itsensor SM1-485 Pro Digital Solar Meter with External Temperature Probe Input User Manual

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with External Temperature Probe

Input User Manual

User Manual

SM1-485 PRO
fw ver. 80.00-03.01 / hw rev. RGA801F

mapped to SUNSPEC specifications

SM1-485 PRO

The SunMeter® (SM1-485 PRO) is a high technology electronic device primary designed to accurately measure the solar radiation and make it available to the user through the portal of VSN700 Management System.

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 photovoltaic monocrystalline cell 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.

It's equipped with an additional input for an external 2-wire PT100 RTD element in order to sense the temperature of nearby items, i.e. photovoltaic modules, ambient, etc.

The measures can be read by a powerful versatile EIA/TIA-RS485 bus interface with the well known industry standard protocol Modbus RTU and SUNSPEC mapping.

SM1-485 PRO installation overview

TM3 (optional)   SM1-485 PRO

FEMALE M8 3P CONNECTOR FOR TM3

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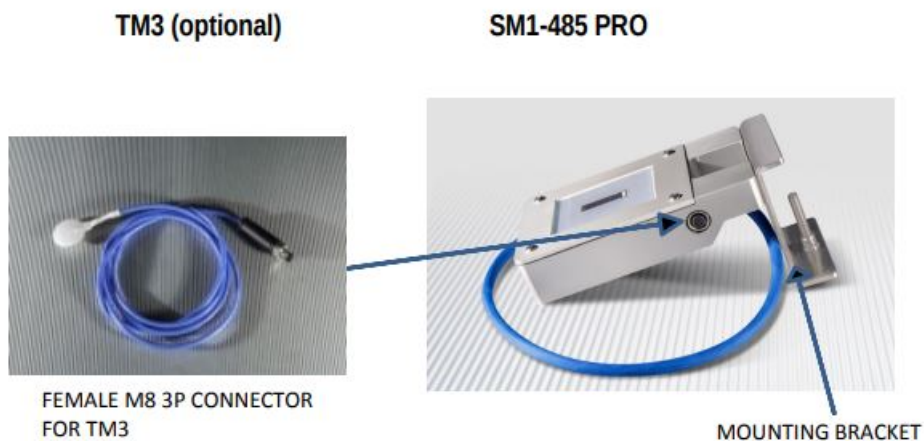
SM is provided with a bracket to apply it to structures or directly to a PV module as shown in Fig. 1 and 2:

hold tight against the profile during the screwing

35mm MIN.
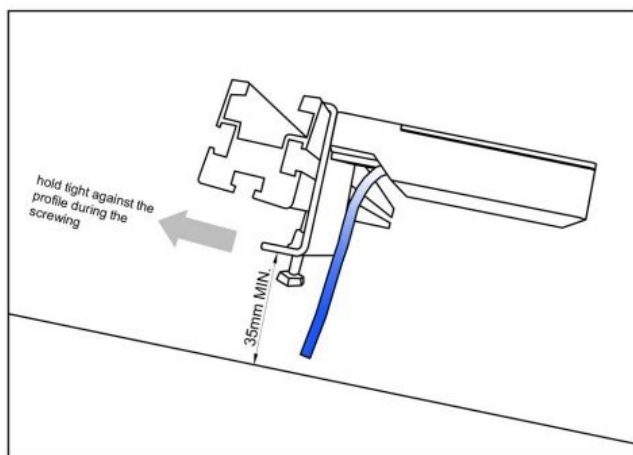
SUNMETER mounted with screws for long term monitoring

Fig 1

frame of PV module

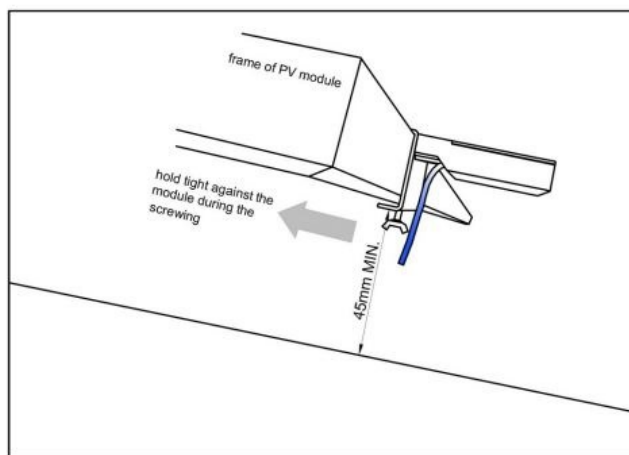hold tight against the module during the screwing

45mm MIN.

