Product Catalogue

Instruments for measuring solar radiation and atmospheric properties

KIPP & ZONEN
SINCE 1830

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The Kipp & Zonen Product Catalogue

Welcome to our comprehensive catalogue of Solar Radiation and Atmospheric Science Instruments and Accessories. We hope that you will find it both interesting and informative.

The company began in 1830 when Dutch pharmacist Petrus Jacobus Kipp bought a pharmacy shop in the centre of Delft and gave it his name. Shortly afterwards he started an instrument business and became an important adviser to the Royal Academy, now the Delft University of Technology.

In 1844 he designed a constant-flow gas generator, which was used in chemical laboratories all over the world. This 'Kipp Generator' remains part of our company logo today. In 1866 his two sons joined the business and the name changed to Kipp & Zonen ('Sons').

By 1927 the extensive catalogue of scientific instruments included laboratory glassware, galvanometers, electronic chart recorders, analytical instruments, telephones, and the first 'Solarimeters' for measuring solar radiation.

Today, Kipp & Zonen focuses on designing, manufacturing, and marketing, class-leading, high quality instruments for the measurement of solar radiation and atmospheric properties. To support our customers worldwide we have sales offices in France, Singapore and the USA, and a network of distributors in more than 40 countries.

Precise long-term measurements of the radiation budget and atmospheric properties are fundamental to understanding the Earth's climate system and improving weather and climate forecast models.

Kipp & Zonen provides the widest range available of instruments to meet these needs in Meteorology, Climatology, Agriculture, Hydrology, and Industry.

Our products have guaranteed quality at levels of price and performance to suit all applications and are fully traceable to the relevant international standards.

The limited reserves, rising prices and concerns over the security of supply of traditional energy sources; together with the increasing awareness of climate change, have resulted in rapid development of alternative energy sources.

Recent years have seen rapid exponential growth in renewable energy markets. Kipp & Zonen provides solar radiation measurement solutions for both photovoltaic and thermal solar energy systems, and for other industrial applications such as material testing and building automation.

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Our Capabilities

Kipp & Zonen is a leading authority in the measurement of solar radiation and atmospheric properties and is widely recognized for expertise, quality and service. We support significant research and development and maintain close links with the scientific community and international bodies such as the World Meteorological Organisation (WMO).

We take part in scientific comparisons and field campaigns, are involved with the creation of international standards and are a founder member of the Association of the Hydro-Meteorological Equipment Industry (HMEI). We have in-house facilities for research, development, software, manufacture and testing, and we can provide customer-specific solutions.

High quality customer support is essential to our business and includes provision of spare parts, repair, service and calibration. Our experts are available to give assistance and advice on the most appropriate equipment for an application. For our more complex products we offer on-site installation, commissioning and training.

Kipp & Zonen produces the widest range available of radiometers for the measurement of solar and sky radiation. The solar instruments portfolio covers the spectrum from the Ultraviolet (UV) to the Far Infrared (FIR) and includes integrated net radiometers. The instruments fully comply with World Meteorological Organisation (WMO) and ISO requirements, where applicable.

We make high precision sun trackers, a range of accessories, and provide interfacing and data logging solutions. There is also a PAR quantum sensor, the Lite™ range of low-cost sensors, a sunshine duration sensor, and more.

Our expertise, close links with the scientific community, and strategic partnerships have led to high-end solutions for the measurement of atmospheric properties such as stratospheric Ozone, UV spectra, aerosols, heat fluxes, evapo-transpiration and the ground-truthing of satellite data. The Brewer Spectrophotometer, LAS MkII Large Aperture Scintillometer, Sky Radiometers and a spectral Sun Photometer all form part of our Atmospheric Science Instruments range.

About this Catalogue

The catalogue is arranged by types of product, for instance Pyranometers. For each type there is an introduction to the measurement made, the technology used, the typical applications and the range of models available.

Each model has a description, key specifications, part numbers and a list of available options and accessories. The catalogue gives a comprehensive overview of our product range at the time of publication but much additional product information, including improvements and new introductions, is available from our website at **www.kippzonen.com**

Additional Product Information

Our website contains a lot more information than it is possible to include in this catalogue. Brochures, Instruction Sheets and Manuals are free to download in pdf. These are always the latest versions and therefore may differ slightly from the information printed in this catalogue. Also available are application guides, technical documents, scientific papers, FAQ section, and more. Please go to **www.kippzonen.com** and have a browse.

Part Numbering

All items in this catalogue have a basic 7-digit part number. Where there are no built-in options available this is the whole number.

Many Kipp & Zonen instruments have built-in options available, such as temperature sensors. To minimise errors in ordering we use a part number system whereby each option has a unique code attached to the basic instrument number. Options are identified by 3 extension numbers, in the format 0123456-123.

For instruments with connectors, a cable of the required length with pre-wired waterproof plug (or a plug only) can be ordered with the instrument or separately.

Price and Delivery

Please contact your local Kipp & Zonen sales office or distributor for prices and delivery times. Their contact information can be found on our website at **www.kippzonen.com**

Quality

Kipp & Zonen is an ISO 9001:2008 certified company.

Warranty

The products in this price list have a world-wide 2 year warranty valid from the date of invoice, with the exception of some items, such as consumables.

After registration within 6 months of purchase, an extension of this standard 2-year warranty to 5 years is granted to all CMP and SMP, CGR and SGR, CHP and SHP, CUV and SUV model radiometers.

All other instruments and accessories are excluded from the warranty extension.

Spare Parts, Service, Calibration and Repairs

Contact your local Kipp & Zonen sales office or distributor for a quotation. Please give the instrument type, the serial number and a description of the problem or the work/parts required. Their contact information can be found on our website www.kippzonen.com

Disclaimer

Whilst every effort has been made to ensure that the information and specifications quoted in this catalogue are correct at the date of going to press, Kipp & Zonen reserves the right to alter specifications without notice due to product changes and improvements. For this reason there may sometimes be differences between this catalogue and the latest product brochures.

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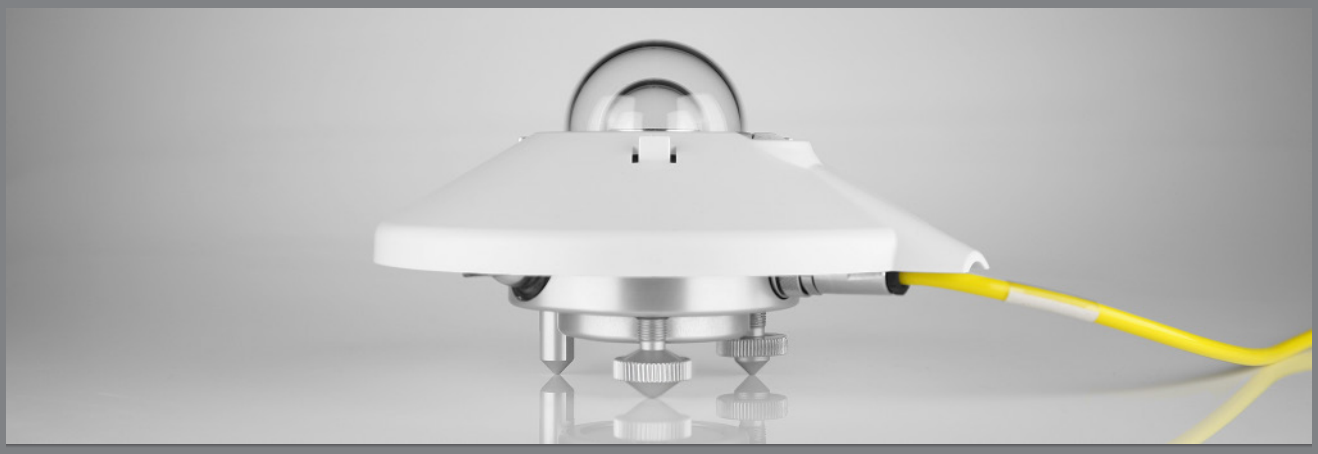


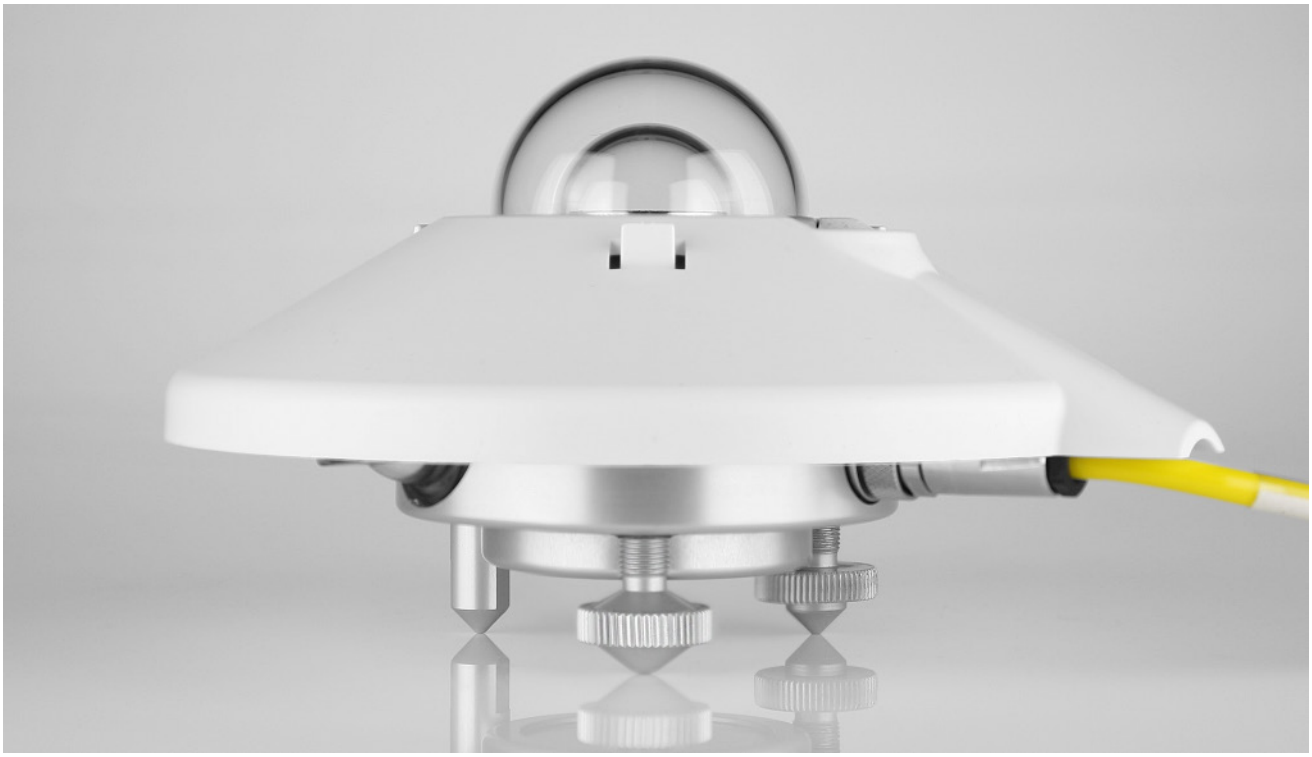
Solar Instruments

Introduction

Kipp & Zonen is the specialist in the measurement of solar and sky radiation, from the ultraviolet to the far infrared. Kipp & Zonen solar instruments are relied upon by meteorological networks all over the world and are widely used in climate research, hydrology, agriculture, water resource management, materials testing, renewable energy and public health applications.

