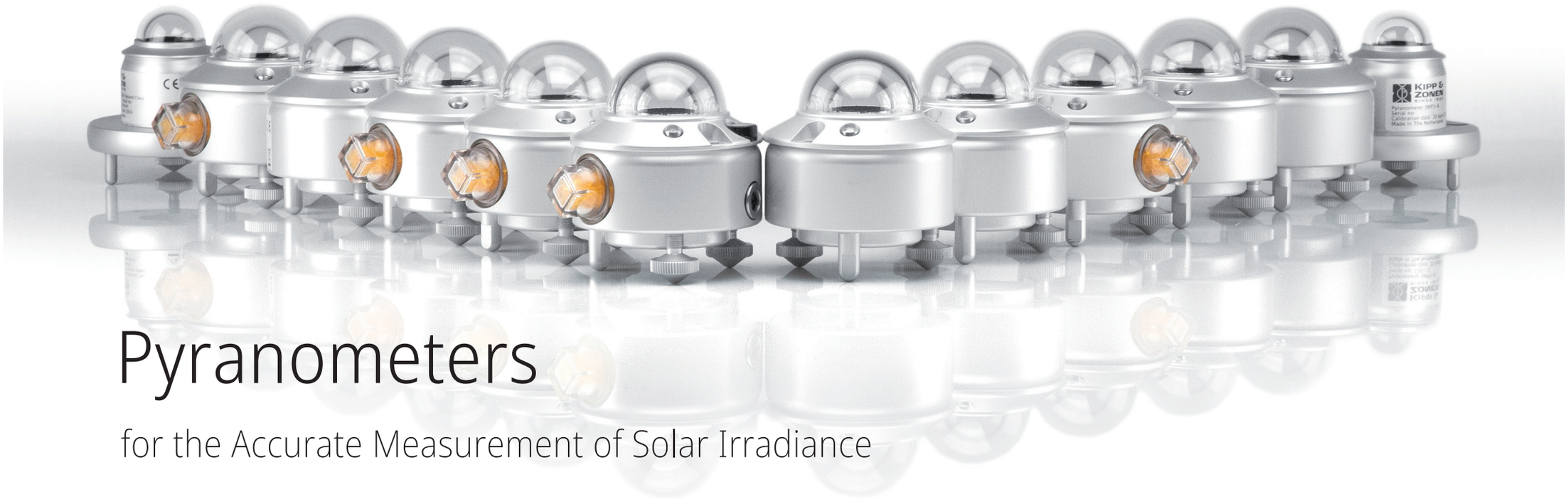
MEDITECNA
Instrumentación | Proyectos | Servicios

OTT HydroMet

KIPP & ZONEN
an OTT HydroMet brand



Pyranometers

for the Accurate Measurement of Solar Irradiance

The widest range of high quality, reliable pyranometers available

ISO 9060:2018 Spectrally Flat, from Class C to beyond the requirements of Class A

Accurate and independent data for performance ratio calculations

5 year worldwide manufacturer warranty

Installed around the world by national meteorology and climate networks

Used by major solar energy organisations for performance monitoring

A choice of analog or industry standard Modbus® RTU outputs

Mean Time Between Failures (MTBF) in excess of 10 years®



If you want to measure solar radiation on Earth's surface, you start with a pyranometer. Solar radiation drives almost every dynamic process on the Earth from ocean current circulation to weather, climate and the biosphere. The determination of the radiation budget at the surface of the Earth is fundamental to understanding the Earth's climate system and weather patterns.

SOLAR IRRADIANCE

PV systems harnessing solar irradiance are the most widely installed source of zero-emission renewable energy. High quality, reliable radiation data is crutial to the efficienct operation of solar energy projects in both photovoltaic (PV) and concentrating solar power (CSP) thermal systems. A pyranometer is a radiometer designed for measuring the irradiance in W/m^2 resulting from radiant fluxes incident upon a plane surface (horizontal or tilted) from the hemisphere above, and integrated over a wavelength range of at least 300 to 3000 nanometers (nm).