SUNMETER mounted with butterfly-screws for short time monitoring

Fig 2

Installation steps

1. Select the location for the SM1-485 PRO
2. Install the PV Panel Temperature Sensor (optional)
3. Wire the M12 female connector of SM1-485 PRO to the wires of the Management System
4. Make connections to 9 ÷30 VDC power supply and to Management System through RS485
5. Verify and validate the installation via the Management System

Equipment and supplies

We supply:	You supply:

SM1-485 PRO, which includes:
    Sunmeter with aluminium bracket
    1 stainless steel screw (permanent positioning)
    1 split ferrite core with plastic casing
    (optional) PV Panel Temperature Sensor
	9 ÷30 VDC Power
	RS485 line

Tab 1

Site selection and mounting

SM1-485 PRO location

We suggest to mount SM1-485 PRO on the lateral side of a PV module because, if applied on the top side of array PV fields, it can cause a shadow on the next array!
A more accurate control of the system's performance can be obtained mounting SM1-485 PRO with the same tilt and azimut (orientation) of the PV.
Take into account the needs of all attached sensors to determine the optimal mounting location. Ambient air temperature and irradiance measurements can be affected by obstructions, local topography, and shadowings.
A simple way to think of obstruction is the rule of 5. It is good if the obstruction is at a distance of at least 5 times its height above the location of Sunmeter.

TM3 Temperature Sensor (optional)

Fig 3

This sensor is designed to be attached directly to any solar panel. When placed on the center back side of the panel, it accurately measures the temperature of the panel.

Prior to installation of the TM3 temperature sensor onto the PV panel, the installation area of the panel back should be thoroughly cleaned. This cleaning will ensure a good bond between sensor and panel and allows accurate panel temperature readings.

After cleaning, peel off the protective adhesive tape on the temperature sensor and stick it onto the back of the panel.

Firmly press the sensor into place. Refer to the picture on the right. The cable should be secured within 8 inches of the temperature-sensing element.

Run the cable back to the SM1-485 PRO unit and connect to the TM3 temperature sensor terminals.

We suggest to connect the TM3 to the SM1-485 PRO before powering the SM1-485 PRO, otherwise you will have to wait 5 minutes for the SM1-485 PRO to read the TM3. This is because the SM1-485 PRO has a system that protects the sensitive reading of a pt100, so the system disables the channel when it is open and periodically checks for a connection.

The IP67 3-pin M8 connector carries the temperature signal to the SM1-485 PRO as in the following table and figure, that shows a front view of the female connector on the side of the SM1-485 PRO:

#	Name	Description
1	PT100.1	2-wire RTD connection 1
3	PT100.2	2-wire RTD connection 2

Tab 2
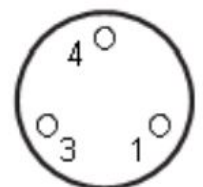
Wiring instructions for the SM1-485 PRO

Connections

Sunmeter with SUNSPEC mapping for ABB is provided with a cable ending with 4 poles free pins.

Name	Color	Description
GND	BLACK	power supply ground reference and for output signals
SUPPLY +VIN	RED	power supply input, 9-30 Vdc, typ. 90mA @ 12 Vdc
RS485+/B	GREEN	communication bus non inverting signal
RS485-/A	GREEN/WHITE	communication bus inverting bus signal
SHIELD	BLACK/PIN BLUE	ground

Tab 3

Supply 12 Vdc Power

1. Run wire from the 12 Vdc source to the SM1-485 PRO.
2. Find the wires at the end of the cable connected to the SM1-485 PRO.
3. Connect the power source as explained in the previous table.
4. SM1-485 PRO can accept a voltage in the range of 9 to 30 Vdc. These inputs are reverse polarity, surge, over-voltage and over-current protected.

Connection to the monitoring or management system

The Modbus (RS485) connection is the same as any other RS485 device connection to a Sun Spec compliant management system. Refer to your management system documentation for any unique installation requirements.

