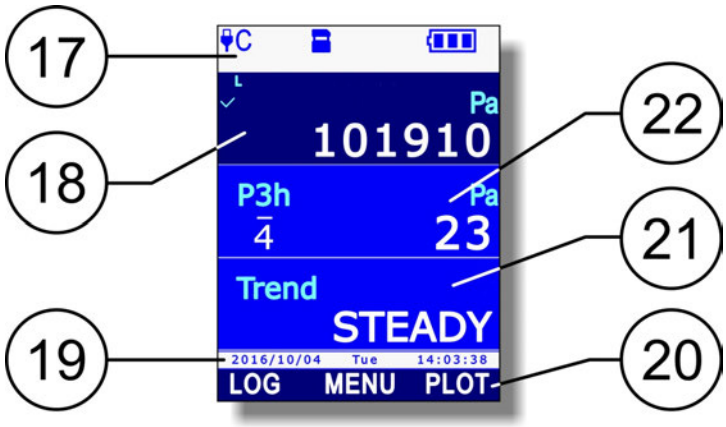


Fig. 2.1.1:display description

17. Status bar: shows information about logging state, battery charge level, presence of SD card, USB connection state, etc.
18. Display of the atmospheric pressure.
19. Date and time. During execution of the commands the line shows information messages.
20. Command bar (indications vary according to the function enabled).
21. Display of the third measurement.
22. Display of the second measurement.

2.2 KEY TO THE SYMBOLS IN THE STATUS BAR

	Instrument connected to a USB port on your PC
	Instrument connected to a USB port on your PC and communicating
	Instrument connected to the external power supply unit
	Instrument in MSD mode (Mass Storage Device): connected to the PC, it works as an SD card reader
	SD card inserted in the instrument
	Logging session enabled. The logging interval, in the case of automatic recording, or the MANL indication, in the case of manual recording, is shown under the symbol; the interval background turns light blue during acquisition time.
	Auto-off between two logging instants activated
	Start and stop logging instants programmed by the user
	Only the logging start time is programmed
	Only the logging stop time is programmed
	"Monitor" function active (enabled by DeltaLog9 software)
	The reduced level of brightness for the display is set
	Reduced brightness level temporarily suspended following the push of a key (the level will return to its “reduced” state after a few moments of inactivity)
	Auto-off function activated (*)
	Auto-off function disabled or temporarily suspended (for example, following the activation of the logging) (*)
	Battery charge between 67% and 100% (**)
	Battery charge between 34% and 66% (**)
	Battery charge between 4% and 33% (**)
	Battery charge less than 4% (**)

(*) The symbol is off if the instrument is connected to the external power supply unit or to the USB port of the PC.

(**) The symbol flashes when the battery is charging.

2.3 OVERVIEW OF THE FUNCTIONS IN THE COMMAND BAR

F1, **F2** and **F3** keys allow selecting the functions indicated in the display command bar. Press the **SELECT** key to scroll cyclically through the main functions available in the command bar (or alternatively the ESC key to scroll the functions in the opposite direction).

Some features include sub-functions (displayed in the command bar when you select the main function by pressing the corresponding function key) or opening a menu. The scheme in Fig. 2.3.1 illustrates the functions listed using the SELECT key and the corresponding sub-functions.

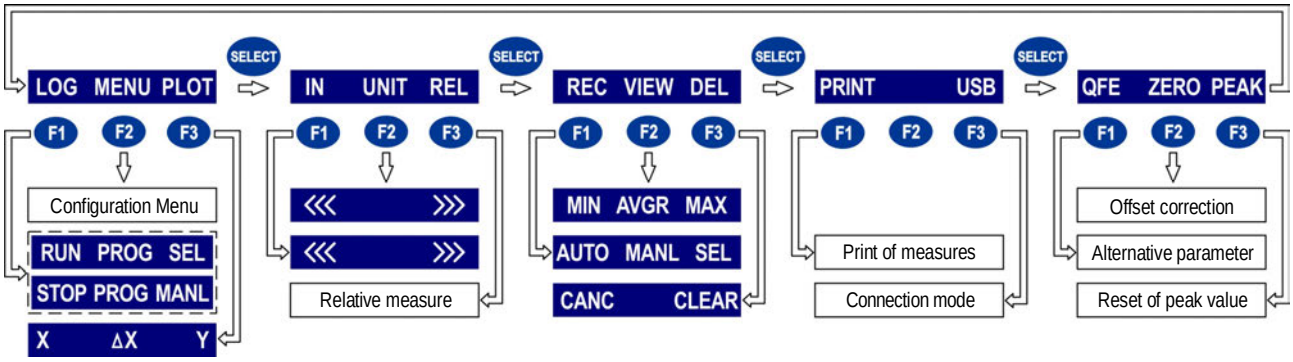


Fig. 2.3.1: functions in the command bar

The commands shown in the scheme are briefly outlined below. For a detailed description, please refer to the sections in the manual for the respective functions.

1. **LOG** (logging): logging on and off. If logging is not enabled, the following sub-functions appear:
   - **RUN**: manual start of the logging.
   - **PROG** (program): setting the programmed start and stop of the logging.
   - **SEL** (select): selects the measurement line indicated by the cursor on the display for logging. If the measurement line has been already selected, the selection is canceled.

   If logging is enabled, the following sub-functions appear instead of RUN and SEL:
   - **STOP**: manual stop of the logging.
   - **MANL** (manual): manual acquisition of a sample (function enabled only if the setting of the logging interval is MANUAL).
2. **MENU**: opens the configuration menu of the instrument.
3. **PLOT**: displays the real-time graphics of the measurement indicated by the cursor on the display. The following sub-functions appear:
   - **X**: displays the vertical cursors.
   - **ΔX**: sets the scale of abscissae.
   - **Y**: displays the horizontal cursors and the zoom functions of the axis of ordinates.
4. **IN** (input): selection of the quantities to be displayed. The following sub-functions are shown:
   - **<<<**: scrolls backward the available quantities in the display line indicated by the cursor.
   - **>>>**: scrolls forward the quantities available in the display line indicated by the cursor.
5. **UNIT**: selects the measurement unit. The following sub-functions are shown:
   - **<<<**: scrolls backwards the measurement units available for the quantity shown in the display line indicated by the cursor.
   - **>>>**: scrolls forward the measurement unit available for the quantity shown in the display line indicated by the cursor.
6. **REL**: displays the relative measurement, that is the difference between the current value and the one stored when the key was pressed, in the display line indicated by the cursor.

7. **REC** (record): calculation of minimum, average and maximum values. The following sub-functions appear:
   - **AUTO**: starts the automatic update, once per second, of the minimum, average and maximum values.
   - **MANL** (manual): updates the minimum, average and maximum values taking into account the measurement at the time when the command is selected.
   - **SEL** (select): selects the measurement line indicated by the cursor on the display for the REC function. If the measurement line is already selected, the selection is cancelled.
8. **VIEW**: views the minimum, average and maximum values (calculated with the REC function) of the selected quantity. The following sub-functions appear:
   - **MIN**: displays the quantity minimum value in the display line indicated by the cursor. Press the function key again to return to the current measurement value.
   - **AVRG** (average): displays the quantity average value in the display line indicated by the cursor. Press the function key again to return to the current measurement value.
   - **MAX**: displays the quantity maximum value in the display line indicated by the cursor. Press the function key again to return to the current measurement value.
9. **DEL**: deletes minimum, average and maximum values. The following sub-functions appear:
   - **CANC** (cancel): disables the REC function and deletes the minimum, average and maximum values.
   - **CLR** (clear): resets the minimum, average and maximum value calculation.
10. **PRINT**: sends the three measurements displayed when the key is pressed to the printer connected with the RS232C output. Also the information about the connected probes (type of probe, serial number, type of calibration used) are printed.
11. **USB**: activation and deactivation of the MSD (Mass Storage Device) to read the SD card from the PC (see paragraph 14.1 at page 82).
12. **QFE/REAL** - **QNH/QFF**: displays the altimetric parameter QFE instead of the atmospheric pressure (REAL) and vice versa - displays the altimetric parameter QFF instead of the altimetric parameter QNH and vice versa.
13. **ZERO**: corrects the offset of the probes provided with this function.
14. **PEAK**: resets the peak value of the pressure probes.

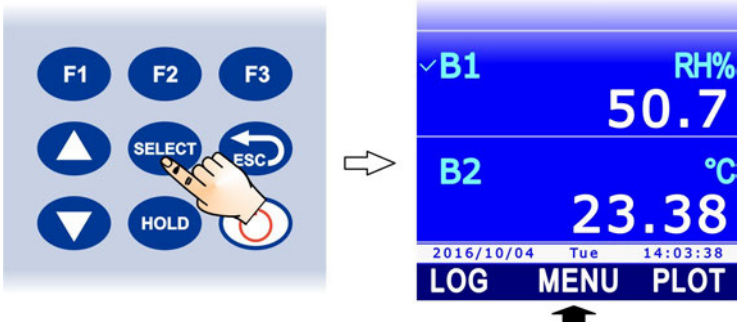
Note: some functions may appear disabled (grayed out) according to the selected quantity and the instrument state.

2.4 HELP FUNCTION

The instrument is provided with a quick HELP function that briefly describes the meaning of the symbol appearing in the display status bar and the function of the commands available through the SELECT key.

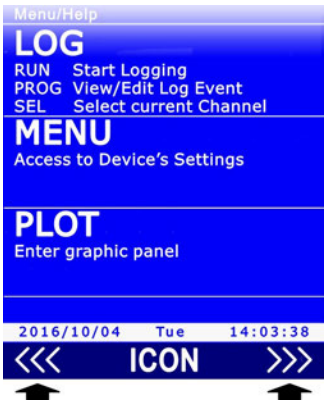
To access the HELP function:

1. Press the **SELECT** key to display the **MENU** command in the command bar.
2. Select the **MENU** command by pressing the **F2** key.

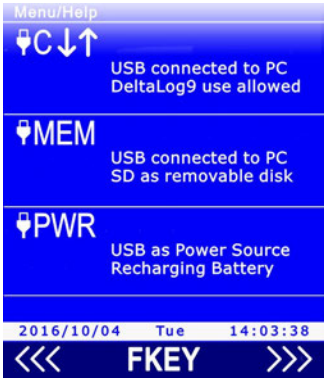


3. If necessary, select the **HELP** item using ▲ and ▼ keys, then press **F3** key (OK command) to confirm.

4. The HELP of the commands available with the SELECT key appears. To cycle through the list of commands, select repeatedly "**<<<**" (**F1** key) or "**>>>**" (**F3** key)



5. To display the help of the symbols appearing in the display status bar, select the **ICON** command by pressing **F2** key.
6. To cyclically scroll the symbols' list, repeatedly select "**<<<**" (**F1** key) or "**>>>**" (**F3** key). To return to the Help of the commands, select the **FKEY** command by pressing the **F2** key.



7. Press **ESC** key twice to exit the menu and return to the measurement mode.

3 MEASUREMENT MODE

Switching on and off the instrument is obtained by pressing the ON/OFF key.

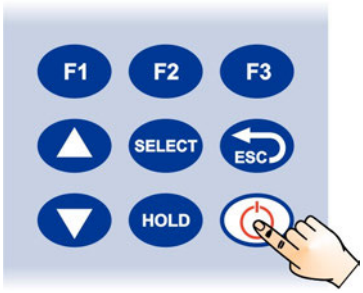


Fig. 3.1: ON/OFF key

At startup, the instrument displays (by default) the atmospheric pressure measurement and graph. To view the other measured quantities and the main functions of the instrument, press **ESC**.

The instrument displays three measurement lines at the same time. **The first measurement line always displays the atmospheric pressure**.

In addition to the atmospheric pressure measurement, the instrument provides the following barometric information:

- **P3h**: barometric tendency (3 hours) in numerical form.
- **Trend**: barometric trend (3 hours) in descriptive form (steady, increasing or decreasing).
- **IntT**: internal temperature of the barometric sensor.
- **ALT**: altitude.
- **QNH**: atmospheric pressure at mean sea level calculated considering the international standard atmosphere (ISA).
- **QFE**: atmospheric pressure at ground level.
- **QFF**: atmospheric pressure at mean sea level calculated considering the real temperature.

By default, the quantities QFE, IntT, ALT, QNH and QFF are not displayed; see paragraph 3.4. to display them.

The quantities measured by the probe connected to input **B** are identified by the letter **B** followed by a sequential number helping to differentiate the various quantities measured by the probe (in case of combined probe) or any derived quantities.

If there are more than three quantities, use ▼ key to cyclically scroll the list of the available quantities. During the scrolling operation, a small sequential number appears over the quantity identifier, marking the position of the measurement in the list.

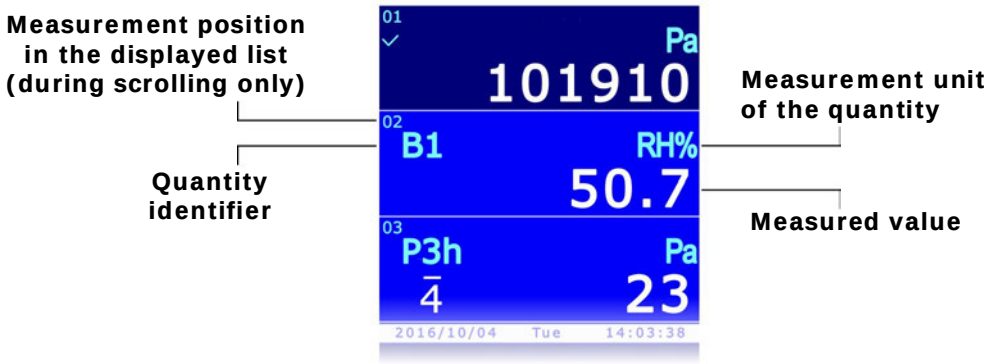


Fig. 3.2: measurements display

With the next switch-on, the instrument displays the list of the quantities as it appears at switch-off.

Note: the probe can be connected to input **B** even if the instrument is on, but it can not be replaced while the instrument is on; if the probe connected to input **B** is replaced while the instrument is on, the instrument has to be turned off and on to display the new probe measures.

3.1 SELECTING A MEASUREMENT LINE

Some functions of the instrument have effect on the selected measurement line, indicated by a check mark next to the quantity identifier. Use the ▲ and ▼ keys to select a measurement line. The currently selected measurement line is highlighted with the first press of the ▲ or ▼ key: repeatedly press the ▲ or ▼ key until the desired measurement line is highlighted and wait some seconds for the checkmark to appear.

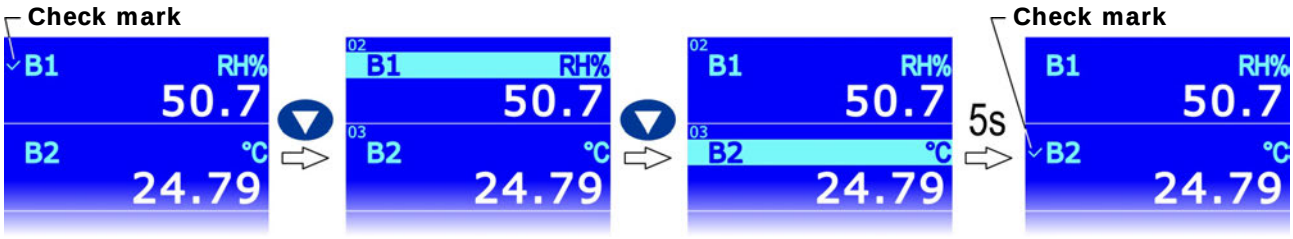


Fig. 3.1.1: selecting a measurement line

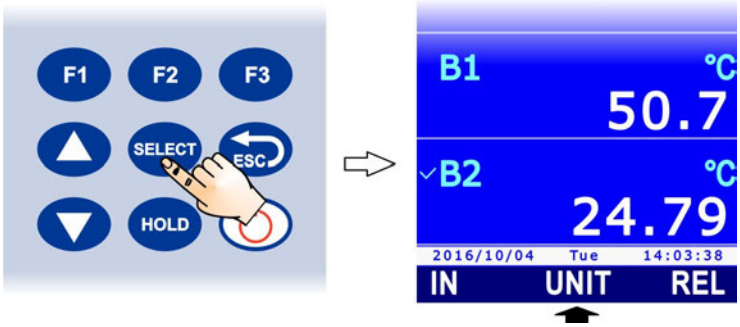
3.2 SELECTING THE MEASUREMENT UNIT

Several measurement units are available for some quantities (temperature, pressure, ...). To change the measurement unit of a quantity in a measurement line:

1. Select the desired measurement line using ▲ and ▼ keys.

2. Press **SELECT** until the **UNIT** command in the command bar is selected, then select the command by pressing **F2**.

   Note: if the quantity has no measurement unit available for selection or RECORD and/or LOG functions are enabled, the command is disabled.



3. Select "**<<<**" (**F1** key) or "**>>>**" (**F3** key) to cyclically scroll the available measurement units.

4. Press **ESC** to exit the **UNIT** command.

If the unit of measurement of the atmospheric pressure is changed, the unit of measurement of the barometric tendency P3h is also automatically changed, and vice versa.

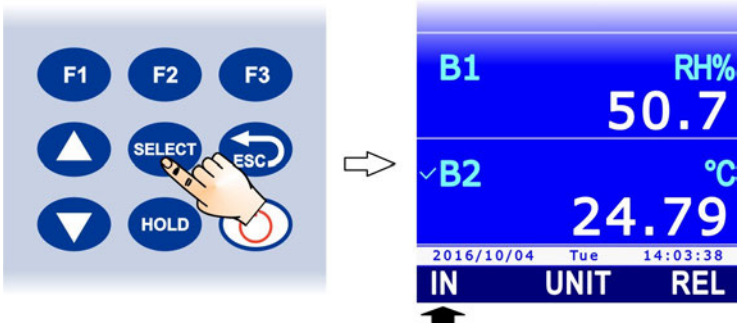
The measurement unit change affects the display and the immediate print of the measurements (PRINT command). **The data already stored in the SD card maintain the measurement units selected at storage.**

3.3 CHANGING THE QUANTITY VIEWED IN THE DISPLAY LINE

A quantity can be displayed in any measurement line of the display (except the first line, reserved to the atmospheric pressure):

1. Select the desired line with ▲ and ▼ keys.

2. Press the **SELECT** key to display the **IN** command in the command bar, then select the command by pressing **F1** key.



3. Select "**<<<**" (**F1**) or "**>>>**" (**F3**) to cyclically scroll the available quantities.

If you don't want quantities to be displayed in the line, select "__".

4. Press **ESC** to exit the IN command.

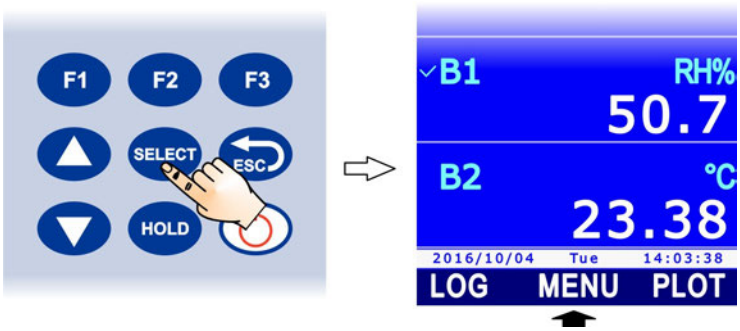
The same quantity can be displayed in several lines, e.g., for the simultaneous display of minimum and maximum values, or the current value and the average value, etc. (*note*: to display the minimum, average and maximum values of a quantity you need to activate the RECORD function, see chapter 5).

3.4 DERIVED QUANTITIES AND NUMBER OF MEASUREMENT LINES DISPLAYED

The number of measurement lines displayed can be configured. Up to 24 measurement lines can be displayed. The number of measurement lines displayed at the same time is always 3, further measurement lines can be seen by scrolling the list using ▼ key.

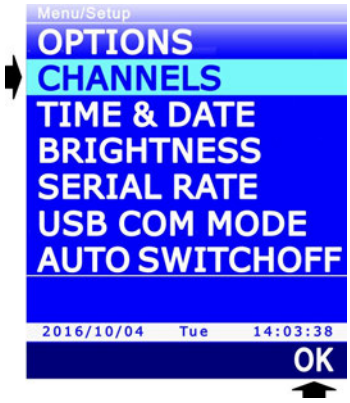
By default, the instrument displays only the quantities measured and the main derived quantities. For instance, connecting a combined relative humidity and temperature probe displays only the temperature, the relative humidity and the dew point temperature, but not the other derived quantities: absolute humidity, mixing ratio, etc. To enable any other derived quantities as well, or to disable some of the visible quantities, proceed as follows:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing **F2**.



2. Select the **SETUP** item using ▲ and ▼, then press **F3** (**OK** command) to confirm.

3. Select the **CHANNELS** item using ▲ and ▼, then press **F3** (**OK** command) to confirm.



4. Using ▲ and ▼, select **SENSOR INPUTS** for the barometric quantities or **PROBE INPUTS** for the quantities of the probe connected to input **B**, then press **F3** (**OK** command) to confirm.

5. The list of the available measured and calculated quantities, relevant to the selected input is displayed. The checkmark next to a quantity indicates that the quantity measurement is enabled (appears in the display). Using ▲ and ▼, select the quantity to be enabled or disabled, then press **F1** (**SEL** command) to toggle between the enabled and disabled states of the quantity.

6. Press **F3** (**OK** command) to confirm.

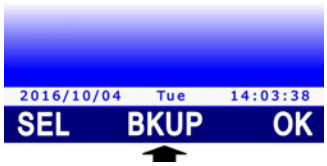
   Note: the enabled state of several quantities can be changed by selecting them one at a time, before confirming; the changed quantities are displayed in yellow to highlight changes.

Attention: in the list of the barometric quantities, the parameters **QFE** and **QFF** can not be selected. In order to display the parameter QFE, select (in measurement mode) the atmospheric

pressure measurement line and use the appropriate function key (see paragraph 2.3). In order to display the parameter QFF, enable the parameter QNH, then select (in measurement mode) the QNH measurement line and use the appropriate function key (see paragraph 2.3).

The instrument allows the setting of the quantity enable state to be saved, so as to be able to restore it afterwards and cancel any changes carried out thereafter.

Select the **BKUP** command (**F2** key) to save or restore the saved setting.



Select the **SAVE** command (**F1**) to save the setting. Select the **LOAD** command (**F2**) to restore the previously saved setting. Select the **BASIC** command (**F3**) to return to the default setting.

Press **F3** (**OK** command) to confirm the restore operation.

Press **ESC** to return to the previous menu.

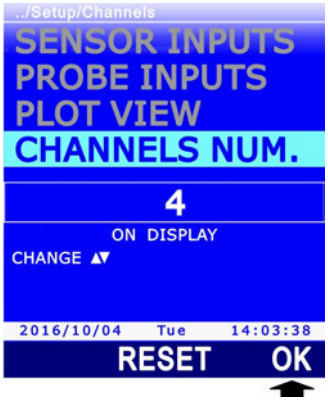
Number of displayed measurement lines:

The number of the displayed measurement lines is automatically updated when quantities are enabled or disabled. If you want a different measurement number to be displayed, e.g. to show simultaneously both the current value of a quantity and the relevant statistical information (Min, Max, Avg), the number of displayed measurement lines can be set manually:

1. Select the **CHANNELS NUM.** item in the CHANNELS menu, using ▲ and ▼, then press **F3** (**OK** command) to confirm.

2. Set the number of measurement lines to be displayed using ▲ and ▼ (select the **RESET** command with **F2** key to set the default number), then press **F3** (**OK** command) to confirm.

   Note: the current setting is shown in white, while the other available settings appear in yellow to show that they are not the current setting.



3. The instrument returns to CHANNELS NUM item, repeatedly press **ESC** to exit the menu.

3.4.1 BAROMETRIC DERIVED QUANTITIES

Barometric Tendency in numerical form (P3h):

The barometric tendency in numerical form is the difference between the current atmospheric pressure *P(t)* and the atmospheric pressure measured 3 hours before *P(t-3h)*, if the instrument is on at least for 3 hours. The value is updated every 10 minutes.

If the instrument is on for less than 3 hours, the displayed value is the difference between the current atmospheric pressure and the first atmospheric pressure value measured after switching on the instrument.

In addition to the pressure difference, an index and a graphic symbol representing the evolution of the atmospheric pressure during the last 3 hours are displayed. If the instrument is on for less than 3 hours, the index and the graphic symbol are replaced by the symbol "**!**".

