Pyranometers

Class B, C

User manual

Revisions list

Issue	*Date*	*Description of changes*
Origin	26/01/2021	
A (1)	07/05/2021	Added DPA053 installation
B (2)	25/05/2021	Added use of DPA980 and DPA983 sensors
3	22/12/2023	Removed external temperature measurement of the DPA980 and DPA983 sensors
4	08/03/2024	Translated Italian text in chapter 5.1

About this manual

The information contained in this manual may be changed without prior notification. No part of this manual may be reproduced, neither electronically nor mechanically, under any circumstance, without the prior written permission of LSI LASTEM.

LSI LASTEM reserves the right to carry out changes to this product without timely updating of this document.

Summary

1 Introduction

The LSI LASTEM pyranometer is an instrument to measure the solar irradiance (direct and diffuse) which reaches the terrestrial surface.

With this instrument it is possible to measure not only the global radiation (see WMO n°8 7th ed.), but also the reflected sun radiation (*albedometer*) and the diffuse radiation by means of the occultation band.

The pyranometer measures radiation values within 300 and 3000 nm, with a visibility of 2π steradians. The element used to for the measurement is a thermopile whose external surface has been darkened with matt black paint bearing a reflecting power < than 2% (e>0.98) in the spectral area of the sensor.

The following table compares the specifications required for the pyranometers in "first class" or "second class" (ISO 9060) or in "good quality" (WMO n°8, 7th ed.) and the Lsi Lastem pyranometers.

	ISO 9060	C standard	B class	B class Lsi Lastem	C class	C class Lsi Lastem
1	Response time (95%)	< 15 s	< 30 s	16 s	< 60 s	20 s
2	Zero offset: (a) Net thermal radiation response of 200 (b) Response to variation of 5 Kh^{-1}	7 Wm^{-2} 2 Wm^{-2}	15 Wm^{-2} 4 Wm^{-2}	12 Wm^{-2} 2 Wm^{-2}	30 Wm^{-2} 8 Wm^{-2}	14 Wm^{-2} 3 Wm^{-2}
3	Stability (drift/year)	0.8 %	1.5 %	< 1 %	3 %	< 1.5 %
4	Non-linearity	0.5 %	1 %	0.75 %	3 %	1.5 %
5	Directional response	10 Wm^{-2}	20 Wm^{-2}	20 Wm^{-2}	30 Wm^{-2}	30 Wm^{-2}
6	Sensitivity/year variation	2 %	5 %	< 2 %	10 %	< 2 %
7	Temperature response	2 %	4 %	< 4 %	8 %	< 7 %
8	Tilt response	0.5 %	2 %	-	5 %	-
WMO n° 8, 7ª ed., Pyranometer table 7.5						
9	Total uncertainty: - Hourly total - Daily total	 3 % 2 %	 8 % 5 %	 < 8% < 5 %	 20 % 10 %	 < 20 % < 10 %

1) Response time of the pyranometer to reach 95% of the final value in case of a rapid change in Irradiance;
2a) Pyranometer offset signal not generated by the sun, but in the conditions of night sky at -10 ° C and +30°C sensor body temperature
2b) Offset signal of the pyranometer not generated by the sun, but by an ambient temperature change of 5 ° C in 1 hour;
3) Change in sensitivity over a year;
4) Non-linearity of the sensitivity value in the range from 100 to 1000 W / m2;
5) Error of the angular response when the pyranometer is hit by a perpendicular radiation of 1000 W / m2 compared to when it is inclined. The cosine of the angle with respect to the zenith of the location must be taken into account.
6) Spectral sensitivity deviation from the ideal value of the product between the absorption coefficient and transmission of the glass compared to the average value between 200 and 3000 nm.
7) Change in sensor sensitivity due to a rapid temperature change within a range of 50 degrees Celsius.
8) Variation of the sensitivity of the horizontal sensor when it is hit by a perpendicular irradiance of 1000 W / m2 compared to when it is rotated by 90 °. This is the sensitivity variation only due to mechanical inclination.
9) Acceptable uncertainty of the measurement of total solar energy received in an hour or per day in Wh / m2 or MJ / m2. The reference value is the measurement made with another instrument with higher class.

