English

Operating manual

pH meters / thermometers
HD2105.1 – HD2105.2

Companies / Brands of GHM

www.deltaohm.com

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CONTENTS

INTRODUCTION

The **HD2105.1** and **HD2105.2** are portable instruments with a large LCD display. They measure the pH, the mV, and the redox potential (ORP) in mV. They measure the temperature using Pt100 or Pt1000 immersion, penetration or contact probes.

The electrode calibration can be carried out manually or automatically on one, two or three points and the calibration sequence can be chosen from a list of 13 buffers.

The temperature probes are fitted with an automatic detection module, with the factory calibration settings already being memorized inside.

The HD2105.2 is a **data logger**. It memorizes up to 34,000 pH or mV and temperature samples which can be transferred from the instrument connected to a PC via the RS232C serial port or USB 2.0 port. The storing interval, printing, and baud rate can be configured using the menu.

The HD2105.1 and HD2105.2 models are fitted with an RS232C serial port and can transfer the acquired measurements in real time to a PC or to a portable printer.

Display, printing and, for the model HD2105.2, storing always include temperature, in °C or °F, and pH or mV.

The *Max*, *Min* and *Avg* function calculates the maximum, minimum or average values.

Other functions include: the relative measurement REL, the Auto-HOLD function, and the automatic turning off that can also be disabled.

The instruments have IP66 protection degree.

This manual describes the HD2105.1 and HD2105.2 models: if not otherwise specified, the description is intended to be applicable to both models.

Temperature-pH meter
HD2105.1

HD2105.1

1. BNC connector for the pH/mV electrode.

2. 8-pole DIN45326 connector, input for Pt100 temperature probes with SICRAM module, 4-wire direct Pt100 probes, 2-wire Pt1000 probes complete with TP47 module.

3. External auxiliary power supply connector input.

4. Battery symbol: displays the battery charge level.

5. Function indicators.

6. Secondary display line.

7. **CAL/▲** key: during normal operation starts the pH electrode calibration; in the menu, increases the current value.

8. **FUNC/ENTER** key: during normal operation displays the maximum (MAX), the minimum (MIN) and the average (AVG) of current measurements; in the menu, confirms the current selection.

9. **REL/▼** key: enables the relative measurement (displays the difference between the current value and the logged value when the key is pressed); in the menu, decreases the current value.

10. **SERIAL** key: starts and ends the data transfer to the serial communication port.

11. **MENU** key: allows access to and exit from the menu.

12. **pH/mV-ESC** key: when pressed for at least one second, changes the main variable measurement between pH and mV. When the Auto-HOLD function is enabled, slight pressure updates the measurement. In the menu, cancels the operation in progress without making changes.

13. **°C/°F** key: when the probe is not connected, allows manual modification of the temperature. When double pressed, changes the unit of measurement for the temperature between degrees Celsius and Fahrenheit.

14. **ON-OFF/AUTO-OFF** key: turns the instrument on and off; when pressed together with the MENU key, disables the automatic turn off.

15. Electrode efficiency indicators.

16. MAX, MIN and AVG symbols.

17. Main display line.

18. Line for symbols and comments.

19. 8-pole MiniDin connector for RS232C. For the connection to PC (with cable HD2110CSNM or C206) or printer (with cable HD2110CSNM).

Temperature-pH meter
HD2105.2
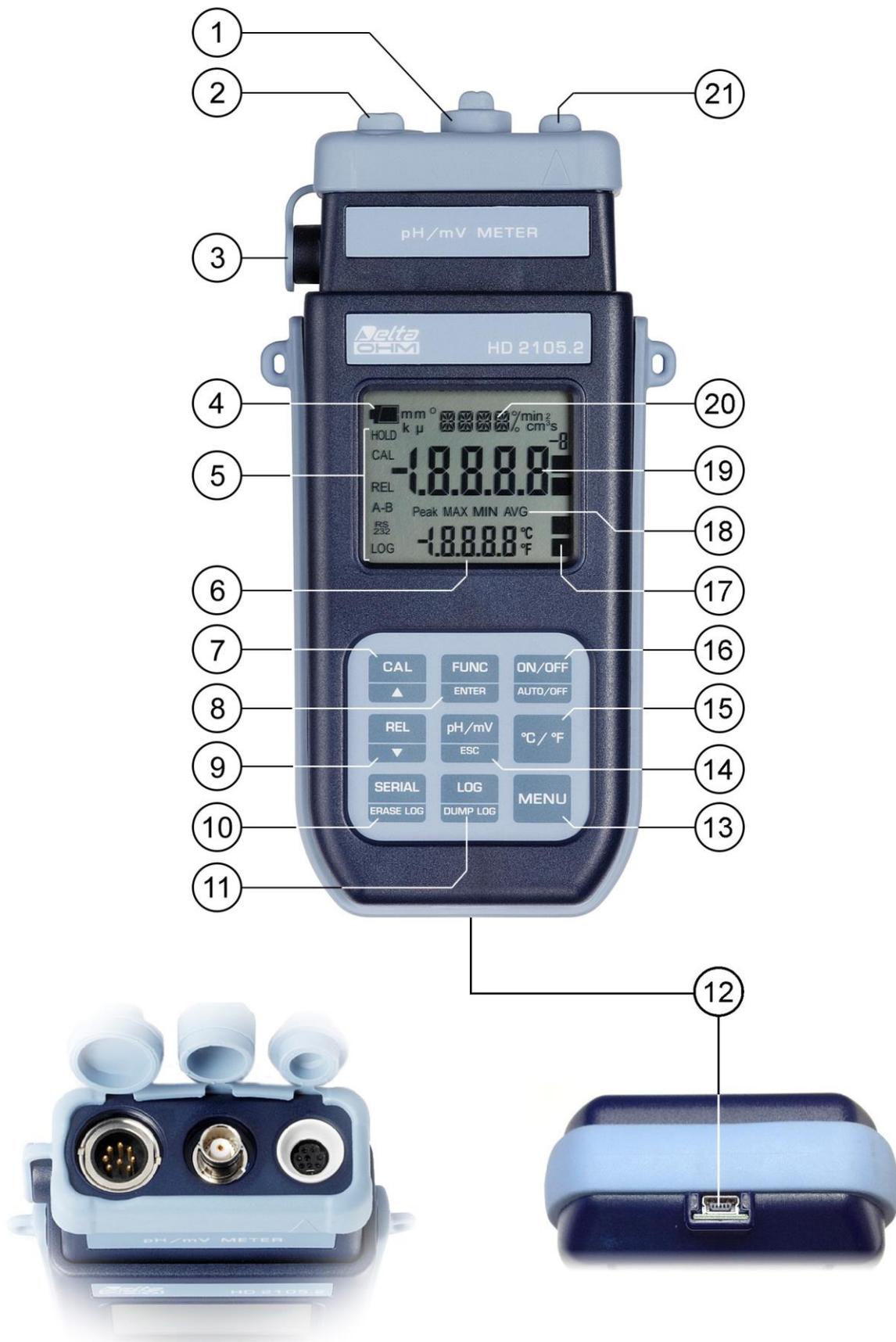
HD2105.2

1. BNC connector for the pH/mV electrode.

2. 8-pole DIN45326 connector, input for Pt100 temperature probes with SICRAM module, 4-wire direct Pt100 probes, 2-wire Pt1000 probes complete with TP47 module.

3. External auxiliary power supply connector input.

4. Battery symbol: displays the battery charge level.

5. Function indicators.

6. Secondary display line.

7. **CAL/▲** key: during normal operation starts the pH electrode calibration; in the menu, increases the current value.

8. **FUNC/ENTER** key: during normal operation displays the maximum (MAX), the minimum (MIN) and the average (AVG) of current measurements; in the menu, confirms the current selection.

9. **REL/▼** key: enables the relative measurement (displays the difference between the current value and the logged value when the key is pressed); in the menu, decreases the current value.

10. **SERIAL/ERASE LOG** key: starts and ends the data transfer to the serial communication port. In the menu, clears the data contained in the instrument's memory.

11. **LOG/DUMP LOG** key: during normal operation, starts and ends the saving of the data in the internal memory; in the menu, starts the data transfer from the instrument's memory to the PC.

12. Mini-USB type B connector for USB 2.0. For the connection to PC (with cable CP23).

13. **MENU** key: allows access to and exit from the menu.

14. **pH/mV-ESC** key when pressed for at least one second, changes the main variable measurement between pH and mV. When the Auto-HOLD function is enabled, slight pressure updates the measurement. In the menu, cancels the operation in progress without making changes.

15. **°C/°F** key: when the probe is not connected, allows manual modification of the temperature. When double pressed, changes the unit of measurement for the temperature between degrees Celsius and Fahrenheit.

16. **ON-OFF/AUTO-OFF** key: turns the instrument on and off; when pressed together with the MENU key, disables the automatic turn off.

17. Electrodes efficiency indicators.

18. MAX, MIN and AVG symbols.

19. Main display line.

20. Line for symbols and comments.

21. 8-pole MiniDin connector for RS232C. For the connection to PC (with cable HD2110CSNM or C206) or printer (with cable HD2110CSNM).

