

HD32.1

Thermal Microclimate

ENGLISH

The **Basic Kit** for microclimate analysis is composed of:

- HD32.1 with the **Operating Program A: Microclimate Analysis**
- software DeltaLog10 - Moderate Environments.

In order to use the other three software modules

- DeltaLog10 - Hot and very hot Environments
- DeltaLog10 - Cold Environments
- DeltaLog10 - Discomfort Analysis

and the operating programs

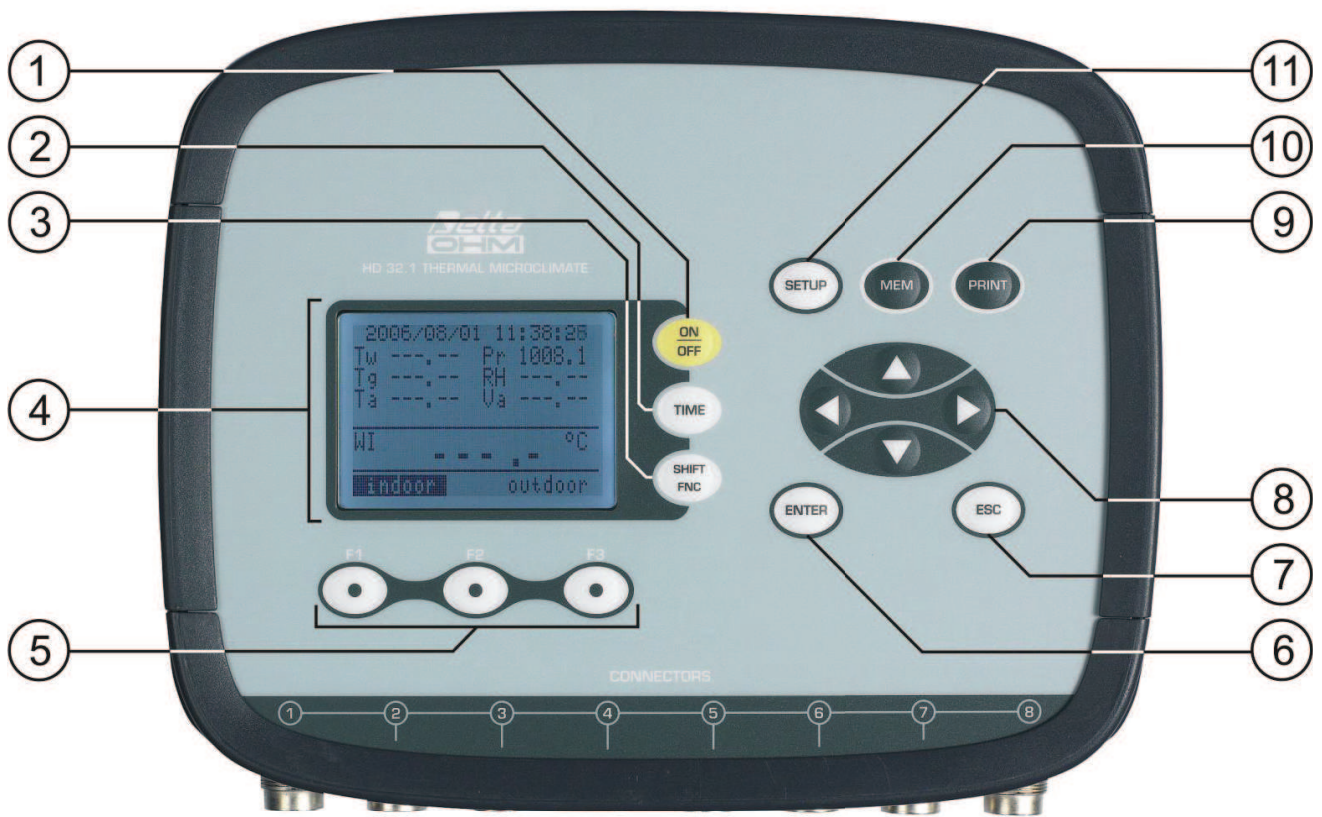
- **Operating Program B: Discomfort Analysis**
- **Operating Program C: Physical Quantities**

you need to activate them according to the instructions in the CDRom DeltaLog10, item "Documents and product activation".

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

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

Thermal Microclimate HD32.1



HD32.1

1. **ON/OFF** key: Turns the instrument on and off.
2. **TIME** key: Allows the display of **date** and **time**, in the first line for about 8 seconds.
3. **SHIFT FNC** key: Activates the Shortcut window.
4. Graphic display.
5. Function keys **F1**, **F2**, **F3**: Activate the function in the bottom line of the display.
6. **ENTER** key: In the menu, confirms the data entered.
7. **ESC** key: Allows exiting from the menu or, in case of a submenu, exiting from the current level display.
8. Navigation keys **▲ ▼ ◀ ▶**: Allows navigation through the menus.
9. **PRINT** key: Starts and ends the data transfer to the serial/USB communication port.
10. **MEM** key: Starts and ends the recording of the data.
11. **SETUP** key: Allows entering and exiting the instrument's functioning parameter setting menu.
12. SICRAM inputs for the probes.
13. Battery cover.
14. RS232 serial port.
15. USB port.
16. Power supply input.

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1. GENERAL CHARACTERISTICS

The **HD32.1** Thermal Microclimate has been designed for microclimate analysis in the workplace; the instrument is used to detect the necessary parameters to establish if a certain workspace is suitable to perform certain activities.

The instrument can manage **three operating programs** that can be loaded by the user, according to the measurements program and the quantities being detected.

The instrument has eight inputs for probes with SICRAM module: The probes are fitted with an electronic circuit that communicates with the instrument. The calibration settings are memorized inside.

All SICRAM probes, except the vane probe, can be plugged into any input: They will be automatically detected when you turn the instrument on.

NOTE: The vane probe, complete with SICRAM module, for wind speed measurement can be exclusively connected to input 8.

The instrument comes with a barometric pressure sensor. The barometric pressure is displayed only by the Microclimate Analysis operating program.

The machine can be programmed to perform the logging (capture) of a measurement session. You can specifically set a sampling interval per each session.

Furthermore, the auto-start function can be used to activate the setting of the measurements' initial date and time, and the automatic start and end of the data logging session.

NOTE: The set capture interval is valid for all the probes connected to the machine.

Other operating programs user selectable/settable common parameters are:

- The units of measurement for the displayed temperature quantities: °C, °F, °K.
- The system date and time
- The display of the **maximum, minimum, and average** statistic parameters and their deletion.
- The data transfer speed via the serial RS232 port.
- The setting and enabling/disabling of the keyboard protection password.

The operating programs are:

- **prog. A: HD32.1 Microclimate Analysis**
- **prog. B: HD32.1 Discomfort Analysis**
- **prog. C: HD32.1 Physical Quantities**

The **operating program A: Microclimate Analysis, HD32.1**, can simultaneously detect the following quantities:

- Globe thermometer temperature
- Natural ventilation wet bulb temperature
- Environment temperature
- Atmospheric pressure
- Relative humidity
- Wind speed

The **operating program A: Microclimate Analysis** displays also:

- The local turbulence intensity **Tu**, for DR (Draught Rating) calculation.
- The **WBGT** index (Wet Bulb Glob Temperature) with or without solar radiation.
- The **WCI** index (Wind Chill Index)
- The average radiation temperature **t_r**.

The **operating program B: Discomfort Analysis**, HD32.1, can simultaneously detect the following quantities:

- Air temperature detected at head height (1.7 m for a standing person; 1.1 m for a seated person).
- Air temperature detected at abdomen height (1.1 m for a standing person; 0.6 m for a seated person).
- Air temperature detected at ankle height (0.1 m).
- Temperature at floor level.
- Temperature of the net radiometer.
- Net radiation.
- Radiant asymmetry temperature.

The **operating program B: Discomfort Analysis** is used to calculate the local discomfort indexes due to vertical temperature gradients or radiant asymmetry temperature.

The **operating program C: Physical Quantities**, HD32.1, can simultaneously detect the following physical quantities:

- Temperature
- Relative humidity
- Illuminance, luminance, PAR, irradiance
- Wind speed
- carbon monoxide concentration CO.
- carbon dioxide concentration CO₂

By using the **operating program C: Physical Quantities**, HD32.1, you can simultaneously manage up to six different probes complete with SICRAM module: one or two light probes and a probe for each of the other physical quantities. **If two or more probes of the same physical quantity are connected (light probes excluded), the instrument recognizes only one probe.** If, for example, you insert two Pt100 temperature probes complete with SICRAM module to inputs 1 and 2, the probe connected to input 1 is immediately recognized while the probe connected to input 2 is ignored. **The probe is detected during turn on**, therefore if a probe is changed, it is necessary to turn the machine off and on. During turn on the instrument performs a scan from input 1 to input 8. The probes arrangement in relation to the inputs is arbitrary, except for the vane probes.

The vane probe, complete with SICRAM module, for wind speed measurement can be exclusively connected to input 8.

2. WORKING PRINCIPLE

2.1 THE OPERATING PROGRAM A: MICROCLIMATE ANALYSIS

By *microclimate* is meant those environmental parameters that influence the heat exchange between the person and the surrounding spaces, and that determinate the so-called "thermal well-being".

The microenvironment climatic factors, together with the type of work performed, generate a series of biological responses linked to thermal well-being (Comfort) or uneasiness (Discomfort).

The human organism, indeed, tends to maintain a thermal balance so that the body temperature is optimum.

The **HD32.1, Thermal Microclimate**, through its **operating program A: Microclimate Analysis** measures the following quantities:

- t_{nw} : natural ventilation wet bulb temperature
- t_g : globe thermometer temperature
- t_a : environment temperature
- p_r : atmospheric pressure
- RH : relative humidity
- v_a : wind speed

In addition to the direct measurements performed with the probes connected, the instrument can directly calculate and display the following well-being data:

- *WBGT index*
- *Tu index*
- *WCI index*
- *Average radiation temperature t_r*

2.1.1 WBGT Index

WBGT (Wet Bulb Globe Temperature) is one of the indexes used to determine the thermal stress of a person in a hot environment. It represents the value, related to the metabolic output linked to a specific work activity, that causes a thermal stress when exceeded. The WBGT index combines the measurements of the natural ventilation wet bulb temperature t_{nw} with the globe thermometer temperature t_g and, in some situations, with the air temperature t_a . The calculation formula is the following:

- Inside and outside buildings without solar radiation:

$$WBG_{enclosed\ spaces} = 0.7 t_{nw} + 0.3 t_g$$

- Outside buildings with solar radiation:

$$WBGT_{outdoor\ spaces} = 0.7 t_{nw} + 0.2 t_g + 0.1 t_a$$

where:

- t_{nw} = natural ventilation wet bulb temperature;
- t_g = globe thermometer temperature;
- t_a = air temperature.

The measured data should be confronted with the limit values prescribed by regulations; when exceeded you have to:

- Reduce directly the thermal stress on the workplace being examined;
- Proceed to a detailed analysis of the thermal stress.

In the following table are reported the thermal stress index WBGT limit values as provided for by ISO 7243:

METABOLIC RATE CLASS	METABOLIC RATE, M		WBGT LIMIT VALUE			
	RELATIVE TO A UNIT AREA OF THE SKIN W/m ²	TOTAL (FOR A SKIN SURFACE AVERAGE AREA OF 1.8 m ²) W	PERSON ACQUAINTED TO THE HEAT °C		PERSON NOT ACQUAINTED TO THE HEAT °C	
0 (RESTING)	M ≤ 65	M ≤ 117	33		32	
1	65 < M ≤ 130	117 < M ≤ 234	30		29	
2	130 < M ≤ 200	234 < M ≤ 360	28		26	
3	200 < M ≤ 260	360 < M ≤ 468	DEAD AIR 25	NON DEAD AIR 26	DEAD AIR 22	NON DEAD AIR 23
4	M > 260	M > 468	23	25	18	20

NOTE – THESE VALUES HAVE BEEN DETERMINED BY USING A MAXIMUM REFERENCE RECTAL TEMPERATURE OF 38 °C FOR THE PEOPLE BEING EXAMINED.

In order to calculate the WBGT index, the following probes should be connected:

- The natural ventilation wet bulb temperature probe.
- The globe thermometer probe.
- The dry bulb temperature probe, if the measurement is performed with solar radiation.

In order to measure the WBGT index, you should refer to the following regulations:

- ISO 7726
- ISO 7243

2.1.2 Turbulence Intensity (Tu index)

Turbulence Intensity: Local turbulence intensity percentage, defined as the ratio between the local wind speed standard deviation and the local air average speed (ISO 7726):

$$Tu = \frac{SD}{v_a} \times 100$$

where:

v_a = average local wind speed

SD = local wind speed standard deviation

$$SD = \sqrt{\frac{1}{n-1} \cdot \sum_{i=1}^n (v_{a_i} - v_a)^2}$$

From the turbulence calculation, knowing the average values of the local wind speed and environment temperature, you can get the **DR** (Draught Rating), according to ISO 7730:

$$DR = (4 - t_a) \cdot (0.05)^{0.62} \cdot (0.37 \cdot v_a \cdot Tu + 3.14)$$

The discomfort from air current is defined as an undesired local cooling of the body due to air motion. The *DR* indicates the percentage of unsatisfied people due to air current. **The *DR* index is calculated when the temperature goes from 20 °C to 26 °C and the average wind speed is < 0.5 m/s.**

The *DR* index is calculated using the DeltaLog10 software.

2.1.3 WCI Index

WCI (Wind Chill Index) allows a synthetic evaluation of the effects of cold environments on man. It shows the cooling index due to the wind. It allows evaluating the discomfort perceived during exposure to low temperatures and wind. The index does not consider the clothing and the work intensity. **The WCI index is calculated by the instrument in presence of air under 10°C.**

The WCI index calculation formula is:

$$WCI = 13.12 + 0.6215 t_a - 11.37 v_a^{0.16} + 0.4275 t_a v_a^{0.16}$$

where:

t_a : air temperature (in °C);

v_a : Wind speed (in km/h) calculated at 10 m from the ground.

As the instrument measures the wind speed at 1.5 m from the ground, the formula is corrected as follows:

$$WCI = 13.12 + 0.6215 t_a - 11.37(1.5 v_{1.5})^{0.16} + 0.4275 t_a (1.5 v_{1.5})^{0.16}$$

where $v_{1.5}$ is the wind speed measured by the instrument at 1.5 m from the ground.

The following tables report some WCI values and the relevant frostbite risks (source: NOAA – National Weather Service).

		Air temperature °C												
		10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
Wind speed v_a Km/h	10	8.6	2.7	-3.3	-9.3	-15.3	-21.1	-27.2	-33.2	-39.2	-45.1	-51.1	-57.1	-63.0
	15	7.9	1.7	-4.4	-10.6	-16.7	-22.9	-29.1	-35.2	-41.4	-47.6	-51.1	-59.9	-66.1
	20	7.4	1.1	-5.2	-11.6	-17.9	-24.2	-30.5	-36.8	-43.1	-49.4	-55.7	-62.0	-68.3
	25	6.9	0.5	-5.9	-12.3	-18.8	-25.2	-31.6	-38.0	-44.5	-50.9	-57.3	-63.7	-70.2
	30	6.6	0.1	-6.5	-13.0	-19.5	-26.0	-32.6	-39.1	-45.6	-52.1	-58.7	-65.2	-71.7
	35	6.3	-0.4	-7.0	-13.6	-20.2	-26.8	-33.4	-40.0	-46.6	-53.2	-59.8	-66.4	-73.1
	40	6.0	-0.7	-7.4	-14.1	-20.8	-27.4	-34.1	-40.8	-47.5	-54.2	-60.3	-67.6	-74.2
	45	5.7	-1.0	-7.8	-14.5	-21.3	-28.0	-34.8	-41.5	-48.3	-55.1	-61.8	-68.6	-75.3
	50	5.5	-1.3	-8.1	-15.0	-21.8	-28.6	-35.4	-42.2	-49.0	-55.8	-62.7	-69.5	-76.3
	55	5.3	-1.6	-8.5	-15.3	-22.2	-29.1	-36.0	-42.8	-49.7	-56.6	-63.4	-70.3	-77.2
	60	5.1	-1.8	-8.8	-15.7	-22.6	-29.5	-36.5	-43.4	-50.3	-57.2	-64.2	-71.1	-78.0

The values that can cause frostbite within ≤ 30 minutes are reported in bold.

Wind Chill (°C)	Frostbite risk
> -28	Low
-28 to -39	Medium: The exposed body parts can freeze within 10 to 30 minutes
-40 to -44	High: The exposed body parts can freeze within 5 to 10 minutes (*)
Alarm level -44 to -47	High: The exposed body parts can freeze within 2 to 5 minutes (*)
-48 and colder	High: The exposed body parts can freeze in less than 2 minutes (*)

(*): With v_a higher than 50 km/h the frostbite process can be faster.

In order to calculate the WCI index, the following probes should be connected:

- The dry bulb temperature probe for air temperature measurement t_a .
- The hot-wire probe for wind speed measurement.

In order to measure the WCI index, refer to the following:

- ISO 7726
- NOAA Specifications, National Weather Service.

2.1.4 Average Radiation Temperature t_r

The average radiation temperature is defined as the temperature of a thermally uniform simulated environment that would exchange with a man the same thermal radiation power exchanged in the real environment.

In order to evaluate the average radiation temperature you have to measure: The globe thermometer temperature, the air temperature and the wind speed measured near the globe thermometer. The average radiation temperature calculation formula is the following:

- In case of **natural convection**:

$$t_r = \left[\left(t_g + 273 \right)^4 + \frac{0.25 \times 10^8}{\varepsilon_g} \left(\frac{|t_g - t_a|}{D} \right)^{1/4} \times (t_g - t_a) \right]^{1/4} - 273$$

- In case of **forced convection**:

$$t_r = \left[\left(t_g + 273 \right)^4 + \frac{1.1 \times 10^8 \times v_a^{0.6}}{\varepsilon_g \times D^{0.4}} (t_g - t_a) \right]^{1/4} - 273$$

where:

D = globe thermometer diameter

ε_g = 0.95 assumed emissivity of the globe thermometer

t_g = globe thermometer temperature

t_a = air temperature.

v_a = wind speed

The average radiation temperature does not correspond to air temperature: If within a room very high temperature surfaces are present (for example, a fireplace), these hot areas remarkably influence the average radiation temperature.

