SUNMETER WIND®

USER MANUAL

fw ver. 80.20-02.00 / hw rev. RGA801F

GENERAL DESCRIPTION

The SunMeter® (SM) is a high technology electronic device primary 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 an high performance DSP (Digital Signal Processor) in order to enhance the signal precision and stability, achieving results that are comparable to best class radiometers.

It's equipped with an additional input for an external 2-wire PT100 RTD element in order to sensing 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^2 temperature compensated
temperature range:	-30 ÷ +90 °C measurable with external PT100 RTD
wind speed:	0-180 Km/h
digital:	PNP-like connection

Outputs:

serial:	RS485, standard Modbus RTU protocol

Measurements precision:

irradiance:	< ± 2%
temperature:	< ± 0.5 °C
wind speed:	Depending on the anemometer

Supply:	9 ÷ 30 Vdc, protected against reverse polarity
Encapsulation:	resin, UV resistant, wide spectral transparency
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, + 3 way connector for the anemometer input 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.

PIECE'S LIST

- SUNMETER
- 3-way connector for the anemometer input
- aluminium bracket
- 2 stainless steel screws (to fasten SM to the bracket)
- 1 stainless steel screw (to fasten the bracket)
- instruction manual

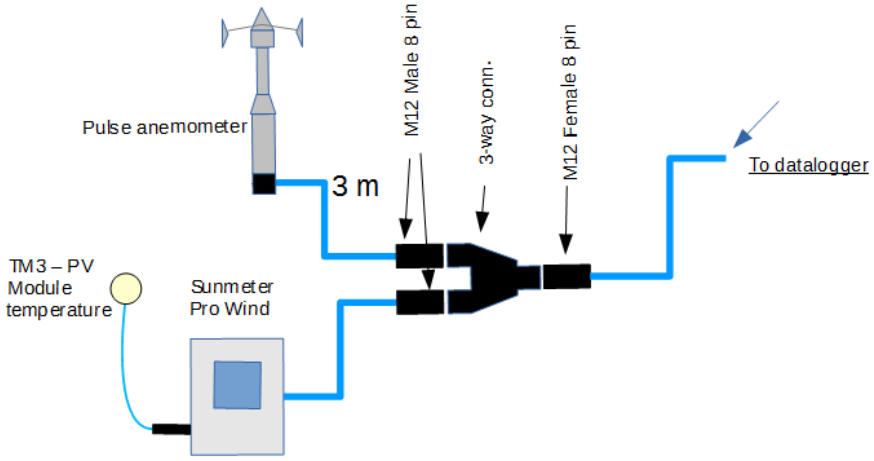
Scan the QR code for SunMeter best practice manual

Some “inclusions” may be present and clearly visible into the protective encapsulation resin; could be present bubbles in the area of wires soldered to PCB too. This is due to the resin coating process and do not affect overall performance and/or accuracy.

Important : the case presents in the lower part 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.

CONNECTIONS



The IP67 8-pin M12 circular male connector carries all the signals to and from the SM as in Tab. 1 and Fig. 3, that shows the back side view of the female connector supplied (or a front view of the male connector):

#	Name	Description	Cable colors
1	SUPPLY +VIN	power supply input, 9-30 Vdc, typ. 90mA @ 12 Vdc (**note 1**)	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 (**note 3**)	
5	RS485-/A	communication bus inverting bus signal (**note 2**)	White/Green
6	RS485+/B	communication bus non inverting signal (**note 2**)	Green
7	Digital Input	Pulse imput from anemometer. (to be shorted to GND Signal to activate) (**note 4**)	Yellow
8	PT100.2	2-wire RTD connection 2	

Tab. 1

Female connector back view with connection scheme

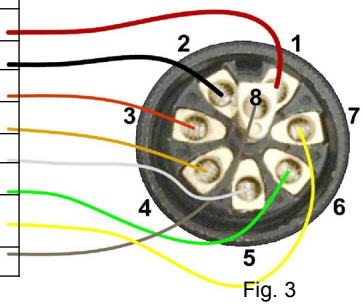


Fig. 3

The IP67 3-pin circular male connector carries PT100 RTD signals to the SM as in Tab. 2 and Fig. 4, that shows a front view of the female connector (or a back side view of the male connector supplied):

#	Name	Description
1	PT100.1	2-wire RTD connection 1
4	-	Not connected
3	PT100.2	2-wire RTD connection 2

Tab. 2

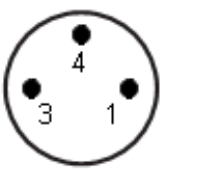


Fig. 4

The IP67 8-pin M12 circular male connector carries anemometer signals to and from the SM as in Tab. 3 and Fig. 5, that shows a back view of the female connector (or a front view of the male connector supplied):

#	Name	Description	Cable colors
1	SUPPLY +VIN	power supply input, 9-30 Vdc, typ. 90mA @ 12 Vdc (**note 1**)	Red
2	GND	power supply ground reference and for output signals	Black
3	-	Not connected	
4	-	Not connected	
5	-	Not connected	
6	-	Not connected	
7	Digital Input	Pulse output from anemometer. (to be shorted to GND Signal to activate) (**note 4**)	Yellow
8	-	Not connected	

