

# **LP PYRA 03**



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

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

# LP PYRA 03

## 1 Introduction

LP PYRA 03 pyranometer measures the irradiance on a plane surface (Watt/ m<sup>2</sup>). Measured irradiance ( Global Irradiance) is the result of the sum of direct solar irradiance and of diffuse irradiance.

LP PYRA 03 is a Second Class pyranometer in accordance with ISO 9060 and with the criteria of the WMO “Guide to Meteorological Instruments and Methods of Observation”, fifth edition (1983).

The pyranometer is produced in three versions:

LP PYRA 03	PASSIVE *
LP PYRA 03 AC	ACTIVE ,4..20 mA CURRENT output
LP PYRA 03 AV	ACTIVE , 0..1** or 0..5 or 0..10 V VOLTAGE output, to be defined at the order.

\* Using SICRAM Module VP 472 it is possible to connect passive pyranometer to Indicator D09847.

\*\* 0..1 output version can be connected to indicator HD2302.0 using SICRAM Module VP 474. The indicator reads directly in W/m<sup>2</sup>.

## 2 Working Principle

LP PYRA 03 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 wave lengths. The pyranometer spectral range is determined by the transmission of the glass dome type K5.

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, LP PYRA 03 is equipped with a 4mm thick dome which is 32mm in outer diameter. 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, three silica gel tablets are inserted inside the pyranometer to absorb humidity.

### **3 Installation and Mounting of the Pyranometer for the Measurement of Global Radiation:**

- PYRA 03 pyranometer is to 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.**
- Pyranometer is to 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, when the pyranometer is used without the white shade disk, it is to 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. In any case, it is better to follow this suggestion even when the shade disk is applied.
- In order to allow an accurate horizontal positioning of the instrument, use the holes on the pyranometer body or suitable accessories (figure 1,2).

