Solarimeter
SL 100

Table of contents

1   Introduction

In addition to environmental applications, and face to development of renewable energy, SL 100 instrument allows to control on test or on site, equipment with thermal or photovoltaic sensors.

SL100 instrument is a portable instrument which can measure and display:

Instantaneous:
 Irradiance or irradiation for spot check measures in W/m².

On a timed duration of measurement:
- Max./min. values
- Average value of irradiance
- **A**ccumulated energy or radiant exposure in Wh/m²

Data are saved when the instrument is stopped or in case of battery failure.

Its sensor is composed of a strained silicon cell, not very sensitive to the thermal changes. It absorbs the solar radiation through a diffusor and a correction filter. The output voltage of the sensor is related to the received radiation.

SL 100 instrument is mainly an efficient and easy-to-use instrument: with small size, it has a large display with a resolution of 64*128 pixels involving a very high electronic technology.

2   General information

2.1   Measured units

SL 100 instrument can process the energy intensity emitted by the solar radiation in a precise place of the earth.

Expression of the solar energy and associated units:

Irradiance is the solar radiant **flow** received by unit area, expressed in W/m².

The radiant exposure or global irradiation is the **quantity** of solar energy by unit area: it's the product of irradiance by the duration of irradiation, expressed in Wh/m²

## 2.2   Use

Solar radiation :

Among all solar radiations, (opposite draw)
SL 100 was designed to measure the sum of direct solar radiation and diffuse solar radiation, which constitutes global solar radiation.

For any application, before, during and after the installation of solar thermal photovoltaic sensors, it's required to control means of measurement to obtain valid and coherent results. Means of use of the instrument has at least so much importance on the result than the quality of the instrument.
It is definitely necessary to take into account the influence of environment, in particular:

1. Position or direct correctly solar cell of SL 100 instrument, according to location of solar sensors or supports (roof, terrace...)
2. Avoid dark areas (present or to come)
3. Go away as much as possible from reflecting zones

4
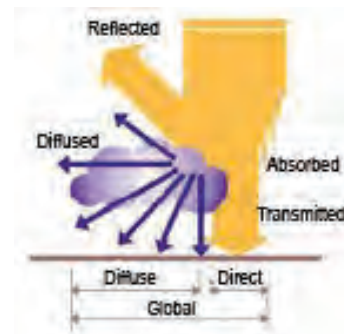
3 Operating principle

3.1   Keyboard presentation

When being switched on, "measurement screen" is displayed. From this screen, the operator has access to three others screens by pressing ⟳ on keyboard; return to measurement screen is obtained by activating ⎋ .

① ② ③ **Function keys** ▬
Directly associated to text displayed shown above on display, they allow measurement setting.

④ **Key "leaves current screen"** ⎋

⑤ **Screen key** ⟳
From measurement screens, give access to other screens

⑥ **On/Off key** ⏻
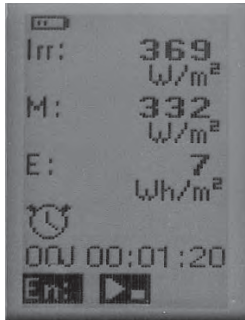

3.2   Instrument offers 3 groups of screens

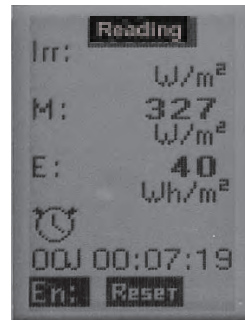### 1- Screens during measurement
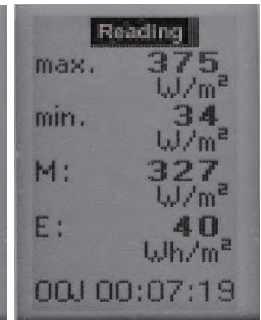

Irradiance
Min./Max value

Irradiation, average, accumulated energy,
Min./Max instantaneous irradiation

2- Reading screens after measurement

Irradiation, average, accumulated energy,
Min./Max instantaneous irradiation

3- Setting screens

Brightness   *About*

Accessible from principal measurement screen by successive pushes on [icon] key, those different screens allow instrument setting. They also inform users.

4.1   Brightness

To optimize display reading, the operator can :
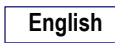
1. Adjust brightness by pressing [+] and [-] function keys.
2. Backlight LCD display for a better reading in a dark place.
"No" means backlight is switch off and "**Yes**" it is switch on.
In this last case, battery life is reduced by about 15%.

Brightness

4.2   About

Information on origin of manufacture and dates of last and next audits.

By pressing [**French**] or [**English**] keys, you can choose language :

French or English.

