REV. 2.1
15/04/2013

HD2106.1
HD2106.2

ENGLISH

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 correction without prior notice.

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INTRODUCTION

The **HD2106.1** and **HD2106.2** are portable instruments with a large LCD display. They measure conductivity, liquid resistivity, total dissolved solids (TDS) and salinity using combined 4-ring and 2-ring conductivity/temperature probes. Temperature only is measured by Pt100 or Pt1000 immersion, penetration or contact probes.
The probe calibration can be performed automatically in one or more of the 147µS/cm, 1413µS/cm, 12880µS/cm or 111,800µS/cm conductivity calibration solutions.
The temperature probes are automatically detected by the instrument upon turning on.

The HD2106.2 is a **datalogger**. It memorizes up to 36,000 conductivity and temperature samples that 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 HD2106.1 and HD2106.2 models are fitted with an RS232C serial port and can transfer the acquired measurements to a PC or to a portable printer in real time.
Display, printing and logging (model HD2106.2) always include temperature in °C or °F, and one of the parameters of conductivity measure (χ or Ω or TDS or NaCl).

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 which can also be disabled.
The instruments have IP66 protection degree.

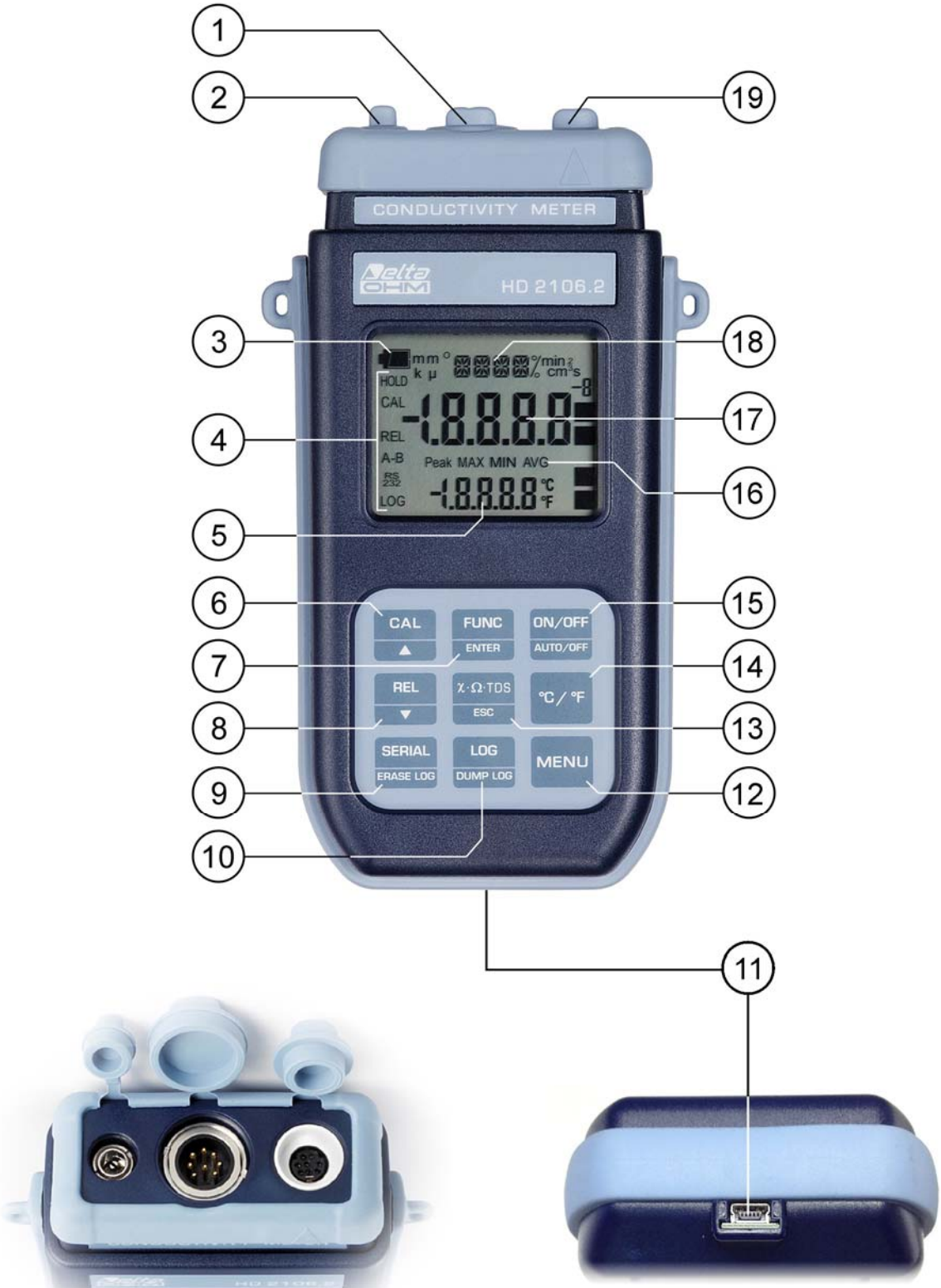
This manual describes the HD2106.1 and HD2106.2 models: if not otherwise specified, the description is intended to be applicable to both models.

Conductivity meter – Thermometer
HD2106.1

HD2106.1

1. 8-pole DIN45326 connector, input for combined 4-ring or 2-ring conductivity/temperature probes, for direct 4-wire Pt100 temperature probes and 2-wire Pt1000 probes complete with TP47 module.
2. External auxiliary power supply connector input (positive at centre).
3. Battery symbol: displays the battery charge level.
4. Function indicators.
5. Secondary display line.
6. **CAL/▲** key: during normal operation starts the conductivity probe calibration; in the menu, increases the current value.
7. **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. This updates the display measurement when the *Auto-Hold* function is enabled.
8. **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.
9. **SERIAL** key: starts and ends the data transfer to the serial communication port.
10. **MENU** key: allows access to and exit from the menu.
11. **χ-Ω-TDS/ESC** key: changes the main variable measurement between conductivity, resistivity, total dissolved solids (TDS) and salinity. In the menu, cancels the operation in progress without making changes.
12. **°C/°F** key: when the probe is not connected, allows manual modification of the temperature. When the probe is connected, if this key is pressed twice, it changes the unit of temperature measurement from degrees Celsius to Fahrenheit.
13. **ON-OFF/AUTO-OFF** key: turns the instrument on and off; when pressed together with the CAL key, disables the automatic turn off.
14. MAX, MIN and AVG symbols.
15. Main display line.
16. Line for symbols and comments.
17. 8-pole MiniDin connector for RS232C. For the connection to PC (with cable HD2110CSNM or C206) or printer (with cable HD2110CSNM).

Conductivity meter – Thermometer
HD2106.2



HD2106.2

1. 8-pole DIN45326 connector, input for combined 4-ring or 2-ring conductivity/temperature probes, for direct 4-wire Pt100 temperature probes and 2-wire Pt1000 probes complete with TP47 module.
2. External auxiliary power supply connector input (positive at centre).
3. Battery symbol: displays the battery charge level.
4. Function indicators.
5. Secondary display line.
6. **CAL/▲** key: during normal operation starts the conductivity probe calibration; in the menu, increases the current value.
7. **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. This updates the display measurement when the *Auto-Hold* function is enabled.
8. **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.
9. **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.
10. **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.
11. Mini-USB type B connector for USB 2.0. For the connection to PC (with cable CP23).
12. **MENU** key: allows access to and exit from the menu.
13. **χ-Ω-TDS/ESC** key: changes the main variable measurement between conductivity, resistivity, total dissolved solids (TDS) and salinity. In the menu, cancels the operation in progress without making changes.
14. **°C/°F** key: when the probe is not connected, allows manual modification of the temperature. When the probe is connected, if this key is pressed twice, it changes the unit of temperature measurement from degrees Celsius to Fahrenheit.
15. **ON-OFF/AUTO-OFF** key: turns the instrument on and off; when pressed together with the CAL key, disables the automatic turn off.
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).