2 Technical features

2.1 Class B Pyranometer

PN	DPA154	DPA855	DPA980
Output	µV	4÷20 mA	RS485-Modbus
Protocol	-	-	Modbus RTU®, TTY-ASCII
Programmable output	-	-	Inst, max/min/ave (1÷3600 sec)
RS485 protection	-	-	Galvanic insulation (3 kV, UL1577)
RS485 speed	-	-	1200÷115 kbps
Power supply	-	10÷30 Vac/dc	10÷30 Vac/dc
Max. Load	-	300 Ohm	300 Ohm
Power consumption	-	0,5 W	0,5 W
EMC	-	EN 61326-1: 2013	EN 61326-1: 2013
Sensitivity	10÷15 µV/W/m^2	NA	NA
Measuring range	0÷4000 W/m^2	0÷1500 W/m^2	0÷1500 W/m^2
Cable	L=10 m included	Not included (see Accessories)	Not included (see Accessories)
Data logger compatibility	• M-Log (ELO008) • Alpha-Log (using ALIEM module) • E-Log	• M-Log (ELO008) • Alpha-Log (using ALIEM module) • E-Log	• M-Log (ELO008) using RS485->232 converter • Alpha-Log • E-Log using RS485->232 converter

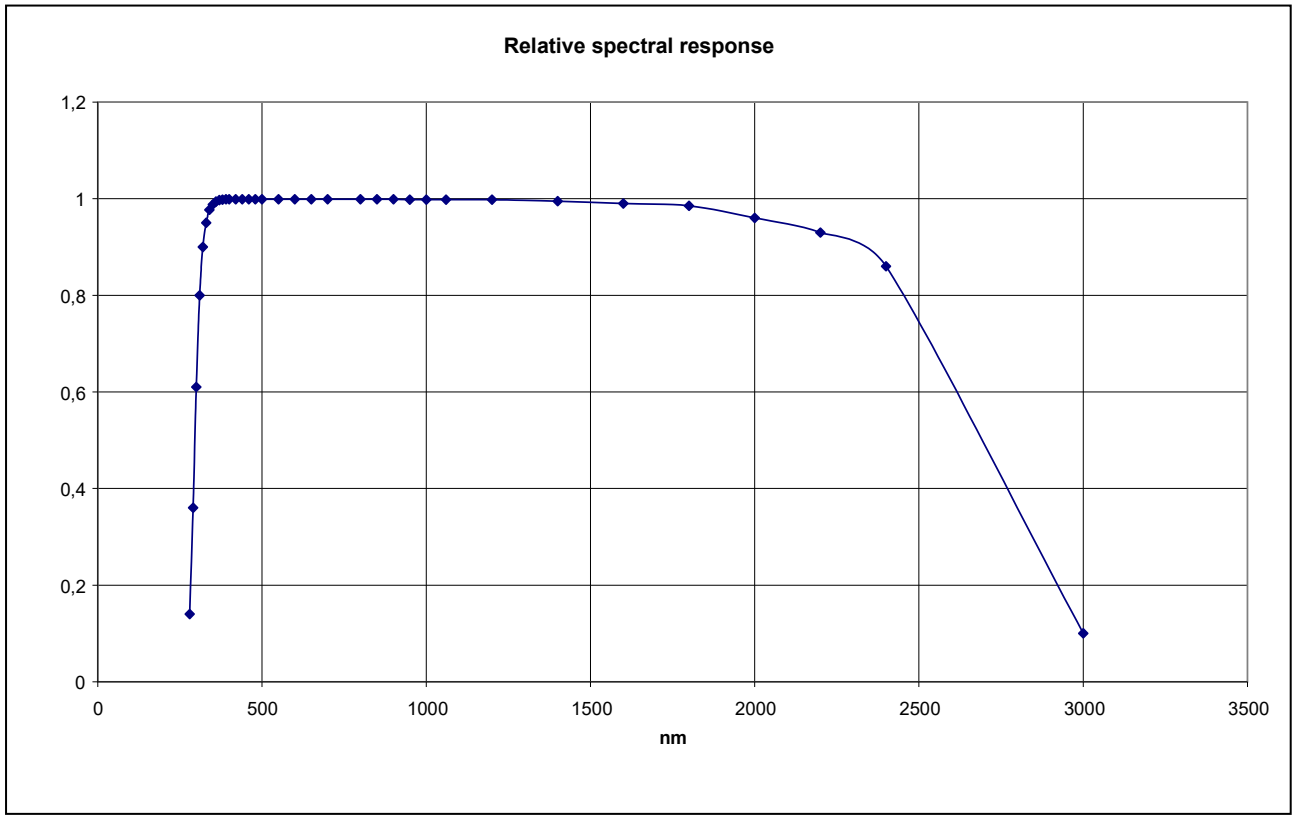
Class B Pyranometer	ISO 9060 2018 Classification	Spectrally flat Class B (First Class)
	IEC 61724-1:2017 Classification	Class B
	WMO performance level	Good Quality Pyranometer
	Estimate of the achievable accuracy for daily WMO sums	±5%
	Spectral range	285÷3000 nm
	Instability	<± 1% (difference per year)
	Response time	16 s
	Non linearity	<± 1% (100÷1000 W/m^2)
	Directional response	<±20 W/m^2
	Temperature response	<± 4% (-10÷40°C)
	Irradiance range	0÷4000 W/m^2
	Zero offset (response to a net thermal radiation of 200W/m^2)	<12W/ m^2
	Zero offset b (response to a 5K/h of thermal change)	<±3 W/m^2
	Supplied with each sensor	Calibration certificate
	Operative temperature	-40÷80°C
	Calibration traceability	WRR
	Housing	Anodized aluminium
General information	Ricalibration	Every 2 years
	Mounting (pole Ø 45÷65 mm)	Using DYA034 (horizontal) or DYA035 (tilting) arm + DYA049 collar
	Protection	IP66

