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Operating manual

Photo-radiometers

HD2102.1 – HD2102.2

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INTRODUCTION

The **HD2102.1** and **HD2102.2** are portable instruments with a large LCD display. They measure **illumination**, **luminance, PAR** and **irradiance** (across VIS-NIR, UVA, UVB and UVC spectral regions or in the measurement of effective irradiance according to the UV action curve).

The probes are fitted with the SICRAM automatic detection module: in addition to detection, the unit of measurement selection is also automatic. The factory calibration settings are already memorized inside the instruments.

In addition to instantaneous measurement the instruments calculate the acquired measurements time integral Q(t). Some thresholds can be associated with the integrated measurement and with the integration time, which can be set in the menu. When exceeded these thresholds cause the instrument to stop the integral calculation.

The HD2102.2 instrument is a **datalogger**. It memorizes up to 38,000 samples with single probes and 14,000 with combined probes. Data can be transferred from the instrument connected to a PC via the RS232C serial port or USB 2.0 port. The storing interval, printing, and baud rate can be configured using the menu.
The HD2102.1 and HD2102.2 models are fitted with an RS232C serial port and can transfer the acquired measurements in real time to a PC or to a portable printer.

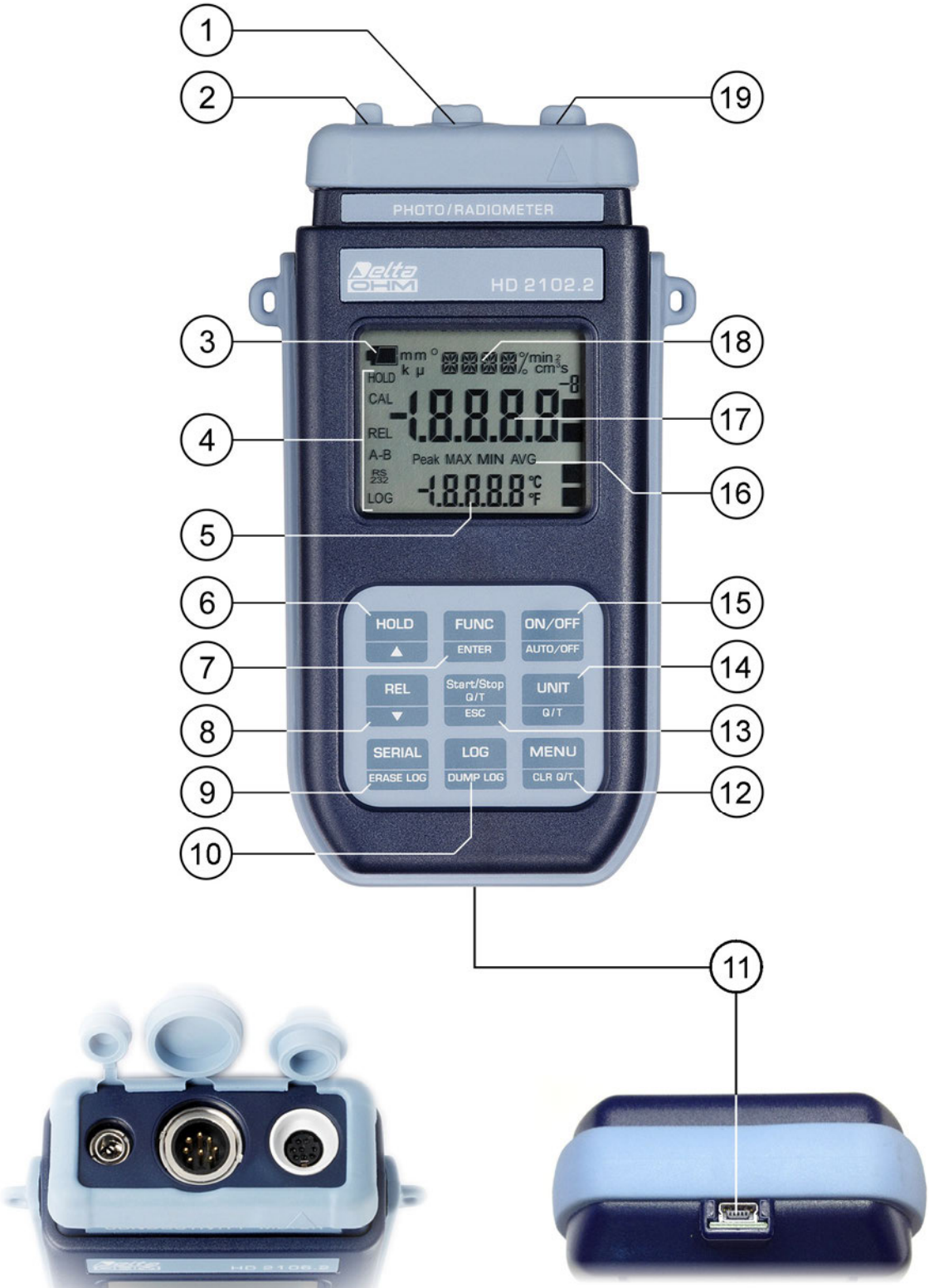
The ***Max***, ***Min*** and ***Avg*** function calculate the maximum, minimum or average values.
Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off that can also be disabled.
The instruments have IP66 protection degree.

Photo-Radiometer
HD2102.1

HD2102.1

1. Input for probes, 8-pole DIN45326 connector.
2. External auxiliary power supply connector input.
3. Battery symbol: displays the battery charge level.
4. Function indicators.
5. Secondary display line.
6. **HOLD/▲** key: freezes the measurement during normal operation; in the menu, increases the current value.
7. **FUNC/ENTER** key: during normal operation displays the maximum (MAX), the minimum (MIN) and the average (AVG) of current measurements. In the menu, confirms the current selection. Pressed with other keys, activates the secondary function. During integral Q(t) calculation, alternates the display of Q(t) and integration time.
8. **REL/▼** key: enables the relative measurement (displays the difference between the current value and the logged value when the key is pressed); in the menu, decreases the current value.
9. **SERIAL** key: starts and ends data transfer to the serial communication port.
10. **MENU - CLR Q/T** key: allows access to and exit from the menu. If the integral Q(t) calculation is enabled, pressing the MENU/CLR_Q/T and FUNC/ENTER keys simultaneously resets its value.
11. **Start-Stop_Q/T - ESC** key: if the integral Q(t) calculation is enabled, starts and ends the calculation. In the menu, cancels the operation in progress without making changes.
12. **UNIT - Q/T** key: during normal operation, selects the unit of measurement for the main variable. When pressed together with the FUNC key, starts and ends the integral Q(t) calculation procedure.
13. **ON-OFF/AUTO-OFF** key: turns the instrument on and off; when pressed together with the HOLD key, disables the automatic turn off.
14. MAX, MIN and AVG symbols.
15. Main display line.
16. Line for symbols and comments.
17. 8-pole MiniDin connector for RS232C. For the connection to PC (with cable HD2110CSNM or C206) or printer (with cable HD2110CSNM).

