

## Operating manual

Thermocouple thermometers

**HD2108.1 – HD2108.2**

**HD2128.1 – HD2128.2**



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## INTRODUCTION

The **HD2108.1** and **HD2108.2 with one input** and the **HD2128.1** and **HD2128.2 with two inputs** are portable instruments with a large LCD display. They measure the temperature using immersion, penetration or air contact probes. The sensor may be a thermocouple of type K, J, T, N, R, S, B or E.

The HD2108.2 and HD2128.2 instruments are **dataloggers**. The HD2108.2 memorizes up to 76,000 samples, the HD2128.2 up to 38,000 pairs of values. These data can be transferred from the instrument connected to a PC via the RS232C serial port or USB 2.0 port. The logging interval, printing, and baud rate can be configured using the menu.

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

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

Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off that can also be disabled. The HD2128.1 and HD2128.2 calculate the A-B difference of the temperatures captured by the two input channels.

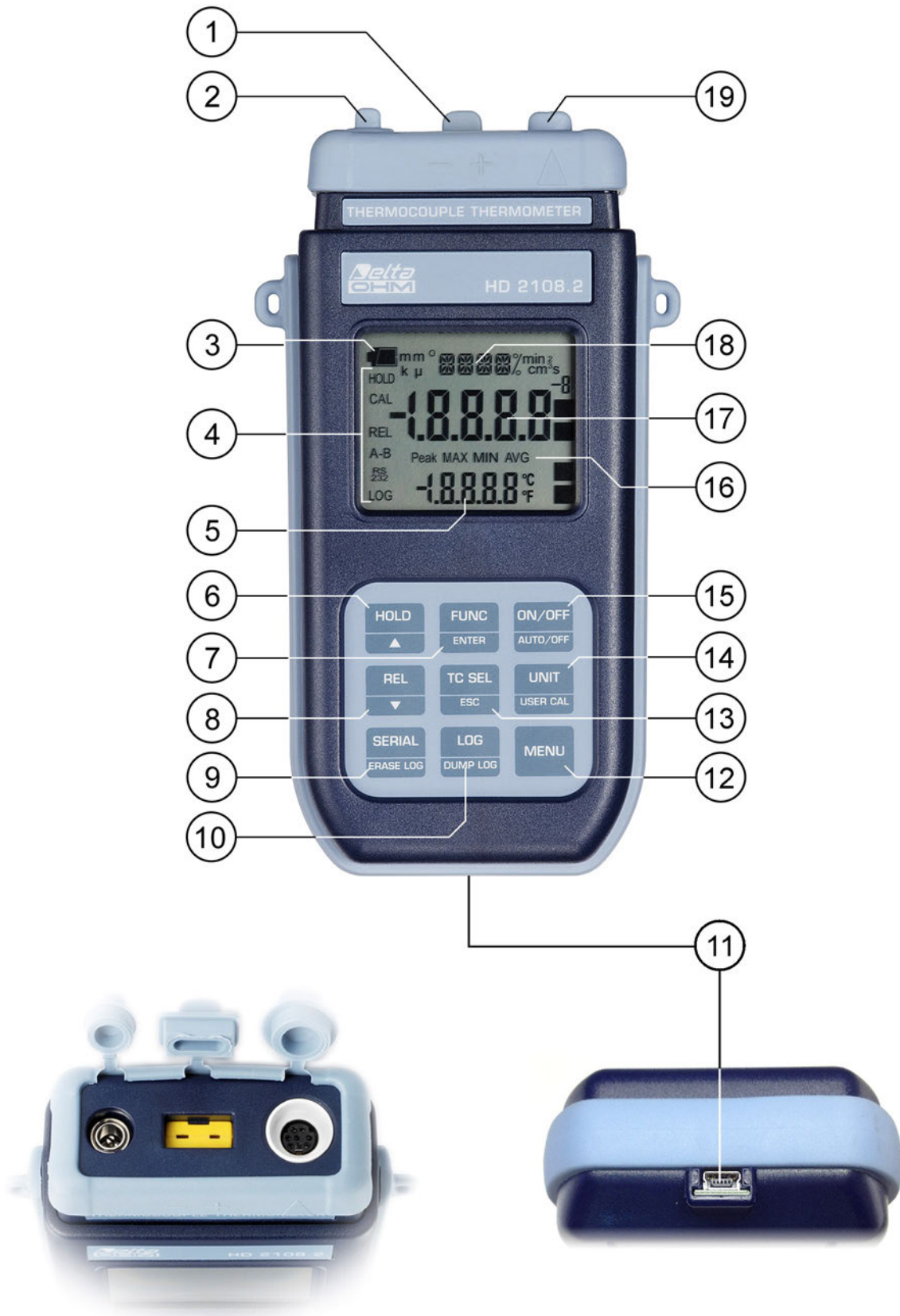
**The instruments have IP66 protection degree.**

**This manual describes the HD2108.1, HD2108.2, HD2128.1 and HD2128.2 models: if not otherwise specified, the description is intended to be applicable to all models.**

