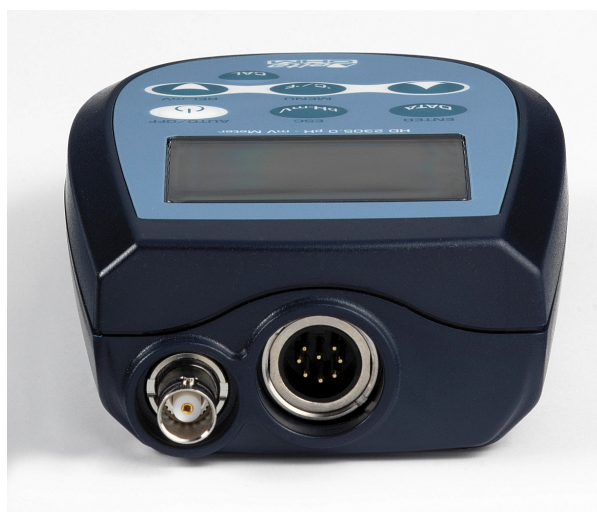


HD2305.0

Our instruments' quality level is the results of the product continuous development. This can bring about differences between the information written in this manual and the instrument that you have purchased. We cannot entirely exclude errors in the manual, for which we apologize.

The data, figures and descriptions contained in this manual cannot be legally asserted. We reserve the right to make changes and corrections without prior notice.

pH meter - Thermometer HD2305.0



HD2305.0

1. 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.
2. pH/mV input, female BNC
3. Battery symbol: displays the battery charge level.
4. Function indicators.
5. Secondary display line.
6. **DATA/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. In calibration mode, acquires the nominal buffer value.
7. **pH-mV/ESC** key: during normal operation switches the display between pH and mV; in the menu, resets the value set with the arrows. In calibration mode, allows you to exit calibration.
8. **▲** key: in the menu, increases the current value. In calibration mode, increases the displayed nominal buffer value.
9. **°C/°F/MENU** key: it allows selection of the unit of measurement; when pressed together with the DATA key, it allows to open the menu.
10. **CAL**: starts the calibration procedure.
11. **▼/REL-mV** key: during normal operation enables the relative measurement (displays the difference between the current value and the logged value when the key is pressed); press the key again to return to the normal measurement. It works only if you are displaying the **mV**. In the menu, decreases the current value. In calibration mode, decreases the displayed nominal buffer value.
12. **ON-OFF/AUTO-OFF** key: turns the instrument on and off; when pressed together with the °C/°F/MENU key, disables the *AutoPowerOff* function.
13. **MAX** (maximum value), **MIN** (minimum value) and **AVG** (average value) symbols.
14. Main display line.
15. Line for symbols and comments.

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1. GENERAL CHARACTERISTICS

The pH meter - Thermometer Model HD2305.0 is a portable instrument that allows measurement of **pH** and **redox potential (ORP)** in **mV**.

It also measures the temperature using Pt100 or Pt1000 immersion, penetration or contact probes.

The electrode calibration can be carried out on one, two or three points at 4.01pH, 6.86pH and 9.18pH.

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

The units of measurement for the measurable quantities are:

- pH
- mV
- °C
- °F

Using the Max, Min and Avg function of this instrument respectively obtains the maximum, minimum or average values.

Other available functions are:

- the relative measurement REL;
- the automatic turning off which can also be disabled.

For further details see chapter 2.

2. DESCRIPTION OF THE FUNCTIONS

The keyboard of the pH meter Model HD2305.0 is composed of *double-function* keys. The function on the key is the "main function", while the one above the key is the "secondary function".

When the instrument is in standard measurement mode, the main function is active.

Once the Settings Menu has been opened, by pressing simultaneously the **DATA+°C/°F** keys, 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.