2.2 Class C Pyranometer

			
PN	**DPA053**	**DPA863**	**DPA983**
Output	µV	4÷20 mA	RS485-Modbus
Protocol	-	-	Modbus RTU®, TTY-ASCII
Programmable output	-	-	Inst., max., min., ave. (1÷3600 s)
RS485 protection	-	-	Galvanic insulation (3 kV, UL1577)
RS485 speed	-	-	1200÷115 kbps
Power supply	-	10÷30 Vac/dc	10÷30 Vac/dc
Power consumption	-	0.5 W	0.5 W
EMC	-	EN 61326-1: 2013	EN 61326-1: 2013
Sensitivity	10÷15 µV/W/m²	NA	NA
Measuring range	Vedi campo di irradianza	0÷1500 W/m²	0÷1500 W/m²
Cable	Included L = 5 m	Not included (see accessories)	Not included (see accessories)
Mounting	DYA032 arm + DYA049 collar (horizontal) DYA048 plate + DYA035 (tilting) arm + DYA049 collar	DYA034 (horizontal) or DYA035 (tilting) arms + DYA049 collar	DYA034 (horizontal) or DYA035 (tilting) arms + DYA049 collar
Data logger compatibility	• M-Log (ELO008) • Alpha-Log (with ALIEM module) • E-Log	• M-Log (ELO008) • Alpha-Log (with ALIEM module) • E-Log	• M-Log (ELO008) with RS485->232 converter • Alpha-Log • E-Log. with RS485->232 converter

Class C Pyranometer	ISO 9060 2018 Classification	Class C (Second Class)
	EC 61724-1: 2017 Classification	Class C
	WMO performance level	Moderate Quality
	Estimate of the achievable accuracy for daily WMO sums	±10%
	Spectral range	285÷3000 nm
	Temperature response	<± 0,7% (-10÷40°C)
	Irradiance range	0÷2000 W/m²
	Ricalibration	Every 2 years
	Operative temperature	-40÷80°C
	Calibration traceability	WRR
General	Material	Anodized aluminium
	Protection	IP66