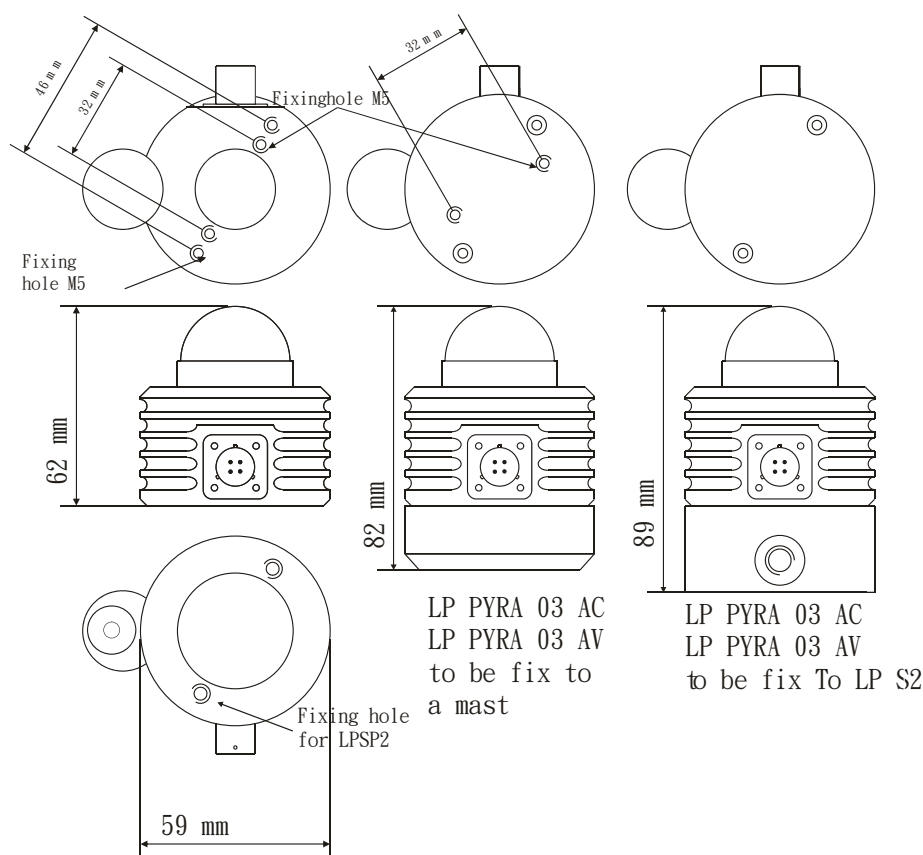


Fig 1

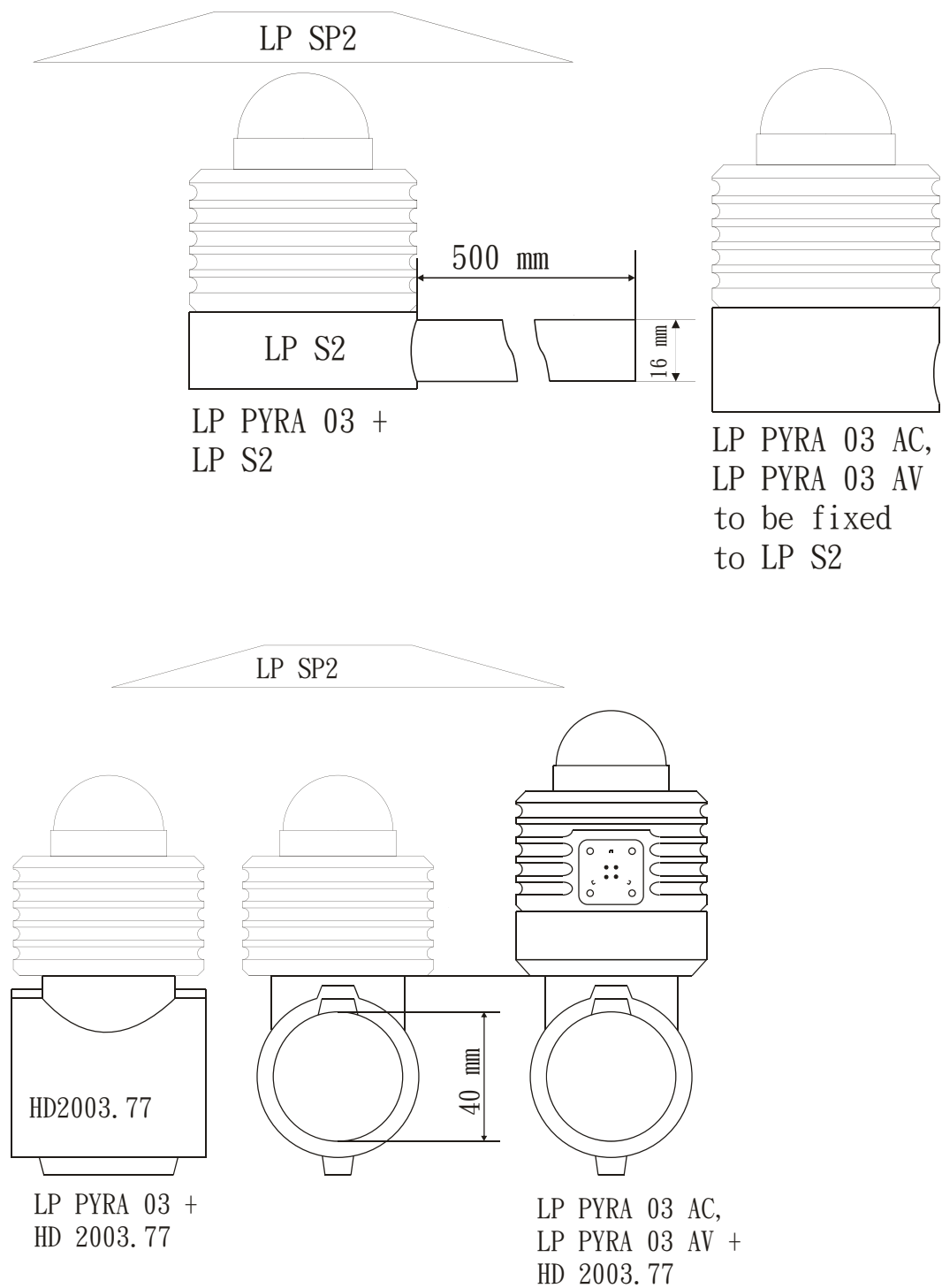


Fig. 2

## **4 Electrical Connection and Requirements for Electronic Readout Devices:**

LP PYRA 03 is produced in 3 versions, LP PYRA 03, LP PYRA 03 AC and LP PYRA 03 AV.