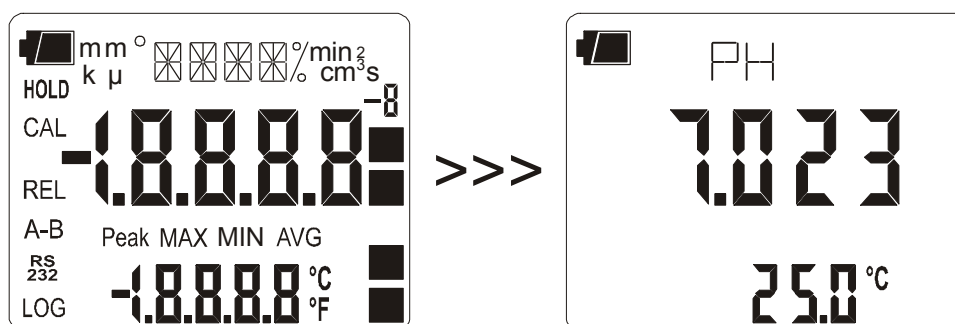


ON-OFF and AUTO-OFF key

This key has two functions:

- **ON/OFF:** to turn the instrument on press **ON**, to turn it off press **OFF**.

The turning on enables all display segments for a few seconds, starts an **Auto-test** including the detection of the probe connected to the input, and sets the instrument ready for normal measurement. The following is displayed:



- **AUTO/OFF:** the *AutoPowerOff* function can be disabled by simultaneously pressing this key and the "°C/°F-MENU" key when turning the instrument on.

During turning on, should no probes be connected, the "**NO_PRBE_SER_NUM**" message is displayed in the line for symbols for a few seconds, while the "**ERR**" message is shown in the central part of the display, and the last manually-set **temperature** appears in the secondary line. 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, while the "**ERR**" message is shown in the central part of the display, and a sequence of "beeps" is simultaneously issued. As the data are captured upon turning the instrument on, it is necessary to turn it off and on again.

Caution! Replace the probes when the instrument is off.



pH-mV/ESC key

The "pH-mV" key has three functions:

- **pH-mV:** pressing this key once switches the display between pH and mV;
- **ESC:** once the MENU has been opened with the DATA+°C/°F keys, the "pH-mV" key will allow to cancel the parameters set using the ▲ and ▼ arrows.
- In **calibration** mode, it allows to exit calibration.



DATA/ENTER key

The "DATA" key is used for the following functions:

- **DATA:** during normal measurement, by pressing this key once the maximum (MAX) value of the measurements captured by the probe connected to the instrument is displayed, updating it with the acquisition of new samples;
 - by pressing this key again the minimum (MIN) value is displayed;
 - by pressing this key a third time the average (AVG) value is displayed.

The acquisition frequency is once a second.

The MAX, MIN and AVG values remain in the memory until the instrument is on, even after exiting the DATA display function. When the instrument is off, the previously memorized data are cleared. Upon turning on, the instrument automatically starts memorizing the MAX, MIN and AVG values.

To reset the previous values and start with a new measurement session:

- press DATA until the **FUNC_CLRD** message appears;
- use the ▲ and ▼ arrows to select **YES**;
- confirm by pressing ENTER.
- **ENTER:** once the MENU has been opened with the DATA+°C/°F keys, the **DATA** key will perform the ENTER function and the MENU can be browsed and the displayed parameter confirmed. In calibration mode, acquires the nominal buffer value.



▲ key

Once the MENU has been opened with the **DATA** and °C/°F keys, the ▲ key will allow to increase the value of the selected parameter. In calibration mode, it allows to increase the nominal buffer value.



°C/°F/MENU key

The "°C/°F" key is used for the following functions:

- **°C/°F:** when the temperature probe is connected, 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 ($\blacktriangle$ and $\blacktriangledown$). Confirm using **DATA/ENTER**. The display stops blinking, and the temperature displayed is used for compensation. If the temperature probe is not present, to change the unit of measurement between $^{\circ}\text{C}$ and $^{\circ}\text{F}$, it is necessary to press **twice** the $^{\circ}\text{C}/^{\circ}\text{F}$ key.