**The table below illustrates all existing differences between the various models.**

	<b>HD2108.1</b>	<b>HD2108.2</b>	<b>HD2128.1</b>	<b>HD2128.2</b>
<b>TC Inputs:</b>	1	1	2	2
<b>Storage capacity</b>	---	76,000 samples	---	38,000 temperature pairs
<b>PC interface</b>	RS232C	RS232C + USB2.0	RS232C	RS232C + USB2.0
<b>Datalogger</b>	NO	YES	NO	YES
<b>A-B function</b>	NO	NO	YES	YES

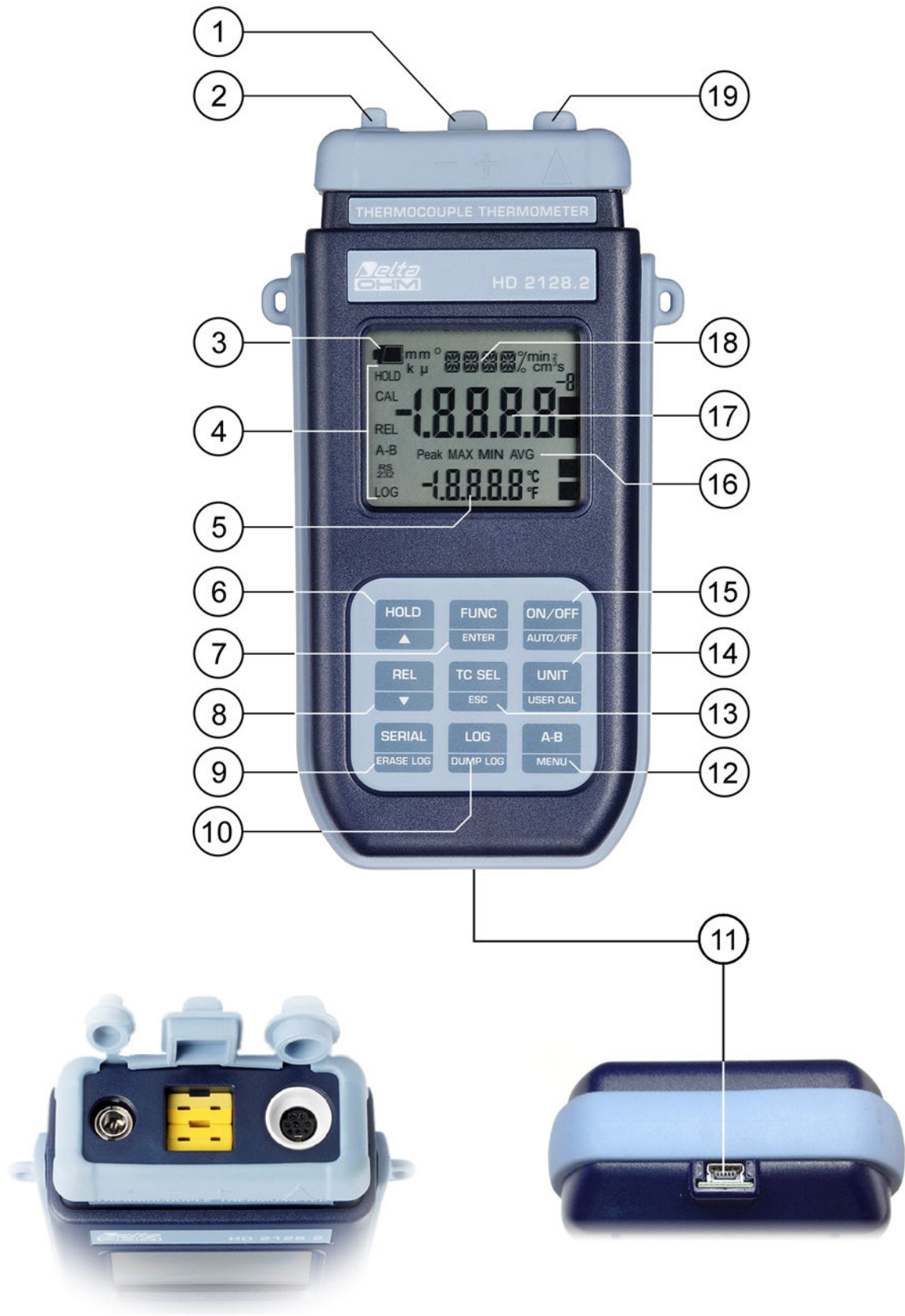
# HD2108.1 and HD2108.2 Thermocouple Thermometers with one input