Total (sensor + glass dome) relative spectral response



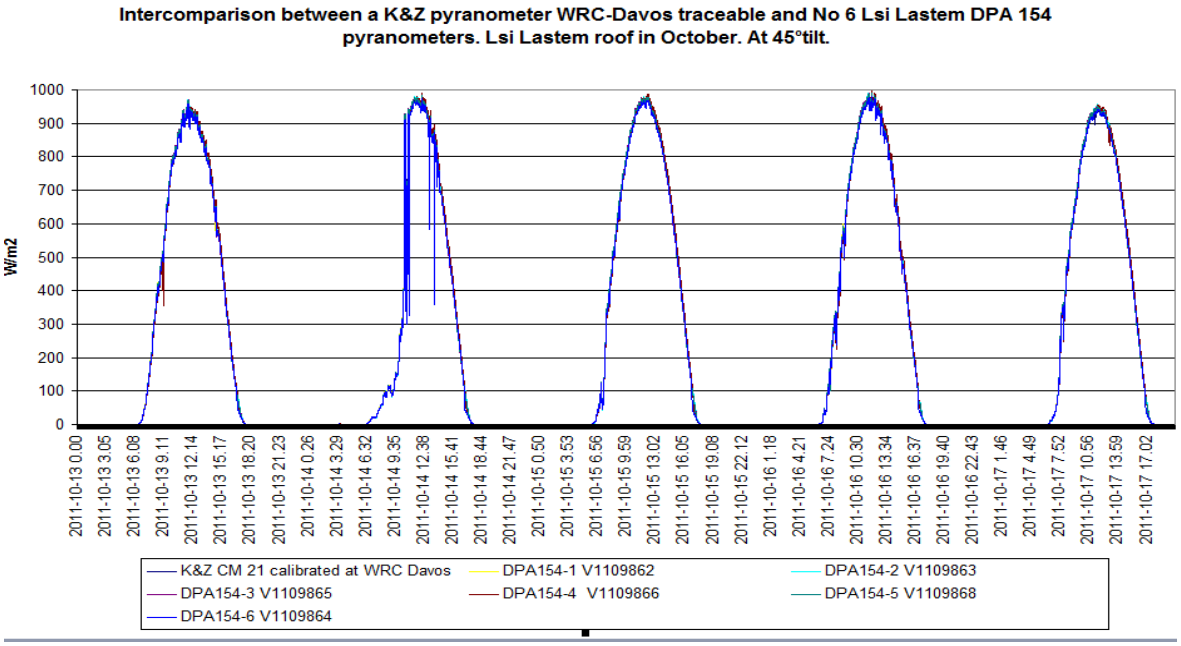
3 Calibration

Each pyranometer is supplied with a *Calibration Report* produced by comparison, under the sun or under a lamp (ISO 9847), with a pyranometer calibrated at the WRC-PMOD in Davos (WRC: World Radiation Center; PMOD: Phisikalisch Meteorologisches Observatorium Davos).
The *Calibration Report* contains the *Calibration Factor* whit its expanded uncertainty.

An overall accuracy value is not supplied; there are however many available features according to the classes of the WMO n°8 and ISO 9060. Besides, the accuracy, each sensor is influenced by the quick temperature changes due to the quick movements of clouds and rain conditions.

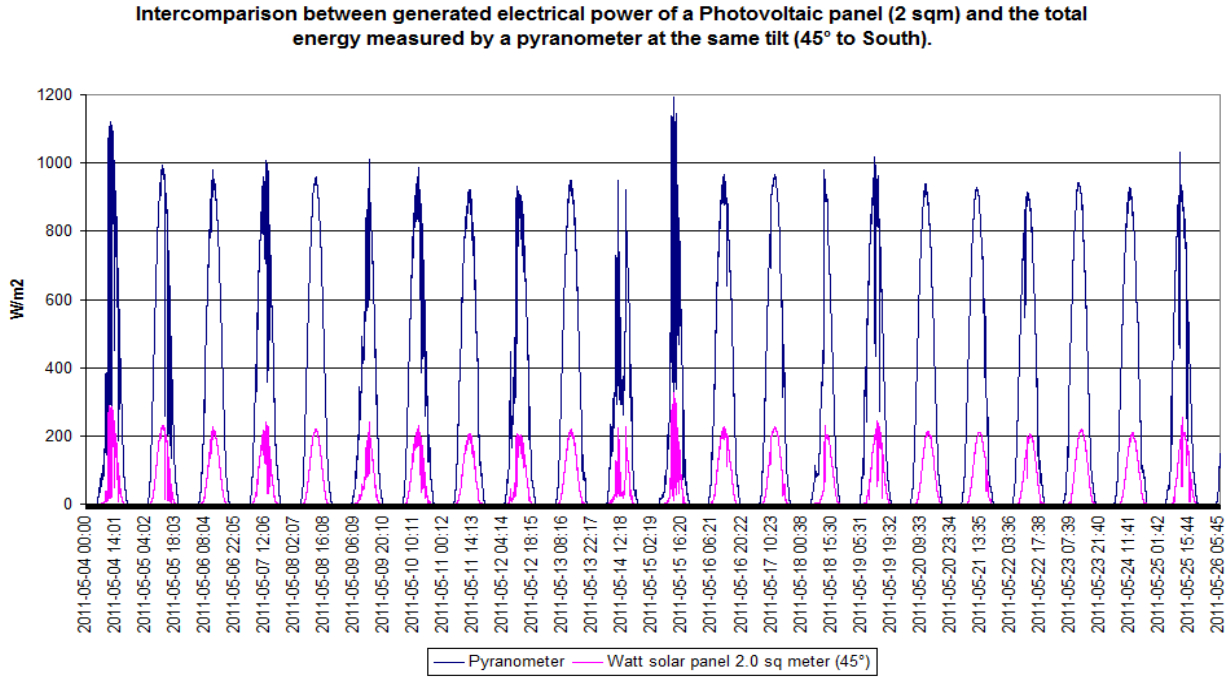
It is not necessary to re-calibrate the instrument frequently. It is advisable to re-calibrate the instrument every 2 to 3 years in order to keep calibration uncertainty variations in the range of the pyranometer class.

Measures example:



Typical mean values of Daily totals of energy (MJ/m2)of global radiation in three North Italy town during an year.

Locality	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Turin	5.0	8.1	13.3	17.1	20.0	22.4	22.2	18.8	14.1	9.8	6.1	4.4
Aosta	3.6	6.2	11.8	16.0	19.4	21.8	21.5	18.2	13.6	9.4	5.4	3.6
Milan	5.2	8.1	13.6	17.3	20.4	22.6	22.7	19.3	14.3	9.6	5.9	4.3



4 Installation

The pyranometers must be exposed towards the equator in a place that, in every season, is free of shadows during the day and installed at a height of 2 m on grassy places.