Tab. 3

Female connector back view with connection scheme

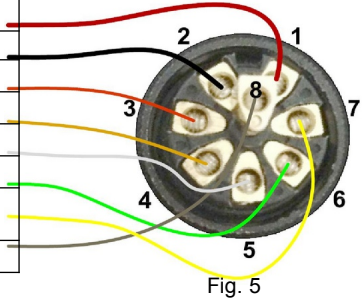


Fig. 5

We strongly suggest to use shielded connection cables with twisted pairs, AWG22 / 0.32mm^2

Notes:

1) if analog output is used, please pay attention to choose a power supply greater than the compliance voltage, see also note 3.
2) 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/+12Vdc 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's Signal GND.
3) please check load restrictions:
   - in voltage modes (0÷5 / 0÷10 V) minimum load impedance is 250 / 500 Ω, we recommend a load impedance > 5 kΩ
   - in current modes (0÷20 / 4÷20 mA) maximum load impedance is 1.2 kΩ, we recommend a load impedance in the 200-500 Ω range
   - the compliance voltage (maximum output voltage) at full 20 mA output current and beyond, is about 2.5V less than power supply voltage so choose it accordingly in order to leave sufficient margin.
4) 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, widely used as an industry standard. Simple, efficient and reliable, 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

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

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

Tab. 4

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

Data is accessible through Modbus functions by 16 bits units called "registers". In the current implementation of SM these registers are available:

<table>
<tr><th>Register #</th><th>Description</th><th>Access</th><th>NV save</th></tr>
<tr><td>0x0101
or
0x0201</td><td>Current irradiance level [W/m^2]</td><td>R</td><td></td></tr>
<tr><td>0x0102</td><td>Current PT100 temperature [°C], 2-complement value, fixed point 14.2 format (14 bits integer, 2 bits fractional)</td><td>R</td><td></td></tr>
<tr><td>0x0103</td><td>Status, bit coded
<table>
<tr><th>Bit</th><th>Description</th></tr>
<tr><td>0</td><td>Factory calibration/configuration
1 = OK; 0 = need recalibration</td></tr>
<tr><td>1</td><td>Not volatile parameters
1 = OK; 0 = default loaded, need to be changed/saved</td></tr>
<tr><td>2</td><td>Digital input monitor
1 = not active (open); 0 = active (shorted to GND)</td></tr>
<tr><td>3</td><td>PT100 RTD element
1 = OK; 0 = shorted or open circuit (not present/malfunctioning)</td></tr>
<tr><td>4</td><td>Analog output
1 = OK; 0 = output current can't flow at desired level due to wire break/high load impedance/output voltage approaching positive supply</td></tr>
<tr><td>5</td><td>Watchdog
1 = reset by watchdog timeout occurred; 0 = normal operation</td></tr>
<tr><td></td><td>All undefined bits read as 0</td></tr>
</table></td><td>R</td><td></td></tr>
</table>

0x0104	**WindSpeed,** instant wind speed, unsigned fixed point 10.6	R	
0x0202	**Current PT100 temperature** [°C], Module temperature multipl. By 10 (to get value in °C divide by 10)	R	
0x0204	**WindSpeed** [m/s], current wind speed multipl. By 10 (to get value in m/s divide by 10)	R	
0x8031	**Constant** for digital pulse, unsigned fixed point 5.11	W	Y
0x8001	**Serial number**, least significant word	R	
0x8002	**Serial number**, most significant word	R	
0x8003	**Firmware main version**, hexadecimal	R	
0x8004	**Firmware minor version**, hexadecimal	R	
0x8005	**Node address**, range 1 ÷ 247, decimal, **default 1**	R/W	Y
0x8006	**Bitrate**, coded, range 0 ÷ 4, decimal, **default 1** 0 – 9600 bps 1 – 19200 bps 2 – 38400 bps 3 – 57600 bps 4 – 115200 bps	R/W	Y
0x8007	**Serial configuration**, coded, range 0 ÷ 3, decimal, **default 0** 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
0x8008	**Serial reply delay** [ms], range 0 ÷ 100, decimal, **default 1**	R/W	Y
0x800B	**PT100 RTD reading enable**, coded, range 0 ÷ 1, decimal, **default 1** 0 – disabled 1 – enabled	R/W	Y
0x8101	**Not volatile params save command**, write 1 to execute (then wait 1 s before to send next message)	W	
0x8102	**Software reset command**, write 1 to execute (then wait 6 s before to send next message)	W	
0x8201	**Analog output level** [], range 0 ÷ 65535, decimal, fixed point 0.16 format (16 bits fractional)	W	

Tab. 5

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

NOTE

Every Sunmeter and Anemometer is configured with a constant value (K) equal to 0.6804.
In the case of a product replacement request, kindly inform us in prior if the Sunmeter or Anemometer have a different value of K instead of the standard value mentioned above.
For replacement requests, please contact our support team.

OPTIONALS

Available upon request:

- TM3: PT100 RTD element for PV moduls temperature sensing, 2 wire, with adhesive part for the rear of the PV modules
- 3 WAYS connector HUB: for to easily connect Anemometer. IP67 code.

CONTACTS

Software utilities (for MS Windows systems) can be found on our website; other solar products and support requests can be requested to the following address:

Soluzione Solare
Tel. +39.0444.530234 - Fax +39.0444.1830563 Vicenza – Italy
E-mail: support@soluzionesolare.it