On the following pages you will find a complete range of high quality instrumentation, from reliable cost-effective products to the best performance available. There is a wide range of accessories; including sun trackers, shadow rings, ventilation units, mountings, power supplies, signal amplifiers and data acquisition solutions.

For the latest product information, brochures, manuals and application information visit our website at **www.kippzonen.com**.



Pyranometers

For the accurate measurement of solar irradiance

Scientists, researchers and commercial companies in renewable energy, climatology, weather, agriculture, water resources and environment all require accurate and reliable measurements of solar radiation. The measurement is made by pyranometers, which are radiometers designed for measuring the total (global) irradiance on a plane surface resulting from radiant fluxes in the wavelength range from 300 to 3000 nanometers (nm).

Kipp & Zonen has been manufacturing pyranometers for over 90 years. We produce models at all price and performance points, up to the very best available.

Our pyranometers are designed for a long operating life with simple maintenance. All models have built-in levelling facilities, except the CM4, and a wide range of accessories is available.

The SP Lite2 silicon photo-diode pyranometer, is compact and low cost and is ideal for use in solar energy applications, plant growth, evapo-transpiration and building automation.

The CM4 high temperature pyranometer has a thermopile detector and is specially designed for measuring solar or artificial light irradiance under the most extreme temperature conditions.

The CMP series of thermopile pyranometers are known for their ergonomic and user-friendly features to facilitate installation, maintenance, and exchange for recalibration.

The SMP series are the world's first smart pyranometers with built-in intelligence. Building on the proven CMP series design and measurement technology they add digital signal processing to improve performance and interfaces optimised for industrial data acquisition and control systems.

The 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.

All models, except the SP Lite2, comply with the requirements of ISO 9060:1990 and are fully traceable to the World Radiometric Reference (WRR) in Davos, Switzerland, where Kipp & Zonen instruments form part of the World Standard Group.

SP Lite2

SP Lite2 is designed for all-weather measurement of solar radiation. It has a specially shaped diffuser that gives very good directional response and is largely self-cleaning. The detector is a silicon photo-diode, so the spectral response is not as broad or flat as our CMP/SMP series pyranometers with thermopile detectors.

SP Lite2 is available either with a high sensitivity of 60 to 100 µV/W/m² or with a sensitivity adjusted to 10 ± 0.5 µV/W/m². In both cases the actual value is given on the calibration certificate and instrument label. The standard cable length is 5 m with an option of 15 m.

The mounting flange incorporates a bubble level and 3 adjustment screws for easy levelling. A threaded hole takes the accessory screw-in mounting rod for fitting to masts and poles with the CMB1 mounting bracket.

Two SP Lite2 instruments can easily be bolted back-to-back and fitted with the mounting rod to make a simple albedometer.

Specifications	
Spectral range (overall)	400 to 1100 nm
Sensitivity Sensitivity (10 µV/W/m² version)	60 to 100 µV/W/m² 10 ±0.5 µV/W/m²
Impedance Impedance (10 µV/W/m² version)	50 Ω < 10 Ω
Expected output range (0 to 1500 W/m²) Expected output range (10 µV/W/m² version)	0 to 150 mV 0 to 15 mV
Maximum operational irradiance	2000 W/m²
Response time (95 %)	< 500 ns
Non-stability (change/year)	< 2 %
Non-linearity (100 to 1000 W/m²)	< 2.5 %
Directional response (up to 80° with 1000 W/m² beam)	< 10 W/m²
Temperature response	- 0.15 %/°C
Field of view	180°
Accuracy of bubble level	< 0.2°
Detector type	Photo-diode
Operational temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

Part number	Instrument
0339920-001	SP Lite2 Silicon Pyranometer • 5 m cable
0339920-003	SP Lite2 Silicon Pyranometer • 15 m cable
0339920-021	SP Lite2 Silicon Pyranometer • 10 µV/W/m² • 5 m cable
0339920-023	SP Lite2 Silicon Pyranometer • 10 µV/W/m² • 15 m cable
0339920-701	SP Lite2 Silicon Pyranometer • METEON • 5 m cable
0339920-703	SP Lite2 Silicon Pyranometer • METEON • 15 m cable
0339920-801	SP Lite2 Silicon Pyranometer • AMPBOX • 5 m cable
0339920-803	SP Lite2 Silicon Pyranometer • AMPBOX • 15 m cable
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 1600 W/m²	

SP Lite2 Silicon Albedometer
A low-cost Silicon Albedometer can be self-assembled by ordering: 2x SP Lite2 Silicon Pyranometer + 1x Mounting Rod
Note: SP Lite2 Albedometer can be used with the AMPBOX but it has two individual outputs, so 2x AMPBOX are required

Part number	Accessories
0338720	Mounting Rod Screw-in 300 mm long x 12 mm ø
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall

CM4

CM4 is a high temperature pyranometer for measuring solar or artificial light irradiance under the most extreme temperature conditions. With an operating temperature range from -40 °C to +150 °C and measurement up to 4000 W/m² it is a unique instrument. All the radiometer components are specially selected for their ability to withstand these extremely high temperature and irradiance levels.

CM4 has internal first-order temperature compensation, but it is also supplied with a built in Pt-100 temperature sensor to provide additional information on the measurement conditions. To optimize the accuracy in different applications the CM4 is supplied with calibration information split into temperature sections. Beside the standard calibration factor for +25 °C the following intervals are defined: -20 to +25, +25 to +75, +25 to +100, +75 to +100 and +100 to +150 °C. For each temperature range the sensitivity and the maximum temperature error (in %) are specified. CM4 is supplied as standard with 10 m of special high temperature signal cable.

CM4 is specifically designed for use in environmental chambers and solar simulators and materials testing. The CLF4 levelling fixture is a base with levelling screws and an accurately machined cap that can be placed over the pyranometer dome, and has a bubble level with 0.2° accuracy mounted on the top.

Specifications	
Classification to ISO 9060:1990	Second Class
Spectral range (50 % points)	300 to 2800 nm
Sensitivity	4 to 10 µV/W/m²
Impedance	200 to 2000 Ω
Expected output range (0 to 2500 W/m²)	0 to 25 mV
Maximum operational irradiance	4000 W/m²
Response time (63 %) Response time (95 %)	< 2.5 s < 8 s
Zero offsets (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 15 W/m² < 4 W/m²
Non-stability (change/year)	< 1 %
Non-linearity (100 to 1000 W/m²)	< 3 %
Directional response (up to 80° with 1000 W/m² beam)	< 20 W/m²
Spectral selectivity (350 to 1500 nm)	< 3 %
Temperature response (Over any 50 °C interval in the range from -25 °C to +150 °C)	< 3 %
Tilt response (0° to 90° at 1000 W/m²)	< 1 %
Field of view	180°
Temperature sensor output	Pt-100 4 wire
Detector type	Thermopile
Operating temperature range	-40 °C to +150 °C
Storage temperature range	-40 °C to +150 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

Part number	Instrument
0356900-022	CM4 High Temperature Pyranometer • 10 m cable
0356900-722	CM4 High Temperature Pyranometer • METEON • 10 m cable
0356900-822	CM4 High Temperature Pyranometer • AMPBOX • 10 m cable
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 4000 W/m²	
Note: AMPBOX and METEON are not suitable for use in extreme temperatures	

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
0356700	CLF4 Levelling Fixture High temperature design for CM4 only

CMP3

CMP3 is an ISO Second Class pyranometer designed for shortwave global solar radiation measurements in the spectral range from 300 to 2800 nm. The thermopile detector measures irradiance up to 2000 W/m² with a response time less than 18 seconds and typical sensitivity of 10 µV/W/m², that varies less than 5 % from -10 °C to +40 °C.

CMP3 is smaller and lighter than the other CMP series pyranometers. 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 horticulture, monitoring solar energy installations, industrial applications, and entry level weather stations.

Two CMP3's can easily be mounted back-to-back and fitted with the accessory mounting rod to make a low-cost albedometer.

Specifications	
Classification to ISO 9060:1990	Second Class
Sensitivity	5 to 20 µV/W/m²
Impedance	20 to 200 Ω
Expected output range (0 to 1500 W/m²)	0 to 30 mV
Maximum operational irradiance	2000 W/m²
Response time (63 %)	< 6 s
Response time (95 %)	< 18 s
Spectral range (20% points)	285 to 3000 nm
Spectral range (50 % points)	300 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 15 W/m² < 5 W/m²
Non-stability (change/year)	< 1 %
Non-linearity (100 to 1000 W/m²)	< 1.5 %
Directional response (up to 80° with 1000 W/m² beam)	< 20 W/m²
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0° to 90° at 1000 W/m²)	< 1 %
Temperature response	< 5 % (-10 °C to +40 °C)
Field of view	180°
Accuracy of bubble level	< 0.2°
Temperature sensor output	-
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

Part number	Instrument
0338920-002	CMP3 Pyranometer • 10 m cable
0338920-000	CMP3 Pyranometer • no plug, no cable
0338920-702	CMP3 Pyranometer • METEON • 10 m cable
0338920-700	CMP3 Pyranometer • METEON • no plug, no cable
0338920-802	CMP3 Pyranometer • AMPBOX • 10 m cable
0338920-800	CMP3 Pyranometer • AMPBOX • no plug, no cable
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 1600 W/m²	

CMP3 Second Class Albedometer
An ISO Second Class Albedometer can be self-assembled by ordering: 2x CMP3 Pyranometer + 1x Mounting Rod
Note: CMP3 Albedometer can be used with the AMPBOX but it has two individual outputs, so 2x AMPBOX are required

Part number	Accessories
0338720	Mounting Rod Screw-in 300 mm long x 12 mm ⌀
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a CMP3 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement
Note: CMP3 cannot be used with the Glare Screen Kit	

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

SMP3

SMP3 is our entry level smart pyranometer. It is ISO Second Class, with the same housing and detector design as the passive CMP3 model. SMP3 is equipped with a smart interface. There are two versions, one has an analogue output of 0 to 1 V, the other has 4 to 20 mA. Both have a 2-wire RS-485 interface with Modbus® (RTU) protocol. All the outputs are protected against short-circuits.

SMP series pyranometers have analog outputs that 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. An integrated temperature sensor and polynomial functions provide correction for the temperature sensitivity of the detector. The response time is improved and the output ranges are standardised.

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, and they operate from a wide range of supply voltages.

SMP3 is ideal for solar energy performance monitoring and for the new generation of all-digital automatic weather stations.

The included Smart Sensor Explorer Software allows up to 10 smart radiometers to be connected to a Windows™ computer; for configuration, testing, read-out of settings and parameters and basic data logging function.

