



# Smart Pyranometers

The more intelligent way to measure solar irradiance

Enhanced performance by digital signal processing  
RS-485 serial data interface with Modbus® protocol  
0 to 1 V voltage output  
4 to 20 mA current output  
Extremely low power

## Introduction

Solar radiation drives almost every dynamic process on the Earth's surface and above, from ocean current circulation to the weather, and life itself. Precise long-term measurements of the radiation budget at the surface are fundamental to understanding the Earth's climate system and weather forecasting, and are important in agriculture, hydrology and ecology. Accurate solar radiation data has also become crucial information in solar energy and other industrial applications.

For pricing or any further information, please contact Omni Instruments Ltd.

Kipp & Zonen has been manufacturing pyranometers for over 80 years. These instruments are designed for measuring the total (global) irradiance from the sun and sky falling on a plane surface in the wavelength range from 300 nm (nanometers) to 3000 nm. We produce models at all price and performance points, up to the very best available, designed for a long operating life in all environments, from deserts to the Antarctic.

Our pyranometers meet, or exceed, the requirements of ISO 9060:1990 and IEC 60904 and are fully traceable to the World Radiometric Reference (WRR) in Davos, Switzerland, where Kipp & Zonen instruments form part of the World Standard Group.

Now, Kipp & Zonen makes the link between our class-leading instruments and industry standard interfaces to bring you something completely new, the SMP series of smart pyranometers.

Building on the proven CMP Series design and technology that is used around the world, the new SMP pyranometers add digital

signal processing and interfaces optimised for industrial data acquisition and control systems. Kipp & Zonen has developed a smart interface that features Modbus® data communication for connection to programmable logic controllers (PLC's), inverters, digital control equipment and the latest generation of data loggers. Amplified Voltage or Current outputs are also included for devices that have high level analogue inputs or current loop interfaces.

The smart interface not only provides versatile outputs. An integrated temperature sensor and digital polynomial functions provide correction for the temperature sensitivity of the detector. The response time has been improved and the output ranges are standardised, making it easy to interchange instruments for recalibration. Using Modbus® a range of instrument status and configuration information is available, with user-selectable options.

SMP pyranometers have extremely low power consumption so that internal heating does not affect the detector performance. They operate from a wide range of supply voltages, making them ideal for power-critical applications.

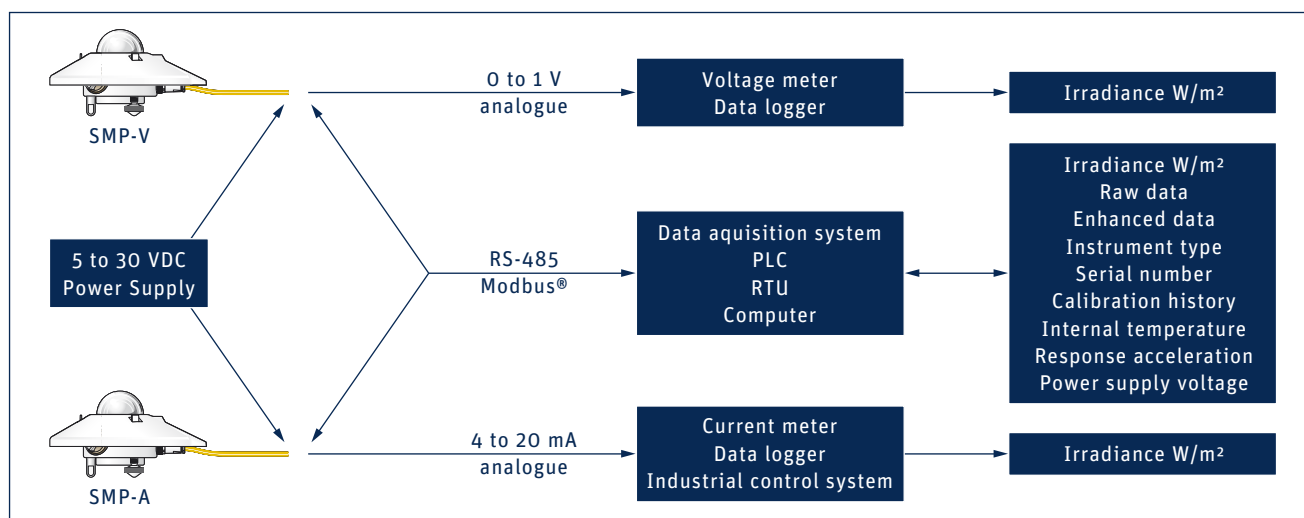
## Interfacing

SMP Series pyranometers are equipped with a smart interface. There are two versions, one has an analogue output of 0 to 1 V, the other is 4 to 20 mA. Both have a 2-wire RS-485 interface with Modbus® (RTU) protocol. All the outputs are protected against short-circuits, and reversed polarity.

