Operating manual

Pyranometer
LPPYRA-Lite

www.deltaohm.com

Keep for future reference.

TABLE OF CONTENTS

1   INTRODUCTION

LPPYRA-Lite pyranometer measures the irradiance on a flat surface (W/m^2). The measured irradiance (Global Irradiance) is the sum of direct solar irradiance and diffuse irradiance.

LPPYRA-Lite is a Spectrally Flat Class C (Second Class) pyranometer in accordance with ISO 9060:2018 and with the criteria of the WMO "Guide to Meteorological Instruments and Methods of Observation'".

The pyranometer is available in the following versions:

- **LPPYRA-Lite**: PASSIVE.

  The passive version can be connected to the instruments D09847 and HD31 by using VP472 SICRAM module.

- **LPPYRA-LiteAC**: ACTIVE with 2-wire (current loop) 4..20 mA output (0…2000 W/m^2).

- **LPPYRA-LiteS**: With RS485 Modbus-RTU output.

- **LPPYRA-LiteS12**: With SDI-12 output.

The pyranometer is supplied factory calibrated. The calibration is carried out in accordance with the ISO 9847:1992 (type IIc) standard: "Calibration of field pyranometers by comparison to a reference pyranometer". The pyranometer is calibrated by comparison with the reference sample calibrated annually at WRC (World Radiation Center).

An optional fixing base integrating a levelling device is available as an accessory, for installations where horizontal positioning is required.

2 WORKING PRINCIPLE

LPPYRA-Lite pyranometer is based on a thermopile sensor. The thermopile sensitive surface is coated with a black matt paint, which allows the pyranometer not to be selective at different wavelengths.

Radiant energy is absorbed by the thermopile black surface, thus creating a difference of temperature between the center of the thermopile (hot junction) and the pyranometer body (cold junction). Thanks to the Seebeck effect, the difference of temperature between hot and cold junction is converted into a Difference of Potential.

In order to grant the thermopile a proper thermal insulation from the wind and reduce the sensitivity to thermal irradiance, LPPYRA-Lite is equipped with a glass dome. The dome protects the thermopile from the dust, which might change spectral sensitivity if it lies on the black surface,

To prevent internal condensation forming on the internal side of the dome under certain climatic conditions, silica gel tablets are inserted inside the pyranometer to absorb humidity.
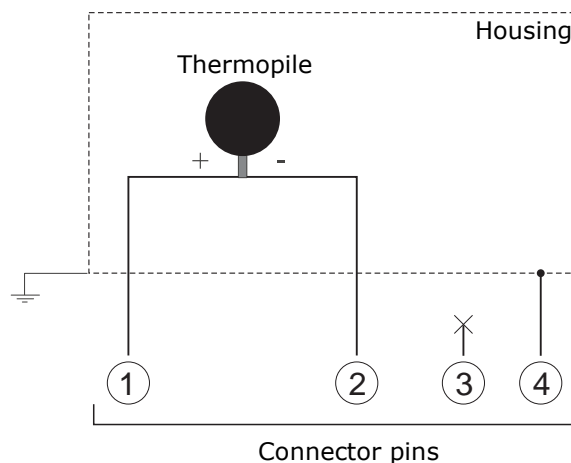

Fig. 2.1: scheme of principle LPPYRA-Lite (version with mV output)

3 INSTALLATION

- The pyranometer must be mounted in an easy-to-reach location in order to clean the dome regularly and carry out maintenance. At the same time, make sure that no buildings, constructions, trees or obstructions exceed the horizontal plane where the pyranometer lies. If this is not possible, select a site where obstructions in the path of the sun from sunrise to sunset do not exceed 5 degrees of elevation. **N.B.: The presence of obstructions on the horizon line affects significantly the measurement of direct irradiance.**

- The pyranometer must be located far from any kind of obstruction, which might reflect sunlight (or sun shadow) onto the pyranometer itself.

- In compliance with ISO TR9901 standard and WMO recommendations, the pyranometer must be positioned so that its connector is pointed to the North Pole, if the instrument is used in the Northern Hemisphere, and to the South Pole, if used in the Southern Hemisphere.

- For fixing, use the two holes under the pyranometer body or the suitable accessories (see the figures below). In order to allow an accurate horizontal positioning, the optional **LPS40/32BL** fixing base integrating a levelling device can be used. The mast height does not exceed the pyranometer plane to avoid measurement errors caused by any reflection or shadow of the mast itself.

- It is preferably to thermally insulate the pyranometer from its mounting bracket ensuring, at the same time, a good electrical contact to ground.
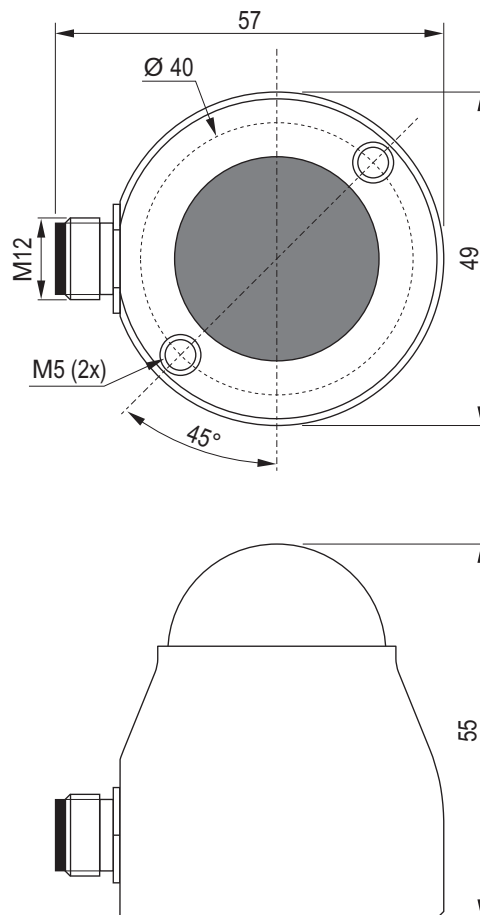
Fig. 3.1: dimensions and fixing holes