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:

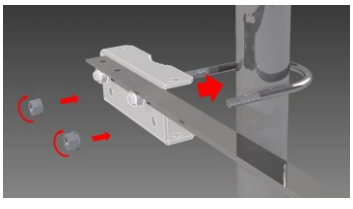
- Disconnect the power supply.
- Discharge the accumulated electrostatic discharges touching an earthed conductor or apparatus.

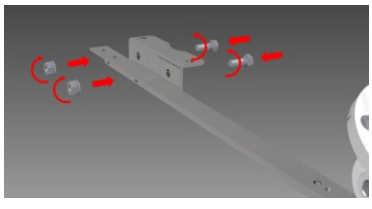
For more information about safety regulations, please refer to manual INSTUM_05290.

4.2 Mechanical installation

The pyranometer must face equator and be exposed in a place with no shades throughout the day in every season; best installed at a height of 2 m on grassy ground. Do the Installation on pole using a DYA049 collar and DYA032-034-035 support. Follow these steps:

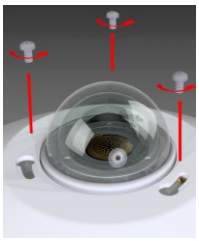
1. Fix the DYA032-034-035 support the DYA049 collar and mount them on pole.
2. Turn the support until the sensor points to the terrestrial equator.





For DPA154/DPA855/DPA980/DPA863/DPA983 sensors:

3. Remove the radiant protective screen from the pyranometer body.



4. Mount the body of the sensor on the DYA032-34-035 support, having care to level the sensor horizontally using the two leveling feet and the bubble level.

5. Fix the pyranometer to the supporting disc using the two longest screws; use an Allen wrench n° 4 for this purpose.

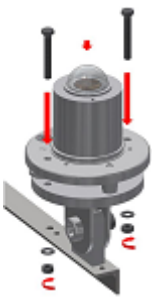
6. Reassemble the protective screen on the pyranometer body.

For DPA053 sensor on DYA0035 tilting arm and DYA048 plate:

3. Remove the radiant protective screen from the pyranometer body.

4. Fix the pyranometer to the supporting DYA048.

5. Mount the pyranometer with the plate on the DYA035 support, having care to level the sensor horizontally using the two leveling feet and the bubble level.
   Then, fix the pyranometer to the supporting disc on DYA035 using the two longest screws; use an Allen wrench n° 4 for this purpose.



6. Reassemble the protective screen on the pyranometer body.

For DPA053 sensor on DYA032 arm:

3. Mount and fix the the pyranometer on the DYA032 support.

4.3 Electrical connection

Connections must be performed following the drawing of the pyranometer:

PN	Wire color	Nome	Significato
DPA053 DPA154	Brown	+ output	Thermopile output +
	Blue	- output	Thermopile output -
	Schield	Gnd	Ground

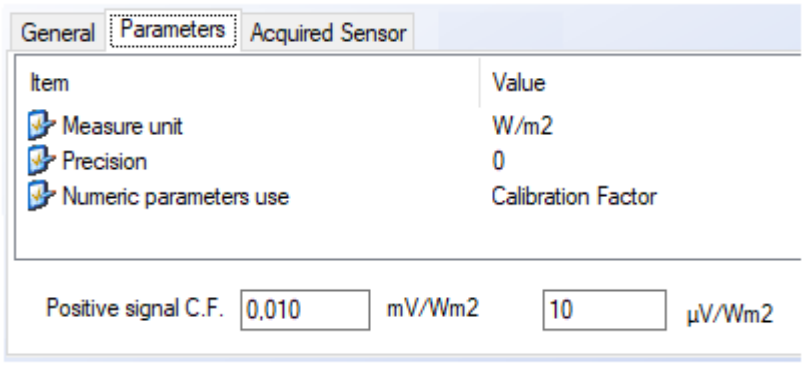
PN	Wire color	Nome	Significato
DPA855 DPA863	Red	Power In +	Power supply +
	Blue	Power In -	Power supply -
	Schield	Gnd	Ground
	Green	Output -	- 4÷20 mA
	Brown	Output +	+ 4÷20 mA

PN	Wire color	Nome	Significato
DPA980 DPA983	Red	Power In	Power, Vdc or Vac
	Blue	Power In	Power, Vdc or Vac
	Shield	Gnd	Earthing
	Green	RS-485 D+	Serial Line - positive RS-485 (non-inverting signal)
	Brown	RS-485 D-	Serial Line - negative RS-485 (inverting signal)

4.4 LSI LASTEM data logger configuration

If the pyranometer 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 (eg DPA154) from the *3DOM Sensor Library*.
- If the sensor has a voltage output (direct thermopile output), replace the default value of the *Positive signal C.F.* with *Calibration factor* value found on the *Calibration certificate* supplied with the sensor. Below is the window for setting the parameters of the ALIEM data logger.