String the cable between the SM1-485 PRO and the management system to complete the physical connection. The connection to the management system can be as a single RS485 device or as part of a daisy chain of RS485 devices.

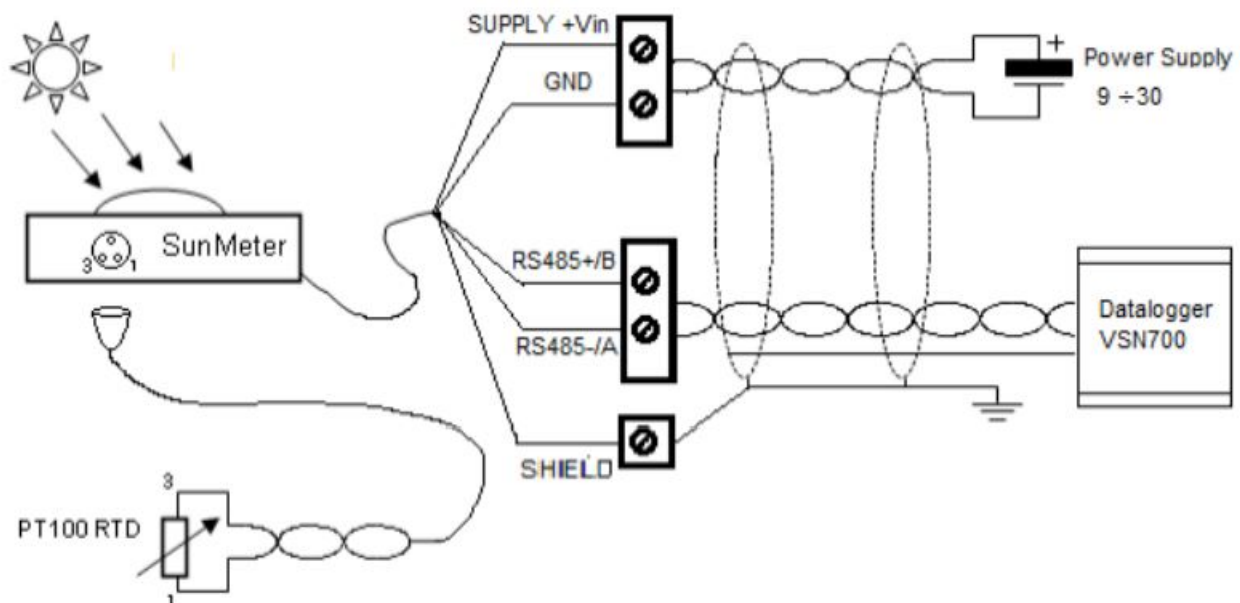Here is shown a schematic of typical connection/usage of Sunmeter

Fig 4

Wherever is needed more length than 3m We strongly suggest to use a shielded connection cable with twisted pairs, AWG22 / 0.32mm2 to connect the poles the a wires' poles.

Notes:

1. Balanced differential bus RS485 needs to be terminated, at the extremities of the bus, by a 100120 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 carry a ground reference among the bus's signals and to connect it to the SM's GND. Do not attempt to supply voltage to these wires

2. Strong EMC disturbances can affect the external temperature measures through PT100 gauge. In this case apply the ferrite provided with the SUNMETER PRO around its main cable in position close to the sensor
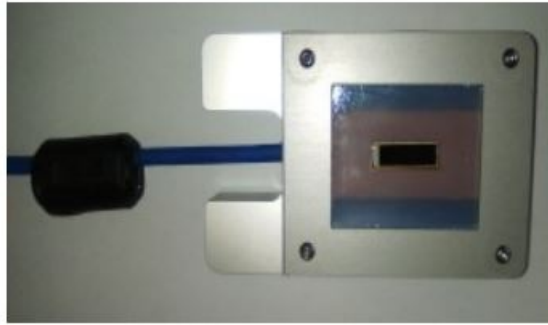

Fig 5

Connections to VSN700 series products

This section shows how to tap the 24VDC power and make RS485 connections from a VSN700 series management system. Most monitoring systems will have a means of supplying 24VDC power. Consult your monitoring system documentation for information.

You can power the SM1-485 PRO either with a dedicated power supply or power supply from the VSN700 Datalogger.