## HD2108.1 and HD2108.2

1. Input for thermocouple, standard mignon connector.
2. External auxiliary power supply connector input.
3. Battery symbol: displays the battery charge level.
4. Function indicators.
5. Secondary display line.
6. **HOLD/▲** key: freezes the measurement during normal operation; in the menu, increases the current value.
7. **FUNC/ENTER** key: displays the maximum (MAX), the minimum (MIN) and the average (AVG) of current measurements. In the menu, confirms the current selection.  
When pressed together with the UNIT/UserCal key, starts the calibration procedure for the probe connected to the instrument.
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 (**for HD2108.1**) or **SERIAL/ERASE LOG** (**for HD2108.2**): starts and ends data transfer to the serial/USB communication port. In the menu, clears the data contained in the instrument's memory.
10. **LOG/DUMP LOG** key (**for HD2108.2**): 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 (**only HD2108.2**). For the connection to PC (with cable CP23).
12. **MENU** key: allows access to and exit from the menu.
13. **TC SEL/ESC** key: in measurement mode, selects the type of thermocouple K, J, T, N, R, S, B and E. In the menu cancels the operation in progress without making changes.
14. **UNIT/USER CAL** key: during normal operation, selects the unit of measurement for the temperature between °C, °F or °K; displays the voltage generated by the probe ("mV") or the voltage in mV equivalent to the read temperature, and indicated at 0°C ("mV\*C"). When pressed together with the FUNC key, starts the calibration procedure for the probe connected to the instrument.
15. **ON-OFF/AUTO-OFF** key: turns the instrument on and off; when pressed together with the HOLD 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).

# HD2128.1 and HD2128.2 Thermocouple Thermometers with two inputs



## HD2128.1 and HD2128.2

1. Input for 2 thermocouples, standard mignon connectors (the upper one is input "A", the lower one input "B").
2. External auxiliary power supply connector input.
3. Battery symbol: displays the battery charge level.
4. Function indicators.
5. Secondary display line (temperature measured at input B).
6. **HOLD/▲** key: freezes the measurement during normal operation; in the menu, increases the current value.
7. **FUNC/ENTER** key: displays the maximum (MAX), the minimum (MIN) and the average (AVG) of current measurements. In the menu, confirms the current selection.  
When pressed together with the UNIT/UserCal key, starts the calibration procedure for the probe connected to the instrument.
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 (**for HD2128.1**) or SERIAL/ERASE LOG (**for HD2128.2**): starts and ends data transfer to the serial communication port. In the menu, clears the data contained in the instrument's memory.
10. **A-B** key **for HD2128.1**: displays the difference of the two inputs A and B.  
**LOG/DUMP LOG** key (**for HD2128.2**): 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 (**only HD2128.2**). For the connection to PC (with cable CP23).
12. **MENU** key **for HD2128.1**: allows access to and exit from the menu.  
**A-B/MENU** key **for HD2128.2**: displays the difference of the two inputs A and B. When pressed together with the FUNC/ENTER key, allows access to and exit from the menu.
13. **TC SEL/ESC** key: in measurement mode, selects the type of thermocouple K, J, T, N, R, S, B and E. In the menu cancels the operation in progress without making changes.
14. **UNIT/USER CAL** key: during normal operation, selects the unit of measurement for the temperature between °C, °F or °K; displays the voltage generated by the probe ("mV") or the voltage in mV equivalent to the read temperature, and indicated at 0°C ("mV\*C"). When pressed together with the FUNC key, starts the calibration procedure for the probe connected to the instrument.
15. **ON-OFF/AUTO-OFF** key: turns the instrument on and off; when pressed together with the HOLD key, disables the automatic turn off.
16. MAX, MIN and AVG symbols.
17. Main display line (temperature measured at input A).
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

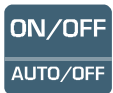
In some versions, the instrument keyboard is composed of single-function keys and double-function keys such as the ON-OFF/Auto-OFF.

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.

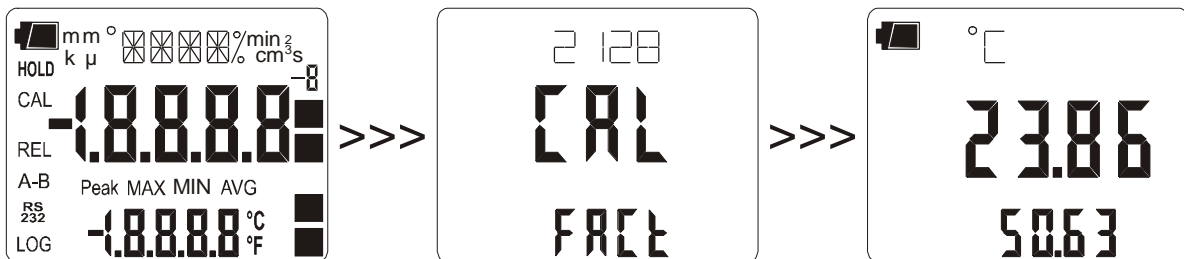
The HD2128.1 and HD2128.2 models measure two temperatures: The upper connector is input "A", and the corresponding temperature is displayed in the main line. The lower connector is input "B", and the corresponding temperature is displayed in the secondary line.

Each key specific function is described in detail below.



### ON-OFF/Auto-OFF key

The instrument is turned on and off using the ON/OFF key. The turning on enables all display segments for a few seconds, and then the type of calibration enabled (CAL FACT = factory calibration; CAL USER = user calibration). The instrument is then ready for normal measurement.



**If no probe is connected to one of the input connectors, the BURN message appears in the corresponding line.**



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### 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 HOLD key pressed down during the turning on phase: 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

It enables the display and logging of the maximum (MAX), minimum (MIN) and average (AVG) value of the measurements captured by the probe connected to the instrument, updating them with the acquisition of new samples. The acquisition frequency is once a second.