Specifications	
Classification to ISO 9060:1990	Second Class
Analogue output • V-version	0 to 1 V
Analogue output range*	-200 to 2000 W/m²
Analogue output • A-version	4 to 20 mA
Analogue output range*	0 to 1600 W/m²
Serial output	RS-485 Modbus®
Serial output range	-400 to 2000 W/m²
Response time (63 %)	< 1.5 s
Response time (95 %)	< 12 s
Spectral range (20 % points)	285 to 3000 nm
Spectral range (50 % points)	300 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 15 W/m² < 5 W/m²
Non-stability (change/year)	< 1 %
Non-linearity (100 to 1000 W/m²)	< 1.5 %
Directional response (up to 80° with 1000 W/m² beam)	< 20 W/m²
Temperature response	< 2 % (-20 °C to +50 °C) < 4 % (-40 °C to +70 °C)
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0° to 90° at 1000 W/m²)	< 1 %
Field of view	180°
Accuracy of bubble level	< 0.2°
Power consumption (at 12 VDC)	V-version: 55 mW A-version: 100 mW
Software, Windows™	Smart Sensor Explorer Software, for configuration, test and data logging
Supply voltage	5 to 30 VDC
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

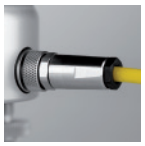
Part number	Instrument
0374900-102	SMP3-V Smart Pyranometer • 0 to 1 V version • 10 m cable
0374900-100	SMP3-V Smart Pyranometer • 0 to 1 V version • no plug, no cable
0374900-202	SMP3-A Smart Pyranometer • 4 to 20 mA version • 10 m cable
0374900-200	SMP3-A Smart Pyranometer • 4 to 20 mA version • no plug, no cable

SMP3 Second Class Albedometer
An ISO Second Class Albedometer can be self-assembled by ordering: 2x SMP3 Pyranometer + 1x Mounting Rod

Part number	Accessories
0338720	Mounting Rod Screw-in 300 mm long x 12 mm ⌀
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a SMP3 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement
Note: SMP3 cannot be used with the Glare Screen Kit	

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

CMP6



CMP6 is an ISO First Class pyranometer. It has a similar detector to CMP3, but has improved performance due to the increased thermal mass and the double glass dome construction. The tilt response and levelling accuracy are also improved. The bubble level is visible through the snap-on white sun shield. The drying cartridge keeps the instrument free of internal condensation and is easily removable.

CMP6 is ideal for cost-effective, good quality, measurements in meteorological and hydrological networks and agriculture. Performance can be further improved by using the CVF4 Ventilation Unit.

A range of mounting accessories is available.

Specifications	
Classification to ISO 9060:1990	First Class
Sensitivity	5 to 20 µV/W/m²
Impedance	20 to 200 Ω
Expected output range (0 to 1500 W/m²)	0 to 30 mV
Maximum operational irradiance	2000 W/m²
Response time (63 %)	< 6 s
Response time (95 %)	< 18 s
Spectral range (20% points)	270 to 3000 nm
Spectral range (50 % points)	285 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 10 W/m² < 4 W/m²
Non-stability (change/year)	< 1 %
Non-linearity (100 to 1000 W/m²)	< 1 %
Directional response (up to 80° with 1000 W/m² beam)	< 15 W/m²
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0° to 90° at 1000 W/m²)	< 1 %
Temperature response	< 4 % (-10 °C to +40 °C)
Field of view	180°
Accuracy of bubble level	< 0.1°
Temperature sensor output	
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

Part number	Instrument
0362900-002	CMP6 Pyranometer • 10 m cable
0362900-000	CMP6 Pyranometer • no plug, no cable
0362900-702	CMP6 Pyranometer • METEON • 10 m cable
0362900-700	CMP6 Pyranometer • METEON • no plug, no cable
0362900-802	CMP6 Pyranometer • AMPBOX • 10 m cable
0362900-800	CMP6 Pyranometer • AMPBOX • no plug, no cable
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 1600 W/m²	

CMP6 First Class Albedometer
A ventilated ISO First Class Albedometer can be self-assembled by ordering: 2x CMP6 Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a CMP6 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Mounts the radiometer at the correct height when used with a CVF4
0305722	Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

SMP6

The SMP6 is a first class pyranometer that combines the sensor technology and housing from the CMP6. The SMP6 has both digital and analogue outputs, low maintenance, extremely robust and reliable and comes with 5 years warranty (*).

The SMP6 has an internal desiccant that will last for at least 10 years. This minimizes maintenance significantly.

The interval for dome cleaning can be extended, and the quality of measurements maximized, by fitting SMP6 with the CVF4 ventilation unit.

The SMP6 has a RS-485 Modbus® RTU interface, amplified analogue output, improved response time and temperature corrected measurement data. The wide and low power supply range from 5 to 30 VDC makes integration in meteorological and solar energy stations easy. The SMP6 is extreme robust and reliable and comes with 5 years warranty

Thanks to standardised output and connections of every SMP6, exchanging instruments for recalibration is easy.

SmartExplorer Windows™ software for data logging, display of data and Modbus® address setting is provided as standard.

Specifications	
Classification to ISO 9060:1990	First Class
Analogue output • V-version	0 to 1 V
Analogue output range*	-200 to 2000 W/m²
Analogue output • A-version	4 to 20 mA
Analogue output range*	0 to 1600 W/m²
Serial output	RS-485 Modbus®
Serial output range	-400 to 2000 W/m²
Response time (63 %)	< 1.5 s
Response time (95 %)	< 12 s
Spectral range (20 % points)	270 to 3000 nm
Spectral range (50 % points)	285 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 10 W/m² < 4 W/m²
Non-stability (change/year)	< 1 %
Non-linearity (100 to 1000 W/m²)	< 1 %
Directional response (up to 80° with 1000 W/m² beam)	< 15 W/m²
Temperature response	< 1.5 % (-20 °C to +50 °C) < 3 % (-40 °C to +70 °C)
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0° to 90° at 1000 W/m²)	< 1 %
Field of view	180°
Accuracy of bubble level	< 0.1°
Power consumption (at 12 VDC)	V-version: 55 mW A-version: 100 mW
Software, Windows™	Smart Sensor Explorer Software, for configuration, test and data logging
Supply voltage	5 to 30 VDC
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

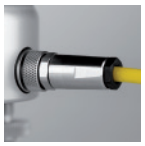
Part number	Instrument
0374920-102	SMP6-V Smart Pyranometer • 0 to 1 V version • 10 m cable
0374920-100	SMP6-V Smart Pyranometer • 0 to 1 V version • no plug, no cable
0374920-202	SMP6-A Smart Pyranometer • 4 to 20 mA version • 10 m cable
0374920-200	SMP6-A Smart Pyranometer • 4 to 20 mA version • no plug, no cable

SMP6 First Class Smart Albedometer
A ventilated ISO First Class Smart Albedometer can be self-assembled by ordering: 2x SMP6 Smart Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit
An unventilated ISO First Class Smart Albedometer can be self-assembled by ordering: 2x SMP6 Smart Pyranometer + 1x CMF1 Mounting Fixture + 1x Glare Screen Kit

Part number	Accessories
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a SMP6 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Mounts the radiometer at the correct height when used with a CVF4
0305722	Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

CMP10



CMP10 is the secondary standard pyranometer with the best price-quality-performance ratio on the market. Based on the established CMP11 technology, and with the same performance, CMP10 extends this quality to applications where maintenance is difficult and/or forms a major part of the cost of ownership.

The CMP10 has internal desiccant that will last for at least 10 years if the housing is not opened. This minimizes maintenance significantly.

The interval for dome cleaning can be extended, and the quality of measurements maximized, by fitting CMP10 with the CVF4 ventilation unit.

Kipp & Zonen provides every CMP10 with a 5-year warranty as standard. This warranty applies provided that the CMP10 is used only under atmospheric conditions, that the housing is not opened and that the Kipp & Zonen cable and connector is correctly fitted.

Specifications	
Classification to ISO 9060:1990	Secondary Standard
Sensitivity	7 to 14 µV/W/m²
Impedance	10 to 100 Ω
Expected output range (0 to 1500 W/m²)	0 to 20 mV
Maximum operational irradiance	4000 W/m²
Response time (63 %)	< 1.7 s
Response time (95 %)	< 5 s
Spectral range (20% points)	270 to 3000 nm
Spectral range (50 % points)	285 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 7 W/m² < 2 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (100 to 1000 W/m²)	< 0.2 %
Directional response (up to 80° with 1000 W/m² beam)	< 10 W/m²
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0° to 90° at 1000 W/m²)	< 0.2 %
Temperature response	< 1 % (-10 °C to +40 °C)
Field of view	180°
Accuracy of bubble level	< 0.1°
Temperature sensor output	
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

Part number	Instrument
0379900-002	CMP10 Pyranometer • 10 m cable
0379900-000	CMP10 Pyranometer • no plug, no cable
0379900-702	CMP10 Pyranometer • METEON • 10 m cable
0379900-700	CMP10 Pyranometer • METEON • no plug, no cable
0379900-802	CMP10 Pyranometer • AMPBOX • 10 m cable
0379900-800	CMP10 Pyranometer • AMPBOX • no plug, no cable
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 1600 W/m²	

CMP10 Secondary Standard Albedometer
A ventilated ISO Secondary Standard Albedometer can be self-assembled by ordering: 2x CMP10 Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit

Part number	Accessories
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a CMP10 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Mounts the radiometer at the correct height when used with a CVF4
0305722	Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

SMP10

SMP10 is a ISO Secondary Standard pyranometer that combines the sensor technology from the CMP11, the Smart interface from the SMP11 and the low maintenance from the CMP10.

The SMP10 has internal desiccant that will last for at least 10 years if the housing is not opened. This minimizes maintenance significantly.

The interval for dome cleaning can be extended, and the quality of measurements maximized, by fitting SMP10 with the CVF4 ventilation unit.

The SMP10 has Modbus® interface, amplified analogue output, improved response time and temperature corrected measurement data. The wide and low power supply range from 5 to 30 VDC makes integration in meteorological and solar energy stations easy. The SMP10 is protected against over voltage, reversed polarity and short circuiting.

Thanks to the identical sensitivity and connections of every SMP10, exchanging instruments for recalibration is easy.

The included Smart Sensor Explorer software allows up to 10 smart radiometers to be connected to a Windows™ computer; for configuration, testing, read-out of settings and parameters and basic data logging functions.

Specifications	
Classification to ISO 9060:1990	Secondary Standard
Analogue output • V-version	0 to 1 V
Analogue output range*	-200 to 2000 W/m²
Analogue output • A-version	4 to 20 mA
Analogue output range*	0 to 1600 W/m²
Serial output	RS-485 Modbus®
Serial output range	-400 to 4000 W/m²
Response time (63 %)	< 0.7 s
Response time (95 %)	< 2 s
Spectral range (20 % points)	270 to 3000 nm
Spectral range (50 % points)	285 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 7 W/m² < 2 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (100 to 1000 W/m²)	< 0.2 %
Directional response (up to 80° with 1000 W/m² beam)	< 10 W/m²
Temperature response	< 1 % (-20 °C to +50 °C) < 2 % (-40 °C to +70 °C)
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0° to 90° at 1000 W/m²)	< 0.2 %
Field of view	180°
Accuracy of bubble level	< 0.1°
Power consumption (at 12 VDC)	V-version: 55 mW A-version: 100 mW
Software, Windows™	Smart Sensor Explorer Software, for configuration, test and data logging
Supply voltage	5 to 30 VDC
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

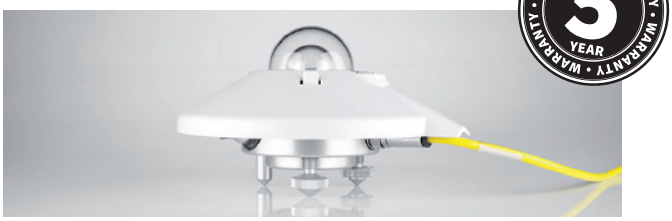
Part number	Instrument
0374905-102	SMP10-V Smart Pyranometer • 0 to 1 V version • 10 m cable
0374905-100	SMP10-V Smart Pyranometer • 0 to 1 V version • no plug, no cable
0374905-202	SMP10-A Smart Pyranometer • 4 to 20 mA version • 10 m cable
0374905-200	SMP10-A Smart Pyranometer • 4 to 20 mA version • no plug, no cable

SMP10 Secondary Standard Smart Albedometer
A ventilated ISO Secondary Standard Smart Albedometer can be self-assembled by ordering: 2x SMP10 Smart Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit
An unventilated ISO Secondary Standard Smart Albedometer can be self-assembled by ordering: 2x SMP10 Smart Pyranometer + 1x CMF1 Mounting Fixture + 1x Glare Screen Kit

Part number	Accessories
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a SMP10 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Mounts the radiometer at the correct height when used with a CVF4
0305722	Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

CMP11



CMP11 is an ISO Secondary Standard pyranometer. Compared to the CMP6 the detector design is different with faster response, better linearity, and has temperature compensation for greater accuracy with temperature changes. The tilt response and levelling accuracy are also improved.

