Member of GHM GROUP

English

Operating manual

Pyranometer

LPPYRA-Lite

Members of GHM GROUP:

GREISINGER

HONSBERG

Martens

DeltaOHM

VAL.CO

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).

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.

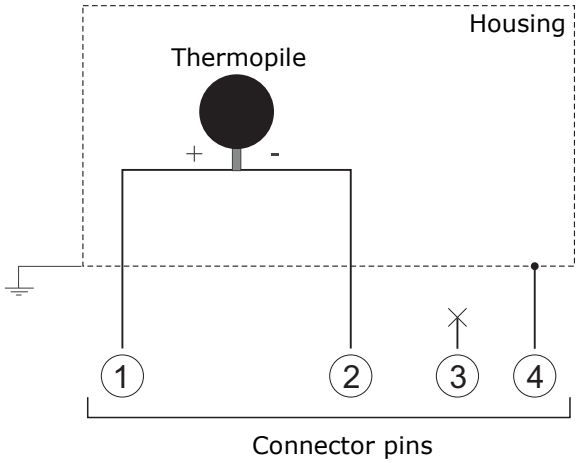


Fig. 2.1: scheme of principle LPPYRA-Lite (version with mV output)

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.

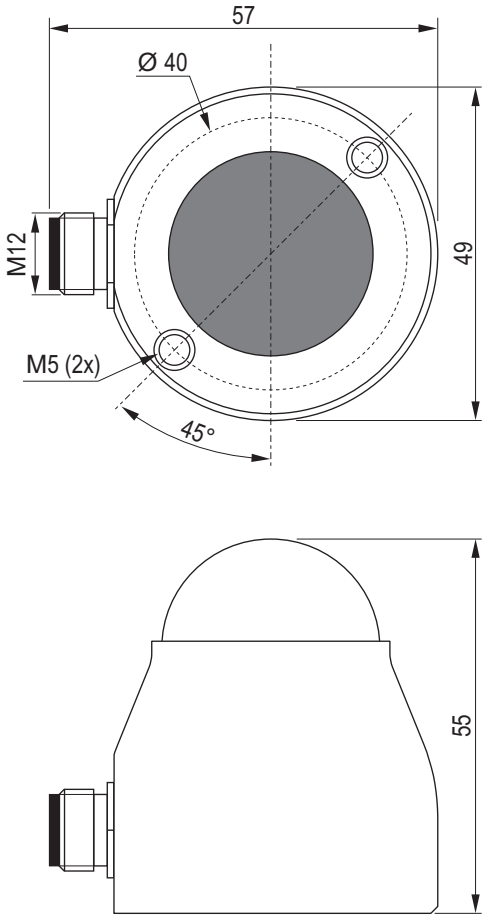
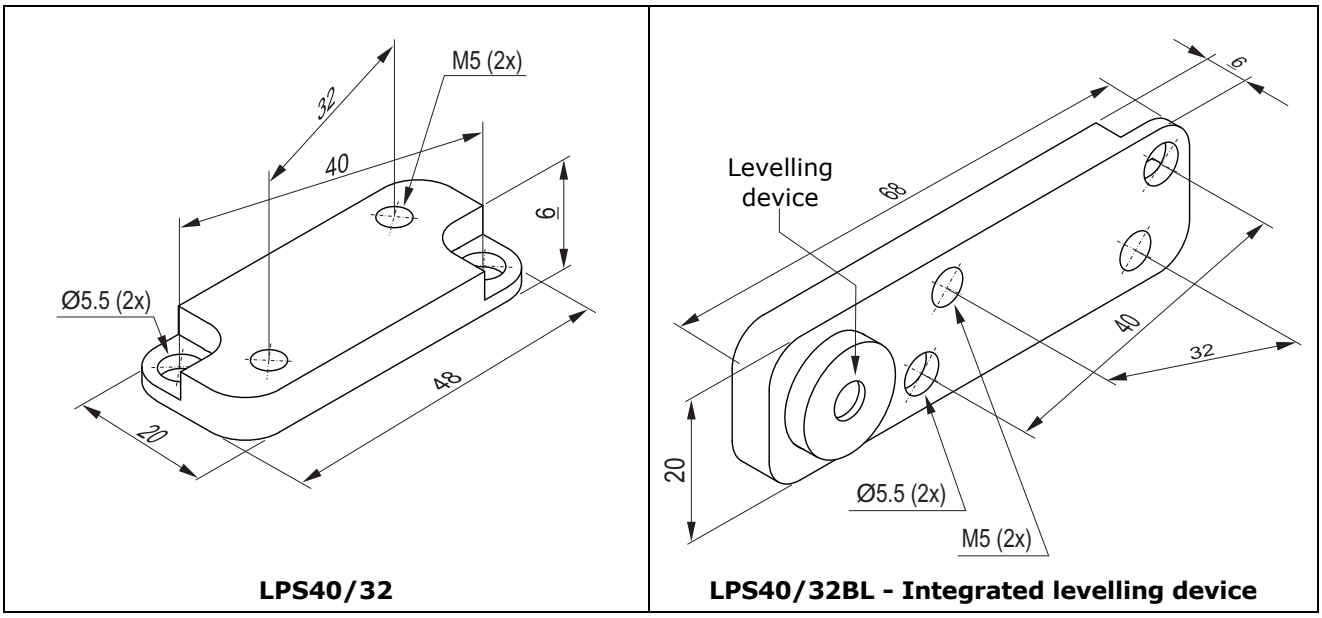


