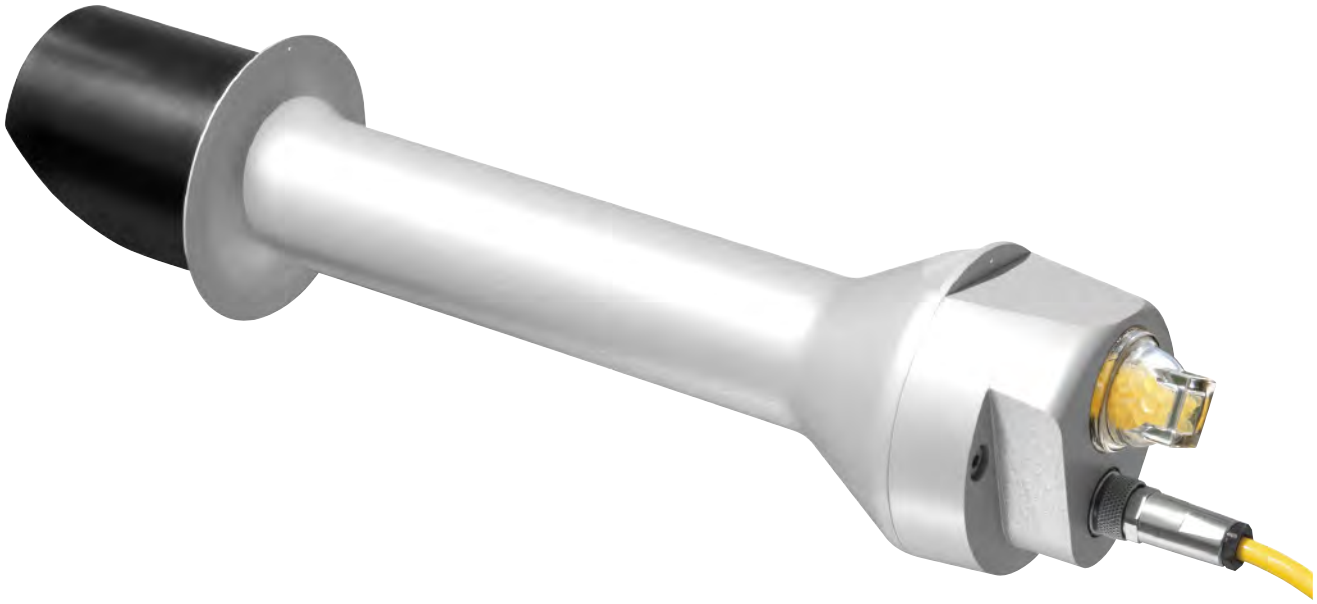
KIPP & ZONEN
SINCE 1830



Pyrheliometers

FOR UNATTENDED DIRECT NORMAL INCIDENCE SOLAR RADIATION MEASUREMENT

Classical passive model with mV output, or Smart version with
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 is the driving force behind biological and geophysical processes in meteorology, climate and our environment. The sun irradiates the top of the earth's atmosphere at an average intensity of 1367 W/m². As the solar rays travel through our atmosphere they are absorbed and scattered. This results in different components of solar radiation reaching the earth's surface. The direct component travels in a straight beam from the sun, whilst a diffuse component comes from all directions, due to the atmospheric scattering process.

A pyrheliometer is an instrument designed specifically to measure the direct beam solar irradiance with a field of view limited to 5°, also known as DNI: direct normal incidence. This is achieved by the shape of the collimation tube, with precision apertures, and the detector design.

The front aperture is fitted with a quartz window to protect the instrument and to act as a filter that passes solar radiation between 200 nm and 4000 nm in wavelength. Pyrheliometers include a rain shield and integrated alignment aids.

Choice of pyrheliometer

CHP 1 Pyrheliometer is a pyrheliometer that offers reliability and durability without requiring any power. The detector is similar to that used in our highest level pyranometers CMP 21 and CMP 22, which minimizes the influence of ambient temperature fluctuations and provides a fast response time. Both Pt-100 and 10 kΩ thermistor temperature sensors are fitted as standard, to allow use of the individual temperature response data supplied with each CHP 1. Thanks to the signal cable connector and screw-in desiccant cartridge the design is easy to install and maintain.

The specifications exceed ISO and WMO performance criteria for First Class Normal Incidence Pyrheliometers. Every CHP 1 is supplied with a calibration certificate traceable to the World Radiometric Reference.



SHP1 Pyrheliometer is a combination of the CHP 1 design and sensor technology with our smart interface advantages that make the SHP1 the best commercially available pyrheliometer. Key features are digital signal processing and interfaces optimised for industrial data acquisition and control systems.

