

Operating manual

Anemometers / thermometers
HD2103.1 – HD2103.2



Companies / Brands of GHM

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INTRODUCTION

The **HD2103.1** and **HD2103.2** are portable instruments with a large LCD display. They are designed for use in the fields of air conditioning, heating, ventilation and environmental comfort. They use hot-wire or vane probes to measure air speed, flow rate, and temperature inside pipelines and vents. Temperature only is measured by immersion, penetration or air contact probes. The temperature sensor used can be chosen from the Pt100, Pt1000 or Ni1000. The probes are fitted with the SICRAM module, with the factory calibration settings already being memorized inside.

The HD2103.2 instrument is a **data logger**. It memorizes up to 38,000 samples which can be transferred from the instrument connected to a PC via the RS232C serial port or USB 2.0 port. The memorization interval, printing, and baud rate can be configured using the menu.

The HD2103.1 and HD2103.2 models are fitted with an RS232C serial port and can transfer the acquired measurements in real time to a PC or to a portable printer.

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 instruments have IP66 protection degree.

This manual describes the HD2103.1 and HD2103.2 models: if not otherwise specified, the description is intended to be applicable to both models.

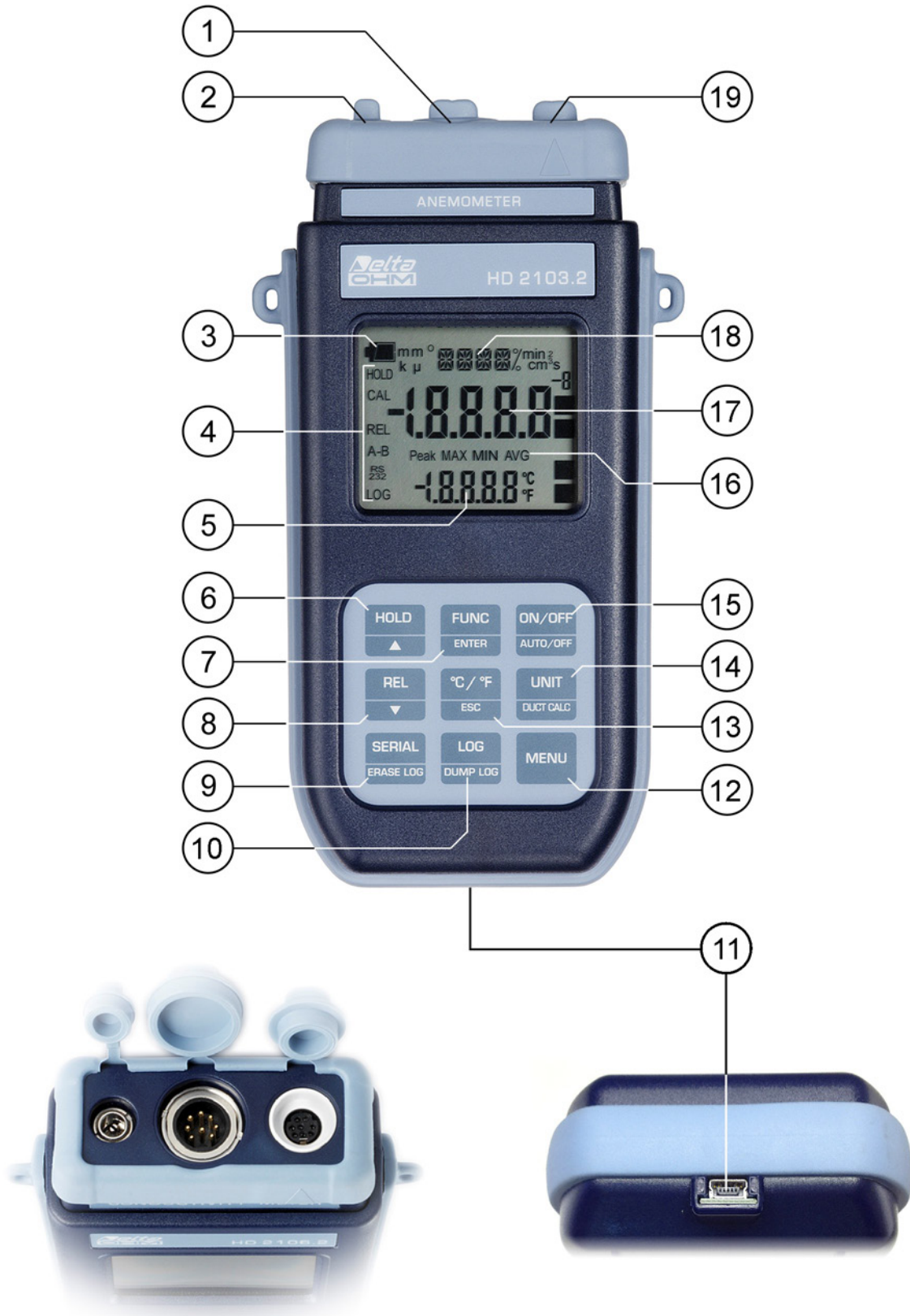
Thermo-Anemometer HD2103.1



HD2103.1

1. Input for probes, 8-pole DIN45326 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: during normal operation displays the maximum (MAX), the minimum (MIN) and the average (AVG) of current measurements; in the menu, confirms the current selection.
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 data transfer to the serial communication port.
10. **MENU** key: allows access to and exit from the menu.
11. **°C/°F-ESC** key: changes the unit of measurement for temperature between degrees Celsius and Fahrenheit; in the menu, cancels the operation in progress without making changes.
12. **UNIT/DUCT CALC** key: during normal operation, selects the unit of measurement for the main variable. When pressed together with the FUNC key, starts the calculation procedure for the duct flow rate.
13. **ON-OFF/AUTO-OFF** key: turns the instrument on and off; when pressed together with the HOLD 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).

Thermo-Anemometer HD2103.2



HD2103.2

1. Input for probes, 8-pole DIN45326 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: during normal operation displays the maximum (MAX), the minimum (MIN) and the average (AVG) of current measurements; in the menu, confirms the current selection.
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 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. **°C/°F-ESC** key: changes the unit of measurement for temperature between degrees Celsius and Fahrenheit; in the menu, cancels the operation in progress without making changes.
14. **UNIT/DUCT CALC** key: during normal operation, selects the unit of measurement for the main variable. When pressed together with the FUNC key, starts the calculation procedure for the duct flow rate.
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).

KEYBOARD AND MENU DESCRIPTION

Foreword

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

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

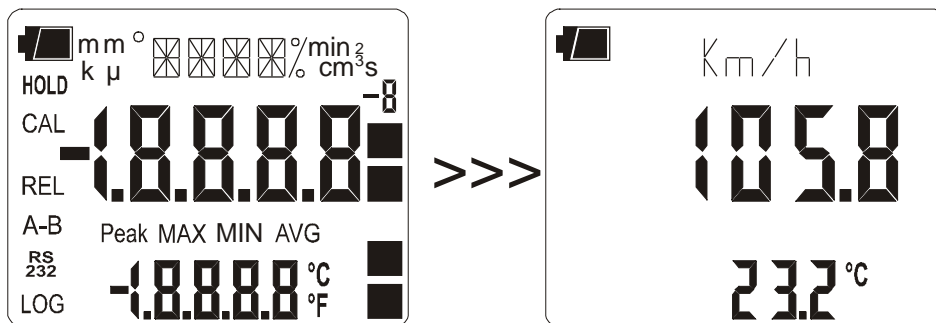
The pressing of a key is accompanied by a short confirmation beep: a longer beep sounds if the wrong key is pressed.

Each key specific function is described in detail below.



ON-OFF/Auto-OFF key

The instrument is turned on and off using the ON/OFF key. The turning on enables all display segments for a few seconds, starts an auto-test including the detection of the probe connected to the input, and sets the instrument ready for normal measurement.



During turning on, should no probes be connected, the message "NO_PRBE_SER_NUM" is displayed in the line of symbols for a few seconds, and in the main line a series of dashes appears while the ERR message replaces the temperature.

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

Replace the probes when the instrument is off.



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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 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 measurements captured by the probe connected to the instrument, updating them with the acquisition of new samples. The acquisition frequency is once a second.

The calculation is performed on the variable appearing on the display upon pressure of the FUNC key: by changing the variable or unit of measurement, the Max, Min and Avg values are cleared.

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.

In the menu, the ENTER key confirms the current parameter and then goes to the next one. Pressed together with the UNIT/DuctCalc key, enables the flow rate calculation (please see the UNIT key description).