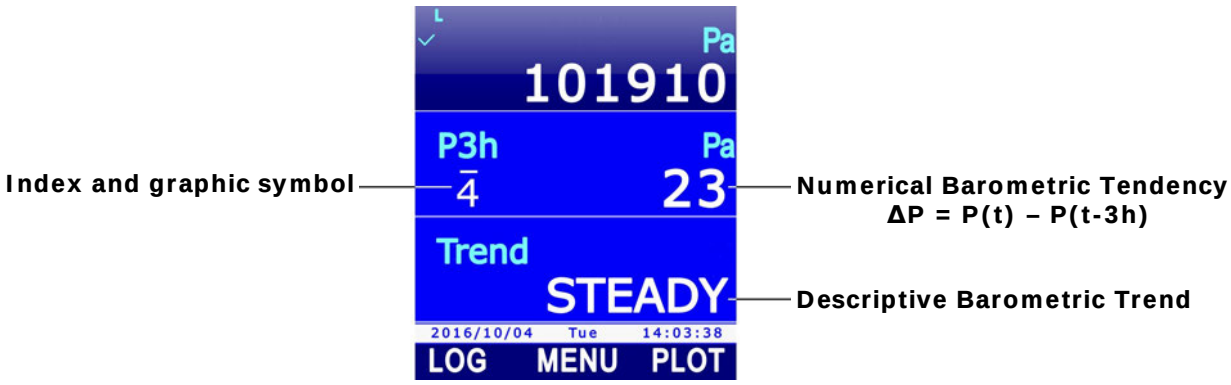


Fig. 3.4.1: barometric tendency and trend

The index and the graphic symbol are in accordance with the following table:

TAB. 3.4.1: indexes and graphic symbols of the barometric tendency

ΔP = P(t) – P(t-3h)	PRESSURE EVOLUTION	SYMBOL	INDEX
ΔP > 70 Pa	Increasing, then decreasing.		0
	Increasing, then steady or increasing more slowly.		1
	Increasing (steadily or unsteadily).		2
	Decreasing or steady, then increasing.		3
	Increasing, then increasing more rapidly.		
-70 Pa < ΔP < 70 Pa	Increasing, then decreasing.		0
	Steady.		4
	Decreasing, then increasing.		5
ΔP < -70 Pa	Decreasing, then increasing.		5
	Decreasing, then steady or decreasing more slowly.		6
	Decreasing (steadily or unsteadily).		7
	Increasing or steady, then decreasing.		8
	Decreasing, then decreasing more rapidly.		

Barometric Trend in descriptive form:

The barometric trend in descriptive form can take the following three values:

- **INCREASE** if $P(t) - P(t\text{-}3h) > 70$ Pa
- **STEADY** if $-70 \text{ Pa} < P(t) - P(t\text{-}3h) < 70$ Pa
- **DECREASE** if $P(t) - P(t\text{-}3h) < -70$ Pa

Altitude (ALT):

The altitude is calculated according to the following equation.

$$ALT = \frac{R \bullet T_0}{g \bullet M} \ln \frac{P_0}{QFE}$$

with:

R = universal gas constant (8.314472 J K^{-1} mol^{-1})

T_0 = standard temperature at mean sea level (288.15 K)

g = earth's surface gravitational acceleration (9.80665 m/s^2)

M = average molar mass of dry air (28.9644 g/mol)

P_0 = standard atmospheric pressure at mean sea level (101325 Pa)

QFE = atmospheric pressure (in Pa) at ground level (see the parameter QFE below)

QNH:

The parameter **QNH** represents the value of the atmospheric pressure at mean sea level in standard atmospheric conditions (ISA – International Standard Atmosphere), calculated as a function of the atmospheric pressure measured, the measurement site elevation and the instrument height above ground. To set the measurement site elevation and the instrument height above ground, see paragraphs 9.3 at page 57 and 9.4 at page 59.

The QNH parameter is used in aviation to determine the altitude of the aircrafts. Entering the QNH value in an altimeter, this will indicate the airport elevation when the aircraft is on the runway.

QFE:

The parameter **QFE** represents the value of the atmospheric pressure at ground level calculated as a function of the atmospheric pressure measured, the instrument height above ground and the air temperature. To set the instrument height above ground and the air temperature, see paragraphs 9.4 at page 59 and 9.5 at page 61.

If the instrument height above ground is zero, the value of the parameter QFE coincides with the atmospheric pressure measured.

The QFE parameter is used in aviation to determine the altitude of the aircrafts. Entering the QFE value in an altimeter, this will indicate zero when the aircraft is on the runway.

QFF:

The parameter **QFF** represents the value of the atmospheric pressure at mean sea level calculated as a function of the atmospheric pressure measured, the measurement site elevation, the instrument height above ground and the air temperature. To set the measurement site elevation, the instrument height above ground and the air temperature, see paragraphs 9.3 at page 57, 9.4 at page 59 and 9.5 at page 61.

The parameter QFF is mainly used in meteorology.

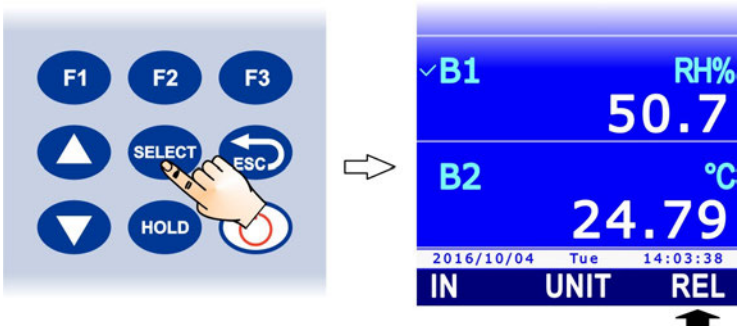
3.5 DISPLAYING THE RELATIVE MEASUREMENT (REL)

The instrument allows the relative measurement of the quantities to be displayed, i.e. the difference between the current measurement value and a reference value, consisting in the measurement value at the moment of the REL function activation.

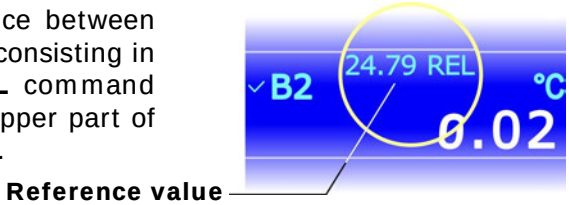
To activate the relative measure:

1. Select the quantity you want the relative measure to be enabled, using ▲ and ▼.

2. Press **SELECT** to display the **REL** command in the command bar, then select the command by pressing **F3**.



3. The selected measurement line shows the difference between the quantity current value and the reference value, consisting in the measurement value at the moment of the **REL** command activation. The reference value is displayed in the upper part of the measurement line (followed by the symbol **REL**).



Select again the **REL** command (**F3** key) to disable the display of the relative measure and return to the current measurement value.

3.6 HOLDING THE MEASUREMENT ON THE DISPLAY (HOLD)

The HOLD function holds the current measurement values on the display. The function affects all the measurement lines. When the HOLD function is active, the measurement values on the display are not updated, but remains set to the value present at the moment of the function activation.

Press **HOLD** to activate the function. The function activation is highlighted by the orange bars over and under the measurement area on the display, and by the word HOLD flashing in the top bar. The clock in the bottom bar remains stopped to the moment the key was pressed.

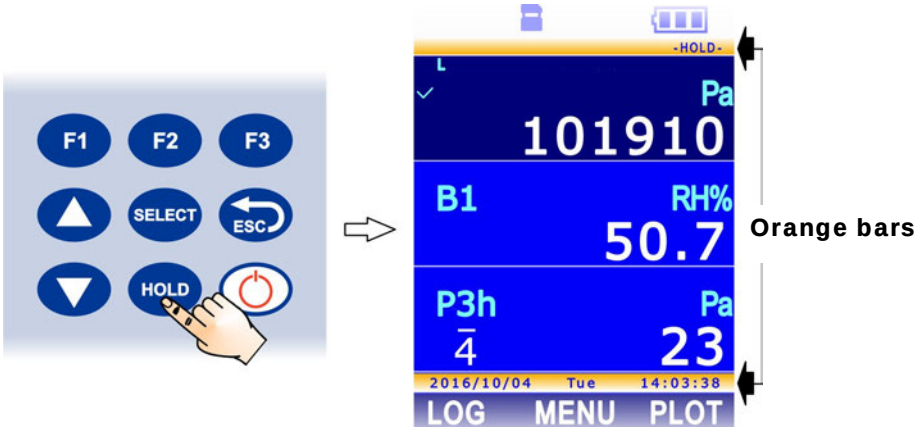


Fig. 3.6.1: HOLD function activation

Press again **HOLD** to disable the HOLD function and return to the current measurement values.

3.7 MEASUREMENT GRAPH

The graph of a quantity measured by the instrument can be shown in the display. Zoom functions and vertical and horizontal cursors are available during the graphical representation, allowing the graph to be analyzed in detail.

Select the quantity you want the graph to be displayed using ▲ and ▼. Press **SELECT** to display the **PLOT** command in the command bar, then press **F3**.

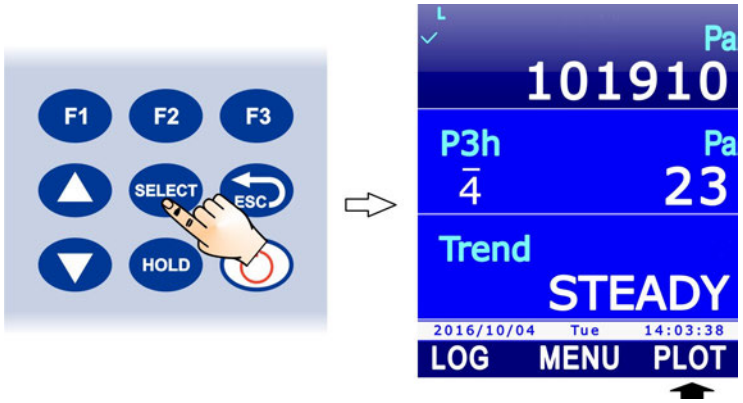


Fig. 3.7.1: PLOT command

If the graph of another quantity was previously started, a message appears asking to confirm the change: select **YES** (**F3** key) to continue (or press F1 to select NO and exit). The quantity graph appears on the display.

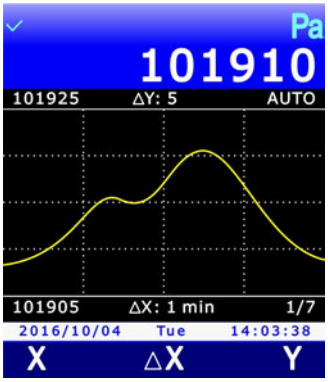


Fig. 3.7.2: graph display

The minimum and maximum values of the ordinate axis (y-axis) are shown at the left of the graph. Over the graph, in the middle, there is the ordinate scale: **ΔY** is the difference between two horizontal lines of the graph grid. Under the graph, in the middle, there is the abscissa scale: **ΔX** is the difference between two vertical lines of the graph grid.

Note: **ΔY** does not appear in the graph of the *Trend* barometric parameter, because it is not numeric.

Horizontal cursors and ordinate axis scale:

By selecting the **Y** command (**F3** keys), the horizontal cursors and the zoom commands of the ordinate axis are displayed.

The **CUR** command (**F2** key) activates alternatively the lower or the upper cursor. The active cursor is light blue, while the non-active cursor is white. You can move the active cursor using ▲ and ▼. The positions of the two cursors appear in the command bar.

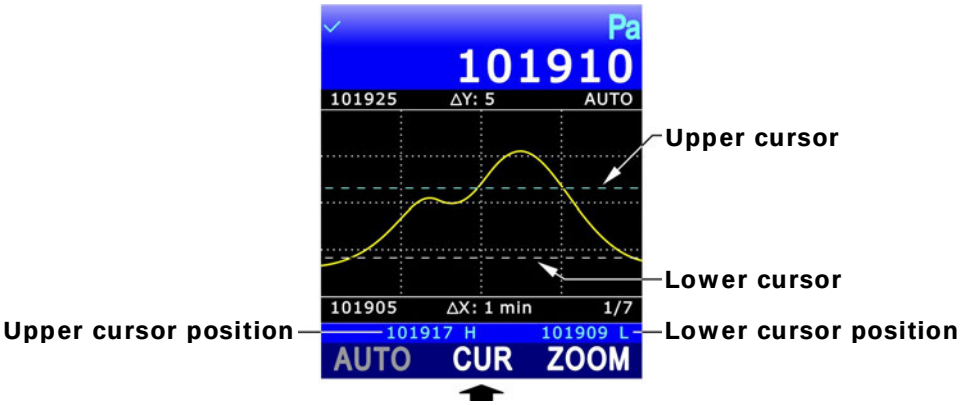


Fig. 3.7.3: horizontal cursors

The **ZOOM** command (**F3** key) enlarges the graph area included between the two horizontal cursors: the minimum and maximum values of the ordinate axis are equal to the values indicated by the lower and the upper cursor respectively. The indication AUTO (automatic ordinate scale) is replaced by the indication ZOOM over the graph, on the right.

The **AUTO** command (**F1** key) allows zooms to be disabled and to return to the automatic ordinate scale.

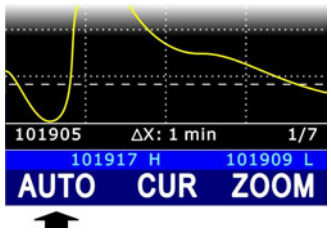


Fig. 3.7.4: AUTO command

Vertical cursors and x-axis scale:

Selecting **X** command (**F1** key) displays the vertical cursors of the abscissa axis (x-axis).

The **CUR** command (**F2** key) activates alternatively the lower or the upper cursor. The active cursor appears light blue, while the non-active cursor is white. The active cursor can be moved using **<<<** (**F1** key) and **>>>** (**F3** key) commands. The time distance between cursors (Δx) and the difference of the two measurements in correspondence with the cursors (Δy) appear over the command bar.

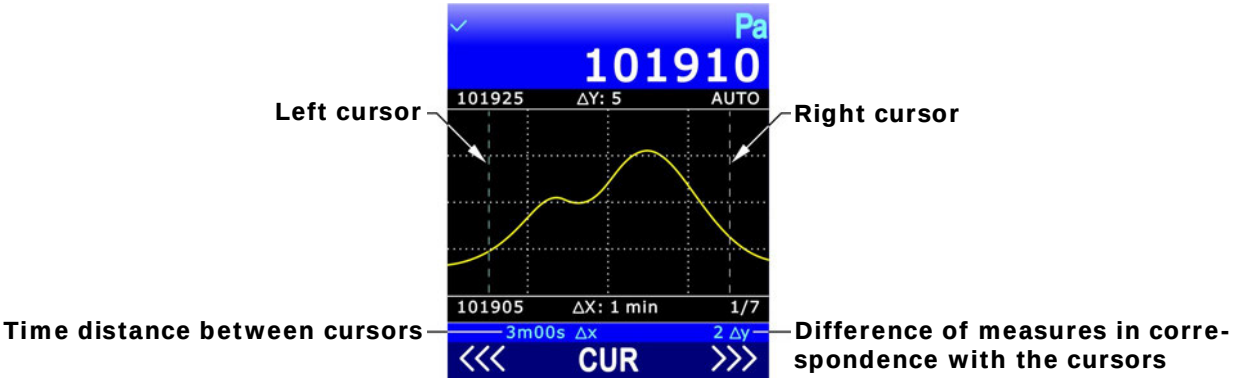


Fig. 3.7.5: vertical cursors

Press **ESC** to return to the previous command level.

The time interval between two vertical lines of the graph grid is set by default to 1 minute. Select **ΔX** command (**F2** key) to change the interval.

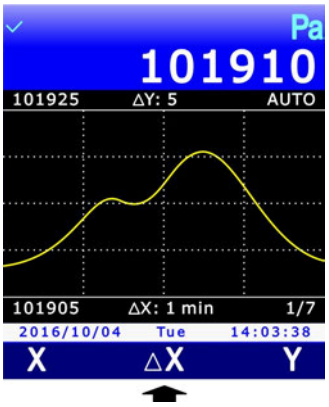


Fig. 3.7.6: command ΔX

The available intervals can be cyclically set to: 1 min, 5 min, 10 min, 30 min, 1 hour, 2 hours, 4 hours through the **NEXT** command (**F3** key). The sequential number of the selected interval appears under the graph on the right (e.g. 2/7 indicates the second interval of the seven available, that is 5 min).

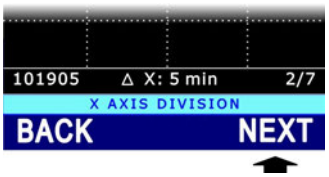


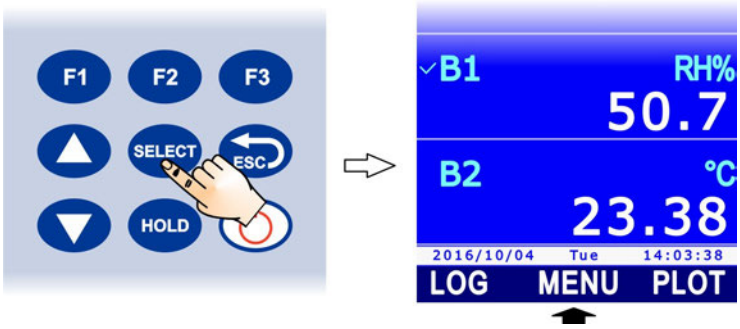
Fig. 3.7.7: x-axis scale setting

The time interval returns to the default value (1 min) by selecting the **BACK** command (**F1** key). If the interval returns to 1 minute (with the BACK command, or by setting the value from 4 hours to 1 minute with the NEXT command), the graph is reinitialized.

Viewing the graph at instrument startup:

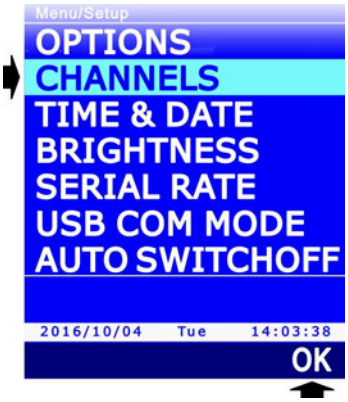
By default, at startup the instrument displays the graph of the last quantity selected for the graphical representation (by default, the atmospheric pressure). If you wish not to display the graph at startup, proceed as follows:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing **F2**.



2. Select the **SETUP** item using ▲ and ▼, then press **F3** (**OK** command) to confirm.

3. Select the **CHANNELS** item using ▲ and ▼, then press **F3** (**OK** command) to confirm.



4. Select the **PLOT VIEW** item using ▲ and ▼, then press **F3** (**OK** command) to confirm.

5. Using ▲ and ▼, select "F3KEY ONLY" to disable the graphical representation at startup or "POWER ON" to enable it.

   Note: the current setting is shown in white, while the other available setting appears in yellow color to highlight that it is not the current setting.

6. Select **OK** (**F3** key) to confirm, or ESC to exit without changing the value.
7. The instrument returns to the PDF FILE SIZE menu item, repeatedly press **ESC** to exit the menu and return to the measurement mode.

4 THE PROBES

The probes of the instrument are equipped with an “intelligent” module acting as interface between the probe and the instrument. Inside the module there is a microprocessor circuit with permanent memory performing different functions:

- allows the instrument to recognize the type of connected probe: Pt100, humidity probe, pressure probe, ...;
- stores into memory the probe calibration data: in this way the probe can be connected to another instrument with no need to be recalibrated;
- recognizes the instrument with which it was calibrated (user-calibration);
- maintains the factory-calibration data and those concerning the last calibration made by the user, with the possibility of choosing one of the two calibrations;
- stores into memory a serial number allowing the unique identification of the probe.

The SICRAM probe can be connected even if the instrument is on, but it can not be replaced while the instrument is on; if the probe is replaced while the instrument is on, the instrument has to be turned off and on to display the new probe measures.

SICRAM probes are supplied factory-calibrated and don’t normally require further interventions from the user. Nevertheless, a new calibration can be carried out if needed. See chapter 13 for user-calibration of the probes.

4.1 PRT TEMPERATURE PROBES

Pt100 probes with SICRAM module can be connected. The probes have a 4 wire connection and the excitation current is chosen in such a way as to minimize the sensor’s self-heating effect.

If your instrument needs to be connected to sensors that are not equipped with SICRAM module, one of the following two accessories will have to be placed between sensor and instrument:

- **TP471**: “intelligent” module with microprocessor and permanent memory, designed for 4-wire Pt100 Platinum sensors (**PRT**).
- **TP47**: connector without microprocessor and memory, designed for 4-wire Pt100 and 2-wire Pt1000 Platinum sensors (**PRT**).

TP471 and TP47 are provided with fairlead and cable grommet for 5 mm max diameter cables.

Proceed as follows:

1. Unscrew the fairlead and pull the cable grommet out, remove the identification label, unscrew the ring nut on the opposite side of the module/connector.

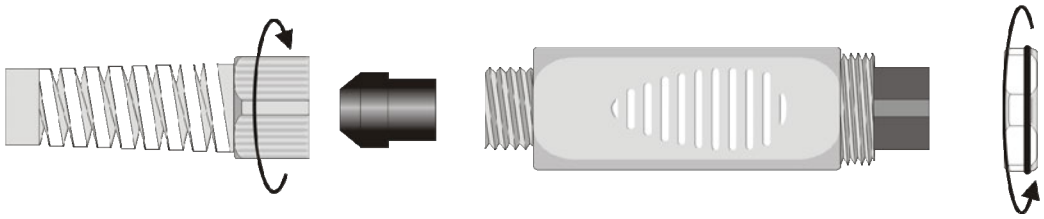


Fig. 4.1.1: opening the module/connector

2. Pass the sensor cable through the fairlead and cable grommet.
3. Open the two module/connector shells and connect the PRT sensor to the printed circuit as shown in the figure below. Take care that the welding is clean and skillfully made.

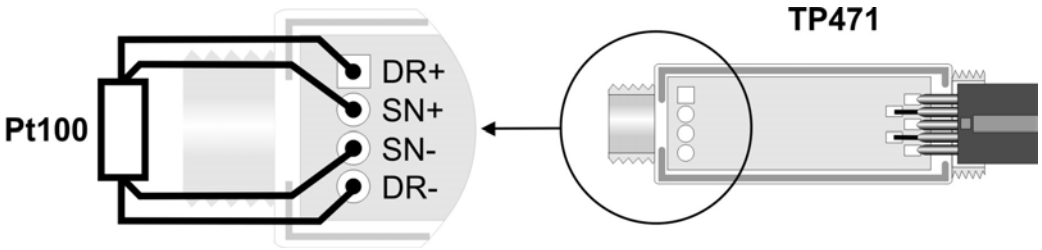


Fig. 4.1.2: connecting 4-wire Pt100 sensor to TP471 module

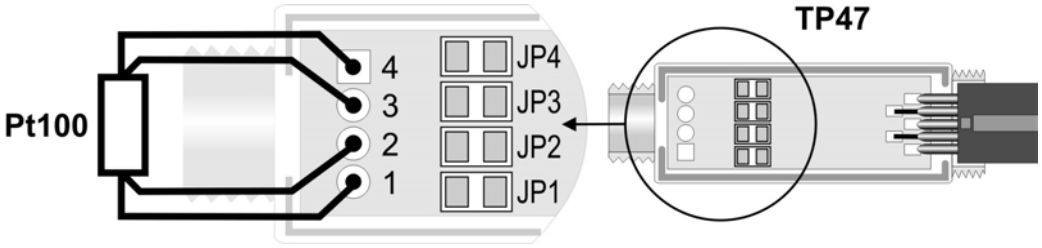


Fig. 4.1.3: connecting 4-wire Pt100 sensor to TP47 connector

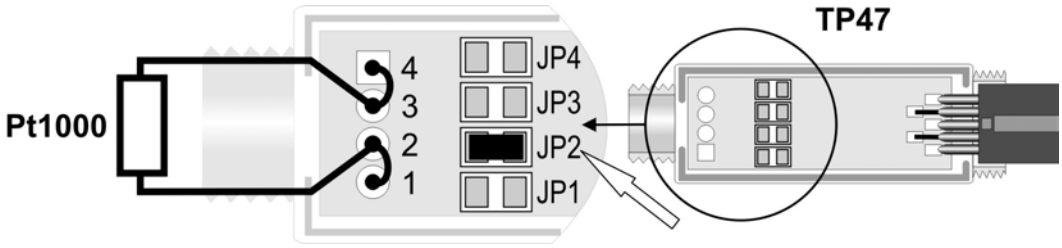


Fig. 4.1.4: connecting 2-wire Pt1000 sensor to TP47 connector

4. Close the two shells, insert the gasket in the module/connector, screw the fairlead and the ring. Make sure that the cable is not twisted when screwing the fairlead.

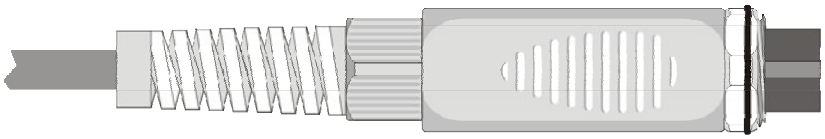


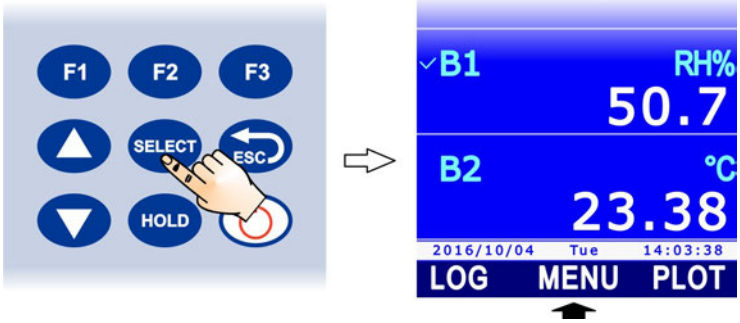
Fig. 4.1.5: PRT sensor connected to the module/connector

See paragraph 13.2 at page 72 for PRT probe calibration.

