



Direct radiometer Heliophanometer

User manual



Revisions list

<i>Issue</i>	<i>Date</i>	<i>Description of changes</i>
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About this manual

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Table of contents

1	Introduction.....	4
1.1	Principle of measurement	4
2	Technical specifications.....	5
3	Report of Calibration	6
4	Installation.....	7
4.1	General safety rules.....	7
4.2	Mechanical installation.....	8
4.3	Modes of operation.....	9
4.4	Electrical connection	10
4.5	Calibration factor.....	10
4.6	Use with LSI LASTEM data logger	10
5	Operational check.....	11
6	Maintenance.....	11
7	Handling.....	11
8	Storage, packaging, preservation, delivery	12
9	Disposal	12
10	Accessories and spare parts	13
11	How to contact LSI LASTEM.....	13
12	EC Declaration of Conformity.....	14
13	ANNEX 1.....	15
13.1	DPD504.1 sensor schematic drawing	15

1 Introduction

The LSI LASTEM direct radiometer and heliophanometer is a sensor for measuring radiation coming directly from the sun and sunshine duration (referring to a certain threshold). Measurement is at visible and near infrared wavelength, with performances of a WMO II class pyranometer.

Being set the measurement site latitude, the instrument does not require any other seasonal repositioning for an ordinary precision relief. Higher precision are obtained with two seasonal repositioning only.

The sensor furnishes sunshine state: sun is “present” when the direct radiation is greater than 120 Wm^{-2} (WMO standard - 1981).

Sensor has two heaters: one for atmospheric moisture and the other for frost. In darkness, the rotating band is stopped and the logic output for sunshine presence is switched to “off”. Normalized outputs let the instrument compatible with the most part of other instrument: data logger, printer, timer.

1.1 Principle of measurement

The sensitive element is made up of a radiation sensing sphere, which receives radiation from an anular sky portion of an amplitude of 90° . A rotating band shadows the sensing sphere as it passes behind the sun: the difference of radiation values in the opposite condition (shadow - light) is, with a good approximation, the direct sunshine radiation.

2 Technical specifications

DPD504.1		
Direct radiation	Measurements	<ul style="list-style-type: none"> • Direct radiation • Sunshine status
	Principle	Non-tracking sensor
	Sensitive element	Photodiode
	Spectral range	300÷1100 nm
	Measuring range	0÷1500 Wm ⁻²
	Accuracy	15% (daily totals)
	Non linearity	< 1.5%
	Thermic drift	< 2% (-10÷40 °C)
	Output	4÷20 mA
Sunshine duration	Threshold	120 Wm ⁻² of direct radiation
	Accuracy	< 0.1 h (in clear sky)
	Output	ON / OFF TTL 0÷5 V
General information	Power supply	10÷14 Vdc
	Power consumption	<ul style="list-style-type: none"> • Sensor: 0.7 W • Anti-condensation heater: 1 W • Defrosting heater: 20 W
	Operative temperature	0÷60 °C (-30÷60 °C with heating)
	Rotating band speed	1 rps
	Operating latitude	0÷60 °
	Mounting	For Ø 45÷65 mm pole using DYA041 arm and DYA049 collar
	Recalibration	Every 2 years
	Protection grade	IP66
	Weight	1.5 kg
	EMC	EN 61326-1:2013
	Actuation time	Always ON recommended (in any case > 2 min)
	Data logger compatibility	<ul style="list-style-type: none"> • M-Log (ELO008) • R-Log (ELR515.1) • E-Log • Alpha-Log (using ALIEM module)

4 Installation

The sensor must be installed away from buildings, trees and other obstacles that may generate shadows or improper light diffusion in each day time and for every day of the year.

4.1 General safety rules

Please read the following general safety rules in order to avoid injuries to people and prevent damages to the product or to possible other products connected with it. In order to avoid any damages, use this product exclusively according to the instructions herein contained.

The installation and maintenance procedures must be carried-out only by authorized and skilled service personnel.

Power the instrument in a suitable manner. Pay attention and observe the power supplies like indicated for the model in your possession.

Carry-out all connections in a suitable manner. Pay strict attention to the connection diagrams supplied with the instrument.

Do not use the product in case of suspected malfunctions. In case of suspected malfunction, do not power the instrument and contact authorized technical support immediately.

Before you carry-out any operation on electrical connections, power supply system, sensors and communication apparatus:

- Disconnect the power supply.
- Discharge the accumulated electrostatic discharges touching an earthed conductor or apparatus.

For safety regulations please refer to manual INSTUM_05290.