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 HOLD key down (please see the ON-OFF key description).

During calculation of the flow rate (Duct Calc), pressing this key adds a new sample.



UNIT/DuctCalc key

In measurement mode, it allows selection of the unit of measurement of the main input quantity (shown in the central line of the display). By repeatedly pressing the function key, the different units of measurement are shown in sequence:

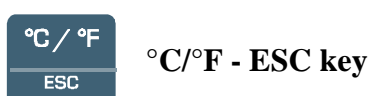
- wind speed: m/s - km/h - ft/min - mph (miles/hour) - knots
- calculated flow rate: l/s (litres/s) - m³/s - m³/min - m³/h - ft³/s - ft³/min
- the apparent temperature WCT (wind chill equivalent temperature)

The WCT parameter represents the apparent temperature in presence of cold wind and is determined up to an actual temperature of 10°C. Above this limit the display shows an error (ERR).

This setting changes the information displayed and the immediate print of data (SERIAL key). **The data recorded using the LOG function (HD2103.2) and those sent to the printer or PC through the serial port using the SERIAL function (HD2103.1 and HD2103.2), keep the chosen unit of measurement and display it.**



Simultaneously pressing the FUNC and UNIT keys starts the spatial averaging calculation, using the unit of measurement selected with the UNIT key. It is possible to calculate the spatial averaging, of the wind speed or flow rate i.e. across a section of a duct. Please see the paragraph dedicated to wind speed measurement on page 14.



Changes the unit of measurement for the temperature between Centigrade or Fahrenheit. When used in the menu, it clears or cancels the active function. It allows exiting the spatial averaging calculation (Duct Calc).



In measurement mode, it displays the difference between the current value and that measured on pressing the key for both measurements - main and secondary. 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.



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, the setting is cancelled by pressing the ESC key.

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

The menu items are listed in this order:

- 1) **Probe type:** the message ">>>_PRBE_TYPE" is scrolled in the comment line. The main line in the center of the display shows the type of probe connected to the instrument. The following probes can be connected to the input:
 - hot-wire probes complete with SICRAM module
 - vane probes complete with SICRAM module

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

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

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

- 2) **SECT m² - SECT inch²**: this parameter defines a duct's **section area** for flow rate calculation. It is expressed in m² or inch². To change the unit of measurement, press UNIT. Use the arrows and confirm with ENTER.
Please see the paragraph dedicated to wind speed measurement on page 14.
- 3) **AVG TIME SECS: time interval according to which the moving average is calculated**, in seconds, during measurement of the flow. The value ranges from 1 (no average) to 99 seconds. Please see the paragraph dedicated to wind speed measurement on page 14.
- 4) **Management of memorized data (only HD2103.2)**: 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 34).
- 5) **Sleep_Mode_LOG (Automatic turning off during recording) (only HD2103.2)**: this function controls the instrument's automatic turning off during logging, occurring between the capture of a sample and the next one. When the interval is lower than 60 seconds, the instrument will always remain on. With intervals greater than or equal to 60 seconds, it is possible to turn off the instrument between loggings: it will turn on at the moment of sampling and will turn off immediately afterwards, thus increasing the battery life. Using the arrows select **YES** and confirm using **ENTER** in order to enable the automatic turning off, select **NO** and confirm to disable it and keep the instrument on continuously.
Note: even if **Sleep_Mode_LOG=YES** is selected, the instrument does not turn off for less than one minute intervals.
- 6) **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.

- 7) **YEAR:** to set the current year. Use the arrows to modify this parameter and confirm using ENTER.
- 8) **MNTH (month):** to set the current month. Use the arrows to modify this parameter and confirm using ENTER.
- 9) **DAY:** to set the current day. Use the arrows to modify this parameter and confirm using ENTER.
- 10) **HOURL:** to set the current hour. Use the arrows to modify this parameter and confirm using ENTER.
- 11) **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 current minute plus one, and as soon as that minute is reached press UNIT: this synchronizes the time to the second. Press ENTER to go onto the next item.
- 12) **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 34).



LOG/DumpLOG key - only HD2103.2

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

To end the logging, press LOG.

The HD2103.2 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**.



>>>



Dump LOG - only HD2103.2

Press the MENU key until the ">>>_LOG_DUMP_or_ERAS" item is displayed and then press on the LOG key: the transfer of the data contained in the instrument internal memory via the serial port is started.

Please see the paragraph dedicated to data transfer on page 34.



SERIAL key - only HD2103.1



SERIAL/EraserLOG key - only HD2103.2

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 HD2103.2

Press the MENU key until the “>>>_LOG_DUMP_or_ERAS” item is displayed and then press on the SERIAL/EraserLOG key: this clears **permanently** all the data contained in the instrument’s memory.

THE PROBES

The instrument works with hot-wire, vane and temperature probes fitted with the SICRAM module. It works also with temperature probes with 4-wire Pt100, 2-wire Pt1000 or Ni1000 sensors.

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

The temperature probes without SICRAM module are not automatically detected by the instrument and must be set up in the **Probe type** menu item (please see the description of the menu on page 10).

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

WIND SPEED MEASUREMENT

The AP471 and AP472 series probes measure the incident wind speed and flow rate; some also measure air temperature. The hot-wire measurement principle is used for the AP471 series and the vane principle for the AP472 series. On request, the probes of the AP471 and AP472 series can be fitted with a telescopic rod that eases measurements in areas difficult to reach (for example vents).

The typical applications are wind speed and flow rate checks in air conditioning, heating and cooling systems, or environmental comfort determination, etc.

Hot-wire probes are usually employed for precise measurements with low-medium wind speeds (up to 10 m/s), the vane probes with speeds from 5 to 50m/s.

In addition, the measured fluid temperature must be considered: the probes measure air flows at 80°C maximum temperature.

The measurements provided by the instrument using the probes are: wind speed, flow rate, and air temperature.

Connecting the probe and turning the instrument on, it is possible to choose the unit of measurement for the value displayed in the main line by using the UNIT key.

The following units are available:

- for wind speed: m/s - km/h - ft/min - mph (miles/hour) - knots;
- for air temperature: °C and °F;
- for flow rate: l/s (litres/s) - m³/s - m³/min - m³/h - ft³/s - ft³/min.

Also the WCT apparent temperature in the presence of air flows is calculated.

Flow rate measurement

The flow rate measurement requires knowledge of the duct or vent area orthogonal to the flow: the menu items indicated by "SECT m2" and "SECT INC2" define the section area m² or inch².

To set the area value, select the "SECT m2" menu item, and using the arrows, set the desired value. Confirm the selection by pressing the ENTER key.

To set the measurement in inch^2 , select the "SECT m2" menu item, and using the UNIT key, change the unit of measurement from m^2 to inch^2 . Proceed to enter the data using the arrows: confirm with ENTER.

The area comprised must be between 0.0001m^2 (1cm^2) and 1.9999m^2 .

After input of the duct's section area, select the unit of measurement for the flow rate by using the UNIT key: l/s - m^3/s - m^3/min - m^3/h - ft^3/s - ft^3/min . **The display shows the calculated flow rate on the section set** with the parameters "SECT m2" and "SECT INC2".

To obtain the correct flow rate measurement, the fact that the air speed is not constant on the section but varies from point to point needs to be considered, therefore an **average** speed over the entire section is required. Furthermore, the speed varies through time at the same point.

This is particularly true when the surface considered is wide or when turbulence is generated, near a grid or diffuser. The anemometers provide some solutions in order to obtain correct measurements even in presence of these disturbance phenomena.

1) *Spatial averaging (Duct Calc function)*

It is always best to perform the measurements at different points and consider the average value as the valid data. Using the *Duct Calc* function (sub-function of the UNIT key), the HD2103.1 and HD2103.2 anemometers can capture more than one measurement and supply the maximum, average, and minimum value. In particular, the average value (AVG) is the most important as it supplies the average speed, and therefore the calculated flow rate **along the entire section** and not on a single measurement point.

Procedure:

Using the UNIT key, select the **speed** or **flow rate** unit of measurement for which you wish to obtain the average, maximum, and minimum.

Enable the calculation function by pressing simultaneously the DUCT CALC and FUNC keys: the central line of the display shows the instantaneous value of the selected variable (**speed or calculated flow rate**) while the lower line figure indicates the number of times the measurement has been logged.

The measurement can be interrupted and there are no time limits to abide by between two subsequent measurements. The captured values are not erased, so it is possible to get some samples, turn the instrument off and later turn it back on again to proceed with the logging of more samples without losing the measurements already carried out. The maximum number of samples is 99.