The average radiation temperature is detected with the globe thermometer. A temperature probe formed by a 150 mm copper ball, painted black matt, with emissivity equal to $\varepsilon_g = 0.95$ (according

to **ISO 7726**), and a Pt100 sensor inside. The globe thermometer temperature could be remarkably higher than the air temperature. For example in a mountain cottage, in which air is at 0°C but the presence of a fireplace produces an average radiation temperature of 40°C, ensuring a comfortable condition. In normal conditions, maintaining a certain difference between average radiation temperature and air temperature (where T_{MR} is remarkably higher than T_A) is preferable in order to get a better environment quality. In houses, where fireplaces and ranges are absent, generally the average radiation temperature is equal to the air temperature, or even lower. These conditions (mainly in buildings with large window surfaces) are not particularly healthy as the warm humid air facilitates the development of pathogenic organisms. From this point of view, using lamps or radiating panels is more healthy. It is much more hygienic to use a higher average radiation temperature than the air temperature, in order to guarantee comfort conditions. The regulations use air temperature and not average radiation temperature to assess heating system, but this is wrong.

In order to calculate the average radiation temperature you have to connect the following probes:

- **Globe thermometer probe**
- **Air temperature measurement probe**
- **Hot-wire probe for wind speed measurement**

In order to measure the average radiation temperature, you should refer to the following regulations:

- **ISO 7726**

2.2 THE OPERATING PROGRAM B: DISCOMFORT ANALYSIS

The **HD32.1, Thermal Microclimate**, through its **operating program B: Discomfort Analysis**, measures the following quantities.

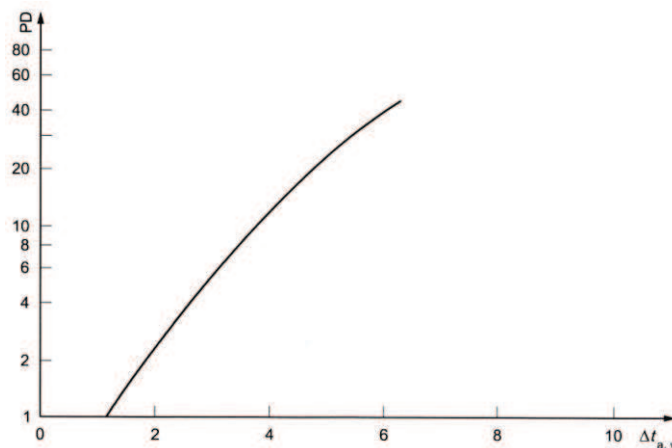
- t_h head temperature: air temperature detected at head height
- t_b : body temperature: air temperature detected at abdomen height
- t_k : ankle temperature: air temperature detected at ankle height
- t_f : floor temperature: air temperature at floor level
- P : net radiation: net radiation, measured in Wm^{-2} .

By knowing the temperatures at head t_h , abdomen t_b , ankles t_k and floor t_f height, you can determine, according to **ISO 7730**, edition February 2006 chapter 6, the following local thermal discomfort indexes:

- *Unsatisfied with the vertical difference of temperature;*
- *Unsatisfied with the floor temperature;*
- *Unsatisfied with the radiant asymmetry.*

2.2.1 Unsatisfied with the vertical difference of temperature

By detecting the temperatures at various heights you can check the presence of a air temperature vertical gradient. This gradient could cause a local discomfort feeling. In the following figure you can see the percentage value of the **unsatisfied with the vertical difference of temperature PD_v** , according to the temperature gradient between head (1.10 m) and ankles (0.10 m) for a seated person. **This index is calculated using the DeltaLog10 software.**



In order to calculate the PD_v index (unsatisfied with the vertical difference of temperature) you have to connect the following probes:

- Probe for the air temperature detected at head height
- Probe for the air temperature detected at ankle height

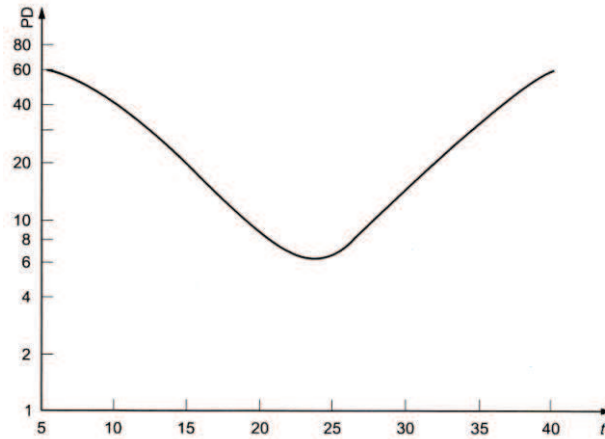
The PD_v index is calculated by the DeltaLog10 software.

In order to calculate the PD_v index (unsatisfied with the vertical difference of temperature) you should refer to the following regulations:

- **ISO 7730**

2.2.2 Unsatisfied with the floor temperature

By measuring the floor temperature you can calculate the **percentage index of the unsatisfied with the floor temperature**. The following diagram shows the PD_f index trend according to the floor temperature.



In order to calculate the PD_f index (unsatisfied with the floor temperature) you have to connect the following probe:

- Floor temperature probe

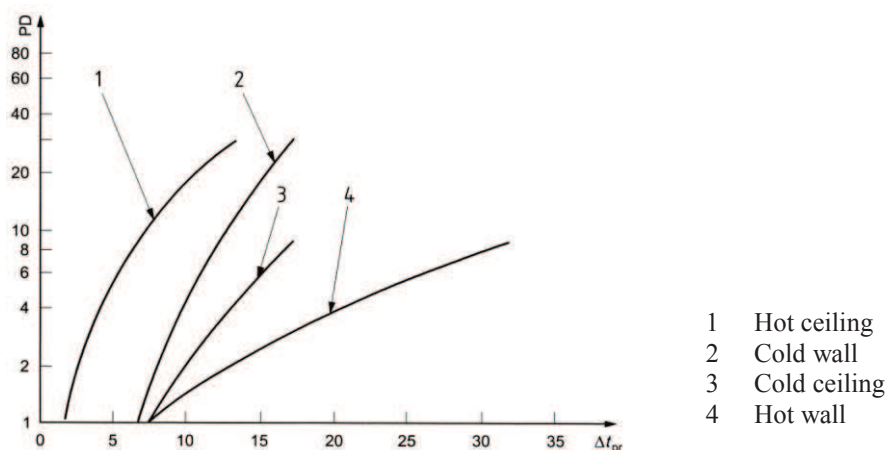
The PD_f index is calculated by the DeltaLog10 software.

In order to calculate the PD_f index (unsatisfied with the floor temperature) you should refer to the following regulations:

- ISO 7730

2.2.3 Unsatisfied with the radiant asymmetry

The radiant temperature asymmetry Δt_{pr} is the difference between the radiant temperatures measured with the net radiometer. The index of the unsatisfied with the radiant asymmetry is calculated according to a vertical (ceiling-floor) or horizontal (wall-wall) asymmetry. From the radiant temperature Δt_{pr} measured by the instrument, you can determine the **percentage of the unsatisfied with the radiant asymmetry** using the DeltaLog10 software. This is reported in the following figure.



In order to calculate the percentage of the unsatisfied with the floor temperature you have to connect the following probe:

- Net radiometer probe for radiant temperature measurement

The percentage of the unsatisfied with the radiant asymmetry is calculated using the DeltaLog10 software.

In order to calculate the percentage of the unsatisfied with the radiant asymmetry, you should refer to the following regulations:

- ISO 7730

2.3 THE OPERATING PROGRAM C: PHYSICAL QUANTITIES

The **HD32.1, Thermal Microclimate**, through its **operating program C: Physical Quantities**, measures the following quantities:

- Temperature.
- Relative humidity and resulting measurements.
- Illuminance, luminance, PAR, irradiance.
- Wind speed and resulting measurements.
- carbon monoxide concentration CO.
- carbon dioxide concentration CO₂

3. THE USER INTERFACE


The user interface consist of an LCD display and of the power, function, and setting keys.
Turn the instrument on and off with the **ON/OFF** key. When you turn the instrument on, the logo and model will be displayed for a few seconds, and then the main display.

3.1 THE DISPLAY

The display changes according to the loaded **operating program**.

3.1.1 The Operating Program A, Microclimate Analysis, Display

The **Thermal Microclimate HD32.1** main display, is divided in three areas:

		10:45:50	
Tnw	20.4°	Pr	1008.3
Tg	20.2°	RH	42.0
Ta	20.1°	Va	0.00
WI		20.2	°C
indoor		outdoor	

The first area displays the **battery's charge status** and the current **time** on the first line and the **measured quantities** arranged on two columns:

Tnw: natural ventilation wet bulb temperature

Tg: globe thermometer temperature

Ta: environment temperature

Pr: atmospheric pressure

RH: relative humidity

Va: wind speed

The second area displays the resulting measurements, that is, the indoor or outdoor WBGT indexes (WI or WO), the WCI and the average radiant temperature Tr (see the previous chapter for further details).

The third area displays the **F1**, **F2** and **F3** options. Please see the **SHIFT FNC** key in the following paragraph.

3.1.2 The Operating Program B, Discomfort Analysis, Display

The **Thermal Microclimate HD32.1** main display, is divided in three areas:

<div> <div></div> <div></div> </div>		10:45:50	
Th	20.4°C	Tk	20.3°C
Tb	20.2°C	Tf	20.0°C
Tn	20.1°C	P	10W/m2
DT	20.0 °C		
°C		°F	°K

The first area displays the **battery's charge status** and the current **time** on the first line and the **measured quantities** arranged on two columns:

Th:	head temperature:	air temperature detected at head height
Tb:	body temperature:	air temperature detected at abdomen height
Tn:	net temperature:	temperature of the net radiometer
Tk:	ankle temperature:	air temperature detected at ankle height
Tf:	floor temperature:	air temperature at floor level
P:	net radiation:	net radiation, measured in Wm^{-2}

The second area displays the radiant asymmetry temperature **DT**. By knowing this parameter you can obtain the **percentage of the unsatisfied with the radiant asymmetry** using DeltaLog10, according to ISO 7730.

The third area displays the **F1**, **F2** and **F3** options. Please see the **SHIFT FNC** key in the following paragraph.

3.1.3 The Operating Program C, Physical Quantities, Display

The **Thermal Microclimate, HD32.1**, display of the **Operating Program C: Physical Quantities**, shows the quantities of the probes connected to the instrument inputs.

The display is divided into three areas:

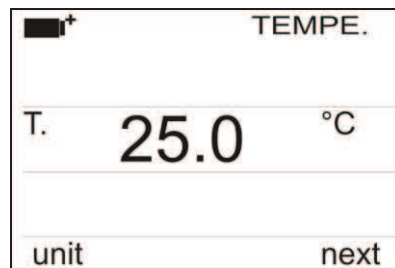
The first area (first line) displays the **battery's charge status**, the current **date** and **time** and the type of probe:

Displayed message	Displayed SICRAM probe
TEMPE	Pt100 probe
RH-TEMPE	RH-temperature combined probe
AIR-TEMP	Vane probe or hot-wire probe and temperature probe
LUX	Light probe
CO	CO probe
CO2	CO ₂ probe

The second area of the display shows the measurements detected by the probes. Each display is associated to the relevant probe. In order to display the measurements, press F3 when the message **next** appears on the last line.

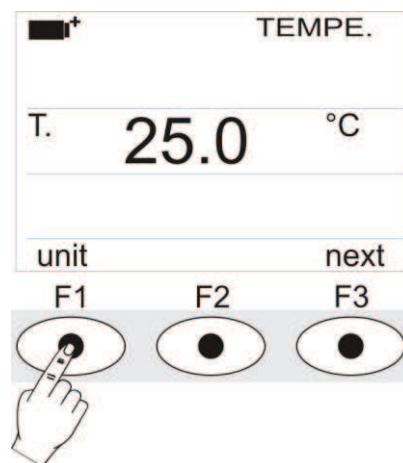
The third area displays the **F1**, **F2** and **F3** options. Please see the **SHIFT FNC** key in the following paragraph.

If a **Pt100 temperature probe** with SICRAM module is present, the following is displayed:

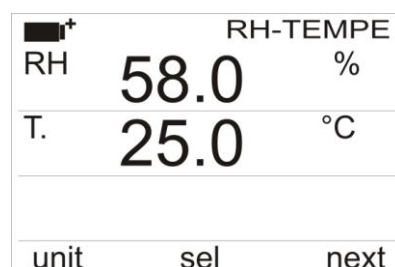


The first display line shows “**TEMPE.**” indicating that the temperature of a **Pt100 probe** complete with SICRAM module is displayed.

By repeatedly pressing **F1** with **unit** on the last line, you can change the unit of measurement: The available units are °C and °F; by pressing **F1** again you can return to °C.



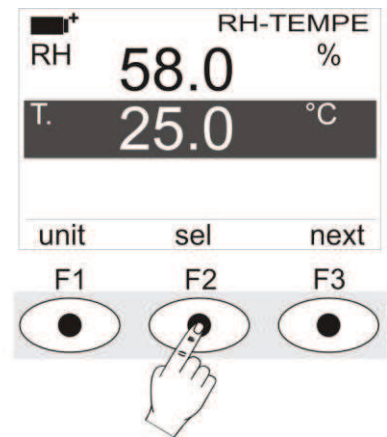
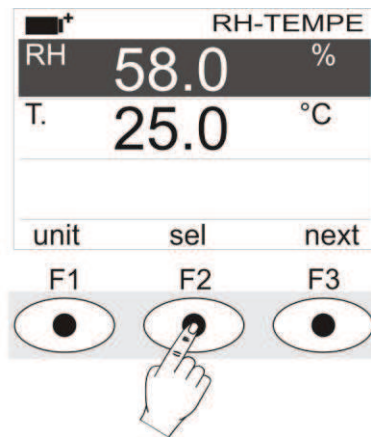
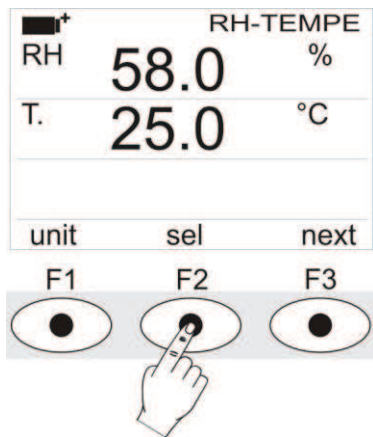
By pressing **F3** with **next** on the last line, you go to the **combined humidity/temperature probe** complete with SICRAM module:



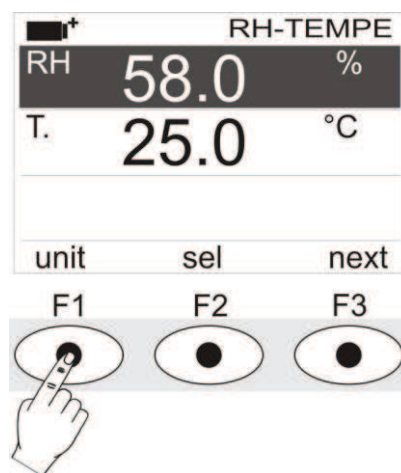
The first display line shows “**RH-TEMPE**” indicating that the measurements of a **combined humidity/temperature probe** complete with SICRAM module are displayed.

The second line displays the relative humidity. The third line displays the temperature.

In order to change the unit of measurement, press **F2** with **sel** displayed on the last line.



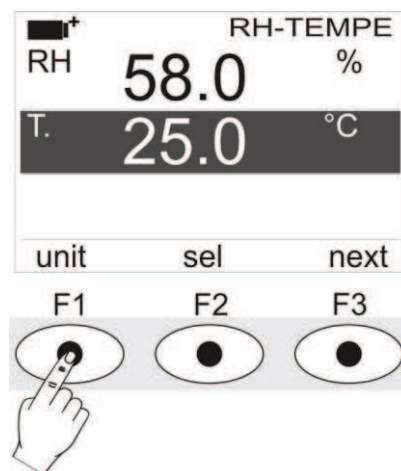
By pressing **F1** when the second line is selected, you can change the relative humidity unit of measurement:



The available units of measurement are:

- **RH:** % of relative humidity (**%RH - Relative Humidity**)
- **SH:** Grams of vapor in a kilogram of dry air (**g/Kg - Specific Humidity**, calculated)
- **AH:** Grams of vapor in a cubic meter of dry air (**g/m³ - Absolute Humidity**, calculated)
- **Pa:** Partial vapor pressure (**hPa**, calculated)
- **H:** Enthalpy (**J/g**, calculated)
- **Td:** Dew point (**°C or °F**, calculated)
- **Tw:** Wet bulb temperature (**°C or °F**)

By pressing **F1** when the third line is selected, you can change the temperature unit of measurement: The available units are °C and °F; by pressing **F1** again you can return to °C.