4.2 Mechanical installation

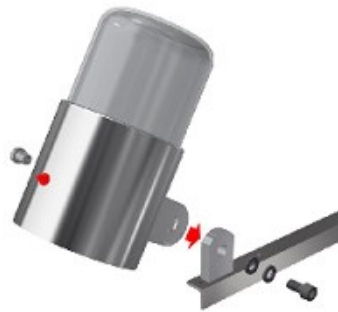
The sensor must be installed with the red nose pointing in the direction of the equator, in an unshaded place all day in any season. Preferably place the sensor at a height of 2 m above a grassy ground. Installation can take place on a pole using the DYA049 collar and DYA041 support. Proceed as indicated:

1. Fix the DYA041 support to the DYA049 collar and mount them on pole.

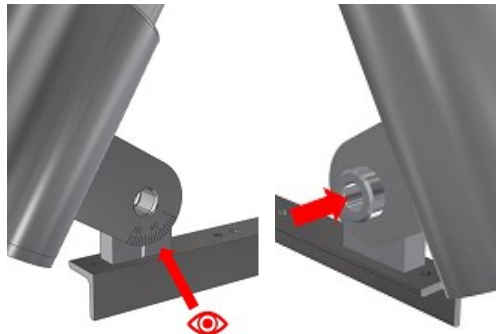


2. Turn the support until it points to the terrestrial equator.

3. Mount the sensor on DYA041 support.



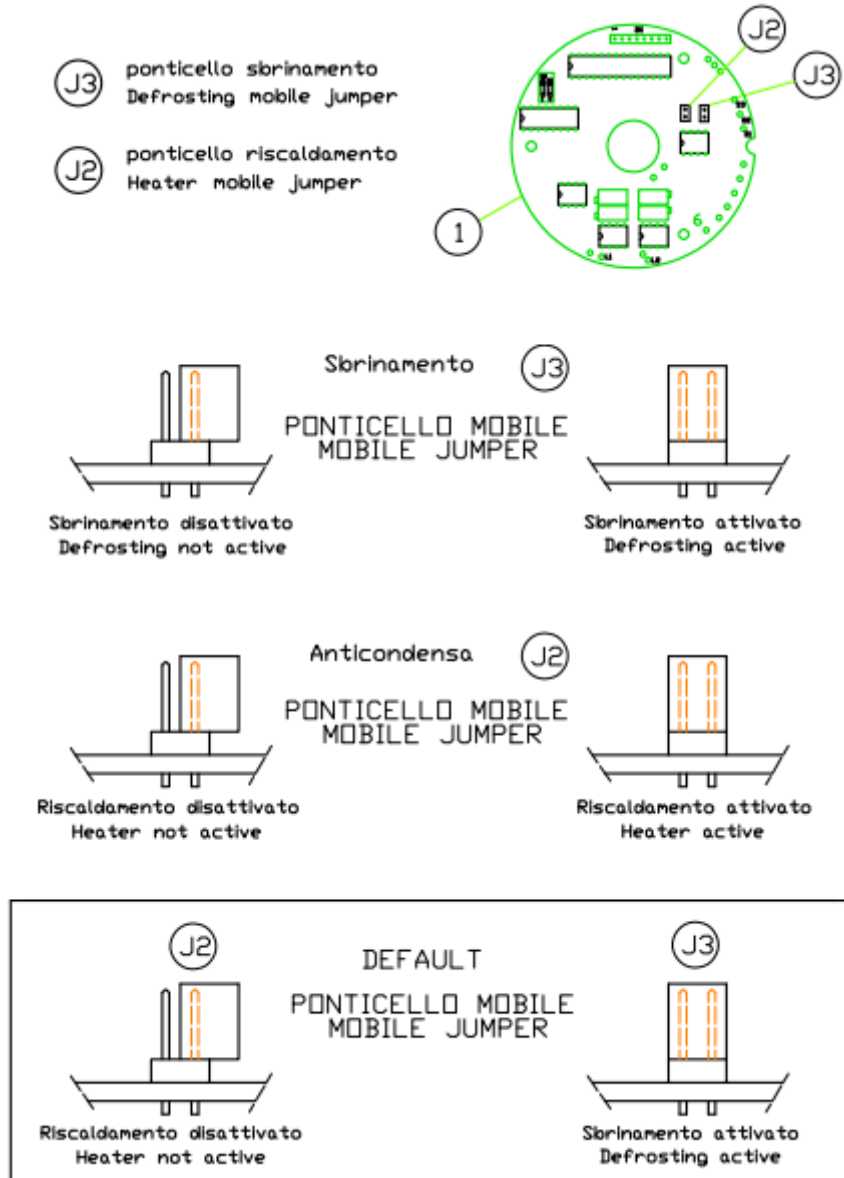
4. Using the notch on the support as a reference, tilt the sensor up to an angle corresponding to the latitude of the site, then tighten the fixing screw.