About - French   *About - English*

5   During measurement

5.1   Irradiance

Once switched on, the instrument measures and displays twice a second the instantaneous value of solar power (or irradiance) in W/m2. This value gives information to users about sunshine local conditions.

Display :
- Solar power W/m^2
- Maximum value
- Minimum Value

Functions :
Reset minimum and maximum values
Activate pause function
Continue measurement

Energetic exposure

5.2   Radiation exposure or global irradiation

The instrument measures twice a second the irradiance and displays it, while memorizing minimum and maximum values. From these data, it calculates and displays the measurement duration : average value, **r**adiation exposure or global irradiation**.**

From start screen, the operator have access to energy measurement over a period controlled by timer and clock, he proceeds as follows:

1 x yet.   `Inst`   Access to exposure measurement and in sunshine control **Irr. Measurement is not launched**

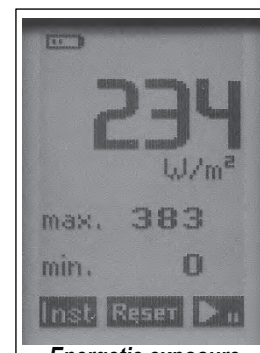**1 x**   `▶ ■`   Launch of the energy accumulation in **Wh/m²** visualized by the "On" pictogram `▶ ■` which flashes . The chronometer starts, it indicates seconds-minutes- hours-day (max : 03D00H00M00S). First average values and accumulated energy values appear.

1 x   `↻`   Switching to second screen to recall max and min.

1 x   `▶ ■`   Stop of measurement,"**Reset**" is displayed.

6   After measurement

After a requested shut-down of measurement, results are saved automatically and systematically presented to the operator before a launch of a new measurement.

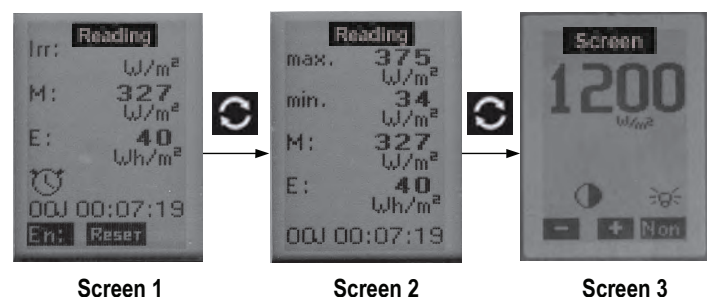## 6.1   Data reading

Three successive screens are displaying by pressing `↻`

Screen 1: Average of Irradiance **M**
　　　　　Radiant exposure **E** on period of measurement

Screen 2:Screen 1 + minimum and maximum value of
　　　　　instantaneous irradiation

Screen 3: Screen of brightness and backlight setting
　　　　　(if necessary during reading of data)

Screen 1　　　　　Screen 2　　　　　Screen 3

6.2   New measurement

After recording of results in his file, the operator can launch a new measurement. Here are the actions :

1. 1 x Reset A message alerts the operator of a reset of memory backup.

2. 1 x Reset Memory is erasing , visualized by the progress Memory is erased, the operator can launch a new measurement.
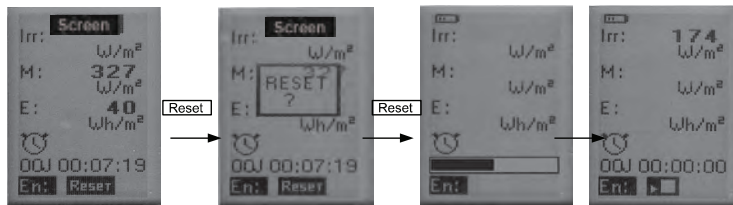
7   Operating information

7.1   Over-range

Although it is quite impossible , in very special conditions of reflections concentrated to the sensor, a pictogram of exceeded range appears ▲ .

It comes for an irradiance higher to **1300 W/m^2**. The maximum value will indicate **1301 W/m²**.

Over-range

7.2   Sensor default

In case of a defective sensor (sensor unplugged) during the measurement, symbols ✷ ✷ ✷ appear and disappear after its proper connection.

During the dysfunction sequence:
The chronometer still running correctly, it indicates to the operator the real duration of measurement containing the time of sensor default.
Max. min., M. irradiation values are false. Only the energetic exposure is exploitable on the duration of running without sensor default detected by the instrument.
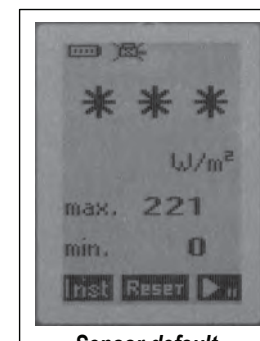
Sensor default

 To remind the operator this default and to keep it into consideration in exploitation of results, a pictogram is at the top of the screen for the measure. It is also displayed after the measurement.