CMP11 is a step up in performance from CMP6 and is particularly suitable for upgrading meteorological networks. The fast response time of 1.7 seconds (63 %) meets the requirements for solar energy research and development applications and materials testing.

CMP11 is ideal for use in sun tracker based solar monitoring stations.

Specifications	
Classification to ISO 9060:1990	Secondary Standard
Sensitivity	7 to 14 µV/W/m²
Impedance	10 to 100 Ω
Expected output range (0 to 1500 W/m²)	0 to 20 mV
Maximum operational irradiance	4000 W/m²
Response time (63 %)	< 1.7 s
Response time (95 %)	< 5 s
Spectral range (20% points)	270 to 3000 nm
Spectral range (50 % points)	285 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 7 W/m² < 2 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (100 to 1000 W/m²)	< 0.2 %
Directional response (up to 80° with 1000 W/m² beam)	< 10 W/m²
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0° to 90° at 1000 W/m²)	< 0.2 %
Temperature response	< 1 % (-10 °C to +40 °C)
Field of view	180°
Accuracy of bubble level	< 0.1°
Temperature sensor output	
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

Part number	Instrument
0362910-002	CMP11 Pyranometer • 10 m cable
0362910-000	CMP11 Pyranometer • no plug, no cable
0362910-702	CMP11 Pyranometer • METEON • 10 m cable
0362910-700	CMP11 Pyranometer • METEON • no plug, no cable
0362910-802	CMP11 Pyranometer • AMPBOX • 10 m cable
0362910-800	CMP11 Pyranometer • AMPBOX • no plug, no cable
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 1600 W/m²	

CMP11 Secondary Standard Albedometer
A ventilated ISO Secondary Standard Albedometer can be self-assembled by ordering: 2x CMP11 Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a CMP11 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement
0305722	Mounts the radiometer at the correct height when used with a CVF4 Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

SMP11

SMP11 has the same housing and detector design as the passive CMP11 model and is an ISO Secondary Standard pyranometer. Like SMP3 and SMP10, the SMP11 is equipped with a smart interface and there are two versions, One has an analogue output of 0 to 1 V, the other has 4 to 20 mA. Both have a 2-wire RS-485 interface with Modbus® (RTU) protocol.

SMP11 has all the smart interface advantages and features of the SMP3 but a significantly higher level of performance, and also has a faster response than the CMP11. SMP series pyranometers can operate from a power supply in the range from 5 to 30 VDC and have both reverse polarity and over-voltage protection.

Through the Modbus® interface the user can access the pyranometer type and serial number, instrument settings, calibration history, status information, and more. Pyranometers can be assigned individual addresses and 'daisy-chained' together for use in site networks.

SMP11 is the best choice for site prospecting, technology research and high quality solar radiation monitoring in renewable energy applications. It is also particularly suitable for upgrading meteorological networks and for use in sun tracker based solar monitoring stations.

The included Smart Sensor Explorer software allows up to 10 smart radiometers to be connected to a Windows™ computer; for configuration, testing, read-out of settings and parameters and basic data logging functions.

Specifications	
Classification to ISO 9060:1990	Secondary Standard
Analogue output • V-version	0 to 1 V
Analogue output range*	-200 to 2000 W/m²
Analogue output • A-version	4 to 20 mA
Analogue output range*	0 to 1600 W/m²
Serial output	RS-485 Modbus®
Serial output range	-400 to 4000 W/m²
Response time (63 %)	< 0.7 s
Response time (95 %)	< 2 s
Spectral range (20 % points)	270 to 3000 nm
Spectral range (50 % points)	285 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 7 W/m² < 2 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (100 to 1000 W/m²)	< 0.2 %
Directional response (up to 80° with 1000 W/m² beam)	< 10 W/m²
Temperature response	< 1 % (-20 °C to +50 °C) < 2 % (-40 °C to +70 °C)
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0° to 90° at 1000 W/m²)	< 0.2 %
Field of view	180°
Accuracy of bubble level	< 0.1°
Power consumption (at 12 VDC)	V-version: 55 mW A-version: 100 mW
Software, Windows™	Smart Sensor Explorer Software, for configuration, test and data logging
Supply voltage	5 to 30 VDC
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

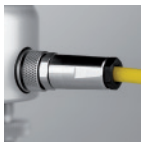
Part number	Instrument
0374910-102	SMP11-V Smart Pyranometer • 0 to 1 V version • 10 m cable
0374910-100	SMP11-V Smart Pyranometer • 0 to 1 V version • no plug, no cable
0374910-202	SMP11-A Smart Pyranometer • 4 to 20 mA version • 10 m cable
0374910-200	SMP11-A Smart Pyranometer • 4 to 20 mA version • no plug, no cable

SMP11 Secondary Standard Smart Albedometer
A ventilated ISO Secondary Standard Smart Albedometer can be self-assembled by ordering: 2x SMP11 Smart Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit
An unventilated ISO Secondary Standard Smart Albedometer can be self-assembled by ordering: 2x SMP11 Smart Pyranometer + 1x CMF1 Mounting Fixture + 1x Glare Screen Kit

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a SMP11 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Mounts the radiometer at the correct height when used with a CVF4
0305722	Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

CMP21



CMP21 is a research grade instrument that exceeds the requirements for an ISO Secondary Standard pyranometer. It is similar to CMP11 but has individually optimised temperature compensation. A standard 10 kΩ thermistor sensor is fitted to monitor the housing temperature; a Pt-100 thermocouple sensor is optional.

Each instrument is supplied with its own temperature response, from -20 °C to +50 °C in 8 steps of 10 °C, and its directional (cosine) response data.

CMP21 is the choice for scientific use and in top level solar radiation monitoring networks such as the Baseline Surface Radiation Network (BSRN) of the World Meteorological Organisation. The excellent temperature response makes CMP21 particularly suitable for reference measurements in extreme climates, from deserts to the Antarctic.

Specifications	
Classification to ISO 9060:1990	Secondary Standard
Sensitivity	7 to 14 µV/W/m²
Impedance	10 to 100 Ω
Expected output range (0 to 1500 W/m²)	0 to 20 mV
Maximum operational irradiance	4000 W/m²
Response time (63 %)	< 1.7 s
Response time (95 %)	< 5 s
Spectral range (20% points)	270 to 3000 nm
Spectral range (50 % points)	285 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 7 W/m² < 2 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (100 to 1000 W/m²)	< 0.2 %
Directional response (up to 80° with 1000 W/m² beam)	< 10 W/m²
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0° to 90° at 1000 W/m²)	< 0.2 %
Temperature response	< 1 % (-20 °C to +50 °C)
Field of view	180°
Accuracy of bubble level	< 0.1°
Temperature sensor output	10 k Thermistor (optional Pt-100)
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

Part number	Instrument
0362920-012	CMP21 Pyranometer • 10 K • 10 m cable
0362920-010	CMP21 Pyranometer • 10 K • no plug, no cable
0362920-022	CMP21 Pyranometer • Pt-100 • 10 m cable
0362920-020	CMP21 Pyranometer • Pt-100 • no plug, no cable
0362920-712	CMP21 Pyranometer • METEON • 10 K • 10 m cable
0362920-710	CMP21 Pyranometer • METEON • 10 K • no plug, no cable
0362920-812	CMP21 Pyranometer • AMPBOX • 10 K • 10 m cable
0362920-810	CMP21 Pyranometer • AMPBOX • 10 K • no plug, no cable
0362920-822	CMP21 Pyranometer • AMPBOX • Pt-100 • 10 m cable
0362920-820	CMP21 Pyranometer • AMPBOX • Pt-100 • no plug, no cable
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 1600 W/m²	

CMP21 Scientific Secondary Standard Albedometer
A ventilated ISO Secondary Standard Albedometer can be self-assembled by ordering: 2x CMP21 Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit
An unventilated ISO Secondary Standard Albedometer can be self-assembled by ordering: 2x CMP21 Pyranometer + 1x CMF1 Mounting Fixture + 1x Glare Screen Kit

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
0999920-3	Extended Temperature Test for CMP21 Temperature response from -40 °C to +50 °C in 10 steps of 10 °C
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a CMP21 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Mounts the radiometer at the correct height when used with a CVF4
0305722	Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

SMP21

The SMP21 is a Secondary Standard pyranometer that combines the sensor technology from the CMP21, has the RS-485 Modbus® interface, analogue output, low maintenance and 5 year warranty.

The SMP21 has an internal desiccant that will last for at least 10 years. This minimizes maintenance significantly.

The interval for dome cleaning can be extended, and the quality of measurements maximized, by fitting SMP21 with the CVF4 ventilation unit.

The SMP21 has Modbus® RTU interface, amplified analogue output, improved response time and individual temperature corrected measurement data. The SMP21 is supplied with individual measured cosine response data. The wide and low power supply range from 5 to 30 VDC makes integration in meteorological and solar energy stations easy. The SMP21 is protected against over voltage, reversed polarity and short circuiting.

Thanks to standardised output and connections of every SMP21, exchanging instruments for recalibration is easy.

SmartExplorer Windows™ software for data logging, display of data and Modbus® address setting is provided as standard.

Specifications	
Classification to ISO 9060:1990	Secondary Standard
Analogue output • V-version	0 to 1 V
Analogue output range*	-200 to 2000 W/m²
Analogue output • A-version	4 to 20 mA
Analogue output range*	0 to 1600 W/m²
Serial output	RS-485 Modbus®
Serial output range	-400 to 4000 W/m²
Response time (63 %)	< 0.7 s
Response time (95 %)	< 2 s
Spectral range (20 % points)	270 to 3000 nm
Spectral range (50 % points)	285 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 7 W/m² < 2 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (100 to 1000 W/m²)	< 0.2 %
Directional response (up to 80° with 1000 W/m² beam)	< 10 W/m²
Temperature response	< 0.3% (-20 °C to +50 °C) < 0.3% (-40 °C to +70 °C)
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0° to 90° at 1000 W/m²)	< 0.2 %
Field of view	180°
Accuracy of bubble level	< 0.1°
Power consumption (at 12 VDC)	V-version: 55 mW A-version: 100 mW
Software, Windows™	Smart Sensor Explorer Software, for configuration, test and data logging
Supply voltage	5 to 30 VDC
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

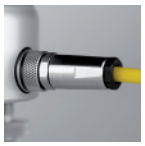
Part number	Instrument
0374930-102	SMP21-V Smart Pyranometer • 0 to 1 V version • 10 m cable
0374930-100	SMP21-V Smart Pyranometer • 0 to 1 V version • no plug, no cable
0374930-202	SMP21-A Smart Pyranometer • 4 to 20 mA version • 10 m cable
0374930-200	SMP21-A Smart Pyranometer • 4 to 20 mA version • no plug, no cable

SMP22 Scientific Secondary Standard Albedometer
A ventilated ISO Secondary Standard Smart Albedometer can be self-assembled by ordering: 2x SMP22 Smart Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit
An unventilated ISO Secondary Standard Smart Albedometer can be self-assembled by ordering: 2x SMP22 Smart Pyranometer + 1x CMF1 Mounting Fixture + 1x Glare Screen Kit

Part number	Accessories
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a CMP21 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Mounts the radiometer at the correct height when used with a CVF4
0305722	Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

CMP22



CMP22 is our highest quality pyranometer and it easily exceeds the requirements for an ISO Secondary Standard instrument. It has all the features of CMP21 but uses very high quality quartz domes for a wider spectral range, improved directional response, and reduced thermal offsets. Because of the high optical quality of these domes the directional response is reduced below 5 W/m² up to 80° solar zenith angle.