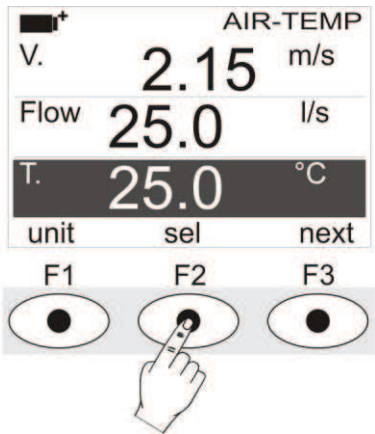
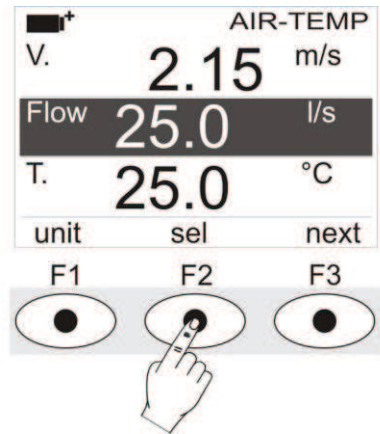
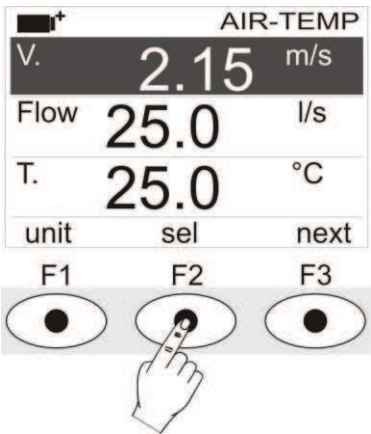
By pressing **F3** with **next** on the last line, you go to the **combined speed/temperature probe** complete with SICRAM module: **The vane probes for wind speed measurement can be exclusively connected to input 8.** The display is as follows:

AIR-TEMP		
V.	2.15	m/s
Flow	25.0	l/s
T.	25.0	°C
unit	sel	next

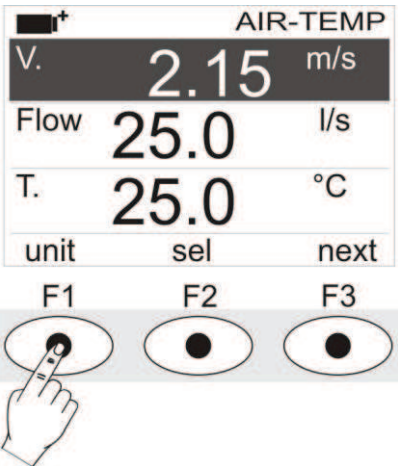
The first display line shows “**AIR-TEMP**” indicating that the measurements of a **combined speed/temperature probe** complete with SICRAM module are displayed.

The second line displays the wind speed. The third line displays the flow rate measurement. In order to get this measurement, you have to set the duct section (see next paragraph). The fourth line displays the temperature, if required.

In order to change the unit of measurement, press **F2** with **sel** displayed on the last line.



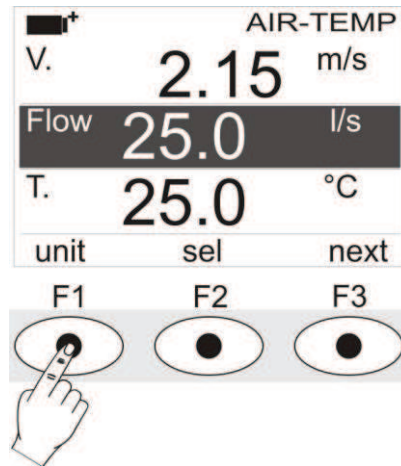
By pressing **F1** when the second line is selected, you can change the wind speed unit of measurement:



The units of measurement for the wind speed are:

- m/s
- km/h
- ft/min
- mph (mile/hour)
- knot

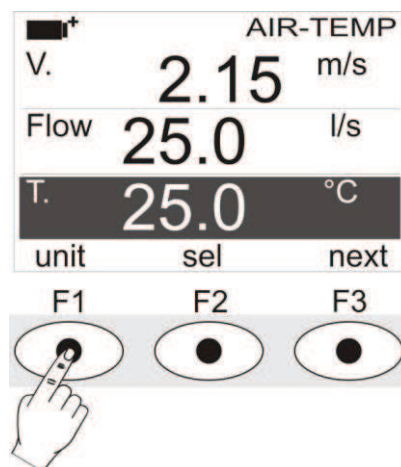
By pressing **F1** when the third line is selected, you can change the flow rate unit of measurement:



The units of measurement for the flow rate are:

- l/s (liter/s)
- m³/s
- m³/min
- m³/h
- ft³/s
- ft³/min

By pressing **F1** when the fourth line is selected, you can change the temperature unit of measurement: The available units are °C and °F; by pressing **F1** again you can return to °C.

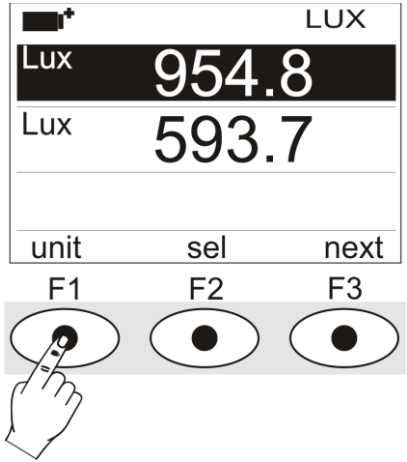


By pressing **F3** with **next** on the last line, you go to the **light probes** complete with SICRAM module:

<div><div></div><div></div></div>		LUX	
Lux	954.8		
Lux	593.7		
unit	sel	next	

The first display line shows “**LUX**” indicating that the measurement of a **light probes** complete with SICRAM module are displayed.

To change the unit of measurement, select one of the rows with F2 key and then press repeatedly **F1**:



The available units of measurement depend on the type of probe:

Type of measurement	Unit of Measurement
Illuminance (Phot)	lux - fcd
Irradiance (RAD - UVA - UVB - UVC)	W/m ² - μW/cm ²
PAR	μmol/(m ² ·s)
Luminance (LUM 2)	cd/m ²

Pushing the **function key F3** when there is the writing **next** on the last line you go on visualizing the measurements detected by **CO₂** probe complete with SICRAM module. The visualization is the following one:

<div> <div></div> <div>+</div> </div> <div>CO2</div>		
CO2	1000	ppm
unit	sel	next

The first line of the display indicates the acronym “**CO₂**”, indicating that the concentration measurement of carbon dioxide detected by the CO₂ probe is visualized on the display, complete with SICRAM module.

The measurement unit in **ppm** (parts per million) can’t vary.

When you start the instrument up, it realizes a warm-up (the heating) of at least 30 seconds of the probe before visualizing CO₂ measurement. The writing “warm-up” stays on for other 30 seconds together with the measurement to indicate that the indicated values could not already be within the declared accuracy limits. When the writing “warm-up” switches off, the instrument is working.

The probe is calibrated by the company and usually doesn’t request any other intervention by the user.

However, there is the possibility to calibrate again: see the chapter that deals with the Probe "*Probe HD320B2 for the measurement of CO₂ carbon dioxide concentration*".

Pushing the **function key F3** when there is the writing **next** on the last line you go on visualizing the measurements detected by **CO₂** probe complete with SICRAM module. The visualization is the following one:

<div> <div></div> <div>+</div> </div> <div>CO</div>		
CO	10.0	ppm
unit	sel	next

The first line of the display indicates the acronym “**CO₂**”, indicating that the concentration measurement of carbon dioxide detected by the CO₂ probe is visualized on the display, complete with SICRAM module.

The measurement unit in **ppm** (parts per million) can’t vary.

When you start the instrument up, it realizes a warm-up (the heating) of at least 30 seconds of the probe before visualizing CO₂ measurement. The writing “warm-up” stays on for other 30 seconds together with the measurement to indicate that the indicated values could not already be within the declared accuracy limits. When the writing “warm-up” switches off, the instrument is working.

The probe is calibrated by the company and usually doesn't request any other intervention by the user.

However, there is the possibility to calibrate again: see the chapter that deals with the Probe "*Probe HD320B2 for the measurement of CO₂ carbon dioxide concentration*".

3.2 THE KEYBOARD

The keys on the instrument perform the following functions:



ON-OFF key


Turns the instrument on and off.

When turning on the instrument using this key, the first screen will be displayed. After few seconds the measured quantities will be displayed.

NOTE: If no probes were connected on turning on, only the barometric pressure will be displayed. The other quantities will be indicated by dashes, instead of the value.



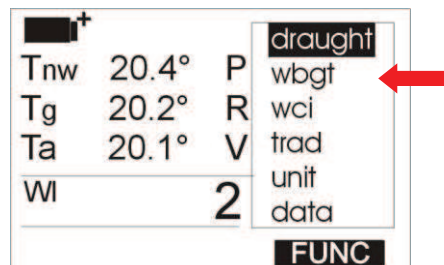
TIME key

It allows the display of **year/month/day** and **hour/minutes/seconds**, in the first line for about 8 seconds. Normally the display shows, on the left, the  icon for the battery's charge status, on the right, hour/minutes/seconds. The battery symbol becomes [~] when the external power supply is connected.



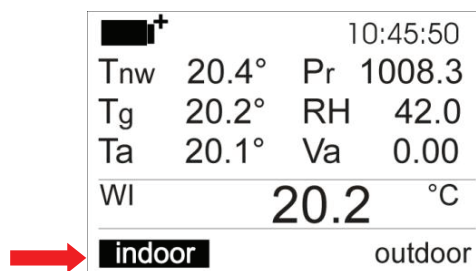
SHIFT FUNCTION key

Activates the Shortcut window. The figure shows the Shortcut menu for the **Microclimate Analysis** operating program.



Function keys F1, F2, F3

These are “function keys”: They activate the function in the last line of the display (indicated by the arrow in the figure); the function, enabled by **SHIFT FNC**, is selected and displayed in “reverse” (e.g. in the figure the **Microclimate Analysis** operating program “WBGT indoor” function is enabled).





SETUP key

Allows entering and exiting the instrument's functioning parameter setting menu.



ENTER key

In the menu, confirms the entered data.



ESC key

Allows exiting from the menu or, in case of a submenu, exiting from the current level display.



MEM key

Allows starting and ending a “logging” session; the data sending interval must be set in the menu.



PRINT key

Allows direct printing of the data via serial port; the data sending interval must be set in the menu.



Arrow keys

Allow navigation through the menus.

4. OPERATION

Before turning on the instrument, connect the SICRAM probes to the inputs: 8-pole male DIN45326 connectors, located in the lower part of the instrument (see figure on page 2), according to the measurement being performed.

NOTE: Connect the probes when the instrument is off. If a probe is connected and the instrument is on, it will be ignored. In this case, it is necessary to turn it off and on.

If a probe is connected when the instrument is on, you will get an acoustic signal (one beep per second) and an indication on the display relevant to the physical quantity being disconnected. The “LOST” message will be displayed.

If you connect multiple probes of the same type, only the first recognized probe is accepted (the first two if light probes): The probes scanning starts from input 1 to input 8.

The barometric pressure sensor is internal: Upon turning on the instrument, should no probes be connected, only the atmospheric value is displayed.

During turning on, the following message is displayed for about 10 seconds:

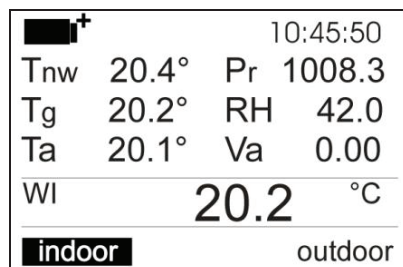


In addition to the Delta Ohm logo the tab name and the operating program code are displayed:

- **prog. A:** HD32.1 Microclimate Analysis
- **prog. B:** HD32.1 Discomfort Analysis
- **prog. C:** HD32.1 Physical Quantities

4.1 THE OPERATING PROGRAM A: MICROCLIMATE ANALYSIS

Connect the probes. Turn on the instrument: After 10 seconds, the measurement display mode will appear:



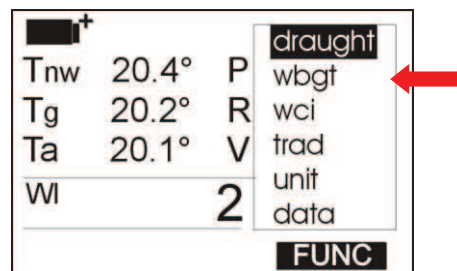
The battery charge symbol and current time are up on the left (for further details, see the par. 10).

The following quantities are reported:

Tnw: Humid temperature, measured by a natural ventilation wet bulb probe
Tg: Globe thermometer temperature, measured by a globe thermometer probe
Ta: Environment temperature, measured by a Pt100 probe
Pr: Barometric pressure, measured by an internal sensor
RH: Relative humidity, measured by a combined humidity/temperature probe
Va: Wind speed, measured by a hot-wire probe

A resulting quantity is displayed in the central part of the display: In this example, the WI index, that is, the WBGT index measured indoor or outdoor without solar radiation.

In order to select the displayed index, press **SHIFT FNC**: A drop-down menu is shown with the following information:



- **draught:** DR index: draught risk
- **wbgt:** WBGT index: wet bulb globe temperature
- **wci:** WCI index: wind chill index
- **trad:** average radiation temperature T_r
- **unit:** temperature measurement unit
- **data:** maximum, medium, average values

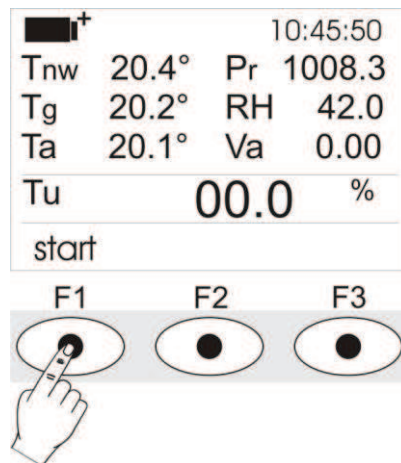
4.1.1 DR Index – Draught Risk

In order to calculate the **DR** index you need to know the **turbulence intensity T_u** obtained from the wind speed. For the turbulence intensity **T_u** calculation, the instrument starts an automatic procedure to capture the wind speed within a preset interval; at the end, the instrument displays the turbulence intensity percentage value. The DeltaLog10 software is then used to obtain the **DR** index.

To start the **T_u** index calculation, proceed as follows after opening the drop-down menu with **SHIFT FNC**:

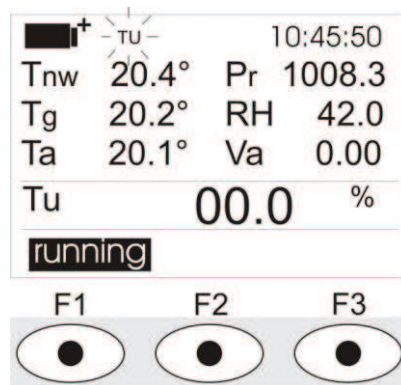
1. Use the arrow keys **▲ ▼** to select “**draught**”;
2. Press ENTER to confirm: the **T_u** message is displayed in the central line of the display;
3. Press ESC to exit the drop-down menu without making any change.

The following screen will appear:



Press **F1** to start the capture procedure:

On the first line, the blinking **TU** symbol and the **start** message replaced by **running**, indicate that the procedure was started.



After few seconds the **TU** symbol will disappear, the **running** message will be replaced by **start** and the turbulence intensity value will be displayed.

4.1.2 WBGT Index

To display the **WBGT** index, proceed as follows after opening the drop-down menu with **SHIFT FNC**:

4. Use the arrow keys **▲▼** to select **WBGT**;
5. Press **ENTER** to confirm: The selected quantity is displayed in the central line of the display;
6. Press **ESC** to exit the drop-down menu without making any change.

Now you can display the **Indoor (WI)** or **Outdoor (WO)** values, by selecting them using the **F1** or **F3** keys (see figure).

NOTE: Once selected, for example *max*, all displayed quantities represent the maximum value. **The average is calculated on the first five minutes of samples, and then on the current average.**

The **F3** key allows choosing to clear (*Clr*) the maximum, minimum and average data of the captured measurements:

1. In order to clear the data, select *Clr* with **F3**;
2. Another drop-down menu will open;
3. Use the arrow keys ▲ ▼ to select *yes*;
4. Press **ENTER** to confirm.
5. Press **ESC** or select *no*, to exit without clearing the data.

4.1.7 Instrument Setup

In order to set the instrument, you have to open the main menu by pressing **SETUP**. See the next chapter for further details.

4.1.8 Start of a new logging session

Press **MEM** to start a **Logging** session: This key 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 "**Log interval**" menu parameter. The data logged between a start and subsequent stop represent a measurement 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.

To end the logging, press **MEM** again.

The instrument can turn off during logging between one capture and the next: The function is controlled by the **Auto_shut_off_Mode** 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.

4.2 THE OPERATING PROGRAM B: DISCOMFORT ANALYSIS

Connect the probes. Turn on the instrument: After few seconds, the measurement display mode will appear:

■+		10:45:50	
Th	25.0 °C	Tk	25.0 °C
Tb	25.0 °C	Tf	25.0 °C
Tn	25.0 °C	P	---- W/m2
DT		0.0	°C
°C		°F	°K

The battery charge symbol and current time are up on the left (for further details, see the par. 10).
The following quantities are reported:

- Th:** Air temperature detected at head height (1.7 m for a standing person; 1.1 m for a seated person)
Tb: Air temperature detected at abdomen height (1.1 m for a standing person; 0.6 m for a seated person)
Tn: Temperature of the net radiometer
Tk: Air temperature detected at ankle height (0.1 m)
Tf: Temperature at floor level
P: Net radiation
DT: Radiant asymmetry temperature

By pressing **SHIFT FNC**, a drop-down menu is shown with the following information:

- **unit:** allows selection of the **unit of measurement**
- **data:** allows display of the **maximum, minimum, and average** values

■+		10:45:50	
Th	25.0 °C	Tk	25.0 °C
Tb	25.0 °C	Tf	25.0 °C
Tn	25.0 °C		
		unit	
DT		0.	data
			FUNC

4.2.1 The unit of measurement "Unit"

Proceed as follows to access **unit** function:

- Use **SHIFT FNC** to open the drop-down menu;
- Use the arrow keys **▲ ▼** to select **unit**;
- Press **ENTER** to confirm: the selected quantity is displayed in the central line of the display;
- The three different temperature units of measurement are displayed in the bottom line of the display, using **F1**, **F2** or **F3**: The unit is selected and displayed near the value shown in the central line;
- Press **ESC** to exit the drop-down menu without making any change.