THE DIFFERENT COMPONENTS OF SOLAR RADIATION

A pyranometer measures global horizontal solar irradiance (GHI); which is composed of diffuse horizontal solar irradiance (DHI) from the sky and direct normal solar irradiance (DNI) from the sun. If shaded from the direct sun a pyranometer measures diffuse horizontal solar irradiance (DHI). Direct normal irradiance (DNI) is measured by a pyrheliometer continuously pointed at the centre of the sun by an automatic sun tracker.

SOLAR ENERGY

A pyranometer tilted in the plane of array (POA) of solar panels provides critical input data to the calculation of performance ratios and efficiencies in photovoltaic energy installations.







Kipp & Zonen Pyranometers

since 1924 · market leader · performance · best available · MTBF · wide range · accurate · 5 year warranty · user friendly · all weather conditions

Kipp & Zonen has been manufactuing pyranometers since 1924. As the market leader, we produce models at all price and performance points, up to the very best available. All comply with the requirements of ISO 9060:2018 'Solar energy - Specification and classification of instruments for measuring hemispherical solar and direct solar radiation' and are fully traceable to the World Radiometric Reference (WRR) in Davos, Switzerland, where Kipp & Zonen instruments form part of the World Standard Group.

THE BEST MTBF PERFORMANCE

Kipp & Zonen pyranometers are designed for simple operation and maintenance and have a wide range of accessories available. The long operational life and reliability is proven by an MTBF (Mean Time Between Failures) of more than 10 years. Many have been in continuous operation for over 30 years.

Kipp & Zonen pyranometers have been developed to be suitable for use in all environments, from the Antarctic to deserts. They are installed around the world for meteorology, hydrology, climate research, solar energy, environmental and materials testing, greenhouse control, building automation and many other applications.

Our top level pyranometers have individually optimized temperature compensation and individually measured directional response, with test results provided. These important features ensure the highest possible accuracy.

5 YEAR WARRANTY

All our pyranometers have a 5-year world-wide factory warranty from date of invoice, subject to correct installation and use. For the latest product support information you can visit our website.

Choice of Pyranometer

ISO 9060:2018 defines three classifications of pyranometer by their key performance parameters; from Class C, to Class B, to Class A and our top models considerably exceed ISO Class A requirements. In effect, this is the calculation of GHI from accurate DHI and DNI measurements.

The most appropriate model for an application largely depends upon the desired accuracy and performance, and the type of signal interface required. We offer two ranges of pyranometers, the passive CMP series and the Smart SMP series, both widely acknowledged by meteorological and solar energy customers.

CMP Series

high quality | durable | accurate | no power required | remote sites | analogue

Our CMP series pyranometers are well known around the world for their high quality, durability and accuracy. The instruments do not require any power and are ideal for remote sites with limited power availability or for field studies. Each has an individual calibration factor/sensitivity to convert the mV output signal to W/m² of irradiance.

The signal output is a very low voltage, typically around 10 millivolts on a bright sunny day. To measure 1 W/m² of irradiance requires a data logger 'accuracy' of better than 10 microvolts. This normally means a specialized meteorological data logger. Industrial type analogue inputs do not usually have sufficient sensitivity and the SMP series should be used.

CMP3 and CMP10 have internal desiccant that lasts for at least 10 years to reduce maintenance costs. Other CMP models have self-indicating desiccant in an easily accessed drying cartridge that should be inspected monthly and the desiccant changed when necessary.

Smart SMP Series

smart | fast | modbus® | network | data logging | status monitoring | digital | accurate | temperature correction | advanced software | internal desiccant | high quality | durable

Our SMP range of pyranometers is based on the proven technology of the CMP series, but has a micro-processor, memory and firmware that makes them Smarter and faster.

SMART INTERFACE

Modbus® RTU interfaces directly to, PLC's, SCADA systems, industrial networks and controllers. Smart instruments are addressable, and up to 247 units can be connected to a single network. Measurement data is updated every second and the user can access irradiance, type and serial number, instrument settings, full calibration history, status information, and more. The digital signal avoids all the issues of analogue-to-digital conversion performance that arise with many industrial data loggers and input modules, preserving the accuracy of the pyranometer's 24-bit differential input ADC.

SMP Series pyranometers can operate from 5 to 30 VDC and the power input has both reverse polarity and over-voltage protection. They have a feed-forward algorithm that makes them faster than our passive CMP series and an integrated temperature sensor and polynomial functions for better temperature correction.

