

# SUNMETER® 2 USER MANUAL

fw ver. 90.05-02.20 / hw rev. RGA801H



## GENERAL DESCRIPTION

The SunMeter® 2 (SM2) is a high technology electronic device primarily designed to accurately measure the solar radiation and make it available to the user in the best suitable way for its applications.

It's mainly intended, but not limited, to be used in solar energy conversion applications (both thermal and photovoltaic) for preliminary studies, for commissioning testing and for continuous performance checking and monitoring.

It's based on a sensing silicon element that through our proprietary TZOS® (True Zero Ohm Shunt) technology is sampled and managed by a high performance DSP (Digital Signal Processor) in order to enhance the signal precision and stability, achieving results that are comparable to best class radiometers.

Its monocrystalline silicon cell is laminated with small microprismatic glass for photovoltaic modules and E.V.A., this improves its durability and stability of measurements over time.

It's equipped with an additional input for an external PT100 RTD element in order to sense the temperature of nearby items, i.e. photovoltaic modules, ambient, etc.

The measures can be read by two outputs: a "universal" multistandard analog output for all old-fashion viewing devices and dataloggers and a powerful, versatile EIA/TIA-RS485 bus interface with the well known industry standard protocol Modbus RTU.

## FEATURES

### Inputs:

irradiance range:	0 ÷ 1500 W/m <sup>2</sup> temperature compensated
temperature range:	-30 ÷ +90 °C measurable with external PT100 RTD
digital:	PNP-like connection

### Outputs:

serial:	RS485, standard Modbus RTU protocol
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### Measurements precision:

irradiance:	< ± 1.9 %
temperature:	< ± 0.5 °C

**Supply:** 9 ÷ 30 Vdc, protected against reverse polarity

**Encapsulation:** small microprismatic glass for photovoltaic modules and E.V.A

**Case:** anodized aluminium with stainless steel screw-clamp to fix it on modules or montage profile

**Wiring:** 50 cm cable, UV resistant

**Connectors:** male M12 8 pin circular, IP67 code, UV resistant, matching female supplied  
female M8 3 pin circular IP67

**Dimensions:** 114 x 70 x 22 mm, with mounting bracket 128 x 70 x 65 mm (overall)

**Operating temperature:** -20°C ÷ +80 °C (transport and storage -35°C ÷ +95 °C)

**Every SM is factory calibrated.**

## PART LIST

- SM 2 with aluminium bracket
- female M12 8 pin circular connector (optional)
- 1 long stainless steel screw (temporary positioning)
- 2 short stainless steel screws (permanent positioning)
- user manual
- calibration report

Scan the QR code for  
SunMeter best practice manual



For the disposal of the products  
contact us

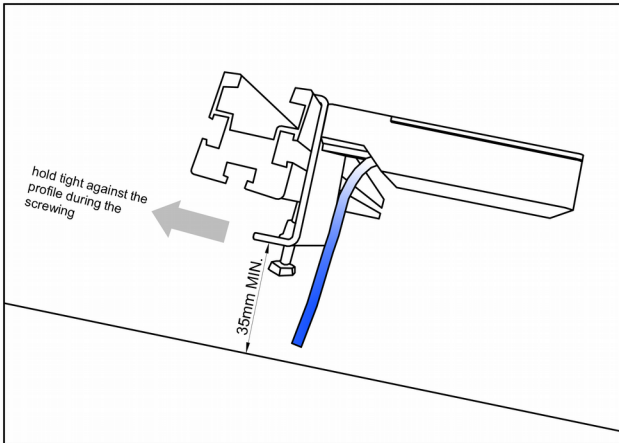


**Important: the case presents a hole with a diameter of a few mm, this hole is terminated by a transpiring membrane whose purpose is the barometric compensation to avoid condensation.**

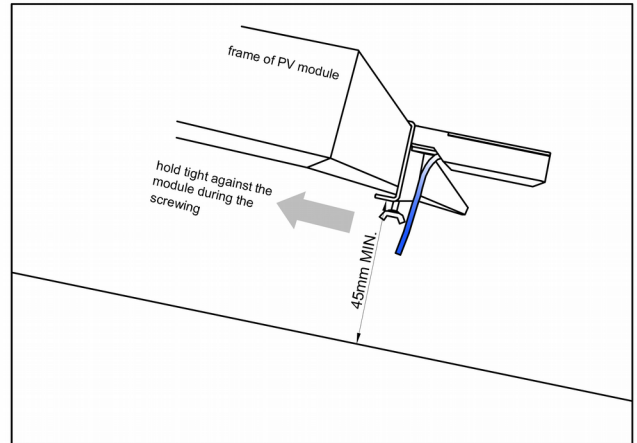
**DON'T PERFORATE. WARRANTY VOID IF REMOVED OR PERFORATED.**

## ASSEMBLY

SM 2 is provided with a bracket to apply it to structures or directly to a PV module as shown in Fig. 1 and 2:



SUNMETER mounted with screws for long term monitoring  
Fig. 1



SUNMETER mounted with butterfly-screws for short time monitoring  
Fig. 2

We suggest to mount SM 2 on the bottom side of a PV module because, if applied on the top side, it may be chosen by a bird as a springboard! The same considerations apply when fastening to a structure's profile. Stainless screws are provided for permanent mounting of SM 2 on your PV plant.