KEYBOARD AND MENU DESCRIPTION

Foreword

The instrument keyboard is composed of single-function keys, like the MENU key, and double-function keys such as the ON-OFF/Auto-OFF key.

In the double-keys, the function in the upper part is the "main function", while the one in the bottom part is the "secondary function". When the instrument is in standard measurement mode, the main function is active. In the menu or in conjunction with the FUNC key, the secondary function is enabled.

The pressing of a key is accompanied by a short confirmation beep: a longer beep sounds if the wrong key is pressed.

Each key specific function is described in detail below.

ON-OFF/Auto-OFF key

The instrument is turned on and off using the ON/OFF key. The turning on enables all display segments for a few seconds, starts an auto-test including the detection of the temperature probe connected to the input, and sets the instrument ready for normal measurement.
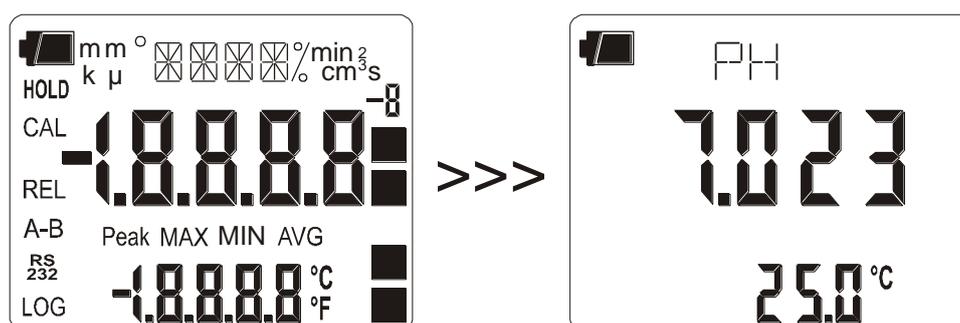
During turning on, should no probes be connected, the message "NO_PRBE_ SER_NUM" is displayed in the line for symbols for a few seconds, and in the secondary line the last manually-set temperature appears. The unit of measurement symbol (°C or °F) starts blinking, and a letter "m" meaning "manual" appears next to the battery symbol.

When the probe fitted with SICRAM module is inserted into a functioning instrument, the "NEW_PROB_DET" (New probe detected) message appears: as the probe's data are captured upon turning the instrument on, it is necessary to turn the instrument off and on again.

Replace the probes when the instrument is off.

ON/OFF + MENU   Automatic turning off

The instrument has an *AutoPowerOff* function that automatically turns the instrument off after about 8 minutes if no key is pressed during the intervening time. The *AutoPowerOff* function can be disabled by holding the MENU key pressed down when turning the instrument on: the battery symbol will blink to remind the user that the instrument can only be turned off by pressing the <ON/OFF> key.

The automatic turning off function is disabled when external power is used. On the other hand, it cannot be disabled when the batteries are discharged.

FUNC/ENTER key

During normal measurement this enables the display and logging of the maximum (MAX), minimum (MIN) and average (AVG) value of the pH, mV and temperature measurements, updating them with the acquisition of new samples. The acquisition frequency is once a second.

In the menu, the ENTER key confirms the current parameter and then goes to the next one.

The MAX, MIN and AVG measurements remain in the memory until the instrument is on, even after exiting the calculation function. To reset the previous values and restart with a new measurement session, press FUNC until the message "FUNC CLR" appears, then use the arrows to select YES and confirm using ENTER.

The pH and temperature values are displayed at the same time. According to settings in the "RCD Mode" menu item, the maximum, minimum and average indications have different meanings: please see the description of this menu item below.

Attention: the data captured using the Record function cannot be transferred to the PC.

CAL/▲ key

It increases the current parameter when used in the menu; when used in measurement mode, it starts the pH electrode calibration (please see the chapter dedicated to calibration on page 17).

°C/°F key

When the temperature probe is connected, the measured value is used to compensate the pH measurement; the key changes the unit of measurement from degrees Celsius to Fahrenheit.

If the probe is not present, the compensation temperature must be entered manually: to manually change the value shown in the display lower line, press °C/°F once. The temperature indicated starts blinking. While the display is blinking, it is possible to change the compensation temperature using the arrows (▲ and ▼). Confirm using ENTER. The display stops blinking, and that temperature is used for compensation.

If the temperature probe is not present, to change the unit of measurement between °C and °F, it is necessary to press **twice** the °C/°F key.

pH/mV-ESC key

Changes the main variable measurement between pH and mV. The selected parameter is used for display, printing, and logging.

The instrument has an Auto-Hold function, which can be set in the MENU, that "freezes" the measurement automatically when it has been stable (**within 1 mV**) for over 10 seconds: the message HOLD is displayed.

To perform a new measurement, it is necessary to press the pH/mV key.

The HOLD message starts blinking, while the display follows the actual measurement trend, until it stabilizes again and the HOLD message remains still.

NOTE: when the Auto-Hold function is enabled, the pH/mV key allows the pH measurement to be relaunched, **and the measurement in mV is disabled. To restore the display in mV, disable the Auto-Hold function in the menu.**

In the menu, the key clears or cancels the active function (ESC).

REL/▼ key

In measurement mode, displays for both measurements – **mV** and **temperature** – the difference between the current value and that measured on pressing the key. The **REL** message appears on the display; press the key again to return to the current measurement.

When used in the menu, it decreases the current variable value.

MENU Key

Upon turning on the instrument, the *AutoPowerOff* function can be disabled by holding the MENU key down (please see the ON-OFF key description).

The first menu item is accessed by initially pressing on the MENU key; press ENTER to go to the following items. To modify the item displayed, use the arrow keys (▲ and ▼). The current value is confirmed by pressing the ENTER key and the display moves on to the next parameter. If pressing ESC the setting is cancelled.

To exit the menu, press the MENU key at any time.

The menu items are listed in this order:

1) **Management of memorized data (only HD2105.2)**: the message "**LOG_DUMP_or_E-RAS**" **(Transfer data or erase)** is scrolled in the comment line. The center figure reports the number of free memory pages (FREE). All memory data are permanently erased by pressing SERIAL/EraseLOG. By pressing LOG/DumpLOG, the data transfer of the logged data on the serial port is started: the "BAUD-RATE" must have previously been set to the maximum value (please see the menu items described below and the paragraph "STORING AND TRANSFERRING DATA TO A PERSONAL COMPUTER" on page 31).

2) **Identifier of the sample being measured**: it is an automatically increased progressive number associated with the single PRINT function (print interval set to 0). The index appears in the single sample printing together with date, time, pH or mV and temperature measured values. This menu item allows the value of the first sample to be set: each time the PRINT key is pressed, the identification ID in the printing is increased by 1 allowing progressive measurement of all measured samples. If the Auto-Hold function, described below in this chapter, is enabled, the print time interval is forced to zero. Pressing SERIAL only causes the print to occur when the measurement has stabilized (HOLD symbol still). Later, it

is possible to repeat the print at will, but while the HOLD mode is on, the sample identifier number is not increased. This is useful when more labels must be printed with the same identification code without increasing the code each time.

The message "SMPL ID REL=RSET SER=PRINT" is scrolled in the comment line: using the arrows (▲ and ▼) the currently measured sample identifier value can be changed.

By holding the REL/▼ key down the proposed number is rapidly set to zero.

The instrument's heading information will be printed using the SERIAL key.

3) **AUTO-HOLD function**: the instrument normally operates in **continuous view** mode, which is set by default. In this mode the displayed measurement is updated every second. If the Auto-Hold function is enabled, the instrument performs the measurement and when it stabilizes it goes in HOLD mode. To update the display indication, press pH/mV (please see the description of the pH/mV key for further explanation).

In the following figure you can see an example of the measurement process with the Auto-Hold function enabled. An electrode is immersed into a liquid and, to perform the measurement, the pH/mV key is pressed: The pH measurement raises progressively reaching the final value. The HOLD symbol blinks. In the stretch indicated by 1, the measurement remains stable for 10 seconds, within two digits: at the end of this interval (point 2), the instrument goes into HOLD mode, presenting the final stable value.
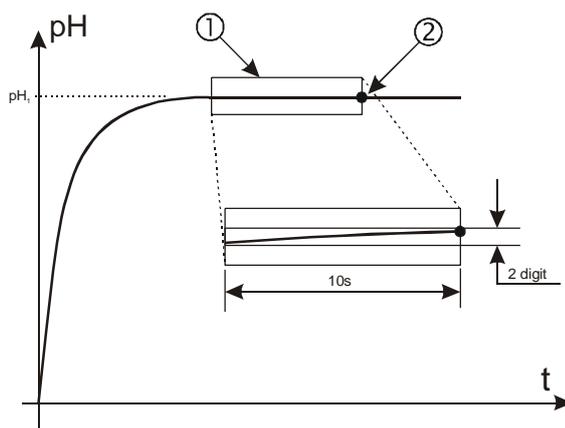
To perform a new measurement, it is necessary to press again the pH/mV key.