The smart interface not only provides versatile outputs, the response time is also improved. The integrated temperature sensor and digital polynomial functions provide individual correction for the temperature sensitivity of the detector from -40 °C to +70 °C. The standardised outputs make it easy to interchange instruments for recalibration. Thanks to the Modbus® protocol, a range of instrument status and configuration information is available, with user-selectable options.

The SHP1 pyrheliometer has extremely low power consumption so that internal heating does not affect the detector performance. It operates from a wide range of supply voltages, making the SHP1 ideal for power-critical applications. The SHP1 is supplied with a comprehensive, traceable, calibration certificate. The specifications exceed ISO and WMO performance criteria for First Class Normal Incidence Pyrheliometers.

Kipp & Zonen smart radiometers are individually addressable and can be linked together in a multi-drop configuration to a single RS-485 cable that can be hundreds of metres in length. This makes installation easier and saves on cable costs. The SHP 1 can be mounted on a Kipp & Zonen sun tracker and linked to smart pyranometers and pyrgeometers to make a complete digital solar monitoring station.



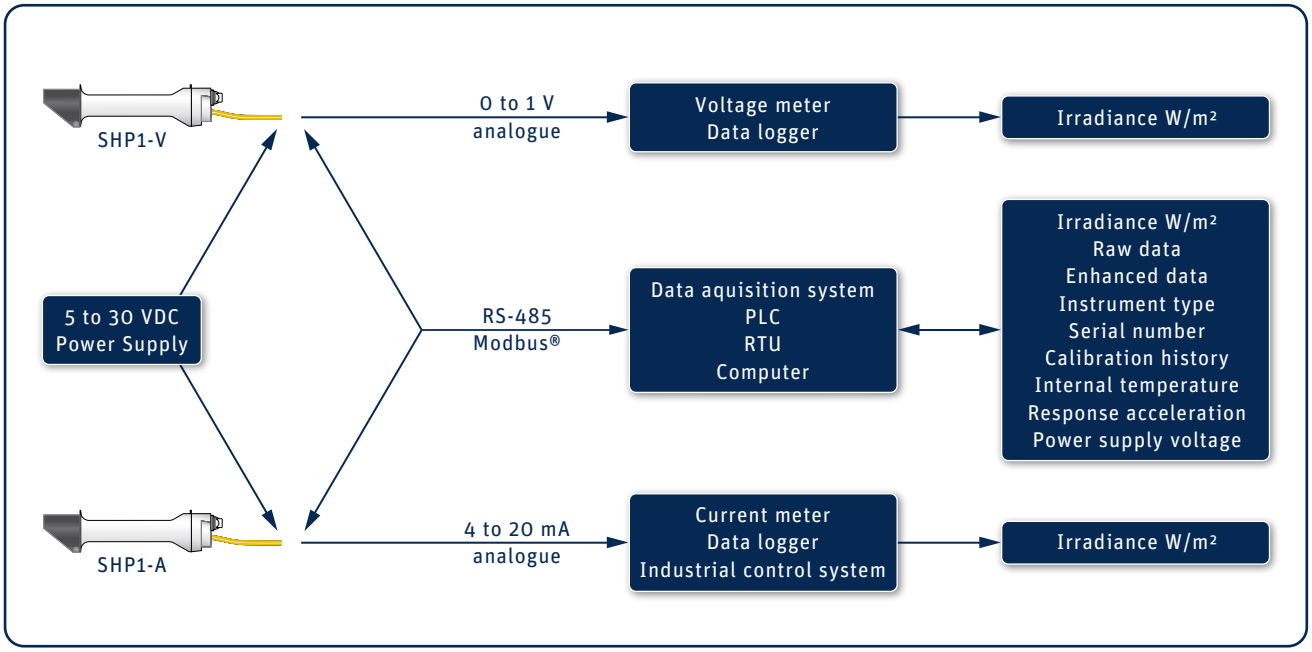
Interfacing

The CHP 1 has a maximum output of 25 mV output under atmospheric conditions and requires a data logger with an analogue input of at least 12 bits resolution over that range. The CHP 1 does not need a power supply.

The SHP1 is equipped with a smart interface. There are two versions, one has an analogue output of 0 to 1 V, the other of 4 to 20 mA. Both have a 2-wire RS-485 interface with Modbus® (RTU) protocol. All the outputs are protected against short-circuits, over-voltage and reversed polarity. SHP1 can operate from a power supply in the range from 5 to 30 VDC.

The analogue outputs allow easy connection to virtually any data logger 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 serial number, instrument settings, calibration history, status information, and more. A recalibrated instrument keeps the same analogue and digital measurement ranges, so saving time by eliminating re-scaling of data collection equipment.