4.1.1 SETTING THE INSTRUMENT TO READ A PRT PROBE WITHOUT SICRAM MODULE

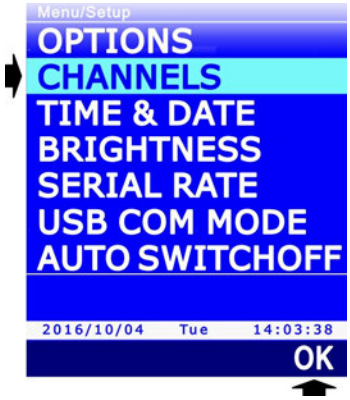
If a PRT probe without SICRAM module is connected, the type of connected probe must be set in the instrument:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing **F2**.



2. Select the **SETUP** item using ▲ and ▼, then press **F3** (**OK** command) to confirm.

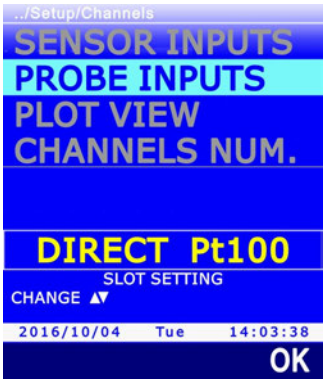
3. Select the **CHANNELS** item using ▲ and ▼, then press **F3** (**OK** command) to confirm.



4. Select the **PROBE INPUTS** item using ▲ and ▼, then press **F3** (**OK** command) to confirm.

5. Using ▲ and ▼, select the probe type: "SICRAM" (default), “DIRECT Pt100” or “DIRECT Pt1000”.

   Note: the current setting appears in white color, while the other available settings are in yellow color to highlight that they are not the current setting.



6. Press **F3** (**OK** command) to confirm.
7. Repeatedly press **ESC** to return to measurement mode.
8. Connect the probe, if not already connected (the probe can also be connected before the setting procedure).

Note: the probe type setting is maintained if the instrument is switched off with the probe connected; the setting returns to the default value (“SICRAM”) instead if the instrument is switched off when the input B is not connected.

4.2 RELATIVE HUMIDITY AND TEMPERATURE COMBINED PROBES

The relative humidity and temperature combined probes use a capacitive sensor for the measurement of relative humidity and a Pt100 sensor for the measurement of temperature. By connecting a relative humidity and temperature combined probe, the instrument can display, besides the two primary quantities, the following derived humidity quantities as well:

- Saturated vapor pressure (Svp) in hPa
- Partial vapor pressure (Pvp) in hPa
- Mixing ratio in g/kg (vapor grams in 1 kg of dry air)
- Enthalpy in J/g
- Absolute humidity in g/m^3 (vapor grams in 1 cubic meter of dry air)
- Dew point Temperature (Td)
- Wet bulb Temperature (Tw)
- Discomfort index (DiscIdx)
- NET index (NetIdx)

Note: **the calculation of the derived quantities is made taking into consideration a barometric pressure fixed value equal to 1013.25 hPa.**

For measuring, place the probe avoiding areas where fast temperature variations may occur creating condensation. The measurement in no condition of fast temperature variations is almost immediate. On the contrary, if fast temperature variations occur, you have to wait the sensors and the probe body to reach thermal balance in order to obtain accurate measurements.

See paragraph 13.3 at page 75 for the calibration of relative humidity and temperature combined probes.

4.2.1 DISCOMFORT INDEX AND NET INDEX

Environmental conditions affect our physiological well-being status: particular values of temperature, humidity and air speed are perceived as unpleasant or even intolerable. While it is easy to quantify the relationship between well-being status and the measure of each variable taken separately, it is even more complex to provide an indication about their combined effect.

For this reason, different evaluation systems have been introduced leading to the formulation of climate qualitative indices (**Comfort Indices**). The two indices provided by the instrument are the **Discomfort Index** and the **NET** index (Net Effective Temperature).

Discomfort index:

$$DI = 0.81 \bullet T + \frac{H}{100} \bullet (0.99 \bullet T - 14.3) + 46.3$$

with T = temperature in °C
H = relative humidity in %

On the basis of the value provided by the discomfort index, climate conditions are defined from comfortable to unsustainable:

Comfortable	Slightly uncomfortable	Uncomfortable	Very uncomfortable	Unsustainable
68	70	75	80	86

NET index:

$$NI = 37 - \frac{37 - T}{0.68 - 0.0014 \bullet H + \frac{1}{1.76 + 1.4 \bullet v^{0.75}}} - 0.29 \bullet \left(1 - \frac{H}{100}\right) \bullet T$$

With T = temperature in °C
H = relative humidity in %
v = air speed in m/s (= 0, because the instrument does not measure the air speed)

NET index provides the so called “apparent temperature”: with optimum weather conditions, the index value is close to the environmental T temperature. As weather conditions deteriorate, humidity influence become more and more evident and the index provides a temperature value that reflects human typical sensations, deviating even significantly from the ambient temperature value:

- in hot climate, the NET index rises as temperature and/or humidity level increases;
- in cold climate, the NET index decreases with temperature and with increasing humidity.

4.3 PRESSURE PROBES

The **PP471** SICRAM module can be connected to the instrument, for connection of absolute, relative and differential pressure probes of the TP704 and TP705 series. Connecting the module to the instrument displays both the instant value and the peak value of pressure. The peak value is characterized by the word "**peak**".

Pressure can be displayed in the following measurement units: Pa, hPa, kPa, mbar, bar, atm, mmHg, mmH_2O, kgf/cm^2, PSI, inHg, inH_2O. See paragraph 3.2 at page 13 for the measurement unit selection.

Some measurement units require the value to be displayed with a multiplication factor. If the displayed value is followed by the indication “E+3”, it means that the value must be multiplied by 1000; if on the contrary it is followed by the indication “E-3”, it means that the value must be divided by 1000.

4.3.1 ZEROING DIFFERENTIAL PRESSURE PROBES

There can be a small difference between the two inputs of the differential probes, that’s why the instrument, with equal pressure applied to the two probe inputs, doesn’t indicate zero value. A zeroing command for the differential value is available:

1. Leave the two inputs of the differential probe open, so as they may detect the same pressure.
2. Press **SELECT** to display the **ZERO** command in the command bar, then select the command by pressing **F2**.

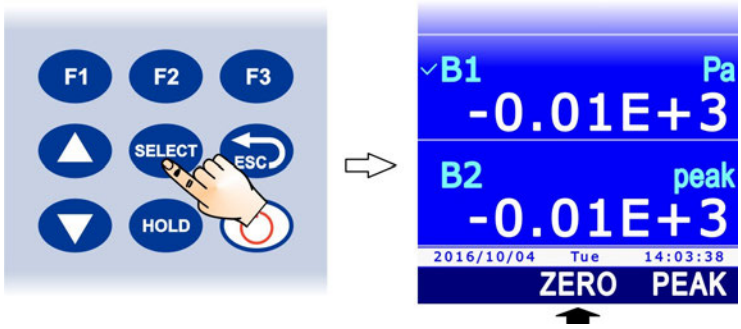


Fig. 4.3.1: ZERO command

3. The instant value is automatically zeroed.

4.3.2 PEAK VALUE RESET

The peak value detected by the probe connected to PP471 module can be reinitialized and set equal to the instant value:

1. Press **SELECT** to display the **PEAK** command in the command bar, then select the command by pressing **F2**.

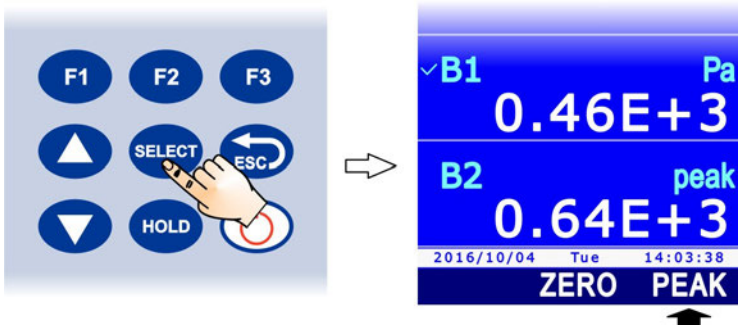


Fig. 4.3.3: PEAK command

2. The peak value is reset to the instant value.

Peak value reset during logging:

If the logging interval is lower than 60 seconds, the peak value is not zeroed: the acquired value is therefore the highest peak since acquisition startup.

For logging intervals equal to or higher than 60 seconds, the peak value is on the contrary re-initialized after each acquisition: the stored peak value is therefore the one related to the single interval between two subsequent acquisitions.

Two different operation modes have been chosen for this reason: when the logging interval is short, the set of the instant measures represents closely enough the pressure trend over time. In the case of long intervals, the mere knowledge of the pressure value of each interval and of the absolute peak value doesn't provide sufficiently precise information: knowing each peak value between two subsequent samplings provides additional information on the pressure time trend.

5 RECORD FUNCTION

RECORD function stores the minimum, average and maximum values of the displayed quantities.

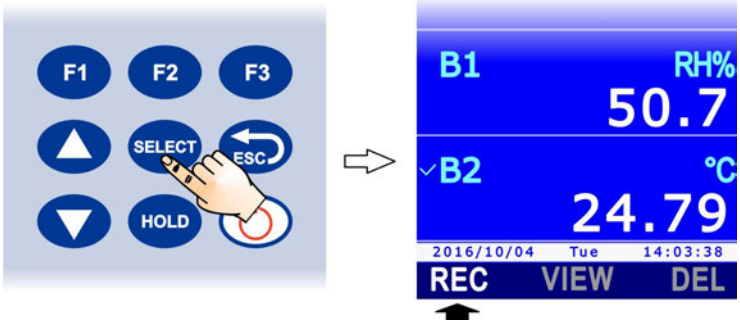
The upgrade of the minimum, average and maximum values takes place after each sample acquired using the RECORD function. The sample acquisition can be **automatic** (once per second) or **manual** (at the touch of a button).

Attention: data acquired using the RECORD function for the calculation of minimum, average and maximum values are not saved in the SD card and cannot be transmitted to a PC. Only the time trend of the minimum, average and maximum values can be recorded in the SD card through the LOGGING function (see chapter 7 at page 36).

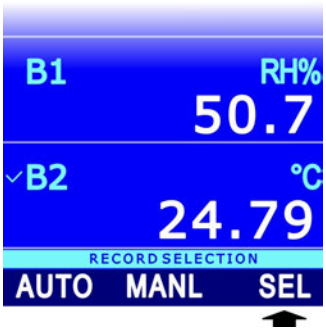
If quantities are not explicitly selected for the RECORD function, the function activation takes place for all the quantities displayed (except for the *Trend* barometric parameter, because it is not numeric). The RECORD function can be started only for some quantities, by explicitly selecting them.

5.1 SELECTING A QUANTITY FOR THE RECORD FUNCTION

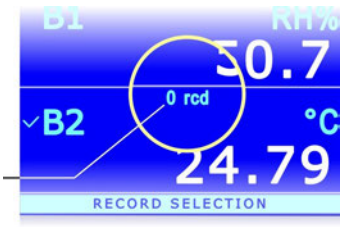
1. Select the quantity you want the RECORD function to be enabled for, using ▲ and ▼.
2. Press **SELECT** to display the **REC** command in the command bar, then select the command by pressing **F1**.



3. Select the **SEL** command by pressing **F3**.



4. The indication "0 rcd" appears on the upper part of the measurement line, to indicate that the quantity has been selected for the RECORD function.

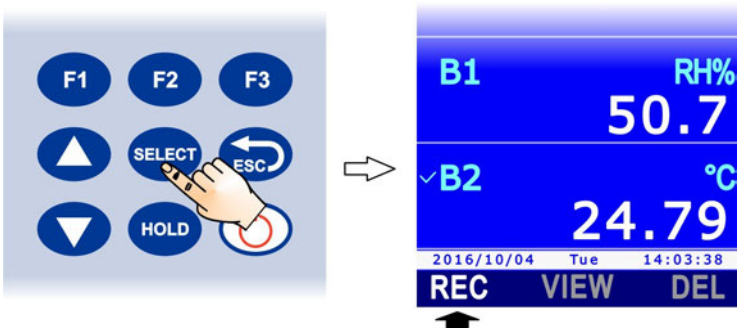


To deselect the quantity for the RECORD function, select again the **SEL** command (**F3** key): the indication "0 rcd" disappears.

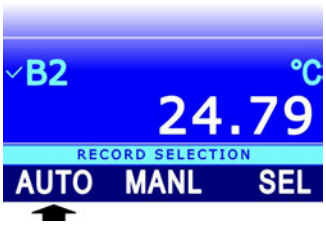
Select in the same way all the quantities you want the RECORD function to be enabled for.

5.2 SAMPLE ACQUISITION

1. Press **SELECT** to display the **REC** command in the command bar, then select the command by pressing **F1**.

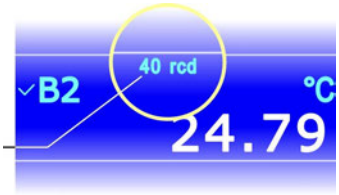


2. Select the **AUTO** command by pressing **F1** to start automatic once-per-second sample acquisition.



Select the **MANL** command by pressing **F2** to manually acquire a sample.

3. The number of acquired samples appears in the upper part of the measurement line.



AUTO and MANL commands start the acquisition of all the quantities selected for the RECORD function. If quantities have not been explicitly selected, the acquisition of all the quantities (except the *Trend* barometric parameter) is started.

Note: in case only some quantities were explicitly selected for the RECORD function, AUTO and MANL commands are available only if one of the quantities chosen for the function is selected on the display (indicated by a checkmark).

Select again the **AUTO** command (**F1** key) to stop the automatic acquisition of the samples.

Press **ESC** to exit the REC menu.

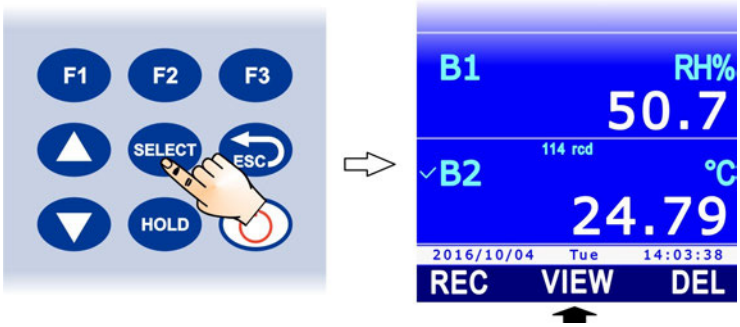
5.3 DISPLAYING MINIMUM, AVERAGE AND MAXIMUM VALUES

To display the minimum, average and maximum values acquired with the RECORD function :

1. Select the desired measurement line using ▲ and ▼.

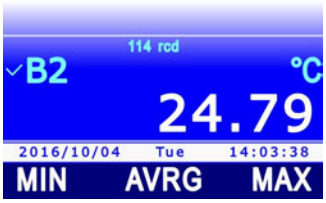
2. Press **SELECT** to display the **VIEW** command in the command bar, then select the command by pressing **F2**.

   Note: the VIEW command is disabled if there are no samples acquired with the RECORD function for the selected quantity.

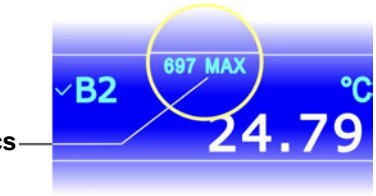


3. Select the command:

   - **MIN** (**F1** key) to display the minimum of the acquired values.
   - **AVRG** (**F2** key) to display the average of the acquired values.
   - **MAX** (**F3** key) to display the maximum of the acquired values



4. The indication of the performed selection is shown in the upper part of the measurement line, next to the number of the acquired samples.



Minimum, average and maximum values can be displayed also when the RECORD function is active: values are updated after each acquisition.

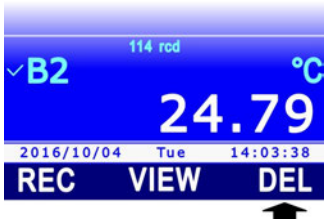
To disable the display of the statistical value and return to the current value, press again the button corresponding to the displayed statistics (e.g., select again MAX with the F3 key if the maximum value is displayed).

Press **ESC** to exit the **VIEW** menu.

Note: by displaying the same quantity in several measurement lines, both the quantity current value and the statistic information can be shown.

5.4 RESETTING AND DISABLING THE RECORD FUNCTION

The acquired values are added to the ones saved in memory. Delete the already acquired values by selecting the **DEL** command (**F3** key) to start a new calculation session of the minimum, average and maximum values.



Then select the **CLR** command by pressing the **F3** key: the counter of the acquired samples is zeroed.

To disable the RECORD function, select instead the **CANC** command by pressing the F1 key.

Press **ESC** to return to the previous menu level.

5.5 RECORD FUNCTION BEHAVIOR AT LOGGING STARTUP

Minimum, average and maximum values calculated with the RECORD function, which appear on the display, can be recorded onto the SD card thanks to the LOGGING function (see chapter 7 at page 36) exactly like the current values of the quantities. The data logger allows various behaviors of the RECORD function to be set at logging startup:

- Automatic reinizialization and activation, if in stop condition, of the function when logging is started.
- Automatic activation, if in stop condition, without reinitialization (the function continues from the reached value) of the function when logging is started.
- The function is neither automatically reinitialized nor automatically enabled, if in stop condition, when logging is started (the row will turn orange to highlight the stop status).

See paragraph 7.12 at page 49 to set the RECORD function behavior at logging startup.

The minimum, average or maximum values are stored (if selected for logging) only if the instrument is set to not turn off between two subsequent samplings, because calculating the minimum, average or maximum values each second requires the instrument to stay always on. If the instrument is set to turn off between two subsequent acquisitions, only the instant value of the signal supplied by the probe will be stored.

5.6 RECORD FUNCTION AND RELATIVE MEASUREMENT

If the RECORD function is used with relative measurements, pay attention that the meaning of the RECORD function is different depending on whether the function is enabled before or after the REL function.

If the REL function is enabled first and secondly the RECORD function, the values acquired by the RECORD function are the relative values of the quantity, and minimum, average or maximum values viewed on the display refer to the relative measurement. If the REL function is disabled, the RECORD function is automatically disabled too, because new relative quantity values are no more available.

If the RECORD function is enabled first (starting therefore to acquire the quantity actual values) and secondly the REL function, the RECORD function is not reinitialized, but continues to acquire the quantity actual values (and not the relative measurement displayed). The value appearing on the display is the difference between current value (if the “rdc” indication appears next to the number of acquisitions of the RECORD function) or the value calculated by the RECORD function (if the MIN, AVG or MAX indication appears next to the number of acquisitions of the RECORD function) and the reference value (actual value of the quantity at the moment in which the REL function was enabled). If the REL function is successively disabled, the RECORD function remains active and continues to acquire the quantity actual values.

The activation order of the functions appears on the display: the firstly enabled function is indicated in the upper part at the center of the measurement line, the secondly enabled function is indicated in the upper part at the right of the measurement line.

RECORD function enabled before REL function

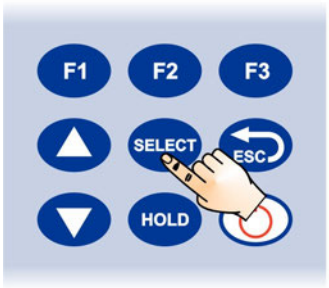
RECORD function enabled after REL function

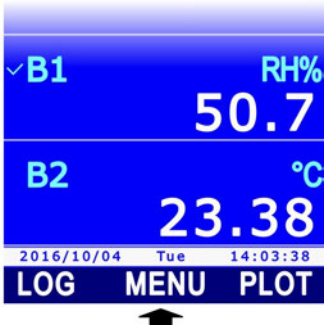
Fig. 5.6.1: activation order of RECORD and REL functions

6 SETTING DATE AND TIME

The logging function stores the date and the time of the acquisition of each sample. Before using the function, make sure that the correct date and time are set in the instrument. If necessary, adjust the instrument clock as follows:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.





2. Select the **SETUP** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. Select the **TIME & DATE** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

4. Select the different the date and time fields with "**<<<**" (**F1** key) or "**>>>**" (**F2** key) commands, the selected field flashes. Use ▲ and ▼ to change the value.

5. Press **F3** (**OK** command) to confirm: a message appears asking to confirm the operation, select **YES** (**F3** key) to continue, or **NO** (**F1** key) to cancel.
6. Press **ESC** to exit.

7 LOGGING

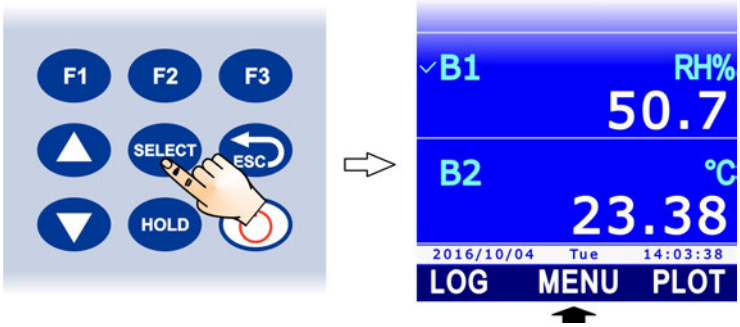
The LOGGING function allows the measurement detected by the instrument to be saved in the SD memory card. The data, stored in CSV format, can be subsequently transferred to a PC.

Logging can be **automatic** (the logging interval can be configured to 1, 5, 10, 15, 30 seconds / 1, 2, 5, 10, 15, 20, 30 minutes / 1 hour) or **manual** (at the touch of a button). Start and stop of automatic logging can be manual (at the touch of a button) or programmed (by setting the initial and final instant).

Either all the measurement lines or only those selected by the user can be logged (the atmospheric pressure is always selected for logging). The logging function requires a SD memory card to be inserted into the instrument; the function is disabled if no SD memory card is inserted.

7.1 SETTING THE AUTOMATIC LOGGING INTERVAL OR THE MANUAL LOGGING

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.



2. Select the **LOG SETTINGS** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

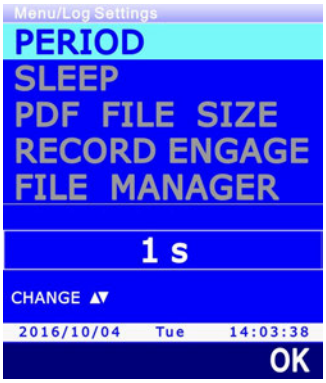
   Note: the item is disabled if the logging is in progress.

3. Select the **PERIOD** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

4. Using ▲ and ▼, select the interval for the automatic logging or the "MANUAL" item to set the manual logging.

   Note: the current setting appears in white, while the other available settings are shown in yellow to highlight that they are not the current setting.

   By selecting an interval exceeding or equal to 60 seconds, the indication "SLEEP AVAILABLE" appears under the interval value, to remind that the Auto-off of the instrument can be enabled between two logging instants (see paragraph 7.5).



5. Select **OK** (**F3** key) to confirm, or ESC to exit without changing the value.
6. The instrument returns to the PERIOD menu item, press **ESC** twice to exit the menu and return to the measurement mode.

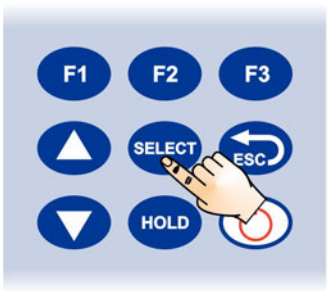
7.2 SELECTING THE MEASUREMENT LINES FOR LOGGING

If measurement lines are not explicitly selected for logging, the logging activation generates the storage of the atmospheric pressure only. Logging can also be performed for other measurement lines by explicitly selecting them.

You can log up to 16 measurement lines.

To select a measurement line for the logging:

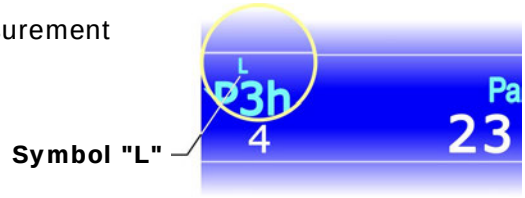
1. In measurement mode, select the desired measurement line using ▲ and ▼.
2. Press **SELECT** to display the **LOG** command in the command bar, then select the command by pressing the **F1** key.



3. Select the **SEL** command by pressing the **F2** key.

   Note: the SEL command is disabled if logging is in progress.

5. The **L** symbol is displayed in the upper part of the measurement line, to indicate that the line is selected for logging.



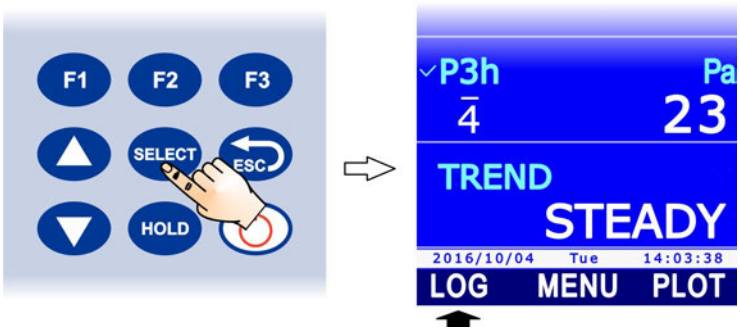
To deselect the measurement line for logging, select again the **SEL** command (**F2** key): the **L** symbol disappears (the atmospheric pressure can not be deselected).