4) **Print and log interval**: sets the interval in seconds between two loggings or data transfers to the serial port. The interval can be set at 0, 1s, 5s, 10s, 15s, 30s, 60s (1min), 120s (2min), 300s (5min), 600s (10min), 900s (15min), 1200s (20min), 1800s (30min) and 3600s (1hour). **If the value 0 is set, SERIAL works on command: the sending of data to the serial port is performed each time the key is pressed**. Recording (LOG) is performed with one second intervals even if the interval is set to 0. With an interval from 1 to 3600s, continuous data transfer is started when the SERIAL key is pressed. To end the recording (LOG) and **continuous** data transfer operations (SERIAL with an interval greater than 0), press the same key again.

5) **Sleep_Mode_LOG (Automatic turning off during recording) (only HD2105.2):** this function controls the instrument's automatic turning off during logging, occurring between the capture of a sample and the next one. When the interval is lower than 60 seconds, the instrument will always remain on. With intervals greater than or equal to 60 seconds, it is possible to turn off the instrument between loggings: it will turn on at the moment of sampling and will turn off immediately afterwards, thus increasing the battery life. Using the arrows select **YES** and confirm using **ENTER** in order to enable the automatic turning off, select **NO** and confirm to disable it and keep the instrument on continuously.

Note: even if **Sleep_Mode_LOG=YES** is selected, the instrument does not turn off for less than one minute intervals.

6) **LAST CAL m/d h/m (Last pH calibration)**: the display shows the month and day (m/d) in the main line, and the hour and minutes (h/m) in the secondary line of the last pH electrode calibration. This menu item cannot be modified. The calibration year is not displayed.

7) **pH RES**: selects the number of leading digits for the pH measurement: using the arrows select 1.23 to obtain the pH hundredths or 1.234 to obtain the thousandths. The chosen resolution is applied to the new logged measurements, while the previous choice still applies for the already memorized ones.

8) **BUFR_1 (First buffer)**: selects the value of the first buffer for the pH electrode calibration. The preset buffers are compensated for temperature. The ATC indication is displayed in the lower line. The USER buffer, defined by the user, is not compensated for temperature: to change its value, go to the "SET USER BUFR" step.

Please see the paragraph dedicated to calibration on page 17.

9) **BUFR_2 (Second buffer)**: selects the value of the second buffer for the pH electrode calibration. No buffer solution values too close (less than 2pH) to the first buffer are proposed. This is also true for the USER buffer, defined by the user at the "SET USER BUFR" step: if, for example BUFR_1=6.860 and USER=5.000, the BUFR_2 USER does not appear among the values because it is too close to BUFR_1. The selection NIL (=no buffer) disables the current buffer. The USER buffer, defined by the user, is not compensated for temperature.

Please see the paragraph dedicated to calibration on page 17.

10) **BUFR_3 (Third buffer)**: selects the value of the third buffer for the pH electrode calibration. No buffer solution values too close (less than 2pH) to the first two buffers are proposed. This is also true for the USER buffer, defined by the user at the "SET USER BUFR" step: The selection NIL (=no buffer) disables the current buffer. The USER buffer is not compensated for temperature.

Please see the paragraph dedicated to calibration on page 17.

11) **SET USER BUFR (Set user buffer)**: this is a buffer whose value can be defined by the user using the arrows; all values from 0 to 14pH are available. This buffer is not compensated for temperature, so the buffer value must be set at the actual solution temperature. As an alternative, the correct value according to temperature can be set in the calibration phase.

12) **RCD MODE (Record mode)**: the instrument captures a pH/mV and a temperature value every second. If the RCD MODE parameter is set to **"pH"** (factory default), the maximum and minimum values displayed using FUNC/ENTER refer to pH: the indicated temperature is that measured at the maximum and minimum pH and is not the maximum and minimum temperature.
If the RCD MODE parameter is set to **"tp"** (=temperature), the maximum and minimum values displayed using FUNC/ENTER refer to temperature: the indicated pH is that measured at the maximum and minimum temperature and is not the maximum and minimum pH.
Finally, if the RCD MODE parameter is set to **"Indep"** (=independent), the maximum and minimum values displayed using FUNC/ENTER are independent: the indicated pH and temperature are the maximum and minimum measured values but are not necessarily referred to the same measurement moment.

13) **Probe type**: the message "PRBE_TYPE" is scrolled in the comment line. The main line in the center of the display shows the type of probe connected to the instrument. The following probes can be connected to the input:

- temperature probes Pt100 complete with SICRAM module
- 4 wire Pt100 probes through module TP47
- 2 wire Pt1000 probes through module TP47
- 2 wire Ni1000 probes through module TP47

The probes fitted with SICRAM module are automatically detected by the instrument **upon turning on**: the *Probe Type* menu item is configured by the instrument and cannot be modified by the user.

If the direct 4-wire Pt100, Pt1000 and Ni1000 temperature probes are connected, the message "NO_PRBE_SER_NUM" appears when turning on. In this case the probe type must be entered manually. Select **Probe type** using the MENU key and then select the type of probe with the arrow keys; confirm using ENTER.

14) **YEAR**: to set the current year. Use the arrows to modify this parameter and confirm using ENTER.

15) **MNTH (month)**: to set the current month. Use the arrows to modify this parameter and confirm using ENTER.

16) **DAY**: to set the current day. Use the arrows to modify this parameter and confirm using ENTER.

17) **HOUR**: to set the current hour. Use the arrows to modify this parameter and confirm using ENTER.

18) **MIN (minutes)**: to set the current minutes. In order to correctly synchronize the minute, it is possible to reset the seconds by pressing the °C/°F key. Use the arrows to set the current minute plus one, and as soon as that minute is reached press °C/°F: this synchronizes the time to the second. Press ENTER to go onto the next item.

19) **BAUD_RATE:** indicates the frequency used for the serial communication with the PC. Values from 1200 to 38400 baud. Use the arrows to modify this parameter and confirm using ENTER. **The communication between instrument and PC (or serial port printer) only works if the instrument and PC baud rates are the same**. If the USB connection is used this parameter value is automatically set (please see the details on page 31).

LOG/DUMP LOG key - only HD2105.2

In measurement mode, this function starts and stops the logging of a data block to be saved in the instrument's internal memory. The data logging frequency is set in the "**Print and log interval**" menu parameter. The data logged between a start and subsequent stop represent a block.

When the logging function is on, the LOG indication is displayed, the battery symbol blinks and a beep is issued each time a logging occurs; **the battery symbol does not appear when using an external power supply**.

To end the logging, press LOG.

If the Auto-HOLD function is enabled (please see the menu), the data logging is disabled.

The HD2105.2 can turn off during logging between a capture and the next one: the function is controlled by the **Sleep_Mode_LOG** parameter. When the logging interval is less than one minute, the logging instrument remains on; with an interval of at least one minute, it turns off between one capture and the next if the parameter **Sleep_Mode_LOG**=YES.

MENU >>> **LOG / DUMP LOG**   **Dump LOG - only HD2105.2**

When the LOG key is pressed after the MENU key, the transfer of the logged data on the serial port is started.
Please see the paragraph dedicated to data transfer on page 31.

SERIAL   **SERIAL key - only HD2105.1**

SERIAL / ERASE LOG   **SERIAL/EraseLOG key - only HD2105.2**

In measurement mode, this function starts and stops the data transfer to the RS232C serial output.
According to the settings entered in the **Print and log interval** menu item, a single sample can be printed if **Print and log interval**=0 or a continuous indefinite printing of the measured data can be set up if **Print and log interval**=1…3600.
The printing operation is accompanied by the display of the RS232 symbol and the blinking of the battery symbol; **when using an external power supply the battery symbol does not appear**.
Press SERIAL to end the continuous printing.

Before starting the printing with SERIAL, set the baud rate. To do so, select the **Baud Rate** menu item and select the maximum value equal to 38400 baud by using the arrows. Confirm by pressing ENTER.
The DeltaLog9 software for PC will automatically set the baud rate value during connection. **If you are using a different program than DeltaLog9, be sure the baud rate is the same for both the instrument and the PC: the communication will only work in this way.**

MENU >>> **SERIAL / ERASE LOG**   **Erase memory - only HD2105.2**

When pressed after the MENU key, the SERIAL key **permanently** erases all the data contained in the instrument's memory.

The instrument works with pH measurement electrodes, redox potential measurement electrodes (ORP), and specific ion electrodes. The pH measurement must always be accompanied by a temperature measurement. The probes with 4-wire Pt100, 2-wire Pt1000 or Ni1000 sensors may be used for measuring temperature or for the automatic compensation of the Nernst coefficient with the pH electrode.

Some probes are fitted with SICRAM module that acts as an interface between the sensor on the probe and the instrument. There is a microprocessor circuit with a permanent memory inside the module that enables the data logger to recognize the type of probe connected and to read its calibration information.

The fitted with SICRAM module are automatically detected while the direct 4-wire Pt100, the Pt1000 and Ni1000 temperature probes are not automatically detected by the instrument and must be set up in the **Probe type** menu item (please see the description of the menu on page 12).

The pH or mV indication is displayed in the main line; the secondary line shows the temperature.