**In the models with two inputs, the HD2128.1 and HD2128.2**, on activation of the key the two display lines represent the MAX, MIN or AVG values for both inputs. **In the models with one input, the HD2108.1 and HD2108.2**, the display shows the current temperature in the main line and the maximum, minimum or average temperature in the secondary line.

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.

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



### HOLD/▲ key

It increases the current parameter when used in the menu; when used in measurement mode, it freezes the measurement in progress, and upon application of pressure on the key, the message **HOLD** appears in the upper side of the display. To return to the current measurement, press the key again.

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



### UNIT/UserCAL key

During measurement allows selection of the unit of measurement for the input temperature. By repeatedly pressing the function key, the different units of measurement are displayed in sequence:

1. °C            Celsius degrees
2. °F            Fahrenheit degrees
3. °K            Kelvin degrees
4. mV           voltage in mV generated by the probe (hot junction)
5. mV\*°C       voltage in mV equivalent to the read temperature indicated at 0°C.  
Represents the voltage signal reported by the table illustrating the thermocouple.

This setting changes the information displayed and the immediate print of data (SERIAL key). **The data recorded using the LOG function (HD2108.2 and HD2128.2) and sent to the printer or PC through the serial port using the SERIAL function, keep the chosen unit of measurement and display it.**



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## Calibration of the probe and selection of the type of calibration

Simultaneous pressure on the UNIT/UserCal and FUNC/Enter keys starts the calibration procedure of the temperature probe connected to the instrument. Please see the paragraph dedicated to calibration on page 14.

To select the type of calibration (USER=user or FACT= factory) press the UNIT/UserCal and FUNC/Enter keys together, then use the arrows to select the desired item, and confirm using ENTER.



## TC SEL/ESC key

In measurement mode, it selects the type of thermocouple K, J, T, N, R, S, B and E. The selected thermocouple is shown in quotation marks in the upper line.

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.



## A-B key - only for HD2128.1

It displays the difference of the temperatures measured by the probes connected to the inputs A and B, and indicates ERR if one of the probes is in error (not connected, faulty or overrange). To end the function, press the key again.



## A-B/MENU key - only for HD2128.2

In measurement mode, it displays in the secondary line the difference of the temperatures measured by the probes connected to the inputs A and B, and indicates ERR if one of the probes is in error (not connected, faulty or overrange). To end the function, press the key again.

To access the instrument menu, press simultaneously the A-B/Menu and FUNC/Enter keys. Please see the description illustrated below.

The first menu item is accessed by initially pressing on the MENU key (**A-B/Menu + FUNC/Enter in the HD2128.2 model**); press ENTER to go to the following items. To modify the item displayed, use the arrow keys (**▲** and **▼**). By pressing the ENTER key, the current value is confirmed and the display moves on to the next parameter. By pressing the FUNC key, 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 HD2108.2 and HD2128.2)**: 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). All memory data are permanently erased by pressing SERIAL/EraseLOG. By pressing LOG/DumpLOG, the data transfer of the logged data on the serial port is started: the “BAUD-RATE” must have previously been set to the maximum value (please see the menu items described below and the paragraph "STORING AND TRANSFERRING DATA TO A PERSONAL COMPUTER" on page 23).
- 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 HD2108.2 and HD2128.2)**: 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) **YEAR**: to set the current year. Use the arrows to modify this parameter and confirm using ENTER.
- 5) **MNTH (month)**: to set the current month. Use the arrows to modify this parameter and confirm using ENTER.
- 6) **DAY**: to set the current day. Use the arrows to modify this parameter and confirm using ENTER.
- 7) **HOUR**: to set the current hour. Use the arrows to modify this parameter and confirm using ENTER.

- 8) **MIN (minutes)**: to set the current minutes. In order to correctly synchronize the minute, it is possible to reset the seconds by pressing the UNIT key. Use the arrows to set the minutes, press the UNIT key to confirm: this synchronizes the time to the second. Press ENTER to go onto the next item.
- 9) **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 23).



### LOG/DumpLOG key - only HD2108.2 and HD2128.2

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.

The HD2108.2 and HD2128.2 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**.



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### Dump LOG - only HD2108.2

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 23.



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### Dump LOG - only HD2128.2

To start the transfer of the data contained in the instrument internal memory via the serial port, press simultaneously the FUNC/Enter and A-B/Menu keys, and then the LOG/DumpLOG key. Please see the paragraph dedicated to data transfer on page 23.



**SERIAL key - only HD2108.1 and HD2128.1**



**SERIAL/EraserLOG key - only HD2108.2 and HD2128.2**

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.**



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**Erase memory - only HD2108.2**

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



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**Erase memory - only HD2128.2**

Press simultaneously the FUNC/Enter and A-B/Menu keys, and then the SERIAL/ERASE LOG key, to **permanently** erase the data contained in the HD2128.2's memory.

## THE PROBES

The instrument works with thermocouple probes of type K, J, T, N, R, S, B or E. The selection is done using the TC SEL key.