A standard 10 kΩ thermistor sensor is fitted to monitor the housing temperature; a Pt-100 thermocouple sensor is optional.

Each instrument is supplied with its own temperature response, from -20 °C to +50 °C in 8 steps of 10 °C, and its directional (cosine) response data.

Kipp & Zonen is confident that CMP22 is the best pyranometer currently available.

Specifications	
Classification to ISO 9060:1990	Secondary Standard
Sensitivity	7 to 14 µV/W/m²
Impedance	10 to 100 Ω
Expected output range (0 to 1500 W/m²)	0 to 20 mV
Maximum operational irradiance	4000 W/m²
Response time (63 %)	< 1.7 s
Response time (95 %)	< 5 s
Spectral range (20% points)	210 to 3600 nm
Spectral range (50 % points)	250 to 3500 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 3 W/m² < 1 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (100 to 1000 W/m²)	< 0.2 %
Directional response (up to 80° with 1000 W/m² beam)	< 5 W/m²
Spectral selectivity (350 to 1500 nm)	< 2 %
Tilt response (0° to 90° at 1000 W/m²)	< 0.2 %
Temperature response	< 0.5 % (-20 °C to +50 °C)
Field of view	180°
Accuracy of bubble level	< 0.1°
Temperature sensor output	10 k Thermistor (optional Pt-100)
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

Part number	Instrument
0362930-012	CMP22 Pyranometer • 10 K • 10 m cable
0362930-010	CMP22 Pyranometer • 10 K • no plug, no cable
0362930-022	CMP22 Pyranometer • Pt-100 • 10 m cable
0362930-020	CMP22 Pyranometer • Pt-100 • no plug, no cable
0362930-712	CMP22 Pyranometer • METEON • 10 K • 10 m cable
0362930-710	CMP22 Pyranometer • METEON • 10 K • no plug, no cable
0362930-812	CMP22 Pyranometer • AMPBOX • 10 K • 10 m cable
0362930-810	CMP22 Pyranometer • AMPBOX • 10 K • no plug, no cable
0362930-822	CMP22 Pyranometer • AMPBOX • Pt-100 • 10 m cable
0362930-820	CMP22 Pyranometer • AMPBOX • Pt-100 • no plug, no cable
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 1600 W/m²	

CMP22 Scientific Secondary Standard Albedometer
A ventilated ISO Secondary Standard Albedometer can be self-assembled by ordering: 2x CMP22 Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit
An unventilated ISO Secondary Standard Albedometer can be self-assembled by ordering: 2x CMP22 Pyranometer + 1x CMF1 Mounting Fixture + 1x Glare Screen Kit

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
0999920-3	Extended Temperature Test for CMP22 Temperature response from -40 °C to +50 °C in 10 steps of 10 °C
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a CMP22 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Mounts the radiometer at the correct height when used with a CVF4
0305722	Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

SMP22

The SMP22 is a Secondary Standard pyranometer that combines the new smart interface with quartz domes and sensor technology from the CMP22. Which has a proven track record of decades, making it the most accurate and reliable pyranometer in the world. The SMP22 has the widest spectral range, improved directional response, and reduced thermal offsets. Because of the highest optical quality domes the directional error is reduced below 5 W/m². The SMP22 comes standard with RS-485 Modbus® interface and 5 year warranty.

The SMP22 has internal desiccant that will last for at least 10 years. This minimizes maintenance significantly.

The interval for dome cleaning can be extended, and the quality of measurements maximized, by fitting SMP22 with the CVF4 ventilation unit.

The SMP22 has a digital interface, amplified analogue output, improved response time and individual temperature corrected measurement data. The SMP22 is supplied with individual measured cosine response data. The wide and low power supply range from 5 to 30 VDC makes integration in meteorological and solar energy stations easy. The SMP22 is extreme robust and comes with 5 years warranty.

Thanks to standardised output and connections of every SMP22, exchanging instruments for recalibration is easy.

SmartExplorer Windows™ software for data logging, display of data and Modbus® address setting is provided as standard.

Specifications	
Classification to ISO 9060:1990	Secondary Standard
Analogue output • V-version	0 to 1 V
Analogue output range*	-200 to 2000 W/m²
Analogue output • A-version	4 to 20 mA
Analogue output range*	0 to 1600 W/m²
Serial output	RS-485 Modbus®
Serial output range	-400 to 4000 W/m²
Response time (63 %)	< 0.7 s
Response time (95 %)	< 2 s
Spectral range (20 % points)	210 to 3600 nm
Spectral range (50 % points)	250 to 3500 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 3 W/m² < 1 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (100 to 1000 W/m²)	< 0.2 %
Directional response (up to 80 ° with 1000 W/m² beam)	< 5 W/m²
Temperature response	< 0.3% (-20 °C to +50 °C) < 0.3% (-40 °C to +70 °C)
Spectral selectivity (350 to 1500 nm)	< 2 %
Tilt response (0 ° to 90 ° at 1000 W/m²)	< 0.2 %
Field of view	180 °
Accuracy of bubble level	< 0.1 °
Power consumption (at 12 VDC)	V-version: 55 mW A-version: 100 mW
Software, Windows™	Smart Sensor Explorer Software, for configuration, test and data logging
Supply voltage	5 to 30 VDC
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

Part number	Instrument
0374940-102	SMP22-V Smart Pyranometer • 0 to 1 V version • 10 m cable
0374940-100	SMP22-V Smart Pyranometer • 0 to 1 V version • no plug, no cable
0374940-202	SMP22-A Smart Pyranometer • 4 to 20 mA version • 10 m cable
0374940-200	SMP22-A Smart Pyranometer • 4 to 20 mA version • no plug, no cable

SMP22 Scientific Secondary Standard Albedometer
A ventilated ISO Secondary Standard Smart Albedometer can be self-assembled by ordering: 2x SMP22 Smart Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit
An unventilated ISO Secondary Standard Smart Albedometer can be self-assembled by ordering: 2x SMP22 Smart Pyranometer + 1x CMF1 Mounting Fixture + 1x Glare Screen Kit

Part number	Accessories
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0367718	Adjustable Tilt Radiometer Mounting Kit For a CMP22 pyranometer to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Mounts the radiometer at the correct height when used with a CVF4
0305722	Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

Pyrgeometers

For the precise measurement of far infrared radiation

Radiation from the sun is mainly in the 'short-wave' range from 300 to 4000 nm (4 µm) that includes the ultraviolet, visible and near-infrared parts of the spectrum. A proportion of this radiation is absorbed by clouds, aerosols and molecules in the atmosphere which warm up and radiate 'long-wave' radiation. This is far infrared thermal energy (FIR) at wavelengths from 4.5 µm to beyond 40 µm.

Both the short-wave and long-wave radiation reach the Earth, where some is reflected and the remainder warms up the surface. The Earth radiates long-wave thermal energy back to the sky. Short-wave radiation is measured by a pyranometer and long-wave radiation by a pyrgeometer.

A pyrgeometer provides a voltage that is proportional to the radiation exchange between the instrument and the sky (or ground) in its field of view. The detector signal output can be positive or negative. In order to calculate the incoming or outgoing FIR it is necessary to know the temperature of the instrument housing close to the detector and the data must be recorded simultaneously with the detector signal.

Kipp & Zonen CGR pyrgeometers are installed around the world for meteorology, hydrology, climate research, and agriculture; wherever accurate measurements of the radiation energy balance are required. They comply with the requirements of the World Meteorological Organisation and are fully traceable to the World Infrared Standard Group (WISG) in Davos, Switzerland, where the CGR4 forms part of the Group.

CGR3

CGR3 is the partner to the CMP3 and CMP6 pyranometers. The flat silicon window transmits infrared radiation and an internal thin film coating blocks short-wave solar radiation from reaching the broadband thermopile detector. The field of view is 150 °. The small size and sealed construction make this instrument the ideal choice for horticulture and agriculture. A screw-in mounting rod is available for easy installation.

The waterproof connector has gold-plated contacts and is fitted with 10 m of high quality signal cable as standard. A 10 K thermistor internal temperature sensor is fitted; a Pt-100 sensor is optional. There is an integrated bubble level and a white sun shield prevents the body heating up.

Two CGR3's can easily be mounted back-to-back and fitted with the accessory screw-in mounting rod to make a low cost net pyrgeometer.

Specifications	
Spectral range (overall)	4.4 to 50 µm
Spectral range (50 % points)	4.5 to 42 µm
Sensitivity	5 to 15 µV/W/m²
Impedance	20 to 200 Ω
Expected output range (-200 to 200 W/m²)	-3 to 3 mV
Operational irradiance (net)	-250 to 250 W/m²
Response time (63 %) (95 %)	< 6 s < 18 s
Zero offset (b) temperature change (5 K/h)	< 5 W/m²
Window heating offset (with 1000 W/m² direct solar radiation)	< 15 W/m²
Non-stability (change/year)	< 1 %
Non-linearity (-250 to 250 W/m²)	< 1 %
Spectral selectivity (8 to 14 µm)	< 5 %
Temperature response	< 5 % (-10 °C to +40 °C)
Tilt response (0° to 90° at ±250 W/m²)	< 3 %
Field of view	150 °
Accuracy of bubble level	< 0.2 °
Temperature sensor output	10 K Thermistor (optional Pt-100)
Detector type	Thermopile
Operational temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

Part number	Instrument
0359920-012	CGR3 Pyrgeometer • 10 K • 10 m cable
0359920-010	CGR3 Pyrgeometer • 10 K • no plug, no cable
0359920-022	CGR3 Pyrgeometer • Pt-100 • 10 m cable
0359920-020	CGR3 Pyrgeometer • Pt-100 • no plug, no cable
0359920-812	CGR3 Pyrgeometer • AMPBOX • 10 K • 10 m cable
0359920-810	CGR3 Pyrgeometer • AMPBOX • 10 K • no plug, no cable
0359920-822	CGR3 Pyrgeometer • AMPBOX • Pt-100 • 10 m cable
0359920-820	CGR3 Pyrgeometer • AMPBOX • Pt-100 • no plug, no cable
Note: AMPBOX is adjusted with offset zero for negative values; 4 mA = -600 W/m², 16 mA = 0 W/m², 20 mA = +200 W/m²	

CGR3 Net Pyrgeometer
A Net Pyrgeometer can be self-assembled by ordering: 2x CGR3 Pyrgeometer + 1x Mounting Rod
Note: CGR3 Net Pyrgeometer can be used with the AMPBOX but it has two individual outputs, so 2x AMPBOX are required

Part number	Accessories
0999915-1	Outdoor Calibration under clear skies For increased accuracy, instead of standard laboratory calibration
0338720	Mounting Rod Screw-in 300 mm long x 12 mm ⌀
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device minimises window heating by the direct sun Correction factors for latitude of location supplied
Note: CGR3 cannot be used with the Glare Screen Kit	

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

SGR3

The SGR3 is a pyrgeometer, designed for meteorological measurements of downward atmospheric long wave radiation. The SGR3 uses a specially designed silicon window. On the inside a solar-blind filter blocks solar radiation. The SGR3 data represents the radiation exchange within the whole hemisphere. This is because the reference SGR3 is calibrated outdoors with respect to a reference CGR4, which has a 180 degrees field of view.