Photo-Radiometer
HD2102.2



HD2102.2

1. Input for probes, 8-pole DIN45326 connector.
2. External auxiliary power supply connector input.
3. Battery symbol: displays the battery charge level.
4. Function indicators.
5. Secondary display line.
6. **HOLD/▲** key: freezes the measurement during normal operation; in the menu, increases the current value.
7. **FUNC/ENTER** key: during normal operation displays the maximum (MAX), the minimum (MIN) and the average (AVG) of current measurements. In the menu, confirms the current selection. Pressed with other keys, activates the secondary function. During integral Q(t) calculation, alternates the display of Q(t) and integration time.
8. **REL/▼** key: enables the relative measurement (displays the difference between the current value and the logged value when the key is pressed); in the menu, decreases the current value.
9. **SERIAL/ERASE LOG** key: starts and ends data transfer to the serial communication port. In the menu, clears the data contained in the instrument's memory.
10. **LOG/DUMP LOG** key: during normal operation, starts and ends the saving of the measured or integrated data Q(t) in the internal memory; in the menu, starts the data transfer from the instrument's memory to the PC.
11. Mini-USB type B connector for USB 2.0. For the connection to PC (with cable CP23).
12. **MENU - CLR Q/T** key: allows access to and exit from the menu. If the integral Q(t) calculation is enabled, pressing the MENU/CLR_Q/T and FUNC/ENTER keys simultaneously resets its value.
13. **Start-Stop_Q/T - ESC** key: if the integral Q(t) calculation is enabled, starts and ends the calculation. In the menu, cancels the operation in progress without making changes.
14. **UNIT - Q/T** key: during normal operation, selects the unit of measurement for the main variable. When pressed together with the FUNC key, starts and ends the integral Q(t) calculation procedure.
15. **ON-OFF/AUTO-OFF** key: turns the instrument on and off; when pressed together with the HOLD key, disables the automatic turn off.
16. MAX, MIN and AVG symbols.
17. Main display line.
18. Line for symbols and comments.
19. 8-pole MiniDin connector for RS232C. For the connection to PC (with cable HD2110CSNM or C206) or printer (with cable HD2110CSNM).

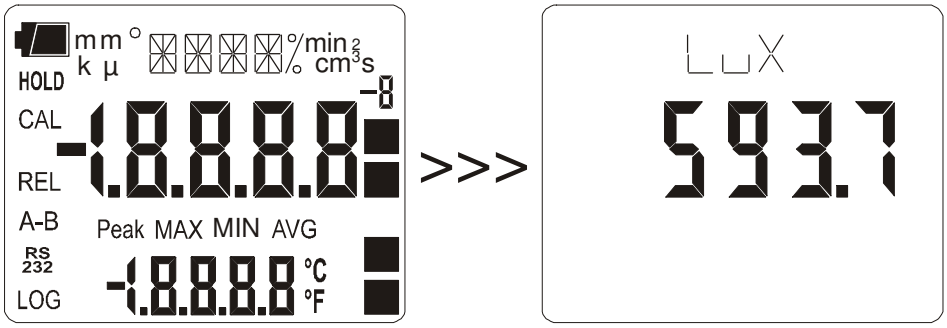
KEYBOARD AND MENU DESCRIPTION

Foreword

The instrument keyboard is composed of single-function keys, like the SERIAL key in the HD2102.1 model, and double-function keys such as the ON-OFF/Auto-OFF key.
In the double-keys, the function in the upper part is the "main function", while the one in the bottom part is the "secondary function". When the instrument is in standard measurement mode, the main function is active. In the menu or in conjunction with the FUNC key, the secondary function is enabled.
The pressing of a key is accompanied by a short confirmation beep: a longer beep sounds if the wrong key is pressed.
Each key specific function is described in detail below.

ON-OFF/Auto-OFF key

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



If during turning on no probes are connected, the message PROB ERR is displayed.
When the probe is inserted into a functioning instrument, it is not detected. As the probe's data are captured upon turning the instrument on, it is necessary to turn the instrument off and on again.
Replace the probes when the instrument is off.

If a combined probe ***LP 471 P-A*** or ***LP 471 A-UVeff*** is connected to the instrument, at switching on, the instrument displays alternatively the measures of the two sensors. Pressing any key (excluded ON/OFF key), automatic commutation is turned off. To reactivate it, press HOLD and REL keys together.

Automatic turning off

The instrument has an ***AutoPowerOff*** function that automatically turns the instrument off after about 8 minutes if no key is pressed during the intervening time. The AutoPowerOff function can be disabled by holding the HOLD key pressed down during the entire turning on phase: the battery symbol will blink to remind the user that the instrument can only be turned off by pressing the <ON/OFF> key.

The automatic turning off function is disabled when external power is used. On the other hand, it cannot be disabled when the batteries are discharged.

FUNC/ENTER key

During normal measurement this enables the display and logging of the maximum (MAX), minimum (MIN) and average (AVG) value of the measurements captured by the probe connected to the instrument, updating them with the acquisition of new samples. The acquisition frequency is once a second.
The MAX, MIN and AVG measurements remain in the memory until the instrument is on, even after exiting the calculation function. To reset the previous values and restart with a new measurement session, press FUNC until the message "FUNC CLR" appears, then use the arrows to select YES and confirm using ENTER.

In the menu, the ENTER key confirms the current parameter and then goes to the next one.

Pressed together with the UNIT-Q/T key, enables the integral Q(t) calculation function.
Pressed together with the MENU-Clear Q/T, resets the previous integral Q(t) calculation (please see the description of the UNIT key).

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

HOLD/▲ key

It increases the current parameter when used in the menu; when used in measurement mode, it freezes the measurement in progress at the current value, the message **HOLD** appears in the upper side of the display. To return to the standard measurement, press the key again.
Upon turning on the instrument, the ***AutoPowerOff*** function can be disabled by holding the HOLD key down (please see the ON-OFF key description).
During calculation of the integral Q(t), by pressing the key the displayed value is frozen **without suspending the calculation in progress**.

UNIT - Q/T key

During measurement and integral Q(t) calculation, it allows selection of the unit of measurement. By repeatedly pressing the **UNIT** key, the desired unit of measurement can be selected. In the combined probes ***LP 471 P-A*** and ***LP 471 A-UVeff***, the key allows to select one of the available measures (in these probes, unit of measurement cannot be changed).

NOTE: The **units of measurement** are determined according to the probe connected to the input, as reported in the following table:

Type of measurement	Unit of Measurement	Integral Q Unit of Measurement
Illuminance (PHOT)	lux - fcd	lux·s - fcd·s
Irradiance (RAD - UVA - UVB - UVC - PYRA)	W/m^2 - $\mu W/cm^2$	J/m^2 - $\mu J/cm^2$
PAR	$\mu mol/(m^2 \cdot s)$	$\mu mol/m^2$
Luminance (LUM 2)	cd/m^2	----

Note: **for the LP471 LUM 2 luminance probe, the integral calculation is not provided**.

This setting changes the information displayed and the immediate print of data (SERIAL key). **The data recorded using the LOG function (*HD2102.2*) and sent to the printer or PC through the serial port using the SERIAL function (*HD2102.1 and HD2102.2*), keep the chosen and displayed unit of measurement.**

While setting the limits for Q(t) calculation, the UNIT key selects the coefficient 3, 6 and 9 that multiplies the displayed value respectively by 10^3, 10^6, 10^9.

FUNC ENTER + UNIT Q/T **Integral Q(t) calculation**

Pressing the FUNC and UNIT keys simultaneously, the integral Q(t) function is started. By pressing the same keys again allows the current function to be exited and to return to standard measurement. Please see the paragraph dedicated to calculation on page 16.

Start/Stop Q/T ESC **Start/Stop Q/T - ESC key**

Starts and ends the Integral Q(t) calculation. The instrument must have previously been set for the calculation by pressing at the same time the FUNC/ENTER and UNIT-Q/T keys.

When used in the menu, it clears or cancels the active function.

REL ▼ **REL/▼ key**

In measurement mode, it displays the difference between the current value and that measured on pressing the key. The **REL** message appears on the display; press the key again to return to the current measurement.

When used in the menu, it decreases the current variable value.

MENU - CLR Q/T key

The first menu item is accessed by initially pressing on the MENU key; press ENTER to go to the following items. To modify the item displayed, use the arrow keys (▲ and ▼). The current value is confirmed by pressing the ENTER key and the display moves on to the next parameter, by pressing the ESC key the set-up is cleared.
To exit the menu, press the MENU key at any time.