LPS40/32

LPS40/32BL - Integrated levelling device
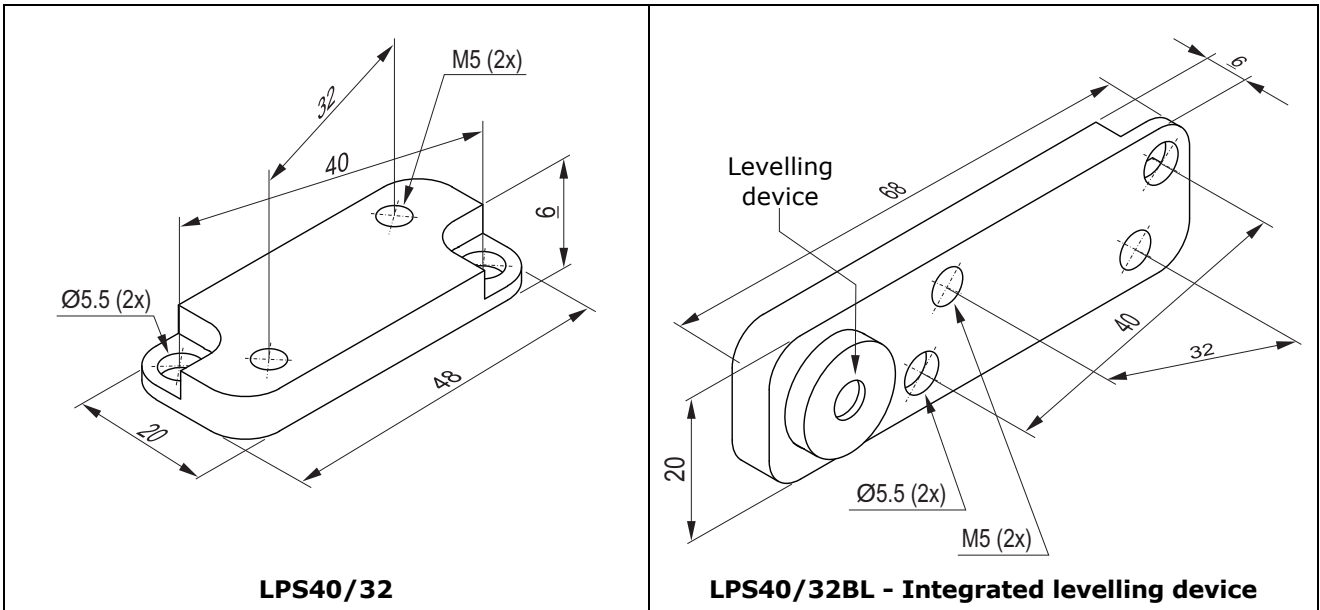
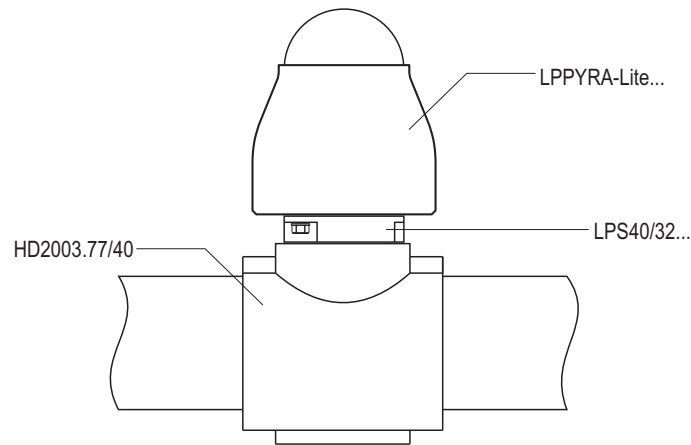**Fig. 3.2: fixing adapters from 40 to 32 mm holes centre distance**