SMARTEXPLORER WINDOWS SOFTWARE

Our free, and easy to use, SmartExplorer Windows™ software enables configuration of Smart pyranometers communication settings, monitoring of measurements and status parameters, and logging of the data. Even if the communication parameters are lost, or unknown, the software is able to establish communication and set the instrument back to a defined state.

SMP models have internal desiccant that lasts for at least 10 years to reduce maintenance costs. In addition, the new SMP12 introduces a tilt sensor and an internal humidity monitor.

All pyranometers with a Smart Interface also have a 0 to 1 V (-V models) or 4 to 20 mA (-A models) analogue output. These fixed analogue outputs eliminate the need to adjust the data logger after re-calibration.



Spectrally Flat Class C Pyranometers

CMP3 Class C single dome small size low cost routine measurement monitoring SMP3

Our Spectrally Flat Class C CMP3 pyranometer is smaller and lighter than the other CMP series pyranometers. It has a robust 4 mm thick glass dome to protect the thermopile from external influences. The small size and low cost make this the ideal choice for horticulture, entry-level weather stations and routine monitoring in solar energy installations. It does not have any compensation for change in sensitivity with temperature. A screw-in mounting rod is available for easy installation to a pole or mast.

SMP3 is the Smart version of CMP3 and is ideal for routine monitoring in solar energy installations. Because of the faster response, standardized digital Modbus® RTU interface and the built-in digital temperature compensation the SMP3 is superior to the CMP3.

Spectrally Flat Class B Pyranometers

CMP6 Class B double glass dome cost-effective good quality SMP6

CMP6 has a similar detector to CMP3, but has improved performance due to the increased thermal mass and the double glass dome construction, making it a Class B pyranometer. It is recommended for cost-effective, good quality, measurements in meteorological and hydrological networks and for agriculture.

SMP6 has similar applications to CMP6. Internal temperature compensation in all SMP's is over a large range from -40 °C to +70 °C and significantly reduces the measurement uncertainty.

Spectrally Flat Class A Pyranometers

CMP10 long-term stability low thermal offset fast response Class A industry standard CMP21 top level CMP22 high quality SMP10 SMP12 SMP22 reliable

Each Class A instrument is supplied with its own temperature and directional (cosine) response data. CMP10 uses a temperature compensated detector with a superior technology to the CMP3 and CMP6. It has better linearity and long-term stability, lower thermal offset and faster response. It is a step up in performance and particularly suitable for upgrading meteorological networks. The faster response time meets the requirements for solar energy research and development applications. CMP10 is also ideal for use in sun tracker based solar monitoring stations. It has internal desiccant instead of the external drying cartridge fitted to the rest of the double dome CMP series.

The CMP21 is characterized and compensated over a larger temperature range. A sensor is fitted to monitor the housing temperature. It is the choice for scientific use and in top level solar radiation monitoring networks such as the Baseline Surface Radiation Network (BSRN) and Global Atmospheric Watch (GAW) of the World Meteorological Organisation (WMO)

CMP22 has all the features of CMP21 but uses vry high quality quartz domes for a wider spectral range, improved directional response, and reduced thermal offsets. Kipp & Zonen is confident that CMP22 is the best passive pyranometer currently available.

SMP10 is the Smart digital equivalent of the CMP10 series pyranometers. They have faster response and more flexible connectivity. Internal temperature compensation in all SMP's is over a large range from -40°C to +70 °C. The digital polynomial temperature correction significantly reduces the measurement uncertainty provides better performance than the passive correction in the CMP versions, especially for extreme climates.

The new SMP12 is a fast response spectrally flat Class A pyranometer combining solid-state dome heating, no moving parts, and best-in-class surge protection to maximize accuracy and minimize maintenance.

The SMP22 shares all class-leading characteristics of the CMP22, in additional to the advantages of a smart pyranometer, including temperature compensation over a large range. A 10 K thermistor internal temperature sensor is standard, a Pt-100 sensor is optional.

Go to page 6 and 7 to compare the specifications of our pyranometers.



Building a System

The system capabilities of Kipp & Zonen pyranometers can be extended with our wide range of compatible products and accessories.