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.

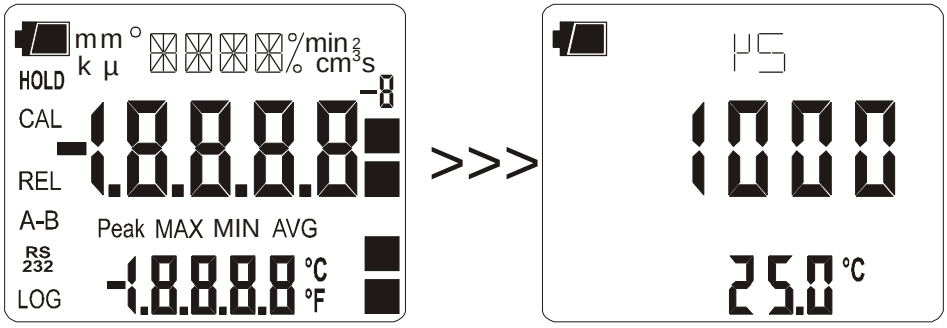
In the double-keys, the function in the upper part is the "main function", while the one in the bottom part is the "secondary function". When the instrument is in standard measurement mode, the main function is active. In the menu or in conjunction with the FUNC key, the secondary function is enabled.

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. Turning on enables all display segments for a few seconds, starts an auto-test, and displays the current values of cell constant (CELL) and temperature coefficient α (ALPH). Finally, it sets the instrument ready for normal measurement.



During turning on, should no probes be connected, 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.

The probe's data are captured upon turning the instrument on: if the ERR message appears in the secondary line, it is necessary to turn the instrument off and then on again.

Replace the probes when the instrument is off.

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 CAL/▲ 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 conductivity, liquid resistivity, total dissolved solids, salinity and temperature measurements, updating them with the acquisition of new samples. The acquisition frequency is once a second. Use the χ.Ω.TDS-ESC key to switch from conductivity to liquid resistivity, to total dissolved solids or to salinity.

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 conductivity (or resistivity or total dissolved solids or salinity) 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 key 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 conductivity probe 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 conductivity 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.

χ.Ω.TDS (conductivity - resistivity - total dissolved solids - salinity) / ESC key

Changes the main variable measurement between conductivity, resistivity, total dissolved solids (TDS) and salinity. The selected parameter is used for display, printing and logging (model HD2106.2).

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 digit**) for over 10 seconds: the message HOLD is displayed.
To perform a new measurement, it is necessary to press the FUNC/ENTER key.
The HOLD message starts blinking, while the display follows the actual measurement trend, until it stabilizes again and the HOLD message remains still.

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

REL/▼ key

In measurement mode, it displays 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

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:

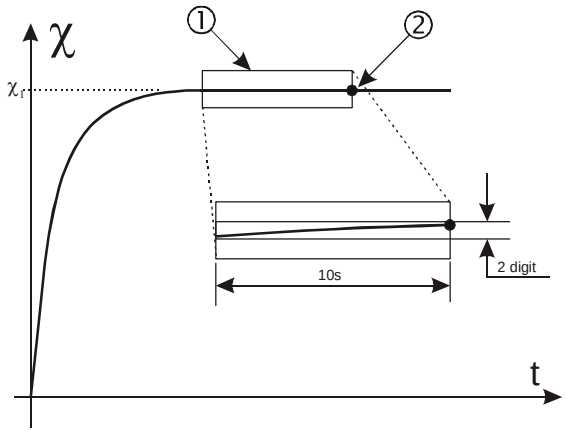
1) **Management of memorized data (only HD2106.2)**: the message "**>>>_LOG_DUMP_or_ERAS" (Transfer data or erase)** is scrolled in the comment line. The center figure reports the number of free memory pages (FREE). Pressing SERIAL/EraseLOG permanently erases all memory data. By pressing LOG/DumpLOG, 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 33).
2) **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.
3) **Sleep_Mode_LOG (Automatic turning off during recording) (only HD2106.2):** 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.

4) **Identifier of the sample being measured**: it is an automatically increased progressive number associated with the single PRINT function (**print interval set to 0**) for the printing of labels. The index appears in the single sample printing together with date, time, conductivity (liquid resistivity, total dissolved solids or salinity) 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 UNT=RSET SER=PRNT" is scrolled in the comment line: using the arrows (▲ and ▼) the currently measured sample identifier value can be changed.
By holding the °C/°F key down the proposed number is rapidly set to zero.
The instrument's heading information will be printed using the SERIAL key.

5) **AUTO-HOLD function**: the instrument normally operates in **continuous view** mode (default setting). 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 FUNC/ENTER.
In the following figure you can see an example of the measurement process with the Auto-Hold function enabled. A probe is immersed into a liquid at conductivity χ_1 and, to perform the measurement, the FUNC/ENTER key is pressed: The conductivity 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.



6) **K CELL (Cell constant):** sets the conductivity probe's cell constant nominal value. The values 0.01, 0.1, 0.7, 1.0 and 10 cm^{-1} (with tolerances from –30% to +50% of nominal value) are admitted. The cell constant must be inserted before starting the probe calibration. An ERR signal is generated if the cell constant's actual value exceeds the limits –30% or +50% of nominal value. In this case it is necessary to check that the value set is correct, that the calibration solutions are in good state, and then proceed with a new calibration.

   The cell constant change entails resetting the calibration date: a new calibration updates the calibration date.

7) **LAST CAL m/d h/m (Last conductivity 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 previous calibration of the conductivity probe. This menu item cannot be modified. The calibration year is not displayed. The cell constant change, using the K CELL parameter, resets the date.

8) **ALPH_T (Temperature coefficient α_T):** the temperature coefficient α_T is the percentage measurement of the conductivity variation according to temperature and is expressed in %/°C (or %/°F). The admitted values vary from 0.00 to 4.00%/°C. Use the arrows (▲ and ▼) to set the desired coefficient α_T, and confirm with ENTER.

9) **REF_TEMP (Reference temperature)**: it indicates the temperature to which the displayed conductivity value is standardized and can be equal to 20°C or 25°C. Using the arrows (▲ and ▼), set the desired value and confirm with ENTER.

10) **TDS (Conversion factor χ/TDS)**: it represents the ratio between the measured conductivity value and the total quantity of dissolved solids in the solution, expressed in mg/l (ppm) or g/l (ppt). This conversion factor depends on the nature of the salts present in the solution: in the field of water quality treatment and control, where the main component is $CaCO_3$ (Calcium Carbonate), a value of 0.5 is usually used. For agriculture water, for fertilizers preparation, and in hydroponics, a factor of about 0.7 is used. Using the arrows (▲ and ▼), set the desired value, selecting it in the 0.4…0.8 range, and confirm with ENTER.