- 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 Use of DPA980/DPA983 sensors

5.1 Configuration

The sensor is equipped with several functions easily configurable through a terminal emulation program (for example *Windows HyperTerminal* or any other commercial or free program available from Internet).

The device configuration and management is carried-out connecting the PC serial line (through USB/RS-232 to RS-485 adapter) to the serial line of the probe. Configure the terminal program as follow:

- Bit rate: default 9600 bps
- Parity: even
- Terminal Mode: ANSI
- Echo: disabled
- Flow control: none

At power-on the device starts operating with Modbus protocol on the serial line thus allowing data communication with external devices. When the configuration operations are needed, the device let to switch to the TTY protocol when a special *escape sequence* is transmitted to it. The protocol switch procedure can be done in this way:

1. Disconnect the sensor RS-485 line from the operating bus where the Modbus master device operates.
2. Connect the PC to the sensor RS-485 line using a proper media converter.
3. On the PC terminal program press slowly three or more times the '#' character.
4. The sensor should propose its main menu. If nothing happens, check the PC terminal configuration against the sensor/Modbus master serial communication configuration, and retry.

The device allows access to its functions through an easy menu interface. You can access to the main menu pressing ESC until the terminal program will show the following instructions:

```
Main Menu:
 1: About this device...
 2: Communication parameters
 3: Sampling
 4: Data Tx
 5: Save configuration
 6: Restart system
 7: Statistics
```

When the menu appears on the terminal window, the Modbus protocol is suspended until the next sensor restart, caused by a power cycle (off/on) or by the available reset command menu. Anyway, before the reset is done, make sure to save any configuration parameter changed with the menu.

The main menu is made up of several items. You can access to the different functions by pressing, on terminal, the numeric keypad corresponding to the desired item. The next function may be a new menu or the request to change the selected parameter; in this case it is shown the current value of parameter and the system waits for the input of a new value; press *Enter* to confirm the new inputted value, or press *Esc* to return to previous menu without changing the selected parameter; the *Esc* key also performs the move to previous menu.

Note: when you need to express decimal values use the dot as decimal separator for numbers input.

5.2 Functions available from menu

5.2.1 About this device…

This menu displays the registry data of the instrument: model, serial number and version of the program.

5.2.2 Communication parameters

This menu allows to program some parameters useful for communication between the device and the external apparatus (PC, PLC, etc.), particularly:

- *Bit rate* e *Stop bits*: it allows to modify the serial communication parameters.
- *Network address*: the network address of the instrument. It is especially necessary for Modbus protocol, in order to address (in univocal way) this instrument with respect to other devices connected on the same RS-485 loop.
- *Modbus parameters*: it offers the possibility to modify some parameters that are typical of Modbus protocol, particularly:
    - *Swap floating point values*: it is useful in case the host system requires the inversion of two 16 bit registers, which represent the floating point value.
    - *Floating point error value*: it shows the value used when the device has to specify an error datum in the registers that collect the floating point data.
    - *Integer error value*: it shows the value used when the device has to specify an error datum in the registers that collect the integer format data.

5.2.3 Sampling

Sampling includes the parameters that adjust the sampling and the processing of detected signals from the inputs, particularly:

- *Radiometer sensitivity*: this parameter is factory programmed and corresponds to the sensitivity of the sensor, expressed in mV/Wm-2; this value is shown in the calibration report of the sensor and can be changed after re-calibration.
- *Elaboration rate*: it is the processing time used for the supplying of statistic data (mean, minimum, maximum, total values); values included into the correspondent Modbus registries are updated according to the time expressed by this parameter.

5.2.4 Data Tx

This menu allows the execution of a fast diagnostic check of the sampled data and processed by the device; directly from the terminal emulation program, it is possible evaluate the right signals acquisition by the instrument:

- *Tx rate*: it shows the transmission rate of data to terminal; if this parameter is set to a value different from zero and saved in the configuration, the sensor will start automatically, after the next power up, the transmission of data in text format; in this way the Modbus protocol is disabled; in order to remove this functionality, set again this parameter to zero and save the configuration data.
- *Start Tx*: it starts the transmission according to the specified rate; it is proposed the measures sampled by means of the device (the display sequence is “irradiance, int. temperature”), updating the display automatically; press Esc to stop the transmission of data to terminal.

5.2.5 Save configuration

Save configuration, after a confirmation request, all changed parameters are saved; please note that the device changes its operation immediately from the first variation of each parameter (except for serial bit rates, that necessarily implies instrument re-start), in order to allow an immediate evaluation of the modifications; re-starting the instrument without saving changes, will reset the device to the previous saved configuration parameters.