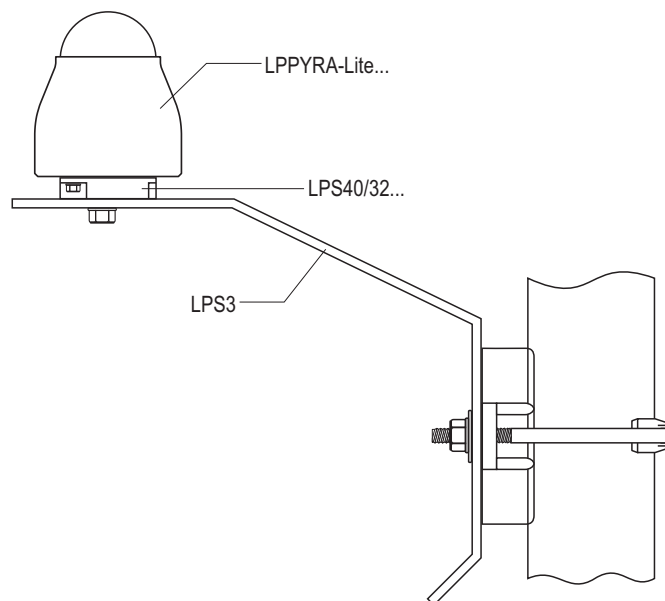**Fig. 3.3: fixing on HD2003.77/40 clamping**
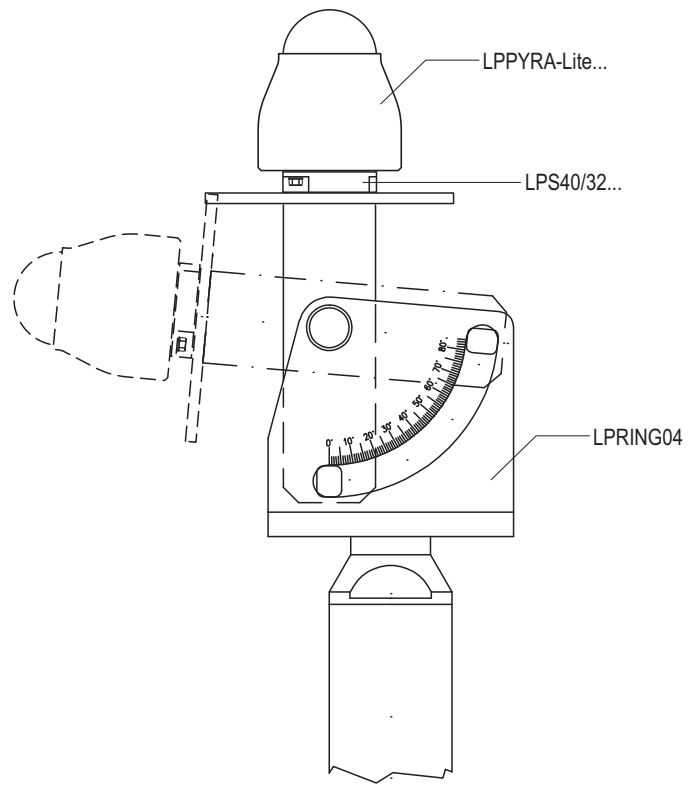

Fig. 3.4: fixing on LPS3 bracket

Fig. 3.3: fixing on LPRING04 adjustable holder

4 ELECTRICAL CONNECTIONS

LPPYRA-Lite and **LPPYRA-LiteAC** have a 4-pole connector and use the **CPM12AA4… optional** cables.

LPPYRA-LiteS and **LPPYRA-LiteS12** have a 8-pole connector and use the **CPM12-8D… optional** cables.

> ⚠️ **The metallic housing of the pyranometer should preferably be grounded (⏚) locally. In this case, do not connect the wire of the cable corresponding to the housing to prevent ground loops.**
>
> **Only if it is not possible to ground locally the metallic case of the pyranometer, connect the wire of the cable corresponding to the housing to ground.** Note: in LPPYRA-LiteAC the housing is not connected to the connector.

In the powered versions, internally there are surge protection devices connected to the housing. Grounding the housing allows the correct protection functionality, in particular against lightning.

4.1 LPPYRA-Lite CONNECTIONS

The pyranometer LPPYRA-Lite is passive and does not require power supply. It is to be connected either to a millivoltmeter or to a data acquisition system. Typically, the pyranometer output signal does not exceed 20 mV. In order to better exploit the pyranometer features, the readout instrument should have 1 µV resolution.

Connector	Function	Color
1	+Vout	Red
2	-Vout	Blue
3	Not connected	White
4	Cable shield (SH) / Housing	Black
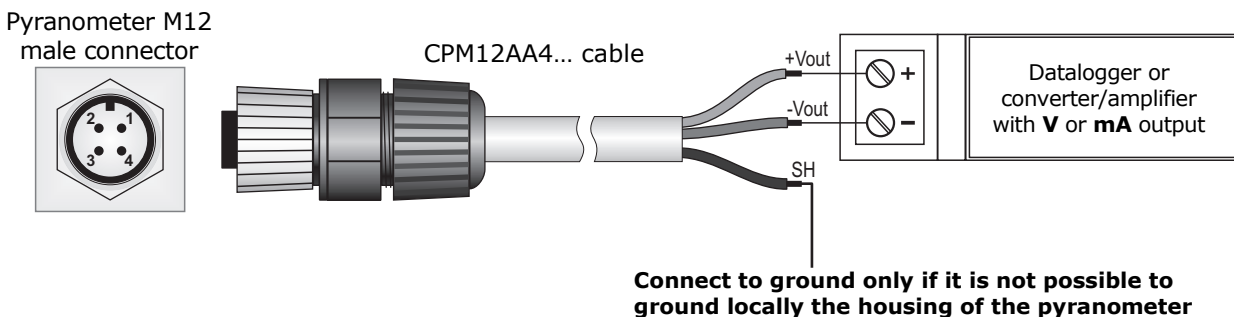
Fig. 4.1: LPPYRA-Lite connections

4.2 LPPYRA-LiteAC CONNECTIONS

The pyranometer LPPYRA-LiteAC has **4...20 mA** output and requires **10...28 Vdc** ex-ternal power supply. It is to be connected to a power supply and an instrument with 4…20 mA input as shown in fig. 4.2. The load resistance of the instrument reading the signal must be **≤ 500 Ω**.