- LP PYRA 03 pyranometer is passive and it does not require any power supply.
- LP PYRA 03 AC, AV are active and need power supply.  
Required voltage is as follows:  
8-30 Vcc for LP PYRA 03 AC and LP PYRA 03 AV with 0..1V and 0..5V output supply.  
14-30 Vcc for LP PYRA 03 AV with 0..10 V output.
- All version are supplied with a 4 pole connector.
- The optional cable is terminated with a connector at one end and it is made of PTFE UV-proof. It is provided with 3 wires and a braided wire (shield). Cable colors and connector poles are matched as follow (figure 3):

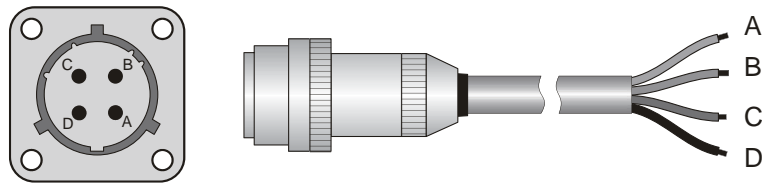


Fig.3

### **LP PYRA 03**

#### **Connector**

A  
B  
C  
D

#### **Function**

Shield (🔌)  
Vout(+)  
Vout (-)  
No connection

#### **Color**

Black  
Red  
Blue  
White

### **LP PYRA 03 AC**

#### **Connector**

A  
B  
C  
D

#### **Function**

Shield (🔌)  
Positive (+)  
Negative (-)  
No connection

#### **Color**

Black  
Red  
Blue  
White

### **LP PYRA 03 AV**

#### **Connector**

A  
B  
C  
D

#### **Function**

Shield (🔌)  
(+) Vout  
(-) Vout e (-)Vcc  
(+) Vcc

#### **Color**

Black  
Red  
Blue  
White

- LP PYRA 03 pyranometer 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 a 1μV resolution.

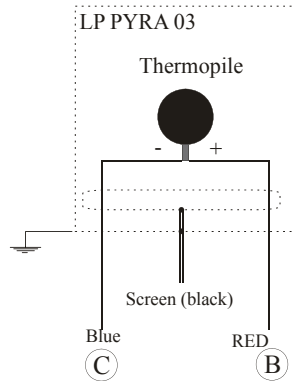


Fig. 4

- LP PYRA 03 AC is to be connected to a DMM and a power supply as show below (Figure 5). To read the signal, the load resistance must be  $\leq 500\Omega$

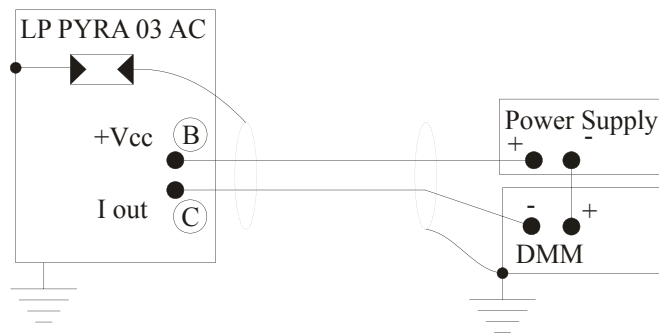


Fig. 5

- LP PYRA 03 AV is to be connected to a DMM and a power supply as show below (Figure 6). To read the signal, the load resistance must be  $\geq 100k\Omega$

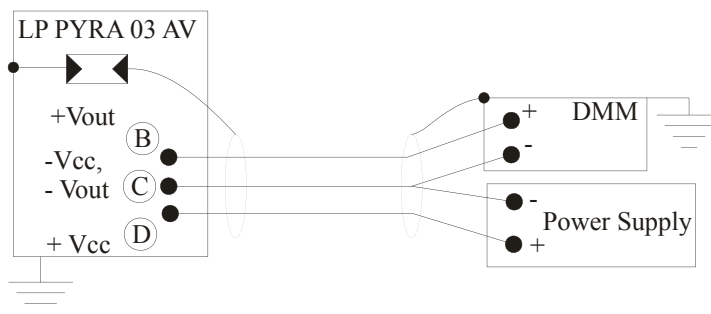


Fig. 6

## **5 Maintenance:**

In order to grant measurement 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, and if necessary using pure ETHYL alcohol. After using alcohol, clean again the dome with water only.