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

12) **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 temperature probe connected to the instrument. Conductivity/temperature combined probes with Pt100 or Pt1000 sensor, or temperature only probes can be connected to the input:

   - 4-wire Pt100 using the TP47 module
   - 2-wire Pt1000 using the TP47 module

   Upon being turned on, the instrument automatically detects the temperature probes: the *Probe Type* menu item is configured by the instrument and cannot be modified by the user.

If no temperature probe or combined probe with temperature sensor is connected, the instrument displays a dotted line (- - - -).

13) **YEAR**: to set the current year. Use the arrows to modify this parameter and confirm using ENTER.
14) **MNTH (month)**: to set the current month. Use the arrows to modify this parameter and confirm using ENTER.
15) **DAY**: to set the current day. Use the arrows to modify this parameter and confirm using ENTER.
16) **HOUR**: to set the current hour. Use the arrows to modify this parameter and confirm using ENTER.
17) **MIN**: 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.
18) **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 33).

LOG/DUMP LOG key - only HD2106.2

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 HD2106.2 can turn off during logging between one capture and the next: 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.

DumpLOG - only HD2106.2

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 33.

SERIAL key - only HD2106.1

SERIAL/EraseLOG key - only HD2106.2

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.**

Erase memory - only HD2106.2

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

CONDUCTIVITY MEASUREMENT

The instruments work with conductivity/temperature combined probes, 4-ring and 2-ring, only conductivity probes, or temperature probes. The 4-wire Pt100, 2-wire Pt1000 probes may be used for measuring temperature, which is used for the automatic compensation of the conductivity.

The instrument obtains the following from the measurement of conductivity:

- the liquid resistivity measurement (Ω, kΩ, MΩ),
- the concentration of total dissolved solids (TDS) according to the χ/TDS conversion factor, which can be modified using the menu,
- the salinity (NaCl quantity in the solution, expressed in g/l).

The conductivity, resistivity, TDS or salinity indication is displayed in the main line, while the secondary line shows the temperature.

The conductivity probes must be periodically calibrated. To facilitate this operation, four automatic calibration solutions recognized by the instrument are provided:

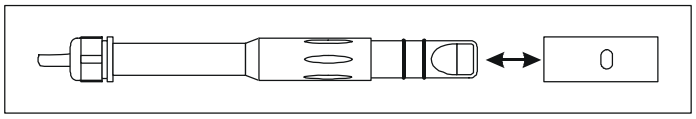
- 0.001 Molar KCl solution (147µS/cm @25°C),
- 0.01 Molar KCl solution (1413µS/cm @25°C),
- 0.1 Molar KCl solution (12880µS/cm @25°C),
- 1 Molar KCl solution (111800µS/cm @25°C),

User calibration of the temperature sensors is not required.

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 must be turned off and back on again.

Standard probe

The standard 4-ring conductivity/temperature combined probe has code **SP06T**.
A bell made of Pocan delimits the cell measurement zone. A positioning key, present in the probe's end part, orients the bell correctly when the probe is introduced. For cleaning, simply pull the bell along the probe's axis without rotating it. **It is not possible to perform measurements without this bell.**



This probe's temperature measuring range is 0…+90°C.

4- ring or 2- ring probes

The HD2106.1 and HD2106.2 conductivity meters use 4-ring or 2-ring probes for conductivity measurement.
The 4-ring probes are preferred to measure high conductivity solutions, either over an extended range or in presence of pollutants. The 2-ring probes operate in a shorter measurement range but with accuracy comparable with the 4-ring probes.

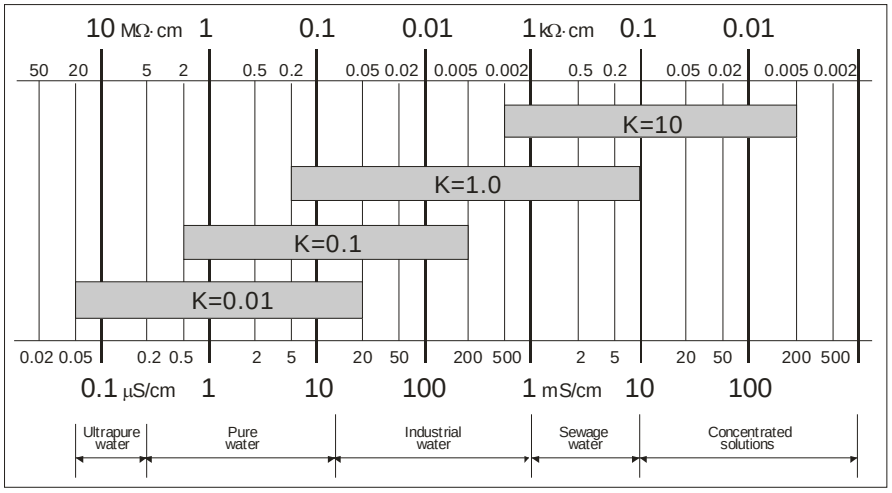
The probes can be in glass or plastic: the first can work in presence of aggressive pollutants, the latter are more resistant to collisions, and so more suitable for industrial use.

Cells with temperature sensor

The probes fitted with built-in Pt100 or Pt1000 temperature sensor simultaneously measure the conductivity and the temperature: that allows automatic correction of the effect of the latter on the solution conductivity.

Choosing the cell constant

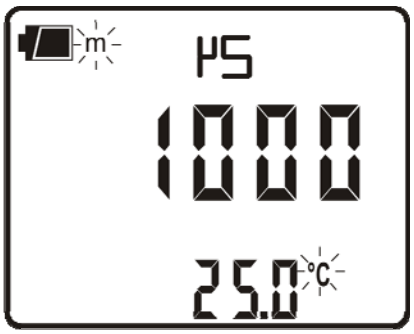
The constant is a piece of information that characterises the cell. It depends on its geometry and is expressed in cm^{-1}. There is no cell capable of measuring the entire conductivity scale accurately enough. Consequently, cells with different constants are used allowing exact measurements on different scales. The cell with constant K = $1cm^{-1}$ allows measurements from low conductivity up to relatively high conductivity.
The theoretical measurement cell is made of two 1 cm^2 metallic plates separated one from the other by 1 cm. This type of cell has a cell constant Kcell of 1 cm^{-1}. In essence, the number, form, material and dimensions of the plates are very different from model to model, from manufacturer to manufacturer.
The low constant K probes are preferably used for low conductivity values, the high constant ones for high values.
The indicative measurement range is reported in the following diagram:



AUTOMATIC OR MANUAL CONDUCTIVITY COMPENSATION

The conductivity measurement refers to a standard temperature, called reference temperature T_REF: that is, the instrument proposes the conductivity you would get if the temperature were T_REF. This temperature could be 20°C or 25°C according to the setting in the T_REF menu item.
The conductivity increase per each grade of temperature variation is a characteristic of the solution and is indicated by the term "temperature coefficient α_T": admissible values from 0.00 to 4.00%/°C, default value 2.00%/°C.
When a combined probe with temperature sensor is present, the instrument automatically applies the temperature compensation function, and proposes the measurement using the reference temperature T_REF according to the coefficient α_T on the display.
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. On the main display an "**m**" (**m**anual) is turned on near the battery symbol (if on). The **MT** indication is printed on the print-outs. On the other hand, if the temperature probe is present, the **AT** symbol appears.