Connector	Function	Color
1	Positive (Iin)	Red
2	Negative (Iout)	Blue
3	Not connected	White
4	Cable shield (SH)	Black
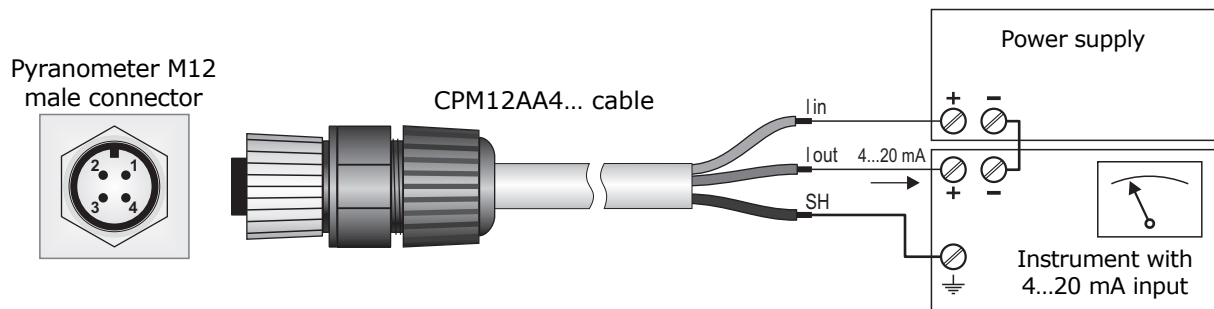
Fig. 4.2: LPPYRA-LiteAC connections

4.3 LPPYRA-LiteS CONNECTIONS

The pyranometer LPPYRA-LiteS has **RS485 Modbus-RTU** output and requires **5...30 Vdc** external power supply. It is to be connected to a power supply and to a PLC, a data logger or a RS485/USB or RS485/RS232 converter for PC as shown in fig. 4.3. The RS485 output is not isolated.

Connector	Function	Color
1	Power supply negative (GND)	Blue
2	Power supply positive (+Vdc)	Red
3	Not connected	
4	RS485 A/-	Brown
5	RS485 B/+	White
6	Housing / Cable shield (SH)	Black
7	Not connected	
8	Not connected	
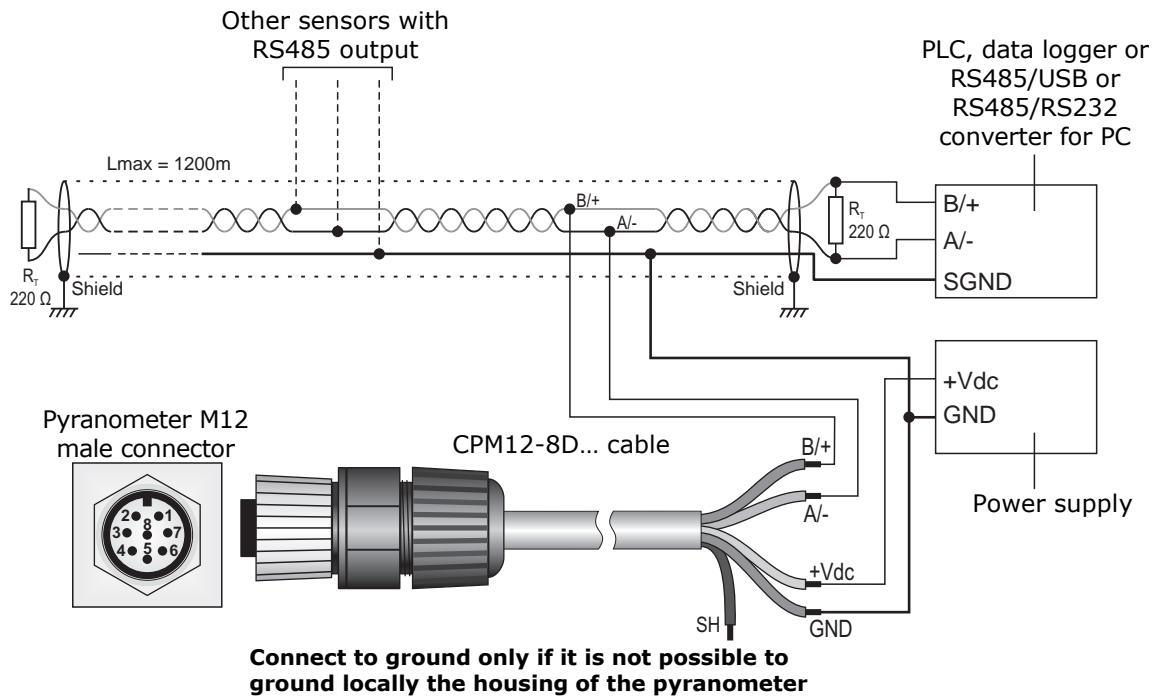
Fig. 4.3: LPPYRA-LiteS connections

Before connecting the pyranometer to the RS485 network, set the address and the communication parameters, if different from the factory preset (see chapter 6).

4.4 LPPYRA-LiteS12 CONNECTIONS

The pyranometer LPPYRA-LiteS12 has **SDI-12** output and requires **7…30 Vdc** external power supply. It is to be connected to a power supply and to an acquisition system (data logger) as shown in fig. 4.4.