To reset the calculation, press FUNC until the message " CLR FUNC " appears, then use the arrows to select YES and confirm using ENTER.

Position the probe in the first measurement point and press HOLD/▲ to capture the first point value.

Repeat the same procedure with all the other points that you feel it is necessary to capture, by pressing HOLD/▲ each time: the indicator will provide the total number of acquired samples. After recording the first sample or at the end of the capture, press FUNC/ENTER. The MAX, MIN and average values of the chosen quantity, that is, **the speed or calculated flow rate on the entire section** will be displayed, according to the variable selected at the beginning of the measurement.

To end the function, press ESC.

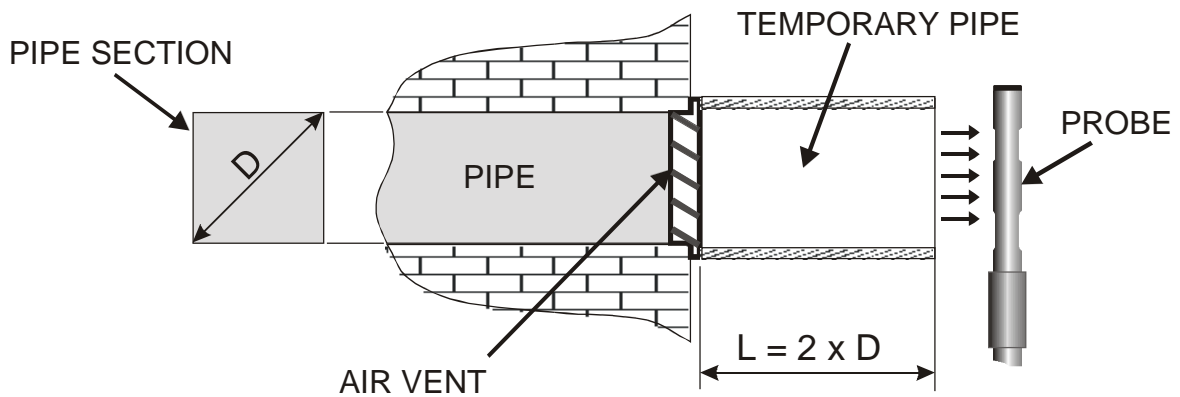
Generally, the greater the number of captured measurements (maximum 99) the greater the accuracy of the result obtained.

2) Moving average

The Duct Calc function provides a spatial averaging of the captured values and therefore compensates the speed differences between one point and another in the duct section. There is also another source of errors due to the variation of the flow **in time**: that is, the flow is not constant but increases or decreases **in the same point**. To compensate for this second source of instability, it is possible to get a temporal moving average of the last **n** measurements capture: with $n > 1$, the displayed value will not be the single captured value but the continuously updated current average of the last **n** measurements.

To set the “**n**” value, use the **AVG TIME SECS** menu function: by using the arrows select the desired **n** value and confirm with ENTER. “**n**” can be set from 1 (no average) to 99.

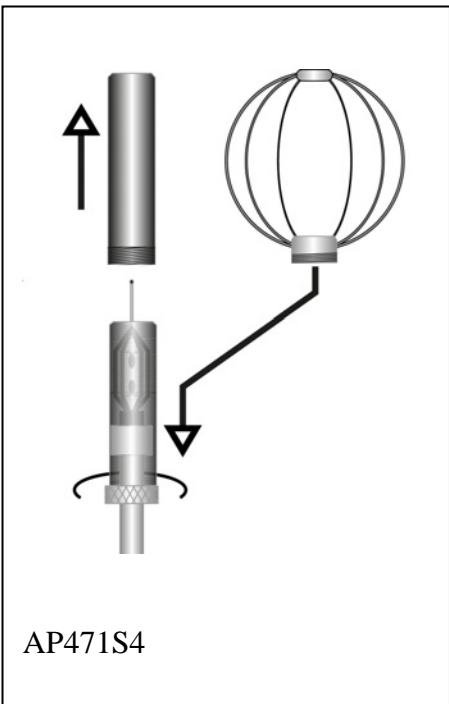
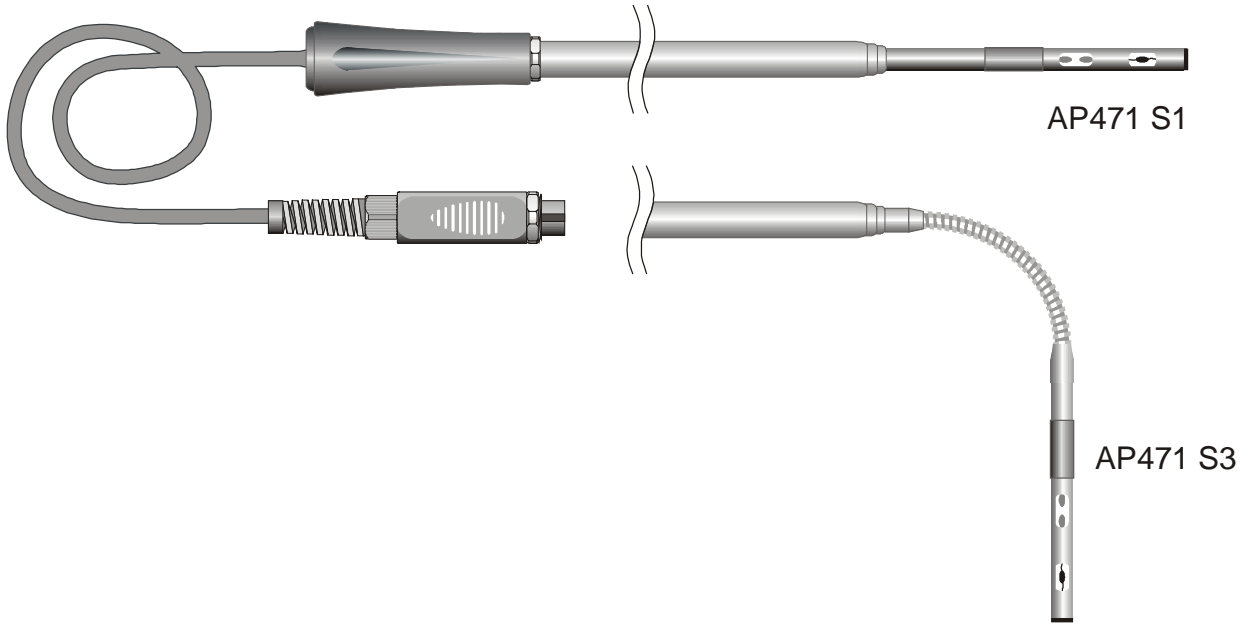
Note: the presence of grids or diffusers with tilting fins introduces errors in the measurement of the flow due to the existing turbulence. These are generated because part of the flow, when meeting the obstacle (fin), is slowed down when the rest of the flow proceeds at maximum speed. In this case, to obtain a correct measurement, it is better to temporarily insert a duct after the grid with a length at least double that of the grid's diagonal and perform the measurements at its end. The area considered for the flow rate calculation will be that of the provisional duct placed between the grid and the probe.



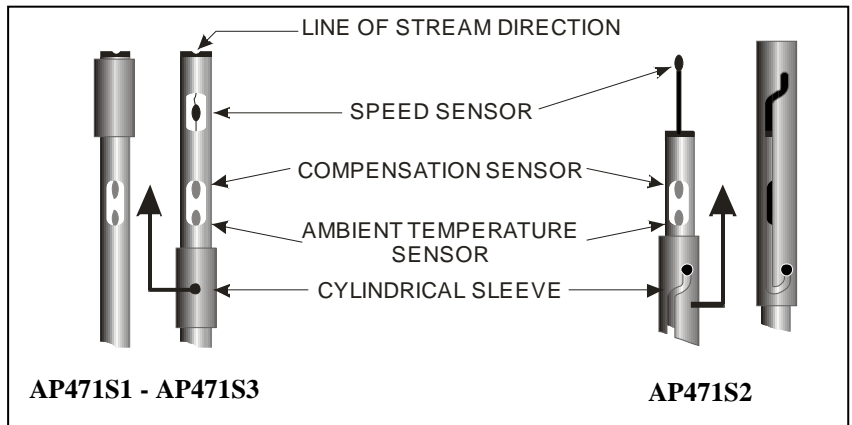
AP471S1 - AP471S2 - AP471S3 - AP471S4

HOT-WIRE WIND SPEED MEASUREMENT PROBES COMPLETE WITH SICRAM MODULE

The AP471S1 and AP471S3 probes measure incident air flows up to 40m/s. The AP471S2, AP471S4 probes are fitted with an omnidirectional sensor allowing measurement of speeds up to 5m/s in any direction of the air flow incident on the probe. The AP471S4 probe is fitted with support base and sensor protection. The wind speed measurement is compensated for according to temperature within the range of 0...+80°C. The probes AP471S1, AP471S2, and AP471S3 measure the environment temperature in the range of -25°C...+80°C; AP471S4 in the range 0°C...+80°C. The AP472S... modules are calibrated in the factory; no calibration is required by the user.