The contacts of the thermocouple probe connector are polarized. They must be inserted on the standard mignon socket located on the instrument in the correct direction. These probes are usually marked with a + and – sign: These symbols must coincide with the corresponding symbols located on the instrument's rubber protection.

The user can choose the unit of measurement for display, printing and logging among the allowed ones: °C, °F or °K. Moreover, the voltage in mV generated by the probe (hot junction) or the voltage in mV equivalent to the read temperature, and indicated at 0°C, can be displayed.

The **HD2128.1** and **HD2128.2** models have two inputs: the upper one is input "A", and the corresponding temperature is displayed in the main line. The lower one is input "B", and the corresponding temperature is displayed in the secondary line.

**If two probes are used, they must be the same type of thermocouple.**

## TEMPERATURE MEASUREMENT

In all versions the thermocouple hot junction is housed in the end part of the probe.

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. The response times are longer than those for liquid measurements.

The temperature measurement by **immersion** is carried out by inserting the probe in the liquid in which the measurement has to be performed; the hot junction is housed in the end part of the probe.

In the temperature measurement by **penetration** the probe tip must be inserted in the material, the hot junction 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. A contact measurement is hard to perform due to various factors: the operator must be experienced in handling the probe and consider all the factors influencing it.

**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.**

## Calibration of the temperature probe on line with the instrument

To calibrate the probes correctly, a knowledge of and abiding by the physical phenomena on which the measurement is based is fundamental: this is the reason why it is recommended to abide by what is reported below carefully, and only to perform new calibrations if technically proficient and using the suitable equipment.

The instrument is provided with the FACT (factory) calibration only. The user is also able to perform a USER calibration of instrument+probe. The calibration information is saved in the instrument memory and not in the probe. The same correction is applied to any probe connected to

the input: it is therefore implied that the USER calibration should only be used with a precise probe: the one used during calibration and no other probe.

To pass from the user to the factory calibration and back again, press the UNIT/UserCal and FUNC/ENTER keys together, then use the arrows to select the type of calibration, and confirm using ENTER.

*Calibration sequence - instrument on line with the probe(s):*

The calibration can be carried out on one or two points **that should differ by at least 10°C** and be included in the probe functioning range.

Insert the probe into a thermostatic bath, the temperature of which is precisely known from a reading taken on a sample reference thermometer. Wait for the measurement to stabilize.

Press simultaneously the UNIT/UserCal and FUNC/ENTER keys, using the arrows select the USER calibration, and confirm with UNIT/UserCal.

**In the HD2128.2 model**, use the arrows to select the input to which the probe being calibrated is connected, choosing the upper connector A or the lower one B: confirm with ENTER.

Use the arrows to select 1 (first calibration point) and confirm using ENTER. The message "UP DOWN 1st MEAS" is scrolled in the comment line. The instrument display shows the measured temperature: use the arrows to correct the indicated value until it coincides with the value measured by the sample reference thermometer.

Confirm by pressing ENTER.

To exit the procedure without performing the second point, select 0 and press ENTER.

To calibrate the second point, select the point 2 using the arrows and press ENTER.


The message "UP DOWN 2nd MEAS" is scrolled in the comment line.

Move the probe to the second thermostatic bath and wait for the measurement to stabilize. The instrument display shows the measured temperature: use the arrows to correct the indicated value until it coincides with the value measured by the sample reference thermometer.

Confirm by pressing ENTER.

The procedure is now complete.

## WARNINGS AND OPERATING INSTRUCTIONS

1. Do not expose the probes to gases or liquids that could corrode the material of the probe. Clean the probe carefully after each measurement.
2. Do not bend the probe connectors or force them upward or downward.
3. Comply with the correct polarity of the probe.
4. Do not bend or force the contacts when inserting the probe connector into the instrument.
5. Do not bend, deform or drop the probes, as this could cause irreparable damage.
6. Always select the most suitable probe for your application.
7. In general, do not use temperature probes in presence of corrosive gases or liquids; the probe external container is made of AISI 316 or INCONEL stainless steel, while the contact probe container is made from AISI 316 or INCONEL stainless steel plus silver. Avoid contact between the probe surface and any sticky surface or substance that could corrode or damage it.
8. To obtain reliable temperature 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. The sensor is not insulated from its 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. The instrument is water resistant and IP66, but should not be immersed in water. Protect the connectors from water by closing them well using their 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.



## 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
<b>ERR</b>	This message appears when a wrong function is called: for example, should the A-B key be pressed or the AVG function be enabled when one of the two probes is not connected.
<b>OVER or UNDR</b>	Measurement overflow: indicates that the probe is measuring a value exceeding the measuring range.
<b>BURN</b>	The probe is disconnected or faulty.
<b>LOG MEM FULL</b>	Memory full; the instrument cannot store further data, the memory space is exhausted.
<b>SYS ERR #</b>	Instrument management program error. Contact the instrument's supplier and communicate the numeric code # reported by the display.
<b>CAL LOST</b>	Program error: it appears after turning on for a few seconds. Contact the instrument's supplier.
<b>CAL FACT</b>	Factory calibration.
<b>CAL USER</b>	User calibration.
<b>BATT TOO LOW CHNG NOW</b>	Indication of insufficient battery charge appearing on turning on. The instrument issues a long beep and turns off. Replace the batteries.