5. Connect the DWA5nnA cable to the sensor.

4.3 Modes of operation

The sensor is endowed with heating for atmospheric moisture and with a no frost system in order to prevent frost forming on the glass dome. By default setting no frost system is ON, while the heating is OFF. In order to change this configuration, operate on instrument electronic board as described in the picture below.



For optimal operation, LSI LASTEM recommends keeping the power supply permanent in order to allow the heaters to be more efficient.

If not allowed by the power supply system, however, maintain an actuation time greater than two minutes.

4.4 Electrical connection

Wiring connections must be performed as following:

Code	Wire color	Name	Description
DPD504.1	Brown	Power In +	+ Power supply (10÷30 Vac/dc)
	White	Power In -	- Power supply
	Shield	Gnd	Ground
	Yellow	Gnd	Ground
	Green	Output 1 +	+ Signal output 1 radiation (4÷20 mA)
	Grey	Output com -	- Common signal outputs
	Red	Output 2 +	+ Signal output 2 sunshine status (TTL 0÷5 V)

Read also ANNEX 1.

4.5 Calibration factor

Measurement obtained by the sensor signal output, in voltage or in current depending on the model, must be multiplied, on the data acquisition system, by the Calibration factor, this is to obtain the most accurate radiation value results.

Example

Measurement range: 0÷1500 Wm⁻²

Electrical output: 4÷20 mA

Wm⁻² each mA: 1500 / 16 = 93,75 Wm⁻²/mA

Calibration factor: 0,96 (value reported on the Report of Calibration)

Electrical output from the measuring sensor: 10 mA (ad esempio)

Corresponding radiation value: 10 – 4 = 6 mA * 93,75 = 562,5 Wm⁻²

Radiation value considering the calibration factor: 562,5 Wm⁻² * 0,96 = 540 Wm⁻²

4.6 Use with LSI LASTEM data logger

If the sensor is used with an LSI LASTEM data logger, proceed with the configuration of the data logger using the 3DOM software:

- Open the data logger configuration.
- Add the sensor by selecting its code (DPD504.1) from the *3DOM Sensor Library*.
- Check the acquisition parameters (input, rate, etc.)
- Save the configuration and send it to the data logger.

For more information about the configuration, refer to the manual of the data logger in use.

5 Operational check

The sensor is equipped with a rotating band. Check that, in the presence of solar radiation, it rotates around the small sphere positioned in the center of the sensor.

To check the sensor output it is necessary to have the accompanying drawing (read ANNEX 1) of the sensor and a multimeter.

To check the direct radiation output, proceed as follows:

1. Set the multimeter to measure signals in direct current (DCA) and 20 mA scale.
2. Disconnect the wire corresponding to the negative signal (- Sig) and connect it to the red test lead (+) of the multimeter. The black test lead (-) fix it in place of the disconnected wire.
3. Darken the sensor with a black cloth; the multimeter should measure approximately 4 mA.
4. With the sensor exposed to the solar radiation the multimeter should measure a value greater than 4 mA.

The radiation measurement value can be compared with other radiometers installed in the same system as long as they are of the same model.

The procedure for verifying the ON/OFF TTL output of the heliophane is the same for all sensors.

1. Set the multimeter to measure signals in direct voltage (DC) and 5 V scale.
2. Connect the red test lead (+) of the multimeter to the red wire (signal output 2) and the black test lead (-) to the grey wire (common output).
3. Darken the sensor with a black cloth; the multimeter should measure approximately 0 V (state OFF).
4. With the sensor exposed to solar radiation greater than a 120 Wm^{-2} the multimeter should measure approximately 5 V.

6 Maintenance

The sensor requires no special maintenance, just wiping with a damp cloth to keep the glass dome clean. It is also advisable to check:

- the integrity of the sensor
- the inclination of the sensor which must correspond to the latitude of the place

For calibration, refer to §3.

7 Handling

Avoid the introduction of electrostatic discharge (ESD). The product, or part of it, is fragile, avoid mechanical shocks, abrasions or scratches on the surface and dome.

8 Storage, packaging, preservation, delivery

For storage, respect the humidity (10÷100% non-condensing) and temperature (-40÷80 °C) limits. Avoid direct sun exposure.

For delivery and storage, use the packaging supplied with the product.

For preservation, it is recommended to respect the environmental limits of humidity (15÷80% non-condensing) and temperature (-10÷50 °C).

Upon receipt of the material, visually check the package for signs of crushing or perforation; in the presence of these signs, check the integrity of the product inside.