Select in the same way all the measurement lines you want the logging to be performed.

Press **ESC** to exit the LOG menu.

7.3 MANUALLY START / STOP AUTOMATIC LOGGING

1. Press **SELECT** to display the **LOG** command in the command bar, then select the command by pressing the **F1** key.

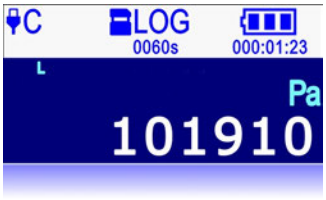


2. To start logging, select the **RUN** command by pressing the F1 key.

   Note: the RUN command is replaced by the STOP command if logging is in progress.

   Note: the RUN command will not go into effect if the instrument is waiting for a programmed startup.

3. The logging of the measurement lines selected for logging is started. The LOG indication, the set logging interval and the logging duration appear in the display status bar.



4. To stop logging, select again the **LOG** command (**F1** key), then select the **STOP** command (**F1** key).

5. After the stop command, the logging stop message appears: wait for the completion of the operation.

7.4 PROGRAMMING AUTOMATIC LOGGING START / STOP TIME

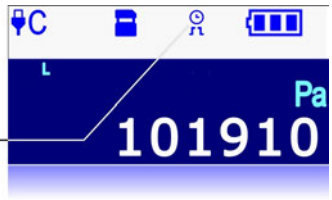
1. Press **SELECT** to display the **LOG** command in the command bar, then select the command by pressing the **F1** key.

2. Select the **PROG** command by pressing the **F3** key to program the logging start/stop time.

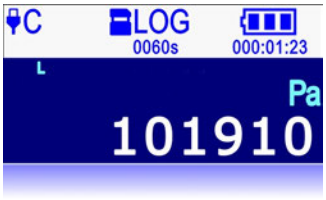
3. Using ▲ and ▼, select **START** to set the start time, or **STOP** command to set the stop time. If a programmed time has not been entered, the fields appear empty, otherwise the entered time is shown. Select **OK** by pressing the **F3** key to continue.

4. Select the different date/time fields using "**<<<**" (**F1** key) or "**>>>**" (**F2** key) commands, the selected field flashes. Use ▲ and ▼ to change the value.

5. Press **F3** (OK command) to confirm.
6. Press **ESC** to return to measuring mode. The programmed logging symbol appears in the display status bar.

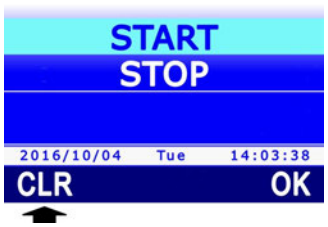


At the set start date/time, the logging of the measurement lines explicitly selected for logging is started. The LOG indication, the set logging interval and the logging duration are shown in the display status bar.



Logging will automatically stop at the set stop date/time. If you want logging to be stopped in advance, date/time programming must be deleted and stop logging manually as explained below:

1. Press **SELECT** to display the **LOG** command in the command bar, then select the command by pressing the **F1** key.
2. Select the **PROG** command by pressing the **F2** key.
3. Select the **CLR** command by pressing the **F1** key. A message is displayed asking to confirm the operation, select **YES** (**F3** key) to continue: logging programming is deleted.



4. Press **ESC** to return to the previous command level.

5. Select the **STOP** command by pressing the **F1** key.

   Note: if you try to stop logging manually without first deleting the programming function, the instrument displays an error message ("Log: Event conflict").

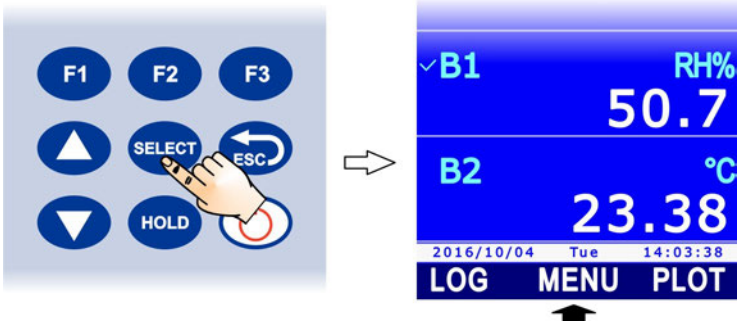
Only the logging start time can be set, in this case it will have to be stopped manually, or only the logging stop time, in this case it will have to be started manually.

After programming the logging function, the instrument can be switched off: it will be switched on automatically at the date/time set for the logging startup.

7.5 AUTO-OFF DURING AUTOMATIC LOGGING

If the logging interval is lower than 60 seconds, the instrument will remain switched on during logging. If the logging interval exceeds or is equal to 60 seconds, the instrument can be set to switch off between to subsequent loggings, to save battery life. If Auto-off is enabled, the instrument will automatically switch on at sampling and switch off immediately after. **If Auto-off is enabled, the barometric tendency P3h can not be logged**. To enable and disable Auto-off:

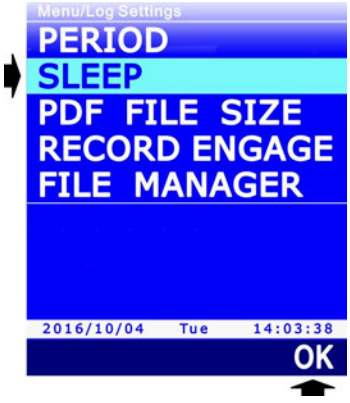
1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.



2. Select the **LOG SETTINGS** item using ▲ and▼, then press the **F3** key (**OK** command) to confirm.

   Note: the item is disabled if logging is in progress.

3. Select the **SLEEP** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.



4. Using ▲ and ▼, select "ENABLED" to enable the Auto-off or "DISABLED" to disable it.

   Note: the current setting is shown in white, while the other available setting appears in yellow color to highlight that it is not the current setting.

5. Select **OK** (**F3** key) to confirm, or ESC to exit without changing the value.

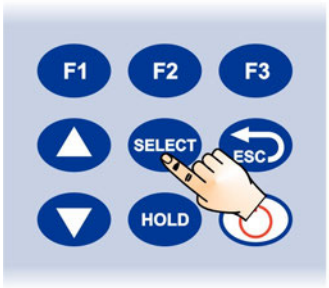
   Note: if you enable the Auto-off and the barometric tendency P3h is selected for logging, a message will appear asking to confirm disabling logging for the barometric tendency P3h.

6. The instrument returns to the SLEEP menu item, press **ESC** twice to exit the menu and return to the measuring mode .

7.6 MANUAL LOGGING

To perform manual logging, it is first necessary to set "MANUAL" as logging interval (see paragraph 7.1). To perform manual logging:

1. Press **SELECT** to display the **LOG** command in the command bar, then select the command by pressing the **F1** key.



2. Start a logging session by selecting the **RUN** command (**F1** key).

   Note: the RUN command does not acquire a sample, but is used to indicate that the samples acquired manually after the command, up to the STOP command, form a logging session.

   Note: the RUN command is replaced by the STOP command if logging is in progress.

   Note: the RUN command will not go into effect if the instrument is waiting for a programmed startup of a logging session.

3. The LOG indication, the MANL indication and the logging session duration appear in the display status bar.

   To manually acquire a sample (consisting of the measurement lines explicitly selected for logging), select the **MANL** command (**F3** key).

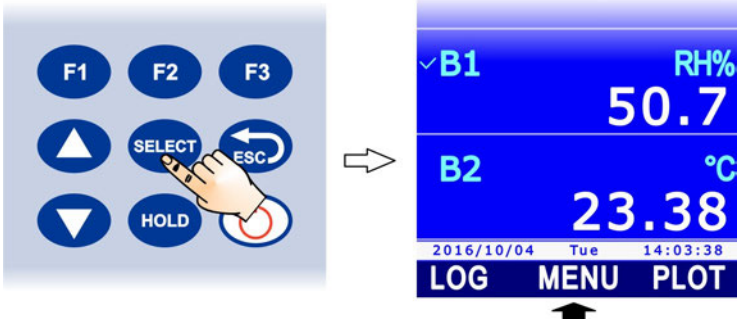
4. To end the logging session, select the **STOP** command (**F1** key).

   After the stop command, the logging stop message appears: wait for the completion of the operation.

7.7 PDF REPORT

At the end of each logging session, the instrument can also automatically create into the SD memory card a PDF report containing the acquired data in table format and, optionally, a graph. To set the PDF report creation mode:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.



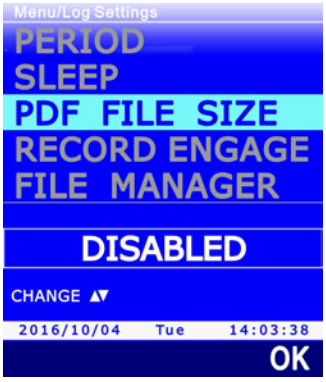
2. Select the **LOG SETTINGS** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

   Note: the item is disabled if logging is in progress.

3. Select the **PDF FILE SIZE** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

4. Using ▲ and ▼, select:
   - **DISABLED**, to disable the automatic creation of the PDF report at the end of the logging session.
   - **FULL**, to enable the automatic creation of the PDF report, with data in graphic and table form, at the end of the logging session.
   - **NO GRAPH**, to enable the automatic creation of the PDF report, with data in table form only, at the end of the logging session.

   Note: the current setting appears in white color, while the other available settings are in yellow color to highlight that they are not the current setting.



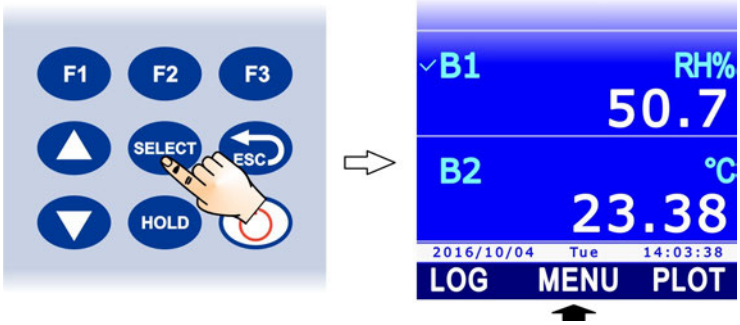
5. Select **OK** (**F3** key) to confirm, or ESC to exit without changing the value.
6. The instrument returns to the PDF FILE SIZE menu item, press **ESC** twice to exit the menu and return to the measurement mode.

Encryption Key for PDF report:

The instrument allows setting an encryption key to generate an alphanumeric control string inserted at the end of the report file and calculated according to the data in the report and the encryption key set. The control string is used to detect any report data tampering. The verification of the report integrity is done with the help of DeltaLog9 application software.

To enter the encryption key for the report:

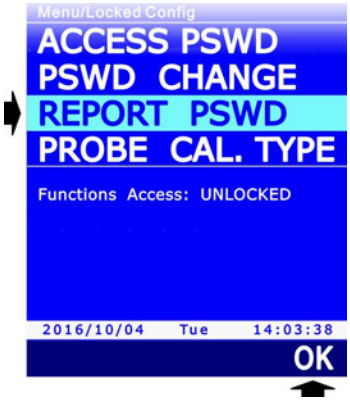
1. Press **SELECT** to display the **MENU** command in the command bar, then select it by pressing the **F2** key.



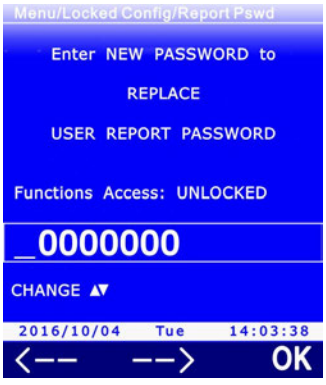
2. Select the **LOCKED CONFIG** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. Select the **REPORT PSWD** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

   Note: the REPORT PSWD item is not shown if the instrument is in protected mode (LOCKED). See paragraph 8.2 to change the protection status.



4. Set the first digit using the password with ▲ and ▼, then select the "-->" command (**F2** key) to move to the next digits (the currently selected digit flashes). To return to a previous digit, select the "<--" command (**F1** key). After setting all the digits, press **OK** (**F3** key) to confirm the new password.

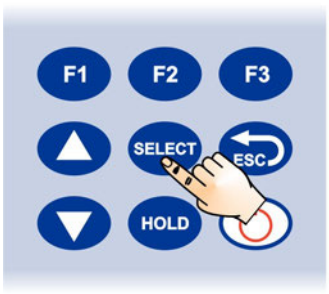


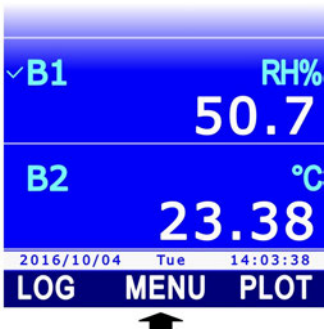
5. The instrument returns to the REPORT PSWD item, press **ESC** twice to exit the menu.

7.8 DISPLAYING LOGGING SESSIONS IN THE SD MEMORY CARD

To display the logging sessions included in the SD memory card:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.

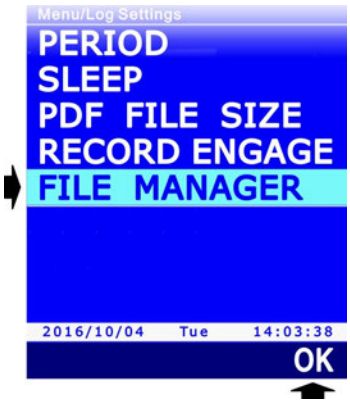




2. Select the **LOG SETTINGS** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

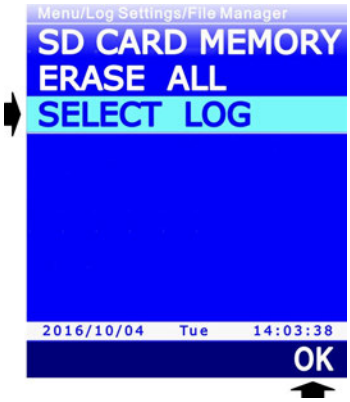
   Note: the item is disabled if logging is in progress.

3. Select the **FILE MANAGER** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.



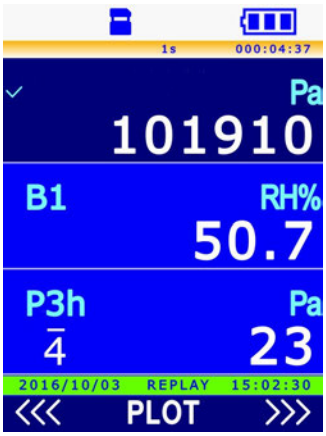
4. A message appears reminding that displaying the information in the SD memory card requires the measuring process to stop (in particular, the measurement of the barometric tendency P3h is stopped). Select **YES** (**F3** key) to continue (or Press F1 to select NO and exit).

5. Wait a few seconds for the instrument to read the content of the SD memory card, then select the **SELECT LOG** item using ▲ and ▼. Press **F3** (**OK** command) to confirm.



6. The list of the stored logging sessions is displayed, starting from the most recent one. Scroll the sessions using ▲ and ▼. The sequential number of the session is shown next to the session date. The size of the CSV and PDF files is indicated for each session (a dash appears in place of the size if the PDF file is not displayed because the PDF report automatic creation option was disabled).

7. To access the data recorded in the selected logging session, select the **VIEW** command by pressing the **F3** key. The stored data appear on the display. The green line under the measurement area shows the date and the time of the displayed sample. The orange line over the measurement area shows:
   - o the logging interval and the logging duration up to the displayed sample, in the case of automatic logging;
   - o the MANL indication and the sequential number of the displayed sample, in the case of manual logging.



8. Select the **<<<** (**F1** key) or **>>>** commands (**F3** key) to scroll the stored data backward and forward in time respectively. To display the graphic trend of the values of one of the stored quantities, select the measurement line using ▲ and ▼, then select the **PLOT** command by pressing the **F2** key (see next paragraph for the details regarding the graph).
9. Repeatedly press **ESC** to exit the stored data display mode.

7.9 STORED DATA GRAPH

The functions already described at paragraph 3.7 concerning the graph of the real time measurements are made available by displaying, through the PLOT command, the stored data graph. The only difference concerns the management of the x-axis zoom: x-axis zoom cannot be performed using real time data (the x-axis can only be changed, causing the graph to be reinitialized, since data are not stored); on the contrary, with stored data (always available), a time interval can be selected using the two vertical cursors and the graph area comprised between the two cursors can be enlarged by pressing **SELECT**.

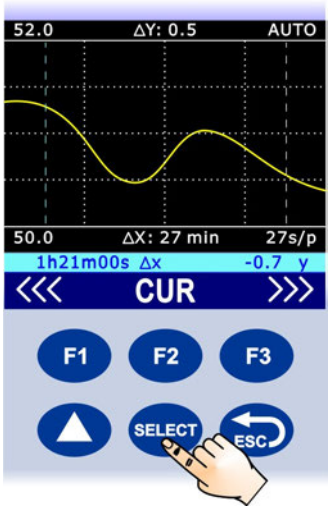


Fig. 7.9.1: stored data horizontal zoom

If the data were stored with an automatic logging, the number displayed on the right under the graph indicates the time corresponding to a pixel on the display (e.g. 27s/p indicates 27 seconds per pixel). The number depends on the logging interval and on the zoom applied. The number is not indicated if the data were stored with a manual logging (in this case, also the value of ΔX is not indicated).

Select the **FULL** command (**F2** key) to cancel the zoom and return to the full x-axis.

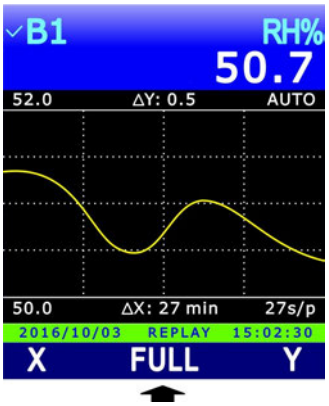


Fig. 7.9.2: FULL command

Note: by displaying the stored data, the FULL command replaces the ΔX command (x-axis choice) available when real time data are displayed.

7.10 DELETING LOGGING SESSIONS IN THE SD MEMORY CARD

The single logging sessions, all the sessions recorded on a determined date or all the sessions stored in the SD memory card can be cancelled.

Attention: the deleted files cannot be recovered!

In order to cancel the single logging sessions or all the sessions recorded on a determined date, access the sessions following the procedure at paragraph 7.8 (Displaying logging sessions in the SD"), then select the **CANC** command by pressing the **F1** key.

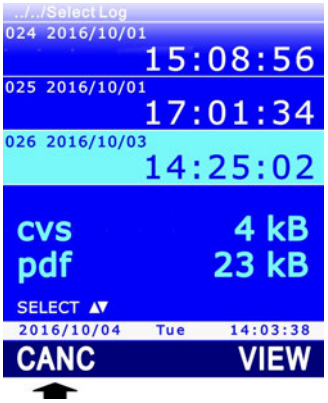


Fig. 7.10.1: deleting stored logging sessions

Select the **FILE** command by pressing the **F1** key to delete the selected session. Select the **DATE** command by pressing the **F2** key to delete all the sessions recorded on the same date of the selected session.

Fig. 7.10.2: deleting single sessions or date-recorded sessions

To erase all the sessions stored in the SD memory card, enter MENU >> LOG SETTINGS >> FILE MANAGER, select the **ERASE ALL** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

Fig. 7.10.3: deleting all the stored logging sessions

Before each erasing operation a message appears asking for confirmation of data cancellation, select **YES** (**F3** key) to confirm or select **NO** (**F1** key) to exit without erasing data.

7.11 DISPLAYING THE AMOUNT OF FREE MEMORY AVAILABLE IN THE SD MEMORY CARD

Before starting new logging sessions make sure that there is enough free memory available in your SD memory card. To display the amount of free memory available in your SD memory card, enter MENU >> LOG SETTINGS >> FILE MANAGER, select the **SD CARD MEMORY** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

Fig. 7.11.1: selecting the SD CARD MEMORY menu item

The display shows: the SD card memory total capacity, the amount of free memory (AVAILABLE), the number of folders divided by logging start date and time, the number of CSV and PDF files stored in the card.

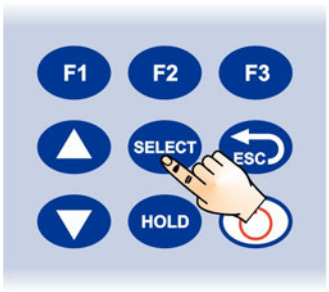
Fig. 7.11.2: displaying the amount of free memory

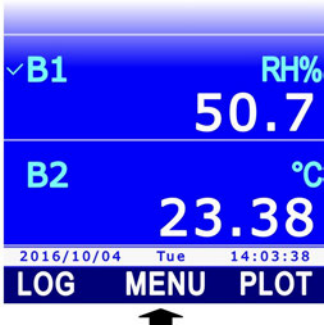
Press **ESC** to exit the screen.

7.12 LOGGING AND RECORD FUNCTION

The minimum, average and maximum values calculated with the RECORD function displayed can be stored into the SD memory card exactly like the current values of the quantities. The data logger allows setting various behaviors of the RECORD function at logging startup.

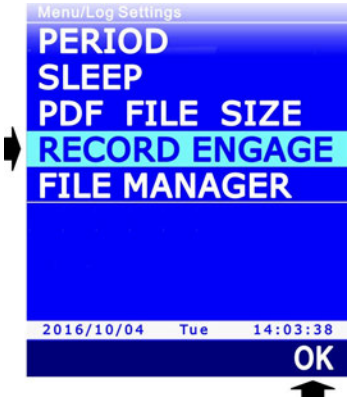
1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.



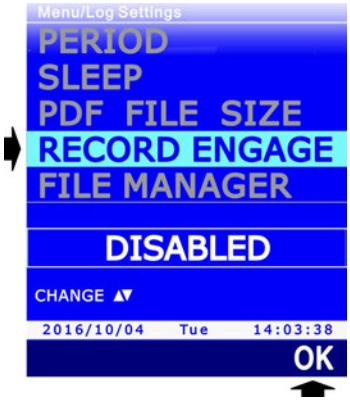


2. Select the **LOG SETTINGS** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. Select the **RECORD ENGAGE** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.



4. Using ▲ and ▼, select one of the three available options:
   - **CLEARED**: the RECORD functions to be stored are automatically reinitialized and reactivated, if in stop mode, at logging startup.
   - **ENABLED**: the RECORD functions to be stored are automatically activated, if in stop mode, but not reinitialized (the function continues from the reached value) at logging startup.
   - **DISABLED**: the RECORD functions to be stored are neither automatically reinitialized nor reactivated, if in stop mode, at logging startup.



5. Select **OK** (**F3** key) to confirm, or ESC to exit without changing the value.
6. The instrument returns to the RECORD ENGAGE menu item, press **ESC** twice to exit the menu and return to the measurement mode.

8 PROTECTED MODE

The calibration of the connected probes can be protected against unwanted alterations by entering a security password. The password (8 digits) is factory-set to the value **11111111** (eight times 1) and can be changed.

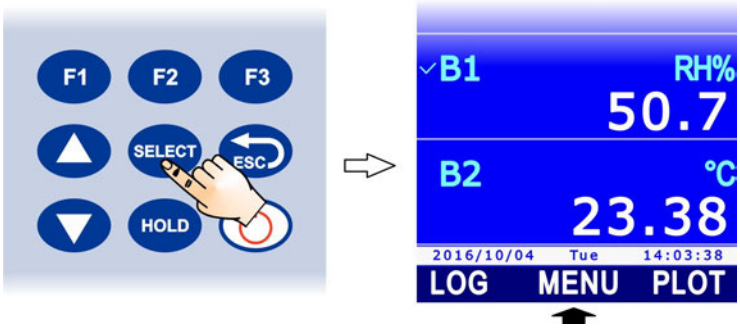
Attention: if the password is changed, be sure to keep it in a safe place. In case of loss of the password, you should contact an authorized Technical Assistance Service.

Note: the password setup is not available if the instrument is in logging; in that case, stop the logging in progress to proceed with configuration.

8.1 PASSWORD CHANGE FOR THE PROTECTED MODE

For security reasons, the preset default password should be changed. To change the password, proceed as follows:

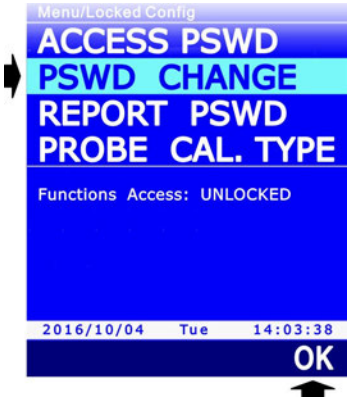
1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.