To manually change the compensation temperature press the °C/°F key once: the indicated temperature value starts blinking. Select the desired temperature value by using the arrows and confirm with ENTER. The display stops blinking, and the temperature displayed is used for compensation.
To change the unit of measurement between °C and °F, press the °C/°F key **twice**.

CALIBRATION OF CONDUCTIVITY

The probe calibration can be carried out on one, two or three points using the standard solutions automatically detected by the instrument (automatic calibration) or other solutions with known value (manual calibration).

The new calibration deletes the data of the previous calibration. For example, if the instrument is calibrated in 4 points and a new 1 point calibration is performed, the instrument will be calibrated in 1 point only.

The CAL symbol will blink when the cell constant is modified using the menu (please see the description of the K_CELL menu item on page 12).

Automatic calibration of conductivity using memorized standard solutions

The instrument can recognize four standard calibration solutions:

- 0.001 Molar KCl solution (147µS/cm @25°C),
- 0.01 Molar KCl solution (1413µS/cm @25°C),
- 0.1 Molar KCl solution (12880µS/cm @25°C),
- 1 Molar KCl solution (111800µS/cm @25°C),

Using one of these solutions, the calibration is automatic; the procedure can be repeated with the remaining standard solutions, up to a maximum of four different points.
The manual calibration is possible with a different conductivity solution from that used in the automatic calibration.

The solution temperature for the automatic calibration must be between 15°C and 35°C: if the solution temperature is under 15°C or over 35°C, the calibration is rejected: CAL ERR indication appears.

1. Turn the instrument on with the ON/OFF key.
2. Set the probe's cell constant by selecting it from the admitted values: 0.01, 0.1, 0.7, 1.0 or 10.0
3. Dip the conductivity meter cell in the calibration solution until the electrodes are covered with liquid.
4. Stir the probe lightly to remove any possible air inside the measurement cell.
5. If the conductivity probe is not fitted with temperature sensor, press °C/°F and, using the arrows, enter the sample solution temperature value manually (manual setting of temperature). Confirm by pressing ENTER.
6. Press the CAL key. The unit of measurement (µS/cm or mS/cm) appears on the comment line. The central line shows the solution conductivity value at the measured temperature, or if the probe is not present, at the manually-set temperature. In the lower line, the closest temperature compensated standard buffer value.

   If the measurement is in TDS, resistivity or salinity, by pressing CAL, the instrument goes automatically into conductivity calibration mode.
7. Press ENTER to confirm the displayed value. The cell constant nominal value (KCELL) and the set temperature coefficient α_T are displayed. Pressed repeatedly the ENTER key allows the calibration on the point to be repeated, for example, in order to obtain a more stable value.
8. To end the probe calibration, press χ.Ω.TDS/ESC.
9. Rinse the probe with water. If you are then going to perform low conductivity measurements, we recommend rinsing the probe using distilled or bidistilled water.

The instrument is calibrated and ready for use.

Manual calibration of conductivity using non memorized standard solutions

Manual calibration is possible at any calibration solution and temperature if it is within the instrument measurement limits and provided that you know the solution's conductivity at the temperature at which the calibration is performed. Proceed as follows:

1. Turn the instrument on with the ON/OFF key.
2. Set the probe's cell constant by selecting it from the admitted values: 0.01, 0.1, 0.7, 1.0 or 10.0
3. Dip the conductivity meter cell into a known conductivity solution until the electrodes are covered with liquid.
4. Stir the probe lightly to remove any possible air inside the measurement cell.
5. Press MENU, and then FUNC/ENTER until the item ALPH appears. The temperature coefficient α_T is displayed. Note down the value displayed as it must be set again at the end of the procedure. Set the value to **0.00**. This excludes the temperature compensation during the conductivity measurement.
6. Measure the temperature by pressing °C/°F. According to the temperature detected, determine the calibration solution conductivity using the table specifying the conductivity according to temperature.
7. Select the conductivity measurement by pressing χ.Ω.TDS/ESC.

8. Press the CAL key. The CAL symbol is turned on. The unit of measurement (µS/cm or mS/cm) appears on the comment line. If the calibration solution conductivity is sufficiently close (-30% to +50%) to one of the standard solutions, the secondary line displays the value. Otherwise it displays the calculated value according to current settings. In the central line the solution conductivity value is indicated according to the cell constant current settings.
9. Use the arrows to select the conductivity value determined at point 4 and confirm using ENTER. If the ERR indication appears, see the note below.
10. The cell constant nominal value (KCELL) and the temperature coefficient α_T set to 0 are displayed. Pressed repeatedly the ENTER key allows the calibration on the point to be repeated, for example, in order to obtain a more stable value.
11. To end the probe calibration, press χ.Ω.TDS/ESC.
12. Go back to the MENU and select ALPH: re-enter the temperature coefficient as it was before the calibration.
13. Rinse the probe with water. If you are then going to perform low conductivity measurements, we recommend rinsing the probe using distilled or bidistilled water.

The instrument is now calibrated and ready for use.

NOTES:

- **Without having pressed ENTER at all, the calibration is interrupted by pressing χ.Ω.TDS/ESC;** the previous values will continue to be used.
- Upon confirming the calibration by using ENTER, the instrument checks that the correction to the conductivity does not exceed the 70% or 150% limits of the theoretical value. If the calibration is rejected 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.
- The most frequent causes of error are due to the probe malfunctioning (deposits, dirt,…) or to the standard solutions deterioration (bad preservation conditions, alteration due to pollution with different conductivity solutions,…).
- If the measurement is in TDS, resistivity or salinity, on the pressing of CAL, the instrument goes automatically in conductivity calibration.

Table of standard solutions at 147µS/cm, 1413µS/cm, 12.88mS/cm and 111.8mS/cm

The table reports the standard solutions automatically detected by the instrument according to temperature.

°C	µS/cm	µS/cm	mS/cm	mS/cm
15.0	121	1147	10.48	92.5
16.0	124	1173	10.72	94.4
17.0	126	1199	10.95	96.3
18.0	128	1225	11.19	98.2
19.0	130	1251	11.43	100.1
20.0	**133**	**1278**	**11.67**	**102.1**
21.0	136	1305	11.91	104.0
22.0	138	1332	12.15	105.9
23.0	141	1359	12.39	107.9
24.0	144	1386	12.64	109.8
25.0	**147**	**1413**	**12.88**	**111.8**

°C	µS/cm	µS/cm	mS/cm	mS/cm
26.0	150	1440	13.13	113.8
27.0	153	1467	13.37	115.7
28.0	157	1494	13.62	117.7
29.0	161	1521	13.87	119.8
30.0	164	1548	14.12	121.9
31.0	168	1581	14.37	124.0
32.0	172	1609	14.62	126.1
33.0	177	1638	14.88	128.3
34.0	181	1667	15.13	130.5
35.0	186	1696	15.39	132.8

DIRECT INPUT INTO Pt100 AND Pt1000 TEMPERATURE PROBES

The instrument accepts the input of Platinum temperature probes with resistances of 100Ω and 1000Ω.
The Pt100 are connected to 4 wires, the Pt1000 to 2 wires, with the excitation current chosen minimizing the sensor self-heating effects.
The 4-wire and 2-wire probes with direct input are checked for conformity with class A tolerance according to norm IEC751 - BS1904 - DIN43760.
The temperature probes are automatically detected by the instrument (please see the description of the Probe Type menu 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

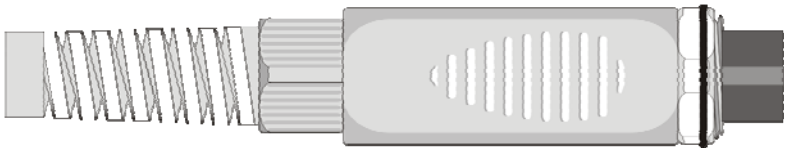
The temperature measurement by **immersion** is carried out by inserting the probe in the liquid for at least 60mm; the sensor is housed in the end part of the probe.