Connector	Function	Cable color
1	Power supply negative (GND) SDI-12 output negative	Blue
2	Power supply positive (+Vdc)	Red
3	Not connected	
4	Not connected	
5	SDI-12 output positive	White
6	Housing / Cable shield (SH)	Black
7	Not connected	
8	Not connected	
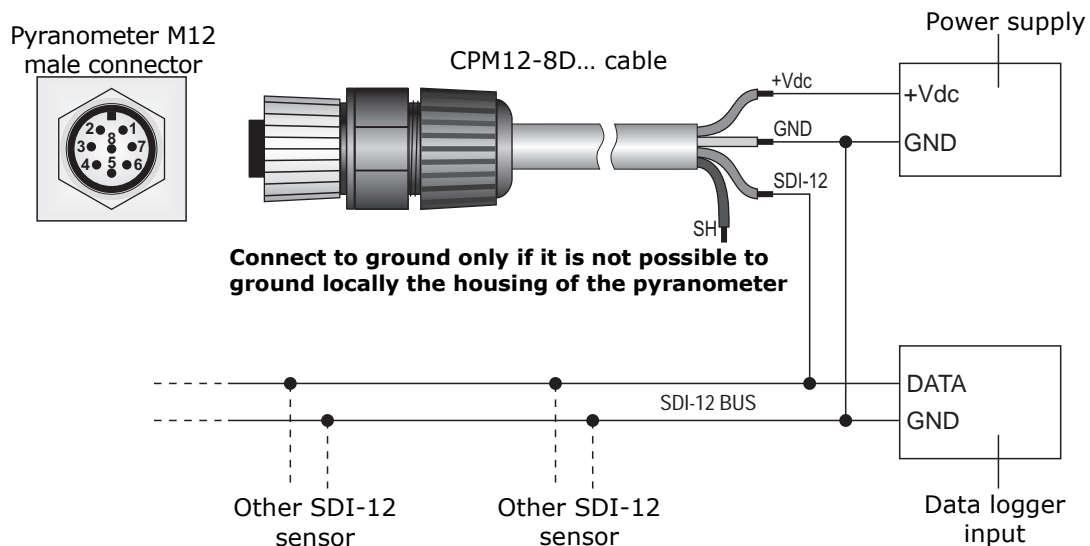
Fig. 4.4: LPPYRA-LiteS12 connections

More SDI-12 sensors can be connected in parallel. The distance between a sensor and the acquisition system (data logger) should not exceed 60 m.

Due to its low power consumption, LPPYRA-LiteS12 is particularly suitable for battery/solar panel-powered data acquisition systems.

Before connecting the instrument to an SDI-12 network containing other sensors, set the address by using the proper SDI-12 command (see chapter 7).

5 MEASUREMENT IN THE MODELS WITH ANALOG OUTPUT

Below are the ways to calculate the global irradiance.

5.1 LPPYRA-Lite

Each pyranometer is distinguished by its own sensitivity (or calibration factor) S expressed in $\mu V/(Wm^{-2})$ and shown in the label on the pyranometer (and in the optional calibration report).

The irradiance E_e is obtained by measuring with a multimeter the difference of potential DDP at the ends of the sensor and applying the following formula:

$$E_e = DDP\ /\ S$$

where:

E_e is the irradiance expressed in W/m^2;

DDP is the difference of potential expressed in μV measured by the multimeter;

S is the sensitivity of the pyranometer expressed in $\mu V/(Wm^{-2})$.

5.2 LPPYRA-LiteAC

The 4…20 mA output signal corresponds to the 0…2000 W/m^2 irradiance range.

The irradiance E_e is obtained by measuring with a multimeter the current I_{out} absorbed by the sensor and applying the following formula:

$$E_e = 125 \cdot (I_{out} - 4)$$

where:

E_e is the irradiance expressed in W/m^2;

I_{out} is the current expressed in mA absorbed by the pyranometer.

6 RS485 MODBUS-RTU OUTPUT

Before connecting the pyranometer to the RS485 network, an address must be assigned and the communication parameters must be set, if different from the factory preset.

6.1 SETTING THE COMMUNICATION PARAMETERS

Connect the pyranometer to the PC in one of the following two ways:

A. By using the optional **CP24** cable, with built-in RS485/USB converter. In this connection mode, the sensor is powered by the PC USB port. To use the cable, it is necessary to install the related USB drivers in the PC.
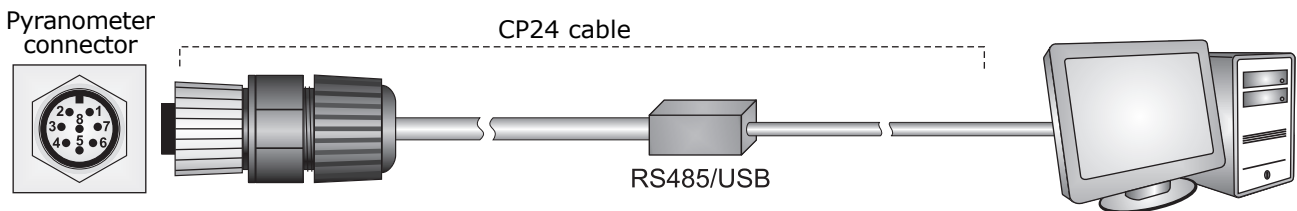
B. By using the supplied 8-pole M12 female connector or the optional **CPM12-8D…** cable and a generic RS485/USB or RS485/RS232 converter. In this connection mode, it is necessary to power the pyranometer separately. If a RS485/USB converter is used, it is necessary to install the related USB drivers in the PC.
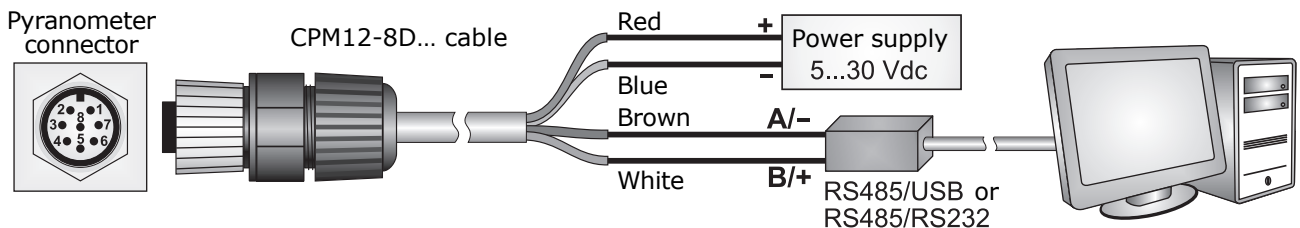
NOTES ON THE INSTALLATION OF UNSIGNED USB DRIVER: before installing unsigned USB driver into operating systems starting from Windows 7, it is necessary to restart the PC by disabling the driver signing request. If the operating system is 64-bit, even after installation the request of driver signing have to be disabled each time the PC is restarted.