## **6 Calibration and Measurements:**

### **LP PYRA 03**

The pyranometer S sensitivity (or calibration factor) allows to determine global irradiance by measuring a signal in Volts at the thermopile ends. The S factor is measured in  $\mu\text{V}/(\text{Wm}^{-2})$ .

- Once the difference of potential (DDP) has been measured at the ends of the sensor, the  $E_e$  irradiance is obtained applying the following formula:

$$E_e = \text{DDP}/S$$

where;

$E_e$ : is irradiance expressed in  $\text{W}/\text{m}^2$ ,

DDP: is the difference of potential expressed in  $\mu\text{V}$  measured by the multimeter,

S: is the calibration factor in  $\mu\text{V}/(\text{W}/\text{m}^2)$  shown on the pyranometer label (and mentioned in the calibration report).

### **LP PYRA 03 AC**

The pyranometer sensitivity is set so that:

$$4..20 \text{ mA} = 0..2000 \text{ W}/\text{m}^2$$

To obtain irradiance the following procedure is to be applied:

-once you know the current ( $I_{out}$ ) absorbed by the instrument and measured with the DMM, following formula must be applied:

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

where;

$E_e$ : Irradiance in  $\text{W}/\text{m}^2$ ,

$I_{out}$ : current in mA absorbed by the pyranometer

### **LP PYRA 03 AV**

The pyranometer sensitivity is set so that according to the version:

$$0..1 \text{ V} = 0..2000 \text{ W}/\text{m}^2$$

$$0..5 \text{ V} = 0..2000 \text{ W}/\text{m}^2$$

$$0..10 \text{ V} = 0..2000 \text{ W}/\text{m}^2$$

To obtain irradiance the following procedure is to be applied:

-once you know the instrument output voltage ( $V_{out}$ ) measured with the DMM, following formula must be applied:

$$E_e = 2000 \cdot V_{out} \quad \text{for the version 0...1 V}$$

$$E_e = 400 \cdot V_{out} \quad \text{for the version 0...5 V}$$

$$E_e = 200 \cdot V_{out} \quad \text{for the version 0...10 V}$$

where;

$E_e$ : Irradiance in  $W/m^2$ ,

$V_{out}$ : Output voltage (in Volt) measured by the voltmeter

Each Pyranometer is factory calibrated it is marked by its own calibration factor. To exploit all LP PYRA 03 Features it is highly recommended that the calibration be checked annually.

The instruments and the equipment of Delta Ohm Photometry-Radiometry meteorological laboratory grant the calibration of pyranometers according to the WMO specifications and ensure that measurements are traceable to the international standards.

## **7 Technical Specifications:**

Typical sensitivity:	10 $\mu V/(W/m^2)$	LP PYRA 03
	4..20 mA (0-2000 $W/m^2$ )	LP PYRA 03 AC
	0..1,5,10V(0-2000 $W/m^2$ )	LP PYRA 03 AV
Impedance:	33 $\Omega \div 45 \Omega$	
Measuring Range:	0-2000 $W/m^2$	
Viewing angle:	2 $\pi$ sr	
Spectral range: (Dome transmission)	305 nm $\div$ 2800 nm (50%)	
	335 nm $\div$ 2200 nm (95%)	
Operating Temperature:	-40 $^{\circ}C \div 80 ^{\circ}C$	
Dimensions:	figure 1	
Weight:	0.45 Kg	