Fig. 3.1: dimensions and fixing holes



LPS40/32 **LPS40/32BL - Integrated levelling device**

Fig. 3.2: fixing adapters from 40 to 32 mm holes centre distance

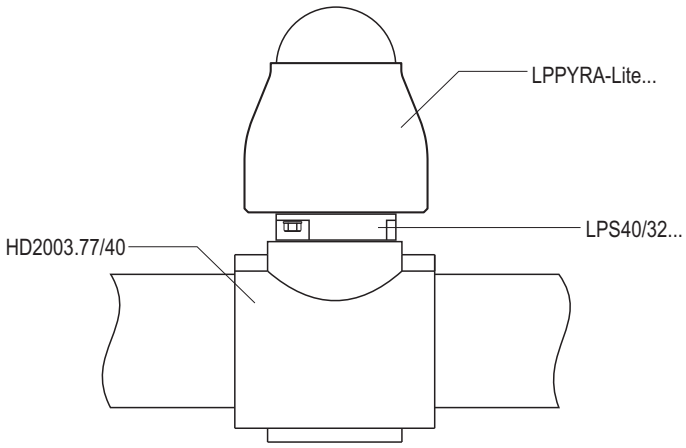


Fig. 3.3: fixing on HD2003.77/40 clamping

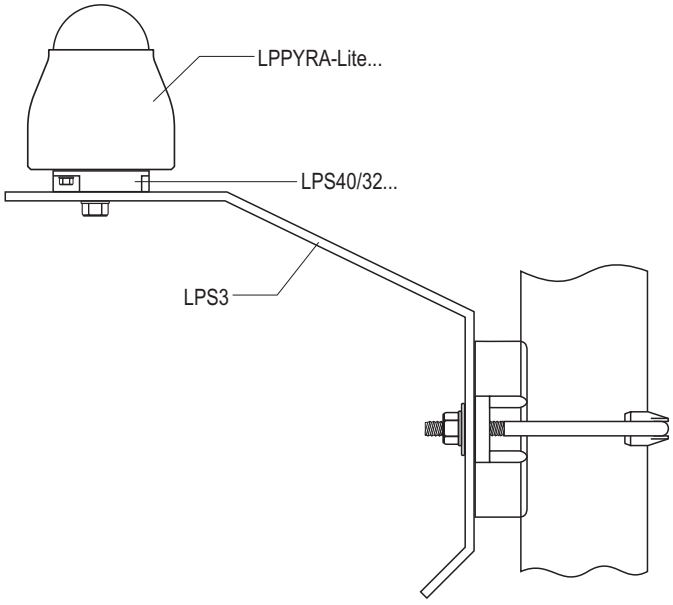


Fig. 3.4: fixing on LPS3 bracket

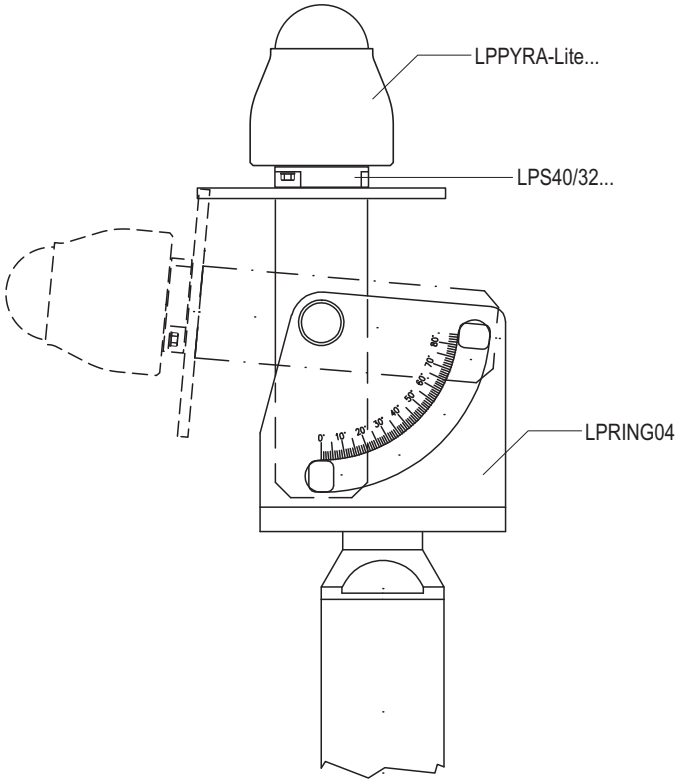


Fig. 3.3: fixing on LPRING04 adjustable holder

4 ELECTRICAL CONNECTIONS

LPPYRA-Lite has a 4-pole connector and uses the **CPM12AA4… 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 version LPPYRA-LiteAC, 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