- **MENU**: to access to the menu press simultaneously **DATA+ $^{\circ}\text{C}/^{\circ}\text{F}$** : the **Probe Type** will be displayed.
 - use the $\blacktriangle$ and $\blacktriangledown$ arrows (respectively located above the HOLD and REL keys) to **modify** the displayed value;
 - press **DATA/ENTER** to **confirm** the modification and go onto the next item;
 - press **CLR/ESC** to **cancel** the modification;
 - to **exit** the menu, press the $^{\circ}\text{C}/^{\circ}\text{F}$ key again.

For further information see chapter 3.



CAL key

Press this key to start the calibration procedure (see par. 4.2 pH electrode calibration).



$\blacktriangledown$ / REL-mV key

The " **$\blacktriangledown$ / REL-mV**" key is used for the following functions:

- **REL-mV**: it displays the difference between the current value and that measured on pressing the key. The "REL" message is displayed on the left. To return to the normal measurement, press the key again. It only works with **mV**, so to enable the REL function select the "mV" unit of measurement using the "**pH-mV**" key.
- **$\blacktriangledown$** : Once the MENU has been opened with the $^{\circ}\text{C}/^{\circ}\text{F}$ /MENU key, the $\blacktriangledown$ key will allow to decrease the value of the selected parameter. During electrode calibration, it allows to decrease the nominal buffer value.

3. THE PROGRAMMING MENU

To access to the menu press simultaneously the following keys:



The item to be set is:

Probe type: the "**PRBE_TYPE_RTD_**" message is displayed 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

The probes fitted with SICRAM module, and Delta Ohm Pt1000 probes, 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.

The temperature probes direct 4 wire Pt100, and the Pt1000 probes that are not manufactured by Delta OHM, when turned on display the message "NO_PRBE_SER_NUM". In this case the probe type must be entered manually.

Access to the menu by selecting **Probe type** using the DATA and °C/°F keys at the same time:

- use the ▲ and ▼ arrows to **modify** the displayed value;
- press **DATA/ENTER** to **confirm** the modification and go onto the next item;
- press **pH-mV/ESC** to **cancel** the modification;
- to **exit** the menu, press the °C/°F key again.

4. PROBES AND MEASUREMENTS

The instrument works with the following probes:

- electrodes for pH measurement;
- electrodes for redox potential ORP measurement (REDOX);
- specific ion electrodes.

Caution! The pH measurement is influenced by the temperature measurement.

The **temperature** is used for the **automatic compensation** of the Nernst coefficient with the pH electrode.

The measurement can be performed using probes with the following sensor:

- 4 wire Pt100;
- 2 wire Pt1000;

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 instrument to recognize the type of probe connected and to read its calibration information.

The Delta Ohm Pt1000 probes are automatically detected while the direct 4 wire Pt100 temperature probe is not automatically detected by the instrument and must be set up in the **Probe type** menu item (please see the menu description on chapter 3).

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

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.

The probes fitted with SICRAM module are calibrated in the factory; no calibration is required by the user.

4.1 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 7 pH.
- *Offset or Asymmetry Potential*: represents the potential (in mV) generated by an electrode when immersed in a buffer solution at 7 pH. 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 paragraph 4.2 pH electrode calibration).

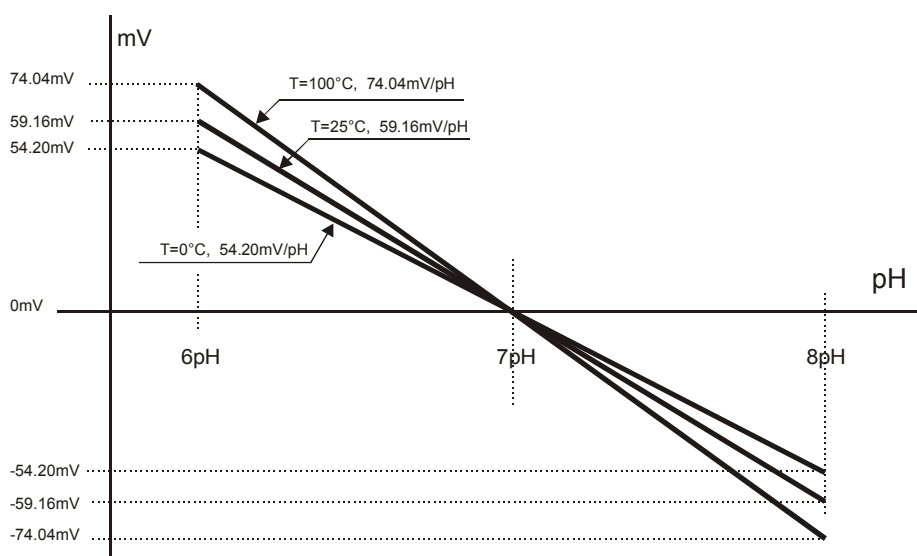
The ORP and specific ion electrodes do not need calibration as their absolute voltage is measured. The ORP (REDOX) buffer solutions are only used to check the quality of an ORP (REDOX) electrode.