5.2.6 Restart system

Restart system, after a confirmation request, it restart the system; warning: this operation cancels the variation of any parameters that have been modified but not definitively stored.

5.2.7 Statistics

The menu allows the display of same statistic data relative to the operation of the instrument, particularly:

- *Show*: it shows the time from last start or re-start of the instrument, the time from last reset of statistical data, the statistical counts relevant to communications over the serial communication line (number of received and transferred byte, number of total received messages, wrong messages and transferred messages). For further information about these data read §5.5.
- *Reset*: it resets the statistical counts.

5.3 Minimal configuration

In order to operate the pyranometer with its Modbus system correctly, you usually have at least to set as follow:

- *Network address*: the default set value is 1
- *Bit rate*: the default set value is 9600 bps
- *Parity*: the default set is Even

After modification of the parameters remember to store them definitively through *Save configuration* command and re-start the system in order to make them active (reset button, switch off/switch on or Restart system command). It is possible to check if the instrument works correctly using the Data Tx function, available on the configuration menu.

5.4 Restart of the sensor

The device can be restarted through menu (see §5.2.6) or with a switch off/on sequence. In both cases the changes to configuration, made through menu and not yet saved, will be cancelled completely.

5.5 Statistical information

The pyranometer collects statistical data that can be useful for diagnostics of possible operation problems. The statistics data can be obtained from the programming and management menu for (see §5.1) and through the proper menu entry.

The activation of display of statistics data produces the following result:

```
Power on time: 0000 00:01:00
Statistical info since: 0000 00:01:00

Com Rx bytes Tx bytes Rx msg  Rx err msg Tx msg
1   0        1        0       0          0
```

Here below you can read the meaning of displayed information:

- *Power on time*: power-up time of the apparatus or from last reset [dddd hh:mm:ss].
- *Statistical info since*: time from last reset of statistics [dddd hh:mm:ss].
- *Com*: number of the device serial port (1=RS-485).
- *Rx bytes*: number of bytes received from serial port.
- *Tx bytes*: number of bytes transferred from serial port.
- *Rx msg*: total number of messages received from serial port (Modbus or TTY/CISS protocol).
- *Rx err msg*: number of wrong messages received from serial port.
- *Tx msg*: number of messages transferred from serial port.

5.6 Modbus protocol

The pyranometer implements Modbus protocol in slave RTU mode. The controls *Read holding registers* (0x03) and *Read input registers* (0x04) are supported for access to acquired data and calculated by the device; both commands supply the same result.

Information available in the Modbus registers are both instantaneous values (last sampled according to the acquisition rate of 1 s), and processed values (mean, minimum, maximum and total of the sampled data for the period corresponding to the processing rate).

The instantaneous and processed data are available in two different formats: floating point and integer; in the first case the datum is included in two consecutive registers of 16 bit and it is expressed in 32 bit IEEE754 format; the storage sequence in two registers (*big endian* or *little endian*) is programmable (see §5.1); in the second case each datum is included in a single 16 bit register; its value, as it does not have any floating point, is multiplied by a factor fixed according to the type of measurement it represents and therefore it has to be divided by the same factor in order to obtain the primary factor (expressed with right decimals).

The table below shows the multiplication factor for each measurement:

Measurement	***Multiplication Factor***
Irradiance	10
Temperature	100

It is possible use tool *Modpoll* in order to check the connectivity through Modbus in an easy and fast way: it is a free tool that can be downloaded from this site: www.modbusdriver.com/modpoll.html.

You can use Modpoll by command line of Windows or Linux prompt. For example, for Windows version you can execute the command:

```
Modpoll –a 1 –r 1 –c 10 –t 3:float –b 9600 –p even com1
```

Replace *com1* with port really used by PC and, if necessary, the other communication parameters, in case they have been modified in comparison with the default parameters set in the device. Modpoll program executes a query every second to the device and displays the results on the PC display. Through –r and –c parameters it is possible to choose from the device which measures and elaborated items. For further information about the commands use –h parameter.

When an Ethernet/RS-232/RS-485 converter is required, Modbus requests can be encapsulated inside TCP/IP using this command (for example considering the Ethernet converter available on port 7001 and IP address 192.168.0.10):

```
Modpoll –m enc –a 1 –r 1 –c 10 –t 3:float –p 7001 192.168.0.10
```

5.6.1 Mappa degli indirizzi

The following table shows the relation between the address of Modbus register and sampled (instantaneous) or calculated (statistic processing) values.