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.

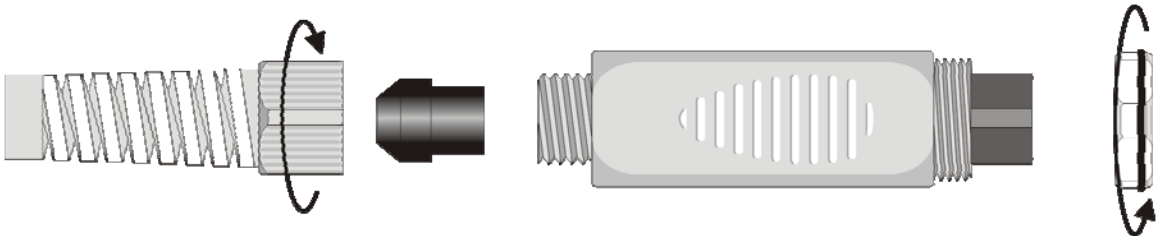
Instructions to connect the TP47 module for conductivity/temperature combined probes, 4-wire Pt100 probes, and 2-wire Pt1000 probes

All Delta Ohm probes are provided with a connector. The HD2106.1 and HD2106.2 instruments also work with conductivity/temperature combined probes, direct 4-wire Pt100 probes, 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.

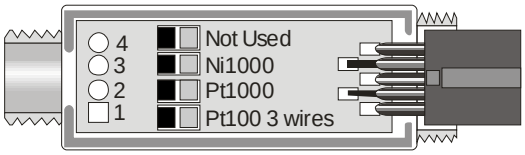


The instructions to connect the probe to the module are provided below.
The module is supplied complete with fairlead and gasket for 5mm maximum diameter cables.

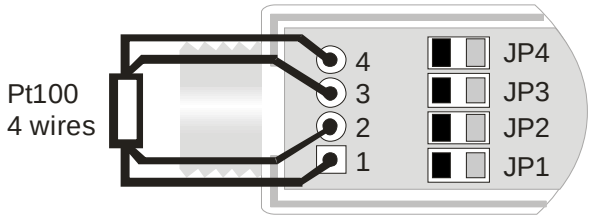
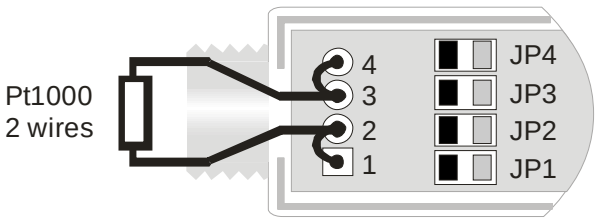
Do the following to open the module and connect a probe:
Unscrew the fairlead and extract the gasket, remove the label using a cutter, unscrew the ring on the opposite side as illustrated in the figure:



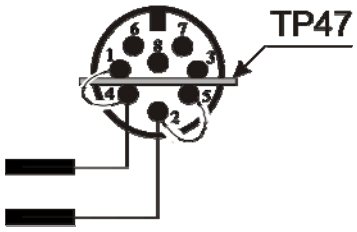
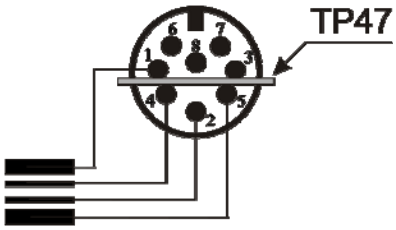
Open the two module shells: the printed circuit to which the temperature probe must be connected is housed inside. The wires coming from the conductivity cell are welded directly onto the connector's pins.
On the left there are the 1…4 points on which the Pt100 or Pt1000 sensor wires must be welded. The JP1…JP4 jumpers are in the center of the card. These must be left open.



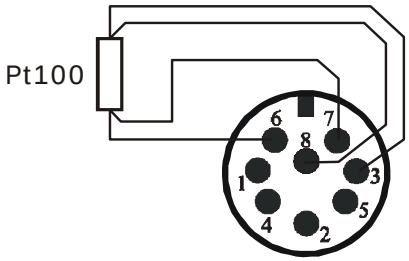
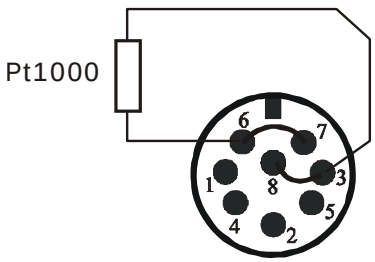
Before welding, pass the probe cable through the fairlead and gasket.
Weld the temperature sensor wires as shown in the table:

Sensor	TP47 card connection	Jumper
Pt100 4 wires		None
Pt1000 2 wires		None

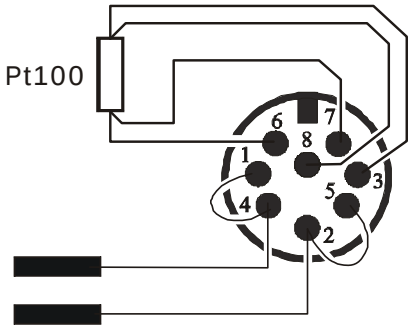
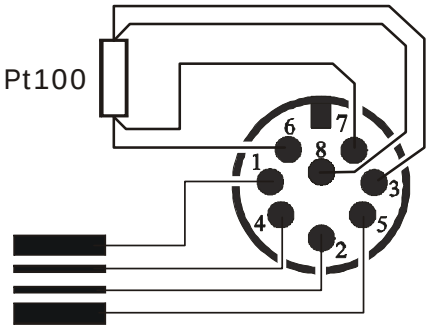
The wires coming from the **conductivity probe** are welded directly on the DIN45326 connector as reported in the following table:

Sensor	Direct connection to the connector DIN45326	Jumper
2-electrode conductivity probe	 Internal view of the connector	Jumper between pins 1 and 4 Jumper between pins 2 and 5
4-electrode conductivity probe	 Internal view of the connector	None

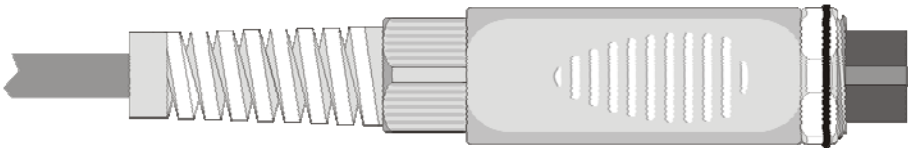
As an alternative, the **Pt100 and Pt1000 sensors** can be welded directly on the connector's pins DIN45326, as reported in the following table:

Sensor	Direct connection to the connector DIN45326	Jumper
Pt100 4 wires	 Internal view of the connector	None
Pt1000 2 wires	 Internal view of the connector	Jumper between pins 6 and 7 Jumper between pins 3 and 8

The wires coming from the **conductivity/Pt100 temperature combined probe** can be welded directly on the connector as reported in the following table.