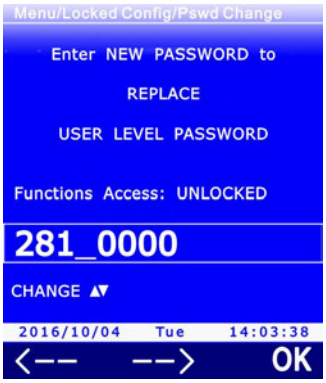
2. Select the **LOCKED CONFIG** item by using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. Select the **PSWD CHANGE** item by using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

   Note: PSWD CHANGE item is not displayed if the instrument is in secure mode. See paragraph 8.2 to change the protection status.



4. Set the first digit of the password by using ▲ and ▼, then select the "-->" command (**F2** key) to move to the next digits (the digit currently selected flashes). To return to the previous digit, select the "<--" command (**F1** key). After setting all the digits, press **OK** (**F3** key) to confirm the new password.

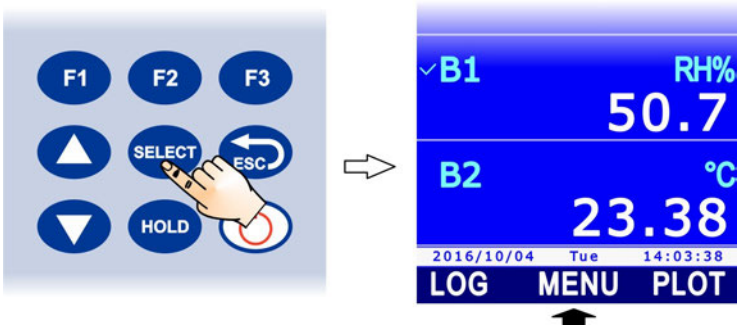


5. The instrument returns to the PSWD CHANGE item, press **ESC** twice to exit the menu.

8.2 ENABLING / DISABLING THE PROTECTED MODE

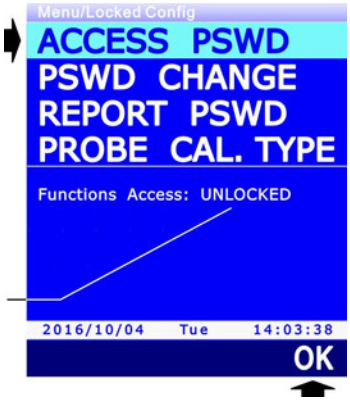
In order to check the calibration protection status, simply enter MENU and check for the presence of the USER CALIBRAT. item: if the function is locked, the item doesn't appear. You need to enter the password to change the protection status; proceed as follows:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing il **F2** key.



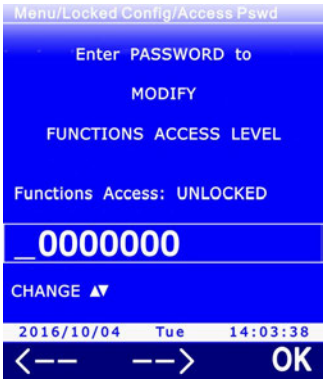
2. Select the **LOCKED CONFIG** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. The current protection status (Access Functions) appears at the end of the menu item list. The word **LOCKED** indicates the protected status; the word **UNLOCKED** indicates the unprotected status. To change the status, select the **ACCESS PSWD** item, using ▲ and ▼ if necessary, then press the **F3** key (**OK** command) to confirm.



Protection status

4. Set the first digit of the password using ▲ and ▼, then select the "-->" command (**F2** key) to move to the next digits (the currently selected digit flashes). To return to the previous digit, select the "<--" command (**F1** key). After setting all the digits, press **OK** (**F3** key) to confirm the new password.



5. The instrument returns to the ACCESS PSWD item. The indication of the protected status appearing at the end of the menu item list is updated to the new status. Press **ESC** twice to exit the menu.

9 MEASUREMENT SETTINGS

The following paragraphs show the procedures for setting the following parameters:

- Type of calibration to be used for the probe connected (par. 9.1).
- Reference altitude (par. 9.2).
- Measurement site elevation, for the calculation of the parameters QNH and QFF (par. 9.3).
- Instrument height above ground, for the calculation of the parameters QNH, QFE and QFF (par. 9.4).
- Air temperature, for the calculation of the parameters QFE and QFF (par. 0).

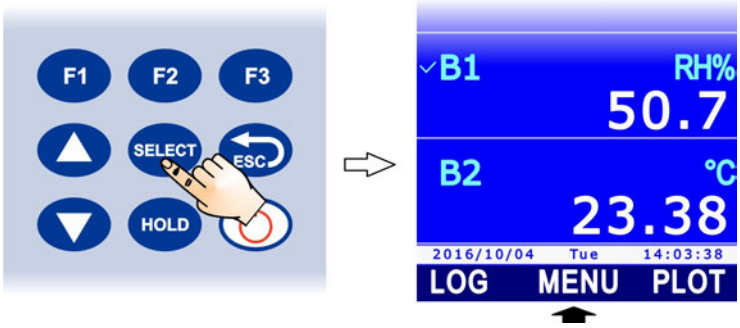
Note: the parameter configuration is not available if the instrument is in logging; in this case, stop the logging in progress to proceed with the configuration.

9.1 TYPE OF CALIBRATION TO BE USED

Setting the type of calibration allows choosing whether to use the factory calibration or the user calibration for the probe connected to the instrument. The return to the factory calibration after a user calibration may be useful, for instance, in the case the user has performed inadvertently an incorrect calibration.

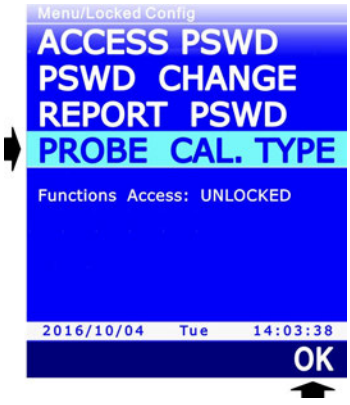
To select the type of calibration:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing il **F2** key.

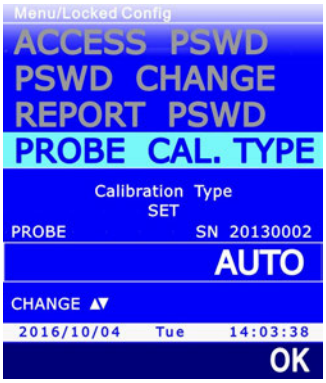


2. Select the **LOCKED CONFIG** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. Select the **PROBE CAL. TYPE** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.



4. Use ▲ keys ▼ to change the setting of the type of calibration for the selected probe. The available settings are:



   - **FACTORY**: factory calibration is used, even if an user calibration is available.
   - **USER**: user calibration is used, if available, even if it has been performed with an instrument different from the one the probe is connected to. If the user calibration is not available, factory calibration is used.
   - **AUTO**: user calibration is used, if available, only if it has been performed with the instrument the probe is connected to.

   Note: if a user calibration is not available for the probe, the default setting is AUTO and cannot be changed.

   Note: the type of calibration cannot be changed if the instrument is in secure mode. See paragraph 8.2 to change the protection status.

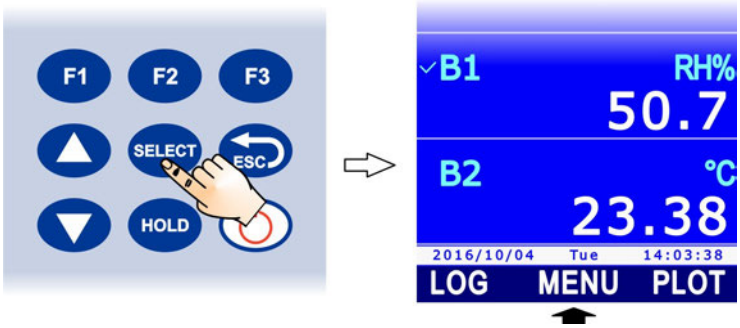
   Note: the current setting appears in white, while the other available settings are shown in yellow to highlight that they are not the current setting.

5. Press **F3** (**OK** command) to confirm the setting. A message appears asking to confirm the change of calibration type: select **YES** (**F3** key) to continue (or press F1 to select NO and exit).
6. Repeatedly press **ESC** to exit the menu.

9.2 REFERENCE ALTITUDE

The instrument allows displaying the altitude with respect to a reference altitude, rather than with respect to the mean sea level. The function is useful, for example, to automatically calculate the instrument height above ground (see paragraph 9.4). To set the reference altitude:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing il **F2** key.



2. Select the **SETUP** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. Select the **OPTIONS** item, using if necessary▲ and ▼, then press the **F3** key (**OK** command) to confirm.

4. Select the **ALTITUDE TARE** item, using if necessary ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

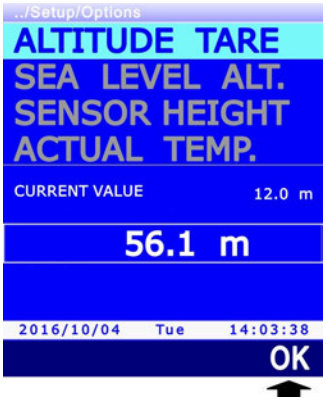
5. Using ▲ and ▼, select:

   - **DISABLED**: to disable the function.
   - **READ VALUE**: to set as reference altitude the current altitude value (*note*: place the instrument at ground level to set as reference altitude the elevation of the measurement site).
   - **MANUAL ENTRY**: to manually set the reference altitude.

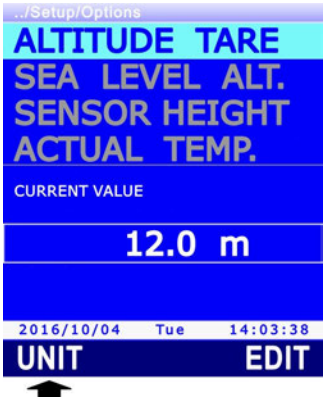
   Note: the current setting appears in white color, while the other available settings are yellow to highlight that they are not the current setting.

6. Press the **F3** key (**OK** command) to confirm.

7. Selecting the READ VALUE option, the current altitude value (with respect to the mean sea level) appears; press the **F3** key (**OK** command) to confirm and set as reference altitude the current altitude value.



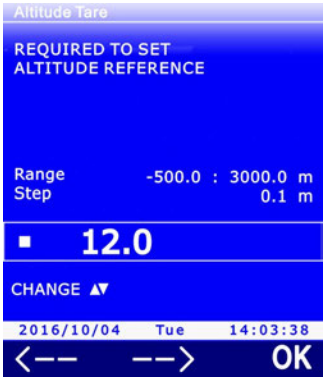
   Selecting the MANUAL ENTRY option, the current setting of the reference value appears. Select the **UNIT** command by pressing the **F1** key to change the measurement unit (m or ft).



8. For manual setting of the reference value, select the **EDIT** command by pressing the **F3** key.

9. Set the first digit using ▲ and ▼, then select the "-->" command (**F2** key) to move to the next digits (the currently selected digit flashes). To return to a previous digit, select the "<--" command (**F1** key). After setting all the digits, press **OK** (**F3** key) to confirm the value.

   The value must be set to one decimal digit after the comma and must be in the range between -500 m and +3000 m (or the values equivalent in other units of measurement).

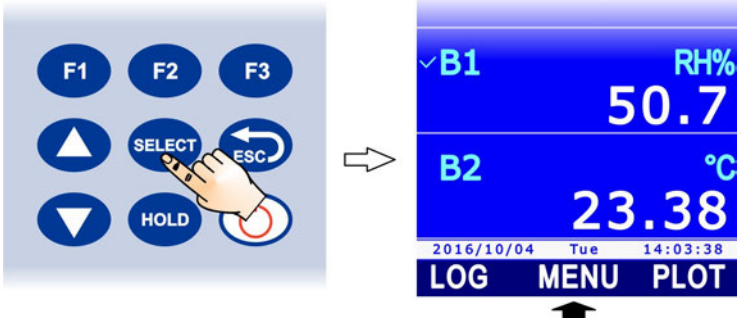


10. Repeatedly press the **ESC** button to exit the menu.

9.3 MEASUREMENT SITE ELEVATION

For the calculation of the parameters QNH and QFF, the measurement site elevation must be set.

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing il **F2** key.

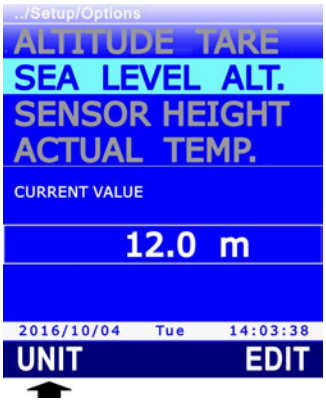


2. Select the **SETUP** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

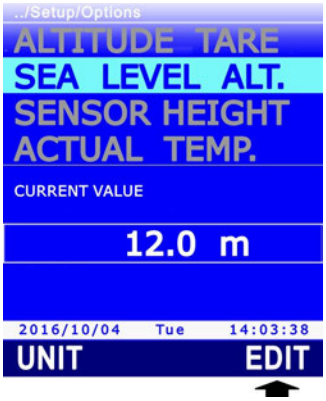
3. Select the **OPTIONS** item, using if necessary▲ and ▼, then press the **F3** key (**OK** command) to confirm.

4. Select the **SEA LEVEL ALT.** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

5. The current setting appears. Select the **UNIT** command by pressing the **F1** key to change the measurement unit (m or ft).

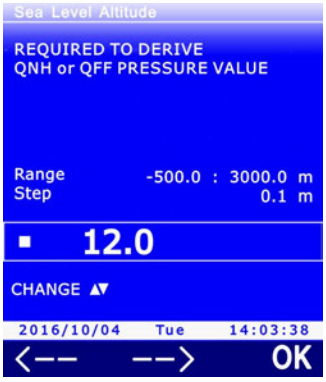


6. For setting the value, select the **EDIT** command by pressing the **F3** key.



7. Set the first digit using ▲ and ▼, then select the "-->" command (**F2** key) to move to the next digits (the currently selected digit flashes). To return to a previous digit, select the "<--" command (**F1** key). After setting all the digits, press **OK** (**F3** key) to confirm the value.

   The value must be set to one decimal digit after the comma and must be in the range between -500 m and +3000 m (or the values equivalent in other units of measurement).

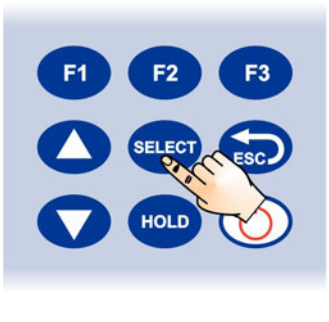


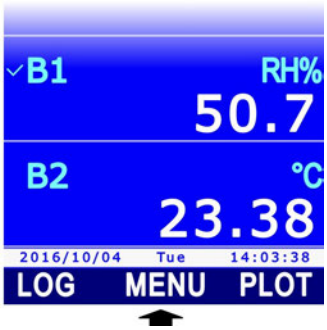
8. Repeatedly press the **ESC** button to exit the menu.

9.4 INSTRUMENT HEIGHT ABOVE GROUND

For the calculation of the parameters QNH, QFE and QFF, the instrument height above ground must be set.

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing il **F2** key.





2. Select the **SETUP** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. Select the **OPTIONS** item, using if necessary▲ and ▼, then press the **F3** key (**OK** command) to confirm.

4. Select the **SENSOR HEIGHT** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

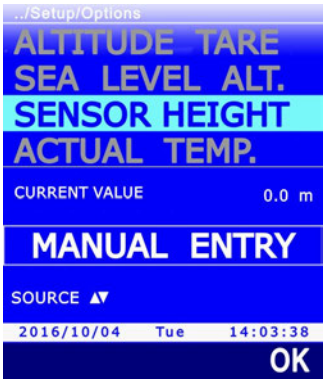
5. Using ▲ and ▼, select:

   - **READ VALUE**: to set as height the value calculated by the instrument.

     Attention: to use this option, it is necessary that the instrument is placed at the correct height and that the elevation of the measurement site is set as the reference altitude (see paragraph 9.2).

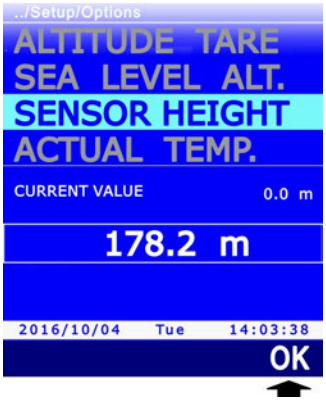
   - **MANUAL ENTRY**: to manually set the height.

   Note: the current setting appears in white color, while the other available settings are yellow to highlight that they are not the current setting.

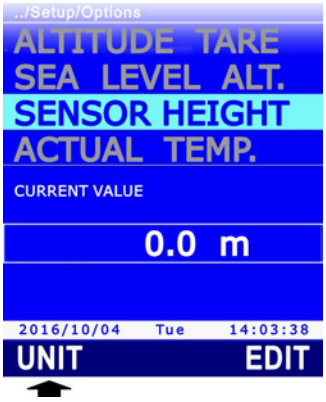


6. Press the **F3** key (**OK** command) to confirm.

7. Selecting the READ VALUE option, the difference between the calculated altitude and the reference altitude appears; press the **F3** key (**OK** command) to confirm and set as height the displayed value.



   Selecting the MANUAL ENTRY option, the current setting appears. Select the **UNIT** command by pressing the **F1** key to change the measurement unit (m or ft).



8. For manual setting of the value, select the **EDIT** command by pressing the **F3** key.

9. Set the first digit using ▲ and ▼, then select the "-->" command (**F2** key) to move to the next digits (the currently selected digit flashes). To return to a previous digit, select the "<--" command (**F1** key). After setting all the digits, press **OK** (**F3** key) to confirm the value.

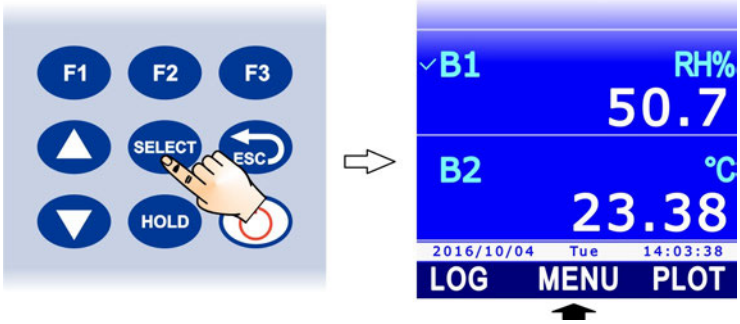
   The value must be set to one decimal digit after the comma and must be in the range between -50 m and +50 m (or the values equivalent in other units of measurement).

10. Repeatedly press the **ESC** button to exit the menu.

9.5 AIR TEMPERATURE

For the calculation of the parameters QFE and QFF, the actual air temperature must be known. The calculation assumes that the air column between the instrument and the mean sea level is at the same temperature (isothermal condition).

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing il **F2** key.



2. Select the **SETUP** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

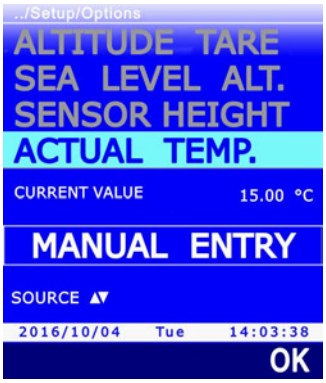
3. Select the **OPTIONS** item, using if necessary▲ and ▼, then press the **F3** key (**OK** command) to confirm.

4. Select the **ACTUAL TEMP.** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

5. Using ▲ and ▼, select:

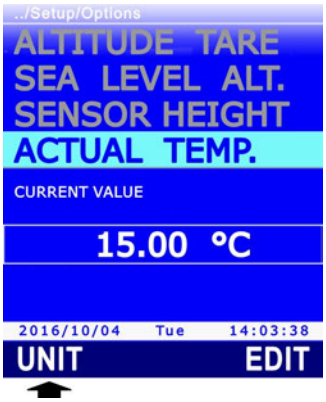
   - **READ VALUE**: to set as temperature the value measured by the connected probe (if present).
   - **MANUAL ENTRY**: to manually set the temperature.

   Note: the current setting appears in white color, while the other available settings are yellow to highlight that they are not the current setting.

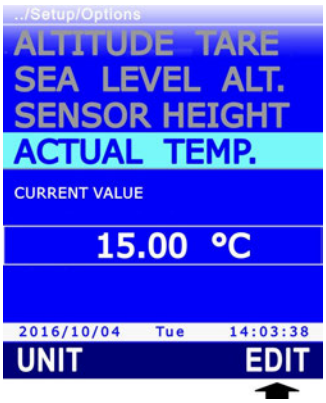


6. Press the **F3** key (**OK** command) to confirm.

7. Selecting the MANUAL ENTRY option, the current setting appears. Select the **UNIT** command by pressing the **F1** key to change the measurement unit (°C, °F or K).

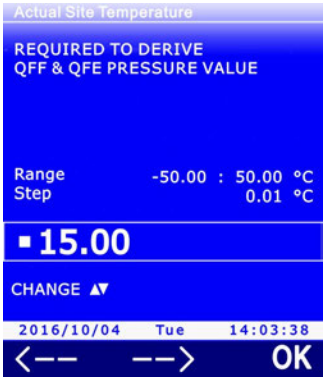


8. For manual setting of the value, select the **EDIT** command by pressing the **F3** key.



9. Set the first digit using ▲ and ▼, then select the "-->" command (**F2** key) to move to the next digits (the currently selected digit flashes). To return to a previous digit, select the "<--" command (**F1** key). After setting all the digits, press **OK** (**F3** key) to confirm the value.

   The value must be set to two decimal digits after the comma and must be in the range between -50 °C and +50 °C (or the values equivalent in other units of measurement).



10. Repeatedly press the **ESC** button to exit the menu.

10 PRINTING MEASUREMENTS

The instrument has one RS232C serial output which allows sending to a serial printer or to a PC, by simply pressing a button, the measurement values of the three quantities displayed when pressing the button.

Connect the RS232C serial output of the instrument to a printer or a PC through the **CP31RS** cable. The communication parameters are:

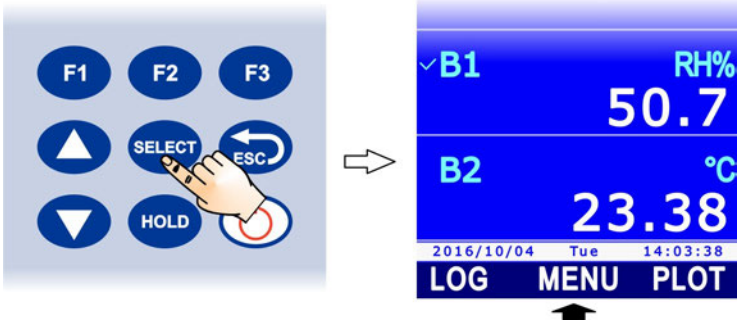
- Data bits = 8
- Parity = None
- Stop bits = 1
- Flow control = Xon / Xoff

The Baud Rate of the instrument can be configured from 1200 to 115200.

10.1 SETTING THE BAUD RATE OF THE INSTRUMENT

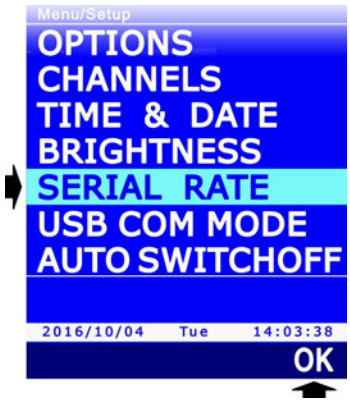
For correct printing, the same Baud Rate must be configured in the instrument and in the serial printer or in the PC. To set the Baud Rate in the instrument:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.



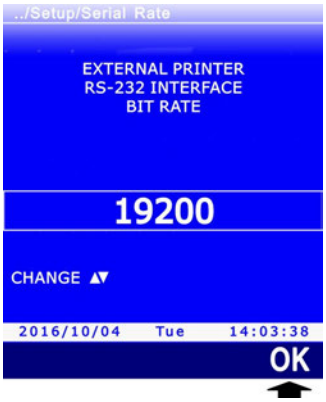
2. Select the **SETUP** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. Select the **SERIAL RATE** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.



4. Select the Baud Rate using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

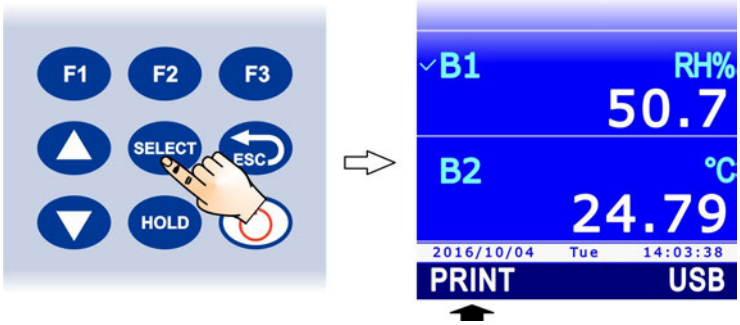
   Note: the current setting appears in white color, while the other available settings are yellow to highlight that they are not the current setting.