User calibration of the temperature sensor is not required: the sensor is calibrated in the factory and the Callendar Van Dusen parameters are recorded in the SICRAM module.

4.1.1 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 function**: automatic temperature compensation. 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 part of the display shows the manually set compensation temperature. By default it is equal to 25°C (see par. 4.1.2 how to manually change the temperature).

To point this condition out, the °C or °F symbol blinks intermittently near the temperature value. Moreover, in the main line an "m" (that is, manual) is turned on near the battery symbol.

4.1.2 How to manually change the temperature

In absence of the temperature probe, it is possible to manually set the temperature. Proceed as follows:

- press the °C/°F key once: the indicated temperature value starts blinking;
- select the solution temperature value by using the arrows;
- confirm by pressing **DATA**: the display stops blinking, and the temperature displayed is used for compensation.

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

4.2 pH ELECTRODE CALIBRATION

The electrode calibration is used to compensate the zero potential and slope departures 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 3 buffers with relevant temperature compensation tables (ATC), one for the acid, one for the neutral, and one for the alkaline band:

@25°C

BUFR_1 (NEUTRAL)	6.860
BUFR_2 (ACID)	4.010
BUFR_3 (ALKALINE)	9.180

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.

4.2.1 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 4.1.1.
- 2) The electrode calibration 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 part of the 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) Press **DATA/ENTER** to proceed with the calibration. 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 **DATA/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)**, 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 one time the **°C/°F key (MENU)**.
- 9) 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.
 - a small square blinking on the lower right: electrode almost exhausted.
 - two 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 DATA/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 parameters:
 - BUFR_1,
 - BUFR_2,
 - BUFR_3.
- 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 exact 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		

- **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 **pH-mV/ESC**, the instrument signals the anomaly through the CAL message blinking.

Temperature characteristics of Delta OHM buffer solutions

The 3 standard buffers 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

4.3 4 WIRE Pt100 AND 2 WIRE Pt1000 TEMPERATURE PROBES

The instrument accepts the input of Platinum temperature probes with resistances of 100Ω (Pt100) and 1000Ω (Pt1000).

The Pt100 are connected to 4 wires, the Pt1000 to 2 wires; the excitation current was chosen in order to minimize 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.

For the temperature probes without SICRAM module (Pt100 4 wires, and Pt1000) the model configuration is required (please see the description of the Probe Type menu, chapter 3).

4.3.1 Temperature measurement

The response time for the measurement of the temperature in **air** is greatly reduced if the air is moving. If the air is still, stir the probe. Please remember that the response times in any case are longer than those for liquid measurements.

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

NOTE: 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 between the surface and the probe is useful (do not use water or solvents). This method also improves the response time.

4.3.2 Connecting the TP47 module for the 4 wire Pt100 and 2 wire Pt1000 probes

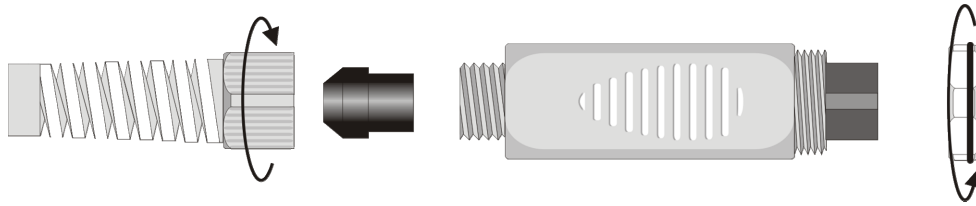
All probes produced by Delta Ohm are provided with a TP47 module.