VENTILATION UNIT

The CVF4 ventilation unit is designed for use with all CMP and SMP Series pyranometers (it is slightly less effective with the CMP3 and SMP3 because of the smaller dome diameter). Ventilation helps to keep the dome clean from soiling, evaporates dew and raindrops, and reduces infrared thermal offsets. The heating can be used to melt frost and snow. Ventilation provides better quality measurement data and reduces the frequency of cleaning, reducing maintenance costs. The CVF4 is waterproof to IP68 and has a 5-year warranty.

SUN TRACKERS

SOLYS sun trackers are all-weather reliable instruments used to accurately point a pyrheliometer at the sun for direct normal irradiance measurements (DNI). When fitted with an optional shading assembly and a pyranometer they measure diffuse horizontal irradiance (DHI) with no need for periodic manual adjustments. Adding a second pyranometer for global horizontal irradiance (GHI) makes a complete high quality solar monitoring station.

SHADOW RING

The combination of a pyranometer and a CM121 shadow ring offers a simple solution for measuring diffuse solar radiation from the sky. It does not require any power, but the ring requires a simple adjustment every few days to ensure that the shadow covers the pyranometer dome completely as the sun declination changes during the year.

MOUNTINGS

We offer mounting fixtures for horizontal pyranometers. CMF1 is a small round plate with integral rod for mounting upward and/or downward facing pyranometers without a ventilation unit. CMF4 does the same for pyranometers fitted with the CVF4 ventilation unit. A screw-in rod is available for CMP3 and SMP3. The CMB1 is a mounting bracket for attaching mounting rods to a mast, pole or wall.

DATA LOGGERS

Kipp & Zonen has a range of high performance products for use with CMP or SMP series pyranometers to acquire and store analogue or digital measurement data. The AMPBOX converts the mV output of a CMP pyranometer into a 4-20 mA signal.

ALBEDOMETER

Two pyranometers, mounted back-to-back, make an albedometer. The albedo of a surface is the extent to which it diffusely reflects solar radiation. It is the ratio of the reflected radiation to the incoming radiation.

ADJUSTABLE TILT MOUNTING KIT

Use the Adjustable Tilt Mounting Kit to securely and accurately mount a CMP or SMP pyranometer at a solar zenith angle between 0° and 90°, to measure global tilted irradiance (GTI) or POA radiation for fixed-angle PV arrays.

GLARE SCREEN KIT

A downward facing pyranometer used to measure reflected solar radiation should not see any radiation coming from the hemisphere above or from the sun when it is below the horizon of the detector. To prevent this, a glare screen kit is available for use with CMP and SMP series pyranometers (except the SMP3 and CMP3).