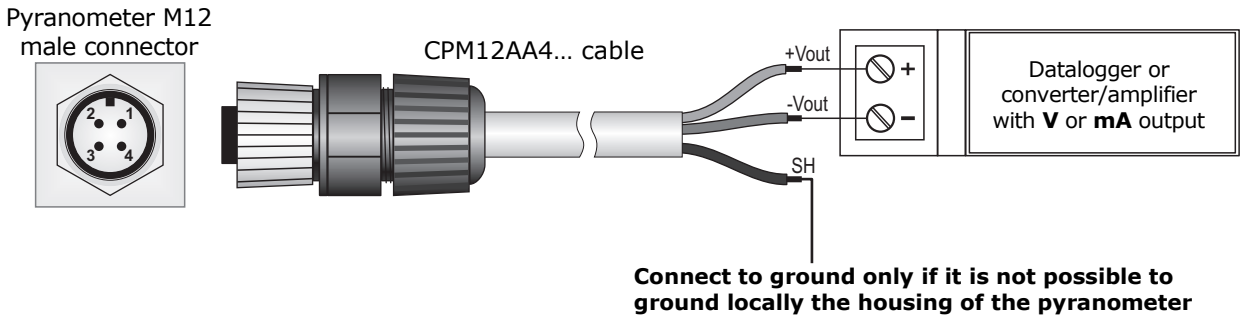


Fig. 4.1: LPPYRA-Lite connections

4.2 LPPYRA-LiteAC CONNECTIONS

The pyranometer LPPYRA-LiteAC has **4...20 mA** output and requires **10...28 Vdc** external 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

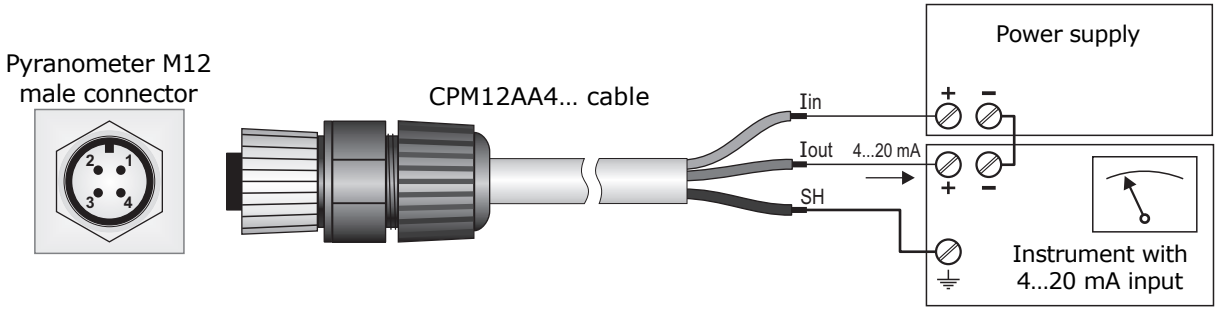


Fig. 4.2: LPPYRA-LiteAC connections

5 MEASUREMENT

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 μV/(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 μV/(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 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.