The HD2305.0 instrument also work with direct 4 wire Pt100, and 2 wire Pt1000 probes manufactured by other producers: for the instrument connection is prescribed the **TP47** connector to which the probe's wires should be welded.

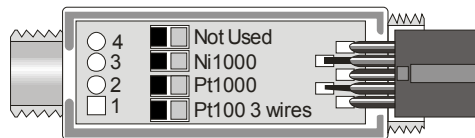


The instructions to connect the Platinum probe to the TP47 module are provided below. The **TP47** module is supplied complete with fairlead and gasket for 5 mm maximum diameter cables. Do the following to open the module and connect a probe:

1. unscrew the fairlead;
2. extract the gasket;
3. remove the label using a cutter;
4. unscrew the ring on the opposite side as illustrated in the figure:



5. 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:



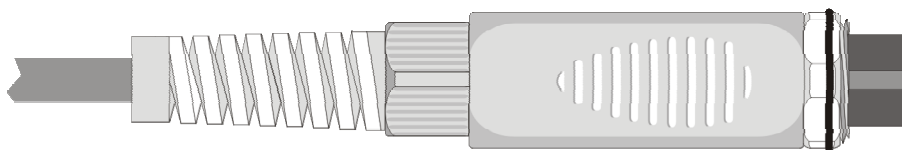
Caution! Before welding, pass the probe cable through the fairlead and gasket.

6. Weld the wires as shown in the table:

Sensor	TP47 board connection	Jumper to close
Pt100 4 wires		None
Pt1000 2 wires		JP2

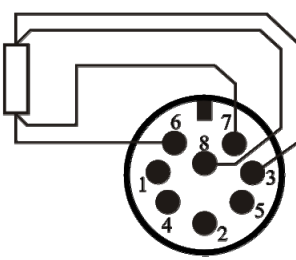
Ensure the welds are clean and perfect.

7. Once the welding operation is complete, close the two shells;
8. insert the gasket in the module;
9. 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.

4.3.3 Direct connection of 4 wire Pt100 sensors to a DIN45326 connector

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

4 wire Pt100 sensors can be soldered directly to the pins of the flying female connector DIN45326 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 9. The P100 probe is recognized upon turning on the instrument: connect the probe when the instrument is switched off and then turn it on. This connector does not guarantee the IP67 protection degree.

5. WARNINGS

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 the temperature 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 product 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 IP67, but should not be immersed in water. 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.

6. 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
>>>_PRBE_TYPE	type of probe connected
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 LOST	Program error: it appears after turning on for a few seconds. Contact the instrument's supplier.
CAL blinking	Calibration not completed correctly.
CAL ERR	calibration error
ERR	This message appears if the pH measurement exceeds the -2.000pH...19.999pH limits, if the mV measurement exceeds the $\pm 2.4V$ limits, if the temperature probe, already detected by the instrument, is disconnected. At the same time an intermittent beep is issued.
FUNC CLRD	max, min and average values cleared
NEW_PROB_DET	new probe detected
OFFS	offset
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.
PLS_EXIT >>> FUNC RES_FOR_FACT ONLY	please exit using ESC >>> function reserved to factory calibration
PRBE_SER #####	serial number ##### of the connected probe
PROB ERR	A probe with SICRAM module has been inserted when not admissible for that specific instrument.
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.
SLPE%	gain %
SYS ERR #	Instrument management program error. Contact the instrument's supplier and communicate the numeric code # reported by the display.
UNDR	Measurement overflow: this appears when the mV measurement is included in the -2.4...-2.0V range.

7. 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: do not use any incompatible solvent for cleaning.

7.1 Notes on pH electrodes use

The average life of a pH electrode is about one year according to the use and maintenance performed.