The menu items are listed in this order:

1. **INTG LIMT ###s**: indicates the **integration limit** value, after which the integral calculation is stopped. The variable, replaced here using the ### symbols, is the one selected before entering the menu. By pressing the UNIT key, it is possible to select the coefficient 3, 6 and 9 that multiplies the displayed value respectively by 10^3, 10^6, 10^9.
   The combined probe ***LP 471 P-A*** has two integration limits ("INTG LIM 1" and "INTG LIM 2") while the probe ***LP 471 A-UVeff*** has three limits.
2. **TIME LIMT HOUR**: indicates the number of hours for the integration time limit, after which the integral calculation is stopped.
3. **TIME LIMT MIN**: indicates the number of minutes for the integration time limit, after which the integral calculation is stopped.
4. **TIME LIMT SEC**: indicates the number of seconds for the integration time limit, after which the integral calculation is stopped.
5. **Management of stored data (only HD2102.2)**: the message ">>>_LOG_DUMP_or_ERAS" (Transfer data or erase) is scrolled in the comment line. The center figure reports the number of free memory pages (FREE). All memory data are permanently erased by pressing SERIAL/EraseLOG. By pressing LOG/DumpLOG, the data transfer of logged data on the serial port is started: "BAUD-RATE" must have previously been set to the maximum value (please see the menu items described below and the paragraph "STORING AND TRANSFERRING DATA TO A PERSONAL COMPUTER" on page 23).
6. **Sleep_Mode_LOG** (Automatic turning off during recording) **(only HD2102.2):** this function controls the instrument's automatic turning off during logging, occurring between the capture of a sample and the next one. When the interval is lower than 60 seconds, the instrument will always remain on. With intervals greater than or equal to 60 seconds, it is possible to turn off the instrument between loggings: it will turn on at the moment of sampling and will turn off immediately afterwards, thus increasing the battery life. Using the arrows select **YES** and confirm using **ENTER** in order to enable the automatic turning off, select **NO** and confirm to disable it and keep the instrument on continuously.
   Note: even if **Sleep_Mode_LOG=YES** is selected, the instrument does not turn off for less than one minute intervals.
7. **Print and log interval**: sets the interval in seconds between two loggings or data transfers to the serial port. The interval can be set at 0, 1s, 5s, 10s, 15s, 30s, 60s (1min), 120s (2min), 300s (5min), 600s (10min), 900s (15min), 1200s (20min), 1800s (30min) and 3600s (1hour). **If the value 0 is set, SERIAL works on command: the sending of data to the serial port is performed each time the SERIAL key is pressed**. Recording (LOG) is performed with one second intervals even if the interval is set to 0. With an interval from 1 to 3600s, continuous data transfer is started when the SERIAL key is pressed. To end the recording (LOG) and **continuous** data transfer operations (SERIAL with an interval greater than 0), press the same key again.

8. **YEAR**: to set the current year. Use the arrows to modify this parameter and confirm using ENTER.
9. **MNTH (month)**: to set the current month. Use the arrows to modify this parameter and confirm using ENTER.
10. **DAY**: to set the current day. Use the arrows to modify this parameter and confirm using ENTER.
11. **HOUR**: to set the current hour. Use the arrows to modify this parameter and confirm using ENTER.
12. **MIN (minutes)**: to set the current minutes. In order to correctly synchronize the minute, it is possible to reset the seconds by pressing the UNIT key. Use the arrows to set the current minute plus one, and as soon as that minute is reached press UNIT: this synchronizes the time to the second. Press ENTER to go onto the next item.
13. **BAUD_RATE:** indicates the frequency used for the serial communication with the PC. Values from 1200 to 38400 baud. Use the arrows to modify this parameter and confirm using ENTER. **The communication between instrument and PC (or serial port printer) only works if the instrument and PC baud rates are the same**. If the USB connection is used this parameter value is automatically set (please see the details on page 23).

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Reset of integral Q(t)

Simultaneous pressure on the FUNC/ENTER and MENU-CLR Q/T keys resets the integral Q(t) and sets the instrument up for the new calculation. Please see the paragraph dedicated to calculation on page 16.

LOG/DumpLOG key - only HD2102.2

In measurement mode, this function starts and stops the logging of a data block to be saved in the instrument's internal memory. The data logging frequency is set in the "**Print and log interval**" menu parameter. The data logged between a start and subsequent stop represent a block.
When the logging function is on, the " ***LOG*** " indication is on the display, the battery symbol blinks and a beep is issued each time a logging occurs; **when using an external power supply the battery symbol does not appear**.
To end the logging, press LOG.

The HD2102.2 can turn off during logging between one capture and the next: the function is controlled by the **Sleep_Mode_LOG** parameter. When the logging interval is less than one minute, the logging instrument remains on; with an interval of at least one minute, it turns off between one capture and the next if the parameter **Sleep_Mode_LOG=YES**.

The variable appearing on the display upon pressing the LOG key is saved: the variable associated with the probe connected to the instrument, with its relevant unit of measurement or the integral Q(t).
With the combined probes ***LP 471 P-A*** and ***LP 471 A-UVeff*** each sample in memory contains three measures (illuminance, UVA irradiance and the ratio of the two measurements with the first probe;

total effective irradiance, the effective irradiance in the range UV-CB and the UVA irradiance with the second probe).

Dump LOG - only HD2102.2

Press the MENU key until the ">>>_LOG_DUMP_or_ERAS" item is displayed and then press on the LOG key: the transfer of the data contained in the instrument internal memory via the serial port is started.
Please, see the paragraph dedicated to data transfer on page 23.

SERIAL key - only HD2102.1

SERIAL/EraseLOG key - only HD2102.2

In measurement mode, this function starts and stops the data transfer to the RS232C serial output.
According to the settings entered in the **Print and log interval** menu item, a single sample can be printed if **Print and log interval=**0 or a continuous indefinite printing of the measured data can be set up if **Print and log interval**=1…3600 s.
The printing operation is accompanied by the display of the RS232 symbol and the blinking of the battery symbol; **when using an external power supply the battery symbol does not appear**.
Press SERIAL to end the continuous printing.

The variable appearing on the display upon pressing the SERIAL key is printed: the variable associated with the probe connected to the instrument, with its relevant unit of measurement or the integral Q(t).
With the combined probe ***LP 471 P-A*** and ***LP 471 A-UVeff*** each sample consists of three measures (illuminance, UVA irradiance and the ratio of the two measurements with the first probe; total effective irradiance, the effective irradiance in the range UV-CB and the UVA irradiance with the second probe).

Before starting the printing with SERIAL, set the baud rate. To do so, select the **Baud Rate** menu item and select the maximum value equal to 38400 baud by using the arrows. Confirm with ENTER.
The DeltaLog9 software for PC will automatically set the baud rate value during connection. **If you are using a different program than DeltaLog9, be sure the baud rate is the same for both the instrument and the PC: the communication will only work in this way.**

Erase memory - only HD2102.2

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

THE PROBES

The instrument works with photometric and radiometric probes of the LP471… series that measure:

- **illuminance** (LP471PHOT),
- **irradiance** (LP471RAD, LP471UVA, LP471UVB, LP471UVC e LP471UVBC),
- **PAR** (LP471PAR and LP471PAR02),
- **luminance** (LP471LUM2)
- **effective irradiance** in the spectral range of blue light (LP471BLUE),
- **illuminance, UVA irradiance** and **UVA irradiance - illuminance ratio** (combined probe LP471P-A),
- **total effective irradiance UVA + UV-CB** according to the UV weighting curve (combined probe LP471A-UVeff for measuring total effective irradiance in the range 250...400 nm),
- **global solar irradiance** in the spectral range 400…1100 nm with silicon photodiode (LP471SILICON-PYRA),
- **global solar irradiance** in the spectral range 300…2800 nm. Probe consisting of a Spectrally Flat Class C pyranometer LPPYRA03 and cable with SICRAM module (LP471PYRA03),
- **global solar irradiance** in the spectral range 283…2800 nm. Probe consisting of a Spectrally Flat Class B LPPYRA02 or Spectrally Flat Class A LPPYRA10 pyranometer and a cable with SICRAM module (LP471PYRA02 − LP471PYRA10).