4.2.2 The maximum, minimum and average values of the captured quantities

Proceed as follows to access **data** function:

- Use **SHIFT FNC** to open the drop-down menu;
- Use the arrow keys **▲ ▼** to select **data**;
- Press **ENTER** to confirm: the selected quantity is displayed in the central line of the display;
- The three quantities **max** (maximum), **min** (minimum) and **avg** (average) are shown in the bottom line of the display, using **F1** or **F2**.

The **F3** key allows choosing to clear (**Clr**) the maximum, minimum and average data of the captured measurements:

- In order to clear the data, select **Clr** with **F3**;
- Another drop-down menu will open;
- Use the arrow keys **▲ ▼** to select **yes**;
- Press **ENTER** to confirm.
- Press **ESC** or select **no**, to exit without clearing the data.

4.3 THE OPERATING PROGRAM C: PHYSICAL QUANTITIES

Connect the probes. Turn on the instrument: After few seconds, the measurement display mode will appear (according to the selected page):

To shift from one display to the other, press **F3**.

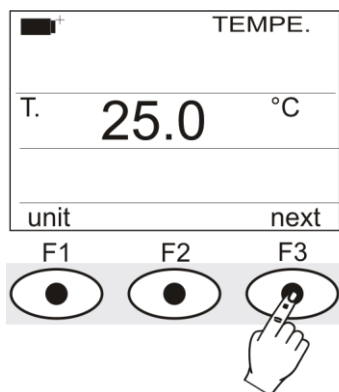


fig. 1-a

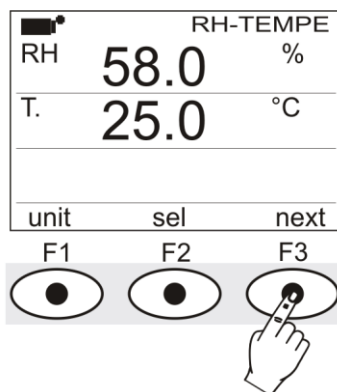


fig. 1-b

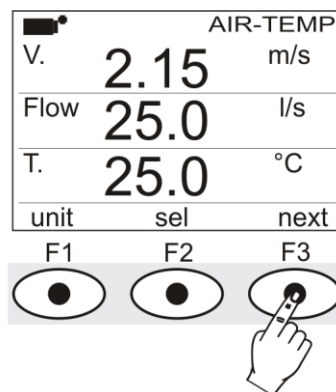


fig. 1-c

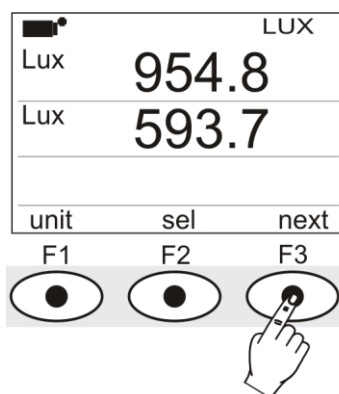


fig. 1-d

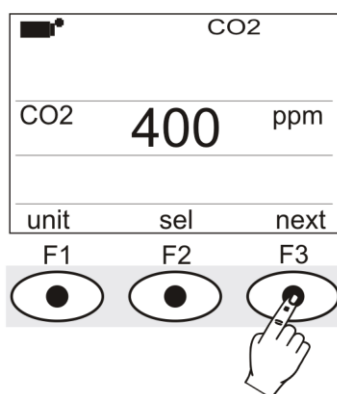


fig. 1-e

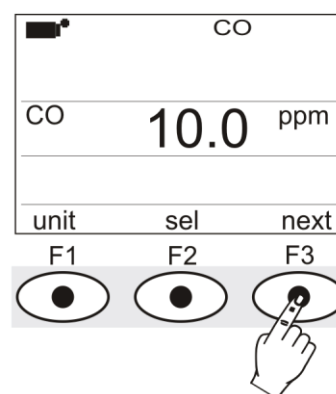


fig. 1-f

fig. 1-a: Display of the measurement using the **Pt100 SICRAM** probe

fig. 1-b: Display of the measurement using the **combined humidity/temperature SICRAM probe**

fig. 1-c: Display of the measurement using the **combined speed/temperature SICRAM probe**

fig. 1-d: Display of the measurement using the **photometric/radiometric SICRAM probe**

fig. 1-e: Display of the measurement using the **CO₂ SICRAM probe**

fig. 1-f: Display of the measurement using the **CO SICRAM probe**

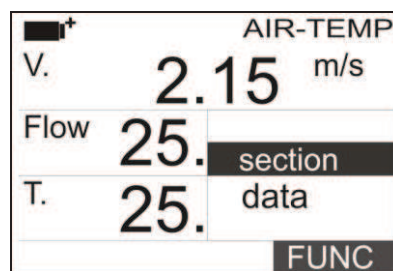
By pressing **SHIFT FNC**, a drop-down menu is shown with the following information:

- **unit:** allows selection of measuring unit for the actual variable.
- **data:** Allows display of the maximum, minimum, and average values.
- **section:** Allows setting the pipeline section for flow rate calculation
- **Cal CO₂:** allows starting of calibration procedure for the CO₂ probe.
- **Cal CO:** allows starting of calibration procedure for the CO probe and sensor change.

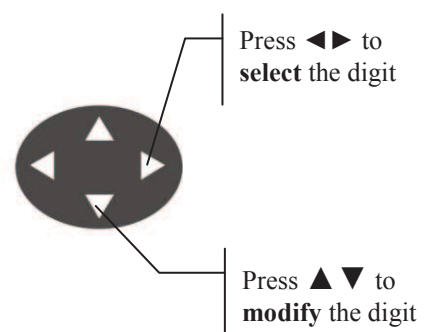
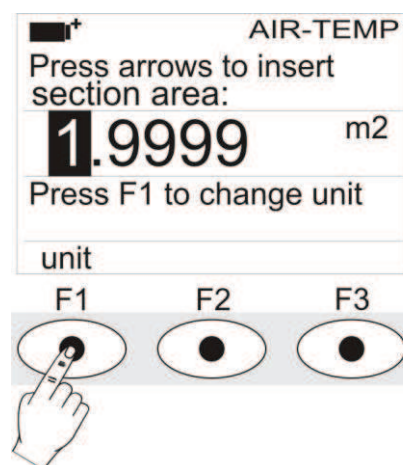
4.3.1 Setting the pipeline section

Proceed as follows to access **section** function:

- Use **SHIFT FNC** to open the drop-down menu;
- Use the arrow keys **▲▼** to select **section**;
- Press **ENTER** to confirm;
- The Shortcut menu will appear:



- Use the **▲▼** navigation keys to select **section** and press **enter**. The following screen will appear:



- Use the **◀▶** navigation keys to highlight the digit in the section. Use the **▲▼** navigation keys to modify the highlighted digit.

The area comprised must be between 0.0001 m² (1 cm²) and 1.9999 m².

Pressing **F1** toggles the display between **m2** and **inch2**;

- Press **enter** to confirm the information and exit from the setting section.
- Press **ESC** to exit the drop-down menu without making any change.

4.3.2 The maximum, minimum and average values of the captured quantities

Proceed as follows to access **data** function:

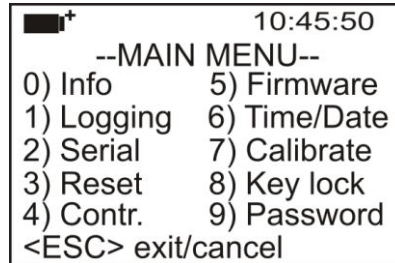
- Use **SHIFT FNC** to open the drop-down menu;
- Use the arrow keys **▲ ▼** to select **data**;
- Press **ENTER** to confirm: the selected quantity is displayed in the central line of the display;
- The three quantities **max** (maximum), **min** (minimum) and **avg** (average) are shown in the bottom line of the display, using **F1** or **F2**.

The **F3** key allows choosing to clear (**Clr**) the maximum, minimum and average data of the captured measurements:

- In order to clear the data, select **Clr** with **F3**;
- Another drop-down menu will open;
- Use the arrow keys **▲ ▼** to select **yes**;
- Press **ENTER** to confirm.
- Press **ESC** or select **no**, to exit without clearing the data.

5. MAIN MENU

To access the programming menu press **SETUP**: The setting menu will be displayed with the following items:



- | | |
|------------|--------------|
| 0) Info | 5) Firmware |
| 1) Logging | 6) Time/date |
| 2) Serial | 7) Calibrate |
| 3) Reset | 8) Key lock |
| 4) Contr. | 9) Password |

If you do not press any key within 2 minutes, the instrument goes back to the main display.

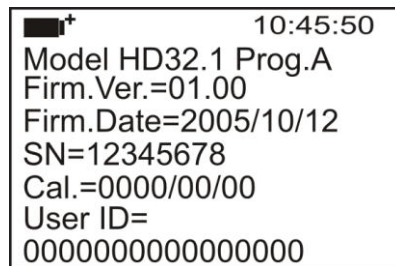
Use the arrow keys **▲ ▼ ◀ ▶** and press **ENTER** to select an item.

To exit the selected item and return to the previous menu, press **ESC**.

To exit immediately from the main menu, press **SETUP** again.

5.1 INFO MENU

Once you enter the main menu by pressing **SETUP**, press **▼** and **ENTER** to access the **Info** menu, The following information on the instrument will be displayed: Instrument code and operating program, firmware date and version, serial number, instrument calibration date, user identification code.



- **Model HD32.1 Prog. A: Microclimate Analysis Operating Program**
- **Model HD32.1 Prog. B: Discomfort Analysis Operating Program**
- **Model HD32.1 Prog. C: Physical Quantities Operating Program**

To change the USER ID, press **ENTER**. Using the arrows **◀ ▶**, select the figure you want to change and modify it with arrows **▲ ▼**. Proceed for all other figures and, at the end, confirm with the **ENTER** key. Note: The USER ID can also be changed by software.

Press **ESC** to return to the main menu. Press **SETUP** to exit the menu.

5.2 LOGGING MENU

Once you enter the main menu by pressing **SETUP**, to access the **Logging** menu proceed as follows:

1. Use the arrow keys **▲ ▼** to select **Logging**;
2. Press **ENTER**:

The parameter setting submenu for the logging sessions (measured data capture) will be displayed.

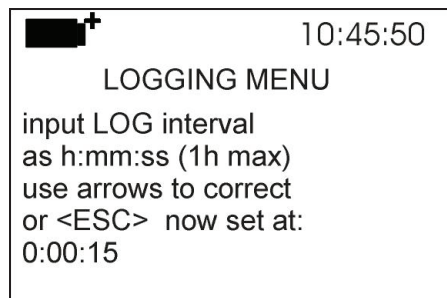


You can set the data capture frequency (**Log interval**) and the automatic logging start (**Start/stop time**). **The capture interval is the same for all probes.**

5.2.1 Log Interval

Use this item to set the LOG interval (interval between two subsequent sample captures): To enter this setting, proceed as follows:

Once you have accessed the **LOGGING** submenu (previous par.) use the arrow keys **▲ ▼** to select **Log Interval**:



1. Use the arrow keys **▲ ▼** to select the interval duration from 15 seconds to one hour;
2. Press **ENTER** to confirm and return to the Logging menu;
3. Press **ESC** to return to the **Logging** menu without making any change;
4. Press **ESC** again to return to the main menu;
5. Press **SETUP** to exit immediately from the menu.

These are the available values: 15 seconds - 30 seconds - 1 minute - 2 minutes - 5 minutes - 10 minutes - 15 minutes - 20 minutes - 30 minutes - 1 hour

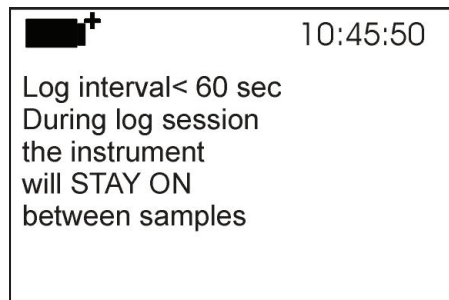
Storage interval	Storage Capacity	Storage interval	Storage Capacity
15 seconds	About 11 days and 17 hours	10 minutes	About 1 year and 104 days
30 seconds	About 23 days and 11 hours	15 minutes	About 1 year and 339 days
1 minute	About 46 days and 22 hours	20 minutes	About 2 years and 208 days
2 minutes	About 93 days and 21 hours	30 minutes	About 3 years and 313 days
5 minutes	About 234 days and 17hours	1 hour	About 7 years and 261 days

5.2.2 Self Shut-off mode

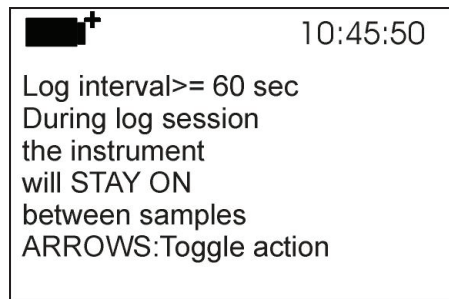
The **Self shut-off mode** item controls the instrument's automatic turning off during logging, occurring between the capture of a sample and the next one. **When the interval is lower than 60 seconds, the instrument will always remain on.** With intervals greater than or equal to 60 seconds, it is possible 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.

Once you have accessed the **LOGGING** submenu (previous par.) use the arrow keys ▲ ▼ to select **Self shut_off mode**:

- If the set **Log Interval** (see previous par.) is lower than 60 seconds, the following will be displayed



- If the set **Log Interval** (see previous par.) is greater or equal to 60 seconds, the following will be displayed



1. By using the arrow keys ▲ ▼ you can select:

STAY ON (the instrument stays on)

SHUT OFF (the instrument stays off)

2. Press **ESC** to return to the **Logging** menu;
3. Press **ESC** again to return to the main menu;
4. Press **SETUP** to exit immediately from the menu.

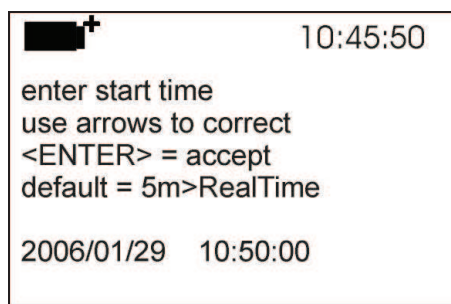
5.2.3 Start/stop time – Automatic start

The logging start and end can be programmed by entering the date and time. When called, the function suggests the current time plus 5 minutes as the start time: Press <ENTER> to confirm or set the date and time using the arrow keys. Then you are asked to set the data to end the recording: By default the instrument suggests the start time plus 10 minutes. The default suggested values are such to allow the user to setup an instrument ready for measurement.

NOTE: By default the set time is 5 minutes after the current time.

To enter this setting, proceed as follows.

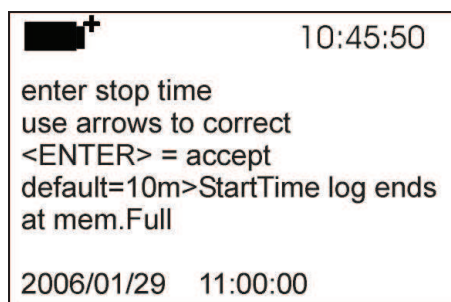
Once you have accessed the **LOGGING** submenu (previous par.) use the arrow keys ▲ ▼ to select **Start/Stop time**: The following message “Enter start time” will be displayed:



enter start time
use arrows to correct
<ENTER> = accept
default = 5m>RealTime
2006/01/29 10:50:00

1. Use the arrow keys ◀ ▶ to select the data to be changed (year/month/day and hour:minutes:seconds);
2. Once selected, the data will start blinking;
3. Use the arrow keys ▼ ▲ to change its value;
4. Confirm by pressing **ENTER**;
6. Press **ESC** to return to the **Logging** menu without making any change;
7. Press **ESC** again to return to the main menu;
8. Press **SETUP** to exit immediately from the menu.

After setting the logging start time, the logging end time (enter stop time) window will be displayed:



enter stop time
use arrows to correct
<ENTER> = accept
default=10m>StartTime log ends
at mem.Full
2006/01/29 11:00:00

1. Use the arrow keys ◀ ▶ to select the data to be changed (year/month/day and hour:minutes:seconds);
2. Once selected, the data will start blinking;
3. Use the arrow keys ▼ ▲ to change its value;
4. Confirm by pressing **ENTER**;
5. Press **ESC** to return to the **Logging** menu without making any change;
6. Press **ESC** again to return to the main menu;
7. Press **SETUP** to exit immediately from the menu.

NOTE: By default the acquisition end time is 10 minutes after the logging session start time.

8. Once both values have been set, a summary will be displayed: Start and end time of the LOG session.



10:45:50
<ENTER> to confirm
Start time
2006/01/29 10:50:00
End time
2006/01/29 11:00:00
<ESC> exit/cancel

9. Press **ENTER** to confirm or **ESC** to exit without enabling the automatic start: In both cases, you will return to the **LOGGING** menu.

10. Press **SETUP** to exit immediately from the main menu.

When the instrument starts automatically a LOG session, a beep is issued on each capture and the blinking **LOG** message is shown at the top of the display.

Press **MEM** to stop the session before the set time.

To cancel the automatic start setting, use the **Cancel auto start** function as illustrated in the following paragraph.

NOTE: The automatic logging session is started even when the instrument is off. If it is off when the automatic logging session is started, the instrument is turned on few seconds earlier and remains on at the end of logging. If it is powered by the battery, it is turned off when idle for some minutes at the end of the logging session.

See paragraph 4.2.2 to set the automatic shut off.

5.2.4 Cancel auto start

Once the LOG session start and end times are set, you can prevent the session automatic start by using **Cancel auto start**.