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

The new electrodes must be conditioned for half a day by immersing them into a buffer at 6.86pH or 4pH.

Calibrate the electrode with solutions closer to the values being measured. A new electrode must always be calibrated at neutral pH (6.86pH) first point and at least a second point.

Some of the most frequent problems and their possible solutions are reported below.

Wrong pH measurement. Carry out the following checks:

Check that the diaphragm is not obstructed and possibly clean it using the HD62PT solution.

Check that the reference system is not contaminated and, in case of a filling type electrode, replace the electrolyte with the **KCL3M** solution.

Check that no air bubbles are present in the electrode tip and that it is sufficiently immersed.

Even dirt residuals deposited on the membrane can alter the measurement: use the **HD62PP** solution for protein cleaning.

Slow response or wrong measurements. Possible causes are aging or erosion of the membrane or a connector short circuiting.

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

8. 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:

**BATT TOO LOW
CHNG NOW**

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

To replace the batteries, proceed as follows:

1. switch the instrument off;
2. unscrew the battery cover counter clockwise;
3. replace the batteries (3 1.5V alkaline batteries - type AA);
4. screw the cover on clockwise.



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.

8.1 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.

9. 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 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 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

10. TECHNICAL CHARACTERISTICS

10.1 TECHNICAL INFORMATION ON THE pH METER – THERMOMETER

Instrument

Dimensions (Length x Width x Height)	140x88x38mm
Weight	160g (complete with batteries)
Material	ABS
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 **IP67**

Power

Batteries	3 x 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	< 20µA

Connections

Input module for the temperature probes	8-pole male DIN45326 connector
pH/mV input	Female BNC

Unit of Measurement

pH - mV
°C - °F;

Measurement of pH by Instrument

Measurement range	-2.00...+19.999pH
Resolution	0.01
Accuracy	±0.01pH ±1digit
Input impedance	>10 ¹² Ω
Calibration error @25°C	Offset > 20mV Slope < 50mV/pH or Slope > 63mV/pH Sensitivity < 85% or Sensitivity > 106.5%
Automatic/manual temperature compensation	-50...+150°C

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
Resolution	0.1°C

Accuracy $\pm 0.1^{\circ}\text{C} \pm 1 \text{ digit}$
 Drift after 1 year $0.1^{\circ}\text{C}/\text{year}$

EMC standard regulations

Security EN61000-4-2, EN61010-1 level 3
 Electrostatic discharge EN61000-4-2 level 3
 Electric fast transients EN61000-4-4 level 3,
 EN61000-4-5 level 3
 Voltage variations EN61000-4-11
 Electromagnetic interference susceptibility IEC1000-4-3
 Electromagnetic interference emission EN55020 class B

10.2 INSTRUMENT PROBES AND MODULES TECHNICAL DATA

10.2.1 pH ELECTRODES

ORDER CODE	MEASURING RANGE AND USE	DIMENSIONS
KP20	0...14pH / 0...80°C / 3bar Glass body - GEL filled 1 ceramic diaphragm Waste water, Drinking water, Water emulsions, Galvanic, Fruit-juices, Water suspensions, Paints, Titration, Varnish.	
KP30	0...14pH / 0...80°C / 3bar 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.	
KP50	0...14pH / -5...100°C / 3bar Glass body - GEL filled 1 Teflon ring diaphragm Varnish, Cosmetics, Water emulsions, Galvanic, Creams, Deionised water, TRIS buffer, Drinking water, Fruit-juices, Solutions of low ionic content, Mayonnaise, Preserved foods, Paints, Titration, Titration in water solutions, Water suspensions, Soap, Waste water, Viscous samples.	