The SGR3 has Modbus® interface, amplified analogue output, improved response time and temperature corrected measurement data. The long wave net- and downward radiation are directly available over Modbus®. The wide and low power supply range from 5 to 30 VDC makes integration in meteorological and solar energy stations easy. The SGR3 is extremely robust and comes with 5 years warranty (*).

The base of the instruments contains the mounting holes, a spirit level and levelling feet for exact levelling. For ease of mounting, exchange and recalibration the instruments have a waterproof connector. The improved temperature dependency and directional response make these instruments the ideal choice for meteorological and agricultural applications.

Thanks to standardised output and connections of every SGR3, exchanging instruments for recalibration is easy.

SmartExplorer Windows™ software for data logging, display of data and Modbus® address setting is provided as standard.

Specifications	
Analogue output • V-version	0 to 1 V
Analogue output range (1)	0 to 1000 W/m²
Analogue output • A-version	4 to 20 mA
Analogue output range (1)	0 to 1000 W/m²
Serial output	RS-485 Modbus®
Serial output range (1)	0 to 1000 W/m²
Response time (63 %)	< 6 s
Response time (95 %)	< 18 s
Spectral range (50 % points)	4500 to 42000 nm
Zero offsets (unventilated) (b) temperature change (5 K/h)	< 5 W/m²
Non-stability (change/year)	< 1 %
Non-linearity (-250 to 250 W/m²)	< 1 %
Window heating offset (with 1000 W/m² direct solar radiation)	< 15 W/m²
Temperature response	< 5 % (-20 °C to +50 °C) < 5 % (-40 °C to +70 °C)
Spectral selectivity (8 to 14 µm)	< 5 %
Tilt response (0° to 90° at 1000 W/m²)	< 3 %
Field of view	150 °
Accuracy of bubble level	< 0.2 °
Power consumption (at 12 VDC)	V-version: 55 mW A-version: 100 mW
Software, Windows™	Smart Sensor Explorer Software, for configuration, test and data logging
Supply voltage	5 to 30 VDC
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
Ingress Protection (IP) rating	67

(1) Longwave down radiation

Part number	Instrument
0376910-102	SGR3-V Smart Pyrgeometer • 0 to 1 V version • 10 m cable
0376910-100	SGR3-V Smart Pyrgeometer • 0 to 1 V version • no plug, no cable
0376910-202	SGR3-A Smart Pyrgeometer • 4 to 20 mA version • 10 m cable
0376910-100	SGR3-A Smart Pyrgeometer • 4 to 20 mA version • no plug, no cable

SGR3 Smart Net Pyrgeometer
A Smart Net Pyrgeometer can be self-assembled by ordering: 2x SGR3 Smart Pyrgeometer + 1x Mounting Rod

Part number	Accessories
0999915-1	Outdoor Calibration under clear skies For increased accuracy, instead of standard laboratory calibration
0338720	Mounting Rod Screw-in 300 mm long x 12 mm ⌀
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device minimises window heating by the direct sun Correction factors for latitude of location supplied
Note: CGR3 cannot be used with the Glare Screen Kit	

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

CGR4

CGR4 is the best pyrgeometer currently available and is the choice for scientific use and in top level solar radiation monitoring networks such as the Baseline Surface Radiation Network (BSRN) of the World Meteorological Organisation.

CGR4 has a specially designed silicon meniscus dome that provides a 180° field of view and has a hard-carbon coating on the outside to smooth the spectral response and provide extra surface protection. Each instrument is supplied with its own temperature response data from -20 °C to +50 °C in 8 steps of 10 °C. A 10 K thermistor internal temperature sensor is fitted; a Pt-100 sensor is optional.

Pyrgeometers use infrared window materials that absorb a large part of the short-wave solar radiation and creates an offset in the readings. It is normally necessary to shade pyrgeometers from direct solar radiation to minimise this heating effect. However, the unique design of CGR4 reduces the dome heating offset to a negligible level (particularly when ventilated), eliminating the need for dome temperature measurements or dome shading.

Specifications	
Spectral range (overall)	4.4 to 50 µm
Spectral range (50 % points)	4.5 to 42 µm
Sensitivity	5 to 15 µV/W/m²
Impedance	20 to 200 Ω
Expected output range (-200 to 200 W/m²)	-3 to 3 mV
Operational irradiance (net)	-250 to 250 W/m²
Response time (63 %) (95 %)	< 6 s < 18 s
Zero offset (b) temperature change (5 K/h)	< 2 W/m²
Window heating offset (with 1000 W/m² direct solar radiation)	< 4 W/m²
Non-stability (change/year)	< 1 %
Non-linearity (-250 to 250 W/m²)	< 1 %
Spectral selectivity (8 to 14 µm)	< 5 %
Temperature response	< 1 % (-20 °C to +50 °C)
Tilt response (0° to 90° at ±250 W/m²)	< 1 %
Field of view	180°
Accuracy of bubble level	< 0.1°
Temperature sensor output	10 K Thermistor (optional Pt-100)
Detector type	Thermopile
Operational temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

Part number	Instrument
0363900-012	CGR4 Pyrgeometer • 10 K • 10 m cable
0363900-010	CGR4 Pyrgeometer • 10 K • no plug, no cable
0363900-022	CGR4 Pyrgeometer • Pt-100 • 10 m cable
0363900-020	CGR4 Pyrgeometer • Pt-100 • no plug, no cable
0363900-812	CGR4 Pyrgeometer • AMPBOX • 10 K • 10 m cable
0363900-810	CGR4 Pyrgeometer • AMPBOX • 10 K • no plug, no cable
0363900-822	CGR4 Pyrgeometer • AMPBOX • Pt-100 • 10 m cable
0363900-820	CGR4 Pyrgeometer • AMPBOX • Pt-100 • no plug, no cable

Note: AMPBOX is adjusted with offset zero for negative values;
4 mA = -600 W/m², 16 mA = 0 W/m², 20 mA = +200 W/m²

CGR4 Net Pyrgeometer
A ventilated Net Pyrgeometer can be self-assembled by ordering: 2x CGR4 Pyrgeometer + 1x CMF4 Mountinf Fixture + 2x CVF4 Ventilation Unit
An unventilated Net Pyrgeometer can be self-assembled by ordering: 2x CGR4 Pyrgeometer + 1x CMF1 Mountinf Fixture + 1x GlareScreen Kit
Note: CGR4 Net Pyrgeometer can be used with the AMPBOX but it has two individual outputs, so 2x AMPBOX are required

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
0999920-3	Extended Temperature Test for CGR4 Temperature response from -40 °C to +50 °C in 10 steps of 10 °C
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0305722	Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings
Note: It is not necessary to use shading with the CGR4. The effect of direct solar heating is very small and insignificant when the CVF4 is used	

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

SGR4

SGR4 pyrgeometer is an instrument for the highest quality scientific measurements. The specially designed meniscus dome provides a 180° field of view with negligible directional response error. A hard-carbon coating on the outside of the dome smoothes the spectral response and provides extra protection to the silicon surface. The excellent thermal stability of the dome construction and coupling to the instrument body eliminates the need for dome temperature measurements or dome shading. SGR4 can be fitted with the CVF4 ventilation unit to further improve its performance.

The SGR4 has an internal desiccant that will last for at least 10 years. This minimizes maintenance significantly.

The interval for dome cleaning can be extended, and the quality of measurements maximized, by fitting SGR4 with the CVF4 ventilation unit.

The SGR4 has Modbus® interface, amplified analogue output, improved response time and temperature corrected measurement data. The long-wave net- and downward radiation are directly available over Modbus®. The wide and low power supply range from 5 to 30 VDC makes integration in meteorological and solar energy stations easy. The SGR4 is extremely robust and comes with 5 years warranty (*).

Thanks to standardised output and connections of every SGR4, exchanging instruments for recalibration is easy.

SmartExplorer Windows™ software for data logging, display of data and Modbus® address setting is provided as standard.

Specifications	
Analogue output • V-version	0 to 1 V
Analogue output range (1)	0 to 1000 W/m²
Analogue output • A-version	4 to 20 mA
Analogue output range (1)	0 to 1000 W/m²
Serial output	RS-485 Modbus®
Serial output range (1)	0 to 1000 W/m²
Response time (63 %)	< 6 s
Response time (95 %)	< 18 s
Spectral range (50 % points)	4500 to 42000 nm
Zero offsets (unventilated) (b) temperature change (5 K/h)	< 2 W/m²
Non-stability (change/year)	< 1 %
Non-linearity (-250 to 250 W/m²)	< 1 %
Window heating offset (with 1000 W/m² direct solar radiation)	< 4 W/m²
Temperature response	< 1 % (-20 °C to +50 °C) < 1 % (-40 °C to +70 °C)
Spectral selectivity (8 to 14 µm)	< 5 %
Tilt response (0° to 90° at ±250 W/m²)	< 1 %
Field of view	180°
Accuracy of bubble level	< 0.1°
Power consumption (at 12 VDC)	V-version: 55 mW A-version: 100 mW
Software, Windows™	Smart Sensor Explorer Software, for configuration, test and data logging
Supply voltage	5 to 30 VDC
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
Ingress Protection (IP) rating	67

(1) Longwave down radiation

Part number	Instrument
0376900-102	SGR4-V Smart Pyrgeometer • 0 to 1 V version • 10 m cable
0376900-100	SGR4-V Smart Pyrgeometer • 0 to 1 V version • no plug, no cable
0376900-202	SGR4-A Smart Pyrgeometer • 4 to 20 mA version • 10 m cable
0376900-200	SGR4-A Smart Pyrgeometer • 4 to 20 mA version • no plug, no cable

SGR4 Smart Net Pyrgeometer
A ventilated Smart Net Pyrgeometer can be self-assembled by ordering: 2x SGR4 Smart Pyrgeometer + 1x CMF4 Mountinf Fixture + 2x CVF4 Ventilation Unit
An unventilated Smart Net Pyrgeometer can be self-assembled by ordering: 2x SGR4 Smart Pyrgeometer + 1x CMF1 Mountinf Fixture + 1x GlareScreen Kit

Part number	Accessories
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ⌀
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0305722	Glare Screen Kit Sun protection screen for downward facing radiometers, with fixings

Note: It is not necessary to use shading with the SGR4. The effect of direct solar heating is very small and insignificant when the CVF4 is used

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

Pyrheliometers

For unattended direct normal incidence solar radiation measurement

Solar rays travelling through our atmosphere are absorbed and scattered, resulting in different components of solar radiation reaching the Earth's surface. The direct component travels in a straight beam from the sun. Diffuse components come from all directions, due to atmospheric scattering processes.

A pyrheliometer is an instrument designed specifically to measure the direct beam solar irradiance with a field of view limited to 5 °. 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 short-wave radiation between 200 nm and 4000 nm in wavelength.