Sensor	Direct connection to the connector DIN45326	Jumper
2-ring conductivity probe Pt100 temperature sensor	 Internal view of the connector	Jumper between pins 1 and 4 Jumper between pins 2 and 5
4-ring conductivity probe Pt100 temperature sensor	 Internal view of the connector	None

Ensure the welds are clean and perfect. Once the welding operation is complete, close the two shells, insert the gasket in the module, 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.

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 CONDUCTIVITY PROBES

The service life of a cell can be unlimited, provided that the necessary maintenance is performed and that it does not break. Some of the most frequent problems and their possible solutions are reported below.

Measurement of conductivity different from the expected value. Check that the cell used is suitable for the measurement range. Check that the cell is not dirty, that there are no air bubbles inside it. Calibrate again using the appropriate standard.

Slow response or instability. Check that the cell is not dirty, that there are no traces of oil or air bubbles inside it. If you work with a black Platinum cell, new regeneration of the electrode could be necessary.

Cell constant value not accepted. Check that the standard solutions are in good condition, that the probe's constant cell value coincides with that selected in the instrument and that the solution temperature is within the range 15…35°C.

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 appears if the conductivity/temperature probe is measuring a value exceeding the set measuring range.
CAL ERR	This appears when, during calibration, the read value exceeds the limits of -30% or +50% of the standard solution value compensated for temperature or the solution temperature is less than 15°C or higher than 35°C.
LOG MEM FULL	Memory full; the instrument cannot store further data, the memory space is full.
CAL blinking	No calibration has yet been effected, or the cell constant value has been modified in the menu (please see the description of the K_CELL menu item on page 12).
m	No probe with temperature sensor connected. The letter "m" indicates that the displayed temperature was entered manually.
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.
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 indication	Explanation
ALPH	temperature coefficient α_T
AUTO-HOLD	automatic function holding the displayed measurement
BATT TOO LOW - CHNG NOW	battery discharged - replace it immediately
BAUDRATE!	baud rate value!
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!
KCEL	Cell constant K
KOHM	measurement of resistivity in kΩ
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_DUMP_OR_ERAS	transfer or erase data
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
MOHM	measurement of resistivity in MΩ
NaCl!	measurement of salinity in g/l
OHM	measurement of resistivity in Ω
PLS_EXIT >>> FUNC RES_FOR_FACT ONLY!	please exit using ESC >>> function reserved to factory calibration
PRBE_TYPE	type of probe connected
PRNT AND LOG INTV	printing and logging intervals
PRNT INTV!	printing interval!!
PROB COMM LOST	lost communication with probe
RCD MODE	record function operating mode (max, min, avg)
REF_TEMP	reference temperature
SLP_MODE_LOG	turning off during recording mode
SMPL ID REL=RSET SER=PRINT	identifier of the sample - REL=reset - SERIAL=print heading
SYS ERR #	program error number #
TDS	total dissolved solids
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:

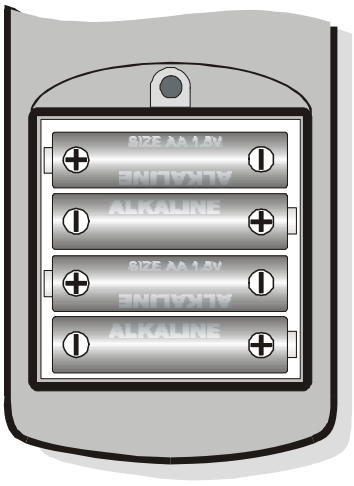
BATT TOO LOW
CHNG NOW

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

In order to avoid data loss, the logging session is ended, if the HD2106.2 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.

Maintenance

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

In the conductivity/temperature combined probe the bell and the body of the probe are made of Pocan, the conductivity and temperature sensors are made of Platinum.
During the use control the compatibility of these materials with the liquid that you want to measure. The probe must be preserved in a dry space. At regular intervals check that no deposits or corrosion are present on the sensitive part of the probe.
Any possible deposits should be removed using detergent on a wet rag. Particularly resistant deposits can be removed leaving the probe immersed in soap water for some hours and then rinsing it. Do not allow hands to touch the electrodes after cleaning.
Do not use any abrasive product for cleaning.

SERIAL INTERFACE AND USB

The HD2106.1 and HD2106.2 instruments are fitted with an electrically isolated RS-232C serial interface; the HD2106.2 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 HD2106.2).

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 1000	Captured measurements (24 characters) AT = automatic temperature compensation
G0	Model HD2106 -2	Instrument model

Command	Response	Description
G1	M=conductivity meter	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=Cond + Pt100	Type of probe connected to input
GB	User ID=0000000000000000	User code (set with T2xxxxxxxxxxxxxxx)
GC		Print instrument's heading
K0		Stop printing data
K1	PRINTOUT IMMEDIATE MODE	Immediate printing of data
K4	&	Start logging data
K5	&	Stop logging data
K6	&	Disable REL function
K7	&	Enable REL function
KP	&	Auto-power-off function=ENABLE
KQ	&	Auto-power-off function=DISABLE
LD	PRINTOUT OF LOG	Print data logged in flash
LE	&	Erase data in flash memory
LN	&1999	Number of free pages in the 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 conductivity n=0 > µS/cm n=1 > Ω n=2 > TDS n=3 > NaCl
RA	& #	Reading of LOG/PRINT interval set
RP	& 600	Battery level (Resolut. 0.01V)
RUA	U= °C	Temperature measurement unit
RUB	U= uS	Conductivity measurement unit
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 HD2106.1 and HD2106.2 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 HD2106.2 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 HD2106.2

The *Logging* function allows the recording up to 36.000 data pair measurements [T-χ] registered by the probes connected to the inputs. Logging always includes **two** parameters. Each data pair is composed of: temperature in °C or °F, conductivity or resistivity or TDS or NaCl. 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 samples. The logged parameters are selected using the "°C/°F" and "χ-Ω-TDS/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 HD2106.2

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

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 data pair is composed of: temperature in °C or °F, conductivity or resistivity or TDS or NaCl. The printed parameters are selected using the "°C/°F", and "χ-Ω-TDS/ESC" keys.

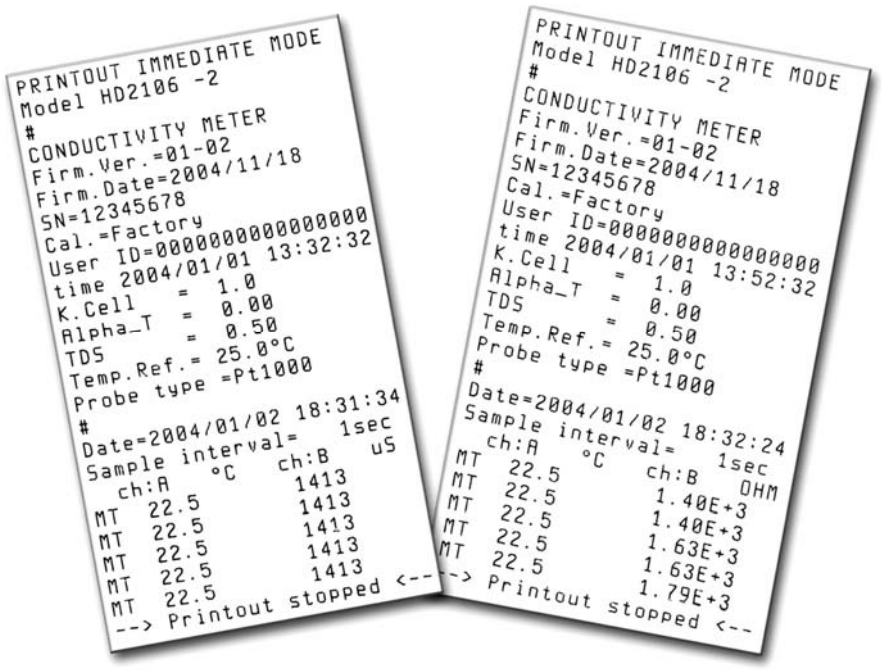
The function is started by pressing SERIAL. The time interval between two consecutive prints can be set from 1 second to 1 hour (please see the **Print and log interval** menu item on page 10). If the print interval is equal to 0, by pressing SERIAL the single data is sent to the connected device. If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



CONNECTION TO A PC

HD2106.1

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).