7.3   Power source

 When the instrument is equipped with alkaline batteries, it can operate for **72 hours minimum**. A symbol informs the user about electric power remaining. If battery is low, less than 1 bar on the pictogram, the instrument stops measuring, save current measurement and switches off.

8.1   Servicing

The SL 100 instrument conception allows a reduce maintenance which consists in changing batteries and cleaning the sensor with a cloth slightly dampened.

8.2   Regular checking

Like most measuring instruments, it is strongly recommended to regularly control and calibrate SL100. Return to the manufacturer each year will provide necessary metrological traceability.

8.3   Batteries replacement – adaptors

Batteries :
To replace batteries, open the back hatch and insert the 3 new batteries of type 1.5 V / AAA-LR3 inside.
Warning : respect meaning of batteries. If storage is very long, remove batteries.

Adaptors :
Depending on the conditions of measurement, there are several possibilities of power supply of SL100 instrument:
- Connecting to the USB plug of a computer
- USB adapter type
- Medium capacity battery pack
- High-capacity battery pack
(Cf : accessories)

Note: when using with an external power, it is recommended to remove batteries from SL100 instrument. An internal protection, however, allows to secure all if you forget it.

9 Main specifications

SL100

Solar irrigation measuring range	from 1W/m^2 to 1300 W/m^2
Energetic exposure	from 1 Wh/m 2 to 500 kWh/m^2
Calculation accuracy	better than 0.5W/m^2
Display Accuracy	1 W/m^2
Response time (95%)	< 1s
Non-linearity	< 3%
Sampling frequency	2 Hz
Measurement capacity	72 hours – 03J00H00M00S
Operating and storage temperature	from -10°C to +50°C
Size of housing without sensor	120 x 58 x 34 mm
Weight of housing with batteries and without sensor	135 g
Electronic	digital.
Conformity	in accordance with RoHS directives
Connector	mini-DIN – cable 1.25 m
Power supply	3 LR3-AAA batteries
Autonomy	72 hours minimum in continuous mode
Mini-USB plug	
Power consumption	60 mW
Electromagnetic Compatibility	in accordance with 89/336/CEE directives

9.1   Solar cell

Spectral response	from 400 to 1100 nm
Nominal calibration coefficient	100mv for 1000W/m^2
Response in cosine	corrected until 80°
Coefficient in temperature	+0.1%/°C
Operating temperature	from -30°C to +60°C
Humidity dependence	100% RH
UV performance	excellent (PMMA filter)
Mode	photovoltaic
Surface active	1 cm^2
Material	Polycristallin silicon
Front face	Translucent PMMA
Tightness	Polyurethance resine and housing in PMMA and polyacetol
Cell weight	60 g
Cell dimensions	30 x 32 mm

10   Metrology

10.1   Traceability

The calibration of this instrument consists in determinate the calibration coefficient of the sensor by comparison to a standard radiometer linked to the World Radiation Reference. A calibration certificate is supplied with the instrument..

10.2   Change the sensor

If you need to change the sensor, you can ask to the After-Sales Service to get a new one.
This sensor is supplied with a calibration certificate indicating its coefficient expressed in **µV/W/m^2**.

To modify this **coefficient** and adapt this new sensor to the SL100 housing, you have to program its value by pressing the following keys: | **+** | | **-** | several times.

Press | **Val** | to finalise the saving of this new calibration coefficient

Calibration coefficient
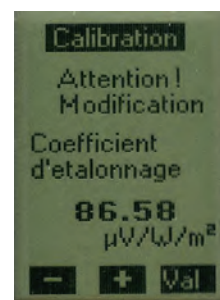
Reminder: in order to avoid any unwanted manipulation, an alert appears: **Caution! Modification.** Quit this function pressing   or

10.3   Standard reference

This instrument is based on recommendations and requirements of the standard ISO9060 -1990: Solar energy - Specification and classification of instruments for measuring solar radiation hemispheric and direct.

11   Delivery and packaging

- SL100 housing
- Silicium sensor and 1.25 metre of cable with mini -DIN connector
- Transport case with foam protection
- 3 LR3-AAA batteries
- Instructions for use
- Calibration certificate

10

- Tripod
- Fixing kit for solar panels
- Extensions : 4 m (possibility to connect 2 extensions max)
- Power supply adaptor