The electrode for pH measurement

The electrode for pH measurement, generally in glass, generates an electrical signal proportional to the pH according to Nernst law. Of this signal the following aspects are considered:

Zero point: The pH where the electrode generates a potential of 0 mV. In most electrodes, this value is found at about 7pH.

Offset or Asymmetry Potential: mV generated by an electrode when immersed in a buffer solution at 7pH. Generally, oscillates between ± 20 mV.

Slope: response of the electrode expressed in mV per pH units. The theoretical electrode slope at 25°C is 59.16 mV/pH. When the electrode is new the slope is close to the theoretical value.

Sensitivity: it is the electrode's slope expression in relative terms. It is obtained by dividing the actual value of the slope by the theoretical value, and is expressed as a %. The asymmetry potential and the slope vary in time with the use of the electrode, which necessitates regular calibration.

The pH electrodes must be calibrated using the buffer solutions (see the calibration chapter below). The ORP and specific ion electrodes do not need calibration as their absolute voltage is measured. **The redox buffer solutions are only used to check the quality of a redox electrode.**
**No calibration of the temperature sensor is required by the user: the sensor is calibrated in the factory and the Callendar Van Dusen parameters are recorded in the SICRAM module.**

The probes are detected during turn on, and this cannot be performed when the instrument is already on, therefore if a probe is connected and the instrument is on, it is necessary to turn it off and on.

AUTOMATIC OR MANUAL pH COMPENSATION

In a correct measurement of pH, the results need to be expressed together with the temperature value at which the reading is performed.

The electrode slope varies according to the temperature in a known mode according to Nernst law: e.g., a 1pH variation, that at 25°C means 59.16mV, at 100°C means 74.04mV.
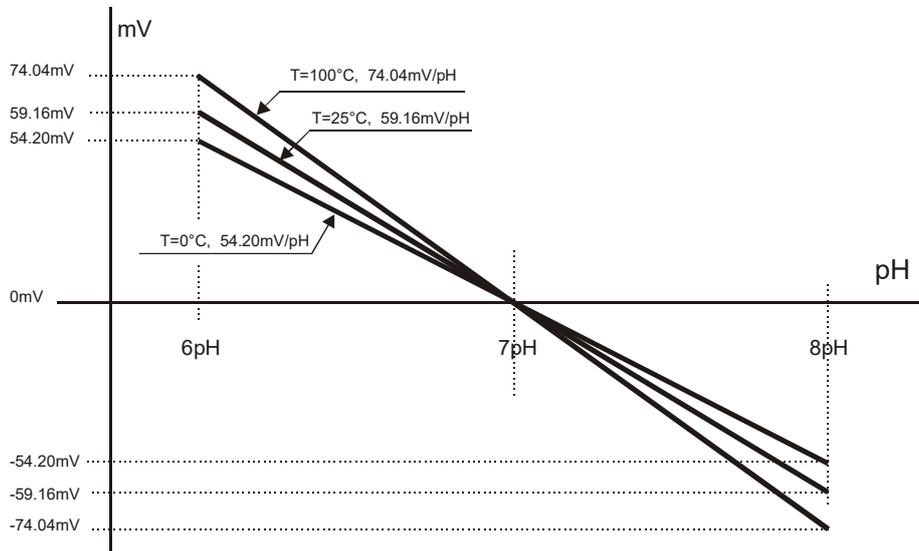
When a temperature probe is present, the instrument automatically applies the ATC automatic temperature compensation function. To disable it, the temperature probe must be disconnected.

If the temperature probe is not present, and the correct value is not entered manually, the extent of the error committed in pH measurement is proportional to temperature and pH value itself.

In absence of the temperature probe, the lower display shows the manually set compensation temperature (default=25°C).

To point this condition out, the °C or °F symbol blinks intermittently near the temperature value. Moreover, on the main display an "m" (**m**anual) is turned on near the battery symbol (if present). On the print-outs, the **MT** indication is printed. Instead, if the probe is present, the **AT** symbol is printed.
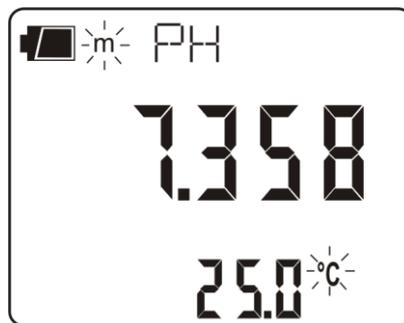
To manually change the compensation temperature press °C/°F once: the indicated temperature value starts blinking. By using the arrows select the desired temperature value and confirm with ENTER. The display stops blinking, and that temperature is used for compensation.

To change the unit of measurement between °C and °F, it is necessary to press twice the °C/°F key.

pH ELECTRODE CALIBRATION

The electrode calibration is used to compensate the zero potential and slope deviations to which the electrode is subject with time.

The calibration frequency depends on the accuracy desired by the user and by the effects that the measured sample have on the electrode. Generally, we recommend daily calibration, but it is the user's responsibility from personal experience, to establish the most appropriate frequency.

The calibration may be carried out using 1, 2 or 3 points. When using 1 point, the electrode offset is corrected, with 2 points the offset and the gain is corrected; finally, in case a three points calibration is carried out two offsets and two slopes are calculated, **the second point is the one in which the zero is performed**.

The instrument has a memory of 13 buffers with relevant temperature compensation tables (ATC) plus an "User" buffer, not compensated. The three buffers can be selected by using the **BUFR_1, BUFR_2, BUFR_3** menu items. Usually one for the acid, one for the neutral, and one for the alkaline band will be selected:

@25°C

BUFR_1 (NEUTRAL)	**6.860**	6.865	7.000	7.413	7.648
BUFR_2 (ACID)	1.679	2.000	4.000	4.008	**4.010**
BUFR_3 (ALKALINE)	**9.180**	9.210	10.010		

The buffers in bold are predefined in the factory, these are the "DeltaOHM" ones.

> If electrode calibration was not carried out on the instrument, or the batteries have been changed or the last calibration failed, the display blinks the CAL message.

Calibration procedure

1) Insert the temperature probe and the electrode in the solution of a calibration buffer. If no temperature probe is available, use another thermometer and enter the value manually as indicated in the paragraph "*Automatic or manual pH compensation*".

2) The electrode calibration mode is started by pressing CAL.

3) Among the three prepared buffers, the instrument automatically detects the closest to the pH value being read and flags it up on the lower display.
If the buffer is not detected the first buffer BUFR_1 is proposed.

4) At this point the CAL symbol is not blinking on the display and the following is shown from the upper side downward:
   a) the chosen buffer nominal value at 25°C (scrolling indication)
   b) the pH measurement value with the current calibration
   c) the temperature compensated buffer value

The detected and temperature compensated buffer value, shown in the lower line, can be modified using the arrows.

5) To proceed with the calibration press ENTER. The electrode offset mV value (OFFS) is shown on the display for few seconds.

After a few seconds the instrument shows the measurement again, corrected according to the new calibration, **but remains in calibration mode**.

Pressed repeatedly the ENTER key allows the calibration on the point to be repeated, for example, in order to obtain a more stable value.

6) To end the electrode calibration, press pH/mV (ESC) to exit calibration, or continue the calibration for the second point.

7) Extract the electrode from the buffer, clean it carefully, and insert it in the following buffer.

8) Press MENU.

The instrument displays the value detected on the new buffer: continue by repeating the steps from point 3.

NOTES:
- After calibration, the instrument displays **an electrode quality indication**:
  - No signal: electrode functioning.
  - 1 small square blinking on the lower right: electrode almost exhausted.
  - 2 small squares blinking on the lower right: electrode exhausted to be replaced.
- **The 3 point calibration must always be carried out according to the fixed sequence: NEUTRAL>>ACID>>BASIC**. The basic buffer must be the last in the sequence.
- **Without having pressed ENTER at all, the calibration is interrupted by pressing pH/mV (ESC);** the previous values will continue to be used.
- The buffers are always presented in the sequence set in the menu with the BUFR_1-BUFR_2-BUFR_3 parameters. The 2 point calibration is possible using the sequence BUFR_1-BUFR_2 or BUFR_2-BUFR_3 or even BUFR_1-BUFR_3. **The 3 point calibration is only possible using the exactly described sequence BUFR_1-BUFR_2-BUFR_3.**

		Allowed calibration sequences:		
Number of calibration points	1	BUFR_1	BUFR_2	BUFR_3
	2	BUFR_1 - BUFR_2	BUFR_2 - BUFR_3	BUFR_1 - BUFR_3
	3	BUFR_1 - BUFR_2 - BUFR_3		

- A buffer can be disabled in the option selection phase (MENU mode) by choosing the **NIL** value. In this case, the disabled buffer is excluded from the sequence and will not be proposed.
- If no other buffer is expected after the first, as the BUFR_2 and BUFR_3 have been set to NIL, the calibration mode is exit by pressing MENU.
- **In any case where no operation is performed, the calibration mode automatically stops after 60 seconds.**
- If the calibration is rejected by the instrument because it is considered to be excessively corrupted, the **CAL ERR** message will appear, followed by a long beep. The instrument remains in calibration mode and maintains the previous calibration values: at this point, if the calibration is interrupted using ESC, the instrument signals the anomaly through the CAL message blinking.