HD2106.2

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 HD2106.2

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 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
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 storing - model **HD2106.2***	
Type	2000 pages containing 18 samples each
Quantity	36000 pairs of measurements [χ or Ω o TDS or NaCl] and [°C or °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 **HD2106.2***	
Type	1.1 - 2.0 electrically isolated

Connections

Conductivity input	8-pole male DIN45326 connector
Input module for the temperature probes	8-pole male DIN45326 connector
RS232 serial interface	8-pole MiniDin connector
USB interface (only **HD2106.2**)	Mini-USB type B connector
Mains adapter (cod. **SWD10**)	2-pole connector (positive at centre)

Measurement of conductivity by Instrument

Measurement range (Kcell=0.1) / Resolution	0.00…19.99µS/cm / 0.01µS/cm
Measurement range (K cell=1) / Resolution	0.0…199.9µS/cm / 0.1µS/cm 200…1999µS/cm / 1µS/cm 2.00…19.99mS/cm / 0.01mS/cm 20.0…199.9mS/cm / 0.1mS/cm
Measurement range (K cell=10) / Resolution	200…1999mS/cm / 1mS/cm
Accuracy (conductivity)	±0.5% ±1digit

Measurement of resistivity by Instrument

Measurement range (Kcell=0.1) / Resolution	Up to 100MΩ·cm / (*)
Measurement range (Kcell=1) / Resolution	5.0…199.9Ω·cm / 0.1Ω·cm 200…999Ω·cm / 1Ω·cm 1.00k…19.99kΩ·cm / 0.01kΩ·cm 20.0k…99.9kΩ·cm / 0.1kΩ·cm 100k…999kΩ·cm / 1kΩ·cm 1…10MΩ·cm / 1MΩ·cm
Measurement range (Kcell=10) / Resolution	0.5…5.0Ω·cm / 0.1Ω·cm
Accuracy (resistivity)	±0.5% ±1digit

Measurement of total dissolved solids (with coefficient χ/TDS=0.5)

Measurement range (Kcell=0.1) / Resolution	0.00…19.99mg/l / 0.05mg/l
Measurement range (Kcell=1) / Resolution	0.0…199.9 mg/l / 0.5 mg/l 200…1999 mg/l / 1 mg/l 2.00…19.99 g/l / 0.01 g/l 20.0…99.9 g/l / 0.1 g/l
Measurement range (Kcell=10) / Resolution	100…999 g/l / 1 g/l
Accuracy (total dissolved solids)	±0.5% ±1digit

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below.

K cell = 0.01 cm^{-1}	
Conductivity (µS/cm)	Resistivity (MΩ·cm)
0.001 µS/cm	1000 MΩ·cm
0.002 µS/cm	500 MΩ·cm
0.003 µS/cm	333 MΩ·cm
0.004 µS/cm	250 MΩ·cm
…	…

K cell = 0.1 cm^{-1}	
Conductivity (µS/cm)	Resistivity (MΩ·cm)
0.01 µS/cm	100 MΩ·cm
0.02 µS/cm	50 MΩ·cm
0.03 µS/cm	33 MΩ·cm
0.04 µS/cm	25 MΩ·cm
…	…

Measurement of salinity

Measurement range / Resolution	0.000…1.999g/l / 1mg/l 2.00…19.99g/l / 10mg/l 20.0…199.9g/l / 0.1g/l
Accuracy (salinity)	±0.5% ±1digit

Measurement of temperature by Instrument

Pt100 measurement range	-50…+200°C
Pt1000 measurement range	-50…+200°C
Resolution	0.1°C
Accuracy	±0.25°C
Drift after 1 year	0.1°C/year

Automatic/manual temperature compensation	0…100°C with α_T=0.00…4.00%/°C
Reference temperature	20°C or 25°C
χ/TDS conversion factor	0.4…0.8
Cell constant K (cm^{-1})	0.01, 0.1, 0.7, 1.0 and 10.0
Standard solutions automatically detected (@25°C)	147µS/cm 1413µS/cm 12880µS/cm 111800µS/cm

TECHNICAL DATA OF PROBES WITH MODULE IN LINE WITH THE INSTRUMENT

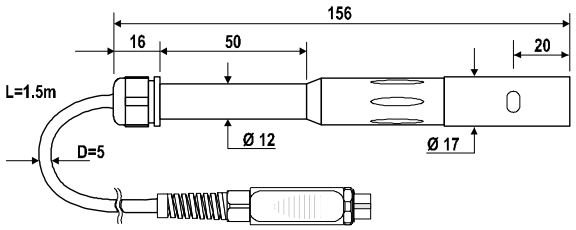
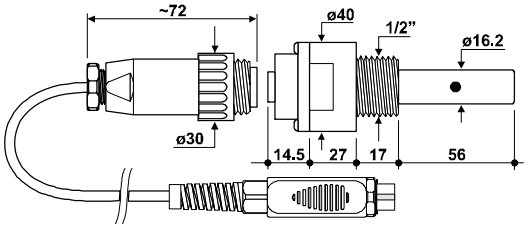
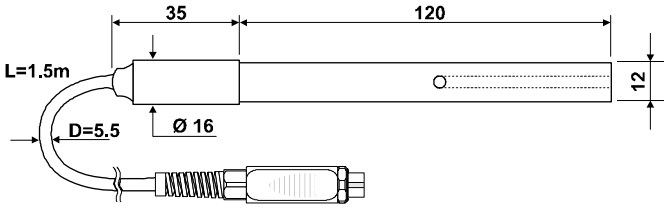
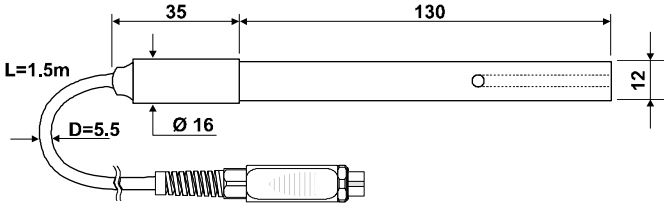
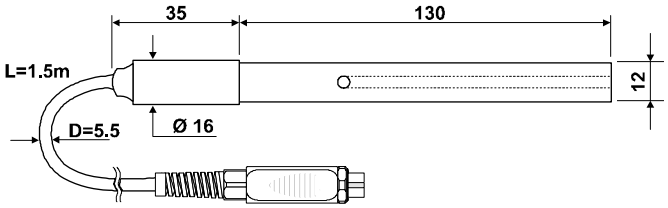
4-WIRE OR 2-WIRE Pt100 TEMPERATURE PROBES COMPLETE WITH TP47 MODULE