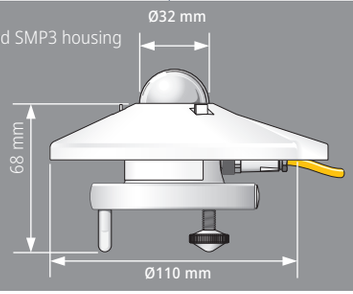
CMP pyranometers

Specifications		CMP3	CMP6	CMP10	CMP21	CMP22
Classification to ISO 9060:2018		Spectrally Flat Class C	Spectrally Flat Class B	Spectrally Flat Class A	Spectrally Flat Class A	Spectrally Flat Class A
Sensitivity		24 to 32 µV/W/m²	5 to 20 µV/W/m²	7 to 14 µV/W/m²	7 to 14 µV/W/m²	7 to 14 µV/W/m²
Impedance		80 to 140 Ω	20 to 200 Ω	10 to 100 Ω	10 to 100 Ω	10 to 100 Ω
Expected output range (0 to 1500 W/m²)		0 to 48 mV	0 to 30 mV	0 to 21 mV	0 to 21 mV	0 to 21 mV
Maximum operational irradiance		2000 W/m²	2000 W/m²	4000 W/m²	4000 W/m²	4000 W/m²
Response time (63 %)		< 6 s	< 6 s	< 1.66 s	< 1.66 s	< 1.66 s
Response time (95 %)		< 20 s	< 12 s	< 5 s	< 5 s	< 5 s
Instrument accuracy	Spectral range (20% points)	285 to 3000 nm	270 to 3000 nm	270 to 3000 nm	270 to 3000 nm	210 to 3600 nm
	Spectral range (50 % points)	300 to 2800 nm	285 to 2800 nm	285 to 2800 nm	285 to 2800 nm	200 to 3600 nm
	Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h) (c) total zero offset	 < 15 W/m² < 5 W/m² < 20 W/m²	 < 8 W/m² < 2 W/m² < 10 W/m²	 < 7 W/m² < 2 W/m² < 9 W/m²	 < 7 W/m² < 2 W/m² < 9 W/m²	 < 3 W/m² < 1 W/m² < 4 W/m²
	Additional signal processing errors	n.a.	n.a.	n.a.	n.a.	n.a.
	Non-stability (change/year)	< 1 %	< 1 %	< 0.5 %	< 0.5 %	< 0.5 %
	Non-linearity (100 to 1000 W/m²)	< ±3 %	< 1 %	< 0.2 %	< 0.2 %	< 0.2 %
	Directional response (up to 80 ° with 1000 W/m² beam)	< 20 W/m²	< 20 W/m²	< 10 W/m²	< 10 W/m²	< 5 W/m²
	Clear sky GHI spectral error	< 0.2 %	< 0.1 %	< 0.1 %	< 0.1 %	< 0.04 %
	Spectral selectivity (350 to 1500 nm)	< 3 %	< 3 %	< 3 %	< 3 %	< 3 %
	Tilt response (0 ° to 180 ° at 1000 W/m²)	< 1.5 %	< 1 %	< 0.2 %	< 0.2 %	< 0.2 %
	Temperature response	< 4 % (-10 °C to +40 °C)	< 2 % (-10 °C to +40 °C)	< 1 % (-10 °C to +40 °C)	< 1 % (-20 °C to +50 °C)	< 0.5 % (-20 °C to +50 °C)
	Field of view	180 °	180 °	180 °	180 °	180 °
	Accuracy of bubble level	< 0.2 °	< 0.1 °	< 0.1 °	< 0.1 °	< 0.1 °
Temperature sensor output					10 k Thermistor (optional Pt-100)	10 k Thermistor (optional Pt-100)
Detector type		Thermopile	Thermopile	Thermopile	Thermopile	Thermopile
Operating and storage temperature range		-40 °C to +80 °C	-40 °C to +80 °C	-40 °C to +80 °C	-40 °C to +80 °C	-40 °C to +80 °C
Humidity range		0 to 100 %	0 to 100 %	0 to 100 %	0 to 100 %	0 to 100 %
MTBF (Mean Time Between Failures)		> 10 years	> 10 years	> 10 years	> 10 years	> 10 years
Ingress Protection (IP) rating		67	67	67	67	67
Recommended applications		Economical solution for routine measurements in weather stations, field testing	Good quality measurements for hydrology networks, greenhouse climate control	Meteorological networks, PV panel and thermal collector testing, materials testing	Meteorological networks, reference measurements in extreme climates, polar or arid	Scientific research requiring the highest level of measurement accuracy and reliability

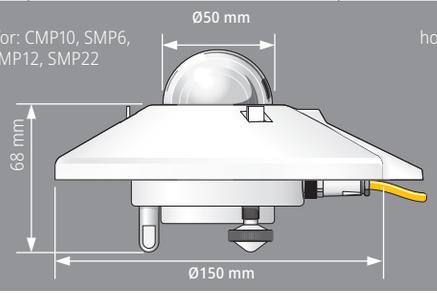
Note:
The performance specifications quoted are worst-case and/or maximum values.

Standard 10 k thermistor or optional Pt-100 temperature sensor with CMP21 and CMP22.
Individual directional response and temperature dependence test data with CMP10, CMP21 and CMP22.