All probes, except LUM 2, have an angular response according to cosine law.
Upon turning on the instrument automatically detects the probe connected to the input: it is sufficient to connect it. If the instrument is already on, turn it off and back on again in order for the probe to be detected.
The **unit of measurement** is determined according to the probe connected to the input: if a probe has more units of measurement, use the UNIT key to select the desired unit.
In the combined probes, **UNIT** key allows to select one of the available measures (in these probes, unit of measurement cannot be changed).

All probes are calibrated in factory; no calibration is required by the user.
In addition to instantaneous measurement the instrument calculates the time integral Q(t) of the acquired measurement. Some thresholds can be associated with the integrated measurement and with the integration time, which can be set in the menu. When exceeded, these thresholds cause the instrument to stop the integral calculation.

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.

COMBINED PROBE LP471P-A

LP471P-A is a 2-sensor combined probe with SICRAM module for measuring **illuminance** (lux) with standard photopic spectral response and **irradiance** ($\mu W/cm^2$) in **UVA** spectral range (315...400 nm, with peak at 365 nm). The probe also provides the ratio of UVA irradiance and illuminance in µW/lumen (quantity of interest in the museums field).

Equipped with diffuser for the correction according to the cosine law.

At switching on, the instrument displays alternatively the measures of the two sensors. Pressing any key (except ON/OFF), automatic commutation is turned off. To reactivate it, press HOLD and REL keys together.

To select the measure to display, press UNIT key.

COMBINED PROBE LP471A-UVeff

LP471A-UVeff is a 2-sensor combined probe with SICRAM module for measuring **total effective irradiance** according to the UV weighting curve. Two sensors are used to correctly measure the total effective irradiance in the range 250...400 nm.

Both sensors are equipped with diffuser for the correction according to the cosine law.

The probe provides the total effective irradiance ("Er" at display), the effective irradiance in the range UV-CB ("BC" at display) and the UVA irradiance ("A" at display).

At switching on, the instrument displays alternatively the measures UVA and UV-CB of the two sensors. Pressing any key (except ON/OFF), automatic commutation is turned off. To reactivate it, press HOLD and REL keys together.

To select the measure to display, press UNIT key.

PROBES LP471PYRA10 - LP471PYRA02 - LP471PYRA03

LP471PYRA… probes measure the **global solar radiation** in the spectral range 283…3000 nm (**LP471PYRA10** and **LP471PYRA02**) or 300…2800 nm (**LP471PYRA03**). They are composed of a pyranometer (LPPYRA02, LPPYRA03 or LPPYRA10) and a cable with SICRAM module.

Since calibration data of pyranometer are saved in SICRAM module, the cable cannot be used together with other pyranometers.

The global solar radiation is expressed in W/m^2 or $\mu W/cm^2$. Measuring range is 0…2000 W/m^2.

No user calibration is required.

PROBE LP471SILICON-PYRA

LP471Silicon-PYRA measures the **global solar radiation** using a silicon photodiode in the spectral range 400…1100 nm.

The particular geometry and the diffuser allow the sensor to have a field of view of 180° according to the cosine law.

The probe is suitable for the measurement of natural sunlight. Under overcast skies, or for reflected light measurements, the use of a thermopile pyranometer is recommended (LP471PYRA…).

The global solar radiation is expressed in W/m^2 or $\mu W/cm^2$. Measuring range is 0…2000 W/m^2.

No user calibration is required.

Q/TIME INTEGRATION

In addition to instantaneous measurement, the instrument calculates the following summation:

$$(1) \quad Q(t) = \sum_{0}^{t} u(t) \cdot \Delta t, \quad \Delta t = 1\text{sec}$$

where u(t) is the instantaneous value of the input variable compared to time t. The sampling interval is fixed at 1 second.
As soon as either the Q(t) value or the integration time t reach the set limit, the integration is stopped.

Maximum integration time: 100 hours, 00 minutes, 00 seconds
Integration interval: 1 second

How to set the limits

To set the integration limit, enter the "**INTG LIMT ###S**" menu item. Use the arrows to set the desired value. Confirm by pressing ENTER.
To set the final integration time, enter the **TIME LIMT HOUR, TIME LIMT MIN** and **TIME LIMT SEC** menu items. Use the arrows to set the desired value in hours, minutes and seconds. Confirm each item using ENTER.
To cancel the limit, set its value to 0.
Combined probe LP471P-A has two integration limits, one for illuminance and one for irradiance. The integral calculation of irradiance/illuminance ratio is not provided.
LP471A-UVeff probe has three integration limits, one for each band.

How to perform an integration measurement

After setting the limits, as illustrated above, exit the menu and return to normal measurement.
Simultaneously press FUNC/ENTER and UNIT-Q/T.
To start and stop the integral calculation press Start/Stop Q/T.
To cancel the previous integration values and reset it, simultaneously press FUNC/ENTER and MENU - CLR Q/T: **if an integration is started without pressing the CLR Q/T key, the calculation will continue from the previous values**.
The integral calculation can be suspended at any moment pressing Start/Stop Q/T: in this status, to resume the integration, press the key again.

If one or more limits have been enabled in the menu, on reaching of the first, the calculation stops. Pressing FUNC/ENTER alternates the display of Q(t) and integration time.

Because the integration process proceeds according to discrete steps, the Q(t) value according to which the integration is stopped could be slightly different than the set limit, but will be equal to the first integration value that exceeds the limit.

Note: **for the LP471LUM2 luminance probe, the integral calculation is not provided**.

WARNINGS AND OPERATING INSTRUCTIONS

1. Do not bend the probe connectors or force them upward or downward.
2. Do not bend or force the contacts when inserting the probe connector into the instrument.
3. The sensors and filters should not exceed the temperature limits established with consequent irreparable degradation of their characteristics.
4. Do not drop the probes: as this could cause irreparable damage.
5. Avoid taking measurements in presence of high frequency sources, microwave ovens or large magnetic fields; results may not be very reliable.
6. The instrument is water resistant, it is IP66 but should not be immersed in water without closing the free connectors using caps. The probe connectors must be fitted with sealing gaskets. Should the instrument fall into the water, check for any water infiltration. Gently handle the instrument in such a way as to prevent any water infiltration from the connectors' side.

INSTRUMENT SIGNALS AND FAULTS

The following table lists all error indications and information displayed by the instrument and supplied to the user in different operating situations:

Display indications	Explanation
ERR	This appears if the probe has already been detected by the instrument, but is disconnected. At the same time an intermittent beep is issued.
PROB COMM LOST	This appears if the probe has already been detected by the instrument, but is disconnected. At the same time an intermittent beep is issued.
OVER or - - - -	Measurement overflow: indicates that the probe is measuring a value exceeding the measuring range.
LOG MEM FULL	Memory full; the instrument cannot store further data, the memory space is exhausted.
PROB ERR	A probe with SICRAM module has been inserted when not admissible for that specific instrument.
CAL LOST	Program error: it appears after turning on for a few seconds. Contact the instrument's supplier.
SYS ERR #	Instrument management program error. Contact the instrument's supplier and communicate the numeric code # reported by the display.
FUNC CLRD	Max, min and average values cleared.
PLS_EXIT >>> FUNC RES_FOR_FACT ONLY	Please exit using ESC key >>> This function is reserved to factory calibration.
PRBE_SER #### ####	Serial number #### #### of connected probe.
BATT TOO LOW CHNG NOW	Indication of insufficient battery charge appearing on turning on. The instrument issues a long beep and turns off. Replace the batteries.