ORDER CODE	MEASURING RANGE AND USE	DIMENSIONS
KP61	2...14pH / 0...80°C / 3bar Glass body Liquid reference 3 ceramic diaphragms Waste water, Mixtures, Bread, Fruit-juices , Varnish, Cosmetics, Creams, Deion- ised water, Drinking water, Water emulsions, Galvanic, Soap, Yoghurt, Milk, Titra- tion, Preserved foods, Titra- tion in water solutions, Wa- ter suspensions, Mayon- naise, Wine, Solutions of low ionic content, Butter, Proteic substances, Paints, Viscous samples.	Diagram of the KP61 probe. It is a long, thin cylindrical device. The total length is indicated as 120. The main body has a diameter of Ø 16. The tip has a diameter of Ø 12. There is a small connector at the base with a label 'S7'.
KP62	0...14pH / 0...80°C / 3bar Glass body- GEL filled 1 ceramic diaphragm Paints, Varnish, Drinking wa- ter, Water emulsions, Fruit- juices , Galvanic, Water sus- pensions, Titration, Waste water.	Diagram of the KP62 probe. It is a long, thin cylindrical device. The total length is indicated as 130. The main body has a diameter of Ø 16. The tip has a diameter of Ø 12. There is a small connector at the base with a label 'S7'.
KP63	0...14pH / 0...80°C / 1bar Glass body Liquid reference KCl 3M 1 ceramic diaphragm Cable L=1m with BNC Paints, Varnish, Drinking wa- ter, Water emulsions, Fruit- juices , Galvanic, Water sus- pensions, Titration, Waste water.	Diagram of the KP63 probe. It is a long, thin cylindrical device. The total length is indicated as 120. The main body has a diameter of Ø 16. The tip has a diameter of Ø 12. It features a BNC cable connector at the base. The cable is labeled 'BNC'.
KP64	0...14pH / 0...80°C / 0.1bar Glass body Liquid reference KCl 3M Teflon ring diaphragm Paints, Varnish, Cosmetics, Creams, Deionised water, Drinking water, Water emul- sions, Fruit-juices, Soap, So- lutions of low ionic content, Preserved foods, Water sus- pensions, Titration, Titration in water solutions, TRIS buffer, Waste water, Viscous samples, Wine.	Diagram of the KP64 probe. It is a long, thin cylindrical device. The total length is indicated as 120. The main body has a diameter of Ø 16. The tip has a diameter of Ø 6. There is a small connector at the base with a label 'S7'.

ORDER CODE	MEASURING RANGE AND USE	DIMENSIONS
KP70	2...14pH / 0...50°C / 0.1bar Body epoxy – GEL filled 1 open hole Mixtures, Bread, Paints, Varnish, Cosmetics, Creams, Drinking water, Water emulsions, Fruit-juices, Galvanic, Soap, Mayonnaise, Preserved foods, Cheese, Milk, Water suspensions, Viscous samples, Waste water, Butter, Yoghurt.	
KP80	2...14pH / 0...60°C / 1bar Glass body– GEL filled 1 open hole Mixtures, Bread, Butter, Paints, Varnish, Cosmetics, Water emulsions, Creams, Drinking water, Galvanic, Fruit-juices, Soap, Mayonnaise, Preserved foods, Water suspensions, Titration in water solutions, Viscous samples, Milk, Titration, Waste water, Yoghurt.	
KP100	0...14pH / 0...80°C / 1bar Glass body – Liquid reference KCl 3M Teflon ring diaphragm. pH combined electrode, flat membrane, S7 connector glass body, for skin, leather, paper.	

10.2.2 REDOX ELECTRODES

ORDER CODE	MEASURING RANGE AND USE	DIMENSIONS
KP90	±2000mV 0...80°C 5bar Glass body Liquid reference KCl 3M General use	
KP91	±1000mV 0...60°C 1bar Epoxy body – GEL filled Cable L=1m with BNC General use Not heavy duty	

10.2.3 TEMPERATURE PROBES

Temperature probes Pt100 sensor using SICRAM module

Model	Type	Application range	Accuracy
TP87	Immersion	-50°C...+200°C	±0.25°C (-50°C...+200°C)
TP472I.0	Immersion	-50°C...+400°C	±0.25°C (-50°C...+350°C) ±0.4°C (+350°C...+400°C)
TP473P.0	Penetration	-50°C...+400°C	±0.25°C (-50°C...+350°C) ±0.4°C (+350°C...+400°C)
TP474C.0	Contact	-50°C...+400°C	±0.3°C (-50°C...+350°C) ±0.4°C (+350°C...+400°C)
TP475A.0	Air	-50°C...+250°C	±0.3°C (-50°C...+250°C)
TP472I.5	Immersion	-50°C...+400°C	±0.3°C (-50°C...+350°C) ±0.4°C (+350°C...+400°C)
TP472I.10	Immersion	-50°C...+400°C	±0.3°C (-50°C...+350°C) ±0.4°C (+350°C...+400°C)