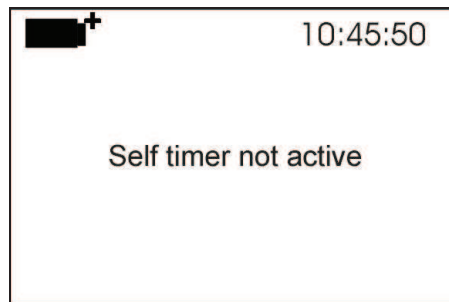
Once you have accessed the **LOGGING** submenu:

1. Use the arrow keys **▲ ▼** to select **Cancel auto start**
2. The LOG session start and end times will be displayed:



10:45:50
Self-timer abort
start scheduled at
2006/01/29 10:50:00
stop scheduled at
2006/01/29 11:00:00
ARROW delete schedule

3. By pressing ▲ the following message will be displayed: "Self timer not active";

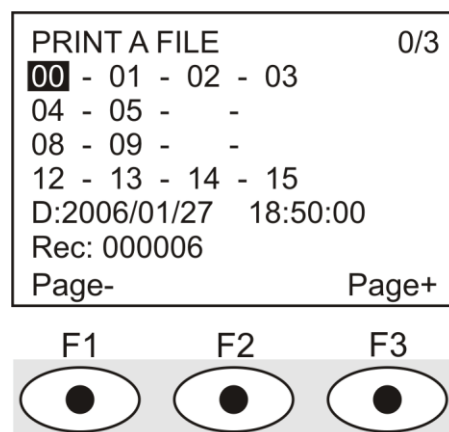


4. Press **ENTER** to cancel the automatic start;
5. Press **ESC** to exit without cancelling the automatic start;
6. Press **ESC** again to exit from the submenu;
7. Or press **SETUP** to exit immediately from the main menu.

See the previous paragraph to set a new automatic start time after cancelling the previous one.

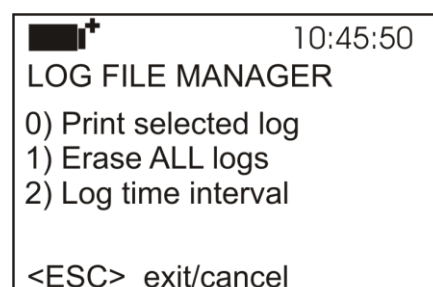
5.2.5 Log File Manager

This item allows managing the captured logs: the instrument allows printing the files of the captured data (**Print selected log**) and deleting all memory (**Erase ALL logs**). The instrument can store up to 64 LOG sessions numbered progressively from 00 to 63, in a 4-line and 4-column layout. If there are more than 16 sessions, press F1 (**Page-**) to go back to the previous screen and F3 (**Page+**) to go to the next one. The current page (0,1,2 or 3) and the total pages with stored data are displayed in the upper right corner: in the example below, "0/3" refers to page 0 of 3 with stored data.



Once you have accessed the **LOGGING** submenu:

1. Use the arrow keys ▲ ▼ to select **Log File manager**: the following submenu will display



- 0) Print selected log
- 1) Erase ALL logs
- 2) Log time interval

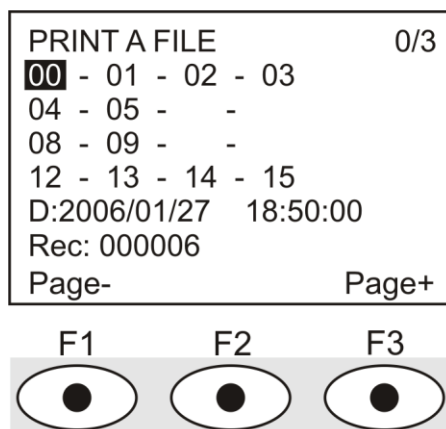
- 2. Use the arrow keys ▲▼ to select a menu item;
- 3. Press **ENTER** to confirm;
- 4. Press **ESC** to go back to menu;
- 5. Press **SETUP** to exit the main menu directly.

NOTE: you can connect a PC or a serial port printer to the instrument RS232 serial port. If you connect a parallel port printer, you will need a parallel-serial converter between the instrument and the printer (not supplied with the instrument). Before starting the printing via the RS232C port, set the baud rate. To do so, select **Baud Rate** in the **Serial** menu (see par. 5.3.1 Baud Rate) and select the maximum value equal to **38400 baud**. If you connect a printer, set its maximum value allowed.

The instrument to Pc or printer communication is possible provided that the instrument baud rate is the same as that of computer or printer.

0) Print selected log:

By selecting this item, the page of the log to be printed will be displayed:



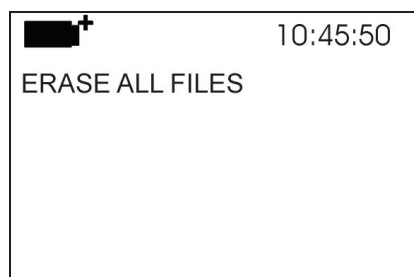
- 1. Use the arrow keys ▲▼◀▶ to select the log to be printed ;press F1 and F3 to go to another page;
- 2. once you select a file, the acquisition start date and time and the number of samples in the file (Rec)are displayed in the lower corner of the display. **Files are stored in ascending order.** Each file is identified by date and time only, **both shown on the display.** In the example above, the 00 file is selected: logging began on 27th January 2006 at 18.50. The file contains 6 samples.
- 3. Press **ENTER** to print the selected log (or press **ESC** to return to the previous menu, without printing);

NOTE: You can print a file only by using the same operating program that generated the data.

- 4. The data transfer message will be displayed a few seconds, then the instrument will go back to the **Print selected log** page to select another log to be printed;
- 5. Repeat the procedure to print the required sessions or press **ESC** to exit this menu;
- 6. Press **SETUP** to exit immediately from the main menu.

1) Erase all memory

If you select this item, “ERASE ALL FILES” will display:

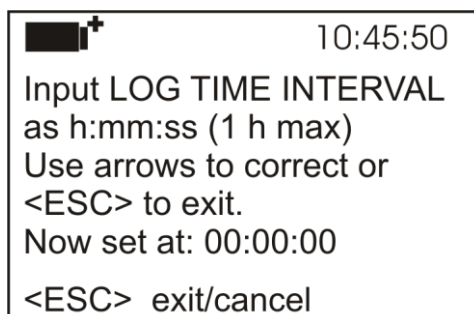


1. press ENTER to erase all files;
2. press ESC to undo and back to the previous menu;
3. press SET to exit the main menu directly.

2) Log time interval

It refers to logging time: when the set time interval expires, logging stops. Press the MEM key to stop logging before the set time interval expires.

To disable this function, set time at 0. In this case, if you press the MEM key or the memory is full, logging will stop.



Use the arrow keys to change the set time, the allowed maximum value is 1 hour.

Press **ENTER** to confirm.

Press **ESC** to exit this submenu without saving changes.

Press **SETUP** to exit the main menu directly.

5.3 SERIAL MENU (SERIAL COMMUNICATION)

The **Serial** submenu allows setting the data transfer speed via serial port (**Baud rate**) and the record printing interval (**Print Interval**).

The LOG sessions can be downloaded on a PC, through serial **RS232** or **USB** connection.

In case of serial connection, the transfer speed can be set by the user (see next par.) but it can not be higher than 38400 bps.

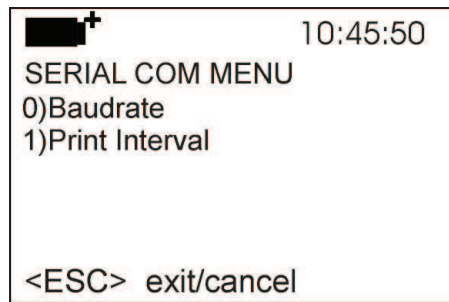
In case of USB connection, the transfer speed is fixed at 460800 bps.

After downloading the data on the PC, using the dedicated software, they will be processed by this software for graphic display and the calculation of the comfort/stress indexes.

The instrument can be connected directly to an 80 column serial printer.

To access the **Serial** submenu, proceed as follows:

1. Press **SETUP**;
2. Use the arrow keys **▲ ▼** to select **Serial**;
3. Press **ENTER**;
4. You will get the **Serial** submenu.

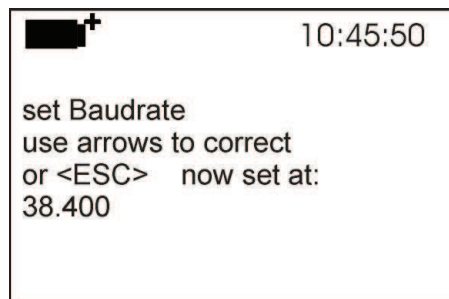


5.3.1 Baud Rate

The **Baud Rate** indicates the speed used for the serial communication with the PC.

To set the **Baud rate**, proceed as follows:

1. Use the arrow keys ▲ ▼ to select the item;
2. Press **ENTER**: You will get the following message:



3. Use the arrow keys ▼ ▲ to set the value;
4. Press **ENTER** to confirm and return to the previous page, or press **ESC** to cancel the change and exit the menu item;
5. Press **ESC** over and over to exit from the submenus;
6. Press **SETUP** to exit immediately from the main menu.

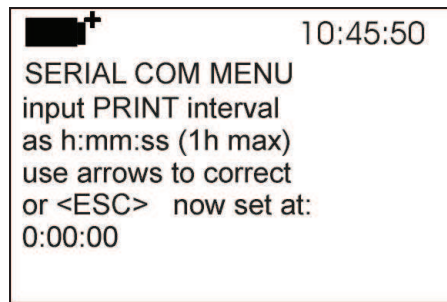
WARNING: The communication between instrument and PC (or serial port printer) only works if the instrument and PC baud rates are the same. If the USB connection is used this parameter value is automatically set.

NOTE: When setting the baud-rate, check the printer speed.

5.3.2 The Print Interval

To set the **Print Interval**, proceed as follows:

1. Use the arrow keys ▲ ▼ to select the item;
2. Press **ENTER**: You will get the following message:



3. Use the arrow keys ▼▲ to set the value;
4. Press **ENTER** to confirm and return to the previous page, or press **ESC** to cancel the change and exit the menu item;
5. Press **ESC** over and over to exit from the submenus;
6. Press **SETUP** to exit immediately from the main menu.

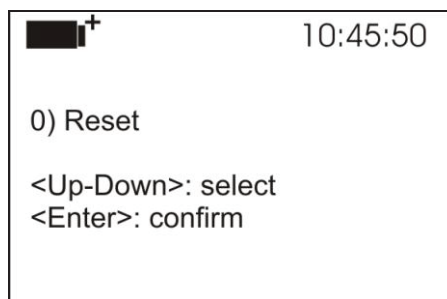
The print interval can be set from 0 seconds to one hour:

0 s - 15 s - 30 s - 1 min. - 2 min. - 5 min. - 10 min. - 15 min. - 20 min. - 30 min. - 1 hour.

5.4 RESET

To enter the **Reset** submenu in order to carry out a complete reset of the instrument, proceed as follows:

1. Press **SETUP**
2. Use the arrow keys ▲▼ to select **Reset**
3. Press **ENTER**: You will get the following message



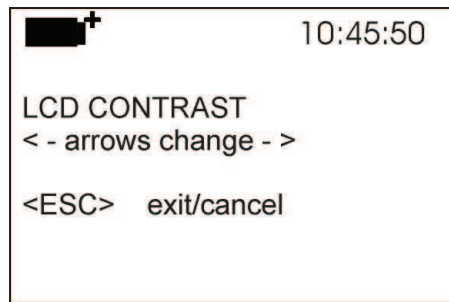
4. Use the arrow keys ▲▼ to select **Reset**
5. Press **ENTER** to confirm, or press **ESC** over and over to exit from the submenus
6. Press **SETUP** to exit immediately from the main menu.

5.5 CONTRAST

This menu item allows increasing or decreasing the contrast on the display:

To access the **Contrast** submenu, proceed as follows:

1. Press **SETUP**;
2. Use the arrow keys ▲▼ to select **Contr.**
3. Press **ENTER**:
4. You will get the following message



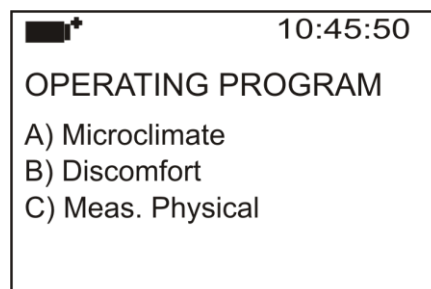
5. Use the arrow keys ◀▶ to decrease or increase the contrast;
6. Press **ENTER** or **ESC** to return to the main menu;
7. Press **SETUP** to exit immediately from the main menu.

5.6 FIRMWARE

This menu item allows changing the instrument's **operating program**.

To access the *Firmware* submenu, proceed as follows:

1. Press **SETUP**;
2. Use the arrow keys ▲▼ to select *Firmware*;
3. Press **ENTER**;
4. You will get the following display:



5. Use the arrow keys ▲▼ to select the operating program that you want to install;
6. Press **ENTER** to confirm and wait for the chosen program self-installation;
7. At the end the instrument will reset and get ready for the chosen program.

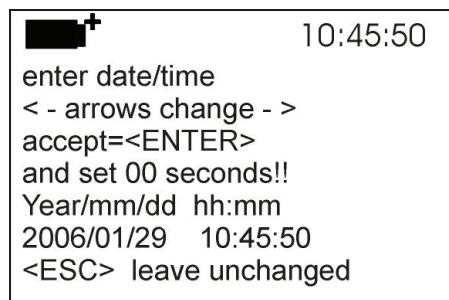
Note: The operating program must be present in the instrument.

5.7 TIME/DATE

This menu item allows setting the date and time that will be shown at the top of the display.

To access the *Time/date* submenu, proceed as follows:

1. Press **SETUP**;
2. Use the arrow keys ▲▼ to select *Time/date*
3. Press **ENTER**;
4. You will get the following message



enter date/time
 < - arrows change - >
 accept=<ENTER>
 and set 00 seconds!!
 Year/mm/dd hh:mm
 2006/01/29 10:45:50
 <ESC> leave unchanged

5. Use the arrow keys ◀ ▶ to select the data to be set (year/month/day and hour:minutes);
6. Once selected, the data will start blinking;
7. Use the arrow keys ▼ ▲ to enter the correct value;
8. Press **ENTER** to confirm and return to the main menu;
9. Or press **ESC** to return to the menu without making any change;
10. Press **SETUP** to exit immediately from the main menu.

NOTE: In regard to the time, you can set hours and minutes. The seconds are always set to 00 (set 00 seconds!!).

5.8 CALIBRATE

The *Calibrate* menu is reserved to Technical Support. It reports the calibrations and the last calibration performed:

To access the *Calibrate* submenu, proceed as follows:

1. Press **SETUP**;
2. Use the arrow keys ▲ ▼ to select *Calibrate*
3. Press **ENTER**;
4. You will get the following message:



CALIBRATION MENU
 Instrument is
 calibrated
 Calibrated:2006/07/07

5. Press **ENTER** or **ESC** to go back to the main menu: you cannot change anything: **only Technical Support can calibrate the instrument.**
6. Press **SETUP** to exit the main menu directly.

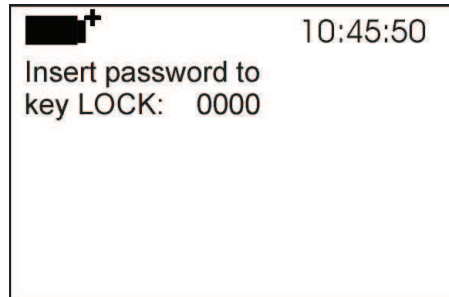
NOTE: You cannot change the calibration date.

5.9 KEY LOCK

This menu item allows LOCKING/UNLOCKING the instrument, when the password has been input: See the next chapter for further details.

To access the **Key lock** submenu, proceed as follows:

1. Press **SETUP**;
2. Use the arrow keys **▲ ▼** to select **Key lock**
3. Press **ENTER**:
4. You will get the following message: “Enter password”



5. Use the arrow keys **▼ ▲** to enter the correct password;
6. Press **ENTER** to confirm (or **ESC** to cancel);

By pressing **ENTER** you return to the main menu and the instrument is locked: A “key” is displayed at the top left of the display;

WARNING! When the instrument is locked by a password, all keys are locked, except **MEM**, used to start the LOG session and **SETUP**, **ENTER** and **ESC** that allow entering the main menu to unlock the instrument.

Therefore the user has to set all required parameters, protect the instrument using the KEY LOCK function and start the LOG session, in order to prevent any undesired access by unauthorized personnel.

To *unlock* the instrument, repeat the steps above: Enter the main menu and unlock the instrument using the **Key lock** and entering the password.

If the password is wrong, you will get the message “Wrong password”.

5.10 PASSWORD

This menu item allows setting a password to protect the instrument from unauthorized access. There are two types of passwords available, **both consisting of four characters**:

The default password consists of four zeros: 0000.

- The *user password*: can be set by the user to protect the instrument from unauthorized access;
- The *factory password* is **reserved to Technical Support**.

To access the **Password** submenu, proceed as follows:

1. Press **SETUP**;
2. Use the arrow keys **▲ ▼** to select **Password**
3. Press **ENTER**:
4. The following message will appear:

■■■+ 10:45:50

Insert
old password: 0000

<ESC> exit/cancel

5. Use the arrow keys ▲ ▼ to select the current password
6. Press **ENTER** to confirm (or **ESC** to cancel);
7. The following message will appear:

■■■+ 10:45:50

old password: xxxx

Insert
new password: 0000

<ESC> exit/cancel

8. Use the arrow keys ▼ ▲ to enter the new password;
9. Press **ENTER** to confirm (or **ESC** to cancel) and go back to the main menu;
10. Press **SETUP** to exit the main menu directly.