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

Display indications	Explanation
>>>_LOG_DUMP_or_ERAS	transfer or erase data
BATT TOO LOW - CHNG NOW	battery discharged - replace it immediately
BAUDRATE >>>	baud rate value
COMM STOP	printing complete
COMM STRT	printing started
DAY_	day
DUMP_END	data transfer complete
DUMP_In_PROG >>>	data transfer in progress
ERR	error
FUNC CLR	max, min and average values clearing
FUNC CLRD	max, min and average values cleared
HOUR	hour
INTG LIMT fcdS >>>>	integration limit in fcd
INTG LIMT J/m2 >>>>	integration limit in J/m^2
INTG LIMT luxS >>>>	integration limit in lux
INTG LIMT uJ/cm2 >>>>	integration limit in $\mu J/cm^2$
INTG LIMT umolm2 >>>>	integration limit in $\mu mol/m^2$
LOG In PROG	logging in progress
LOG MEM FULL	memory full
LOG_CLRD	memory data cleared
LOG_STOP	logging complete
LOG_STRT	logging started
MIN >>> USE_UNIT_TO_ZERO SEC	minutes >>> use the UNIT key to reset the seconds
MNTH	month
NEW_PROB_DET	new probe detected
NO_PRBE_ SER_NUM	the connected probe's serial number is absent
OVER	maximum limit exceeded
PLS_EXIT >>> FUNC RES_FOR_FACT ONLY	please exit using ESC >>> function reserved to factory calibration
PRNT AND LOG INTV	printing and logging intervals
PRNT INTV >>>	printing interval
PROB COMM LOST	lost communication with probe
PROB ERR	error - unexpected probe
PRBE_SER #### ####	serial number #### #### of the connected probe
SLP_MODE_LOG	turning off during recording mode
SYS ERR #	program error number #
TIME LIMT HOUR	integration time limit in hours
TIME LIMT MIN	integration time limit in minutes
TIME LIMT SEC	integration time limit in seconds
YEAR	year

LOW BATTERY WARNING AND BATTERY REPLACEMENT

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

In this case, batteries should be replaced as soon as possible.
If you continue to use it, the instrument can no longer ensure correct measurement. The memory data are maintained.
If the battery charge level is insufficient, the following message appears when you turn the instrument on:

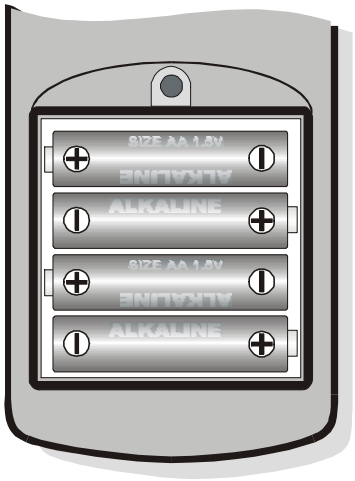
BATT TOO LOW
CHNG NOW

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

In order to avoid data loss, the logging session is ended, if the HD2102.2 is logging and battery voltage falls below the minimum operating level.

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

To replace the batteries, switch the instrument off and unscrew the battery cover counterclockwise. After replacing the batteries (4x1.5V alkaline batteries - type AA) screw the cover on clockwise.



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

MALFUNCTIONING UPON TURNING ON AFTER BATTERY REPLACEMENT

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

WARNING ABOUT BATTERY USE

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

INSTRUMENT STORAGE

Instrument storage conditions:

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

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

SERIAL INTERFACE AND USB

The HD2102.1 and HD2102.2 instruments are fitted with an electrically isolated RS-232C serial interface; the HD2102.2 also has an USB 2.0 interface.
The following serial cables can be used:

- **HD2110CSNM**: serial connection cable with 8-pole MiniDin connector on one end and 9-pole Sub D connector on the other end;
- **C.206**: serial connection cable with 8-pole MiniDin connector on one end and USB type A connector on the other end. With integrated RS232/USB converter;
- **CP23**: connection cable with Mini-USB type B connector on one end and USB type A connector on the other end (only for HD2102.2).

The connection via the C.206 cable requires the previous installation of the cable USB drivers. Install the drivers **before connecting the C.206 cable to the PC**.
The connection via the CP23 cable does not require the installation of USB drivers: when connecting the instrument to the PC, the Windows® operating system automatically recognizes the device as an HID device (Human Interface Device) and uses the drivers already included in the operating system.

Cable	Instrument port	PC port	Installation of USB drivers
HD2110CSNM	RS232 (MiniDin)	RS232 (9-pole SubD)	No
C.206	RS232 (MiniDin)	USB	Yes
CP23	USB (Mini-USB)	USB	No

The instrument standard serial transmission parameters are:

- Baud rate 38400 baud
- Parity None
- N. bit 8
- Stop bit 1
- Protocol Xon/Xoff

It is possible to change the RS232C serial port baud rate by setting the "***Baudrate***" parameter in the menu (please see page 12). The possible values are: 38400, 19200, 9600, 4800, 2400, 1200. The other transmission parameters are fixed.
The USB 2.0 connection does not require the setting of parameters.

The instruments are provided with a complete set of commands and data queries to be sent via the PC. The serial commands work with a standard serial communication program (e.g. Hyperterminal) only through the RS232 serial port of the instrument, using the cable HD2110CSNM or the cable C.206.

All the commands transferred to the instrument must have the following structure:
XYcr where: **XY** is the command code and **cr** is the Carriage Return (ASCII 0D)

Command	Response	Description
G0	Model HD2102 -21	Instrument model
G1	M=Luxmeter	Model description
G2	SN=12345678	Instrument serial number
G3	Firm.Ver.=01-00	Firmware version

Command	Response	Description
G4	Firm.Date=2004/06/15	Firmware date
G5	cal 0000/00/00 00:00:00	Calibration date and time
G6	Probe=Sicram RAD	Type of probe connected to input
G7	Probe SN=11119999	Probe serial number
G8	Probe cal.=2004/01/12	Probe calibration date
GB	User ID=0000000000000000	User code (set with T2xxxxxxxxxxxxxxx)
GC		Print instrument's heading
K0		Stop printing data
K1	PRINTOUT IMMEDIATE MODE	Immediate printing of data
K4	&	Start logging data
K5	&	Stop logging data
K6	&	Disable REL function
K7	&	Enable REL function
KP	&	Auto-power-off function=ENABLE
KQ	&	Auto-power-off function=DISABLE
LD	PRINTOUT OF LOG	Print data logged in flash
LE	&	Erase data in flash memory
LN	&1999	Number of free pages in the flash memory
P0	&	Ping (locks the instrument keyboard for 70 seconds)
P1	&	Unlocks the instrument keyboard
RA	Sample Interval= #	Reading of LOG/PRINT interval set
RP	& 720	Battery level (Resolut. 0.01V)
RUA	U= W/m2	Unit of measurement of the first variable.
RUB	U= uW/cm2	Unit of measurement of the second variable for combined probes.
RUC	U= uW/lm	Unit of measurement of the third variable for combined probes.
S0	123.4	Print of measurement (14 characters for single probe, 43 for combined probe). Combined probes provide three measurements.
S1	Re 123.4	Print of relative measurement (14 characters for single probe, 43 for combined probe). Combined probes provide three measurements.
WA#	&	Setting LOG/PRINT interval. # is a hexadecimal number 0…D that represents the position of the interval in the list 0, 1, 5, 10, …, 3600 seconds.
WC0	&	Setting SELF off
WC1	&	Setting SELF on

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

STORING AND TRANSFERRING DATA TO A PERSONAL COMPUTER

The HD2102.1 and HD2102.2 instruments can be connected to a personal computer via an RS232C serial port or USB 2.0 port, and exchange data and information through the DeltaLog9 software running in a Windows operating environment. Both models can send in real time input measured values directly to a PC, through the SERIAL function; the HD2102.2 can also store the values measured by using the ***Logging*** function (LOG key) in its internal memory. If necessary, the data stored in the memory can be transferred to a PC later.