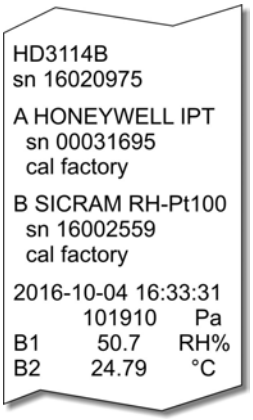
5. The instrument returns to the SERIAL RATE item, Press **ESC** twice to exit the menu.

10.2 SENDING MEASUREMENTS FOR PRINTING

1. Press **SELECT** to display the **PRINT** command in the command bar.



2. Select the **PRINT** command by pressing the **F1** key, the three measurements currently displayed and the information regarding the barometric sensor and the connected probe (type of sensor/probe, serial number and type of calibration) are sent to the printer or to the PC.



10.3 RECEIVING MEASUREMENTS INTO PC

You need to activate a serial communication program in your PC, such as Hyperterminal, if you want to receive the measurements sent by the instrument with the PRINT function into your PC.

The RS232C serial output of the instrument must be connected to a RS232C serial port of your PC or, if your PC doesn't have serial ports, to a USB port through a RS232C/USB converter (e.g. **C205M** adapter cable). If a RS232C/USB converter is used, install into your PC the related USB drivers.

The number of the COM port the instrument is connected to must be set in the communication program and the communication parameters indicated at the beginning of the chapter must be configured (8N1, Xon/Xoff, Baud Rate equal to the one set in the instrument).

If the serial communication program has the autosave function of the received characters (e.g. the "Transfer >> Capture Text " command in Hyperterminal), the function for saving the received measurements into a file of your PC can be enabled.

11 INFORMATION ON INSTRUMENT

The instrument hardware and firmware revision can be displayed, along with the serial number and the calibration date of the instrument, of the barometric sensor and of the connected probe.

To access information, enter "**MENU >> INFO**", then select the "**DEVICE HW/FW**" item for information concerning the instrument, the "**SENSOR SN/CAL**" item for information concerning the barometric sensor and the "**PROBE SN/CAL**" item for information concerning the connected probe.

The information concerning the instrument is divided into two screens: the first screen shows model, serial number, hardware and firmware revision; the second screen shows the dates of the hardware ohmmetric and voltmetric calibration. Press **F1** key to toggle from one screen to the other (the indication corresponding to the key changes from **CALIB** to **HW/FW** according to the displayed screen).

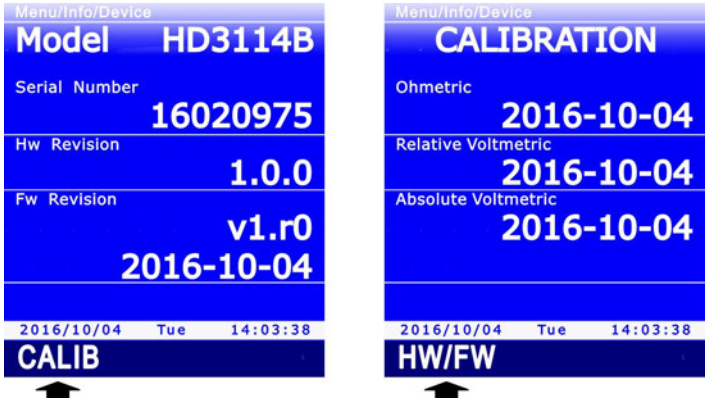


Fig. 11.1: information concerning the instrument

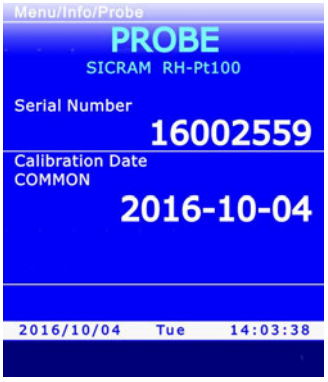


Fig. 11.2: information concerning the connected probe

12 USE OF THE BATTERY

The instrument is provided with one 3.7 V–2250 mA/h lithium-ion **rechargeable** battery, placed in the battery compartment.

The battery symbol on the display continuously provides information about the battery charge status. As the battery runs out, the symbol "empties".

			
Battery level 67...100%	Battery level 34...66%	Battery level 4...33%	Battery level < 4%

Fig. 12.1: battery charge levels

If the battery charge is insufficient to ensure a correct measurement, the instrument turns off. The data stored in the SD memory card are retained even with a discharged battery.

Battery starts recharging when the instrument's USB port is connected to a PC USB port (at least 500 mA) or to the external stabilized power supply unit **SWD05**. The battery symbol flashes when the battery is recharging.

The battery charge is complete when the symbol stops flashing. A complete recharging operation requires about 7 hours starting from a completely discharged battery.

If you plan to have the instrument powered uniquely by battery, make sure that the charge level is sufficient to complete measurements.

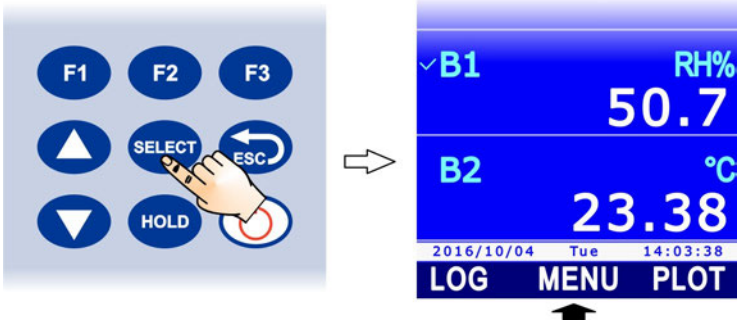
The battery autonomy depends on the type of the connected probe. For instance, with a Pt100 probe connected the autonomy is about 18 hours of continuous operation, starting from a completely charged battery.

12.1 AUTOMATIC SWITCH-OFF FUNCTION

In order to save the battery charge, the auto-switchoff function can be enabled. It allows the instrument to automatically switchoff after a certain number of minutes since the last key pressure. The auto-off time can be configured to 2, 5, 10, 15, 20 or 30 minutes.

To set the auto-off:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.



2. Select the **SETUP** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. Select the **AUTO SWITCHOFF** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

4. Set the number of minutes using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

   Note: the current setting appears in white, while the other settings appear in yellow to highlight that they are not the current setting.

   Note: during the setting, the battery symbol in the status bar of the display is replaced by the battery charge percent level.

   If you want the auto-switchoff function to be disabled, select the DISABLED option.

5. The instrument returns to the AUTO SWITCHOFF menu item, press **ESC** twice to exit the menu and return to the measurement mode.

The auto-switchoff is automatically disabled if the external power supply or the PC is connected.

See paragraph 7.5 at page 40 to enable or disable the auto-switchoff during logging.

If the auto-switchoff is enabled but functions requiring the instrument to remain switched on are active (e.g. the RECORD function, the measurement of the barometric tendency P3h, the LOGGING function with interval lower than 60 s, etc.), the instrument doesn't switch off automatically but the display brightness is reduced.

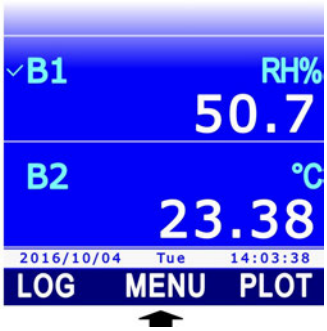
The auto-switchoff is automatically disabled when the calibration menu is entered.

12.2 DISPLAY BRIGHTNESS

To save more battery life, besides the auto-switchoff function, the instrument can additionally automatically reduce the display brightness a few instants after the last key pressure.

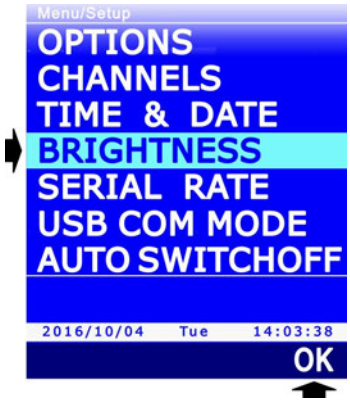
To set the brightness level:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.

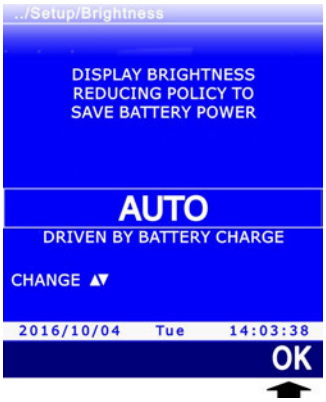


2. Select the **SETUP** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. Select the **BRIGHTNESS** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.



4. Set the brightness level using ▲ and ▼, then press the **F3** key (**OK** command) to confirm. The available settings are:



- **AUTO**: the brightness level is always set to maximum until the battery charge exceeds 4%. If the battery charge is lower than 4%, the brightness level is automatically reduced.
- **30%**: the brightness level is reduced to 30% a few instants after the last key pressure. Brightness rises automatically to the maximum level when a key is pressed, then decreases again if no keys are pressed.

Note: the current setting appears in white color, while the other available setting appears in yellow to highlight that it is not the current setting.

5. Repeatedly press **ESC** to exit the menu.

12.3 PROLONGING BATTERY LIFE

The battery can be charged and discharged hundreds of times, but its capacity diminishes with use. The battery life can be prolonged with a few practical measures:

- When first using the device, make a complete charge of the battery.
- From time to time, make a complete cycle of discharging and recharging.
- Do not leave the battery discharged for a long period.
- Do not discharge the battery below the minimum threshold: recharge the battery when the battery symbol on the display reaches the minimum level.
- Do not expose the battery to extreme temperatures.

12.4 REPLACING THE BATTERY

When the battery capacity is heavily reduced, it is necessary to replace it. To replace the battery proceed as follows:

1. Disconnect the external power supply unit or the PC, if connected.
2. Remove the protective rubber shell, if any.
3. Untighten the 4 screws securing the battery compartment cover on the back of the instrument.
4. Remove the battery.
5. Remove the connector paying attention not to tear the wires away.
6. Attach the connector to the new battery: the connector has a reference which prevents an erroneous insertion.
7. Place the battery in its housing.
8. Close the battery compartment with the 4 fixing screws.

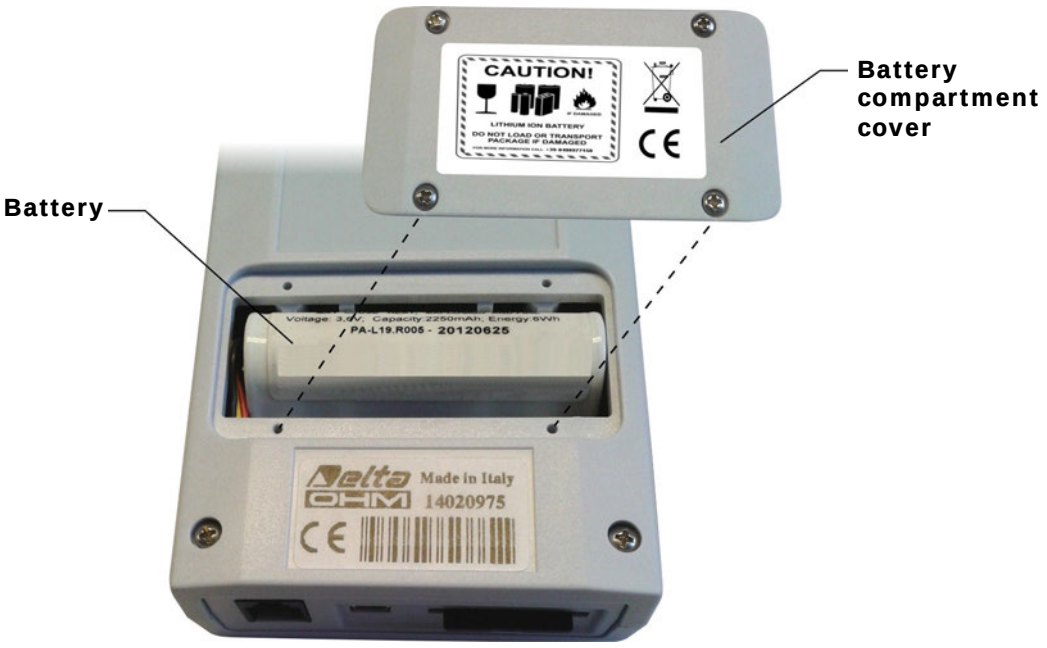


Fig. 12.2: battery compartment

For replacement, use a 3.7 V **rechargeable** lithium-ion battery, capacity 2250 mA/h, dimensions 22 x 18.5 x 67.5 mm, with 3-pole JST connector (code **HD35-BAT1**).

12.5 IMPORTANT WARNINGS

Do not short-circuit the battery: it may explode with serious damage to persons. Additionally, to avoid any risk of explosion:

- Do not expose the battery to high temperature.
- Do not use charging devices different from those indicated.
- Do not overcharge the battery allowing it to charge for a long time after reaching the full charge status.

Battery Disposal:

- Dispose of dead batteries in the dedicated bins or deliver them to authorized collection centers. Follow the relevant regulation.
- Do not dispose as household waste.
- Do not throw batteries into fire.

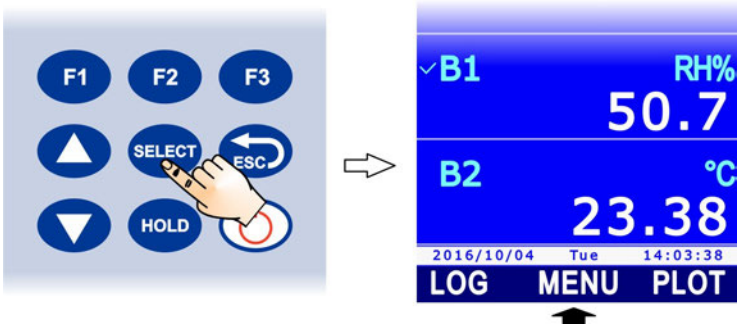
13 CALIBRATION

The probes are supplied factory-calibrated and usually don't require additional user intervention. Nevertheless a new calibration can be performed.

Note: it is essential to know and respect the physical phenomena measurements are based on in order to achieve correct calibration: it is recommended to perform new calibrations only if you have the adequate technical expertise and to carefully follow the procedures described in this manual.

To access probe calibration:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.



2. Select the **USER CALIBRAT.** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

   Note: the USER CALIBRAT. item is not displayed if the instrument is in protected mode. See paragraph 8.2 to change the protection status.

3. The serial numbers of the barometric sensor (1) and connected probe (2) are displayed. Select the barometric sensor or the probe using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

4. The displayed screen depends on the type of probe selected. According to the type of probe, continue as indicated in the paragraphs below.

13.1 CALIBRATION OF THE BAROMETRIC SENSOR

The measurement of the barometric pressure can be corrected by adding an offset.

After selecting the barometric sensor for calibration, the instrument displays the pressure value measured by the sensor and the offset value.

Repeatedly select "**<<<**" (**F1** key) or "**>>>**" (**F3** key) to decrease or increase the offset.

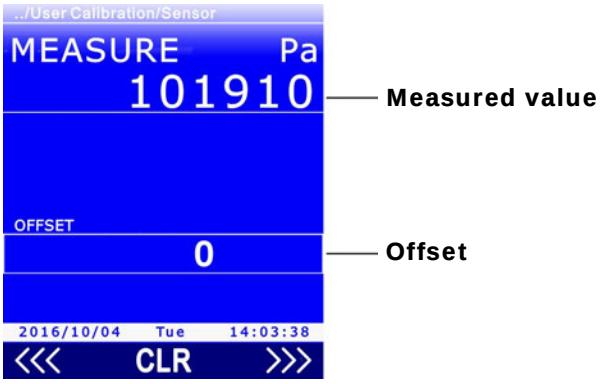


Fig. 13.1.1: barometric pressure calibration

To reset the offset, select **CLR** (**F2** key). To exit, press **ESC**.

13.2 CALIBRATION OF TEMPERATURE-ONLY PROBES WITH PRT SENSOR

Selecting a Pt100 or Pt1000 temperature-only probe for calibration displays four possibilities:

- **NEW TUNING**: calibrates the probe in one, two or three points. The possible calibration points are 0 °C, one point ranging from 95 °C to 105 °C and one point ranging from 150 °C to 400 °C. The probe can be calibrated either in one point or in two points: for the non-calibrated points, the instrument will use the values stored in the previous user-calibration or, failing this, the factory values.
- **STANDARD PT100**: sets the user-calibration with the nominal values of the Pt100 sensor. An option to be used if the probe is not calibrated and it is not possible to perform a new calibration.
- **FACTORY**: sets the user-calibration equal to the factory calibration. It is useful if incorrect user-calibration data were entered and if you are temporarily unable to perform a new calibration.
- **PARAMETERS**: displays and/or changes the coefficients of the Callendar Van Dusen equation used by the instrument to obtain the temperature depending on the resistance of the PRT sensor (see appendix for details).

Fig. 13.2.1: PRT probe calibration types

Select the desired type of calibration using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

If a message is displayed reminding that the operation will change the probe calibration data, select **YES** (**F3** key) to continue (or Press F1 to select NO and exit).

13.2.1 NEW TUNING OPTION FOR PRT SENSORS

1. The instrument suggests that the first calibration point is set to 0 °C (*SETPOINT* line). If you don't want the point to be calibrated, press **F1** (**SKIP** command) to move to the next point, otherwise place the probe in a bath at 0 °C. The display shows the temperature value measured by the probe (*MEASURE* line). When the reading is stable, press **F3** (**OK** command) to confirm: the instrument displays a countdown (*ACQUIRING*) of a few seconds, then moves to the next calibration point.

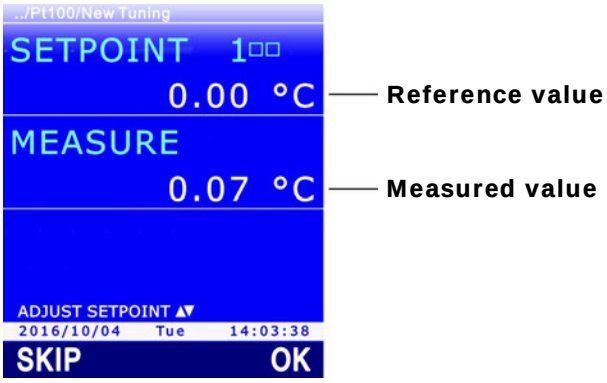


Fig. 13.2.2: PRT calibration at 0 °C

2. The instrument suggests that the second calibration point is set to 100 °C (*SETPOINT* line). If you don't want the point to be calibrated, press **F1** (**SKIP** command) to move to the next point, otherwise place the probe in a bath ranging from 95 °C to 105 °C. The display shows the temperature value measured by the probe (*MEASURE* line). The calibration point can be adjusted using ▲ and ▼. When the reading is stable, press **F3** (**OK** command) to confirm: the instrument displays a countdown (*ACQUIRING*) of a few seconds, then moves to the next calibration point.

3. The instrument suggests that the third calibration point is set to 200 °C (*SETPOINT* line). If you don't want the point to be calibrated, press **F1** (**SKIP** command) to terminate the calibration, otherwise place the probe in a bath ranging between 150 °C and 400 °C. The display shows the temperature value measured by the probe (*MEASURE* line). The calibration point can be adjusted using ▲ and ▼. When the reading is stable, press **F3** (**OK** command) to confirm: the instrument displays a countdown (*ACQUIRING*) of a few seconds and at the end, a message reminding that the operation will change the probe calibration data, select **YES** (**F3** key) to continue (or press F1 to select NO and exit).

Calibration can be exited at any moment by pressing **ESC**.

Note: the boxes near the SETPOINT number represent the three available calibration points; a box becomes full when the corresponding point is calibrated.

13.2.2 PARAMETERS OPTION FOR PRT SENSORS

The instrument displays the parameters (R_0, α, δ and β) used for calculating temperature depending on the measured resistance of the PRT sensor (see appendix for details).

1. Select the parameter you want to be changed using ▲ and ▼, then press the **F1** key (command **EDIT**) to confirm.

Fig. 13.2.3: parameters for temperature calculation equation

2. Set the first digit using ▲ and ▼, then select the "-->" command (**F2** key) to move to the next digits (the currently selected digit flashes). To return to a previous digit, select the "<--" command (**F1** key). After setting all the digits, press **OK** (**F3** key) to confirm the value.

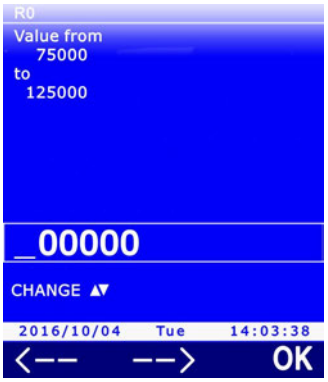


Fig. 13.2.4: setting a parameter of the equation

R_0 parameter is expressed in thousands: enter 100000 to indicate 100.000 Ω.

α parameter is expressed without zeroes on the left: enter 385055 to indicate 0.00385055.

δ parameter is expressed without decimal point: enter 1499785 to indicate 1.499785.

β parameter is expressed without the zero on the left: enter 10863 to indicate 0.10863.

3. To definitively save the changed values in the instrument, select the **SAVE** command by pressing the **F3** key: a message appears reminding that the operation will change the probe calibration data, select **YES** (**F3** key) to continue (or press F1 to select NO and exit).

Calibration can be exited at any moment by pressing **ESC**.

13.3 CALIBRATION OF COMBINED RELATIVE HUMIDITY AND TEMPERATURE PROBES

When selecting a combined probe for calibration, you will be asked which of the two sensors you want to calibrate. Select the sensor using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

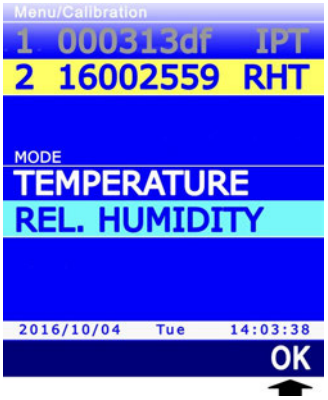


Fig. 13.3.1: selecting the sensor to be calibrated

13.3.1 CALIBRATION OF THE TEMPERATURE SENSOR OF RH / T COMBINED PROBES

If the combined RH/T probe has a Pt100 sensor, two options are displayed:

Fig. 13.3.2: types of calibration for the temperature sensor

- **NEW TUNING**: calibrates the probe at any point within the operating range of the probe.
- **STANDARD PT100**: sets the user calibration with the nominal values of the Pt100sensor. Select this option if the probe is not calibrated and it is not possible to perform a new calibration.

Select the type of desired calibration using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

By selecting the NEW TUNING option, the display shows the temperature value measured by the probe. Place the probe to be calibrated, together with a reference thermometer, in a constant temperature environment (**respecting the operating range of the RH probe**) and wait for the measurement to become stable; using ▲ and ▼, adjust the reading of the instrument to coincide with the reading of the reference thermometer, then press the **F3** key (**OK** command) to confirm: a message appears reminding that the operation will change the probe calibration data, select **YES** (**F3** key) to continue (or Press F1 to select NO and exit).

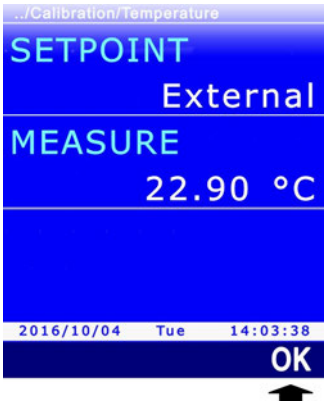


Fig. 13.3.3: calibration of the Pt100 sensor to the reference value

13.3.2 CALIBRATION OF THE RELATIVE HUMIDITY SENSOR

Before starting the calibration operation, better **verify**, using saturated solutions (75.4%RH and 33%RH), if a new calibration is needed: proceed with calibration only if an error of a few humidity points in one of the two calibration points is discovered.

When selecting the calibration of the relative humidity sensor, four options are displayed:

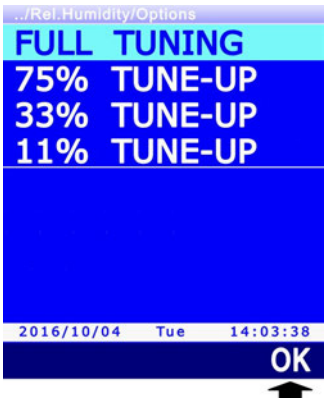


Fig. 13.3.4: types of RH sensor calibration

- **FULL TUNING**: calibrates the probe in one, two or three points. The possible calibration points are 75%RH, 33%RH and 11%RH. The probe can also be calibrated in one or in two points only: as for the non-calibrated points, the instrument will use the values stored in the previous user calibration or, failing this, the factory values. As for one-point calibration it is recommended to use the next options.
- **75% TUNE-UP**: calibrates the probe at 75%RH.
- **33% TUNE-UP**: calibrates the probe at 33%RH.
- **11% TUNE-UP**: calibrates the probe at 11%RH.

Select the desired type of calibration using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

Pre-calibration operations:

Check that the elements below are all present inside the chamber with saturated saline solutions:

- solid state salt,
- liquid solution or wet salt, especially for the 75%RH solution.

The instrument and the saturated solutions to be used for this operation must be placed in a stable temperature environment for the entire calibration period. Wait for at least a couple of

hours at stable temperature so as the instrument and the saturated solutions may reach thermal balance with the environment before starting the calibration procedure. To obtain a good calibration, it is essential that the probe and the solution have the same temperature. You should keep in mind that the plastic material is a poor heat conductor.