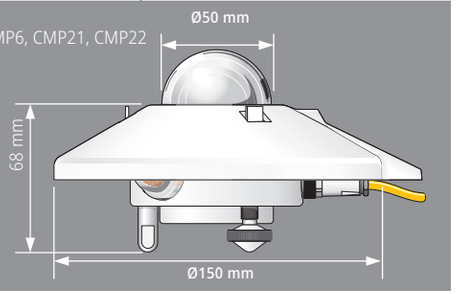
CMP3 and SMP3 housing



housing for: CMP10, SMP6, SMP10, SMP12, SMP22



housing: CMP6, CMP21, CMP22



SMP pyranometers

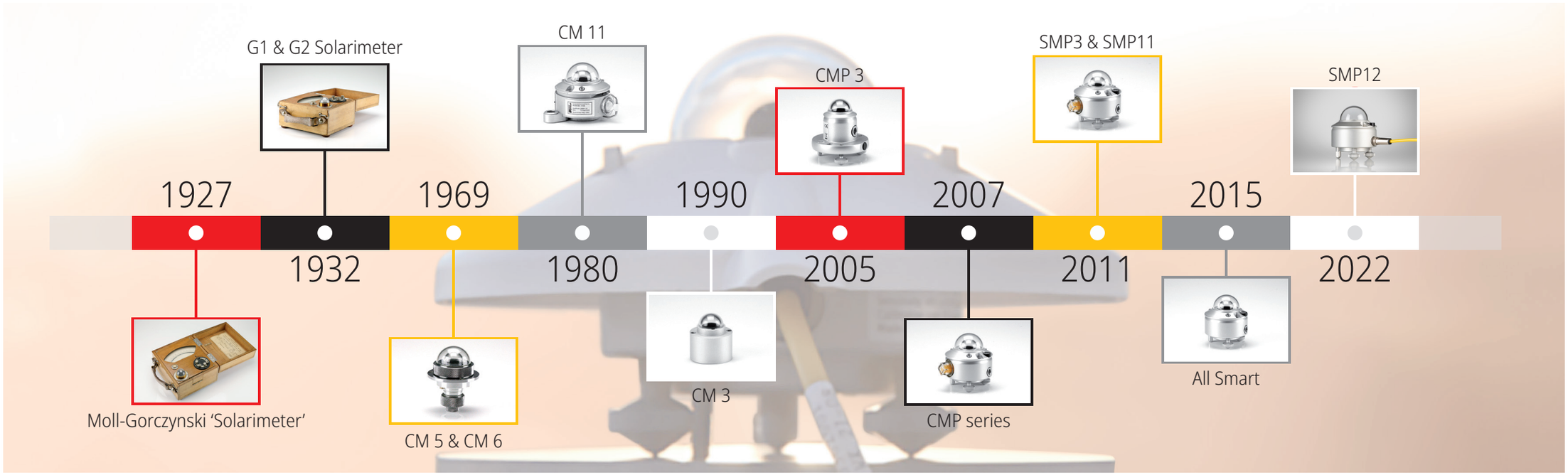
Specifications		SMP3	SMP6	SMP10	SMP12	SMP22
Classification to ISO 9060:2018		Spectrally Flat Class C	Spectrally Flat Class B	Spectrally Flat Class A	Fast Response Spectrally Flat Class A	Spectrally Flat Class A
Analogue output • V-version		0 to 1 V	0 to 1 V	0 to 1 V	0 to 1 V	0 to 1 V
Analogue output range • V-version*		-200 to 2000 W/m²	-200 to 2000 W/m²	-200 to 2000 W/m²	-200 to 2000 W/m²	-200 to 2000 W/m²
Analogue output • A-version		4 to 20 mA	4 to 20 mA	4 to 20 mA	N/A	4 to 20 mA
Analogue output range • A-version*		0 to 1600 W/m²	0 to 1600 W/m²	0 to 1600 W/m²	N/A	0 to 1600 W/m²
Serial output		RS-485 Modbus®	RS-485 Modbus®	RS-485 Modbus®	RS-485 Modbus®	RS-485 Modbus®
Serial output range*		-400 to 2000 W/m²	-400 to 2000 W/m²	-400 to 4000 W/m²	-400 to 4000 W/m²	-400 to 4000 W/m²
Instrument accuracy	Response time (63 %)	< 1.5 s	< 1.5 s	< 0.7 s	< 0.15 s	< 0.7 s
	Response time (95 %)	< 12 s	< 12 s	< 2 s	< 0.5 s	< 2 s
	Spectral range (20 % points)	285 to 3000 nm	270 to 3000 nm	270 to 3000 nm	280 to 3000 nm	210 to 3600 nm
	Spectral range (50 % points)	300 to 2800 nm	285 to 2800 nm	285 to 2800 nm	285 to 2750 nm	250 to 3500 nm
	Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h) (c) total zero offset	 < 15 W/m² < 5 W/m² < 20 W/m²	 < 8 W/m² < 2 W/m² < 10 W/m²	 < 7 W/m² < 2 W/m² < 9 W/m²	 < 1 W/m² < 1.5 W/m² < 3 W/m²	 < 3 W/m² < 1 W/m² < 4 W/m²
	Additional signal processing errors	< 3 W/m²	< 2 W/m²	< 2 W/m²	< 3 W/m²	< 1 W/m²
	Non-stability (change/year)	< 1 %	< 1 %	< 0.5 %	< 0.5 %	< 0.5 %
	Non-linearity (100 to 1000 W/m²)	< 3 %	< 1 %	< 0.2 %	< 0.2 %	< 0.2 %
	Directional response (up to 80 ° with 1000 W/m² beam)	< 20 W/m²	< 15 W/m²	< 10 W/m²	< 10 W/m²	< 5 W/m²
	Temperature response	< 3 % (-20 °C to +50 °C) < 4 % (-40 °C to +70 °C)	< 2 % (-10 °C to +40 °C) < 4 % (-40 °C to +70 °C)	< 1 % (-20 °C to +50 °C) < 2 % (-40 °C to +70 °C)	< 1 % (-10 °C to +40 °C) < 2 % (-40 °C to +70 °C)	< 0.3 % (-20 °C to +50 °C) < 0.3 % (-40 °C to +70 °C)
	Clear sky GHI spectral error	< 0.2 %	< 0.1 %	< 0.1 %	< 0.1 %	< 0.04 %
	Spectral selectivity (350 to 1500 nm)	< 3 %	< 3 %	< 3 %	< 3 %	< 3 %