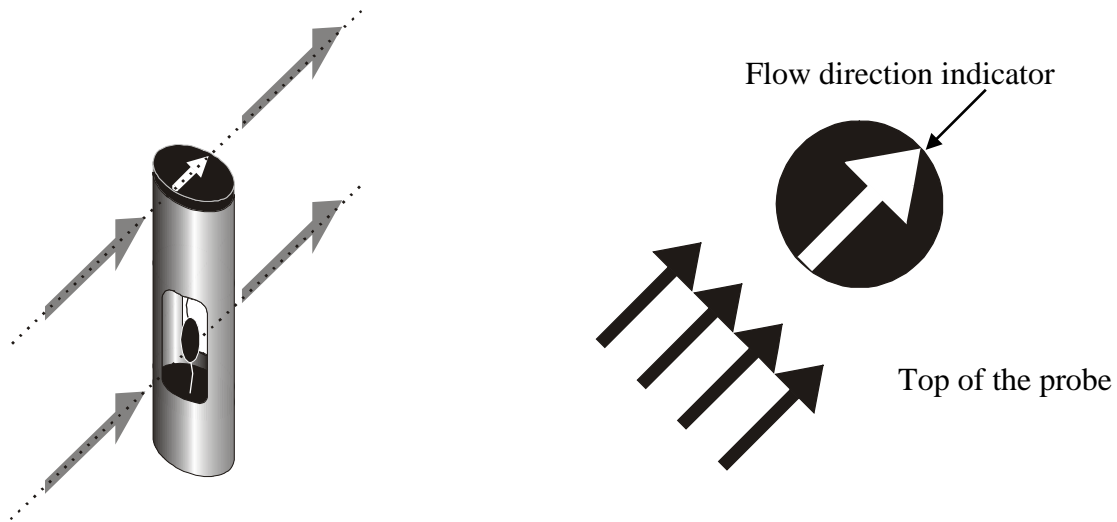
The AP471S1, S2 and S3 probes are fitted with a cylindrical protection screen that can slide longitudinally over a groove. The screen has two end-of-travel positions that block it in measurement condition (completely low) or rest condition (completely high). To reduce the space occupied when not used, the AP471S4 is supplied with a protection cylinder that can be screwed on the probe's head.



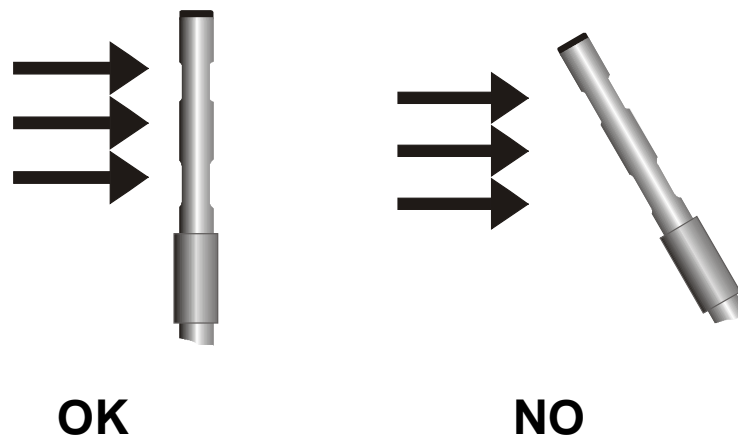
Operation

Where present, extend the telescopic rod to the necessary length paying attention to the cable so that it can slide freely and without strain.

Uncover the sensor and introduce the probe in the air flow being measured, maintaining the arrow at the top of the probe parallel to the flow, as indicated in the figures.



The probe should be maintained orthogonal to the flow and not tilted in relation to it:



Proceed with measurement following the instructions provided in this chapter.

Care and maintenance of the probes

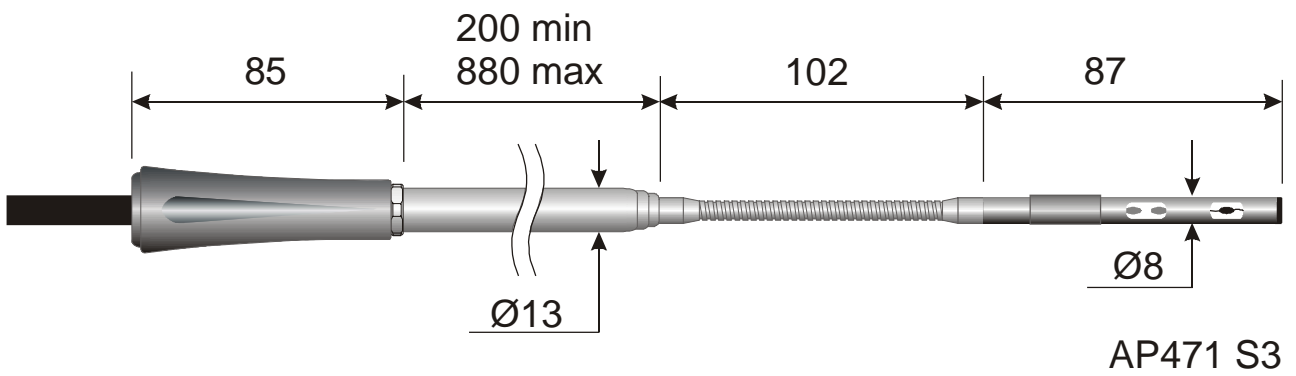
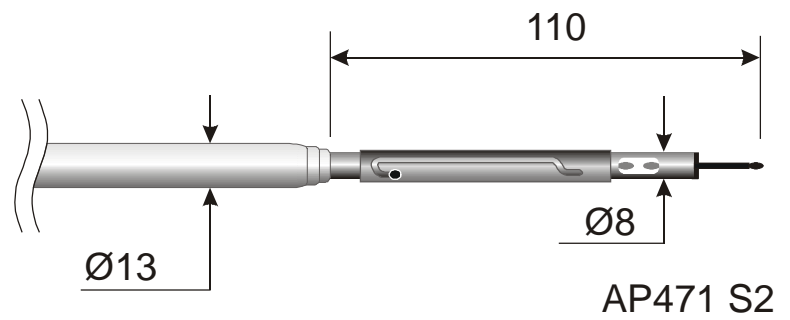
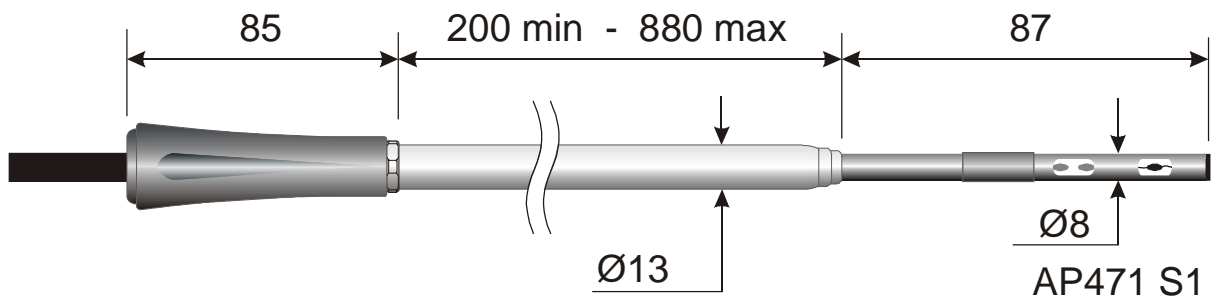