Value Type	*Measurement*	*Address*	*Value*
Floating point, 2 x 16 bit	Irradiance	0	Instantaneous
		2	Mean
		4	Minimum
		6	Maximum
		8	Total
	Int. temperature	10	Instantaneous
		12	Mean
		14	Minimum
		16	Maximum
		18	Total
Integer, 1 x 16 bit	Irradiance	1000	Instantaneous
		1001	Mean
		1002	Minimum
		1003	Maximum
		1004	Total
	Int. temperature	1005	Instantaneous
		1006	Mean
		1007	Minimum
		1008	Maximum
		1009	Total

6 Operational check

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

Identify the sensor output: current (4÷20 mA) or voltage (thermopile). Proceed as follows:

- For sensors with direct voltage output signal (µV):
  1. Set the multimeter to measure voltage signals and scale in µV.
  2. Connect the red test lead (+) of the multimeter to the wire corresponding to the positive signal (+ Sig) and the black test lead (-) to the negative signal wire (- Sig) of the sensor (it is not necessary to disconnect the sensor from the data logger.)
  3. Darken the sensor with a black cloth; the multimeter should measure around 0 µV.
  4. With the sensor exposed to the sun the multimeter should measure a value greater than 0 µV.
- For sensors with 4÷20 mA current output signal:
  1. Set the multimeter to measure signals in direct current (DC) 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 sun the multimeter should measure a value greater than 4 mA.

Verification of the digital output (RS485) can be done using a PC, equipped with an RS232 serial port and in which the third-party program, example *modpoll.exe* (https://www.modbusdriver.com/modpoll.html) is installed.

1. Connect the sensor serial cable to the PC serial port.
2. Open a DOS Prompt window and type the following command (it is assumed that the transmission parameters are set as follows: *Baudrate: 9600 bps*, *Parity: None* and that the PC serial port used is COM1):

   modpoll -a 1 -r 1 -c 4 -t 3:float -p none -b 9600 -p none com1 [Enter]

   For the list of available commands, type the command *modpoll /help*.
3. With the rotor stopped you should read 0 as the first value displayed by the program.
4. With the rotor moving, a value greater than 0 should be read as the first value displayed by the program.

For more information on versions with digital output, refer too *INSTUM_01242 – DPA870/873 Modbus pyranometer- User manual*.

The radiation value read can be compared with other radiometers installed in the same system as long as they are of the same type and have the same Azimuth.

7 Maintenance

The pyranometer does not require special maintenance, just cleaning. It is also advisable to check:

- the status of the external dome in the winter months, when an icy layer may form on it
- the status of the silica salt every 3-6 months depending on humidity of the site
- that the sensor is leveled.

For recalibration, refer to chap. 3.

8 Spare parts

Code	Descrizione
DYA032	Horizontal arm for fixing DPA053-053.1 to DYA049 collar
DYA034	Horizontal arm for fixing DPA863-873 to DYA049 collar
DYA035	Tilting arm for fixing DPA863-873 to DYA049 collar
DYA049	Collar for fixing DYA032-034-035 to ø 45-65 mm pipe
DWA410	Cable for DPA154-855-870-863-873 L = 10 m
DWA425	Cable for DPA154-855-870-863-873 L = 25 m
DWA426	Cable for DPA154-855-870-863-873 L = 50 m
DWA427	Cable for DPA154-855-870-863-873 L = 100 m
DYA048	Plate for levelling DPA053 on DYA034-035 arm
DYA120	Radiant shield for DPA053
DEA420.1/2	Signal amplifier for Pyranometers. Output: 4÷20 mA. Programmable pyranometer sensitivity (µV/Wm2). Power supply 10÷30 Vac/dc
MDMMA1010.1	Same features as DEA420 but with Modbus-RTU output
MC4390	Container with silica salt
MC1175	External white screen

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 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

11 CE Conformity Declaration

Descrizione del Prodotto: Piranometro con uscita normalizzata

Modelli: DPA855, DPA863, DPA980, DPA983

	Pyranometri First Class ISO9060
DPA855	Sensore/Piranometro/First Class/4÷20mA/ 10÷30V
DPA980	Sensore/Piranometro/First Class/RS485/10÷30V
	Pyranometri Second Class ISO9060
DPA863	Sensore/Piranometro/Second Class/4÷20mA/10÷30V
DPA983	Sensore/Piranometro/Second Class/RS485/ 10÷30V

Produttore: LSI LASTEM Srl

LSI Lastem Srl dichiara sotto la propria responsabilità che i suddetti dispositivi sono prodotti in conformità alle direttive EMC 89/336 EEC (included EEC 93/68):

- EN 50082-1
- EN 55011
- EN 55022 (CISPR 22) – Electromagnetic interference
- EN55024 (IEC61000-4-2,3,4,5,6,8,11) – Electromagnetic immunity
- EN 61000-3-2 (IEC610000-3-2) – Power line harmonics
- EN 61000-3-3 (IEC610000) – Power line flicker
- EN 60950 (IEC60950) – Product safety

Settala, 18 Ottobre 2013 Luca Lesi