Model	Type	Application range	Accuracy
TP47.100.O 1/3 DIN – Thin Film	Pt100 4 wires	-50…+250°C	1/3 DIN
TP47.1000.O 1/3 DIN – Thin Film	Pt1000 2 wires	-50…+250°C	1/3 DIN
TP87.100.O 1/3 DIN – Thin Film	Pt100 4 wires	-50…+200°C	1/3 DIN
TP87.1000.O 1/3 DIN – Thin Film	Pt1000 2 wires	-50…+200°C	1/3 DIN

Temperature drift @ 20°C

Pt100	0.003%/°C
Pt1000	0.005%/°C

2 AND 4-ELECTRODE CONDUCTIVITY PROBES

ORDER CODE	MEASUREMENT RANGE	DIMENSIONS
SP06T	K=0.7 5µS/cm …200mS/cm 0…90°C 4-electrode cell Pocan/Platinum	
SPT401.001	K=0.01 0.04µS/cm …20µS/cm 0…120°C 2-electrode cell AISI 316 steel	
SPT01G	K=0.1 0.1µS/cm …500µS/cm 0…80°C 2-electrode cell Glass/Platinum	
SPT1G	K=1 10µS/cm …10mS/cm 0…80°C 2-electrode cell Glass/Platinum	
SPT10G	K=10 500µS/cm …200mS/cm 0…80°C 2-electrode cell Glass/Platinum	

ORDER CODES

HD2106.1	Kit including: instrument HD2106.1, 4 x 1.5V alkaline batteries, operating manual, case and DeltaLog9 software.
HD2106.2	Kit including: instrument HD2106.2 **datalogger**, 4 x 1.5V alkaline batteries, operating manual, case and DeltaLog9 software.
	The conductivity probes, the temperature probes, the standard reference solutions and the 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.
CP23	Connection cable Mini-USB type B – USB type A.
DeltaLog9	Software for transfer and management of the data on PC using Windows (from 98) operating systems.
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 ∅12mm electrodes.
HD22.3	Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.

CONDUCTIVITY PROBES AND COMBINED CONDUCTIVITY AND TEMPERATURE PROBES

SP06T	Combined conductivity and temperature 4-electrode cell in Platinum, body in Pocan. Cell constant K = 0.7. Measurement range 5µS/cm …200mS/cm, 0…90°C.
SPT401.001	Combined conductivity and temperature 2-electrode cell in AISI 316 steel. Cell constant K = 0.01. Measurement range 0.04µS/cm …20µS/cm, 0…120°C.
SPT01G	Combined conductivity and temperature 2-electrode Platinum-wire cell, glass body. Cell constant K = 0.1. Measurement range 0.1µS/cm …500µS/cm, 0…80°C.
SPT1G	Combined conductivity and temperature 2-electrode Platinum-wire cell, glass body. Cell constant K = 1. Measurement range 10µS/cm …10mS/cm, 0…80°C.
SPT10G	Combined conductivity and temperature 2-electrode Platinum-wire cell, glass body. Cell constant K = 10. Measurement range 500µS/cm …200mS/cm, 0…80°C.

STANDARD CONDUCTIVITY CALIBRATION SOLUTIONS

HD8747	Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C - 200cc.
HD8714	Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C - 200cc.
HD8712	Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C - 200cc.
HD87111	Standard calibration solution 1mol/l equal to 111800µS/cm @25°C - 200cc.

TEMPERATURE PROBES COMPLETE WITH TP47

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 2 metres.
TP87.1000.O	Immersion probe, sensor Pt1000. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 2 metres.
TP47	Only connector for probe connection: Pt100 direct 4 wires, Pt1000 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.

CERTIFICATO DI CONFORMITÀ DEL COSTRUTTORE

MANUFACTURER'S CERTIFICATE OF CONFORMITY

rilasciato da

issued by

DELTA OHM SRL STRUMENTI DI MISURA

DATA
DATE 2008/05/28

Si certifica che gli strumenti sotto riportati hanno superato positivamente tutti i test di produzione e sono conformi alle specifiche, valide alla data del test, riportate nella documentazione tecnica.

We certify that below mentioned instruments have been tested and passed all production tests, confirming compliance with the manufacturer's published specification at the date of the test.

La riferibilità delle misure ai campioni internazionali e nazionali è garantita da una catena di riferibilità che ha origine dalla taratura dei campioni di prima linea dei laboratori accreditati di Delta OHM presso l'Istituto Primario Nazionale di Ricerca Metrologica.

The traceability of measures assigned to international and national reference samples is guaranteed by a reference chain which source is the calibration of Delta OHM accredited laboratories reference samples at the Primary National Metrological Research Institute.

Tipo Prodotto: **Conduttivimetro - Termometro RTD**
Product Type: ***Conductivity meter - RTD Thermometer***

Nome Prodotto: **HD2106.1 – HD2106.2**
Product Name:

Responsabile Qualità
Head of Quality

DELTA OHM SRL
35030 Caselle di Selvazzano (PD) Italy
Via Marconi, 5
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Cod. Fisc./P.Iva IT03363960281 - N.Mecc. PD044279
R.E.A. 306030 - ISC. Reg. Soc. 68037/1998

WARRANTY

TERMS OF WARRANTY

All DELTA OHM instruments are subject to accurate testing, and are guaranteed for 24 months from the date of purchase. DELTA OHM will repair or replace free of charge the parts that, within the warranty period, shall be deemed non efficient according to its own judgement. Complete replacement is excluded and no damage claims are accepted. The DELTA OHM guarantee only covers instrument repair. The guarantee is void in case of incidental breakage during transport, negligence, misuse, connection to a different voltage than that required for the appliance by the operator. Finally, a product repaired or tampered by unauthorized third parties is excluded from the guarantee. The instrument shall be returned FREE OF SHIPMENT CHARGES to your dealer. The jurisdiction of Padua applies in any dispute.

The electrical and electronic equipment marked with this symbol cannot be disposed of in public landfills. According to the UE Directive 2002/96/EC, the European users of electrical and electronic equipment can return it to the dealer or manufacturer upon purchase of a new one. The illegal disposal of electrical and electronic equipment is punished with an administrative fine.

This guarantee must be sent together with the instrument to our service centre.

IMPORTANT: Guarantee is valid only if coupon has been correctly filled in all details.

Instrument code ❑ **HD2106.1** ❑ **HD2106.2**

Serial Number _____

RENEWALS

Date	Date
Inspector	Inspector
Date	Date
Inspector	Inspector
Date	Date
Inspector	Inspector

CE CONFORMITY	
The product complies with 2004/108/CE (EMC) and 2006/95/CE (low voltage) directives, and meets the requirements of the following technical standards:	
Safety	EN61010-1
Electrostatic discharge immunity test	EN61000-4-2 Level 3
Radiated, radio-frequency, electromagnetic field immunity	EN61000-4-3 Level 3
Electrical fast transient/burst immunity	EN61000-4-4 Level 3
Immunity to conducted disturbances, induced by RF fields	EN61000-4-6
Voltage dips, short interruptions and voltage variations immunity	EN61000-4-11
Radio disturbance characteristics (conducted and radiated emissions)	EN55022:2007 class B