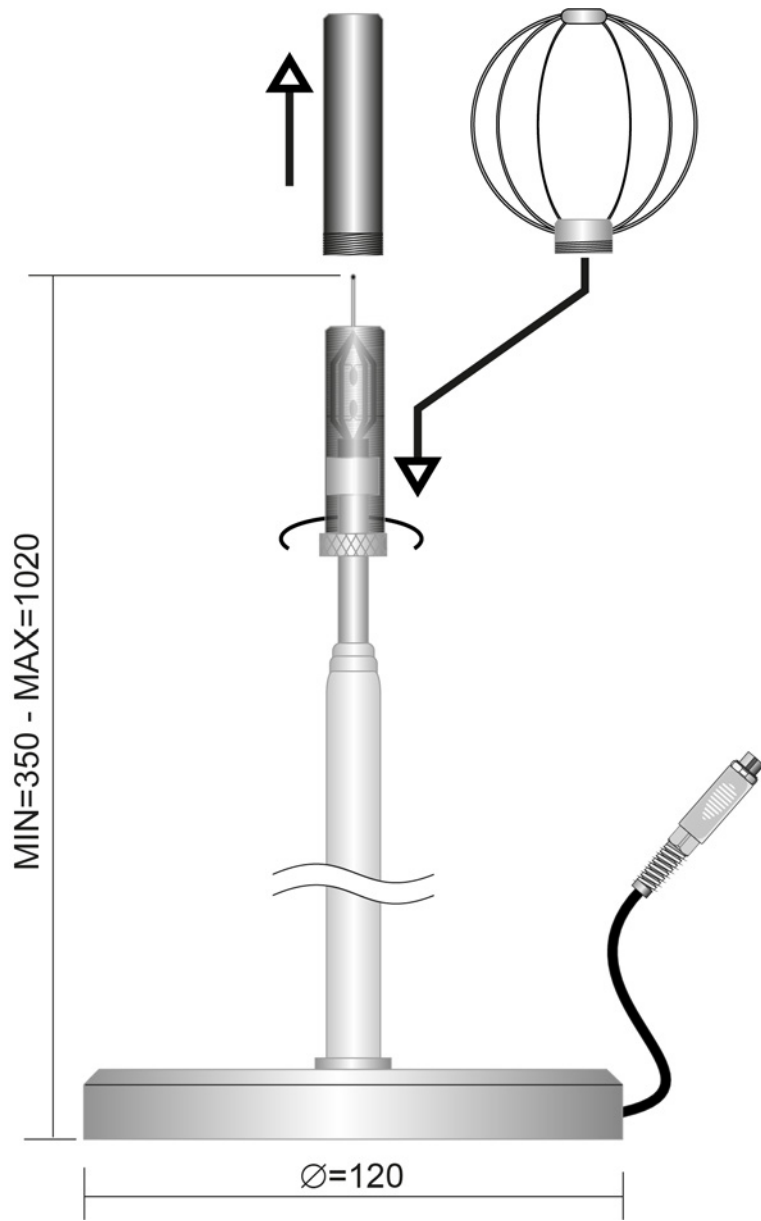
The speed sensor of the AP471S... probes is heated and, **in the presence of gas vapours, could trigger a fire or explosion. Do not use the probe in the presence of inflammable gases. Ensure that no gas or explosive vapor leakage is present in the measurement spaces.**

The probe is very delicate and should be handled with extreme care. Even a simple collision, especially of the omnidirectional probes that have an uncovered sensor, could render the probe unusable. After measurement, the sensor set on the probe head must be protected with the supplied metallic screen or threaded cylinder. During use, the AP471S4 omnidirectional probe must be protected with the special metallic grid. During transportation, the sensor must be closed into a cylinder screwed on the end part of the probe.

Do not let fingers touch the sensors. Use only alcohol to clean the probe.

Dimensions





AP471S4

AP472S1 - AP472S2

VANE WIND SPEED MEASUREMENT PROBES COMPLETE WITH SICRAM MODULE

The AP472S1 and AP472S2 vane probes measure the incident wind speed and flow rate. The probe AP472S1 measures also the temperature using a thermocouple of type K. On request, they can be fitted with a telescopic rod that eases measurements in areas difficult to reach (for example vents). The probes' speed and temperature measurement ranges are outlined in the table below:

| | Speed (m/s) | Temperature (°C) | Temperature sensor | Diameter (mm) |
|----------------|-------------|------------------------------------|--------------------|---------------|
| AP472S1 | 0.6...25 | -25...+80 | Thermocouple K | 100 |
| AP472S2 | 0.5...20 | -25...+80 (working temperature) | ---- | 60 |

Greater diameters are suitable for flow measurements in the presence of turbulence with medium-low air speeds (i.e. at the exit of the ducts). Lower diameters are suitable in applications where the probe surface must be much smaller than the duct cross section within which the measurement is carried out, i.e. ventilation ducts.

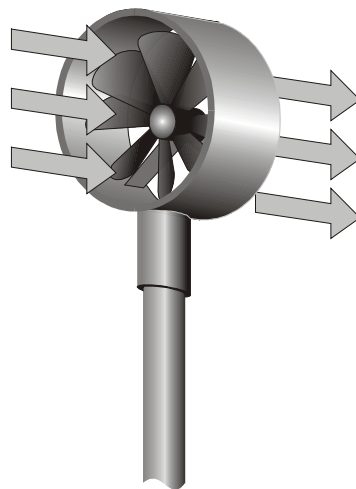
Calibration

The AP472S1 and AP472S2 probes are calibrated in the factory; no calibration is required by the user.

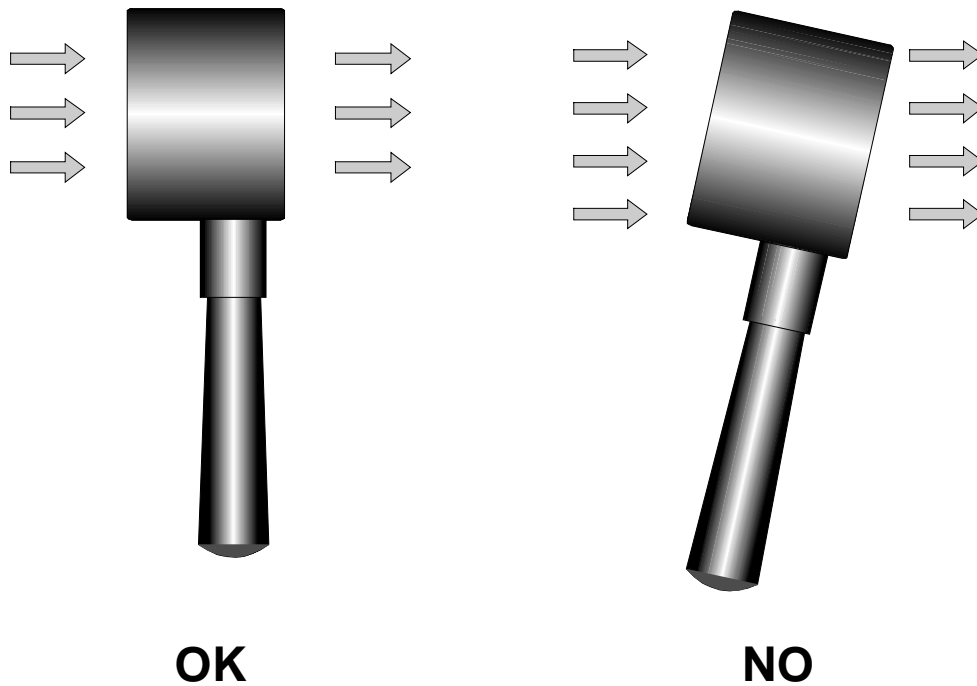
Operation

Where present, extend the telescopic rod to the necessary length paying attention to the cable so that it can slide freely and without strain.

Introduce the probe in the air flow being measured, maintaining the arrow at the top of the probe parallel to the flow as indicated in the following figure.