The calibration must be performed in a temperature range from 15 to 30°C.

Full calibration procedure (FULL TUNING option):

1. Unscrew the protection cover of the probe and, if necessary, tighten the M12×1 thread ring nut (the thread ring nut is necessary only for ∅ 14 mm probes).

   Avoid any contact of the sensitive element with hands or any other object or liquids. **If moisture is inside the measurement chamber, dry it with clean absorbent paper**.

2. Unscrew the closure cap of the 75%RH saturated solution. Tighten the thread ring nut with the probe to the saturated solution container and wait for at least 30 minutes.

3. In the instrument, select the calibration option **FULL TUNING** and press **F3** (**OK** command) to confirm.

4. The instrument suggests that the first calibration point is set to 75%RH (*SETPOINT* line) and displays the temperature and the relative humidity measured by the probe (*MEASURE* line).

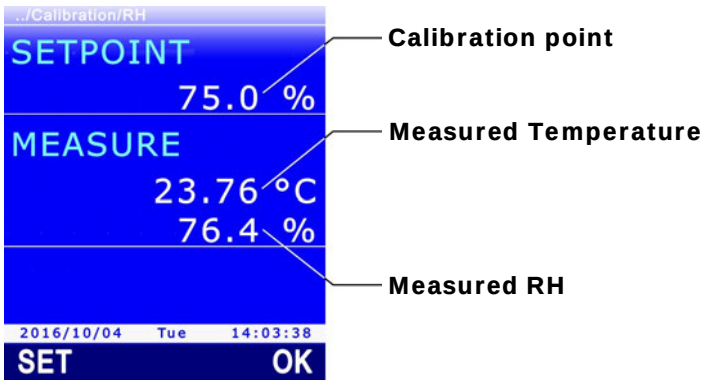


Fig. 13.3.5: calibration at 75%RH

5. Using ▲ and ▼, set the calibration point (*SETPOINT* line) to the saturated solution value at the measured temperature (see the table below).

TAB. 13.3.1: saturated solution at 75%RH

Temperature (°C)	Solution 75%RH
15	75.6
20	75.4
25	75.2
30	75.0

6. When the reading is stable, press **F3** (**OK** command) to confirm. The instrument displays a countdown (*ACQUIRING*) of a few seconds; at the end, a message is shown reminding that the operation will change the calibration data of the probe, select **YES** (**F3** key) to continue (or press F1 to select NO and exit), the instrument moves to the next calibration point.

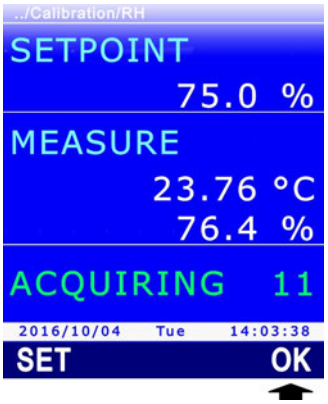


Fig. 13.3.6: calibration point confirmation

During the countdown you can exit the procedure without calibrating the point by pressing **ESC**.

In alternative to the **F3** key (**OK** command) calibration can be confirmed by pressing the **F1** key (**SET** command). Pressing the SET command keeps the instrument in the current screen, instead of moving immediately to the next point. This allows confirmation of the performed correction before continuing. After pressing the SET command, you need to select the OK command (F3 key) to move to the next point, or press **ESC** to exit calibration.

7. Remove the probe (with thread ring, if any) from the saturated solution container and close the container.
8. Unscrew the closing cap of the 33%RH saturated solution. Tighten the thread ring nut with probe to the saturated solution container and wait at least 30 minutes.
9. The instrument suggests that the second calibration point is set to 33%RH. Using ▲ and ▼, set the calibration point to the saturated solution value at the measured temperature (see the table below).

TAB. 13.3.2: saturated solution at 33 %RH

Temperature (°C)	Solution 33 %RH
15	33.3
20	33.0
25	32.7
30	32.4

Note: press **ESC** if you want to exit the procedure without calibrating the point.

10. When the reading is stable, press **F3** (**OK** command) to confirm. The instrument displays a countdown (*ACQUIRING*) of a few seconds; at the end, a message is shown reminding that the operation will change the calibration data of the probe, select **YES** (**F3** key) to continue (or press F1 to select NO and exit), the instrument moves to the next calibration point.
11. Remove the probe (with thread ring nut, if any) from the saturated solution container and close the container.
12. Unscrew the closing cap of the 11%RH saturated solution. Tighten the thread ring nut with probe to the saturated solution container and wait at least 30 minutes.
13. The instrument suggests that the third calibration point is set to 11%RH. Using ▲ and ▼, set the calibration point at 11.3 %RH (solution value between 15 and 30 °C).

    Note: press **ESC** if you want to exit the procedure without calibrating the point.
14. When the reading is stable, press **F3** (**OK** command) to confirm. The instrument displays a countdown (ACQUIRING) of a few seconds; at the end, a message is shown reminding that the operation will change the calibration data of the probe, select **YES** (**F3** key) to continue (or press F1 to select NO and exit), the instrument exits calibration.

15. Remove the probe (with thread ring nut, if any) from the saturated solution container and close the container.
16. Unscrew the M12X1 thread ring nut, if any, from the probe and reposition the sensor protection cover.

Single-point calibration procedure (75%, 33%, 11% TUNE-UP options):

By selecting 75% TUNE-UP, 33% TUNE-UP and 11% TUNE-UP options the calibration of the relative humidity sensor is performed only in the selected point. The procedure is entirely similar to the information given about complete calibration, with the difference that the instrument exits calibration after confirming the point, instead of moving to the next point:

1. Unscrew the protection cover of the probe and, if necessary, tighten the M12×1 thread ring nut (the thread ring nut is necessary only for ∅ 14 mm probes).

   Avoid any contact of the sensitive element with hands or any other object or liquids. **If moisture is inside the measurement chamber, dry it with clean absorbent paper**.
2. Unscrew the closure cap of the saturated solution. Tighten the thread ring nut with probe to the saturated solution container and wait for at least 30 minutes.
3. In the instrument, select **75% TUNE-UP**, **33% TUNE-UP** or **11% TUNE-UP** calibration options according to the point to be calibrated, then press the **F3** key (**OK** command) to confirm.
4. The instrument suggests the calibration point (*SETPOINT* line) and displays the temperature and the relative humidity measured by the probe (*MEASURE* line).
5. Using ▲ and ▼, set the calibration point (*SETPOINT* line) to the value of the saturated solution at the measured temperature (see the tables shown in the complete calibration procedure).
6. When the reading is stable, press **F3** (**OK** command) to confirm. The instrument displays a countdown (*ACQUIRING*) of a few seconds; at the end, a message is shown reminding that the operation will change the calibration data of the probe, select **YES** (**F3** key) to continue (or press F1 to select NO and exit).

   During the countdown you can exit the procedure without calibrating the point by pressing **ESC**.

   In alternative to the **F3** key (**OK** command) calibration can be confirmed by pressing the **F1** key (**SET** command). Pressing the SET command keeps the instrument in the current screen, instead of moving immediately to the next point. This allows confirmation of the performed correction before continuing. After pressing the SET command, you need to select the OK command (F3 key) or press **ESC** to exit calibration.
7. Remove the probe (with thread ring nut, if any) from the saturated solution container and close the container.
8. Unscrew the M12X1 thread ring nut, if any, from the probe and reposition the sensor protecting cover.

14 COMMUNICATING WITH A PC

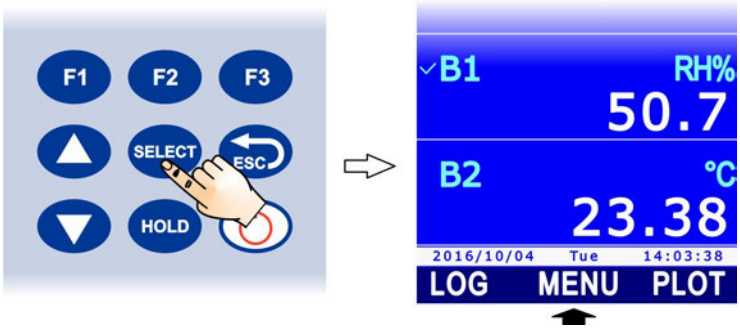
Connect the USB port of the instrument to your PC with the help of **CP31** cable. The USB port can operate in two modes: **HID** (Human Interface Device) or **VIRTUAL COM**.

HID mode has the advantage of requiring no USB driver installation: when you connect the instrument to your PC, Windows® operating system automatically recognizes the instrument and uses the drivers already included in the operating system.

VIRTUAL COM mode requires, on the contrary, USB drivers to be installed and is used mainly for communicating with the instrument by sending commands through a generic serial communication program.

To set the port operation mode:

1. Press **SELECT** to display the **MENU** command in the command bar, then select the command by pressing the **F2** key.

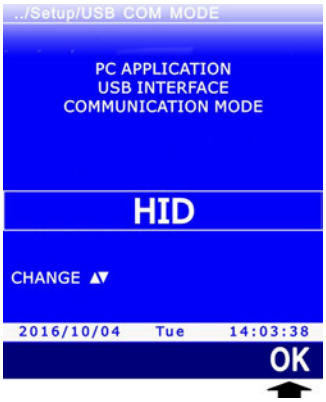


2. Select the **SETUP** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

3. Select the **USB COM MODE** item using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

4. Select HID or VIRTUAL COM modes using ▲ and ▼, then press the **F3** key (**OK** command) to confirm.

   Note: the current setting appears in white color, while the other available setting is yellow to highlight that it is not the current setting.



5. The instrument returns to the USB COM MODE item, press **ESC** twice to exit the menu.

Note: To change the USB port operation mode, the instrument must be connected to the PC. If the PC doesn't detect the instrument after changing the USB port mode, switch the instrument on and off.

Installing USB drivers:

If you select the VIRTUAL COM mode, you need to install the relevant USB drivers into your PC. The driver installation is requested by Windows® operating system the first time the instrument in VIRTUAL COM mode is connected to your PC.

When the operating system asks you to install the USB drivers, select the driver installation option through a specific path, then select **DeltaOHM_VirCOMDriver** folder included in the installation folder of DeltaLog9 software (DeltaLog9 software needs to be previously installed, the software installation folder is usually "C:\DeltaLog9", if this has not been changed during installation).

Note: if during the installation of the USB drivers a system protection message appears, select " *Install driver software*".

14.1 STORED DATA TRANSFER TO PC

Each time a logging session is launched, the instrument opens a new file, in CSV format, where the measurements acquired within the end of the session are stored. The file is created in a folder identified by the logging start time (e.g. "R_194905" if the logging operation has been started at 19:49:05), in turn contained in a folder identified by the logging start date (e.g. "D_160513" if the logging operation has been started on 13/05/2016).

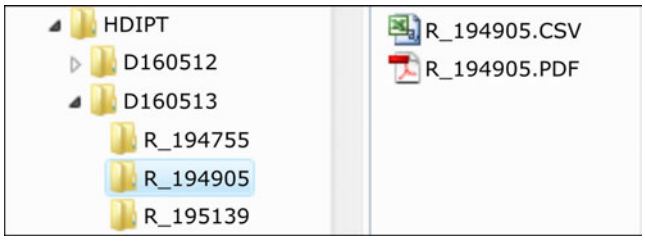


Fig. 14.1.1: structure of the SD memory card

The report in PDF format is also contained in the same folder of the CSV file of the logging session, if generated.

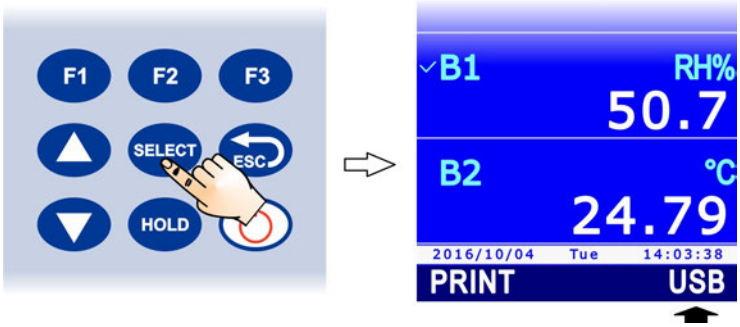
The stored data can be transferred to PC in the following ways:

- Removing the SD memory card from the instrument and inserting it in a card reader connected to your PC.
- Connecting the USB port of the instrument to your PC through the **CP31** cable and with the help of DeltaLog9 application software. Additionally, the use of DeltaLog9 software allows the analysis of the downloaded data through the processing functions included in the software. See the software instructions for data download through DeltaLog9 software.
- Connecting the USB port of the instrument to your PC through the **CP31** cable and setting the instrument to "card reader" mode; thanks to this mode, the SD card inserted in the instrument is read by the PC as a disc unit (therefore, it allows data files to be copied using Windows® Explorer).

To set the instrument to "card reader" mode:

1. Press **SELECT** to display the **USB** in the command bar, then select the command by pressing the **F3** key.

   Note: USB command is disabled if logging is in progress or the instrument is not connected to the PC.



2. A message appears reminding that the “card reader" mode requires the measurement process to be stopped (and consequently the automatic RECORD function as well, if enabled). Select **YES** (**F3** key) to continue (or Press F1 to select NO and exit).
3. In “card reader" mode, the display shows the image of a SD card. Select again the **USB** command by pressing the **F3** key to return to the measurement mode; a message will appear asking to confirm exit from the “card reader" mode, select **YES** (**F3** key) to exit.

   Note: the exit from the “card reader" mode is automatic if you disconnect the USB cable.

14.2 SERIAL COMMANDS

If the USB port of the instrument is set to VIRTUAL COM mode, communication with the instrument is possible by sending commands through a generic serial communication program (e.g. Hyperterminal, etc.).

Communication parameters must be set to PC as follows:

- Baud rate: 115200
- Data bits: 8
- Parity: None
- Stop bit: 1

The available serial commands are listed below.

Date/Time:

Command	Response	Description
RTC:	RTC:yyyy/mm/dd HH:MM:SS|	Reads the date and time set in the instrument.
RTC:yyyy/mm/dd HH:MM:SS	RTC:yyyy/mm/dd HH:MM:SS; ok|	Enters date/time.

Note: date and time cannot be entered if the instrument is logging.

Information:

Command	Response	Description
FWVERSION:	FWVERSION:*version*|	Reads firmware version.
DEVSTATE:	*Information on instrument*|	Reads the instrument general information: model, HW and FW revision, serial number, connected probes, calibration dates.
ACTIVEPRB:	*Information on probes*|	Reads the information on the connected probes: type of probe, serial number, type of used calibration, calibration date.

Power supply:

Command	Response	Description
BATTERY:	BATTERY:*charge*%|	Reads battery charge percent.
BATSAVE:	BATSAVE:nn|	Reads the auto-switchoff time, in minutes, set in the instrument.
BATSAVE:nn (nn = 00, 02, 05, 10, 15, 20, 30)	BATSAVE:nn; ok|	Sets the auto-switchoff time to nn minute value.

Password:

Command	Response	Description
USER:	USER:n|	Reads the activation status of the protected mode: ▪ protected mode enabled if n=1 ▪ protected mode disabled if n=2
USER:*password*	USER:Locked; ok| USER:Unlocked; ok|	Changes the activation status of the protected mode.
USERPWD:*password*	USERPWD:*password*; ok|	Changes the password for the management of the protected mode.

Print of measurements (through USB):

Command	Response	Description
PRBINPUT:x (x = A, B)	*List of quantities*|	Lists the quantities measured by the barometric sensor (x=A) or by the probe connected (x=B).
MONTIME:	MONTIME:nn|	Reads the periodic print interval of measurements on PC (the value is in seconds).
MONTIME:nn (nn = 1, 5, 10, 15, 30, 60, 120, 300, 600, 900, 1200, 1800, 3600)	MONTIME:nn; ok|	Sets the periodic print interval of measurements on PC to nn second value.
MONCHN:cc (cc = 01...24)	MONCHN:cc;n|	Indicates whether the measurement with sequential number cc on the display of the instrument is selected for periodic print: ▪ not selected if n=0 ▪ selected if n=1
MONCHN:cc;n (cc = 01...24; n=0,1)	MONCHN:cc;n; ok|	Selects/deselects the measurement with sequential number cc on the display of the instrument for periodic print: ▪ deselects if n=0 ▪ selects if n=1
MONITOR:n (n = 0,1)	*Measured values*|	Enables/disables periodic print of measurements on PC: ▪ disables if n=0 ▪ enables if n=1 If quantities for periodic print have been selected, only the selected quantities are printed, otherwise all the quantities displayed by the instrument are printed.
CHNSHOT:cc (cc = 01...24)	*Measured value*|	Single print on PC of the measurement with sequential number cc on the display of the instrument.
HOLD:	HOLD:n; ok|	Enables/disables the HOLD function: ▪ disables if n=0 ▪ enables if n=1
REL:cc (cc = 01...24)	REL:cc;n|	Indicates the activation status of the REL function for the measurement with sequential number cc on the display of the instrument: ▪ disabled if n=0 ▪ enabled if n=1
REL:cc;n (cc = 01...24; n=0,1)	REL:cc;n; ok|	Enables/disables the REL function for the measurement with sequential number cc on the display of the instrument: ▪ disables if n=0 ▪ enables if n=1
PEAKCLEAR:B	PEAKCLEAR:on; ok|	Reset of the peak value detected by the pressure probe connected to input B.

Logging:

Command	Response	Description
LOGTIME:	LOGTIME:nn|	Reads the logging interval set in the instrument (the value is in seconds). If nn=0, the manual logging is set.
LOGTIME:nn (nn = 0, 1, 5, 10, 15, 30, 60, 120, 300, 600, 900, 1200, 1800, 3600)	LOGTIME:nn; ok|	Sets the logging interval to nn seconds value. If nn=0, the manual logging is set.
LOGOFF:	LOGOFF:n|	Reads the enabling status of the auto switch off during logging: ▪ disabled if n=0 ▪ enabled if n=1
LOGOFF:n (n = 0,1)	LOGOFF:n; ok|	Enables/disables auto switch off during logging: ▪ disables if n=0 ▪ enables if n=1
LOG:n (n = 0,1)	LOG:start; ok| LOG:stop; ok|	Starts/stops logging: ▪ stops if n=0 ▪ starts if n=1
LOGSTART:	LOGSTART:yyyy/mm/dd HH:MM|	Reads the logging programmed start date/time.
LOGSTART: yyyy/mm/dd HH:MM	LOGSTART:yyyy/mm/dd HH:MM; ok|	Sets the date and the time of logging programmed start.
LOGSTOP:	LOGSTOP:yyyy/mm/dd HH:MM|	Reads the logging programmed stop date/time.
LOGSTOP: yyyy/mm/dd HH:MM	LOGSTOP:yyyy/mm/dd HH:MM; ok|	Sets the date and the time of logging programmed stop.
LOGCLR:	LOGCLR:ok|	Deletes the settings of the logging programmed start/stop.
LOGCHN:cc (cc = 01…24)	LOGCHN:cc;n|	Indicates whether the measurement with sequential number cc on the display of the instrument is selected for logging: ▪ not selected if n=0 ▪ selected if n=1
LOGCHN:cc;n (cc = 01…24; n=0,1)	LOGCHN:cc;n; ok|	Selects/deselects the measurement with sequential number cc on the display of the instrument for logging: ▪ deselects if n=0 ▪ selects if n=1

RECORD function (statistics):

Command	Response	Description
RCDCHN:cc (cc = 01…24)	RCDCHN:cc;n|	Indicates whether the measurement with sequential number cc on the display of the instrument is selected for RECORD function: ▪ not selected if n=0 ▪ selected if n=1
RCDCHN:cc;n (cc = 01…24; n=0,1)	RCDCHN:cc;n; ok|	Selects/deselects the measurement with sequential number cc on the display of the instrument for the RECORD function: ▪ deselects if n=0 ▪ selects if n=1
RCDMAN:cc (cc = 01…24)	RCDMAN:cc; ok|	Manual acquisition, for the RECORD function, of a sample of the measurement with sequential number cc on the display of the instrument. If measurements for the RECORD function have not been selected, the command enables the RECORD function for all the measurements.
RCDSTATUS:cc (cc = 01…24)	RCDSTATUS:cc;n;m|	Indicates the RECORD function status for the measurement with sequential number cc on the display of the instrument: ▪ function disabled if n=0 ▪ function enabled and automatic acquisition enabled if n=1 ▪ function enabled and automatic acquisition disabled if n=2 ▪ current value displayed if m=0 ▪ minimum value displayed if m=1 ▪ average value displayed if m=2 ▪ maximum value displayed if m=3
RCDSTATUS:cc;n;m (cc = 01…24; n=0,1,2; m=0,1,2,3)	RCDSTATUS:cc;n;m; ok|	Sets the RECORD function for the measurement with sequential number cc on the display of the instrument: ▪ function disabled if n=0 ▪ function enabled and automatic acquisition enabled if n=1 ▪ function enabled and automatic acquisition disabled if n=2 ▪ current value displayed if m=0 ▪ minimum value displayed if m=1 ▪ average value displayed if m=2 ▪ maximum value displayed if m=3
RCDSYNCH:cc (cc = 01…24)	RCDSYNCH:cc; ok|	Reset of statistics

15 FIRMWARE UPDATE

The firmware, i.e. the program which manages all the functions of the instrument, can be updated following the indications below:

1. Connect the USB port of the instrument to a USB port of your PC through the CP31 cable.
2. On your PC, launch DeltaLog9 application software;
3. Connect DeltaLog9 to the instrument (see software instructions).
4. On DeltaLog9 software, select "Options >> Firmware Update" and follow the procedure described in the software instructions.

Refer to "**www.deltaohm.com**" website at Support >> Firmware section to check for the availability of firmware updates.

Additionally, the instrument has the menu item "MENU >> FW UPGRADE", which is addressed to the Technical Assistance Service.

16 RESET OF THE INSTRUMENT

In case of blocked functionalities of the instrument, a hardware reset can be performed through the button placed inside the battery compartment.

Proceed as follows:

1. Remove the protective rubber shell, if any.
2. Untighten the 4 screws fixing the battery compartment cover on the back of the instrument.
3. Press (e.g. using a small screwdriver) the reset button on top left of the battery.

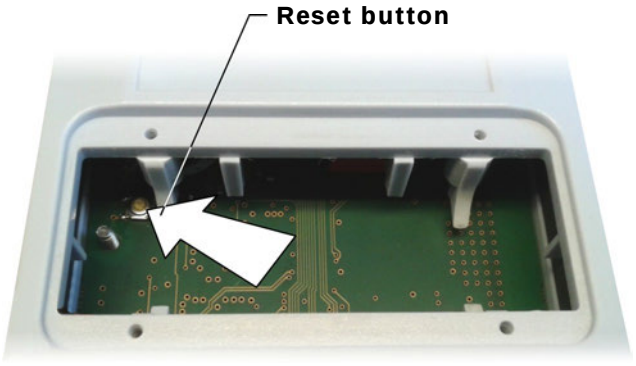


Fig. 16.1: reset button

4. Close the battery compartment with the 4 screws.

After reset, the instrument enters a waiting state for a new firmware for two minutes: press **ESC** to immediately exit the wait state and enter the normal measurement mode. If you exceed the two-minute time limit, the instrument switches off; in this case, press **ON/OFF** to switch it on again: the instrument restarts in normal measuring mode.

The reset sets back instrument parameters to factory defaults. After a reset operation, check configuration and, if necessary, reset operating parameters to the desired values.

17 USAGE INSTRUCTIONS AND WARNINGS

1. Do not expose the probes to gases or liquids that could corrode the material of the probes.
2. Do not bend the connectors by applying upward or downward force.
3. Do not bend or force contacts while inserting the probe connector into the instrument.
4. Do not bend, deform or drop the probes: this could cause irreparable damage.
5. Use the most appropriate probe to the measurement you want to perform.
6. Temperature probes should not generally be used in the presence of corrosive gases or liquids, the container housing the sensor is made of AISI 316, AISI 316 stainless steel plus silver for contact probes. Avoid the probe surface from getting into contact with sticky surfaces or with substances that might corrode or damage the probe. If the sensor breaks or becomes defective, it can be replaced. In this case the probe must be recalibrated.
7. Above 400°C and below –40°C, avoid Pt100 temperature probes from receiving violent impacts or thermal shocks, as this could cause irreparable damage to the probes.
8. Avoid over-rapid temperature variations in order to obtain reliable temperature measurements.
9. Contact temperature probes must be kept vertical to the measurement surface. Apply oil or thermal conductive paste between the surface and the probe to improve contact and reduce the reading time. Never use water or solvents for this purpose.
10. Measurements on non-metallic surfaces require considerable time due to their poor thermal conductivity.
11. **Temperature probes are not insulated with respect to the external casing, pay special attention not to come into contact with live parts (above 48V): it could be dangerous not only for the instrument, but also for the operator who could be electrocuted.**
12. Avoid performing measurements in the presence of high-frequency sources, microwaves or strong magnetic fields, because they would be unreliable.
13. Thoroughly clean the probes after use.
14. The instrument is water-resistant but is not waterproof, so it should never be submerged in water. Should it fall into the water, immediately pull it out and check that no water penetration occurred. The instrument must be handled so as water cannot penetrate from the connector side.