Procedure:

1. Start with the pyranometer not powered (if the CP24 cable is used, disconnect one end of the cable).

2. In the PC, start a serial communication program. Set the Baud Rate to 57600 and set the communication parameters as follows (the pyranometer is connected to a COM type port):

> Data Bits: 8
> Parity: None
> Stop Bits: 2

In the program, set the COM port number to which the pyranometer will be connected.

3. Switch the pyranometer on (if the CP24 cable is used, connect both ends of the cable).

4. Within 10 seconds from the pyranometer power on, send the **@** command and press **Enter**.

Note: if the pyranometer does not receive the **@** command within 10 seconds from power on, the RS485 MODBUS mode is automatically activated. In such a case, it is necessary to switch off and on again the pyranometer.

5. Send the command **CAL USER ON**.

Note: the command CAL USER ON is disabled after 5 minutes of inactivity.

6. Send the serial commands given in the following table to set the RS485 MODBUS parameters:

Command	Response	Description
CMAnnn	&|	Set RS485 address to nnn Ranging from 1 to 247 Preset on 1
CMBn	&|	Set RS485 Baud Rate n=0 ⇒ 9600 n=1 ⇒ 19200 n=2 ⇒ 38400 n=3 ⇒ 57600 n=4 ⇒ 115200 Preset on 1 ⇒ 19200
CMPn	&|	Set RS485 transmission mode n=0 ⇒ 8-N-1 (8 data bits, no parity, 1 stop bit) n=1 ⇒ 8-N-2 (8 data bits, no parity, 2 stop bits) n=2 ⇒ 8-E-1 (8 data bits, even parity, 1 stop bit) n=3 ⇒ 8-E-2 (8 data bits, even parity, 2 stop bits) n=4 ⇒ 8-O-1 (8 data bits, odd parity, 1 stop bit) n=5 ⇒ 8-O-2 (8 data bits, odd parity, 2 stop bits) Preset on 2 ⇒ 8-E-1
CMWn	&|	Set receiving mode after RS485 transmission n=0 ⇒ Violate protocol and go in Rx mode right after Tx n=1 ⇒ Respect protocol and wait 3.5 characters after Tx Preset on 1 ⇒ Respect the protocol

7. You can check the parameters setting by sending the following serial commands:

Command	Response	Description
RMA	*Address*	Read RS485 address
RMB	*Baud Rate* (0,1)	Read RS485 Baud Rate 0 ⇒ 9600 1 ⇒ 19200 2 ⇒ 38400 3 ⇒ 57600 4 ⇒ 115200
RMP	*Tx Mode* (0,1,2,3,4,5)	Read RS485 transmission mode 0 ⇒ 8-N-1 1 ⇒ 8-N-2 2 ⇒ 8-E-1 3 ⇒ 8-E-2 4 ⇒ 8-O-1 5 ⇒ 8-O-2
RMW	*Rx Mode* (0,1)	Read receiving mode after RS485 transmission 0 ⇒ Violate protocol and go in Rx mode right after Tx 1 ⇒ Respect protocol and wait 3.5 characters after Tx

Note: it is not required to send the CAL USER ON command to read the settings.

6.2 READING THE MEASURES WITH THE MODBUS-RTU PROTOCOL

In MODBUS mode, you can read the values measured by the pyranometer through the function code 04h (Read Input Registers). The following table lists the quantities available with the appropriate register address:

Address	Quantity	Format
0	Internal temperature in °C (x10)	16-bit Integer
1	Internal temperature in °F (x10)	16-bit Integer
2	Solar radiation in W/m^2	16-bit Integer
3	Status register: bit0=1 $\Rightarrow$ solar radiation measurement error bit2=1 $\Rightarrow$ configuration data error bit3=1 $\Rightarrow$ program memory error	16-bit Integer
4	Average values of the last 4 measurements	16-bit Integer
5	Signal generated by the sensor in µV/10 [e.g.: 816 means 8160 µV, the resolution is 10 µV]	16-bit Integer

OPERATING MODE: the pyranometer enters RS485 MODBUS-RTU mode after 10 seconds from power on. In the first 10 seconds from power on the pyranometer does not reply to requests from the MODBUS master unit. After 10 seconds, it is possible to send MODBUS requests to the pyranometer.

7 SDI-12 OUTPUT

The LPPYRA-LiteS12 pyranometers are compatible with version 1.3 of SDI-12 protocol.

The protocol communication parameters are: Baud rate = 1200. Data bits = 7, Parity = Even, Stop bits = 1.