If you intend to use a dedicated power supply, we recommend the 24VDC 0.75A with ABB Power One Order No. YPA000007. Connect the red wire with white pin of the SM1-485 PRO to the positive terminal of the power supply and the black wire with white pin to the GND of the power supply.

If you are deriving supplying the power from the VSN700 datalogger, connect the red wire with white pin of the SM1-485 PRO to the VSN700 terminal 6 and the black wire with white pin to terminal 5 of the VSN700.

To connect the RS485, connect the green wire with white pin of the SM1-485 PRO to terminal to the VSN700 terminal 4 and the green/white wire with white pin of the SM1-485 PRO to terminal to the VSN700 terminal 3. See the figure below. Note that some VSN700 models may have RS485 connection points in other locations.

SM1-485 PRO logic connection diagram with logger and inverter
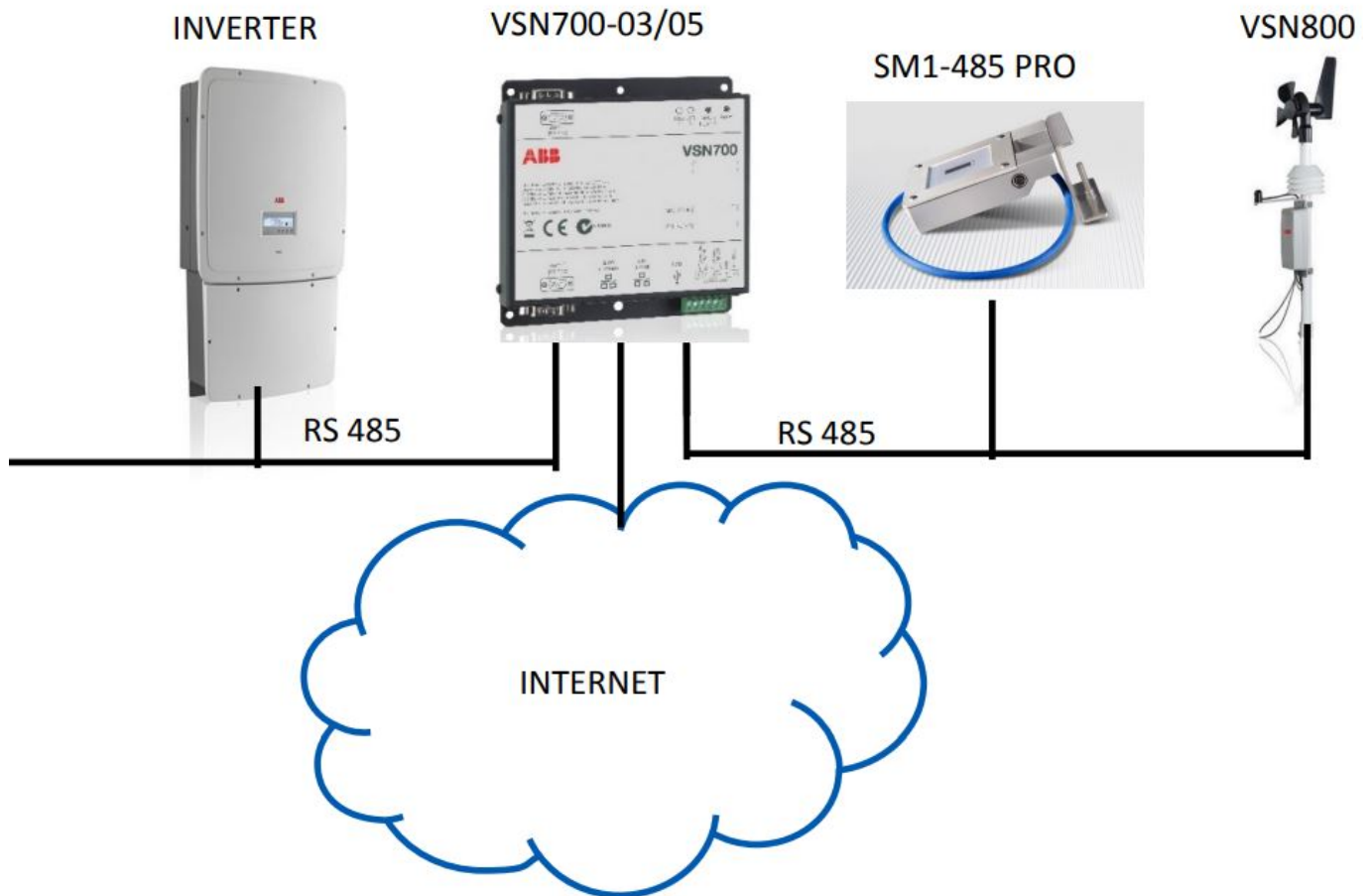
SM1-485 PRO connection diagram with logger and inverter
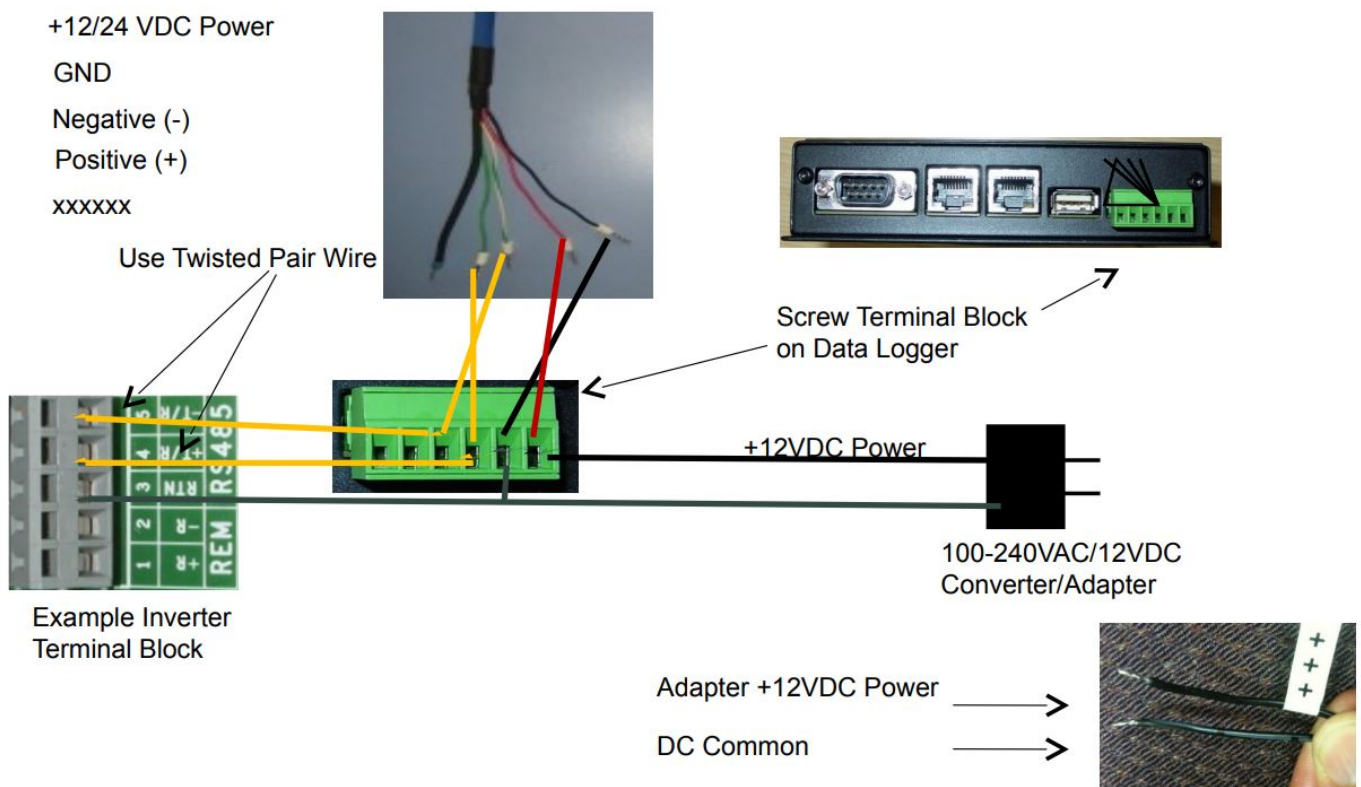
New SM1-485 PRO logic connection scheme with new inverter models (integrated Ethernet / Wi-Fi connectivity)
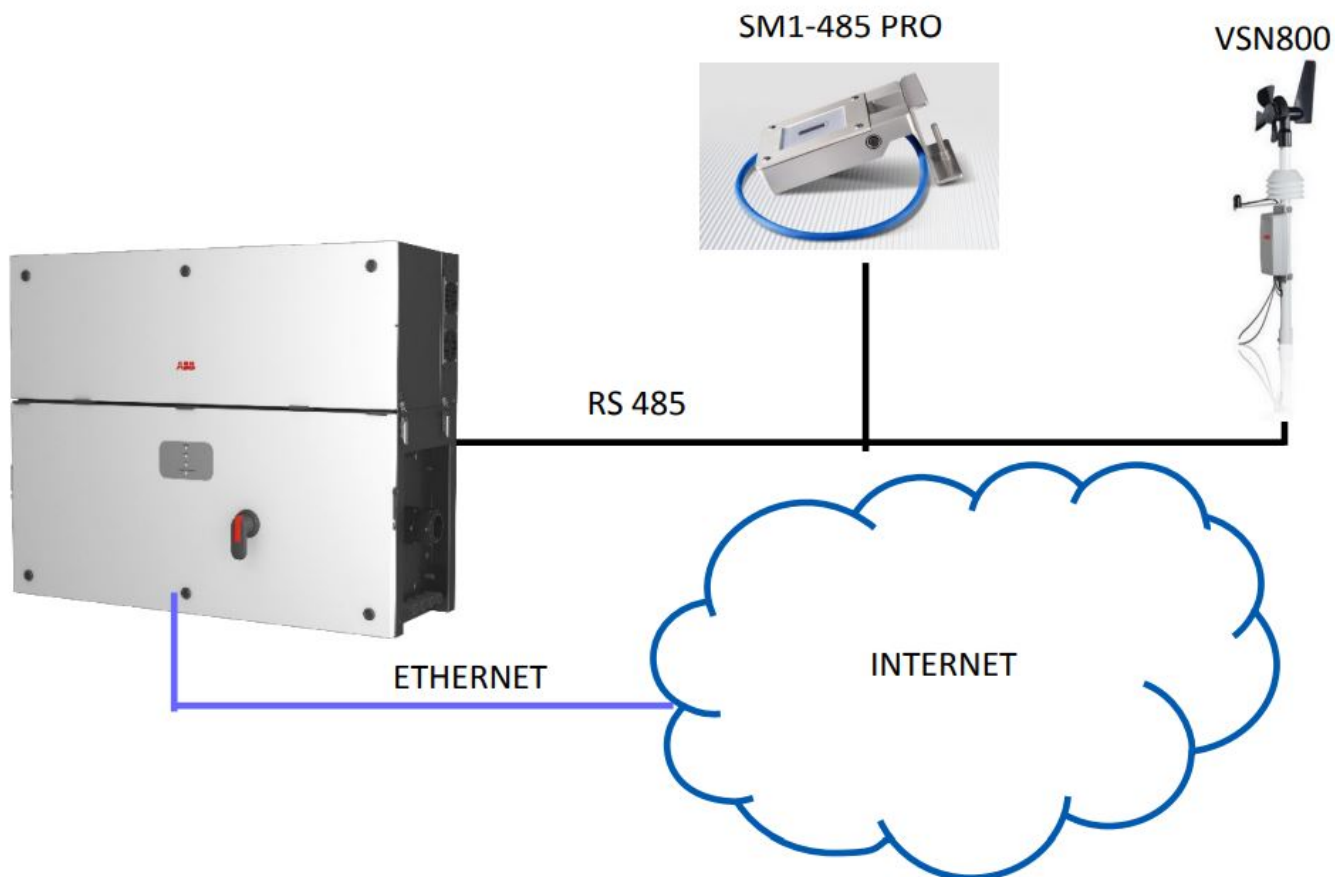
New SM1-485 PRO sensor connection diagram with new inverter models (integrated Ethernet / Wi-Fi connectivity)