The Kipp & Zonen CHP1 pyrheliometer is an all-weather instrument for the continuous measurement of direct solar radiation and exceeds the specifications for high end networks, such as the Baseline Surface Radiation Network (BSRN). These networks need accurate and reliable long-term measurements for climate change investigations and validating satellite data (ground-truthing).

The SHP1 is the world's first smart pyrheliometer with built-in intelligence. Building on the proven CHP1 design and measurement technology it adds digital signal processing to improve performance and interfaces optimised for industrial data acquisition and control systems. The fast response time and individual temperature correction make it the best ISO First Class pyrheliometer available.

Good quality Direct Normal Incidence (DNI) irradiance data is often needed in the renewable energy sector, in particular for concentrating systems (CPV and CSP). For example, when 'prospecting' for sites to locate solar farms the incoming energy available throughout the year is a key part of the decision making process.

Pyrheliometers must be pointed accurately at the sun at all times and Kipp & Zonen automatic sun trackers are specifically designed for this purpose.

CHP1

CHP1 exceeds ISO performance criteria for First Class Normal Incidence Pyrheliometers. Every CHP1 is calibrated upon manufacture, and is supplied as standard with a WRR (World Radiometric Reference) traceable calibration certificate.

Thanks to the superior mechanical design, CHP1 offers excellent performance under any atmospheric condition. The zero offsets have been reduced to a minimum and the temperature response is limited to just ± 0.5 % between -20 °C and +50 °C. The rain shield protects the window and there are integrated alignment aids.

Both Pt-100 and 10 K thermistor temperature sensors are fitted as standard, to allow use of the individual temperature response data supplied with each CHP1, and for easy connection to any type of data logger.

Thanks to the signal cable connector and screw-in desiccant cartridge the instrument is easy to install and maintain.

Specifications	
Classification to ISO 9060:1990	First Class
Spectral range (50 % points)	200 to 4000 nm
Sensitivity	7 to 14 µV/W/m²
Impedance	10 to 100 Ω
Expected output range (0 to 1500 W/m²)	0 to 20 mV
Maximum operational irradiance	4000 W/m²
Response time (63 %) (95 %)	< 1.7 s < 5 s
Zero offset (b) temperature change (5 K/h)	 < 1 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (100 to 1000 W/m²)	< 0.2 %
Spectral selectivity (350 to 1500 nm)	< 1 %
Temperature response	< 0.5 % (-20 °C to +50 °C)
Tilt response (0° to 90° at 1000 W/m²)	< 0.5 %
Field of view	5° ± 0.2°
Temperature sensor output	10 K thermistor and Pt-100
Required sun pointing accuracy	< 0.5° from centre
Detector type	Thermopile
Operational temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

Part number	Instrument
0368900-032	CHP1 Pyrheliometer • 10 K + Pt-100 • 10 m cable
0368900-030	CHP1 Pyrheliometer • 10 K + Pt-100 • no plug, no cable
0368900-832	CHP1 Pyrheliometer • AMPBOX • 10 K + Pt-100 • 10 m cable
0368900-830	CHP1 Pyrheliometer • AMPBOX • 10 K + Pt-100 • no plug, no cable
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 1600 W/m²	

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
0999920-3	Extended Temperature Test for CHP1 Temperature response from -40 °C to +50 °C in 10 steps of 10 °C
0368700	Calcium Fluoride Window Kit Tube end-cap with Calcium Fluoride (CaF_2) window to replace standard end-cap with Quartz window. Spectral range 0.2 - 9.5 µm (50 % points)
Note: Calcium Fluoride is soft and slightly hygroscopic and is not suitable for continuous outdoor use	
Note: The CHP1 must be mounted on an automatic sun tracker such as the Kipp & Zonen SOLYS2, SOLYS Gear Drive or 2AP	

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

SHP1

SHP1 is a pyrheliometer for the measurement of direct solar radiation according to ISO 9060 First Class.

The SHP1 combines the CHP1 sensor technology with smart interface advantages, which makes the SHP1 the best commercially available First Class pyrheliometer.

The smart interface provides both analogue and digital outputs and individual correction for the temperature sensitivity of the detector from -40 °C to + 70 °C.

The improved response time and the standardised output make it easy to interchange instruments for recalibration.

SHP1 pyrheliometers have extremely low power consumption and operate from a wide range of supply voltages, making them ideal for power-critical applications.

SHP1 pyrheliometer is available in 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.

The included Smart Sensor Explorer software allows up to 10 smart radiometers to be connected to a Windows™ computer; for configuration, testing, read-out of settings and parameters and basic data logging functions.

Specifications	
Classification to ISO 9060:1990	First Class
Spectral range (50 % points)	200 to 4000 nm
Maximum operational irradiance	4000 W/m²
Analogue output • V-version Analogue output range	0 to 1 V -200 to 2000 W/m²
Analogue output • A-version Analogue output range	4 to 20 mA 0 to 1600 W/m²
Serial output	RS-485 Modbus®
Serial output range	-400 to 4000 W/m²
Response time (63 %) (95 %)	< 0.7 s < 2 s
Zero offset (b) temperature change (5 K/h)	 < 1 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (100 to 1000 W/m²)	< 0.2 %
Spectral selectivity (350 to 1500 nm)	< 1 %
Temperature response	< 0.5 % (-30 °C to +60 °C)
Tilt response (0 ° to 90 ° at 1000 W/m²)	< 0.5 %
Field of view	5 ° ± 0.2 °
Temperature sensor output	10 K thermistor
Supply voltage	5 to 30 VDC
Power consumption	V-version: 55 mW A-version: 100 mW
Required sun pointing accuracy	< 0.5 ° from centre
Detector type	Thermopile
Windows™ compatible software	Smart Sensor Explorer Software, for configuration, test and data logging
Operational temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

Part number	Instrument
0375900-102	SHP1-V Smart Pyranometer • 0 to 1 V version • 10 m cable
0375900-100	SHP1-V Smart Pyranometer • 0 to 1 V version • no plug, no cable
0375900-202	SHP1-A Smart Pyranometer • 4 to 20 mA version • 10 m cable
0375900-200	SHP1-A Smart Pyranometer • 4 to 20 mA version • no plug, no cable

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
0368700	Calcium Fluoride Window Kit Tube end-cap with Calcium Fluoride (CaF_2) window to replace standard end-cap with Quartz window. Spectral range 0.2 - 9.5 µm (50 % points)
Note: Calcium Fluoride is soft and slightly hygroscopic and is not suitable for continuous outdoor use	
Note: The SHP1 must be mounted on an automatic sun tracker such as the Kipp & Zonen SOLYS2, SOLYS Gear Drive or 2AP	

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

Sun Trackers

For solar tracking and two-axis positioning operations

Solar radiation is normally measured using a pyranometer mounted horizontally, that sees the whole hemisphere above it and responds to radiation from both the sun and the sky, the Global Horizontal Irradiance (GHI). However, it is often necessary to accurately measure the Direct Normal Irradiance (DNI) of the beam form the sun; particularly in solar energy, meteorology and climatology applications.

A pyrheliometer has a view slightly larger than the sun and its aureole and does not see the rest of the sky. To make DNI measurements it must point precisely at the sun and this is achieved using an automatic two-axis sun tracker. The sun tracker provides a stable mounting for the pyrheliometer and moves horizontally (azimuth) and vertically (zenith) to follow the solar arc throughout the year.

Precision stepping motors controlled by a micro-processor drive through belts or gears to provide movement with the desired torque and accuracy. An on-board programme uses accurate longitude, latitude, altitude, date, and time information for the measurement site to calculate the sun's position. Older designs need to have this information entered manually using a computer and software; but newer sun trackers, such as the SOLYS and the RaZON$^+$, obtain the information automatically through GPS.

An optional shading assembly blocks the direct solar radiation from reaching a pyranometer mounted on the tracker so that the Diffuse Horizontal Irradiance (DHI) from the sky can be measured. Pyrgeometers for measuring far infrared thermal radiation from the sky are normally used shaded from the direct sun to minimise window and dome heating effects.

Kipp & Zonen's fully automatic sun trackers are widely used around the world in high quality solar radiation networks, such as the Baseline Surface Radiation Network (BSRN) of the World Climate Research Programme.

RaZON+ ALL-IN-ONE Solar Monitoring System

More accurate than our CMP11

RaZON+ is an ALL-IN-ONE Solar Monitoring System that accurately measures both direct normal irradiance (DNI) and diffuse horizontal irradiance (DHI). Even though the standard RaZON+ instrument specifications are first or second class, the calculated GHI is even more accurate than our SMP11 or SMP21 secondary standard pyranometers. The integrated PH1 pyrheliometer is tested to be within 1% of our CHP1 and SHP1.

Integrated Logging, GPS and Wi-Fi Communication

All irradiance measurements in W/m², sunshine duration in hours, energy in kilowatt hours/m², solar position angles and status information is logged on the integrated logger. With the Wi-Fi connection you can easily set-up, configure and check the RaZON+ using any smart device like a tablet. RS-485 (Modbus or ASCII) and Ethernet are available for measurement data communication. The integrated GPS receiver provides accurate location information and accurate time stamps.

Anti-Soiling Design and Minimal Maintenance

The innovative features of the pyrheliometer minimize the effects of soiling when operated unattended in remote locations, without compromising the high accuracy of the instrument. Both the pyrheliometer and pyranometer are based on quartz diffuser technology. Thanks to the open collimator tube design and the quartz diffuser, the pyrheliometer is resistant to the effects of soiling. Moreover, RaZON+ is based on a completely maintenance-free gear drive sun tracking mechanism.

Full Weather Station and On-Site Calibration

For beginning of 2017 a firmware upgrade will be available for the RaZON+. The already available Modbus input will then accept Compact Weather Stations, a tilted irradiance (POA) pyranometer or PV Panel Temperature sensor, making it the meteorological center of any Solar Power Plant.