THE *LOGGING* FUNCTION - ONLY FOR HD2102.2

The ***Logging*** function allows the recording of up to 38,000 samples with single probes and up to 14,000 with combined probes. The time interval between two consecutive measurements can be set from 1 second to 1 hour. The logging starts by pressing the LOG key and ends by pressing the same key again: the data memorized in this way form a continuous block of data.

The variable appearing on the display upon pressing the LOG key is saved: the variable associated with the probe connected to the instrument, with its relevant unit of measurement or the integral Q(t).
With the combined probes LP471P-A and LP471A-UVeff each sample in memory contains three measures (Illuminance, UVA irradiance and the ratio of the two measurements with the first probe; total effective irradiance, the effective irradiance in the range UV-CB and the UVA irradiance with the second probe).

See the description of the menu item on page 11.

If the automatic turning off option between two recordings (menu >> **Sleep_Mode_LOG**) is enabled, upon pressing the LOG key the instrument logs the first data and turns off (the LOG ON indication periodically appears on the display to indicate that the ***Logging*** function is active). 15 seconds before the next logging instant, it turns on again to capture the new sample, and then turns off.

The data stored in the memory can be transferred to a PC using the DUMP LOG command: press the MENU key until the “LOG_DUMP_or_ERAS” item is displayed and then press on LOG key. During data transfer the display shows the message DUMP; to stop the data transfer press ESC on the instrument or on the PC. If the connection to the PC is made by DeltaLog9, the software itself manages the connection and sends the appropriate commands: there is no need for any intervention on the instrument by the user.

CLEARING THE MEMORY - ONLY FOR HD2102.2

To clear memory use the Erase Log function (press the MENU key until the “LOG_DUMP_or_ERAS” item is displayed and then the SERIAL/EraseLOG key).
The instrument starts clearing the internal memory; at the end of the operation, it goes back to normal display.

NOTES:
- Data transfer does not cause the memory to be erased; the operation can be repeated as many times as required.
- The logged data remain in memory apart from battery charge conditions.
- In order to print the data to a parallel interface printer, you must use a parallel-serial adaptor (not supplied).

- **The direct connection between instrument and printer via a USB connector does not work.**
- Some keys are disabled during logging. The following keys work: HOLD, FUNC (Max-Min-Avg) and SERIAL.
- Pressing the HOLD, REL and FUNC keys has no effect on the logged data if these keys are pressed **after** starting the recording, otherwise the following is valid.
- The recording started with the display in HOLD mode proceeds normally with the actual measured values (that is, not in "HOLD" mode). Only the display is frozen to the values present when the HOLD key was pressed.
- The same is true for the Max-Min-Avg function.
- If the logging is started when the display is in REL mode, the relative values are logged.
- It is possible to activate both the logging (LOG) and direct transfer (SERIAL) functions at the same time.

THE *PRINT* FUNCTION

The PRINT function sends the measurements taken in real time by the instrument inputs directly to a PC or a printer. Print data units of measurement are the same as those used on the display. The function is started by pressing SERIAL key. The time interval between two consecutive prints can be set from 1 second to 1 hour (please see the **Print and log interval** menu item on page 11).

If the print interval is equal to 0, by pressing SERIAL key the single data is sent to the connected device. If the print interval is higher than 0, the data transfer continues until the operator stops it by pressing SERIAL key again.

The PRINT function works with a standard serial communication program (e.g. Hyperterminal) only through the RS232 serial port of the instrument, using the cable HD2110CSNM or the cable C.206.

Connect the HD40.1 printer using cable HD2110CSNM.

NOTES:

- The printout is formatted across 24 columns.
- Some keys are disabled during serial transmission. The following keys work: ON/OFF, HOLD, FUNC (Max-Min-Avg) and LOG.
- Pressing the HOLD, REL and FUNC keys has no effect on the printed data if these keys are pressed **after** starting the printing, otherwise the following is valid.
- The transfer started with the display in HOLD mode proceeds normally with the actual measured values (that is, not in "HOLD" mode). Only the display is frozen to the values present when the HOLD key was pressed.
- The same is true for the Max-Min-Avg function.
- If the serial transfer is started when the display is in REL mode, the relative values are transferred.
- It is possible to activate both the logging (LOG) and direct transfer (SERIAL) functions at the same time.

CONNECTION TO A PC

HD2102.1

Connection to the PC with the cable:

- **HD2110CSNM**: 8-pole MiniDin connector on one end and 9-pole Sub D connector on the other end;
- **C.206**: 8-pole MiniDin connector on one end and USB type A connector on the other end. With integrated RS232/USB converter (requires the installation of the USB drivers).

HD2102.2

Connection to the PC with the cable:

- **CP23**: Mini-USB type B connector on one end and USB type A connector on the other end;
- **HD2110CSNM**: 8-pole MiniDin connector on one end and 9-pole Sub D connector on the other end;
- **C.206**: 8-pole MiniDin connector on one end and USB type A connector on the other end. With integrated RS232/USB converter (requires the installation of the USB drivers).

The instruments are supplied with the DeltaLog9 software, downloadable from Delta OHM website, that manages the connection, data transfer, graphic presentation, and printing operations of the captured or logged measurements.

CONNECTION TO THE RS232C SERIAL PORT OF THE INSTRUMENT

1. The measurement instrument must be switched off.
2. Using the Delta Ohm HD2110CSNM or C.206 cable, connect the measurement instrument to the first free RS232C (COM) or USB serial port of the PC.
3. Turn on the instrument and set the baud rate to 38400 (MENU >> ENTER until the Baud Rate parameter >> select 38400 using the arrows >> confirm with ENTER). The parameter remains in the memory until replacement of the batteries.
4. Start the DeltaLog9 application and press CONNECT. Wait for the connection to occur and follow the indications on the screen. For a description of the DeltaLog9 application, please refer to its on-line Help.

CONNECTION TO THE USB 2.0 PORT OF THE INSTRUMENT - ONLY FOR HD2102.2

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

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

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

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

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

NOTES ABOUT WORKING AND OPERATIVE SAFETY

Authorized use

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

General safety instructions

This measuring system is constructed and tested in compliance with the EN61010-1 “Safety requirements for electrical equipment for measurement, control and laboratory use” and has left the factory in perfect safety technical conditions.
The smooth functioning and operational safety of the measuring system can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed during operation.
The smooth functioning and operational safety of the instrument can only be guaranteed under the environmental and electrical operating conditions that are in specified in chapter "TECHNICAL CHARACTERISTICS".

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

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

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

Obligations of the purchaser

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

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

TECHNICAL SPECIFICATIONS

Instrument

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

Operating conditions

Operating temperature	-5…50°C
Storing temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP66**

Power Supply

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

Measuring units	lux - fcd - lux/s - fcd/s - W/m^2 - $\mu W/cm^2$ - J/m^2 - $\mu J/cm^2$ - $\mu mol/(m^2 \cdot s)$ - $\mu mol/m^2$ - cd/m^2 µW/lumen for LP471P-A probe
Security of memorized data	Unlimited, independently of battery charge conditions

Time

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

Measured values storage - model HD2102.2

Type (for single channel probes)	2000 pages of 19 samples each
Type (for combined probes)	2000 pages of 7 samples each
Quantity (for single channel probes)	Total of 38000 samples
Quantity (for combined probes)	Total of 14000 samples
Selectable storage interval	1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Selectable print interval	immediate or 1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour

USB interface - model HD2102.2

Type	1.1 - 2.0 electrically isolated

Connections

Input module for the probes	8-pole male DIN45326 connector
RS232 serial interface	8-pole MiniDin connector
USB interface (only **HD2102.2**)	Mini-USB type B connector
Mains adapter (cod. **SWD10**)	2-pole connector (positive at centre)

TECHNICAL SPECIFICATIONS OF PROBES IN LINE WITH THE INSTRUMENT

For the spectral response curves of the LP471… probes, see the probes datasheet available on the Delta OHM website.