18 INSTRUMENT STORAGE

Conditions for storage of the instruments:

- Temperature: -25...+65 °C.
- Humidity: below 90 %RH no condensation.
- When storing, avoid places where:
    - there is a high humidity level;
    - instruments are exposed to direct solar radiation;
    - instruments are exposed to high temperature source;
    - there are strong vibrations;
    - there is vapor, salt and/or corrosive gas.

19 SAFETY INSTRUCTIONS

General safety instructions

The instruments have been manufactured and tested in compliance with the safety standard EN61010-1:2010 “Safety requirements for electrical equipment for measurement, control and laboratory use” and left the factory in a safe and secure technical condition.

The proper operation and the operational safety of the instruments can be ensured only if all the regular security measures are observed as well as the specific measures described in this operational manual.

The proper operation and the operational safety of the instruments can be ensured only under the climatic conditions specified in this manual.

Do not use the instruments in places where there are:

- Rapid ambient temperature variations that may cause condensation.
- Corrosive or flammable gases.
- Direct vibrations, shocks to the instrument.
- High-intensity electromagnetic fields, static electricity.

If the instruments are moved from a cold environment to a hot one or vice versa, the formation of condensation might cause problems to their operation. In this case you need to wait for the instrument temperature to reach ambient temperature before operation.

User obligations

The user of the instruments must make sure that the following regulations and directives related to the handling of hazardous materials are fulfilled:

- European directives on safety and health at work.
- National regulations on safety and health at work.
- Accident prevention regulations.

20 TECHNICAL FEATURES

20.1 ATMOSPHERIC PRESSURE

Sensor	Precision piezo-resistive
Measuring range	0…1350 hPa
Resolution	0.01 hPa
Accuracy @ 23 °C	± 0.1 hPa (500…1200 hPa) / ± 0.2 hPa (remaining range)
Accuracy @ full temperature range	± 0.3 hPa (500…1200 hPa) / ± 0.4 hPa (remaining range)
Long-term stability	0.25 hPa / year
Available measurement units	Pa, hPa, kPa, mbar, bar, atm, mmHg, mmH_2O, kgf/cm^2, PSI, inHg, inH_2O

20.2 INSTRUMENT

Power supply	**Rechargeable** 3.7 V Li-ion internal battery, 2250 mA/h capacity, 3-pole JST connector. External power supply unit (**SWD05**), to be connected to the mini-USB connector of the instrument. If connected to PC, it is powered from the computer's USB port (500 mA at least).
Battery life	15 hours of continuous operation (typical duration starting from a fully charged battery and with one Pt100 probe connected). **The actual battery life depends on the type of the probe connected**.
Logging	Manual or automatic with 1, 5, 10, 15, 30 seconds / 1, 2, 5, 10, 15, 20, 30 minutes / 1 hour configurable interval
Storage capacity	SD memory card, capacity up to 4 GB. The logging duration depends on the number of stored quantities and on the capacity of the SD memory card employed. E.g., with a 4 GB SD memory card, the logging duration is of some months even if several quantities with minimum logging interval of 1 s are recorded.
Inputs	1 input with 8-pole DIN45326 connector for Pt100 temperature probes, combined temperature and relative humidity probes, TP704/TP705 pressure probes with PP471 module. The barometric sensor is integrated into the instrument.
Clock stability	1 min/month maximum deviation
Display	Graphic color LCD. Visible area 43 x 58 mm.
USB connection	1 USB port with mini-USB connector. The port can operate in "HID" mode (no USB driver installation required) or in "Virtual COM" mode (USB driver installation required).
RS232C connection	1 RS232C serial output with RJ12 (6P6C) connector for connection of a serial printer. Settable Baud Rate from 1200 to 115200.
Auto-off	Configurable after 2, 5, 10, 15, 20 or 30 minutes from the last key pressure if battery powered. Can be disabled. Automatically disabled with external power supply.
Operating conditions	-10 … 60 °C, 0 … 85% RH no condensation
Storage Temperature	-25 … 65 °C
Materials	ABS, 55 shore rubber protection lateral bands 55 shore rubber protective shell
Dimensions	172x88x35 mm without rubber protective shell 180x102x46 mm with rubber protective shell
Weight	About 400 g (with battery and protective shell)
Degree of protection	IP 64

20.3 TECHNICAL FEATURES OF PROBES AND SICRAM MODULES IN LINE WITH THE INSTRUMENT

20.3.1 Temperature with platinum sensors (PRT)

4-wire Pt100 sensor temperature probes with SICRAM module

Model	Type	Range of use	Accuracy
TP472I	Immersion	-196 °C...+500 °C	±0.25 °C (-196 °C...+300 °C) ±0.5 °C (+300 °C...+500 °C)
TP472I.0 1/3 DIN - Thin film	Immersion	-50 °C...+300 °C	±0.25 °C
TP473P.I	Penetration	-50 °C...+400 °C	±0.25 °C (-50 °C...+300 °C) ±0.5 °C (+300 °C...+400 °C)
TP473P.0 1/3 DIN - Thin film	Penetration	-50 °C...+300 °C	±0.25 °C
TP474C.0 1/3 DIN - Thin film	Contact	-50 °C...+300 °C	±0.3 °C
TP475A.0 1/3 DIN - Thin film	Air	-50 °C...+250 °C	±0.3 °C
TP472I.5	Immersion	-50 °C...+400 °C	±0.3 °C (-50 °C...+300 °C) ±0.6 °C (+300 °C...+400 °C)
TP472I.10	Immersion	-50 °C...+400 °C	±0.3 °C (-50 °C...+300 °C) ±0.6 °C (+300 °C...+400 °C)
TP49A.I	Immersion	-70 °C...+250 °C	±0.25 °C
TP49AC.I	Contact	-70 °C...+250 °C	±0.25 °C
TP49AP.I	Penetration	-70 °C...+250 °C	±0.25 °C
TP875.I	Globe thermometer Ø 150 mm	-30 °C...+120 °C	±0.25 °C
TP876.I	Globe thermometer Ø 50 mm	-30 °C...+120 °C	±0.25 °C
TP87.O 1/3 DIN - Thin film	Immersion	-50 °C...+200 °C	±0.25 °C
TP878.O 1/3 DIN - Thin film	Photovoltaic	+4 °C...+85 °C	±0.25 °C
TP878.1.O 1/3 DIN - Thin film	Photovoltaic	+4 °C...+85 °C	±0.25 °C
TP879.O 1/3 DIN - Thin film	Compost	-20 °C...+120 °C	±0.25 °C

Common features
Resolution 0.01 °C from -200 °C to 350 °C / 0.1 °C from 350 °C to 800 °C
Temperature drift @ 20 °C 0.003 %/°C

4-wire Pt100 and 2-wire Pt1000 probes

Model	Type	Range of use	Accuracy
TP47.100.O 1/3 DIN – Thin film	4-wire Pt100	-50...+250 °C	1/3 DIN
TP47.1000.O 1/3 DIN – Thin film	2-wire Pt1000	-50...+250 °C	1/3 DIN
TP87.100.O 1/3 DIN – Thin film	4-wire Pt100	-50...+200 °C	1/3 DIN
TP87.1000.O 1/3 DIN – Thin film	2-wire Pt1000	-50...+200 °C	1/3 DIN

Common features
Resolution 0.01 °C da -200 °C a 350 °C / 0.1 °C da 350 °C a 800 °C
Temperature drift @ 20 °C
Pt100 0.003 %/°C
Pt1000 0.005 %/°C

TP471 Module for **NON** SICRAM Pt100 temperature probes.

Measuring range	-200 °C ... +850 °C
Accuracy	±0.03 °C to 350 °C ±0.3 °C to 850 °C
Resolution	0.01 °C from -200 °C to 350 °C 0.1 °C from 350 °C to 800 °C
Temperature drift @20 °C	0.002 %/°C
Excitation current	400 μA impulse, Duration=100 ms, Period=1 s

20.3.2 Relative humidity and temperature

Relative humidity and temperature probes with SICRAM module

Model	Temperature sensor	Field of use		Accuracy	
		%RH	Temperature	% RH	Temp
HP472ACR	Pt100	0...100% RH	-20 °C...+80 °C	±1.5% (0...85%RH) ±2.5% (85...100%RH) @ T=15...35 °C (2 + 1.5% measure)% @ T= remaining range	±0.3 °C
HP473ACR	Pt100	0...100% RH	-20 °C...+80 °C		±0.3 °C
HP474ACR	Pt100	0...100% RH	-40 °C...+150 °C		±0.3 °C
HP475ACR	Pt100	0...100% RH	-40 °C...+150 °C		±0.3 °C
HP475AC1R	Pt100	0...100% RH	-40 °C...+180 °C		±0.3 °C
HP477DCR	Pt100	0...100% RH	-40 °C...+150 °C		±0.3 °C
HP478ACR	Pt100	0...100% RH	-40 °C...+150 °C		±0.3 °C
HP480	Pt100	0...100% RH	-40 °C...+60 °C		±0.25 °C

Common features

Relative humidity

Sensor	Capacitive
Resolution	0.1% RH
Temperature drift @ 20 °C	0.02 % RH /°C
Response time % RH at constant temperature	10 s (10→80 % RH; air speed=2 m/s)

Temperature with Pt100 sensor

Resolution	0.1 °C
Temperature drift@ 20 °C	0.003 %/°C

20.3.3 Pressure

PP471 SICRAM module for the measurement of absolute, relative and differential pressures. It operates with TP704 and TP705 series pressure probes. It provides the pressure instant value and peak value. The module is equipped with cable (L=2m) and 8-pole DIN 45326 female connector.

Accuracy	±0.05% full scale (f.s.)
Peak duration	≥ 5 ms
Peak accuracy	±0.5% f.s.
Peak dead band	≤ 2% f.s.

TP704 and TP705 series pressure probes to associate to PP471module

Full scale pressure	Maximum over-pressure	Resolution	ORDERING CODES			Accuracy From 20 to 25°C	Operating temperature	Connection
			Differential pressure	Relative pressure (with regard to atmosphere)	Absolute pressure			
			NON isolated membrane	Isolated membrane	Isolated membrane			
10.0 mbar	20.0 mbar	0.01 mbar	**TP705-10MBD**			0.50 % FSO	0...60 °C	Tubo ∅ 5 mm
20.0 mbar	40.0 mbar	0.01 mbar	**TP705-20MBD**			0.50 % FSO	0...60 °C	Tubo ∅ 5 mm
50.0 mbar	100 mbar	0.01 mbar	**TP705-50MBD**			0.50 % FSO	0...60 °C	Tubo ∅ 5 mm
100 mbar	200 mbar	0.1 mbar	**TP705-100MBD**			0.25 % FSO	0...60 °C	Tubo ∅ 5 mm
				TP704-100MBGI		0.25 % FSO	-30...+80 °C	¼ BSP
200 mbar	400 mbar	0.1 mbar	**TP705-200MBD**			0.25 % FSO	0...60 °C	Tubo ∅ 5 mm
				TP704-200MBGI		0.25 % FSO	-30...80 °C	¼ BSP
400 mbar	1000 mbar	0.1 mbar		**TP704-400MBGI**		0.25 % FSO	-40...125 °C	¼ BSP
500 mbar	1000 mbar	0.1 mbar	**TP705-500MBD**			0.25 % FSO	0...60 °C	Tubo ∅ 5 mm
600 mbar	1000 mbar	0.1 mbar		**TP704-600MBGI**		0.25 % FSO	-40...125 °C	¼ BSP
1.00 bar	2.00 bar	1 mbar	**TP705-1BD**			0.25 % FSO	0...60 °C	Tubo ∅ 5 mm
					TP705BARO	0.25 % FSO	0...60 °C	Tubo ∅ 5 mm
				TP704-1BGI		0.25 % FSO	-40...125 °C	¼ BSP
					TP704-1BAI	0.25 % FSO	-40...120 °C	¼ BSP
2.00 bar	4.00 bar	1 mbar	**TP705-2BD**			0.25 % FSO	0...60 °C	Tubo ∅ 5 mm
				TP704-2BGI		0.25 % FSO	-40...125 °C	¼ BSP
					TP704-2BAI	0.25 % FSO	-25...85 °C	¼ BSP
5.00 bar	10.00 bar	1 mbar		**TP704-5BGI**		0.25 % FSO	-40...125 °C	¼ BSP
					TP704-5BAI	0.25 % FSO	-25...85 °C	¼ BSP
10.0 bar	20.0 bar	0.01 bar		**TP704-10BGI**		0.25 % FSO	-40...125 °C	¼ BSP
					TP704-10BAI	0.25 % FSO	-25...85 °C	¼ BSP
20.0 bar	40.0 bar	0.01 bar		**TP704-20BGI**		0.25 % FSO	-40...125 °C	¼ BSP
					TP704-20BAI	0.25 % FSO	-25...85 °C	¼ BSP
50.0 bar	100.0 bar	0.01 bar		**TP704-50BGI**		0.25 % FSO	-40...125 °C	¼ BSP
					TP704-50BAI	0.25 % FSO	-25...85 °C	¼ BSP
100 bar	200 bar	0.1 bar		**TP704-100BGI**		0.25 % FSO	-40...125 °C	¼ BSP
					TP704-100BAI	0.25 % FSO	-25...85 °C	¼ BSP
200 bar	400 bar	0.1 bar		**TP704-200BGI**		0.25 % FSO	-40...125 °C	¼ BSP
					TP704-200BAI	0.25 % FSO	-25...85 °C	¼ BSP
500 bar	1000 bar	0.1 mbar		**TP704-500BGI**		0.25 % FSO	-40...125 °C	¼ BSP
	700 bar	0.1 mbar			**TP704-500BAI**	0.25 % FSO	-25...85 °C	¼ BSP

21 ORDER CODES

HD31 Temperature, humidity and pressure data logger. Color graphic LCD display. Built-in precision barometric sensor. One input for Pt100 temperature probes, combined temperature and relative humidity probes, TP704/TP705 pressure probes with PP471 module. Direct logging on SD memory card. USB port for connection to PC or external power supply unit. RS232C output for serial printer connection. Provided with: lithium ion rechargeable battery, SD card, rubber protection shell with magnet, CP31 USB cable, SWD05 power supply, instruction manual and case. **DeltaLog9** software downloadable from Delta OHM website is included.
Modules, probes and serial cable for the printer have to be ordered separately.

Accessories

CP31 Direct USB connection cable for connection to PC. Male mini-USB connector on the instrument side and USB type-B male connector on PC side.

CP31RS RS232C connection cable for serial printer connection. RJ12 connector on the instrument side and Sub-D 9-pole female connector on the printer side.

SWD05 Mains power supply unit 100-240 Vac / 5 Vdc - 1 A.

HD35-BAT1 Lithium ion rechargeable battery, 3.7 V, capacity 2250 mA/h, 3-pole JST connector.

HD40.1 Kit including 24-column portable thermal printer, serial interface, paper width 57mm, 4 NiMH rechargeable batteries, 1,2V, SWD10 power supply unit, 5 thermal paper rolls and instruction manual.

BAT-40 Replacement battery pack for HD40.1 printer with integrated temperature sensor.

RCT Kit of 4 thermal paper rolls, width 57mm, diameter 32mm.

Pt100 temperature probes with SICRAM module

TP472I Immersion probe, Pt100 sensor. Stem Ø 3 mm, length 300 mm. Cable length 2 m.

TP472I.0 Immersion probe, Pt100 sensor. Stem Ø 3 mm, length 230 mm. Cable length 2 m.

TP473P.I Penetration probe, Pt100 sensor. Stem Ø 4 mm, length 150 mm. Cable length 2 m.

TP473P.0 Penetration probe, Pt100 sensor. Stem Ø 4 mm, length 150 mm. Cable length 2 m.

TP474C.0 Contact probe, Pt100 sensor. Stem Ø 4 mm, length 230 mm, contact surface Ø 5 mm. Cable length 2 m.

TP475A.0 Air probe, Pt100 sensor. Stem Ø 4 mm, length 230 mm. Cable length 2 m.

TP472I.5 Immersion probe, Pt100 sensor. Stem Ø 6 mm, length 500 mm. Cable length 2 m.

TP472I.10 Immersion probe, Pt100 sensor. Stem Ø 6 mm, length 1000 mm. Cable length 2 m.

TP49A.I Immersion probe, Pt100 sensor. Stem Ø 2.7 mm, length 150 mm. Cable length 2 m. Aluminum handle.

TP49AC.I Contact probe, Pt100 sensor. Stem Ø 4 mm, length 150 mm. Cable length 2 m. Aluminum handle.

TP49AP.I Penetration probe, Pt100 sensor. Stem Ø 2,7 mm, length 150 mm. Cable length 2 m. Aluminum handle.

TP875.I Globe thermometer Ø 150 mm with handle. Cable length 2 m.

TP876.I Globe thermometer Ø 50 mm with handle. Cable length 2 m.

TP87.O Immersion probe, Pt100 sensor. Stem Ø 3 mm, length 70 mm. Cable length 2 m.

TP878.O Contact probe for photovoltaic panels. Cable length 2 m.

TP878.1.O Contact probe for photovoltaic panels. Cable length 5 m.

TP879.O Penetration probe for compost. Stem Ø 8 mm, length 1 m. Cable length 2 m.

Pt100 and Pt1000 temperature probes without SICRAM module

TP47.100.O 4-wire direct Pt100 sensor immersion probe. Probe stem Ø 3 mm, length 230 mm. 4-wire connection cable with connector, length 2 m.

TP47.1000.O Pt1000 sensor immersion probe. Probe stem Ø 3 mm, length 230 mm. 2-wire connection cable with connector, length 2 m.

TP87.100.O 4-wire direct Pt100 sensor immersion probe. Probe stem Ø 3 mm, length 70 mm. 4-wire connection cable with connector, length 2 m.

TP87.1000.O Pt1000 sensor immersion probe. Probe stem Ø 3 mm, length 70 mm. 2-wire connection cable with connector, length 2 m.

Modules for NON SICRAM temperature probes

TP47 Connector for connection to **NON** SICRAM 4-wire Pt100 or 2-wire Pt1000 temperature probes.

TP471 Module for connection to **NON** SICRAM 4-wire Pt100 temperature probes.

Relative humidity and temperature combined probes with SICRAM module

HP472ACR %RH and Temperature combined probe, dimensions Ø26x170 mm. 2 m connection cable.

HP473ACR %RH and Temperature combined probe. Handle size Ø26x130 mm, probe Ø14x120 mm. 2 m connection cable.

HP474ACR %RH and Temperature combined probe. Handle size Ø26x130 mm, probe Ø14x215 mm. 2 m connection cable.

HP475ACR %RH and Temperature combined probe. 2 m connection cable. Handle Ø26x110 mm. Stainless steel stem Ø12x560 mm. Tip Ø13,5x75 mm.

HP475AC1R %RH and Temperature combined probe. 2 m connection cable. Handle 80mm. Stainless steel stem Ø14x480 mm.

HP477DCR %RH and Temperature combined sword probe. 2 m connection cable. Handle Ø26x110 mm. Probe stem 18x4 mm, length 520 mm.

HP478ACR %RH and Temperature combined probe. 5 m connection cable. Stainless steel stem Ø14x130 mm.

HP480 %RH and Temperature probe for compressed air systems. Supplied complete with SICRAM module. 2 m connection cable. Supplied with 15µm AISI 316 sintered stainless steel filter, measurement chamber, airflow control valve and 3 quick connect couplings 1/4" (Italian, German and American standard).

P1 200µm stainless steel protection grid for ∅26 probes, thread M24x1.5. For temperature up to 80 °C.

P2 20µm sintered polyethylene (PE) protection for ∅26 probes, thread M24x1.5. For temperature up to 80 °C.

P3 20µm sintered bronze protection for ∅26 probes, thread M24x1.5. For temperature up to 150 °C.

P4 20µm sintered PE complete cap for ∅26 probes, thread M24x1.5. For temperature up to 80 °C.

P6 10µm sintered stainless steel protection for ∅14 probes, thread M12x1. For temperature up to 180 °C.

P7 20µm PTFE protection for ∅14 probes, thread M12x1. For temperature up to 150 °C.

P8 20µm stainless steel grid and Pocan protection for ∅14 probes, thread M12x1. For temperature up to 100 °C.

HD75 Saturated solution for checking the Relative Humidity sensor at 75% RH, with screw adaptor for ∅14 probes, thread M12×1.

HD33 Saturated solution for checking the Relative Humidity sensor at 33% RH, with screw adaptor for ∅14 probes, thread M12×1.

Module for pressure measurement

PP471 SICRAM module for the measurement of absolute, relative and differential pressures. Operates with TP704 and TP705-series pressure probes. Supplied complete with cable (L=2m) and 8-pole DIN 45326 female connector.

See table at page 93 for TP704 and TP705-series pressure probes.

Delta OHM metrological laboratories LAT N° 124 have been ISO/IEC 17025 accredited by ACCREDIA in Temperature, Humidity, Pressure, Photometry/Radiometry, Acoustics and Air Speed. They can provide calibration certificates for the accredited quantities.

APPENDIX

Callendar-Van Dusen equation

The temperature response of a platinum sensor (e.g. Pt100) is described by the equation of Callendar Van Dusen (1).

$$(1)\quad \begin{aligned} R(t) &= R_0 \bullet (1 + At + Bt^2 + Ct^3(t-100)) && t<0°C \\ R(t) &= R_0 \bullet (1 + At + Bt^2) && t\geq 0°C \end{aligned}$$

The coefficient C is set to 0 for temperatures exceeding zero.

In order to obtain the value of coefficients A, B and C of the equation (1) the probe must be calibrated in three different points at least. Once known, the coefficients are used to determine the temperature depending on the resistance value of the sensor.

Coefficients A, B and C for Standard Platinum probes are defined by EN60751 standard:

A=3.9083 x 10^{-3} °C^{-1}	**B**=-5.775 x 10^{-7} °C^{-2}	**C**=-4.183 x 10^{-12} °C^{-4}

The temperature coefficient α is also defined by the same standard as:

$$(2)\quad \alpha = \frac{\boldsymbol{R}_{100} - \boldsymbol{R}_0}{100 \bullet \boldsymbol{R}_0} = 0{,}00385055 \ \ °C^{-1}$$

Coefficient α can be determined with a calibration operation in 2 points only.

The relationship (1) between the sensor resistance and temperature can be described in an alternative manner by the following equation:

$$(3)\quad \begin{aligned} \boldsymbol{R}(t) &= \boldsymbol{R}_0 \bullet \left\{1 + \alpha \bullet \left[t - \delta \frac{t}{100}\left(\frac{t}{100} - 1\right) - \beta\left(\frac{t}{100} - 1\right)\left(\frac{t}{100}\right)^3\right]\right\} && t < 0\,°C \\ \boldsymbol{R}(t) &= \boldsymbol{R}_0 \bullet \left\{1 + \alpha \bullet \left[t - \delta \frac{t}{100}\left(\frac{t}{100} - 1\right)\right]\right\} && t \geq 0\,°C \end{aligned}$$

where:

$\alpha = A + 100\,B = 0.00385055$ °C^{-1}	$\delta = -\dfrac{100}{\dfrac{A}{100B} + 1} = 1.499785$	$\beta = -\dfrac{10^8 C}{A + 100B} = 0.10863$

The calculation of coefficient α between 0 °C and a temperature exceeding 100 °C can be generalized, by obtaining it from the second of equations (3):

$$(4)\quad \alpha = \frac{\boldsymbol{R}(t) - \boldsymbol{R}_0}{\boldsymbol{R}_0 \bullet \left[t - \delta \dfrac{t}{100}\left(\dfrac{t}{100} - 1\right)\right]} \qquad \delta = \delta_{nominal}$$

This allows performing the calibration at 0 °C and in any point provided that it is higher than 100 °C.

NOTES

NOTES

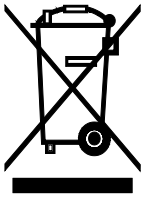
WARRANTY

The manufacturer is required to respond to the "factory warranty" only in those cases provided by Legislative Decree 6 September 2005 - n. 206. Each instrument is sold after rigorous inspections; if any manufacturing defect is found, it is necessary to contact the distributor where the instrument was purchased from. During the warranty period (24 months from the date of invoice) any manufacturing defects found will be repaired free of charge. Misuse, wear, neglect, lack or inefficient maintenance as well as theft and damage during transport are excluded. Warranty does not apply if changes, tampering or unauthorized repairs are made on the product. Solutions, probes, electrodes and microphones are not guaranteed as the improper use, even for a few minutes, may cause irreparable damages.
The manufacturer repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the “Convention on Contracts for the International Sales of Goods” apply.

TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased.
We reserves the right to change technical specifications and dimensions to fit the product requirements without prior notice.

DISPOSAL INFORMATION



Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection point designated by local authorities. Illegal disposal is punished by law.

Disposing of electrical and electronic equipment separately from normal waste helps to preserve natural resources and allows materials to be recycled in an environmentally friendly way without risks to human health.

CE RoHS

senseca

Please note our new name:
Senseca Italy Srl
Via Marconi 5, 35030 Padua, Italy
Documents are in the process of being changed.