Temperature drift @20°C

0.003%/°C

Pt100 4 –wire probes and Pt1000 2-wire probes complete with TP47 module

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

Temperature drift @20°C

0.005%/°C

TP47 Module for the connection of Pt100 4-wire and Pt1000 2-wire probes to instrument series HD23..., without amplifying electronics and linearization.

11. ORDER CODES

HD2305.0	The kit is composed of: instrument HD2305.0, 3 1.5V alkaline batteries, operating manual and case. pH/mV electrodes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector have to be ordered separately.
HD22.2	Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. For Ø12mm electrodes.
HD22.3	Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.
TP47	Module for the connection of Pt100 4-wire and Pt1000 2-wire probes to instrument series HD23..., without amplifying electronics and linearization.

pH ELECTRODES

KP 20	Combined pH electrode for common use, GEL filled with screw connector S7 Epoxy body.
KP 30	Combined pH electrode for common use, GEL filled, cable 1m with BNC, Epoxy body
KP 50	Combined pH electrode for common use, varnish, emulsions GEL filled, with screw connector S7, glass body.
KP 61	Combined pH electrode, 3 diaphragms for milk, cream, etc. Protelyte electrolyte, with screw connector S7, glass body.
KP 62	Combined pH electrode, 1 diaphragm for pure water, Paint, varnish, GEL filled, with screw connector S7, glass body.
KP 63	Combined pH electrode for common use, varnish, cable 1 m with BNC, electrolyte KCl 3M glass body.
KP 64	Combined pH electrode for water, varnish, emulsions, etc., electrolyte KCl 3M with screw connector S7, glass body.
KP 70	Combined pH electrode, micro diam.6.5mm, GEL filled, bread, mixtures, cheese, etc., with screw connector S7, glass body.
KP 80	Combined pointed pH electrode, electrolyte, with screw connector S7, glass body.
KP100	Glass body – Liquid reference KCl 3M, Teflon ring diaphragm. pH combined electrode, flat membrane, S7 connector glass body, for skin, leather, paper.
CP	Extension cable 1.5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.
CP5	Extension cable 5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.
CE	S7 screw connector for pH electrode.
BNC	Female BNC for electrode extension.

ORP ELECTRODES

KP90	REDOX PLATINUM electrode, with screw connector S7, electrolyte KCl 3M, glass body.
KP91	REDOX PLATINUM electrode general use not heavy duty GEL filled, cable 1m with BNC, glass body.

pH STANDARD SOLUTIONS

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.
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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.

PROBES COMPLETE WITH SICRAM MODULE

TP87	Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. Cable length 1 metre.
TP472L.0	Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 metres.
TP473P.0	Pt100 sensor penetration probe. Stem Ø 4 mm, length 150 mm. Cable length 2 metres.

TP474C.0	Pt100 sensor contact probe. Stem Ø 4 mm, length 230 mm, contact surface Ø 5 mm. Cable length 2 metres.
TP475A.0	Pt100 sensor air probe. Stem Ø 4 mm, length 230 mm. Cable length 2 metres.
TP472L.5	Pt100 sensor immersion probe. Stem Ø 6 mm, length 500 mm. Cable length 2 metres.
TP472L.10	Pt100 sensor immersion probe. Stem Ø 6 mm, length 1000 mm. Cable length 2 metres.

TEMPERATURE PROBES WITH MODULE TP47

TP87.100	Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 metre.
TP87.1000	Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2 wire connection cable with connector, length 1 metre.
TP47	Only connector for probe connection: direct 3 and 4 wire Pt100, 2 wire Pt1000.