9 Disposal

This product is a device with high electronic content. In accordance with the standards of environmental protection and collection, LSI LASTEM recommends handling the product as waste of electrical and electronic equipment (RAEE). For this reason, at the end of its life, the instrument must be kept apart from other wastes.

LSI LASTEM is liable for the compliance of the production, sales and disposal lines of this product, safeguarding the rights of the consumer. Unauthorized disposal of this product will be punished by the law.



Recycle or dispose of the packaging material according to local regulations.

10 Accessories and spare parts

Code	Description
DYA041	Lateral arm for DPD503, DPD504 and DPD504.1 mounting
DYA049	Collar for DYA041 mounting on pole \varnothing 45÷65 mm
DWA505A	Cable L=5 m
DWA510A	Cable L=10 m
DWA525A	Cable L=25 m
DWA526A	Cable L=50 m
DWA527A	Cable L=100 m

11 How to contact LSI LASTEM

In case of problem contact the technical support of LSI LASTEM sending an e-mail to support@lsi-lastem.com, or compiling the technical support request module at www.lsi-lastem.com.

For further information refer to addresses and numbers below:

- Phone number +39 02 95.414.1 (switchboard)
- Address: Via ex S.P. 161 – Dosso n. 9 - 20049 Settala Premenugo, Milano
- Web site: www.lsi-lastem.com
- Commercial service: info@lsi-lastem.com
- After-sales service: support@lsi-lastem.com, Repairs: riparazioni@lsi-lastem.com

12 EC Declaration of Conformity



Esperti delle misure tecnologiche ambientali



Dichiarazione di conformità / Declaration of conformity

Oggetto / Subject

Codice prodotto / Product code: DPD503, DPD504, DPD504.1

Descrizione / Description

Sensori radiazione diretta – Eliofanometri / Direct Radiation – Sunshine Duration Meter

Fabbricante / Manufacturer

LSI LASTEM Srl

Via ex S.P. 161 loc. Dosso 9

20049 Settala (MI) – Italy

Dichiarazione / Declaration

Dichiariamo che i prodotti oggetto di questo documento sono stati progettati in accordo e compatibilmente alle seguenti Direttive Europee e norme armonizzate / We declare that the products covered by this document have been designed in compliance with the following European Directives and harmonized standards:

2014/30/EU = Direttiva sulla compatibilità elettromagnetica EMC / EMC electromagnetic compatibility directive.

EN 61000-6-1: 2007, EN 61000-6-2: 2005, EN 50082-1:1998 = Norme generiche relative all'immunità elettromagnetica riferita ad ambienti residenziali ed industriali / Generic standards for electromagnetic immunity in residential and industrial environments.

EN 61000-6-3: 2007+A1:2011+AC:2012, EN 61000-6-4: 2007+A1:2011, EN 55011 = Norme generiche relative alle emissioni elettromagnetiche riferita ad ambienti residenziali ed industriali / Generic standards for electromagnetic emissions in residential and industrial environments.

EN 55022:2010 (CISPR 22) - Limiti e metodi di misura delle caratteristiche di radiodisturbo prodotto dagli apparecchi per la tecnologia dell'informazione / Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement

EN 55024 (IEC61000-4-2,3,4,5,6,8,11) - Limiti e metodi di misura delle caratteristiche di radiodisturbo prodotto dagli apparecchi per la tecnologia dell'informazione / Information technology equipment - Immunity characteristics - Limits and methods of measurement

EN 61000-3-2 (IEC61000-3-2) : 2002 - Compatibilità elettromagnetica (EMC) - Parte 3-2: Limiti - Limiti per le emissioni di corrente armonica (apparecchiature con corrente di ingresso ≤ 16 A per fase) / Electromagnetic compatibility (EMC) Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

EN 61000-3-3 (IEC61000): 2013 = Compatibilità elettromagnetica (EMC) Parte 3-3: Limitazione delle variazioni di tensione, delle fluttuazioni di tensione e del flicker in sistemi di alimentazione in bassa tensione per apparecchiature con corrente nominale ≤ 16 A per fase e non soggette ad allacciamento su condizione. / Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection

EN 60950: 2001 - Apparecchiature per la tecnologia dell'informazione = Sicurezza / Information technology equipment - Safety

2011/65/EU = Direttiva sulla restrizione dell'uso di determinate sostanze pericolose nelle apparecchiature elettriche ed elettroniche. (I nostri prodotti non contengono sostanze definite altamente preoccupanti come definito nell'Art. 33) / The Restriction of Hazardous Substances Directive. (Our products don't contain the "substances" & "preparations" (Article 33) or release any substances.

Il Legale Rappresentante / Legal Representative

Andrea Certo

15/01/2021

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Pag. 1 / 1

13 ANNEX 1

13.1 DPD504.1 sensor schematic drawing