The probe should be maintained orthogonal to the flow and not tilted in relation to it



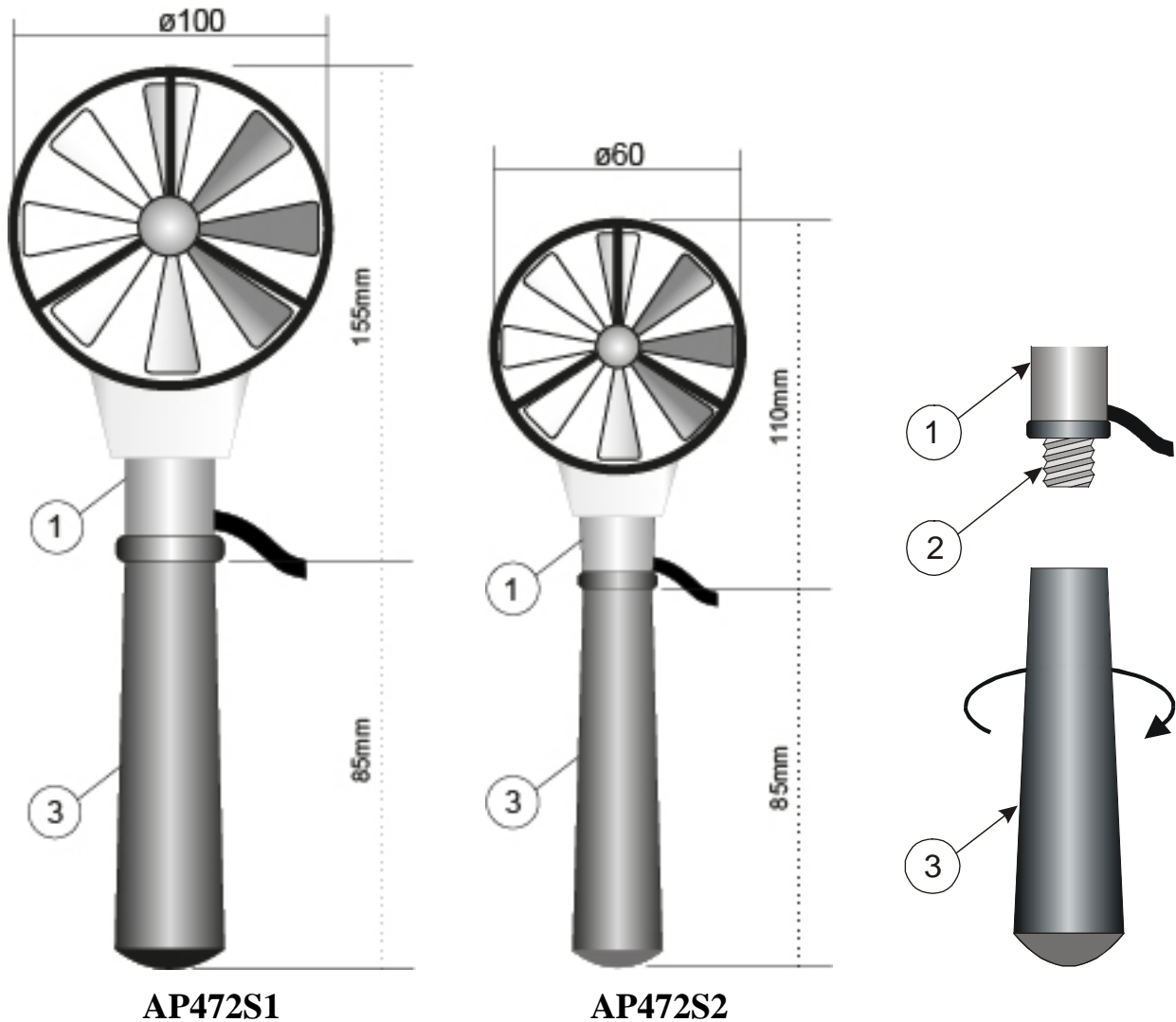
The probe is correctly positioned in relation to the air-flow when the value measured is the maximum possible.

Proceed with measurement following the instructions provided in this chapter.

Care and maintenance of the probes

The probe performance, mainly at low speeds, largely depends on the very slow friction of the vane on its own axis. In order not to compromise this characteristic, it is recommended that forcing is avoided, as well as blocking or rotating the vane with the fingers, and if possible, avoid inserting it in air flows that could spoil the probe.

Dimensions



To mount the telescopic rod on the probes, unscrew the handle (3) holding the probe body still in the point (1). Screw the rod end on the screw (2). The handle (3) is screwed on the telescopic rod.

WCT index

With particularly cold climatic conditions, the effect of wind speed on the perceived temperature is not negligible: i.e. a temperature of -16°C in presence of wind at 30km/h produces on the human body the same sensation of a -37°C temperature in absence of wind.

When measuring the apparent temperature, the WCT parameter (wind chill equivalent temperature) represents the apparent temperature in presence of cold wind and is determined up to an actual temperature of $+10^{\circ}\text{C}$; above this limit the display shows an error (ERR).

The WCT value is displayed in the main line; the secondary line shows the actual temperature.

DIRECT INPUT Pt100, Pt1000 AND Ni1000 TEMPERATURE PROBES

The instrument accepts the input of Platinum temperature probes with resistances of 100 Ω and 1000 Ω , as well as Nickel temperature probes with a 1000 Ω resistance.

The Pt100 are connected to 4 wires, the Pt1000 and Ni1000 to 2 wires, with the excitation current chosen minimizing the sensor self-heating effects.

All probes with SICRAM module are calibrated in the factory, the 2 or 4-wire probes with direct input are **checked for conformity with class A tolerance** according to norm IEC751 - BS1904 - DIN43760.

For the temperature probes without SICRAM module (Pt100 4 wires, Pt1000 and Ni1000) the model configuration is required (please see the description of the Probe Type menu on page 10).

The $^{\circ}\text{C}$ or $^{\circ}\text{F}$ unit of measurement can be chosen for display, printing and logging using the $^{\circ}\text{C}/^{\circ}\text{F}$ -ESC key.

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

How to measure

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

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

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

In order to perform a correct **contact** measurement, the measurement surface must be even and smooth, and the probe must be perpendicular to the measurement plane.

So as to obtain the correct measurement, the insertion of a drop of oil or heat-conductive paste is useful (do not use water or solvents). This method also improves the response time.

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

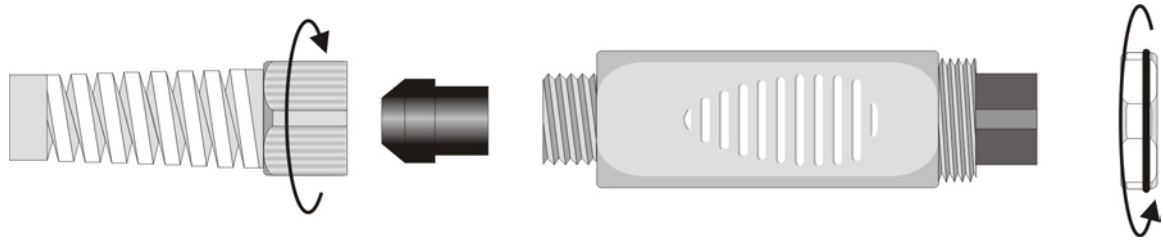
All Delta Ohm probes are provided with a connector. The HD2103.1 and HD2103.2 instruments also work with 4-wire direct Pt100, Pt1000 and Ni1000 probes manufactured by other producers; the TP47 connector is used for the instrument connection to which the probe's wires should be welded.



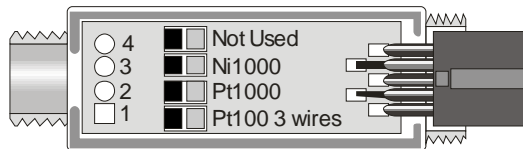
The instructions to connect the Platinum or Nickel probe to the module are provided below. The module is supplied complete with fairlead and gasket for 5mm maximum diameter cables.

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:



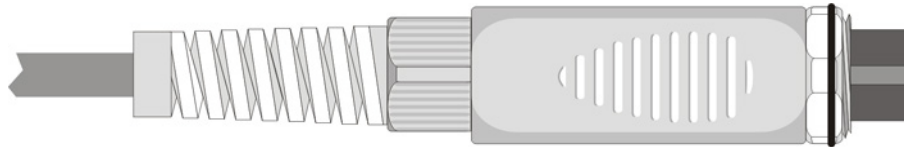
Open the two module shells: the printed circuit to which the probe must be connected is housed inside. On the left there are the 1...4 points on which the sensor wires must be welded. The JP1...JP4 jumpers are in the center of the board. These must be closed with a tin bead for some type of sensors:



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

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

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



Direct connection of 4-wire Pt100 sensors


| Sensor | Direct soldering to the connector |
|---------------|--|
| Pt100 4 wires | <p>4 wire Pt100</p> <p>View of the soldering side of the free female connector</p> |

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

In order to use this type of probe it is necessary to set up the menu item “Probe Type” as described at page 10.

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

WARNINGS AND OPERATING INSTRUCTIONS

1. Do not expose the probes to gases or liquids that could corrode the material of the sensor or the probe itself. Clean the probe carefully after each measurement.
2. Do not bend the probe connectors or force them upward or downward.
3. Do not bend or force the contacts when inserting the probe connector into the instrument.
4. Do not bend, deform or drop the probes, as this could cause irreparable damage.
5. Always select the most suitable probe for your application.
6. Do not use probes in presence of corrosive gases or liquids. The sensor container is made of AISI 316 stainless steel, while the contact probe container is made of 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 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. 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 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.