Temperature characteristics of Delta OHM buffer solutions

The 13 standard buffers reported in the table on page 17 are memorized in the instruments with relevant variations according to temperature: The characteristics of the three Delta Ohm standard buffers at 6.86pH, 4.01pH and 9.18pH (@25°C) are reported below.

6.86 pH @ 25°C

°C	pH	°C	pH
0	6.98	50	6.83
5	6.95	55	6.83
10	6.92	60	6.84
15	6.90	65	6.85
20	6.88	70	6.85
25	6.86	75	6.86
30	6.85	80	6.86
35	6.84	85	6.87
40	6.84	90	6.88
45	6.83	95	6.89

4.01 pH @ 25°C

°C	pH	°C	pH
0	4.01	50	4.06
5	4.00	55	4.07
10	4.00	60	4.09
15	4.00	65	4.10
20	4.00	70	4.13
25	4.01	75	4.14
30	4.01	80	4.16
35	4.02	85	4.18
40	4.03	90	4.20
45	4.05	95	4.23

9.18 pH @ 25°C

°C	pH	°C	pH
0	9.46	50	9.01
5	9.39	55	8.99
10	9.33	60	8.97
15	9.28	65	8.94
20	9.22	70	8.92
25	9.18	75	8.90
30	9.14	80	8.88
35	9.10	85	8.86
40	9.07	90	8.85
45	9.04	95	8.83

DIRECT INPUT INTO Pt100, Pt1000 AND Ni1000 TEMPERATURE PROBES

The instrument accepts the direct input of Platinum temperature probes with a 100Ω, 1000Ω resistance and Nickel temperature probes with a 1000Ω resistance.
The Pt100 are connected to 4 wires, the Pt1000 and Ni1000 to 2 wires, with the excitation current chosen minimizing the sensor self-heating effects.
All probes with SICRAM module are calibrated in the factory; the 2 or 4-wire probes with direct input are **checked for conformity with class A tolerance** according to norm IEC751 - BS1904 - DIN43760.
The probes with SICRAM module are detected by the instrument; the model configuration is required for the other probes (please see the description of the Probe Type menu item on page 12).

The °C or °F unit of measurement can be chosen for display, printing, and logging using the °C/°F-ESC key.

How to measure

The temperature measurement by **immersion** is carried out by inserting the probe in the liquid for at least 60mm; the sensor is housed in the end part of the probe.

In the temperature measurement by **penetration** the probe tip must be inserted to a depth of at least 60mm, the sensor is housed in the end part of the probe. When measuring the temperature on frozen blocks it is convenient to use a mechanical tool to bore a cavity in which to insert the tip probe.

In order to perform a correct **contact** measurement, the measurement surface must be even and smooth, and the probe must be perpendicular to the measurement plane.
So as to obtain the correct measurement, the insertion of a drop of oil or heat-conductive paste is useful (do not use water or solvents). This method also improves the response time.

Instructions to connect the TP47 connector for 4-wire Pt100, Pt1000 and Ni1000 probes

All Delta Ohm probes are provided with a connector. The HD2105.1 and HD2105.2 instruments also work with direct 4-wire Pt100, Pt1000 and Ni1000 probes manufactured by other producers: for the instrument connection is prescribed the TP47 connector to which the probe's wires should be welded.
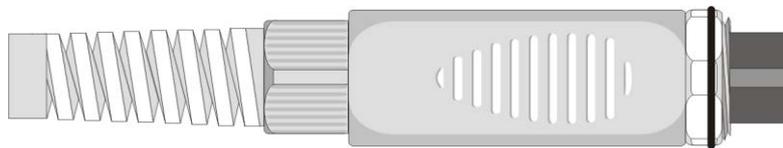
The instructions to connect the Platinum or Nickel probe to the TP47 module are provided below.
The module is supplied complete with fairlead and gasket for 5mm maximum diameter cables.

Do the following to open the module and connect a probe:
unscrew the fairlead and extract the gasket, remove the label using a cutter, unscrew the ring on the opposite side as illustrated in the figure:
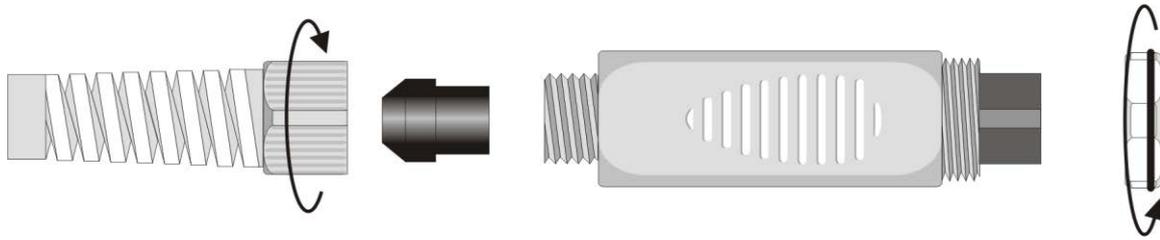
Open the two module shells: the printed circuit to which the probe must be connected is housed inside. On the left there are the 1…4 points on which the sensor wires must be welded. The JP1…JP4 jumpers are in the center of the board. These must be closed with a tin bead for some type of sensors:
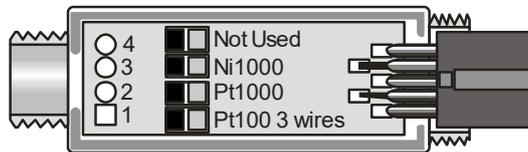
Before welding, pass the probe cable through the fairlead and gasket.
Weld the wires as shown in the table:

Sensor	TP47 card connection	Jumper to close
Pt100 4 wires		None
Pt1000 2 wires		JP2
Ni1000		JP3

Ensure the welds are clean and perfect. Once the welding operation is complete, close the two shells, insert the gasket in the module, and screw the fairlead. At the other end of the module, enter the ring with the O-Ring as indicated in the picture.
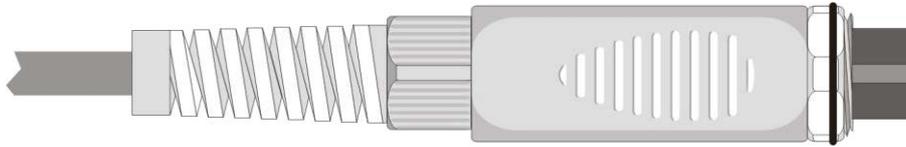
Make sure the cable is not twisted while you are screwing the fairlead. Now the probe is ready.

Direct connection of 4-wire Pt100 sensors

Sensor	Direct soldering to the connector
Pt100 4 wires	4 wire Pt100 View of the soldering side of the free female connector

4-wire Pt100 sensors can be soldered directly to the pins of the free female connector without making use of the TP47 board. The 4 wires of the Pt100 sensors have to be soldered as indicated in the figure on the left.

In order to use this type of probe it is necessary to set up the menu item "Probe Type" as described at page 12.

The P100 probe is recognized upon turning on the instrument: connect the probe when the instrument is switched off and then turn it on.

WARNINGS AND OPERATING INSTRUCTIONS

1. Do not expose the probes to gases or liquids that could corrode the material of the sensor or the probe itself. Clean the probe carefully after each measurement.

2. Do not bend the probe connectors or force them upward or downward.

3. Do not bend or force the contacts when inserting the probe connector into the instrument.

4. Do not bend, deform or drop the probes, as this could cause irreparable damage.

5. Always select the most suitable probe for your application.

6. Do not use probes in presence of corrosive gases or liquids. The sensor container is made of AISI 316 stainless steel, while the contact probe container is made from AISI 316 stainless steel plus silver. Avoid contact between the probe surface and any sticky surface or substance that could corrode or damage it.

7. Above 400°C and below –40°C, avoid violent blows or thermal shocks to Platinum temperature probes as this could cause irreparable damage.

8. To obtain reliable measurements, temperature variations that are too rapid must be avoided.

9. Temperature probes for surface measurements (contact probes) must be held perpendicular against the surface. Apply oil or heat-conductive paste between the surface and the probe in order to improve contact and reduce reading time. Whatever you do, do not use water or solvent for this purpose. A contact measurement is always very hard to perform. It has high levels of uncertainty and depends on the ability of the operator.

10. Temperature measurements on non-metal surfaces usually require a great deal of time due to the low heat conductivity of non-metal materials.

11. Probes are not insulated from their external casing; be very careful not to come into contact with
⚠ live parts (above 48V). This could be extremely dangerous for the instrument as well as for the operator, who could be electrocuted.

12. Avoid taking measurements in presence of high frequency sources, microwave ovens or large magnetic fields; results may not be very reliable.

13. Clean the probe carefully after use.

14. The instrument is water resistant and IP66, but is not watertight and therefore should not be immersed in water without closing the free connectors using caps. The probe connectors must be fitted with sealing gaskets. Should the instrument fall into the water, check for any water infiltration. Gently handle the instrument in such a way as to prevent any water infiltration from the connectors' side.