The analog outputs allow easy connection to virtually any data logger or without the need for sensitive mV inputs. Modbus® interfaces directly to RTU's, PLC's, SCADA systems, industrial networks and controllers. Not only measurement data is available, the user can access the pyranometer type and serial number, instrument settings, calibration history, status information, and more. A recalibrated instrument

keeps the same analog and digital measurement ranges, so saving time by eliminating re-scaling of data collection equipment.

SMP Series pyranometers can operate from a power supply in the range from 5 VDC to 30 VDC and have both reverse polarity and over-voltage protection.



## Choice of Pyranometer

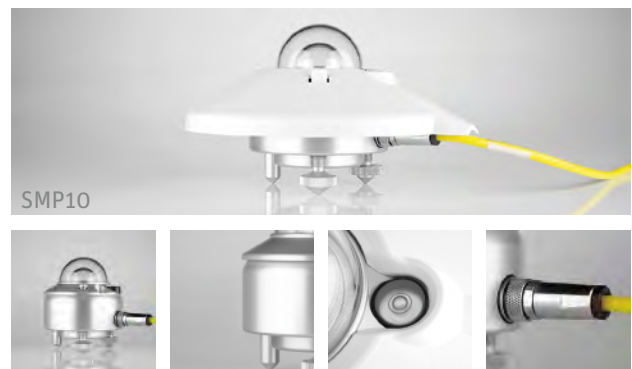
To achieve the required spectral and directional characteristics SMP Series pyranometers use thermopile detectors and glass domes. SMP3, SMP10 and SMP11 both have built-in bubble levels and adjustable levelling feet. Snap-on sun shields reduce solar heating of the housings. The waterproof connectors have gold-plated contacts and are fitted with 10 m of high quality signal cable as standard.

SMP3, SMP10 and SMP11 come in two versions; '-V' with a 0 to 1 V analogue output, and '-A' with 4 to 20 mA. Both versions have the Modbus® interface, very low power requirements and are supplied with comprehensive, traceable, calibration certificates. The most appropriate model for an application largely depends on the desired accuracy and performance.

**SMP3** is smaller and lighter than the SMP11 pyranometer. It has a robust 4 mm thick glass dome to protect the thermopile detector from external influences. The small size and sealed construction make this instrument the ideal choice for monitoring solar energy installations, agriculture, horticulture, hydrology and industrial applications. With its digital temperature compensation it is the fastest and best performing ISO 9060:1990 Second Class pyranometer available.

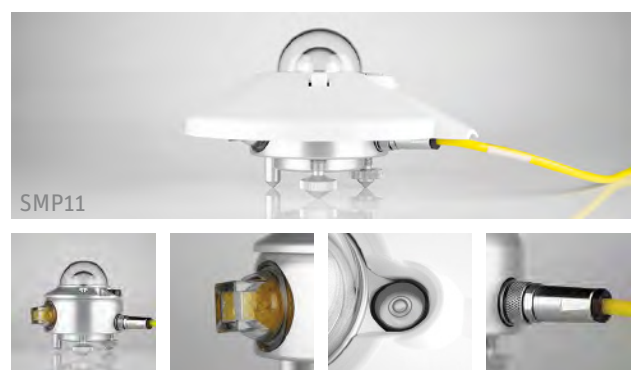


**SMP10** is the secondary standard pyranometer with the best price-quality-performance ratio on the market. With the same specifications and detector as SMP11, SMP10 extends this quality to applications where maintenance is difficult and/or forms a major part of the cost of ownership.



The SMP10 has internal desiccant that lasts for at least 10 years. This minimizes maintenance significantly. The interval for dome cleaning can be extended, and the quality of measurements maximized, by adding the CVF4 ventilation unit.