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:

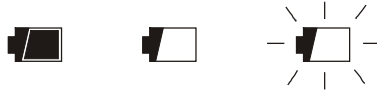
| Display indications | Explanation |
|----------------------------------|---|
| ERR | This appears if the probe, has already been detected by the instrument, but is disconnected. At the same time an intermittent beep is issued. |
| - - - | This appears in the display central line when a temperature only probe is connected. In the lower line the temperature is shown correctly. |
| PROB COMM LOST | This appears if the probe, has already been detected by the instrument, but is disconnected. At the same time an intermittent beep is issued. |
| OVER | Measurement overflow: indicates that the probe is measuring a value exceeding the measuring range. |
| LOG MEM FULL | Memory full; the instrument cannot store further data, the memory space is exhausted. |
| NEW PROBE DET | This message appears when a new probe is inserted while the instrument is on. Turn the instrument off and then back on again. |
| PROB ERR | A probe with SICRAM module has been inserted when not admissible for that specific instrument. |
| SYS ERR # | Instrument management program error. Contact the instrument's supplier and communicate the numeric code # reported by the display. |
| CAL LOST | Program error: it appears after turning on for a few seconds. Contact the instrument's supplier. |
| BATT TOO LOW CHNG NOW | Indication of insufficient battery charge appearing on turning on. The instrument issues a long beep and turns off. Replace the batteries. |

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

| Display indications | Explanation |
|-------------------------------------|--|
| >>> LOG_DUMP_or_ERAS | transfer or erase data |
| >>> PRBE_TYPE | type of probe connected |
| AVG TIME SECS | time interval according to which the moving average is calculated |
| 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 |
| ERR | error |
| FUNC CLR | max, min and average values clearing |
| FUNC CLRd | max, min and average values cleared |
| 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 |
| NEW_PROB_DET | new probe detected |
| NO_PRBE_SER_NUM | the connected probe's serial number is absent |
| OVER | maximum limit exceeded |
| PLS_EXIT >>> FUNC RES_FOR_FACT ONLY | please exit using ESC >>> function reserved to factory calibration |
| PRBE_SER ##### | serial number ##### of the connected probe |
| PRNT AND LOG INTV | printing and logging intervals |
| PRNT INTV >>> | printing interval |
| PROB COMM LOST | lost communication with probe |
| PROB ERR | error - unexpected probe |
| SECT inch ² | section in inch ² |
| SECT m ² | section in m ² |
| SLP_MODE_LOG | turning off during recording mode |
| SYS ERR # | program error number # |
| 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.

If the HD2103.2 is logging and battery voltage falls below the minimum operating level. the logging session is ended in order to avoid data loss.

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

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



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

MALFUNCTIONING UPON TURNING ON AFTER BATTERY REPLACEMENT

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

WARNING ABOUT BATTERY USE

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

INSTRUMENT STORAGE

Instrument storage conditions:

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

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

SERIAL INTERFACE AND USB

The HD2103.1 and HD2103.2 instruments are fitted with an electrically isolated RS-232C serial interface; the HD2103.2 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 HD2103.2).

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 | 3.25 22.7 | Captured measurements (24 characters) |
| G0 | Model HD2103 -2 | Instrument model |

| Command | Response | Description |
|---------|--------------------------|---|
| G1 | M=Thermo-Anemometer | 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=Sicram hot wire | Type of probe connected to input |
| G7 | Probe SN=11119999 | Probe serial number |
| G8 | Probe cal.=2004/01/12 | Probe calibration date |
| GB | User ID=0000000000000000 | User code (set with 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= m/s | Main unit of measurement |
| RUB | U= °C | Secondary unit of measurement |
| WA# | & | Setting LOG/PRINT interval. # is a hexadecimal number 0...D that represents the position of the interval in the list 0, 1, 5, 10, ..., 3600 seconds. |
| WC0 | & | Setting SELF off |
| WC1 | & | Setting SELF on |

Command characters are exclusively upper case characters. Once a correct command is entered, the instrument responds with “&”; when any wrong combination of characters is entered, the instrument responds with “?”. The instrument response strings end with the sending of the CR command (Carriage Return). The instrument does not send the LF command (Line Feed). Before sending commands to the instrument via the serial port, locking the keyboard to avoid functioning conflicts is recommended: use the P0 command. When complete, restore the keyboard with the P1 command.

STORING AND TRANSFERRING DATA TO A PERSONAL COMPUTER

The HD2103.1 and HD2103.2 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 HD2103.2 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 HD2103.2

The *Logging* function allows the recording up to 38,000 measurements registered by the probe connected to the input. 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 item 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 (the LOG ON indication periodically appears on the display to indicate that the *Logging* function is active). 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 HD2103.2

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 logged data remain in the memory apart 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: 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 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, 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

HD2103.1

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).

HD2103.2

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 HD2103.2

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 |
| 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) | Mains adapter 100-240Vac/12Vdc-1A |

Measuring units

°C - °F - m/s - km/h - ft/min - mph - knot -
l/s - m³/s - m³/min - m³/h - ft³/s - ft³/min -
WCT

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 memorization - model **HD2103.2***

| | |
|-----------------------------|--|
| Type | 2000 pages of 19 samples each |
| Quantity | Total of 38000 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 |

(*) It's referred to all the probes except the hot-wire ones, which autonomy is stated forwards in the relevant characteristics.

Selectable print interval

immediate or 1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour

*USB interface - model **HD2103.2***

Type

1.1 - 2.0 electrically isolated

Connections

Input module for the probes

8-pole male DIN45326 connector

RS232 serial interface

8-pole MiniDin connector

USB interface (only **HD2103.2**)

Mini-USB type B connector

Mains adapter (cod. **SWD10**)

2-pole connector (positive at centre)

Temperature measurement

Pt100 measurement range

-200...+650°C

Pt1000 measurement range

-200...+650°C

Ni1000 measurement range

-50...+250°C

Resolution

0.1°C

Accuracy

± 0.1°C (excluding probe error)

Drift after 1 year

0.1°C/year (only the instrument)

TECHNICAL DATA OF PROBES AND MODULES IN LINE WITH THE INSTRUMENT

WIND SPEED MEASUREMENT PROBES

Hot-wire probes: AP471S1 - AP471S2 - AP471S3 - AP471S4

| | AP471S1 - AP471S3 | AP471S2 | AP471S4 |
|---|---|--|----------------|
| Type of measure | Wind speed, calculated flow rate, air temperature | | |
| Type of sensor <i>Speed</i> <i>Temperature</i> | NTC thermistor NTC thermistor | Omnidirectional NTC thermistor NTC thermistor | |
| Measurement range <i>Speed</i> <i>Temperature</i> | 0.1...40 m/s -25...+80°C | 0.1...5 m/s -25...+80°C | 0...80°C |
| Measurement resolution: <i>Speed</i> <i>Temperature</i> | 0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot 0.1°C | | |
| Measurement accuracy: <i>Speed</i> <i>Temperature</i> | ±0.2 m/s (0.10...0.99 m/s) ±0.4 m/s (1.00...9.99 m/s) ±0.8 m/s (10.00...40.00 m/s) ±0.8°C (-10...+80°C) | ±0.2 m/s (0.10...0.99 m/s) ±0.3 m/s (1.00...5.00 m/s) ±0.8°C (-10...+80°C) | |
| Minimum speed | 0.1 m/s | | |
| Air temperature compensation | 0...80°C | | |
| Battery life | Approx. 20 hours @ 20 m/s with alkaline batteries | Approx. 30 hours @ 5 m/s with alkaline batteries | |
| Unit of Measurement <i>Speed</i> <i>Flow rate</i> | m/s – km/h – ft/min – mph – knot l/s - m ³ /s - m ³ /min - m ³ /h - ft ³ /s - ft ³ /min | | |
| Pipeline section for flow rate calculation | 0.0001...1.9999 m ² | | |
| Cable length | ~2 m | | |

Vane probes: AP472S1 - AP472S2

| | AP472S1 | AP472S2 |
|---|---|---|
| Type of measure | Wind speed, calculated flow rate, air temperature | Wind speed, calculated flow rate |
| Diameter | 100mm | 60mm |
| Type of measurement <i>Speed</i> <i>Temperature</i> | Vane K thermocouple | Vane ---- |
| Measurement range <i>Speed</i> <i>Temperature</i> | 0.6...25 m/s -25...+80 (*) | 0.5...20 m/s -25...+80 (*) |
| Resolution <i>Speed</i> <i>Temperature</i> | 0.1°C | 0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot ---- |
| Accuracy <i>Speed</i> <i>Temperature</i> | ± (0.4 m/s + 1.5% f.s.) ±0.8°C | ± (0.4 m/s + 1.5% f.s.) ---- |
| Minimum speed | 0.6 m/s | 0.5 m/s |
| Unit of Measurement <i>Speed</i> <i>Flow rate</i> | m/s – km/h – ft/min – mph – knot l/s - m ³ /s - m ³ /min - m ³ /h - ft ³ /s - ft ³ /min | |
| Pipeline section for flow rate calculation | 0.0001...1.9999 m ² | |
| Cable length | ~2m | |

(*) The indicated value refers to the vane's working range.