NOTES ON THE USE OF THE pH ELECTRODES

The average life of a pH electrode is about 1 year, depending on the use and maintenance.

The electrodes used at high temperatures or in strong alkaline environments normally have a shorter life.

The new electrodes should be conditioned for half a day immersed in a 6.86pH or 4pH buffer.

Calibrate the electrode using buffer solutions close to the values to be measured. A new electrode should always be calibrated at neutral pH (6.86pH) as first point, and at least in a second point.

Following are listed some problems that frequently occur and the possible solutions.

Wrong pH measure. Perform the following checks:

Check the diaphragm is not blocked and if necessary clean it using HD62PT solution.

Check the reference system is not polluted and, if the electrode is refillable, replace the electrolyte.

Check that the tip of the electrode has no air bubbles inside and that the electrode is sufficiently immersed.

Even residues of dirt deposited on the membrane can alter the measure: use the solution for protein cleaning **HD62PP**.

Slow response and wrong measures. A possible cause can be the aging or the erosion of the membrane, or a short-circuit in the connector.

Storage. Store the electrode immersed in the solution **HD62SC**.

INSTRUMENT SIGNALS AND FAULTS

The following table lists all error indications and information displayed by the instrument and supplied to the user in different operating situations:

Display indications	Explanation
ERR	This message appears if the pH measurement exceeds the -2.000pH…19.999pH limits, if the mV measurement exceeds the ±2.4V limits, if the temperature probe, already detected by the instrument, is disconnected. At the same time an intermittent beep is issued.
PROB COMM LOST	This appears if the probe, has already been detected by the instrument, but is disconnected. At the same time an intermittent beep is issued.
OVER	Measurement overflow: this appears when the probe measures a value exceeding the measurement range or the mV measurement is included in the +2.0…+2.4V range.
UNDR	Measurement overflow: this appears when the mV measurement is included in the -2.4…-2.0V range.
LOG MEM FULL	Memory full; the instrument cannot store further data, the memory space is exhausted.
NEW PROBE DET	This message appears when a probe is inserted into a functioning instrument. Turn the instrument off and then back on again.
PROB ERR	A probe with SICRAM module has been inserted when not admissible for that specific instrument.
SYS ERR #	Instrument management program error. Contact the instrument's supplier and communicate the numeric code # reported by the display.
CAL LOST	Program error: it appears after turning on for a few seconds. Contact the instrument's supplier.
CAL blinking	Calibration not completed correctly.
BATT TOO LOW CHNG NOW	Indication of insufficient battery charge appearing on turning on. The instrument issues a long beep and turns off. Replace the batteries.

The following table reports the indications provided by the instrument as they appear on the display, together with their description.

Display indications	Explanation
>>>_LOG_DUMP_or_ERAS	transfer or erase data
>>>_PRBE_TYPE	type of probe connected
AUTO-HOLD	automatic function holding the displayed measurement
BATT TOO LOW - CHNG NOW	battery discharged - replace it immediately
BAUDRATE >>>	baud rate value
BUFR_1	first buffer value
BUFR_2	second buffer value
BUFR_3	third buffer value
CAL ERR	calibration error
COMM STOP	printing complete
COMM STRT	printing started
DAY_	day
DUMP_END	data transfer complete
DUMP_In_PROG >>>	data transfer in progress
FUNC CLR	max, min and average values clearing
FUNC CLRD	max, min and average values cleared
HOUR	hour
LAST CAL m/d h/m	last calibration date month/day hour/minutes
LOG In PROG	logging in progress
LOG MEM FULL	memory full
LOG_CLRD	memory data cleared
LOG_STOP	logging complete
LOG_STRT	logging started
MIN >>> USE_UNIT_TO_ZERO SEC	minutes >>> use the UNIT key to reset the seconds
MNTH	month
NEW_PROB_DET	new probe detected
NIL	disable current buffer
OFFS	offset
OVER	maximum limit exceeded
pH RES	pH measurement resolution
PLS_EXIT >>> FUNC RES_FOR_FACT ONLY	please exit using ESC >>> function reserved to factory calibration
PRBE_SER #### ####	serial number #### #### of the connected probe
PRNT AND LOG INTV	printing and logging intervals
PRNT INTV >>>	printing interval
PROB COMM LOST	lost communication with probe
PROB ERR	error - unexpected probe
RCD MODE	record function operating mode (max, min, avg)
SET USER BUFR	user define buffer value
SLP_MODE_LOG	turning off during recording mode
SLPE%	gain %
SMPL ID REL=RSET SER=PRINT	identifier of the sample - REL=reset - SERIAL=print heading
SYS ERR #	program error number #
UNDR	minimum limit exceeded
YEAR	year

LOW BATTERY WARNING AND BATTERY REPLACEMENT

The battery symbol
on the display constantly shows the battery charge status. To the extent that batteries have discharged, the symbol "empties". When the charge decreases still further it starts blinking…

In this case, batteries should be replaced as soon as possible.
If you continue to use it, the instrument can no longer ensure correct measurement. The memory data are maintained.
If the battery charge level is insufficient, the following message appears when you turn the instrument on:

<center>

BATT TOO LOW
CHNG NOW

</center>

The instrument issues a long beep and turns off. In this case, replace the batteries in order to turn the instrument back on.

In order to avoid data loss, the logging session is ended, if the HD2105.2 is logging and battery voltage falls below the minimum operating level.

The battery symbol turns off when the external power supply is connected.

To replace the batteries, switch the instrument off and unscrew the battery cover counter clockwise. After replacing the batteries (4 1.5V alkaline batteries - type AA) screw the cover on clockwise.

After replacing the batteries, the date, time, baud rate, type of probe, printing interval, logging parameters **must be set again**: **in order to simplify the operation, on insertion of the new batteries the instrument turns on automatically and requests these parameters in sequence**. To go to the next item press ENTER; to return to measurement mode, press MENU.

MALFUNCTIONING UPON TURNING ON AFTER BATTERY REPLACEMENT

After replacing the batteries, the instrument may not restart correctly; in this case, repeat the operation. After disconnecting the batteries, wait a few minutes in order to allow circuit condensers to discharge completely; then reinsert the batteries.

WARNING ABOUT BATTERY USE

- Batteries should be removed when the instrument is not used for an extended time.
- Flat batteries must be replaced immediately.
- Avoid batteries leaking.
- Always use good quality leakproof alkaline batteries. Sometimes on the market, it is possible to find new batteries with an insufficient charge capacity.

INSTRUMENT STORAGE

Instrument storage conditions:
- Temperature: -25…+65°C.
- Humidity: less than 90%RH without condensation.
- Do not store the instrument in places where:
    Humidity is high.
    The instrument may be exposed to direct sunlight.
    The instrument may be exposed to a source of high temperature.
    The instrument may be exposed to strong vibrations.
    The instrument may be exposed to steam, salt or any corrosive gas.

The instrument case is made of ABS plastic and the protections are rubber: do not use any incompatible solvent for cleaning.

SERIAL INTERFACE AND USB

The HD2105.1 and HD2105.2 instruments are fitted with an electrically isolated RS-232C serial interface; the HD2105.2 also has an USB 2.0 interface.
The following serial cables can be used:

- **HD2110CSNM**: serial connection cable with 8-pole MiniDin connector on one end and 9-pole Sub D connector on the other end;

- **C.206**: serial connection cable with 8-pole MiniDin connector on one end and USB type A connector on the other end. With integrated RS232/USB converter;

- **CP23**: connection cable with Mini-USB type B connector on one end and USB type A connector on the other end (only for HD2105.2).

The connection via the C.206 cable requires the previous installation of the cable USB drivers. Install the drivers **before connecting the C.206 cable to the PC**.
The connection via the CP23 cable does not require the installation of USB drivers: when connecting the instrument to the PC, the Windows® operating system automatically recognizes the device as an HID device (Human Interface Device) and uses the drivers already included in the operating system.

Cable	Instrument port	PC port	Installation of USB drivers
HD2110CSNM	RS232 (MiniDin)	RS232 (9-pole SubD)	No
C.206	RS232 (MiniDin)	USB	Yes
CP23	USB (Mini-USB)	USB	No

The instrument standard serial transmission parameters are:
- Baud rate   38400 baud
- Parity   None
- N. bit   8
- Stop bit   1
- Protocol   Xon/Xoff

It is possible to change the RS232C serial port baud rate by setting the "*Baudrate*" parameter in the menu (please see page 13). The possible values are: 38400, 19200, 9600, 4800, 2400, 1200. The other transmission parameters are fixed.
The USB 2.0 connection does not require the setting of parameters.

The instruments are provided with a complete set of commands and data queries to be sent via the PC. The serial commands work with a standard serial communication program (e.g. Hyperterminal) only through the RS232 serial port of the instrument, using the cable HD2110CSNM or the cable C.206.