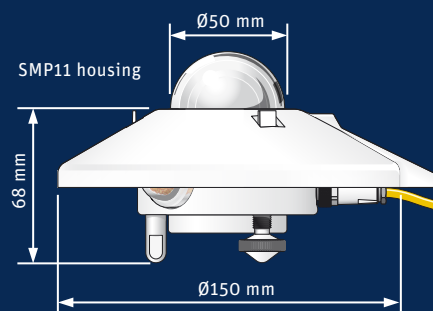
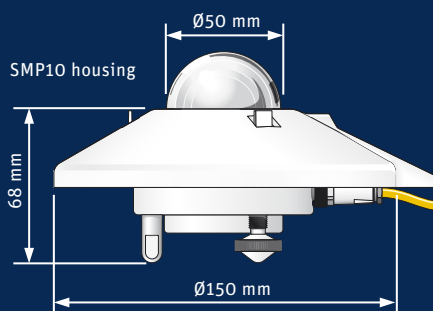
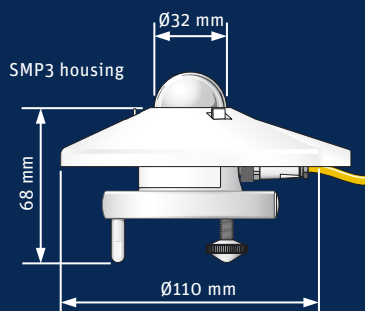
**SMP11** has a dual-dome construction of higher quality glass and increased thermal mass. It uses a more sophisticated detector design than the SMP3 and is a significant step up in performance. SMP11 comfortably exceeds the requirements for ISO Secondary Standard pyranometers and is the ideal choice for site prospecting, technology research and high quality solar radiation monitoring in solar energy applications. It is also particularly suitable for upgrading meteorological networks and for use in sun tracker based solar monitoring stations.



## Building a System

The system capabilities of Kipp & Zonen pyranometers can be extended with our wide range of compatible products and accessories, including; mountings, ventilation unit, adjustable tilt mounting kit, shadow ring, sun trackers and data loggers.





Specifications	SMP3	SMP10 & SMP11
Classification to ISO 9060:1990	Second Class	Secondary Standard
Spectral range (50% points)	300 to 2800 nm	285 to 2800 nm
Analogue output • V-version	0 to 1 V	0 to 1 V
Analogue output range	-200 to 2000 W/m <sup>2</sup>	-200 to 2000 W/m <sup>2</sup>
Analogue output • A-version	4 to 20 mA	4 to 20 mA
Analogue output range	0 to 1600 W/m <sup>2</sup>	0 to 1600 W/m <sup>2</sup>
Serial output	RS-485 Modbus®	RS-485 Modbus®
Serial output range	-400 to 2000 W/m <sup>2</sup>	-400 to 4000 W/m <sup>2</sup>
Response time (63%)	< 1.5 s	< 0.7 s
Response time (95%)	< 12 s	< 2 s
Zero offsets		
(a) thermal radiation (at 200 W/m <sup>2</sup> )	< 15 W/m <sup>2</sup>	< 7 W/m <sup>2</sup>
(b) temperature change (5 K/h)	< 5 W/m <sup>2</sup>	< 2 W/m <sup>2</sup>
Non-stability (change/year)	< 1 %	< 0.5 %
Non-linearity (100 to 1000 W/m <sup>2</sup> )	< 1.5 %	< 0.2 %
Directional response	< 20 W/m <sup>2</sup>	< 10 W/m <sup>2</sup>
(up to 80° with 1000 W/m <sup>2</sup> beam)		
Spectral selectivity (350 to 1500 nm)	< 3 %	< 3 %
Temperature response	< 3 % (-20 °C to +50 °C) < 5 % (-40 °C to +70 °C)	< 1 % (-20 °C to +50 °C) < 2 % (-40 °C to +70 °C)
Tilt response (0° to 90° at 1000 W/m <sup>2</sup> )	< 1 %	< 0.2 %
Field of view	180°	180°
Accuracy of bubble level	< 0.2°	< 0.1°
Supply voltage	5 to 30 VDC	5 to 30 VDC
Power consumption (at 12 VDC)	-V version: 55 mW -A version: 100 mW	-V version: 55 mW -A version: 100 mW
Detector type	Thermopile	Thermopile
Software, Windows™	Smart Sensor Explorer Software, for configuration, test and data logging	Smart Sensor Explorer Software, for configuration, test and data logging
Operating temperature range	-40 °C to +80 °C	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C	-40 °C to +80 °C
Humidity range	0 to 100 % non-condensing	0 to 100 % non-condensing
Ingress Protection (IP) rating	67	67
Recommended applications	Economical solution for efficiency and maintenance monitoring of PV power installations, routine measurements in weather stations, agriculture, horticulture and hydrology	High performance for PV panel and thermal collector testing, solar energy research, solar prospecting, materials testing, advanced meteorology and climate networks

Note: The performance specifications quoted are worst-case and/or maximum values



Go to your local distributor



For pricing information, please  
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