Applications

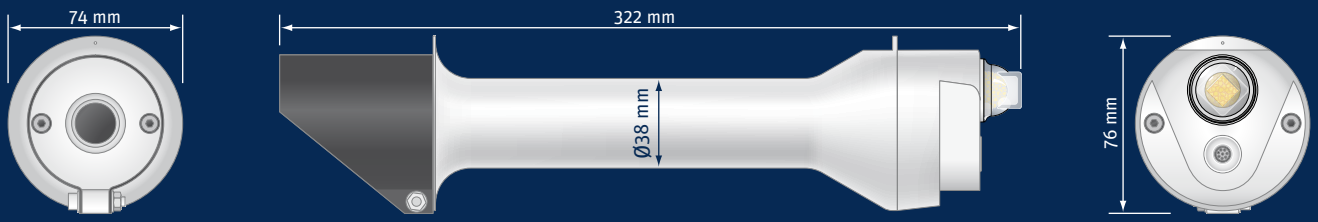
CHP 1 is an all-weather pyrheliometer available for continuous measurements of direct solar radiation. It exceeds the specifications for high end solar radiation networks, such as the Baseline Surface Radiation Network (BSRN) of the World Climate Research Programme (WCRP). These networks require accurate and reliable long-term measurements for climate change investigations.

The SHP1 is particularly suited for use in renewable energy applications. Most solar energy data acquisition and control systems do not have low voltage signal inputs available. For research into photovoltaic systems and materials, accurate direct solar irradiance data is needed. When 'prospecting' for sites to locate solar farms, the incoming energy available throughout the year is a key part of the decision making process.

Building a system

A pyrheliometer needs to be pointed at the sun at all times so that the solar disk always falls within the field of view of the instrument. Kipp & Zonen sun trackers provide a stable mounting to keep the pyrheliometer pointing at the sun to accurately measure the direct solar radiation. More details can be found in our dedicated sun trackers brochure.

Please refer to our website **www.kippzonen.com** for more information on the above products and other accessories available.



Specifications	CHP 1	SHP1
ISO 9060:1990 CLASSIFICATION	First Class	First Class
Response time (63 %)	< 1.7 s	< 0.7 s
Response time (95 %)	< 5 s	< 2 s
Zero offsets due to temperature change (5 K/hr)	< 1 W/m²	< 1 W/m²
Non-stability (change/year)	< 0.5 %	< 0.5 %
Non-linearity (0 to 1000 W/m²)	< 0.2 %	< 0.2 %
Temperature dependence of sensitivity	< 0.5 % (-20 °C to +50 °C)	< 0.5 % (-30 °C to +60 °C)
Sensitivity	7 to 14 µV/W/m²	NA
Other specifications		
Analogue output	10 to 20 mV for 1400 W/m²	-V version: 0 to 1 V -A version: 4 to 20 mA
Analogue output range	0 to 4000 W/m²	-V version: -200 to 2000 W/m² (1) -A version: 0 to 1600 W/m²
Digital output	NA	2-wire RS-485, Modbus® protocol
Operating temperature	-40 °C to +80 °C	-40 °C to +80 °C
Full viewing angle	5° ±0.2°	5° ±0.2°
Maximum irradiance	4000 W/m²	4000 W/m²
Humidity	0 to 100 % RH	0 to 100 % RH
Spectral range (50 % points)	200 to 4000 nm	200 to 4000 nm
Required sun tracker accuracy	< 0.5° from ideal	< 0.5° from ideal
Weight (excluding cable)	0.9 kg	0.9 kg
Slope angle	1° ±0.2°	1° ±0.2°
Temperature sensor	Both Pt-100 and 10k thermistor as standard (2)	Internal (3)
Supply voltage	NA	5 to 30 VDC
Power consumption (at 12 VDC)	NA	-V version: 55 mW -A version: 100 mW
Expected daily uncertainty	< 1 %	< 1 %
Documentation	Calibration certificate traceable to WRR, multi-language instruction sheet, manual on CD-ROM	
Recommended applications	High performance direct radiation monitoring for meteorological stations or concentrated solar energy applications	

(1) The analogue output range of SHP1 can be rescaled by the user to a maximum of -200 to 4000 W/m²

(2) Supplied with individual temperature dependence test data

(3) Output data individually temperature corrected for each SHP1 over -40 °C to +70 °C

Pyheliometers have a standard cable length of 10 m. Optional cable lengths 25 m and 50 m

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

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Go to www.kippzonen.com for your local distributor

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Kipp & Zonen B.V. reserve the right to alter specifications of the equipment described in this documentation without prior notice