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

Display indications	Explanation
>>> CAL_MODE >>> KEY_UNIT FOR_NEW_USER_CAL_	calibration mode >>> press UNIT to start a new user calibration
>>> LOG_DUMP_or_ERAS	transfer or erase data
1ST_MEAS UP DOWN	correct the first point using the arrows ▲/▼
2ND_MEAS UP DOWN	correct the second point using the arrows ▲/▼
BATT TOO LOW - CHNG NOW	battery discharged - replace it immediately
BAUDRATE >>>	baud rate value
CAL_FACT	factory calibration
CAL_USER	user calibration
COMM_STOP	printing complete
COMM_STRT	printing started
DAY_	day
DUMP_END	data transfer complete
DUMP_In_PROG >>>	data transfer in progress
ERR	error
FUNC_CLR	max, min and average values clearing
FUNC_CLRD	max, min and average values clearing
HOUR	hour
LOG_In_PROG	logging in progress
LOG_MEM_FULL	memory full
LOG_CLRD	memory data cleared
LOG_STOP	logging complete
LOG_STRT	logging started
MIN >>> USE_UNIT_TO_ZERO_SEC	minutes >>> use the UNIT key to reset the seconds
MNTH	month
OVER	maximum limit exceeded
PLS_EXIT >>> FUNC_RES_FOR_FACT ONLY	please exit using ESC >>> function reserved to factory calibration
PRNT AND LOG INTV	printing and logging intervals
PRNT INTV >>>	printing interval
SEL_CHAN	input channel selection
SEL_MEAS 1/2	select the first/second calibration point
SLP_MODE_LOG	turning off during recording mode
SYS_ERR #	program error number #
UNDR	minimum limit exceeded
YEAR	year

## LOW BATTERY WARNING AND BATTERY REPLACEMENT

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



In this case, batteries should be replaced as soon as possible.

If you continue to use it, the instrument can no longer ensure correct measurement. The memory data are maintained.

**If the battery charge level is insufficient, the following message appears when you turn the instrument on:**

**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 HD2108.2 and HD2128.2 are logging and battery voltage falls below the minimum operating level.**

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

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



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

## **MALFUNCTIONING UPON TURNING ON AFTER BATTERY REPLACEMENT**

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

## **WARNING ABOUT BATTERY USE**

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

## **INSTRUMENT STORAGE**

Instrument storage conditions:

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

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

## SERIAL INTERFACE AND USB

All instruments are fitted with an electrically isolated RS-232C serial interface; the HD2108.2 and HD2128.2 also have 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 HD2108.2 and HD2128.2).

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 12). 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	24.20 53.82	Captured measurements (24 characters) for HD2128...
	24.20	Captured measurement (24 characters) for HD2108...

Command	Response	Description
G0	Model HD2128 -2	Instrument model
G1	M=Thermometer 2TC Type K	Model description
G2	SN=12345678	Instrument serial number
G3	Firm.Ver.=01-00	Firmware version
G4	Firm.Date=2004/06/15	Firmware date
G5	cal 0000/00/00 00:00:00	Calibration date and time
G6	Probe=Tc K	Type of probe set
G7	Probe SN=11119999	Probe serial number
G8	Probe cal.=2004/01/12	Probe calibration date
GB	User ID=0000000000000000	User code (set with T2xxxxxxxxxxxxxxxxxx)
GC		Print instrument's heading
LN	&1999	Number of free pages in the flash memory
LD	PRINTOUT OF LOG	Print data logged in flash
LE	&	Erase data in flash memory
K1	PRINTOUT IMMEDIATE MODE	Immediate printing of data
K0		Stop printing data
K4	&	Start logging data
K5	&	Stop logging data
K7	&	Enable REL function
K6	&	Disable REL function
KP	&	Auto-power-off function=ENABLE
KQ	&	Auto-power-off function=DISABLE
RA	& #	Reading of LOG/PRINT interval set
RP	& 600	Battery level (Resolut. 0.01V)
RUA	U= °C	Channel A unit of measurement
RUB	U= °C	Channel B unit of measurement (only HD2128.1 and HD2128.2 models)
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 HD2108.1 and HD2108.2, HD2128.1 and HD2128.2 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. All models can send in real time input measured values directly to a PC, through the PRINT function; the HD2108.2 and HD2128.2 can also store the values measured by using the *Logging* function (LOG key) in their internal memory. If necessary, the data stored in the memory can be transferred to a PC later.

### THE LOGGING FUNCTION - ONLY FOR HD2108.2 AND HD2128.2

The Logging function allows the recording up to 76,000 measurements for the HD2108.2 model and 38,000 (2 channels) for the HD2128.2 model. The time interval between two consecutive measurements can be set from 1 second to 1 hour. The logging starts by pressing the LOG key and ends by pressing the same key again: the data memorized in this way form a continuous block of data.

See the description of the menu items on page 11.

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.