The communication with the instrument is performed by sending a command in the following form:

<Address><Command>!

with <Address> = address of the instrument the command is sent to
     <Command> = type of operation requested to the instrument

The instrument reply is as follows:

<Address><Data><CR><LF>

with <Address> = address of the instrument which replies
     <Data> = information sent by the instrument
     <CR> = ASCII character *Carriage Return*
     <LF> = ASCII character *Line Feed*

The sensors come with a factory address preset to 0. The address can be modified by using the proper SDI-12 command reported in the following table.

The following table reports the SDI-12 commands available. For consistency with SDI-12 standard documentation, the instrument address is indicated in the table with the letter **a**.

SDI-12 Commands

Command	Instrument reply	Description
a!	a<CR><LF>	Verifies the presence of the instrument.

aI!	allccccccccmmmmmmvvvssssssss<CR><LF>
	with:
	    a = address of the instrument (1 character)
	    ll = SDI-12 compliant version (2 characters)
	    cccccccc = manufacturer (8 characters)
	    mmmmmm = instrument model (6 characters)
	    vvv = firmware version (3 characters)
	    ssssssss = serial number (8 characters)
	⇒ Example of response:
	    013DeltaOhmLP-PYRA0016051518
	 with:
	    0 = instrument address
	    13 = SDI-12 version 1.3 compliant
	    DeltaOhm = manufacturer's name
	    LP-PYR = instrument model
	    A00 = firmware version A.0.0
	    16051518 = serial number
		Requests for information from the instrument.

aAb! Where: b =new address	b<CR><LF> Note: if the b character is not an acceptable address, the instrument responds with a instead of b.	Modification of the instrument address.

Command	Instrument reply	Description
?!	a<CR><LF>	Request of the address of the instrument. If more than one sensor is connected to the bus, a conflict occurs.
TYPE M (START MEASUREMENT) AND TYPE C (START CONCURRENT MEASUREMENT) COMMANDS		
Irradiance, signal internal level and internal temperature		
aM! **aC!**	atttn<CR><LF> with: ttt = number of seconds necessary for the instrument to make the measure available (3 characters) n = number of detected variables (1 character for aM!, 2 characters for aC!) Note: ttt = 000 means datum immediately available.	Request to execute the measurement.
aD0!	a+n+w…w+v…v+t…t<CR><LF> with: n = content of the status register w…w = irradiance in W/m^2 v…v = signal internal level in mV t…t = internal temperature in the set unit of measurement (default °C) ⇒ Example of response: 0+0+228.7+3.294+25.0 probe address = 0 content of the status register = 0 irradiance = 228.7 W/m^2 signal internal level = 3.294 mV internal temperature = 25.0 °C *Note*: the status register normally contains zero; a value different from zero indicates an error condition.	Reads the measurement.
Irradiance and internal temperature		
aM1! **aC1!**	atttn<CR><LF> with: ttt = number of seconds necessary for the instrument to make the measure available (3 characters) n = number of detected variables (1 character for aM1!, 2 characters for aC1!) Note: ttt = 000 means datum immediately available.	Request to execute the measurement.
aD0!	a+w…w+t…t<CR><LF> with: w…w = irradiance in W/m^2 t…t = internal temperature in the set unit of measurement (default °C) ⇒ Example of response: 0+228.7+25.0 probe address = 0 irradiance = 228.7 W/m^2 internal temperature = 25.0 °C	Reads the measurement.

Command	Instrument reply	Description
Internal temperature		
aM2! **aC2!**	atttn<CR><LF> with: ttt = number of seconds necessary for the in- strument to make the measure available (3 characters) n = number of detected variables (1 character for aM2!, 2 characters for aC2!) Note: ttt = 000 means datum immediately available.	Request to execute the measurement.
aD0!	a+t…t<CR><LF> with t…t = internal temperature in the set unit of measurement (default °C) ⇒ Example of response: 0+25.0 probe address = 0 internal temperature = 25.0 °C	Reads the measurement.
Signal internal level		
aM3! **aC3!**	atttn<CR><LF> with: ttt = number of seconds necessary for the in- strument to make the measure available (3 characters) n = number of detected variables (1 character for aM3!, 2 characters for aC3!) Note: ttt = 000 means datum immediately available.	Request to execute the measurement.
aD0!	a+v…v<CR><LF> with v…v = signal internal level in mV ⇒ Example of response: 0+3.294 probe address = 0 signal internal level = 3.294 mV	Reads the measurement.

In addition to the above-mentioned commands, the sensor also implements the corresponding commands with CRC, that require to add a 3-character CRC code at the end of the reply before <CR><LF>. The format of these commands is obtained from the previous by adding the letter C: aMC!, aMC1!, aMC2!, aMC3!, aCC!, aCC1!, aCC2!, aCC3!. The sensor **does not** implement the type R (Continuous Measurements) commands.

Extended SDI-12 Commands

Command	Instrument reply	Description
aXSCAL USER ON!	a> USER ENABLED!<CR><LF>	Enables the configuration mode.
aXSCFD!	a> &<CR><LF>	Sets °C as temperature unit of measurement.
aXSCFE!	a> &<CR><LF>	Sets °F as temperature unit of measurement.
aXSCAL END!	a> LOCKED!<CR><LF>	Disables the configuration mode.

The extended commands allow setting the temperature unit of measurement. To change the unit of measurement:

1) Send the command **aXSCAL USER ON!** (note: **a**=instrument address).
2) Send the command **aXSCFD!** (to set °C) or **aXSCFE!** (to set °F).
3) Send the command **aXSCAL END!**

For more information about the SDI-12 protocol, visit the website "www.sdi-12.org".

8 MAINTENANCE

In order to grant measurements high accuracy, it is important to keep the outer glass dome clean. Consequently, the more the dome will be kept clean, the more measurements will be accurate.