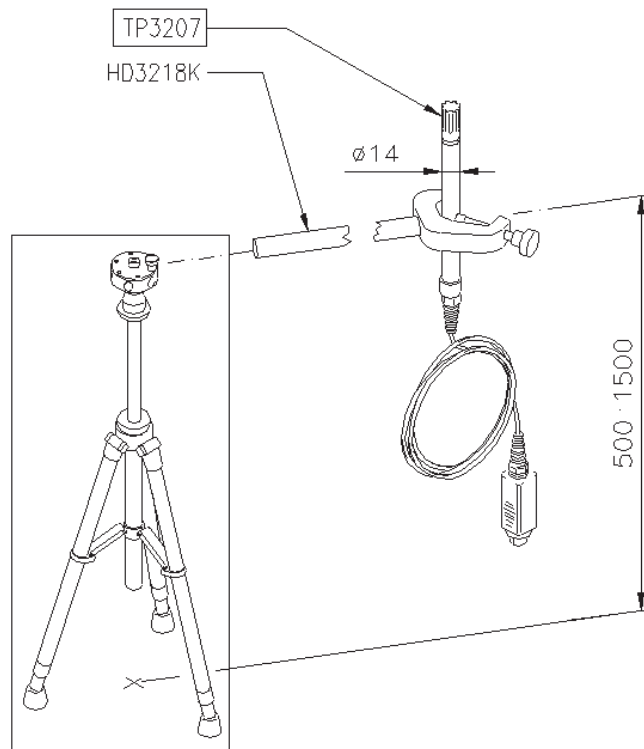
WARNING! The *User password* allows you to lock/unlock the instrument (see paragraph 5.9 Key lock).

6. PROBES AND MEASUREMENTS

6.1 A AND B OPERATING PROGRAM PROBES :

A: Microclimate Analysis

B: Discomfort Analysis



TP3207

Temperature probe

Sensor type:

Thin film Pt100

(*) Measurement uncertainty:

Class 1/3 DIN

Measurement range:

-30°C ... +100°C

Connection:

4 wires plus SICRAM module

Connector:

8-pole female DIN45326

Cable length:

2 meters

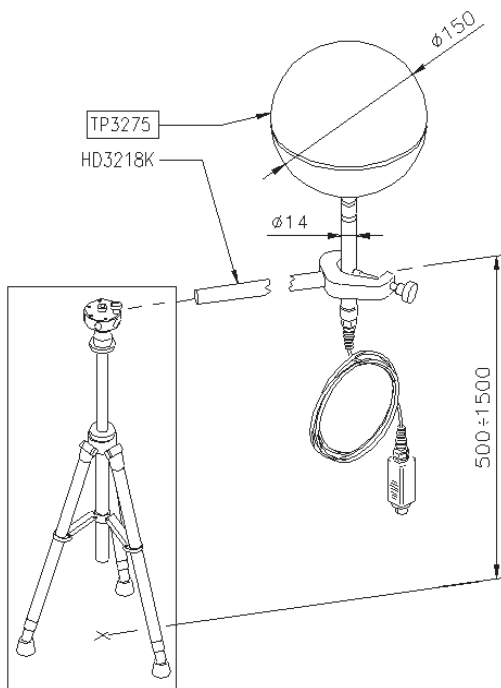
Dimensions:

Ø=14 mm L=140 mm

(**) Response Time T_{95}

15 minutes





TP3275

Globe thermometer probe $\varnothing=150$ mm according to ISO 7243 - ISO 7726

Sensor type:

Pt100

(*) Measurement uncertainty:

Class 1/3 DIN

Measurement range:

-30°C ... +120°C

Connection:

4 wires plus

SICRAM module

Connector:

8-pole female DIN45326

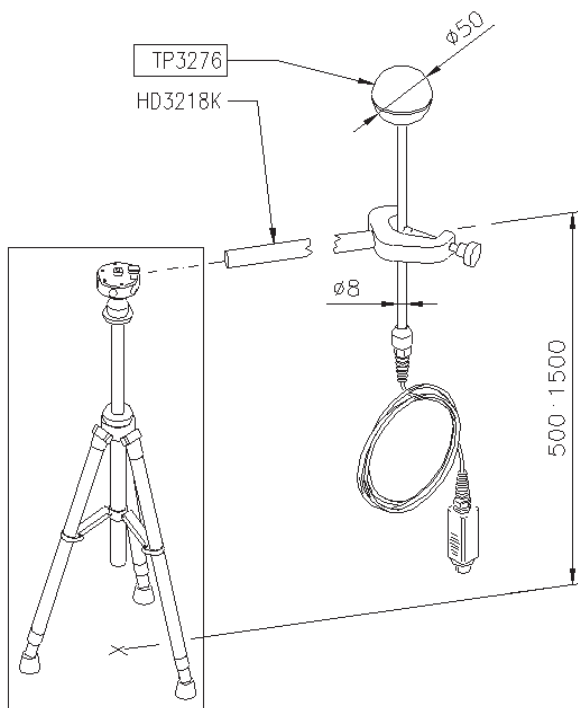
Cable length:

2 meters

(**) T₉₅ Response Time

15 minutes





TP3276

Globe thermometer probe Ø=50 mm

Sensor type: Pt100

(*) Measurement uncertainty: Class 1/3 DIN

Measurement range: -30°C ... +120°C

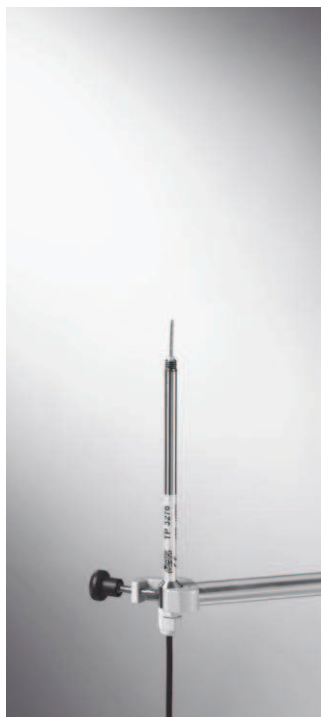
Connection: 4 wires plus SICRAM module

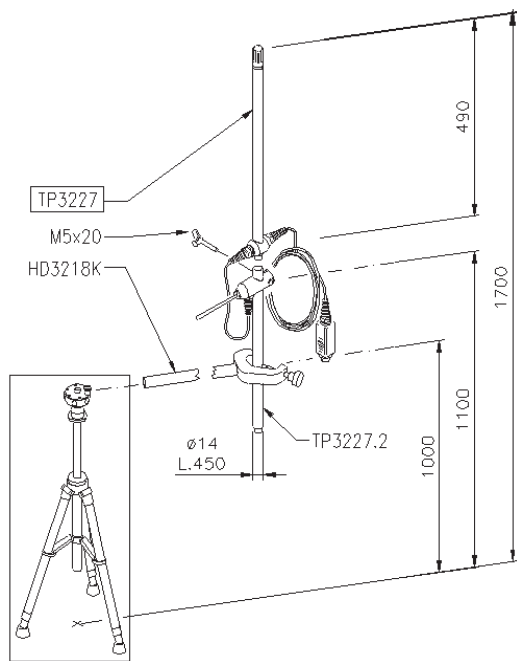
Connector: 8-pole female

DIN45326

Cable length: 2 meters

(**) Response Time T_{95} 15 minutes





TP3227K

Probe composed of 2 standalone temperature probes, Pt100 sensor. Used for local discomfort measurement

Due to vertical temperature gradient in order to study standing or seated persons. Adjustable height, complete with extension code **TP3227.2** (L=450 mm, Ø=14)

Sensor type: Thin film Pt100

(*) Measurement uncertainty: Class 1/3 DIN

Measurement range:

-10°C ... +100°C

Connection:

4 wires plus 2-input SICRAM module

Connector:

8-pole female DIN45326

Cable length:

2 meters

(**) Upper probe T₉₅

15 minutes

Lower probe T₉₅

4 minutes

The **TP3227K** probe can be used for simultaneous measurement of temperature at 1.10 m and 0.10 m.

In order to perform simultaneous measurements at different heights:

- In case of a standing person: 1.70 m, 1.10 m and 0.10 m from the floor
- In case of a seated person: 1.10 m, 0.60 m and 0.10 m from the floor

You can use the following probes:

TP3227K

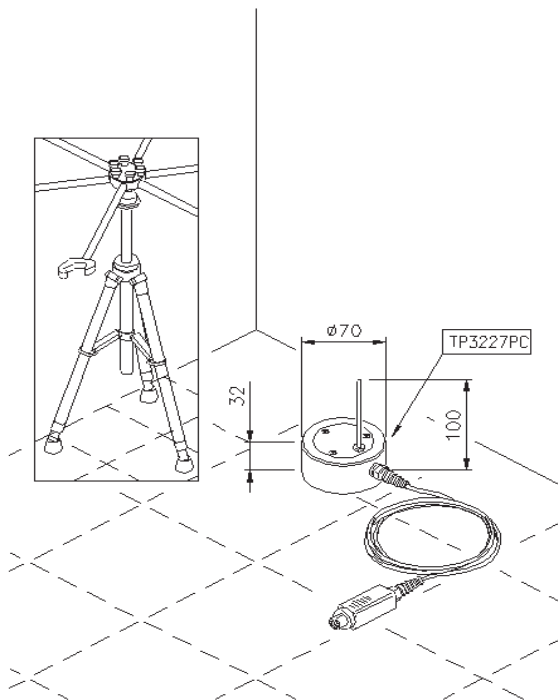
Dual probe capable of measuring:

- Temperature at 1.70 m and 1.10 m from the floor in case of standing person;
- Temperature at 1.10 m and 0.60 m from the floor in case of seated person;

TP3227PC

Dual probe for temperature measurement at floor level and at ankle height (0.10 m).





TP3227PC

Probe composed of 2 standalone temperature probes. Used for local discomfort measurement due to vertical temperature gradient. Suitable for temperature measurement at floor level and at ankle height (0.10 m). The TP3227PC has priority on the TP3227.1, if both are connected.

Sensor type: Thin film Pt100

(*) Measurement uncertainty: Class 1/3 DIN

Measurement range: -10°C ... +100°C

Connection: 4 wires plus 2-input SICRAM module

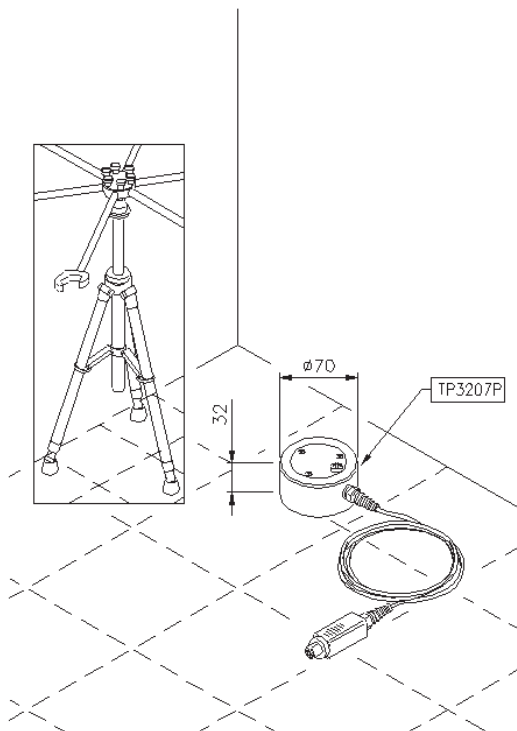
Connector: 8-pole female DIN45326

Cable length: 2 meters

(**) Ankles T₉₅: 4 minutes

Floor T₉₅: 20 minutes



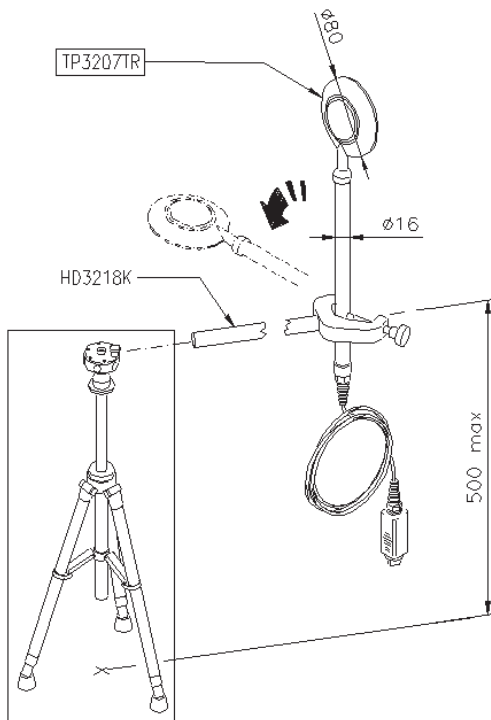


TP3207P

Temperature measurement probe at floor level, used for local discomfort measurement due to vertical temperature gradient.

Sensor type:	Thin film Pt100
(*) Measurement uncertainty:	Class 1/3 DIN
Measurement range:	-10°C ... +100°C
Connection:	4 wires plus SICRAM module
Connector:	8-pole female DIN45326
Cable length:	2 meters
(**) Response Time T_{95}	20 minutes





TP3207TR

Combined probe for radiant temperature measurement.
Used to assess the unsatisfied with the radiant asymmetry percentage.

Sensor type:

Pyranometer / NTC

(*) Measurement uncertainty:

NTC ± 0.15

Typical spectral sensitivity
 $10\mu\text{V}/(\text{W}/\text{m}^2)$

Measurement range:

$-10^\circ\text{C} \dots +100^\circ\text{C}$

Connection:

4 wires plus SICRAM module

Connector:

8-pole female DIN45326

Cable length:

2 meters

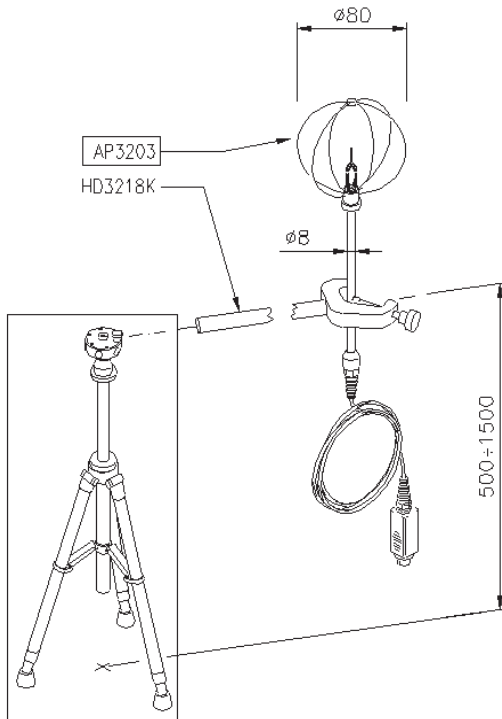
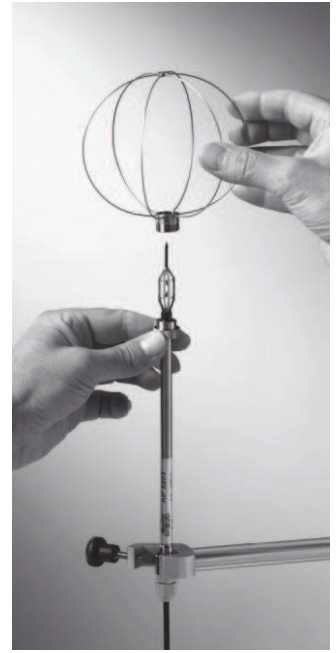
(**) Net radiometer T_{95}

90 seconds

NTC T_{95}

20 minutes





AP3203 / AP3203-F

Omni directional hot-wire probe.

Sensor type: NTC 10Kohm

(*) Measurement uncertainty: $\pm 0.02 \text{ m/s}$ ($0.05 \div 1 \text{ m/s}$)
 $\pm 0.1 \text{ m/s}$ ($1 \div 5 \text{ m/s}$)

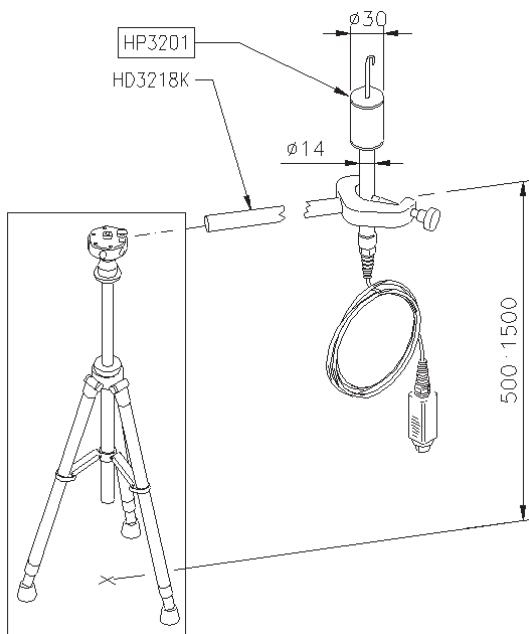
Measurement range: $0.05 \div 5 \text{ m/s}$

$0^{\circ}\text{C} \dots +80^{\circ}\text{C}$ (AP3203) / $-30^{\circ}\text{C} \dots +30^{\circ}\text{C}$ (AP3203-F)

Connection: 7 wires plus SICRAM module

Connector: 8-pole female DIN45326

Cable length: 2 meters



HP3201

Natural ventilation wet bulb probe for WBGT index measurement

Sensor type:

Pt100

(*) Measurement uncertainty:

Class A

Measurement range:

+4°C ... +80°C

Connection:

4 wires plus SICRAM module

Connector:

8-pole female DIN45326

Cable length:

2 meters

Braid length:

16 cm

Tank capacity:

15 cc

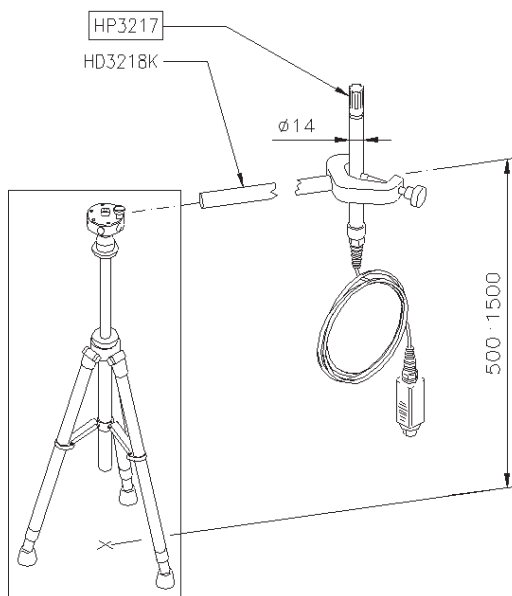
Tank autonomy:

96 hours with RH=50%, t=23°C

(**) Response time T_{95}

15 minutes





HP3217

Relative humidity and temperature combined probe.