TEMPERATURE PROBES Pt100 SENSOR USING SICRAM MODULE

| Model | Type | Application range | Accuracy |
|-----------|-------------------------------|-------------------|---|
| TP472I | Immersion | -196°C...+500°C | $\pm 0.1^\circ\text{C}$ (@ 0 °C) $\pm 0.2^\circ\text{C}$ (-50 °C ≤ t ≤ 250 °C) $\pm 0.3^\circ\text{C}$ (t < -50 °C; t > 250 °C) |
| TP472I.O | Immersion | -50°C...+300°C | |
| TP473P.I | Penetration | -50°C...+400°C | |
| TP473P.O | Penetration | -50°C...+300°C | |
| TP474C.O | Contact | -50°C...+300°C | |
| TP475A.O | Air | -50°C...+250°C | |
| TP472I.5 | Immersion | -50°C...+400°C | |
| TP472I.10 | Immersion | -50°C...+400°C | |
| TP49A.I | Immersion | -70°C...+250°C | |
| TP49AC.I | Contact | -70°C...+250°C | |
| TP49AP.I | Penetration | -70°C...+250°C | |
| TP875.I | Globe-thermometer Ø 150 mm | -30°C...+120°C | |
| TP876.I | Globe-thermometer Ø 50 mm | -30°C...+120°C | |
| TP87.O | Immersion | -50°C...+200°C | |

Common characteristics

| | |
|--------------------------|--|
| Resolution | 0.01°C in the range ±199.99°C, 0.1°C in the remaining field |
| Temperature drift @ 20°C | 0.003%/°C |

Probes Pt100 4 wires and Pt1000 2 wires

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

Common characteristics

| | |
|--------------------------|--|
| Resolution | 0.01°C in the range ±199.99°C, 0.1°C in the remaining field |
| Temperature drift @ 20°C | |
| Pt100 | 0.003%/°C |
| Pt1000 | 0.005%/°C |

ORDER CODES

| | |
|-------------------|--|
| HD2103.1 | Kit including the instrument HD2103.1, 4x1.5V alkaline batteries, operating manual, case and DeltaLog9 software downloadable from Delta OHM website. The probes and the cables must be ordered separately. |
| HD2103.2 | Kit including the HD2103.2 data logger , 4x1.5V alkaline batteries, operating manual, case and, CP23 and DeltaLog9 software downloadable from Delta OHM website. The probes and the cables must be ordered separately. |
| HD2110CSNM | Connection cable 8-pole MiniDin – Sub D 9-pole female for RS232C. |
| C.206 | Connection cable 8-pole MiniDin – USB type A. With integrated RS232/USB converter. |
| SWD10 | Stabilized power supply at 100-240Vac/12Vdc-1A mains voltage. |
| HD40.1 | The kit includes: 24-column portable thermal printer, serial interface, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls. |
| BAT.40 | Spare battery pack for HD40.1 printer with in-built temperature sensor. |
| RCT | The kit includes 4 thermal paper rolls 57mm wide and 32mm in diameter. |

PROBES COMPLETE WITH SICRAM MODULE

WIND SPEED MEASUREMENT PROBES

HOT-WIRE PROBES:

| | |
|----------------|--|
| AP471S1 | Hot-wire telescopic probe, measuring range: 0.1...40 m/s. Cable length 2 metres. |
| AP471S2 | Omnidirectional hot-wire telescopic probe, measuring range: 0.1...5 m/s. Cable length 2 metres. |
| AP471S3 | Hot-wire telescopic probe with terminal tip for easy position, measuring range: 0.1...40 m/s. Cable length 2 metres. |
| AP471S4 | Omnidirectional hot-wire telescopic probe with base, measuring range: 0.1...5 m/s. Cable length 2 metres. |

VANE PROBES:

| | |
|---------------------|--|
| AP472S1 | Vane probe with thermocouple, Ø100 mm. Speed from 0.6 to 25 m/s; temperature from -25 to 80°C. Cable length 2 metres. |
| AP472S2 | Vane probe, Ø60 mm. Measurement range: 0.5...20 m/s. Cable length 2 metres. |
| AST.1 | Telescopic shaft (minimum length 210 mm, maximum length 870 mm) for AP472S1 and AP472S2 vane probes. |
| AP471S1.23.6 | Fixed extension shaft Ø16 x 300 mm, M10 male thread on a side, female on the other. For vane probes AP472S1 and AP472S2. |
| AP471S1.23.7 | Fixed extension shaft Ø16 x 300 mm, M10 female thread on a side only. For vane probes AP472S1 and AP472S2. |

TEMPERATURE MEASUREMENT PROBES

| | |
|------------------|--|
| TP472I | Immersion probe, sensor Pt100. Stem Ø3 mm, length 300 mm. Cable length 2 metres. |
| TP472I.O | Immersion probe, sensor Pt100. Stem Ø3 mm, length 230 mm. Cable length 2 metres. |
| TP473P.I | Penetration probe, sensor Pt100. Stem Ø4 mm, length 150 mm. Cable length 2 metres. |
| TP473P.O | Penetration probe, sensor Pt100. Stem Ø4 mm, length 150 mm. Cable length 2 metres. |
| TP474C.O | Contact probe, sensor Pt100. Stem Ø4 mm, length 230 mm, contact surface Ø 5 mm. Cable length 2 metres. |
| TP475A.O | Air probe, sensor Pt100. Stem Ø4 mm, length 230 mm. Cable length 2 metres. |
| TP472L.5 | Immersion probe, sensor Pt100. Stem Ø6 mm, length 500 mm. Cable length 2 metres. |
| TP472L.10 | Immersion probe, sensor Pt100. Stem Ø6 mm, length 1000 mm. Cable length 2 metres. |
| TP49A.I | Immersion probe, sensor Pt100. Stem Ø2.7 mm, length 150 mm. Cable length 2 metres. Aluminium handle. |
| TP49AC.I | Contact probe, sensor Pt100. Stem Ø4 mm, length 150 mm. Cable length 2 metres. Aluminium handle. |
| TP49AP.I | Penetration probe, sensor Pt100. Stem Ø2.7 mm, length 150 mm. Cable length 2 metres. Aluminium handle. |
| TP875.I | Globe-thermometer Ø150 mm with handle. Cable length 2 metres. |
| TP876.I | Globe-thermometer Ø50 mm with handle. Cable length 2 metres. |
| TP87.O | Immersion probe, sensor Pt100. Stem Ø3 mm, length 70 mm. Cable length 2 metres. |

TEMPERATURE PROBES WITHOUT SICRAM MODULE

| | |
|--------------------|---|
| TP47.100.O | Immersion probe, sensor Pt100 direct 4 wires. Probe's stem Ø3 mm, length 230 mm. 4-wire connection cable with connector, length 2 metres. |
| TP47.1000.O | Immersion probe, sensor Pt1000. Probe's stem Ø3 mm, length 230 mm. 2-wire connection cable with connector, length 2 metres. |
| TP87.100.O | Immersion probe, sensor Pt100 direct 4 wires. Probe's stem Ø3 mm, length 70 mm. 4-wire connection cable with connector, length 2 metres. |
| TP87.1000.O | Immersion probe, sensor Pt1000. Probe's stem Ø3 mm, length 70 mm. 2-wire connection cable with connector, length 2 metres. |
| TP47 | Only connector for probe connection: Pt100 direct 3 and 4 wires, Pt1000 and Ni1000 2 wires. |

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

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NOTES

WARRANTY

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

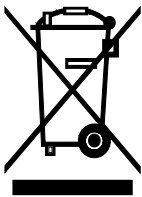
The manufacturer repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the "Convention on Contracts for the International Sales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

TECHNICAL INFORMATION

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

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

DISPOSAL INFORMATION



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

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

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