	Tilt response (0 ° to 180 ° at 1000 W/m²)	< 1.5 %	< 1 %	< 0.2 %	< 0.2 %	< 0.2 %
	Field of view	180 °	180 °	180 °	180 °	180 °
	Accuracy of bubble level	< 0.2 °	< 0.1°	< 0.1 °	< 0.1 °	< 0.1 °
Power consumption (at 12 VDC)		V-version: 55 mW A-version: 100 mW	V-version: 55 mW A-version: 100 mW	V-version: 55 mW A-version: 100 mW	V-version: 3.5 W	V-version: 55 mW A-version: 100 mW
Software, Windows™		SmartExplorer software, for configuration, test and data logging	SmartExplorer software, for configuration, test and data logging	SmartExplorer software, for configuration, test and data logging	SmartExplorer software, for configuration, test and data logging	SmartExplorer software, for configuration, test and data logging
Supply voltage		5 to 30 VDC	5 to 30 VDC	5 to 30 VDC	10 to 30 VDC	5 to 30 VDC
Detector type		Thermopile	Thermopile	Thermopile	Thermopile	Thermopile
Operating temperature range		-40 °C to +70 °C	-40 °C to +70 °C	-40 °C to +70 °C	-40 °C to +70 °C	-40 °C to +70 °C
Storage temperature range		-40 °C to +80 °C	-40 °C to +80 °C	-40 °C to +80 °C	-40 °C to +80 °C	-40 °C to +80 °C
Humidity range		0 to 100 %	0 to 100 %	0 to 100 %	0 to 100 %	0 to 100 %
MTBF (Mean Time Between Failures) **		> 10 years	> 10 years	> 10 years	> 10 years	> 10 years
Ingress Protection (IP) rating		67	67	67	67	67
Recommended applications		Economical solution for efficiency and maintenance monitoring of PV power installations, routine measurements in weather stations, agriculture, horticulture and hydrology	Good quality measurements for Solar Monitoring, hydrology networks, greenhouse climate control	High performance for PV panel and thermal collector testing, solar energy research, solar prospecting, materials testing, advanced meteorology and climate networks	High performance for PV panel and thermal collector testing, solar energy research, solar prospecting, materials testing, advanced meteorology and climate networks	Scientific research requiring the highest level of measurement accuracy and reliability under all conditions

* adjustable with SmartExplorer Software ** extrapolated after introduction in January 2012 **Note:** The performance specifications quoted are worst-case and/or maximum values

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