All the commands transferred to the instrument must have the following structure:
XYcr where: **XY** is the command code and **cr** is the Carriage Return (ASCII 0D)

Command	Response	Description
P0	&	Ping (locks the instrument keyboard for 70 seconds)
P1	&	Unlocks the instrument keyboard
S0	AT 21.3 6.778	Captured measurements (24 characters) AT = automatic temperature compensation, temperature, pH or mV.
G0	Model HD2105 -2	Instrument model

Command	Response	Description
G1	M=pH / Thermometer	Model description
G2	SN=12345678	Instrument serial number
G3	Firm.Ver.=01-01	Firmware version
G4	Firm.Date=2004/06/15	Firmware date
G5	cal 0000/00/00 00:00:00	Calibration date and time
G6	Probe=Sicram Pt100	Type of probe connected to input
G7	Probe SN=11119999	Probe serial number
G8	Probe cal.=2004/01/12	Probe calibration date
GB	User ID=0000000000000000	User code (set with T2xxxxxxxxxxxxxxxx)
GC		Print instrument's heading
K1	PRINTOUT IMMEDIATE MODE	Immediate printing of data
K0		Stop printing data
K4	&	Start logging data
K5	&	Stop logging data
K7	&	Enable REL function
K6	&	Disable REL function
KP	&	Auto-power-off function=ENABLE
KQ	&	Auto-power-off function=DISABLE
LN	&1999	Number of free pages in the flash memory
LD	PRINTOUT OF LOG	Print data logged in flash
LE	&	Erase data in flash memory
LUAn	&	Sets the unit of measurement for the temperature. n=0 > °C n=1 > °F
LUBn	&	Sets the unit of measurement for the pH. n=0 > pH n=1 > mV
RA	& #	Reading of LOG/PRINT interval set
RP	& 600	Battery level (Resolut. 0.01V)
RUA	U= °C	Channel A unit of measurement
RUB	U= pH	Channel B unit of measurement
WA#	&	Setting LOG/PRINT interval. # is a hexadecimal number 0…D that represents the position of the interval in the list 0, 1, 5, 10, …, 3600 seconds.
WC0	&	Setting SELF off
WC1	&	Setting SELF on

Command characters are exclusively upper case characters. Once a correct command is entered, the instrument responds with "&"; when any wrong combination of characters is entered, the instrument responds with "?". The instrument response strings end with the sending of the CR command (Carriage Return). The instrument does not send the LF command (Line Feed).

Before sending commands to the instrument via the serial port, locking the keyboard to avoid functioning conflicts is recommended: use the P0 command. When complete, restore the keyboard with the P1 command.

STORING AND TRANSFERRING DATA TO A PERSONAL COMPUTER

The HD2105.1 and HD2105.2 instruments can be connected to a personal computer via an RS232C serial port or USB 2.0 port, and exchange data and information through the DeltaLog9 software running in a Windows operating environment. Both models can send in real time input measured values directly to a PC, through the PRINT function; the HD2105.2 can also store the values measured by using the *Logging* function (LOG key) in its internal memory. If necessary, the data stored in the memory can be transferred to a PC later.

THE *LOGGING* FUNCTION - ONLY FOR HD2105.2

The *Logging* function allows the recording up to 40000 data pair [T-pH] registered by the probe connected to the inputs. Logging always includes **two** parameters. Each data pair is composed of: [temperature in °C or °F], [pH or mV]. The time interval between two consecutive measurements can be set from 1 second to 1 hour. The logging starts by pressing the LOG key and ends by pressing the same key again: the data memorized in this way form a continuous block of data. The logged parameters are selected using the "°C/°F" and "pH/mV-ESC" keys.

See the description of the menu items on page 10.

If the automatic turning off option between two recordings (MENU >> **Sleep_Mode_LOG)** is enabled, upon pressing the LOG key the instrument logs the first data and turns off. 15 seconds before the next logging instant, it turns on again to capture the new sample, and then turns off.

The data stored in the memory can be transferred to a PC using the DUMP LOG command: MENU >> LOG. During data transfer the display shows the message DUMP; to stop the data transfer press ESC on the instrument or on the PC.

CLEARING THE MEMORY - ONLY FOR HD2105.2

To clear the memory, use the Erase Log function (MENU >> SERIAL).
The instrument starts clearing the internal memory; at the end of the operation, it goes back to normal display.

NOTES:
* Data transfer does not cause the memory to be erased; the operation can be repeated as many times as required.
* The stored data remain in the memory independently of battery charge conditions.
* In order to print the data to a parallel interface printer, you must use a parallel-serial adaptor (not supplied).
* **The direct connection between instrument and printer via a USB connector does not work.**
* Some keys are disabled during logging. The following keys work: ON/OFF, FUNC (Max-Min-Avg) and SERIAL.
* The recording started with the display in Max-Min-Avg mode proceeds normally with the actual measured values. Only the display shows respectively the Max, Min or Avg values.
* The logging is disabled, if the Auto-HOLD function is enabled.
* If the logging is started when the display is in REL mode, the relative values are logged.
* It is possible to activate both the logging (LOG) and direct transfer (PRINT) functions at the same time.

The PRINT function sends the measurements taken in real time by the instrument inputs directly to a PC or a printer. Print data units of measurements are the same as those used on the display. Printing always includes **two** parameters. Each pairs data is composed of: temperature in °C or °F, pH or mV. The printed parameters are selected using the "°C/°F", and "pH/mV" keys.

The function is started by pressing SERIAL. The time interval between two consecutive prints can be set from 1 second to 1 hour (please see the **Print and log interval** menu item on page 10). If the print interval is equal to 0, by pressing SERIAL the single data is sent to the connected device. If the print interval is higher than 0, the data transfer continues until the operator stops it by pressing SERIAL again.

The PRINT function works with a standard serial communication program (e.g. Hyperterminal) only through the RS232 serial port of the instrument, using the cable HD2110CSNM or the cable C.206.

Connect the HD40.1 printer using cable HD2110CSNM.

NOTES:
- The print out is formatted across 24 columns.
- Some keys are disabled during serial transmission. The following keys work: ON/OFF, FUNC (Max-Min-Avg) and LOG.
- The FUNC key has no effect on the print-outs, only on the display.
- If the Auto-Hold function is enabled, the print time interval is forced to zero: pressing SERIAL only causes the print to occur when the measurement has stabilized (HOLD symbol still). Later, it is possible to repeat the print at will, but while the HOLD mode is on, the sample identifier number is not increased. This is useful when more labels must be printed with the same identification code without increasing the code each time.
- If the serial transfer is started when the display is in REL mode, the relative values are transferred.
- It is possible to activate both the logging (LOG) and direct transfer (PRINT) functions at the same time.

Examples of print-outs obtained using the **HD40.1** *printer*

CONNECTION TO A PC

HD2105.1

Connection to the PC with the cable:

- **HD2110CSNM**: 8-pole MiniDin connector on one end and 9-pole Sub D connector on the other end;

- **C.206**: 8-pole MiniDin connector on one end and USB type A connector on the other end. With integrated RS232/USB converter (requires the installation of the USB drivers).

HD2105.2

Connection to the PC with the cable:

- **CP23**: Mini-USB type B connector on one end and USB type A connector on the other end;

- **HD2110CSNM**: 8-pole MiniDin connector on one end and 9-pole Sub D connector on the other end;

- **C.206**: 8-pole MiniDin connector on one end and USB type A connector on the other end. With integrated RS232/USB converter (requires the installation of the USB drivers).

The instruments are supplied with the DeltaLog9 software that manages the connection, data transfer, graphic presentation, and printing operations of the captured or logged measurements. **The DeltaLog9 software is complete with "On-line Help" (also in PDF format) describing its characteristics and functions.**

CONNECTION TO THE RS232C SERIAL PORT OF THE INSTRUMENT

1. The measurement instrument must be switched off.
2. Using the Delta Ohm HD2110CSNM or C.206 cable, connect the measurement instrument to the first free RS232C (COM) or USB serial port of the PC.
3. Turn on the instrument and set the baud rate to 38400 (MENU >> ENTER until the Baud Rate parameter >> select 38400 using the arrows >> confirm with ENTER). The parameter remains in the memory until replacement of the batteries.
4. Start the DeltaLog9 application and press CONNECT. Wait for the connection to occur and follow the indications on the screen. For a description of the DeltaLog9 application, please refer to its on-line Help.

CONNECTION TO THE USB 2.0 PORT OF THE INSTRUMENT - ONLY FOR HD2105.2

The connection via the CP23 cable does not require the installation of USB drivers: when connecting the instrument to the PC, the Windows® operating system automatically recognizes the device as an HID device (Human Interface Device) and uses the drivers already included in the operating system.

To check if the connection has been successfully completed, double-click on "*Device Manager*" from the Control Panel. The following items should appear:

"*Human Interface Device*" >> "*HID-compliant device*"

"*Human Interface Device*" >> "*USB Human Interface Device*"

When the USB cable is disconnected, the items disappear and reappear when it is connected again.

NOTES ABOUT WORKING AND OPERATIVE SAFETY

Authorized use

The technical specifications as given in chapter "TECHNICAL CHARACTERISTICS" must be observed. Only the operation and running of the measuring instrument according to the instructions given in this operating manual is authorized. Any other use is considered unauthorized.