Used for environment comfort indexes measurement

Sensors type:

- Thin film Pt100 for temperature
- Capacity sensor for relative humidity

(*) Measurement uncertainty:

Temperature: 1/3 DIN

Measurement range:

Relative humidity: $\pm 2.5\%$

Connection:

Temperature: $-30^{\circ}\text{C} \dots +100^{\circ}\text{C}$

Connector:

Relative humidity: 5%RH÷98%RH

Cable length:

7 wires plus SICRAM module

Connector:

8-pole female DIN45326

Cable length:

2 meters

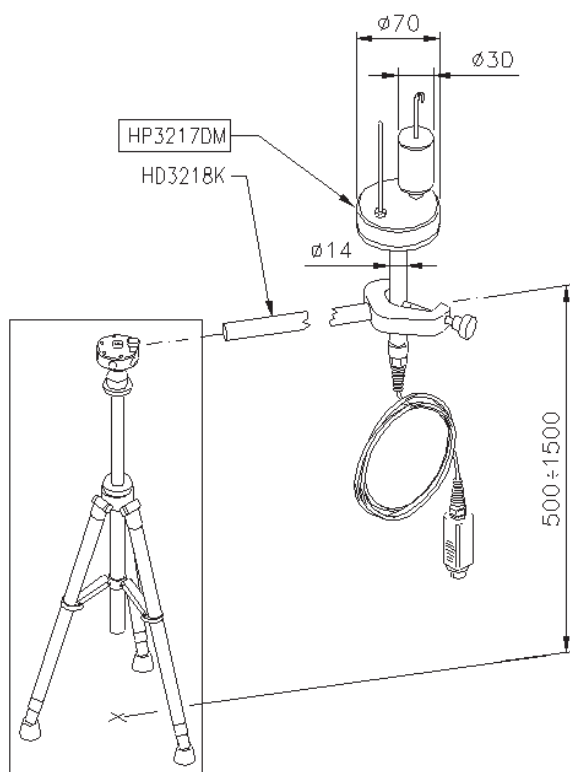
(**) %RH T_{95}

1 minute

Temperature T_{95}

15 minutes





HP3217DM

Two-sensor probe for natural ventilation wet bulb temperature and dry bulb temperature measurement. Used for environment comfort indexes measurement.

Sensor type: Pt100

(*) Measurement uncertainty: Class A

Measurement range:

Natural wet +4°C ... +80°C

Dry temperature -30°C ... +100°C

Connection: 7 wires plus 2-input SICRAM module

Connector: 8-pole female DIN45326

Cable length: 2 meters

Tank capacity: 15 cc

Tank autonomy: 96 hours with RH=50%, t=23°C

(**) Dry bulb T₉₅ 4 minutes

Wet bulb T₉₅ 30 minutes

The TP3217DM has priority on the: HD3201 and TP3207, if connected.





HD320B2

CO₂ Carbon Dioxide probe

CO ₂ measurement principle	Infrared technology (NDIR) with double source
(*) Measurement uncertainty:	$\pm(50\text{ppm}+3\%$ of the measurement) at 20°C, 50%RH and 1013hPa
Measurement range:	0 ... 5000ppm
Resolution:	1ppm
Connector:	8 female poles DIN45326
Cable length:	2 metres
(**) Response Time T ₆₃	2 minutes
Temperature Effect	0.2%/°C CO ₂ (Typical value)
Atmospheric pressure effect	Compensated with the atmospheric pressure, inside the instrument
Long-term stability	5% of the range/5 years (Typical value)
Calibration	At one point on 0ppm or 400ppm
Work Relative Temperature/Humidity	-5 ... +50°C, 0 ... 95%RH no condensing

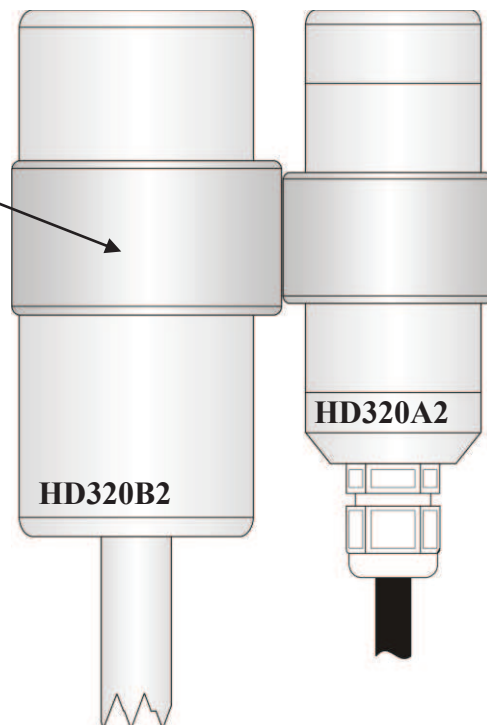


HD320A2

CO₂ Carbon Dioxide probe

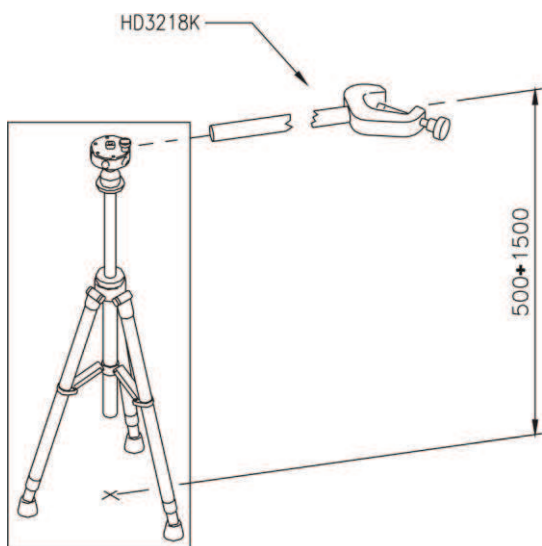
CO measurement principle	Electro chemical cell with two electrodes
(*) Measurement uncertainty:	$\pm(3\text{ppm}+3\% \text{ of the measurement})$ at 20°C, 50%RH and 1013hPa
Measurement range:	0 ... 500ppm
Resolution:	0.1ppm
Connector:	8 female poles DIN45326
Cable length:	2 metres
(**) Response Time T ₆₃	1 minute
Expected life of the probe	Usually, 5 years in normal environment conditions
Long-term stability	5% of the measurement/year (Typical value)
Calibration	At one point on 0ppm
Work Relative Temperature/Humidity	-5 ...+50°C, 0 ... 95%RH no condensing

The CO HD320A2 probe fixes on the HD320B2 probe through the suitable magnetic support code "**HD320A2S**".



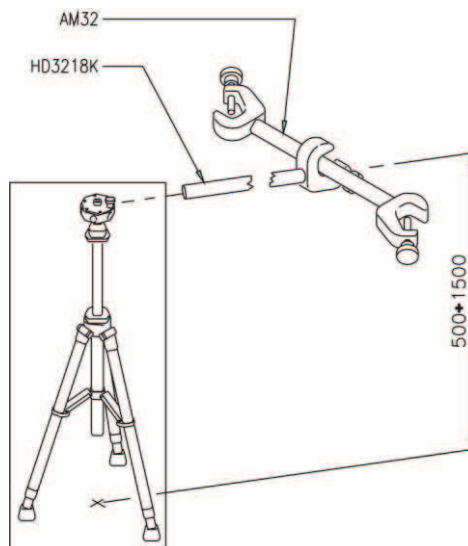
(*) The probe is calibrated. Calibration data are stored in the SICRAM module.

(**) Response time T₉₅ is the time required to reach 95% of the final value. The response time measurement is performed at neglectable air speed (still air).



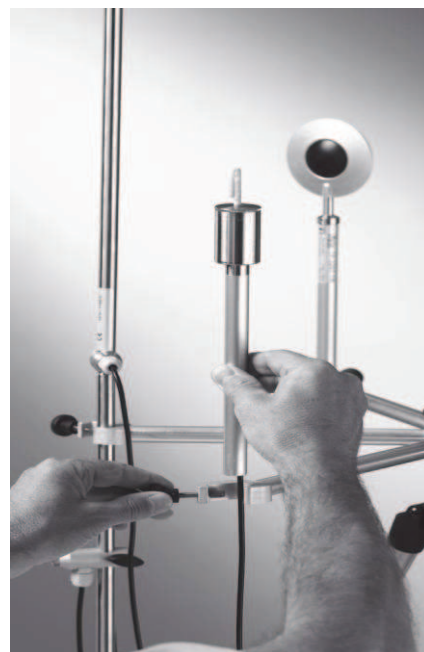
HD3218K

Rod complete with clamp and fastening screw to support the probes.



AM32

Rod complete with 2 clamps and fastening screws to support the probes.

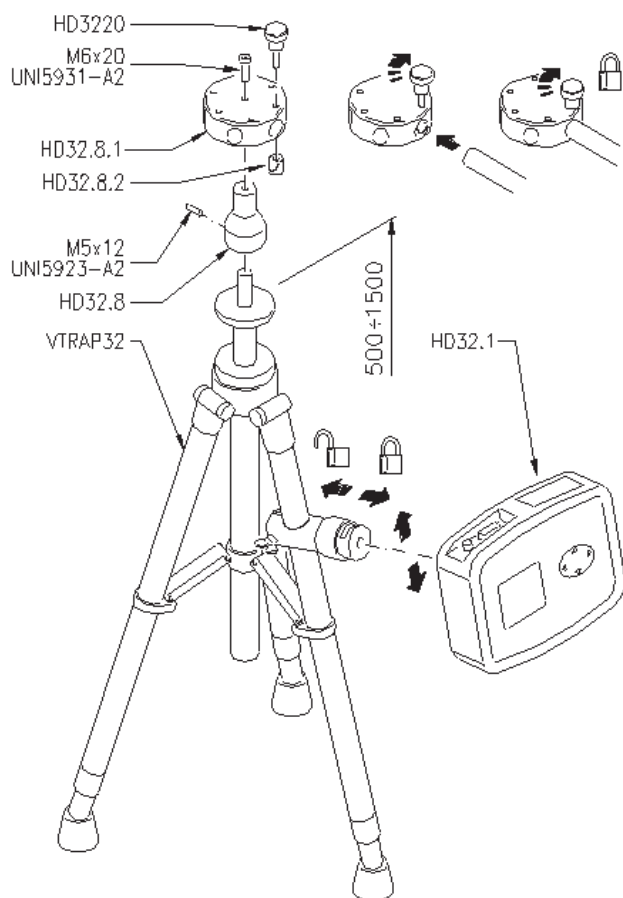


LP471...

LP 32 F/R

Support bracket for photometric-radiometric probes for Light measurement LP471...





VTRAP32K

A tripod code VTRAP32 is available for the measurements. Adjustable height up to 1.50 meters, complete with head that can host up to 6 measurement probes. The same tripod can be used to support the measurement instrument during data capture.

The arms fitted with suitable clamps for the measurement probes can be inserted in the head, code **HD3218K**.

The **VTRAP32K** kit is composed of a tripod code **VTRAP32** and 4 arms code **HD3218K**.




Performing the measurement

The tripod and required probes are assembled where you wish to perform the measurement. Then you need to setup the instrument and start the measurement. If you have to carry out the measurements in another location, you need to move everything in that new location.

At the end of the measurement session, or later, the data are transferred to a PC for processing and reports.

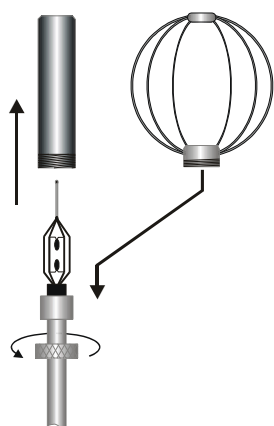
6.1.1 Warnings, care and maintenance of the probes

- Do not expose the probes to gases or liquids that could corrode the material of the probe. Clean the probes carefully after each measurement.
 - Do not bend the probe connectors or force them upward or downward.
 - Comply with the correct polarity of the probes.
 - Do not bend or force the contacts when inserting the probe connector into the instrument.
 - Do not bend, deform or drop the probes, as this could cause irreparable damage.
 - Always select the most suitable probe for your application.
 - To obtain reliable measurements, temperature variations that are too rapid must be avoided.
- 
- Some 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.
- Avoid taking measurements in presence of high frequency sources, microwave ovens or large magnetic fields; results may not be very reliable.
 - The instrument is water resistant, but should not be immersed in water. Should the instrument fall into the water, check for any water infiltration.

Wind speed hot-wire sensor AP3203



- The wind speed hot-wire sensor AP3203 is heated and, **in the presence of gas vapors, could trigger a fire or explosion. Do not use the probe in the presence of inflammable gases. Ensure that no potentially explosive gas or vapor leakage is present in the measurement environments.**
- **The probe is delicate and should be handled with extreme care.** As the sensor is only partially protected during use, a simple collision could render the probe unusable.
- After measurement, the sensor set on the probe head must be protected with the supplied threaded cylinder.
- During use, the AP3203 omni directional probe must be protected with the special metallic sphere.
- The sphere protection must be removed after use, and the sensor must be closed into the special protection cylinder.
- Do not let fingers touch the sensors.
- Use only distilled water to **clean** the probe.



The **AP3203** probe is fitted with a spherical protection screen. To reduce the space occupied when not used, the **AP3203** is supplied with a protection cylinder that can be screwed on the probe's head.

Relative humidity (RH) and temperature probe HD3217

- Do not let fingers touch the sensors. Avoid staining them with oil, grease, resins.
- The sensor base is in alumina so it could easily break.
- The sensors can be cleaned from dust and smog using distilled water and a very soft brush (e.g. badger);
- If the measurements are not consistent, check that the sensors are not dirty, corroded, splintered or broken.
- In order to check the RH measurement consistency you can use the standard saturated salt solutions: **HD75** (75% RH) and **HD33** (33% RH).

Natural ventilation wet bulb probe HP3201

Dual probe for natural ventilation wet bulb and dry bulb temperature measurement HP3217DM

The commissioning is carried out as follows:

- Remove the cover, it is not screwed-on.
- Insert the braid in the temperature probe; the braid has been previously wet with distilled water.
- Fill a container up to $\frac{3}{4}$ with distilled water.
- Close the container's cover.
- **Warning:** Do not turn the probe vertically as water will spill out.
- The braid should protrude about 20 mm from the temperature probe.
- The braid will calcify with time (harden); it should be replaced periodically.

TP3227K probe composed of 2 standalone temperature probes, Pt100 sensor and TP3227PC probe composed of 2 standalone temperature probes, Pt100 sensor:

• Adjustment of the sensors at 1.70 m, 1.10 m and 0.10 m:

Screw the telescopic rod code **TP3227.2 L=450mm** to the probe **TP3227**. Once the rod has been fastened on the clamp, adjust the height to 1.70 m for the fixed sensor. The sliding probe should be placed at 1.10 m from the floor. You should use the combined ankle/floor probe **TP3227PC** to perform the measurements at 0.10 m from the floor.

TP3227K probe composed of 2 standalone temperature probes, Pt100 sensor and TP3227PC probe composed of 2 standalone temperature probes, Pt100 sensor:

- **Adjustment of the sensors at 1.10 m, 0.60 m and 0.10 m:**

Screw the telescopic rod code **TP3227.2 L=450mm** to the probe **TP3227**. Once the rod has been fastened on the clamp, adjust the height to 1.10m for the fixed sensor. The sliding probe should be placed at 0.60 m from the floor. You should use the combined ankle/floor probe **TP3227PC** to perform the measurements at 0.10 m from the floor.

Combined probe for radiant temperature measurement TP3207TR

The face of the probe marked by the symbol  is the air flow hot side. It should be oriented toward the hot source (wall/wall ceiling/floor or floor/ceiling).

6.2 PROBES FOR THE OPERATING PROGRAM C: PHYSICAL QUANTITIES

6.2.1 Temperature measurement using the probe Pt100 complete with SICRAM module

The instrument works with temperature probes fitted with the SICRAM module (with a Platinum Pt100 sensor with 100Ω resistance at 0°C). The excitation current was chosen in order to minimize the sensor self-heating effects. The SICRAM module acts as an interface between the sensor on the probe and the instrument. There is a microprocessor circuit with a permanent memory inside the module that enables the instrument to recognize the type of probe connected and to read its calibration information.

Upon turning on the instrument automatically detects the probes fitted with SICRAM module:

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

In all versions the temperature sensor 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 back and forth. 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 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. 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 improves the response time, in addition to accuracy.

The °C or °F unit of measurement can be chosen for display, printing, and logging.

The sensor is calibrated in the factory, and the Callendar Van Dusen parameters are recorded in the SICRAM module.

6.2.2 Technical information on temperature probes Pt100 using SICRAM module

Model	Type	Application range	Accuracy
TP473P	Immersion	-100°C...+400°C	±0.25°C (-100°C...+350°C) ±0.4°C (+350°C...+400°C)
TP473C	Immersion	-50°C...+400°C	±0.25°C (-50°C...+350°C) ±0.4°C (+350°C...+400°C)
TP472I	Immersion	-196°C...+500°C	±0.25°C (-196°C...+350°C) ±0.4°C (+350°C...+500°C)
TP472I.0	Immersion	-50°C...+400°C	±0.25°C (-50°C...+350°C) ±0.4°C (+350°C...+400°C)
TP473P.0	Penetration	-50°C...+400°C	±0.25°C (-50°C...+350°C) ±0.4°C (+350°C...+400°C)
TP474C.0	Contact	-50°C...+400°C	±0.3°C (-50°C...+350°C) ±0.4°C (+350°C...+400°C)
TP475A.0	Air	-50°C...+250°C	±0.3°C (-50°C...+250°C)
TP472I.5	Immersion	-50°C...+400°C	±0.25°C (-50°C...+350°C) ±0.4°C (+350°C...+400°C)
TP472I.10	Immersion	-50°C...+400°C	±0.25°C (-50°C...+350°C) ±0.4°C (+350°C...+400°C)

Common characteristics

Resolution

0.01°C in the range ±199.99°C,

0.1°C in the remaining range

Temperature drift @20°C

0.003%/°C

6.2.3 Measurement of relative humidity using the combined humidity/temperature probe

The instrument works by using combined humidity/temperature probes (temperature with Pt100 sensor). The combined humidity/temperature probes are fitted with SICRAM module that acts as an interface between the sensor on the probe and the instrument. There is a microprocessor circuit with a permanent memory inside the module that enables the instrument to recognize the type of probe connected and to read its calibration information.