+12/24 VDC Power

GND

Negative (-)

Positive (+)

xxxxxx

Use Twisted Pair Wire

+ 12/24 VDC Power

100-240VAC/12VDC Converter/Adapter

Example of inverter's RS485

Adapter +12/24 VDC Power

DC Common
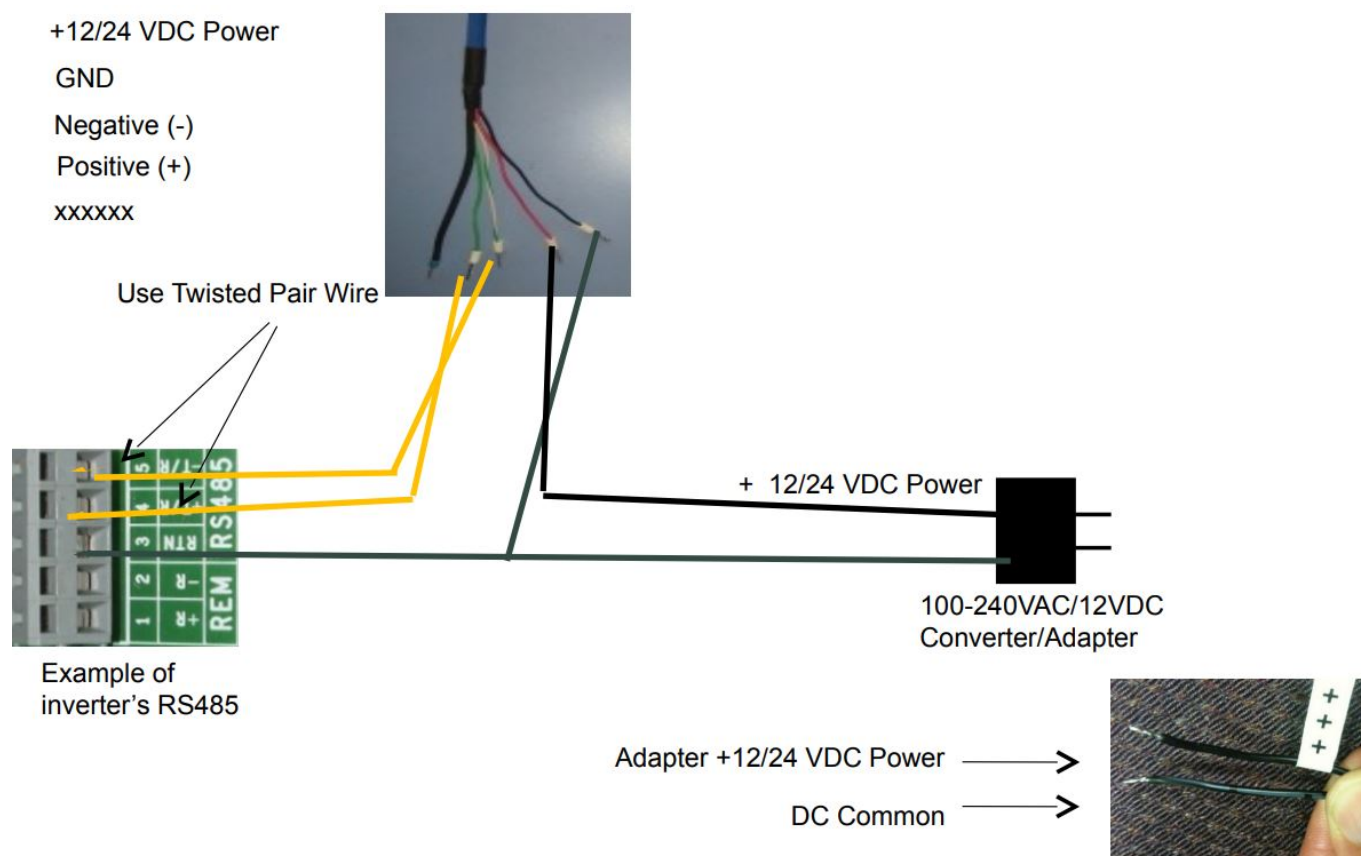
NOTE Not all the FIMER inverters allow connecting supported accessories to the their featured RS485 port.

Please contact FIMER Customer Support for getting further info on what inverter model allows connecting SM1-485 PRO sensor directly to itsRS485 as shown by the above picture.