#### *Data transfer to the PC - only HD2108.2*

Press the MENU and then the LOG key to transfer to the PC the data contained in the instrument's memory. During data transfer the display shows the message DUMP; to stop the data transfer press ESC on the instrument or on the PC.

#### *Data transfer to the PC - only HD2128.2*

Press simultaneously the FUNC/ENTER and A-B/MENU keys and then the LOG key to transfer to the PC the data contained in the instrument's memory. 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 HD2108.2 AND HD2128.2

#### *Erase memory - only HD2108.2*

Press the MENU and then the SERIAL key to erase the data contained in the instrument's memory. The instrument starts clearing the internal memory; at the end of the operation, it goes back to normal display.

#### *Erase memory - only HD2128.2*

Press simultaneously the FUNC/ENTER and A-B/MENU keys and then the SERIAL key to erase the data contained in the instrument's memory. 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 logged data remain in memory aside from the batteries 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, HOLD, FUNC (Max-Min-Avg) and SERIAL.
- Pressing the HOLD, REL and FUNC keys has no effect on the logged data if these keys are pressed **after** starting the recording, otherwise the following is valid.
- The recording started with the display in HOLD mode proceeds normally with the actual measured values (that is, not in “HOLD” mode). Only the display is frozen to the values present when the HOLD key was pressed.
- The same is true for the Max-Min-Avg function.
- 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. 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 11). 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, HOLD, FUNC (Max-Min-Avg) and LOG.
- Pressing the HOLD, REL and FUNC keys has no effect on the printed data if these keys are pressed **after** starting the printing, otherwise the following is valid.
- The transfer started with the display in HOLD mode proceeds normally with the actual measured values (that is, not in “HOLD” mode). Only the display is frozen to the values present when the HOLD key was pressed.
- The same is true for the Max-Min-Avg function.
- 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

### HD2108.1 and HD2128.1

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).

### HD2108.2 and HD2128.2

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 measuring 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. Launch 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 HD2108.2 AND HD2128.2

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

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

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

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

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

## NOTES ABOUT WORKING AND OPERATIVE SAFETY

### Authorized use

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

### General safety instructions

This measuring system is constructed and tested in compliance with the EN 61010-1:2010 safety regulations for electronic measuring instruments. It left the factory in a safe and secure technical condition.

The smooth functioning and operational safety of the measuring system can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed during operation.

The smooth functioning and operational safety of the instrument can only be guaranteed under the environmental and electrical operating conditions that are in specified in chapter "TECHNICAL CHARACTERISTICS".

Do not use or store the product in places such as listed below:

- Rapid changes in ambient temperature which may cause condensation.
- Corrosive or inflammable gases.
- Direct vibration or shock to the instrument.
- Excessive induction noise, static electricity, magnetic fields or noise.

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

### Obligations of the purchaser

The purchaser of this measuring system must ensure that the following laws and guidelines are observed when using dangerous substances:

- EEC directives for protective labour legislation
- National protective labour legislation
- Safety regulations

## INSTRUMENT TECHNICAL CHARACTERISTICS

### *Instrument*

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

### *Operating conditions*

Working temperature	-5...50°C
Storing temperature	-25...65°C
Working relative humidity	0...90%RH without condensation
<b>Protection degree</b>	<b>IP66</b>

### *Measuring units*

°C - °F - °K - mV - mV\*°C

### *Power Supply*

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

### *Security of memorized data*

Unlimited, independently of battery charge conditions

### *Time*

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

### *Measured values storage*

Type - model <b>HD2108.2</b>	2000 pages of 38 samples each
Quantity - model <b>HD2108.2</b>	Total of 76,000 samples
Type - model <b>HD2128.2</b>	2000 pages of 19 samples each
Quantity - model <b>HD2128.2</b>	38,000 pairs of samples
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 **HD2108.2** and **HD2128.2**

Type 1.1 - 2.0 electrically isolated

### Connections

Input for probes 2-pole female polarized standard mignon connector

RS232 serial interface 8-pole MiniDin connector

USB interface (only **HD2108.2** and **HD2128.2**) Mini-USB type B connector

Mains adapter (cod. **SWD10**) 2-pole connector (positive at centre)

### Measurement of temperature by Instrument

TC measurement range: K -200 ... +1370°C

TC measurement range: J -100 ... +750°C

TC measurement range: T -200 ... +400°C

TC measurement range: N -200 ... +1300°C

TC measurement range: R +200 ... +1480°C

TC measurement range: S +200 ... +1480°C

TC measurement range: B +200 ... +1800°C

TC measurement range: E -200 ... +750°C

### Resolution

**0.05°C up to 199.95°C**  
**0.1°C from 200.0°C to full scale**

### Instrument accuracy

Thermocouple K  $\pm 0.1^\circ\text{C}$  up to 600°C  
 $\pm 0.2^\circ\text{C}$  over 600°C

Thermocouple J  $\pm 0.05^\circ\text{C}$  up to 400°C  
 $\pm 0.1^\circ\text{C}$  over 400°C

Thermocouple T  $\pm 0.1^\circ\text{C}$

Thermocouple N  $\pm 0.1^\circ\text{C}$  up to 600°C  
 $\pm 0.2^\circ\text{C}$  over 600°C