LP471PHOT – Illuminance probe, with SICRAM module.

Measurement range (lux)	0.10…199.99	…1999.9	…19999	…199.99x10^3
Resolution (lux)	0.01	0.1	1	0.01x10^3
Spectral range	in agreement with standard photopic curve V(λ)			
α (temperature coefficient) $f_6(T)$	<0.05% K			
Calibration uncertainty	<4%			
f'_1 (in agreement with photopic response V(λ))	<6%			
f_2 (response according to cosine law)	<3%			
f_3 (linearity)	<1%			
f_4 (instrument reading error)	<0.5%			
f_5 (fatigue)	<0.5%			
Class	B			
Drift after 1 year	<1%			
Operating temperature	0…50 °C			
Reference Standard	CIE No. 69 – UNI 11142			

LP471LUM2 - Luminance probe, with SICRAM module.

Measurement range (cd/m^2)	1…1999.9	…19999	…199.99x10^3	…1999.9x10^3
Resolution (cd/m^2)	0.1	1	0.01x10^3	0.1x10^3
Optical angle	2°			
Spectral range	in agreement with standard photopic curve V(λ)			
α (temperature coefficient) $f_6(T)$	<0.05% K			
Calibration uncertainty	<5%			
f'_1 (in agreement with photopic response V(λ))	<8%			
f_3 (linearity)	<1%			
f_4 (instrument reading error)	<0.5%			
f_5 (fatigue)	<0.5%			
Class	C			
Drift after 1 year	<1%			
Functioning temperature	0…50°C			
Reference standard	CIE no.69			

LP471PAR / LP471PAR02 - Quantum radiometric probe for the measurement of the **photon flow in the PAR chlorophyll range**, with SICRAM module.

Measurement range (μmol/m^2s)	0.1… 199.99	200.0…1999.9	2000…10000
Resolution (μmol/m^2s)	0.01	0.1	1
Spectral range	400 nm…700 nm		
Calibration uncertainty	<5%		
f_2 (response according to cosine law)	<6%		
f_3 (linearity)	<1%		
f_4 (instrument reading error)	±1digit		
f_5 (fatigue)	<0.5%		
Drift after 1 year	<1%		
Working temperature	0…50°C		

LP471RAD – Irradiance probe, with SICRAM module.

Measurement range (W/m^2)	$1x10^{-3}$… $999.9X10^{-3}$	1.000…19.999	20.00…199.99	200.0…1999.9
Resolution (W/m^2)	$0.1X10^{-3}$	0.001	0.01	0.1
Spectral range	400 nm…1050 nm			
Calibration uncertainty	<5%			
f_2 (response according to cosine law)	<6%			
f_3 (linearity)	<1%			
f_4 (instrument reading error)	±1digit			
f_5 (fatigue)	<0.5%			
Drift after 1 year	<1%			
Working temperature	0…50°C			

LP471UVA – UVA irradiance probe, with SICRAM module.

Measurement range (W/m^2)	$1x10^{-3}$… $999.9x10^{-3}$	1.000…19.999	20.00…199.99	200.0…1999.9
Resolution (W/m^2)	$0.1x10^{-3}$	0.001	0.01	0.1
Spectral range	315 nm…400 nm (Peak 365 nm)			
Calibration uncertainty	<5%			
f_3 (linearity)	<1%			
f_4 (instrument reading error)	±1digit			
f_5 (fatigue)	<0.5%			
Drift after 1 year	<2%			
Working temperature	0…50°C			

LP471UVB – UVB irradiance probe, with SICRAM module.

Measurement range (W/m^2)	$1x10^{-3}$… $999.9x10^{-3}$	1.000…19.999	20.00…199.99	200.0…1999.9
Resolution (W/m^2)	$0.1x10^{-3}$	0.001	0.01	0.1
Spectral range	280 nm…315 nm (Peak 305 nm)			
Calibration uncertainty	<5%			
f_3 (linearity)	<2%			
f_4 (instrument reading error)	±1digit			
f_5 (fatigue)	<0.5%			
Drift after 1 year	<2%			
Working temperature	0…50°C			

LP471UVC – UVC irradiance probe, with SICRAM module.

Measurement range (W/m^2)	$1x10^{-3}$… $999.9 \cdot 10^{-3}$	1.000…19.999	20.00…199.99	200.0…1999.9
Resolution (W/m^2)	$0.1x10^{-3}$	0.001	0.01	0.1
Spectral range	220 nm…280 nm (Peak 260 nm)			
Calibration uncertainty	<5%			
f_3 (linearity)	<1%			
f_4 (instrument reading error)	±1digit			
f_5 (fatigue)	<0.5%			
Drift after 1 year	<2%			
Working temperature	0…50°C			

LP471UVBC – UVBC irradiance probe, with SICRAM module.

Measurement range (W/m^2)	$1x10^{-3}$… $999.9x10^{-3}$	1.000…19.999	20.00…199.99	200.0…1999.9
Resolution (W/m^2)	$0.1x10^{-3}$	0.001	0.01	0.1
Spectral range	210 nm…355 nm (Peak 265 nm)			
Calibration uncertainty	<7% (calibration @ 254 nm)			
f_3 (linearity)	<2%			
f_4 (instrument reading error)	±1digit			
f_5 (fatigue)	<0.5%			
Drift after 1 year	<2%			
Working temperature	0…50°C			

LP471BLUE – Probe for the measurement of **effective irradiance in the spectral range of blue light**, with SICRAM module.

Measurement range (W/m^2)	$1x10^{-3}$… $999.9x10^{-3}$	1.000…19.999	20.00…199.99	200.0…1999.9
Resolution (W/m^2)	$0.1x10^{-3}$	0.001	0.01	0.1
Spectral range	380 nm…550 nm. Blue hazard action curve B(λ).			
Calibration uncertainty	<10%			
f_2 (response according cosine law)	<6%			
f_3 (linearity)	<3%			
f_4 (instrument reading error)	±1 digit			
f_5 (fatigue)	<0.5%			
Drift after 1 year	<2%			
Functioning temperature	0…50 °C			

LP471P-A – Two-sensor combined probe for **illuminance** and **UVA irradiance measurement**, with SICRAM module. For illuminance specifications see LP471PHOT. For UVA irradiance specifications see LP471UVA.

LP471A-UVeff –Combined probe for the measurement of **total effective irradiance according to UV weighting curve**, with SICRAM module.

Total effective irradiance	
Measurement range (W/m^2)	0.010… 19.999
Resolution (W/m^2)	0.001
Spectral range	UV action curve for erythema measurement (250…400 nm)
Calibration uncertainty	<15%
f_3 (linearity)	<3%
f_4 (instrument reading error)	±1digit
f_5 (fatigue)	<0.5%
Drift after 1 year	<2%
Functioning temperature	0…50°C
Reference Norm	CEI EN 60335-2-27
UVA Irradiance	
Measurement range (W/m^2)	0.1… 1999.9
Resolution (W/m^2)	0.1
Spectral range	315 nm…400 nm
UV-BC Irradiance	
Measurement range (W/m^2)	0.010… 19.999
Resolution (W/m^2)	0.001
Spectral range	250 nm…315 nm

LP471SILICON-PYRA – Probe for the measurement of **global solar irradiance**, with SICRAM module.

Measurement range (W/m^2)	0…999.9x10^{-3}	1.000…19.999	20.00…199.99	200.0…1999.9
Resolution (W/m^2)	0.1x10^{-3}	0.001	0.01	0.1
Spectral range	400 nm…1100 nm			
Calibration uncertainty	<3%			
f_2 (response according to cosine law)	<3%			
f_3 (linearity)	<1%			
f_4 (instrument reading error)	±1 digit			
f_5 (fatigue)	<0.5%			
Drift after 1 year	<2%			
Functioning temperature	0…50 °C			

LP471PYRA02/03/10 – "Spectrally Flat" **pyranometers,** with SICRAM module.