## CONNECTIONS

The IP67 8-pin circular male connector carries all the signals to and from the SM 2 as in Tab. 1 and Fig. 3, which shows a back view of the female connector (the fourth column indicates the colours of cables in the free pin version):

#	Name	Description	Cable colors
1	SUPPLY +VIN	power supply input, 9-30 Vdc, typ. 90mA @ 12 Vdc ( <b>note 1</b> )	Red
2	GND	power supply ground reference and for output signals	Black
3	PT100.1	2-wire RTD connection 1	
4	Analog Output	configurable as 0-5 Vdc, 0-10 Vdc, 0-20 mA, 4-20 mA ( <b>note 3</b> )	
5	RS485-/A	communication bus inverting bus signal ( <b>note 2</b> )	White/Green
6	RS485+/B	communication bus non inverting signal ( <b>note 2</b> )	Green
7	Digital Input	PNP-like digital input (to be shorted to GND Signal to activate) ( <b>note 4</b> )	Yellow
8	PT100.2	2-wire RTD connection 2	

Tab. 1

Female connector back view with connection scheme

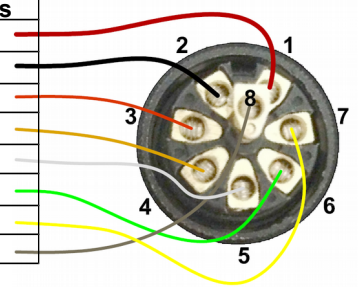


Fig.3

SM 2 typical connections/usage Fig. 4:

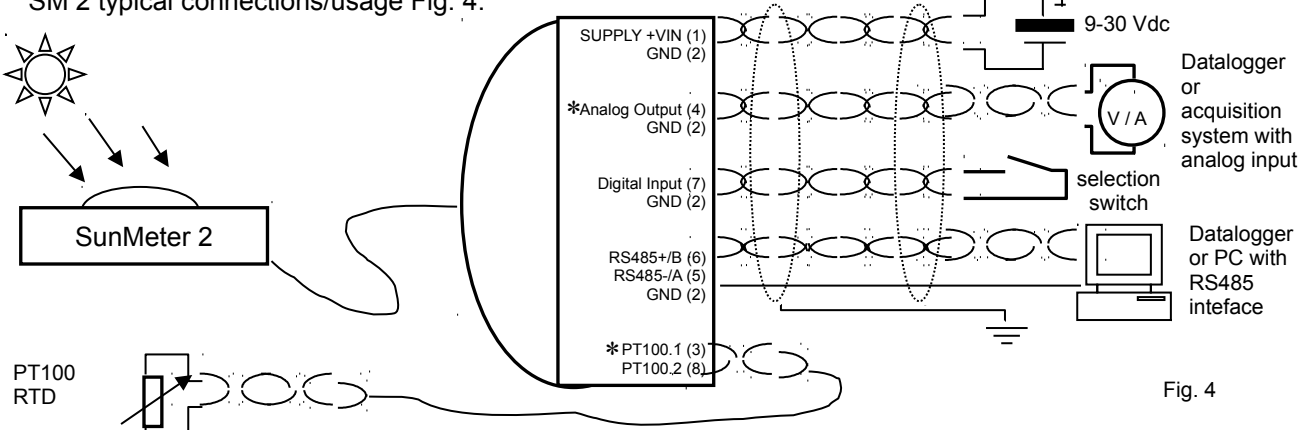


Fig. 4

\* Only for the complete model (Digital and Analog Output)

We strongly suggest to use a shielded connection cable with twisted pairs, AWG22 / 0.32mm<sup>2</sup>

For making proper installations and connections please refer to the user manual from the link <https://solucionesolare.com/wp-content/uploads/2022/12/Best-installation-practice-SM.pdf>

Notes:

- 1) balanced differential bus RS485 needs to be terminated, at the extremities of the bus, by a 100-120 Ω resistor (1/4 W) between RS485+/RS485- lines in order to avoid signal's reflections. In the case that SM is the device at one extremity, place the resistor into the supplied female connector.

Even if RS485 have  $-7/+12\text{Vdc}$  common mode rejection range, normally sufficient to compensate ground potential difference between connected devices, it is strongly recommended to always carrying a ground reference among the bus's signals and to connect it to the SM 2's Signal GND.

- 2) the digital input need to be activated by shorting to GROUND (either supply or signal, latter preferably).  
Do not attempt to supply voltage to this input.

## MODBUS PROTOCOL

Modbus is a Master-Slave protocol that is widely used as an industry standard. It is simple, efficient and reliable. It can be easily used to access and collect data or exchange information between digital systems over a serial line local bus (and with its TCP/IP extension through a LAN or World Wide Web).