Thermocouple R  $\pm 0.25^\circ\text{C}$

Thermocouple S  $\pm 0.3^\circ\text{C}$

Thermocouple B  $\pm 0.35^\circ\text{C}$

Thermocouple E  $\pm 0.1^\circ\text{C}$  up to 300°C  
 $\pm 0.15^\circ\text{C}$  over 300°C

**The precision only refers to the instrument. Error due to the thermocouple or to the cold junction reference sensor is not included.**

Temperature drift @ 20°C 0.02%/°C

Drift after 1 year 0.1°C/year

### Tolerance of the thermocouple probes:

The tolerance of a type of thermocouple corresponds to the maximum acceptable deviation from the e.m.f. of any thermocouple of that type, with reference junction at 0°C. The tolerance is expressed in degrees Celsius, preceded by the sign.

The tolerances refer to the operating temperature expected for the thermocouple, in agreement with the diameter of the thermoelements.

## TOLERANCE CLASSES OF THERMOCOUPLES

Tolerances according to **IEC 60584-2** standard.

The values refer to thermocouples with **reference junction at 0 °C**.

Type of thermocouple	Tolerance class 1		Tolerance class 2		Tolerance class 3	
	Temperature range (°C)	Tolerance (°C)	Temperature range (°C)	Tolerance (°C)	Temperature range (°C)	Tolerance (°C)
<b>B</b>	---	---	+600...+1700	$\pm 0.0025 \cdot t$	+600...+800	$\pm 4$
	---	---	---	---	+800...+1700	$\pm 0.005 \cdot t$
<b>E</b>	-40...+375	$\pm 1.5$	-40...+333	$\pm 2.5$	-167...+40	$\pm 2.5$
	+375...+800	$\pm 0.004 \cdot t$	+333...+900	$\pm 0.0075 \cdot t$	-200...-167	$\pm 0.015 \cdot t$
<b>J</b>	-40...+375	$\pm 1.5$	-40...+333	$\pm 2.5$	---	---
	+375...+750	$\pm 0.004 \cdot t$	+333...+750	$\pm 0.0075 \cdot t$	---	---
<b>K, N</b>	-40...+375	$\pm 1.5$	-40...+333	$\pm 2.5$	-167...+40	$\pm 2.5$
	+375...+1000	$\pm 0.004 \cdot t$	+333...+1200	$\pm 0.0075 \cdot t$	-200...-167	$\pm 0.015 \cdot t$
<b>R, S</b>	0...+1100	$\pm 1$	0...+600	$\pm 1.5$	---	---
	+1100...+1600	$\pm [1+0.003 \cdot (t-1100)]$	+600...+1600	$\pm 0.0025 \cdot t$	---	---
<b>T</b>	-40...+125	$\pm 0.5$	-40...+133	$\pm 1$	-67...+40	$\pm 1$
	+125...+350	$\pm 0.004 \cdot t$	+133...+350	$\pm 0.0075 \cdot t$	-200...-67	$\pm 0.015 \cdot t$

Note: t = temperature of measurement junction in °C.

## ORDER CODES

<b>HD2108.1</b>	The kit is composed of the instrument HD2108.1 <b>with one input</b> , 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. <b>The probes and the cables must be ordered separately.</b>
<b>HD2108.2</b>	The kit is composed of the HD2108.2 <b>with one input, datalogger</b> , 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. <b>The probes and the cables must be ordered separately.</b>
<b>HD2128.1</b>	The kit is composed of the instrument HD2128.1 <b>with two inputs</b> , 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. <b>The probes and the cables must be ordered separately.</b>
<b>HD2128.2</b>	The kit is composed of the HD2128.2 <b>with two inputs, datalogger</b> , 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. <b>The probes and the cables must be ordered separately.</b>
<b>HD2110CSNM</b>	Connection cable 8-pole MiniDin – Sub D 9-pole female for RS232C.
<b>C.206</b>	Connection cable 8-pole MiniDin – USB type A. With integrated RS232/USB converter.
<b>CP23</b>	Connection cable Mini-USB type B – USB type A.
<b>DeltaLog9</b>	Software for transfer and management of the data on PC using Windows (from 98) operating systems.
<b>SWD10</b>	Stabilized power supply at 100-240Vac/12Vdc-1A mains voltage.
<b>HD40.1</b>	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.
<b>BAT.40</b>	Spare battery pack for HD40.1 printer with in-built temperature sensor.
<b>RCT</b>	The kit includes 4 thermal paper rolls 57mm wide and 32mm in diameter.

## THERMOCOUPLE PROBES

The thermocouple probes can be connected to all instruments using the standard miniature connector, which can be obtained from the price list.

**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.**

## NOTES

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## WARRANTY

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

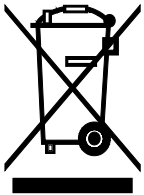
The manufacturer repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the "Convention on Contracts for the International Sales of Goods" apply.

## TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased.

We reserves the right to change technical specifications and dimensions to fit the product requirements without prior notice.

## DISPOSAL INFORMATION



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

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

**CE RoHS**