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

Measurement of relative humidity

The humidity probes are humidity/temperature combined probes: The humidity sensor is a capacitive type sensor, the temperature sensor is a Pt100 (100 Ω at 0°C).

The instrument measures relative humidity %RH and temperature, and starting from the fixed barometric pressure value of 1013.25mbar it calculates the following resulting quantities:

- g/kg Grams of vapor in a kilogram of dry air
- g/m³ Grams of vapor in a cubic meter of dry air
- hPa Partial vapor pressure (hPa)
- J/g Enthalpy
- Td Dew point (°C or °F)
- Tw Wet bulb temperature (°C or °F)

A measurement is performed by placing the probe in the area of whose parameters you wish to measure. Keep the probe far from elements that might interfere with measurement such as: heat or sources of cooling, walls, air-streams, etc. Avoid temperature drops that might cause condensation. A reading taken when no heat drop occurs is practically immediate. In contrast, in conditions involving heat drops, it is necessary to wait until the sensors and their housing have reached a thermal equilibrium in order to prevent heat irradiation or absorption on the relative humidity sensor, which would cause a faulty measurement. Since temperature affects relative humidity; move the probe like a fan in order to speed the response time in the presence of heat drops.

The calibration of the humidity/temperature sensor by the user is not required.

The humidity sensor is calibrated in our laboratory at 23°C at the points of 75%RH, 33%RH and 11.4%RH. On request, the probes can be checked at different isotherms.

The temperature sensor is calibrated in the factory and the Callendar Van Dusen parameters are recorded in the SICRAM module.

6.2.4 Technical information on relative humidity and temperature probes using SICRAM module

Model	Temperature sensor	Application range		Accuracy	
		%RH	Temperature	%RH	Temp.
HP472AC	Pt100	5...98%RH	-20°C...+80°C	±2.5% (5...95%RH)	±0.3°C
HP473AC	Pt100	5...98%RH	-20°C...+80°C	±3% (95...99%RH)	±0.3°C
HP474AC	Pt100	5...98%RH	-40°C...+150°C	±2.5% (5...95%RH) ±3.5% (95...99%RH)	±0.3°C
HP475AC	Pt100	5...98%RH	-40°C...+150°C		±0.3°C
HP475AC1	Pt100	5...98%RH	-40°C...+180°C		±0.35°C
HP477DC	Pt100	5...98%RH	-40°C...+150°C		±0.3°C

Common characteristics

Relative humidity

Sensor	Capacitive
Typical capacity @30%RH	300pF±40pF
Resolution	0.1%RH
Temperature drift @20°C	0.02%RH/°C
Response time %RH at constant temperature	10sec (10→80%RH; air speed=2m/s)

Temperature

Pt100 sensor	100 Ω @ 0°C
Resolution	0.1°C
Temperature drift @20°C	0.003%/°C

Important notes:

- 1) Do not let hands touch the RH sensor.
- 2) The sensor base is in alumina so it could easily break
- 3) Storage of the saturated solutions: The saturated solutions must be stored in a dark environment at a constant temperature of about 20°C with the container well closed inside a dry room.

Relative humidity of saturated salts at different temperatures

Temp. °C	Lithium Chloride	Magnesium Chloride	Sodium Chloride
0	11.23 ± 0.54	33.66 ± 0.33	75.51 ± 0.34
5	11.26 ± 0.47	33.60 ± 0.28	75.65 ± 0.27
10	11.29 ± 0.41	33.47 ± 0.24	75.67 ± 0.22
15	11.30 ± 0.35	33.30 ± 0.21	75.61 ± 0.18
20	11.31 ± 0.31	33.07 ± 0.18	75.47 ± 0.14
25	11.30 ± 0.27	32.78 ± 0.16	75.29 ± 0.12
30	11.28 ± 0.24	32.44 ± 0.14	75.09 ± 0.11
35	11.25 ± 0.22	32.05 ± 0.13	74.87 ± 0.12
40	11.21 ± 0.21	31.60 ± 0.13	74.68 ± 0.13
45	11.16 ± 0.21	31.10 ± 0.13	74.52 ± 0.16
50	11.10 ± 0.22	30.54 ± 0.14	74.43 ± 0.19
55	11.03 ± 0.23	29.93 ± 0.16	74.41 ± 0.24
60	10.95 ± 0.26	29.26 ± 0.18	74.50 ± 0.30
65	10.86 ± 0.29	28.54 ± 0.21	74.71 ± 0.37
70	10.75 ± 0.33	27.77 ± 0.25	75.06 ± 0.45
75	10.64 ± 0.38	26.94 ± 0.29	75.58 ± 0.55
80	10.51 ± 0.44	26.05 ± 0.34	76.29 ± 0.65
85	10.38 ± 0.51	25.11 ± 0.39	
90	10.23 ± 0.59	24.12 ± 0.46	
95	10.07 ± 0.67	23.07 ± 0.52	
100	9.90 ± 0.77	21.97 ± 0.60	

6.2.5 Wind speed measurement

The instrument works with hot-wire and vane probes fitted with the SICRAM module.

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

Note: The vane probes can be exclusively connected to input 8.

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.

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 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.

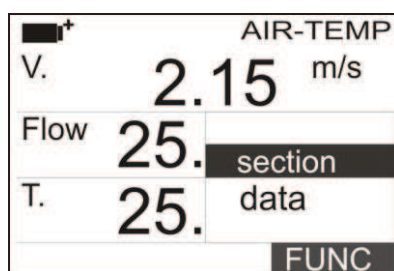
In addition, the measured fluid temperature must be considered: Hot-wire probes measure air flows at 80°C maximum temperature, the vane probes air flows of up to 120°C, depending on the model.

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

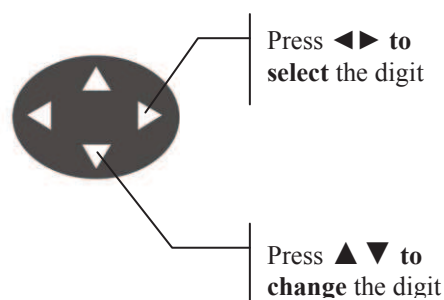
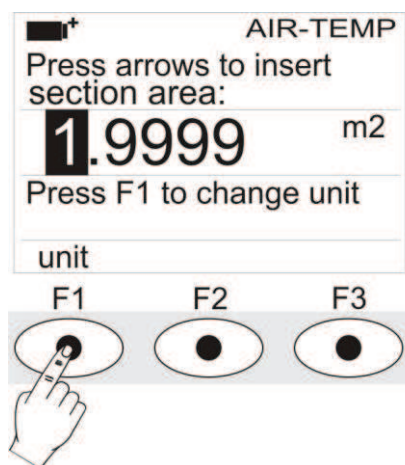
The following units of measurement are available:

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

The flow rate measurement requires knowledge of the duct or vent area orthogonal to the flow: the menu item "SECT" define the section area m² or inch². In order to set this section, you have to open the Shortcut menu by pressing **SHIFT FNC**. The Shortcut menu will appear:



Use the ▲▼ navigation keys to select **section** and press **Enter**. The following screen will appear:



Use the ◀▶ navigation keys to highlight the digits in the section. Use the ▲▼ navigation keys to modify the highlighted digit.

The area comprised must be between 0.0001 m² (1 cm²) and 1.9999 m².

Pressing **F1** toggles the display between **m2** and **inch2**;

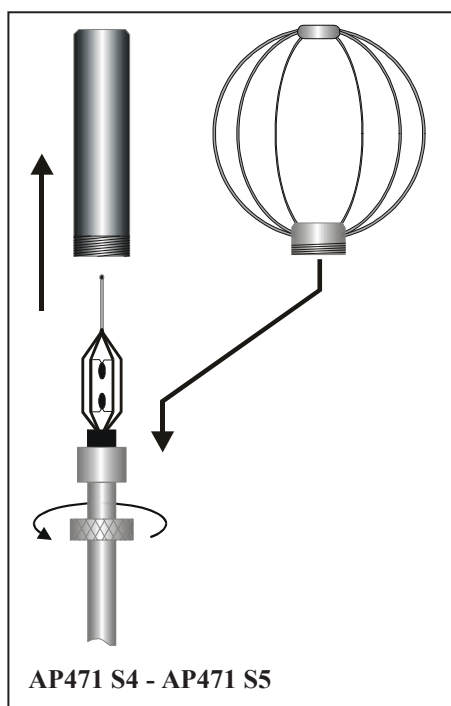
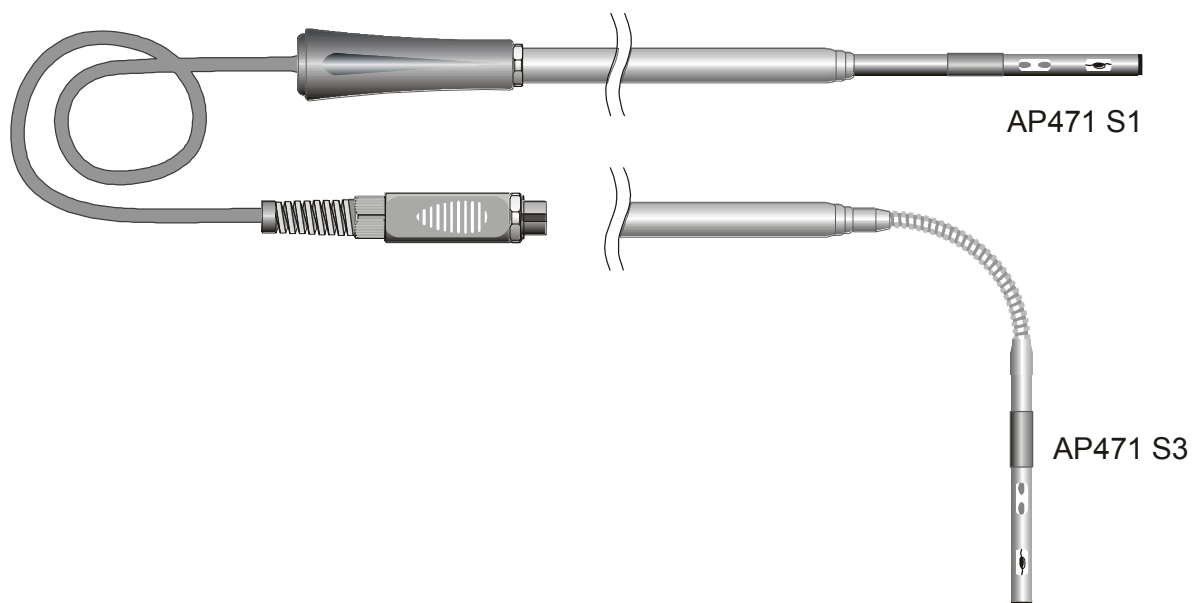
Press **Enter** to confirm the information and exit from the section setting.

6.2.6 AP471S... Hot-wire wind speed measurement probes complete with SICRAM module

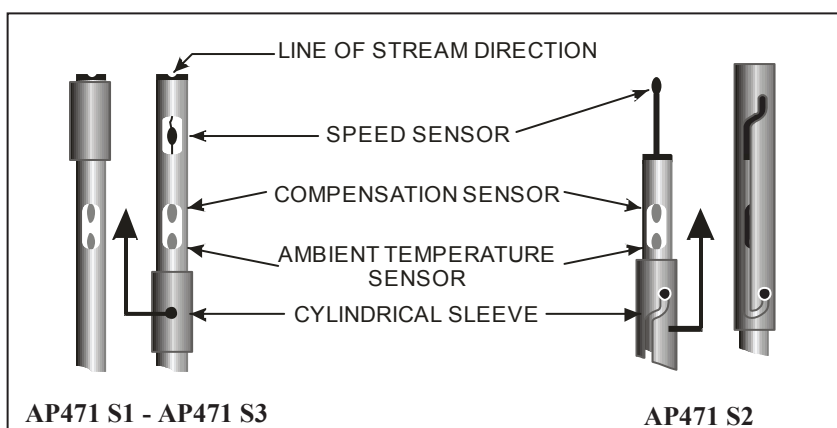
The AP471 S1 and AP471 S3 probes measure incident air flows up to 40m/s. The AP471 S2, AP471 S4 and AP471 S5 probes are fitted with an omni directional sensor allowing measurement of speeds up to 5m/s in any direction of the air flow incident on the probe. The AP471 S4 probe is fitted with support base and sensor protection, the AP471 S5 is identical to the AP471 S4, but instead of a base it is provided with a telescopic rod. The wind speed measurement is compensated for according to temperature within the range of 0°C...+80°C.

The AP471 S1, AP471 S2 and AP471 S3 probes measure the environment temperature in the range of -30°C...+110°C; the AP471 S4 and AP471 S5 probes in the range of 0°C...+80°C.

The AP472 S... modules are calibrated in the factory; no calibration is required by the user.



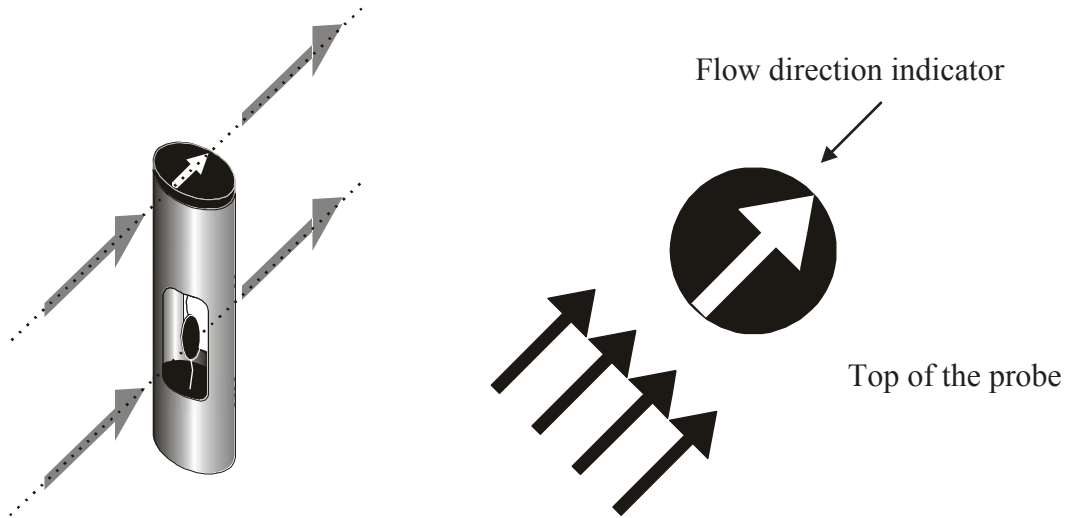
The AP471 S1, S2 and S3 probes are fitted with a cylindrical protection screen that can slide longitudinally over a groove. The screen has two end-of-travel positions that block it in measurement condition (completely low) or rest condition (completely high). To reduce the space occupied when not used, the AP471 S4 and AP471 S5 are supplied with a protection cylinder that can be screwed on the probe's head.



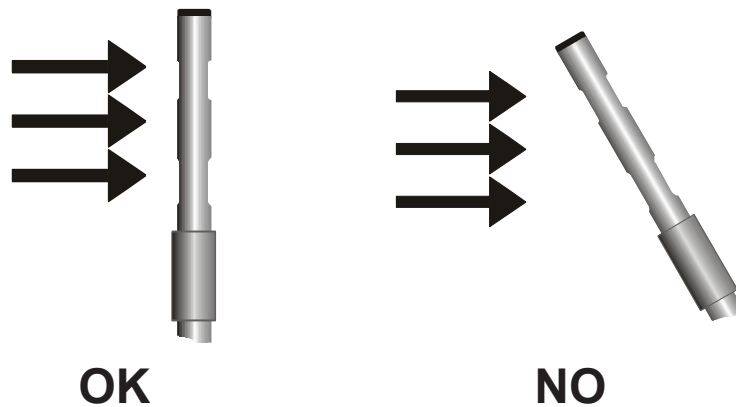
Operation

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.

6.2.7 Technical information on Hot-wire wind speed measurement and temperature probes using SICRAM module

AP471 S1 - AP471 S2 - AP471 S3 - AP471 S4 - AP471 S5

	AP471 S1 - AP471 S3	AP471 S2	AP471 S4 AP471 S5
Type of measurements	Wind speed, calculated flow rate, air temperature		
Type of sensor			
Speed	NTC thermistor	Omni directional NTC thermistor	
Temperature	NTC thermistor	NTC thermistor	
Measurement range			
Speed	0.05...40m/s	0.05...5m/s	
Temperature	-30...+110°C	-30...+110°C	0...80°C
Measurement resolution:			
Speed	0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot		
Temperature	0.1°C		
Measurement accuracy			
Speed	±0.1 m/s (0...0.99 m/s) ±0.25 m/s (1.00...9.99 m/s) ±0.6 m/s (10.00...40.0 m/s)	±0.08m/s (0...0.99 m/s) ±0.2m/s (1.00...5.00 m/s)	
Temperature	±0.4°C (-30...+110°C)	±0.4°C (-30...+110°C)	
Minimum speed	0.05 m/s		
Air temperature compensation	0...80°C		

Care and maintenance of the probes



The speed sensor of the AP471 S... probes is heated and, **in the presence of gas vapors, 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 environments.**

The probe is very delicate and should be handled with extreme care. Even a simple collision, especially of the omni directional 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 AP471 S4 and AP471 S5 omni directional probes 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 distilled water to clean the probe.