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).
The default address of the SM1-485 PRO is 65. If you need to change the address you can download from the FIMER site the program SMConfig, in this way you can change the address by connecting the SM1-485 PRO to a PC with a USB-RS485 cable.
You cannot have two SM1-485 PRO in the same RS 485 chain unless the address of one of the sensor is changed.
If you were to find some problem Contact Customer Support.

SunSpec register map

Start	End	#	Name	Type	Units	Scale Factor	Constants	Description
0001	0002	2	C_SunSpec_ID	uint32	N/A	N/A	"SunS"	Well-known value. Uniquely identifies this as a SunSpec Modbus Map
0003	0003	1	C_SunSpec_DID	uint16	N/A	N/A	0x0001	Well-known value. Uniquely identifies this as a SunSpec Common Model block
0004	0004	1	C_SunSpec_Length	uint16	registers	N/A	65	Length of common model block
0005	0020	16	C-Manufacturer	String(32)	N/A	N/A	"SOL SOL"	Well-known value
0021	0036	16	C-Model	String(32)	N/A	N/A	"SM1-485 PRO"	Manufacturer specific value
0037	0044	8	C-Options	String(16)	N/A	N/A	"0"	Manufacturer specific value
0045	0052	8	C-Version	String(16)	N/A	N/A	"80.00-03.01"	Manufacturer specific value
0053	0068	16	C_Serial Number	String(32)	N/A	N/A	"Serial"	Manufacturer specific value
0069	0069	1	C_DeviceAddress	unint16	N/A	N/A	65	Modbus Id
SunSpec Irradiance Model Registers								
0083	0083	1	C_SunSpec_DID	int16	N/A	0	302	Well-known value. Uniquely identifies this as a SunSpec Irradiance Model
0084	0084	1	C_Sunspec_Length	int16	N/A	0	5	Variable length model block =(5*n), where n=number of sensors blocks
0085	0085	1	E_Irradiance_Global _Horizontal_1	uint16	W/m²	0	N/A	Global Horizontal Irradiance
0086	0086	1	E_Irradiance _Plane-of-Array_1	uint16	W/m²	0	Measured	Plane-of-Array Irradiance
0087	0087	1	E_Irradiance_Diffuse_1	uint16	W/m²	0	N/A	Diffuse Irradiance

0088	0088	1	E_Irradiance_Direct_1	uint16	W/m²	0	N/A	Direct Irradiance
0089	0089	1	E_Irradiance_Other_1	uint16	W/m²	0	N/A	Some other type Irradiance
SunSpec Back of Module Temperature Registers								
0090	0090	1	C_SunSpec_DID	int16	N/A	0	303	Well-known value. Uniquely identifies this as a SunSpec Back of Module Temperature Model
0091	0091	1	C_Sunspec_Length	int16	N/A	0	2	Variable length model block =(5*n), where n=number of sensors blocks
0092	0092	1	E_BOM_Temp_1	int16	°C	-1	Measured	Back of module temperature
0093	0093	1	E_BOM_Temp_2	int16	°C	-1	N/A	Back of module temperature
End of Block Registers								
0094	0094	1	End Of Sunspec Block	uint16	N/A	N/A	0xFFFF	End of SunSpec Block
0095	0095	1	C_Sunspec_Length	uint16	N/A	0	0	Terminate length, zero

Tab 4

Specifications

Inputs:
irradiance range:	0 ÷ 1500 temperature compensated
temperature range:	-30 ÷ +90 °C measurable with external PT100 RTD
digital:	PNP-like connection

Outputs:
serial:	RS 485, standard Modbus RTU protocol

Measurements precision:
irradiance:	< ± 2%
temperature:	≤ 0.5 °C

Non-stability (per year)   ≤ 2%

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 , P67 code;

female M8 3 pin , IP67 code, UV resistant, matching male not supplied;

female M12 8 pin, IP67 for field installation

loose pins → tab.2 (on request)

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.

itsensor
industrial technology webstore

CONTACTS
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Documents / Resources

itsensor SM1-485 Pro Digital Solar Meter with External Temperature Probe Input [pdf] User Manual
SM1-485 Pro Digital Solar Meter with External Temperature Probe Input, SM1-485 Pro, Digital Solar Meter with External Temperature Probe Input, Temperature Probe Input

References

- **ITSensor - Industrial Technology Webstore - ITSensor**
- **ITSensor - Industrial Technology Webstore - ITSensor**

Manuals+,