Please refer to specific detailed documentation and implementations freely available at [www.modbus.org](http://www.modbus.org)


SM 2 is a Modbus RTU slave that implements the following standard access functions:

Function code	Description
<b>0x03</b>	READ HOLDING REGISTERS
<b>0x04</b>	READ INPUT REGISTERS
<b>0x06</b>	WRITE SINGLE REGISTER
<b>0x10</b>	WRITE MULTIPLE REGISTERS

Tab. 2

Please note that in the current implementation of SM 2 function codes 0x03 and 0x04 are equivalent and address the same data area.

Data is accessible through Modbus's functions by 16 bits units called "registers". Here below the main SM2 registers:

Register #	Description	Access	NV save
<b>0x0101</b> or <b>0x0201</b>	<b>Current irradiance level</b> [ $\text{W}/\text{m}^2$ ],	R	
<b>0x0102</b>	<b>Current PT100 temperature</b> [ $^{\circ}\text{C}$ ], 2-complement value, fixed point 14.2 format (14 bits integer, 2 bits fractional)	R	
<b>0x0202</b>	<b>Current PT100 temperature</b> [ $^{\circ}\text{C}$ ], format multipl. by 10 (to get value in $^{\circ}\text{C}$ divide by 10)	R	
<b>0x8001</b>	<b>Serial number</b> , least significant word	R	
<b>0x8002</b>	<b>Serial number</b> , most significant word	R	
<b>0x8005</b>	<b>Node address</b> , range 1 ÷ 247, decimal, <b>default 1</b>	R/W	Y
<b>0x8006</b>	<b>Bitrate</b> , coded, range 0 ÷ 4, decimal, <b>default 1</b> 0 – 9600 bps 1 – 19200 bps 2 – 38400 bps 3 – 57600 bps 4 – 115200 bps	R/W	Y
<b>0x8007</b>	<b>Serial configuration</b> , coded, range 0 ÷ 3, decimal, <b>default 0</b> 0 – 8N1 (8 bit / no parity / 1 stop bit) 1 – 8E1 (8 bit / even parity / 1 stop bit) 2 – 8O1 (8 bit / odd parity / 1 stop bit) 3 – 8N2 (8 bit / no parity / 2 stop bit)	R/W	Y
	Scan the QR code for complete table on the details for RS485 Modbus PRO		

Tab. 3

Please note that, conventionally, Modbus register's numbering starts from 1 but register's addressing start from 0 so, to obtain the register's address you had simply to subtract 1 from its number. That's meaningful depending on, as a master, you are using a high level Modbus utility/program (that normally refers to the registers' number) or a low level driver (that normally directly works with addresses).

## CALIBRATION

Each SM 2 is factory calibrated, with 2 reference points by a primary sensor referred to a first class radiometer. Re-calibration is recommended every 2 years in order to maintain the original precision.




## OPTIONALS

Available upon request:

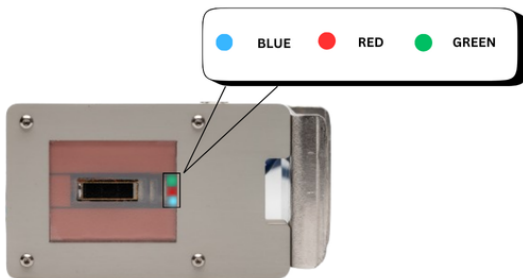
- TEMMETER: PT100 RTD element for PV modules temperature sensing, 2 wire, with fast mounting adhesive for mounting on backsheet of PV modules




- ENVMETER: PT100 thermal sensor for PV modules temperature sensing, 3/4 wires output, with bracket for mounting on a structure for PV modules
- ENVMETER PRO: PT100 thermal sensor for PV modules temperature sensing, 3/4 wires output, with bracket for mounting on a structure for PV modules
- Software utilities (for MS Windows systems) and other solar products on our website

## DIAGNOSTICS

Color Code	Pulsating time interval	Description
 BLUE	3s Pulsating interval	Supply voltage is accurate and sensor core is active
	No light	Sunmeter 2 is not operating
 RED	Pulsating at certain interval period	This pulsating occurs when data is requested from the datalogger  Note : The request from datalogger can be at different speed and parity
	No Light	No request received
 GREEN	Pulsating at certain interval period	This pulsating occurs when data is requested from the datalogger at a matching speed, parity and node address; Sunmeter 2 transmits data to datalogger
Data display on the datalogger/PC		The nodes by TX are matching Sunmeter

## SCHEMATIC OF SUNMETER 2



	BLUE - Power Supply
	RED - (RS 485)
	GREEN - (RS 485)

### Timing on options:

1. 10 min
2. 40 min[default]
3. 8h
4. Always on

				
GoodWe EZLogger-Smx-485	Growatt Shinemaster -Smx-485	Huawei SmartLogger 1000/2000/3000	SMA Data Manager M	Sungrow COM100

## CONTACTS

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