## Technical Specifications According to ISO 9060

1- Response Time: (95%)	<30 sec
2- Zero off-set:	
a) response to a 200W/m <sup>2</sup> thermal radiation:	< 25 W/m <sup>2</sup>
b) response to a 5K/h change in ambient temperature:	<   6   W/m <sup>2</sup>
3a- Long-term instability: (1 year)	<   ±2.5   %
3b- Non-linearity:	<   ±2   %
3c- Response according to the cosine law: Cosine Response	<   ±22   W/m <sup>2</sup>
3d- Spectral selectivity:	<   ±7   %
3e- Response depending on temperature: Temperature response	<8 %
3f- Tilt response:	<   ±4   %

## **8 Ordering Codes**

<b>ORDERING CODE</b>	<b>ARTICLE</b>
<b>LP PYRA 03</b>	Second Class Pyranometer according to ISO 9060. It is Provided with spirit level, 4 pole plug and Calibration Report.
<b>LP PYRA 03 AC</b>	Second Class Pyranometer according to ISO 9060. It is Provided with spirit level, 4 pole plug and Calibration Report. 4..20 mA signal Output
<b>LP PYRA 03 AV</b>	Second Class Pyranometer according to ISO 9060. It is Provided with spirit level, 4 pole plug and Calibration Report. 0..1V, 0..5V, 0..10V signal output (to be defined when order)
<b>CP AA 1.5</b>	4 pole plug with UV proof cable, L=5m.
<b>CP AA 1.10</b>	4 pole plug with UV proof cable, L=10m.
<b>LP SP2</b>	Shade disk for pyranometer LP PYRA 03.
<b>LP S2</b>	Mounting kit including a support for LP PYRA 03 pyranometers, fastener screws of the pyranometer to the support and a support mast.
<b>LP SP2+ LP S2</b>	Mounting kit LP SP2 and LP S2
<b>HD2003.77</b>	Mounting kit to fix LP PYRA 03 to a $\phi$ 40mm mast. Fastener screws of the pyranometer to the support and LP SP2 shade disk also included in the mounting kit.
<b>VP 472</b>	SICRAM module for DO9847K for Pyranometers and Albedometers. The signal produced by the thermopile of pyranometer can be read in mV or $W/m^2$ . The thermopile sensitivity can be set from 5 to 30 mV( $kWm^{-2}$ ).
<b>VP 474</b>	SICRAM module to connect the pyranometer to HD2302.0 indicator. The instrument read directly in $W/m^2$ .

# GARANZIA

# GUARANTEE

# GARANTIE

# GARANTIA

## GUARANTEE CONDITIONS

All DELTA OHM instruments have been subjected to strict tests and are guaranteed for 24 months from date of purchase. DELTA OHM will repair or replace free of charge any parts which it considers to be inefficient within the guarantee period. Complete replacement is excluded and no request of damages are recognized. The guarantee does not include accidental breakages due to transport, neglect, incorrect use, incorrect connection to voltage different from the contemplated for the instrument. Furthermore the guarantee is not valid if the instrument has been repaired or tampered by unauthorized third parties. The instrument has to be sent to the retailer without transport charge. For all disputes the competent court is the Court of Padua.

This guarantee must be sent together with the instrument to our service centre.  
N.B.: Guarantee is valid only if coupon has been correctly filled in all details.

Instrument type ☐ LP PYRA 03

Serial number \_\_\_\_\_

## RENEWALS

Date \_\_\_\_\_

Inspector \_\_\_\_\_

Date \_\_\_\_\_

Inspector \_\_\_\_\_

Date \_\_\_\_\_

Inspector \_\_\_\_\_

Date \_\_\_\_\_

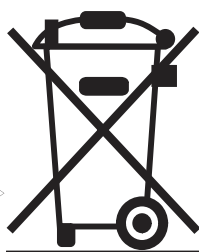
Inspector \_\_\_\_\_

Date \_\_\_\_\_

Inspector \_\_\_\_\_

Date \_\_\_\_\_

Inspector \_\_\_\_\_



### CE CONFORMITY

Safety	EN61000-4-2, EN61010-1 LEVEL 3
Electrostatic discharge	EN61000-4-2 LEVEL 3
Electric fast transients	EN61000-4-4 LEVEL 3
Voltage variations	EN61000-4-11
Electromagnetic interference susceptibility	IEC1000-4-3
Electromagnetic interference emission	EN55020 class B