You can wash it using water and standard papers for lens. If necessary, use pure ETHYL alcohol. After using alcohol, clean again the dome with water only.

To exploit all the pyranometer features, it is highly recommended that the calibration be checked annually.

9   TECHNICAL SPECIFICATIONS

Sensor	Thermopile
Typical sensitivity	$5 \div 15$ µV/Wm^{-2} or normalized 7 µV/Wm^{-2}
Measuring range	$0 \div 2000$ W/m^2
Viewing angle	2π sr
Spectral range (50%)	$300 \div 2800$ nm
Output	**LPPYRA-Lite**: µV/Wm^{-2} (impedance 33...45 Ω) **LPPYRA-LiteAC**: 2-wire (current loop) 4...20 mA ($R_L \leq 500\ \Omega$) **LPPYRA-LiteS**: RS485 Modbus-RTU **LPPYRA-LiteS12**: SDI-12
Power supply	**LPPYRA-Lite**: no power required **LPPYRA-LiteAC**: 10...28 Vdc **LPPYRA-LiteS**: 5...30 Vdc **LPPYRA-LiteS12**: 7...30 Vdc
Consumption	**LPPYRA-Lite**: no power required **LPPYRA-LiteAC**: equal to output signal (4...20 mA) **LPPYRA-LiteS**: 8 mA **LPPYRA-LiteS12**: < 200 µA normal operation < 5 mA during measurement
Connection	**LPPYRA-Lite** e **LPPYRA-LiteAC**: 4-pole M12 **LPPYRA-LiteS** e **LPPYRA-LiteS12**: 8-pole M12
Dimensions	Fig. 3.1
Weight	150 g approx.
Operating temperature/humidity	$-40 \div 80$ °C / $0 \div 100$%
Protection degree	IP 67
MTBF	> 10 years

Technical Specifications According to ISO 9060:2018

Classification	Spectrally Flat Class C
Response time (95%)	< 25 s

Zero offset
 	
  a) **response to a 200 W/m² thermal radiation**
 	
  b) **response to a 5 K/h change in ambiente temperature**
 	
  c) **total zero offset including the effects a), b) and other sources**
	
	$<\lvert\pm20\rvert$ W/m^2
	
	$<\lvert\pm6\rvert$ W/m^2
	
	$<\lvert\pm30\rvert$ W/m^2

Long-term instability (1 year)	$<\lvert\pm2\rvert$ %
Non-linearity	$<\lvert\pm2\rvert$ %
Response according to the cosine law	$<\lvert\pm25\rvert$ W/m^2
Spectral error	$<\lvert\pm2\rvert$ %
Temperature response (-10...+40°C)	< 3 %
Tilt response	$<\lvert\pm3\rvert$ %

10 SAFETY INSTRUCTIONS

General safety instructions

The instrument has been manufactured and tested in accordance with the safety standard EN61010-1:2010 "Safety requirements for electrical equipment for measurement, control and laboratory use" and has left the factory in perfect safety technical conditions.

The instrument proper operation and operating safety can be ensured only if all standard safety measures as well as the specific measures described in this manual are followed.

The instrument proper operation and operating safety can be ensured only in the climatic conditions specified in this manual.

Do not use the instruments in places where there are:

- Corrosive or flammable gases.
- Direct vibrations or shocks to the instrument.
- High-intensity electromagnetic fields, static electricity.

User obligations

The instrument operator shall follow the directives and regulations below that refer to the treatment of dangerous materials:

- EEC directives on workplace safety.
- National law regulations on workplace safety.
- Accident prevention regulations.

11 ACCESSORIES ORDERING CODES

LPS40/32   Fixing adapter from 40 to 32 mm holes centre distance.

LPS40/32BL   Fixing adapter from 40 to 32 mm holes centre distance. With integrated levelling device. Accuracy of levelling device < 0.2°.

LPS3   Fixing bracket for the pyranometer, suitable for $\varnothing$ 40 ÷ 50 mm mast. Installation on horizontal or vertical mast. **LPS40/32... adapter is required**.

LPRING04   Adjustable holder for mounting the pyranometer in an inclined position on $\varnothing$ 40 mm mast with internal thread. **LPS40/32... adapter is required**.

HD2003.77/40   Clamping for mast $\varnothing$40 mm to install the pyranometer on a transverse mast. **LPS40/32... adapter is required**.

CPM12AA4...   Cable with 4-pole M12 connector on one end, open wires on the other end. Length 2 m (CPM12AA4.2), 5 m (CPM12AA4.5) or 10 m (CPM12AA4.10). **For LPPYRA-Lite and LPPYRA-LiteAC**.

CPM12-8D...   Cable with 8-pole M12 connector on one end, open wires on the other end. Length 2 m (CPM12-8D.2), 5 m (CPM12-8D.5) or 10 m (CPM12-8D.10). **For LPPYRA-LiteS and LPPYRA-LiteS12**.

CP24   PC connecting cable for the configuration of LPPYRA-LiteS RS485 Modbus parameters. With built-in RS485/USB converter. 8-pole M12 connector on instrument side and A-type USB connector on PC side.

DELTA OHM metrology laboratories LAT N° 124 are ISO/IEC 17025 accredited by ACCREDIA for Temperature, Humidity, Pressure, Photometry / Radiometry, Acoustics and Air Velocity. They can supply calibration certificates for the accredited quantities.

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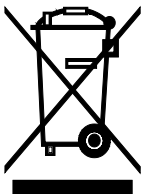
Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection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

$C \epsilon$ **RoHS**

senseca

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