7 TECHNICAL SPECIFICATIONS

Sensor	Thermopile
Typical sensitivity	5÷15 μV/Wm^{-2} or normalized 7 μV/Wm^{-2}
Measuring range	0÷2000 W/m^2
Viewing angle	2π sr
Spectral range (50%)	300÷2800 nm
Output	**LPPYRA-Lite**: μV/Wm^{-2} (impedance 33...45 Ω) **LPPYRA-LiteAC**: 2-wire (current loop) 4…20 mA (R_L ≤ 500 Ω)
Power supply	**LPPYRA-Lite**: passive version, no power required **LPPYRA-LiteAC**: 10…28 Vdc
Consumption	**LPPYRA-Lite**: passive version, no power required **LPPYRA-LiteAC**: equal to output signal (4…20 mA)
Connection	4-pole M12 connector
Dimensions	Fig. 3.1
Weight	150 g approx.
Operating temperature/humidity	-40÷80 °C / 0÷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	< |±20| W/m^2
b) response to a 5 K/h change in ambiente temperature	< |±6| W/m^2
c) total zero offset including the effects a), b) and other sources	< |±30| W/m^2
Long-term instability (1 year)	< |±2| %
Non-linearity	< |±2| %
Response according to the cosine law	< |±25| W/m^2
Spectral error	< |±2| %
Temperature response (-10…+40°C)	< 3 %
Tilt response	< |±3| %

8 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.

9 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 ∅ 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 Ø 40 mm mast with internal thread. **LPS40/32... adapter is required**.
HD2003.77/40	Clamping for mast ∅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).

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.

Member of GHM GRO

DICHIARAZIONE DI CONFORMITÀ UE
EU DECLARATION OF CONFORMITY

Delta Ohm S.r.L. a socio unico – Via Marconi 5 – 35030 Caselle di Selvazzano – Padova – ITALY

Documento Nr. / Mese.Anno:
Document-No. / Month.Year : **5179 / 01.2022**

Si dichiara con la presente, in qualità di produttore e sotto la propria responsabilità esclusiva, che i seguenti prodotti sono conformi ai requisiti di protezione definiti nelle direttive del Consiglio Europeo:
We declare as manufacturer herewith under our sole responsibility that the following products are in compliance with the protection requirements defined in the European Council directives:

Codice prodotto:
Product identifier : **LPPYRA-Lite / LPPYRA-LiteAC**

Descrizione prodotto:
Product description : **Piranometro**
Pyranometer

I prodotti sono conformi alle seguenti Direttive Europee:
The products conform to following European Directives:

Direttive / *Directives*	
2014/30/EU	Direttiva EMC / *EMC Directive*
2014/35/EU	Direttiva bassa tensione / *Low Voltage Directive*
2011/65/EU - 2015/863/EU	RoHS / *RoHS*

Norme armonizzate applicate o riferimento a specifiche tecniche:
Applied harmonized standards or mentioned technical specifications:

Norme armonizzate / *Harmonized standards*	
EN 61010-1:2010	Requisiti di sicurezza elettrica / *Electrical safety requirements*
EN 61326-1:2013	Requisiti EMC / *EMC requirements*
EN 50581:2012	RoHS / *RoHS*

Il produttore è responsabile per la dichiarazione rilasciata da:
The manufacturer is responsible for the declaration released by:

Alessandro Perego

Amministratore delegato
Chief Executive Officer

Caselle di Selvazzano, 28/01/2022

Questa dichiarazione certifica l'accordo con la legislazione armonizzata menzionata, non costituisce tuttavia garanzia delle caratteristiche.
This declaration certifies the agreement with the harmonization legislation mentioned, contained however no warranty of characteristics.

GHM GROUP – Delta OHM | Delta Ohm S.r.l. a socio unico
Via Marconi 5 | 35030 Caselle di Selvazzano | Padova | ITALY
Phone +39 049 8977150 | Fax +39 049 635596
www.deltaohm.com | sales@deltaohm.com

Member of GHM GROUP

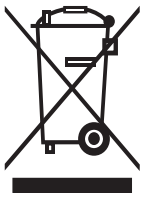
WARRANTY

Delta OHM 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.
Delta OHM 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. In case of discrepancies and/or inconsistencies, please write to sales@deltaohm.com.
Delta OHM 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

V1.2
05/2022