	LP471PYRA02	**LP471PYRA03**	**LP471PYRA10**
Measuring range (W/m^2)	0…2000		
Resolution (W/m^2)	1		
Field of view	2π sr		
Spectral range (50%)	283 nm…2800 nm	300 nm…2800 nm	283 nm…2800 nm
Operating temperature	-40…80 °C		
Technical features according to ISO 9060			
Class	B	C	A
Response time (95%)	<10 s	<20 s	<5 s
Zero Offset a) Response at 200 W/m^2 b) Response to 5 K/h ambient temperature variation c) Total zero offset including the effects a), b) and other sources	<|±10| W/m^2 <|±4| W/m^2 <|±15| W/m^2	<|±15| W/m^2 <|±4| W/m^2 <|±20| W/m^2	<|±7| W/m^2 <|±2| W/m^2 <|±10| W/m^2
Long-term instability (1 year)	<|±1|%	<|±1|%	<|±0.5|%
Non-linearity	<|±1|%	<|±1,5|%	<|±0.2|%
Response according to cosine law	<|±18| W/m^2	<|±20| W/m^2	<|±10| W/m^2
Spectral error	<|±0.5|%	<|±2|%	<|±0.2|%
Temperature response	<1.5%	<3%	<1%
Tilt response	<|±2|%	<|±2|%	<|±0.2|%

ORDERING CODES

HD2102.1 Kit including the instrument HD2102.1, 4 x 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Probes and connection cables must be ordered separately.**

HD2102.2 Kit including the HD2102.2 **datalogger,** 4 x 1.5V alkaline batteries, operating manual, case, USB cable CP23 and DeltaLog9 software downloadable from Delta OHM website. **The probes must be ordered separately.**

Accessories

HD2110CSNM Connection cable 8-pole MiniDin – Sub D 9-pole female for RS232C.

C.206 Connection cable 8-pole MiniDin – USB type A. With integrated RS232/USB converter.

SWD10 Stabilized power supply at 100-240Vac/12Vdc-1A mains voltage.

HD40.1 The kit includes: 24-column portable thermal printer, serial interface, 57 mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

BAT.40 Spare battery pack for HD40.1 printer with in-built temperature sensor.

RCT The kit includes 4 thermal paper rolls 57 mm wide and 32 mm in diameter.

PROBES WITH SICRAM MODULE

LP471PHOT Photometric probe for the measurement of **illuminance**, with SICRAM module, spectral response according to standard photopic vision, diffuser for cosine correction. Measuring range: 0.1…200x10^3 lux. Cable length 1.5 m.

LP471RAD Radiometric probe for the measurement of **irradiance** in the spectral range 400…1050 nm, with SICRAM module, diffuser for cosine correction. Measuring range: 1x10^{-3}…2000 W/m^2. Cable length 1.5 m.

LP471PAR Quantum-radiometric probe for the measurement of **photon flux in the PAR chlorophyll field** (photosynthetically Active Radiation 400…700 nm), with SICRAM module, µmol/m^2s measurement, diffuser for cosine correction. Measuring range 0.1…10x10^3 µmol/m^2s. Cable length 1.5 m.

LP471PAR02 Quantum-radiometric probe for the measurement of **photon flux in the PAR chlorophyll field** (photosynthetically Active Radiation 400…700 nm), with SICRAM module, µmol/m^2s measurement, **quartz** diffuser for cosine correction. Measuring range 0.1…10x10^3 µmol/m^2s. Cable length 1.5 m.

LP471UVA Radiometric probe for the measurement of irradiance in the 315…400 nm **UVA** spectral range, peak at 365 nm, with SICRAM module, quartz diffuser for cosine correction. Measuring range: 1x10^{-3}…2000 W/m^2. Cable length 1.5 m.

LP471UVB Radiometric probe for the measurement of irradiance in the 280…315 nm **UVB** spectral range, peak at 305 nm, with SICRAM module, quartz diffuser for cosine correction. Measuring range: 1x10^{-3}…2000 W/m^2. Cable length 1.5 m.

LP471UVC Radiometric probe for the measurement of irradiance in the 220…280 nm **UVC** spectral range, peak at 260 nm, with SICRAM module, quartz diffuser for cosine correction. Measuring range: $1x10^{-3}$…2000 W/m^2. Cable length 1.5 m.

LP471UVBC Radiometric probe for the measurement of irradiance in the 210…355 nm **UVBC** spectral range, peak at 265 nm, with SICRAM module, quartz diffuser for cosine correction. Measuring range: $1x10^{-3}$…2000 W/m^2. Cable length 1.5 m.

LP471LUM2 Photometric probe for the measurement of **luminance**, with SICRAM module, spectral response according to standard photopic vision, angle of view 2°. Measuring range: 1…$2000x10^3$ cd/m^2. Cable length 1.5 m.

LP471BLUE Radiometric probe for the measurement of **effective irradiance** in the **Blue** light spectral band, with SICRAM module. Spectral range 380…550 nm, diffuser for cosine correction. Measuring range: $1x10^{-3}$…2000 W/m^2. Cable length 1.5 m.

LP471P-A Combined probe for the measurement of **illuminance**, with standard photopic spectral response, and measurement of **irradiance** in the UVA spectral range (315…400 nm, with peak at 365 nm). Diffuser for cosine correction. Illuminance measuring range: 0.1…$200x10^3$ lux. Irradiance measuring range: $1x10^{-3}$…2000 W/m^2. The probe provides the ratio between UV irradiance and illuminance in µW/lumen. With SICRAM module and 1.5 m cable.

LP471A-UVeff Combined probe for the measurement of **effective total irradiance** according to UV action curve (250…400 nm). Diffuser for cosine correction. The probe provides the effective total irradiance (E_{eff}), the effective irradiance in the UV-CB band and UV irradiance. Effective total irradiance measuring range: 0.01…20 W/m^2. Effective irradiance measuring range B_C: 0.01…20 W/m^2. UV irradiance measuring range: 0.1…2000 W/m^2. With SICRAM module and 1.5 m cable.

LPBL Base with level for photometric and radiometric probes (LP471LUM2 and LP471PYRA... excluded).

LPBL3 Adjustable wall mount support for photometric and radiometric probes (LP471LUM2 and LP471PYRA... excluded).

LP471Silicon-Pyra Pyranometer with Silicon photodiode for the measurement of the **global solar irradiance**, diffuser for cosine correction. Spectral range: 400…1100 nm. Measuring range: 0…2000 W/m^2. Fixed cable length 5 m with SICRAM module.

LP471PYRA02.5 LPPYRA02 Spectrally Flat class B pyranometer with 5 m cable and SICRAM module.

LP471PYRA03.5 LPPYRA03 Spectrally Flat class C pyranometer with 5 m cable and SICRAM module.

LP471PYRA10.5 LPPYRA10 Spectrally Flat class A pyranometer with 5 m cable and SICRAM module.

Delta OHM metrological laboratories LAT N° 124 have been ISO/IEC 17025 accredited by ACCREDIA in Temperature, Humidity, Pressure, Photometry/Radiometry, Acoustics and Air Speed. They can provide calibration certificates.

NOTES

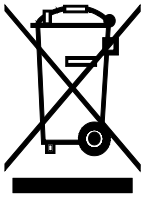
WARRANTY

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

TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased.
We reserves the right to change technical specifications and dimensions to fit the product requirements without prior notice.

DISPOSAL INFORMATION



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

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

CE RoHS

senseca

Please note our new name:
Senseca Italy Srl
Via Marconi 5, 35030 Padua, Italy
Documents are in the process of being changed.