General safety instructions

This measuring system is constructed and tested in compliance with the EN 61010-1:2010 safety regulations for electronic measuring instruments. It left the factory in a safe and secure technical condition.
The smooth functioning and operational safety of the measuring system can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed during operation.
The smooth functioning and operational safety of the instrument can only be guaranteed under the environmental and electrical operating conditions that are in specified in chapter "TECHNICAL CHARACTERISTICS".

Do not use or store the product in places such as listed below:
- Rapid changes in ambient temperature which may cause condensation.
- Corrosive or inflammable gases.
- Direct vibration or shock to the instrument.
- Excessive induction noise, static electricity, magnetic fields or noise.

If the measuring system was transported from a cold environment to a warm environment, the formation of condensate can impair the functioning of the measuring system. In this event, wait until the temperature of the measuring system reaches room temperature before putting the measuring system back into operation.

Obligations of the purchaser

The purchaser of this measuring system must ensure that the following laws and guidelines are observed when using dangerous substances:
- EEC directives for protective labour legislation
- National protective labour legislation
- Safety regulations

INSTRUMENT TECHNICAL CHARACTERISTICS

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols
	Visible area: 52x42mm

Operating conditions

Operating temperature	-5…50°C
Warehouse temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP66**

Power Supply

Batteries	4 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20μA
Mains (cod. **SWD10**)	Output mains adapter 100-240Vac/12Vdc-1A

Units of measurement	pH, mV, °C, °F
Security of memorized data	Unlimited, independent of battery charge conditions

Time

Date and time	Schedule in real time
Accuracy	1min/month max drift

*Measured values storage - model **HD2105.2***

Type	2000 pages containing 17 samples each
Quantity	34000 pairs of measurements composed of [pH or mV] and [°C o °F].
Selectable storage interval	1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Selectable print interval	immediate or 1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour

*USB interface - model **HD2105.2***

    Type   1.1 - 2.0 electrically isolated

Connections

Input module for the temperature probes	8-pole male DIN45326 connector
pH/mV input	Female BNC
RS232 serial interface	8-pole MiniDin connector
USB interface (only **HD2105.2**)	Mini-USB type B connector
Mains adapter (cod. **SWD10**)	2-pole connector (positive at centre)

Measurement of pH by instrument

Measurement range	-2.000…+19.999pH
Resolution	0.01 or 0.001pH selectable from menu
Accuracy	±0.001pH ±1digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset| > 20mV
	Slope > 63mV/pH or Slope < 50mV/pH
	Sensitivity > 106.5% or Sensitivity < 85%
Automatic/manual temperature compensation	-50…+150°C

Standard solutions automatically detected (@25°C)

                                       1.679pH - 2.000pH - 4.000pH - 4.008pH - 4.010pH - 6.860pH - 6.865pH - 7.000pH - 7.413pH - 7.648pH - 9.180pH - 9.210pH - 10.010pH

Measurement of mV by instrument

Measurement range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

Measurement of temperature by instrument

Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Ni1000 measurement range	-50…+250°C
Resolution	0.1°C
Accuracy	±0.1°C ±1digit
Drift after 1 year	0.1°C/year

TECHNICAL DATA OF PROBES

pH ELECTRODES

ORDER CODE	MEASURING RANGE AND USE	DIMENSIONS
KP30	0…14pH / 0…80°C / 2bar Glass body - GEL filled 1 ceramic diaphragm Cable L=1m with BNC Waste water , Drinking water, Water emulsions, Galvanic, Paints, Varnish, Water suspensions, Fruit-juices Titration.	

4-WIRE Pt100 AND 2-WIRE Pt1000 PROBES

Model	Type	Application range	Accuracy
TP47.100.O	Pt100 4 wires	-50…+250°C	Class A
TP47.1000.O	Pt1000 2 wires	-50…+250°C	Class A
TP87.100.O	Pt100 4 wires	-50…+200°C	Class A
TP87.1000.O	Pt1000 2 wires	-50…+200°C	Class A

Common characteristics

Resolution   **0.01°C nel campo ±199.99°C,**

     0.1°C altrove

Temperature drift @ 20°C
Pt100   0.003%/°C
Pt1000   0.005%/°C

TEMPERATURE PROBES Pt100 SENSOR USING SICRAM MODULE

Model	Type	Application Range	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.1°C (@ 0 °C) ±0.2°C (-50 °C ≤ t ≤ 250 °C) ±0.3°C (t < -50 °C; t > 250 °C)
TP472I.O	Immersion	-50°C…+300°C	
TP473P.I	Penetration	-50°C…+400°C	
TP473P.O	Penetration	-50°C…+300°C	
TP474C.O	Contact	-50°C…+300°C	
TP475A.O	Air	-50°C…+250°C	
TP472I.5	Penetration	-50°C…+400°C	
TP472I.10	Penetration	-50°C…+400°C	
TP49A.I	Immersion	-70°C…+250°C	
TP49AC.I	Contact	-70°C…+250°C	
TP49AP.I	Penetration	-70°C…+250°C	
TP87.O	Immersion	-50°C…+200°C	

Common characteristics

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

ORDER CODES

HD2105.1 Kit including: instrument HD2105.1, 4 x 1.5V alkaline batteries, operating manual, case and DeltaLog9 software downloadable from Delta OHM website.

HD2105.2 Kit including: instrument HD2105.2 **data logger**, 4 x 1.5V alkaline batteries, CP23 USB cable, operating manual, case and DeltaLog9 software downloadable from Delta OHM website.

pH/mV electrodes, temperature probes, standard reference solutions and cables have to be ordered separately.

HD2110CSNM Connection cable 8-pole MiniDin – Sub D 9-pole female for RS232C.

C.206 Connection cable 8-pole MiniDin – USB type A. With integrated RS232/USB converter.

SWD10 Stabilized power supply at 100-240Vac/12Vdc-1A mains voltage.

HD40.1 The kit includes: 24-column portable thermal printer, serial interface, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

BAT.40 Spare battery pack for HD40.1 printer with in-built temperature sensor.

RCT The kit includes 4 thermal paper rolls 57mm wide and 32mm in diameter.

HD22.2 Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. For $\varnothing$12mm electrodes.

HD22.3 Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.

pH ELECTRODES

KP30 Combined pH electrode for common use, GEL filled, cable 1m with BNC, Epoxy body

CP Extension cable 1.5m with BNC connector on one side and S7 on the other side, for electrode without cable with S7 connector.

BNC Female BNC for electrode extension.

pH STANDARD SOLUTIONS

HD8600C ACCREDIA ISO 17025 certified buffer solutions kit: pH 4.01+ pH 7.00 + pH 10.01. Two 50 ml bottles for each type (6 bottles in total).

HD8642 Standard solution 4.01pH - 200cc.

HD8672 Standard solution 6.86pH - 200cc.

HD8692 Standard solution 9.18pH - 200cc.

REDOX STANDARD SOLUTIONS

HDR220   Redox standard solution 220mV 0,5 l.

HDR468   Redox standard solution 468mV 0,5 l

ELECTROLYTE SOLUTIONS

KCL 3M   100ml ready for use solution for refilling of the electrodes KP63, KP64, and KP90.

CLEANING AND MAINTENANCE

HD62PT   Diaphragm cleaning (tiourea in HCl) – 500ml.

HD62PP   Protein cleaning (pepsin in HCl) – 500ml.

HD62RF   Regeneration (fluorhydric acid) – 100ml.

HD62SC   Solution for electrode preservation – 200ml.

TEMPERATURE PROBES COMPLETE WITH SICRAM MODULE

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

TP472I.O   Immersion probe, sensor Pt100. Stem Ø 3 mm, length 230 mm. Cable length 2 metres.

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

TP473P.O   Penetration probe, sensor Pt100. Stem Ø 4mm, length 150 mm. Cable length 2 metres.

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

TP475A.O   Air probe, sensor Pt100. Stem Ø 4 mm, length 230 mm. Cable length 2 metres.

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

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

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

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

TP49AP.I   Penetration probe, sensor Pt100. Stem Ø 2.7 mm, length 150 mm. Cable length 2 metres. Aluminium handle.

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

TEMPERATURE PROBES WITHOUT SICRAM MODULE

TP47.100.O   Immersion probe, sensor Pt100 direct 4 wires. Probe's stem Ø 3mm, length 230mm. 4-wire connection cable with connector, length 2 metres.

TP47.1000.O   Immersion probe, sensor Pt1000. Probe's stem Ø 3mm, length 230mm. 2-wire connection cable with connector, length 2 metres.

TP87.100.O   Immersion probe, sensor Pt100 direct 4 wires. Probe's stem Ø 3mm, length 70mm. 4-wire connection cable with connector, length 1 metre.

TP87.1000.O   Immersion probe, sensor Pt1000. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 metre.

TP47   Only connector for probe connection: Pt100 direct 4 wires, Pt1000 and Ni1000 2 wires.

DELTA OHM metrology laboratories LAT N° 124 are accredited by ACCREDIA for Temperature, Humidity, Pressure, Photometry / Radiometry, Acoustics and Air Velocity. They can supply calibration certificates for the accredited quantities.

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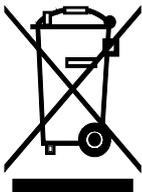
Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection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