Part number	Instrument
0381900	RaZON+ ALL-IN-ONE Solar Monitoring System Shading assembly • PR1 Pyranometer • PH1 Pyrheliometer
0382910	RaZON+ Smart Solar Monitoring Base • SMP enabling kit
0382420	RaZON+ tripod (optional)
0382430	RaZON+ pole mount (optional)

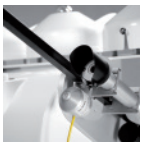
Part number	Accessories
2523176	RaZON+ Wi-Fi adapter Europe (AT, BE, CY, CZ, DK, EE, FI, FR, DE, GR, HU, IE, IT, LV, UA, LT, MT, NL, PL, PT, SK, SI, ES, GB, IS, LI, NO, CH, BG, RO, TR, RU)
2523177	RaZON+ Wi-Fi adapter China
In all other countries Wi-Fi adapter Edimax EW-7811UN should be purchased locally in order to comply with local legislation	

Specifications	
Pointing accuracy	0.2°
Payload	Sufficient for 1 pyranometer and 1 pyrheliometer
Angular velocity	30°/s
Rotation	110° zenith, 600° azimuth
Protection against over rotation	Physical limit stops
Supply voltage	20 to 30 VDC
Power	13 W
Operating temperature range	-20°C to +50°C
Weight	9 kg
Dimensions (WxDxH)	60x60x48 cm
Accuracy of bubble level	< 0.1°
Ingress Protection (IP) rating	65
CE/FCC compliance	Yes
RoHS	Yes
Transmission	Gear drives
Power connections	DC power
Communication interface	RS-485 Modbus® for external sensor/system RS-485 to host, Modbus® or ASCII Ethernet RJ-45 web based Modbus® TCP Wi-Fi (accessory adapter)
Data logging	1 s sampling, 1 minute average logging
GPS, location and time/date	Standard
Installation	Plug-and-play, Wi-Fi enabled device used
Functional self-test	Standard
Test/diagnostic facility	Standard via Ethernet connection
Sun tracking mode	Standard
PC system requirements	Ethernet connection, web browser
Firmware update possible	Flash memory
Maintenance	No scheduled maintenance required Annual inspection recommended
Restart after power interruption	Automatic

PR1 Smart Pyranometer	
Classification to ISO 9060:1990	Second Class
Response time (95%)	< 0.2 s
Response time (63%)	< 0.1 s
Spectral range (50% points)	310 to 2700 nm
Zero offsets (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 1 W/m² 1 W/m²
Non-linearity (100 to 1000 W/m²)	< 0.3 %
Directional response (up to 80° with 1000 W/m² beam)	< 20 W/m²
Temperature response	< 1 % (-20°C to +50°C)
Field of view	180°
Measurement range	0 to 1500 W/m²
Operating temperature range	-40°C to +80°C
Ingress Protection (IP) rating	67

PH1 Smart Pyrheliometer	
Classification to ISO 9060:1990	Second Class
Response time (95%)	< 0.2 s
Response time (63%)	< 0.1 s
Spectral range (50% points)	310 to 2700 nm
Zero offsets (b) temperature change (5 K/h)	 1 W/m²
Non-linearity (100 to 1000 W/m²)	< 0.3 %
Temperature response	< 1 % (-20°C to +50°C)
Field of view	5° ±0.2°
Slope angle	1° ±0.2°
Measurement range	0 to 1500 W/m²
Operating temperature range	-40°C to +80°C
Ingress Protection (IP) rating	67

SOLYS2



SOLYS2 is a cost-effective and simple sun tracking solution. It does not require a computer and software for installation because the integrated GPS automatically configures location and time data. Multi-colour LEDs indicate the operating status.

SOLYS2 has both an isolated 4-wire RS-485 port and an Ethernet port for communication with the SOLYSMonitor Windows™ software, or with data acquisition systems. RS-485 is particularly suited to a permanent remote access connection to regularly obtain the calculated sun position (zenith and azimuth angles) and the GPS time. The information can be used to control solar energy system sun trackers or to update data logger clocks.

The high-efficiency belt drive system requires no maintenance and the low consumption makes it ideal for use with solar and battery power systems. The 'sleep mode' reduces power by 50 % at night-time. The SOLYS2 can operate from AC or DC power and can automatically switch from AC to back-up DC in the case of a mains power outage.

SOLYS2 is supplied with a cast aluminium tripod stand and with the mountings for a Kipp & Zonen pyrheliometer already fitted. The tracker does not suffer from internal clock drift because time is updated by the GPS receiver, so if the support for the tripod is stable and secure the tracker will point accurately at the sun using the internally calculated position. However, it is not always possible to achieve this stability under changing environmental conditions and a sun sensor kit is available to provide active tracking correction for movements of the support platform. These corrections are stored in the tracker log files.

A second side plate can be fitted and mounting kits are available for a range of direct radiation instruments. Top mounting plates are available for global radiometers. A shading assembly for the measurement of diffuse radiation allows SOLYS2 to be configured as a complete solar monitoring station.

SOLYS2 is ideal for concentrating photovoltaic (CPV) and solar thermal energy applications and also meets the requirements of the Baseline Surface Radiation Network (BSRN) of the World Climate Research (WCRP).

Part number	Instrument
0367900-001	SOLYS2 Sun Tracker • SOLYS Tripod Floor Stand Including SOLYS Tripod Floor Stand and mounting for CHP1/SHP1 pyrheliometer

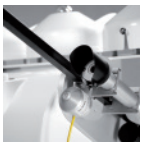
Specifications	
Pointing accuracy	< 0.1 ° passive tracking < 0.02 ° active tracking (sun sensor)
Torque *	> 20 Nm (at max. load & angular velocity) > 23 Nm (at max. load when sun tracking)
Payload (balanced)	20 kg
Communication	Ethernet RJ45 DHCP client, manual configuration ICMP, web interface, mDNS, NTP service, UDP, track commands, status info RS-485 4-wire isolated port Status and recovery info and interface configuration
SOLYSMonitor Software, Windows™	Included, but not required for set-up View or log tracker status, sun position, tracker Pointing position, GPS date and time
Transmission	Inverted tooth belts, no maintenance
Location, time/date information, setup	Automatic by integrated GPS
Indicators	Power, internal temperature and status LEDs
Mounting base	Tripod stand included
Zenith axis fittings	One side plate and CHP1/SHP1 pyrheliometer mounting kit included
Sun sensor for active tracking	Optional accessory
Heater for low temperature operation	Standard (operates on AC power only)
Supply voltage	18 to 30 VDC and 100 to 240 VAC, 50/60 Hz (switches to DC power as back-up)
Power consumption	21 W (reduces to 13 W at night) 100 W extra with heater on (AC only)
Min. operating temperature	-20 °C (DC) -40 °C (AC, heater on)
Max. operating temperature	+50 °C +55 °C (with optional sun shield)
Storage temperature range	-40 °C to +50 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	65

* The standard torque setting is ideal for all normal measurement applications, but it is adjustable in firmware. Torque can be reduced to save power, or increased to a maximum of 30 Nm when sun tracking.

Part number	Accessories
0367703	Shading Ball Assembly Including 2 shading balls, large top plate and second side plate
0353704	Shading Ball and Rod Extra, for third position on shading assembly
0353710	Heavy Duty Tripod Floor Stand
0353750	Height Extension Tube for Heavy Duty Tripod Floor Stand
0367707	Sun Sensor Kit For active tracking of the sun position
0381700	SOLYS Sun Shield Kit Increases maximum operating temperature by 5°C
0367708	Side Mounting Plate For second side of zenith shaft
0367709	Large Top Mounting Plate For up to 3 global radiometers (ventilated or un-ventilated)
0367712	Small Top Mounting Plate For 1 global radiometer (ventilated or un-ventilated)
0367718	Adjustable Tilt Radiometer Mounting Kit To mount a CMP/SMP series pyranometer to a top plate of a SOLYS to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0367713	Tilted Radiometer Mounting Kit * To mount a CMP/SMP series pyranometer to a side plate of a SOLYS
0367710	Pyrheliometer Mounting Kit * To fit a second CHP1/SHP1 pyrheliometer
0367714	PGS-100 Mounting Kit * To fit 1 x Prede PGS-100 Spectral Sun Photometer
0367704	PMO6 Mounting Kit * To fit 1 x PMOD-WRC PMO6 absolute cavity pyrheliometer
0367705	SPO2 Mounting Kit * To fit 1 x Middleton Solar SPO2 (-L) sun photometer
0367706	HF/AHF Mounting Kit * To fit 1 x Eppley HF or AHF absolute cavity pyrheliometer
0367717	NIP Mounting Kit To fit 1 x Eppley NIP pyrheliometer, either as an extension to the standard CHP1/SHP1 mountings, or directly to a side plate

* Note: This mounting kit also requires a side mounting plate (0367708)

SOLYS Gear Drive



SOLYS Gear Drive is a high end sun tracker for all weather conditions and locations. It builds on the features of the SOLYS2 and has enhanced capabilities that make it suitable for use with heavy loads and in the harshest climates.

The mechanical structure of arms and pivots that comprise a shading assembly can accumulate ice and snow in extreme conditions and, together with the radiometers, it can impose considerable loads on the tracker in high winds. SOLYS Gear Drive has the power to point accurately at the sun in very high winds, and to break the ice that can build up overnight when the tracker is 'sleeping'.

The high precision gear drive system requires no maintenance and is much more powerful than the belt drive system of the SOLYS2. The maximum payload is increased to 80 kg and the torque is raised to 60 Nm, allowing SOLYS Gear Drive to carry multiple and/or heavy instruments and other loads. The shading assembly and other mounting accessories from the SOLYS2 can all be fitted.

A large side mounting plate can be fitted to one, or both, sides of the SOLYS Gear Drive to enable the mounting of large instruments multiple pyrheliometers or absolute cavity radiometers.

SOLYS Gear Drive has the mountings for pyrheliometer already fitted and includes the sun sensor for active tracking. However, it does not include a tripod stand. It can be used with the cast aluminium SOLYS Tripod Floor Stand but, for use in extreme conditions and with high loads, the Heavy Duty Tripod Floor Stand is recommended. The height extension tube can also be used.

SOLYS Gear Drive has been tested and protected against the highest levels of ESD, EMC and surge disturbances that might be experienced.

For operation in extremely cold regions an insulated cold weather cover is available that allows use in temperatures down to -50 °C and with wind speeds up to 20 m/s. For very hot climates a sun shield can be fitted, extending the upper temperature range to +60 °C.

Part number	Instrument
0381900	SOLYS Gear Drive Sun Tracker • Sun Sensor

Specifications	
Pointing accuracy	< 0.02 ° active tracking
Torque	> 40 Nm (at max. load & angular velocity) > 60 Nm (at max. load when sun tracking)
Payload (balanced)	80 kg
Communication	Ethernet RJ45 DHCP client, manual configuration ICMP, web interface, mDNS, NTP service, UDP, track commands, status info RS-485 4-wire isolated port Status and recovery info and interface configuration
SOLYSMonitor Software, Windows™	Included, but not required for set-up View or log tracker status, sun position, tracker Pointing position, GPS date and time
Transmission	High precision reduction gears, no maintenance
Location, time/date information, setup	Automatic by integrated GPS
Indicators	Power, internal temperature and status LEDs
Mounting base	Optional tripod stand or heavy duty tripod
Sun sensor for active tracking	Included as standard
Zenith axis fittings included	One CHP1/SHP1 pyrheliometer mounting kit
Heater for low temperature operation	Standard (operates on AC power only)
Supply voltage	18 to 30 VDC and 100 to 240 VAC, 50/60 Hz (switches to DC power as back-up)
Power consumption	25 W (reduces to 13 W at night) 150 W extra with heater on (AC only)
Min. operating temperature	-20 °C (DC) -50 °C (AC, heater on) -50 °C and wind up to 20 m/s (AC, heater on and with optional cold cover)
Max. operating temperature	+55 °C +60 °C (with optional sun shield)
Storage temperature range	-50 °C to +60 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	65

Part number	Accessories
0367703	Shading Ball Assembly Including 2 shading balls, large top plate and second side plate
0353704	Shading Ball and Rod Extra, for third position on shading assembly
0353710	Heavy Duty Tripod Floor Stand
0367711	SOLYS Tripod Floor Stand
0353750	Height Extension Tube for Heavy Duty Tripod Floor Stand
0381700	SOLYS Sun Shield Kit Increases maximum operating temperature by 5°C
0016770	SOLYS Gear Drive Cold Cover Allows operation at -50 °C with 20 m/s wind-chill
0381702	SOLYS Gear Drive Large Side Mounting Plate To fit multiple pyheliometers, absolute cavity radiometers or large instruments
0367708	Side Mounting Plate For second side of zenith shaft
0367709	Large Top Mounting Plate For up to 3 global radiometers (ventilated or un-ventilated)
0367712	Small Top Mounting Plate For 1 global radiometer (ventilated or un-ventilated)
0367718	Adjustable Tilt Radiometer Mounting Kit To mount a CMP/SMP series pyranometer to a top plate of a SOLYS to measure tilted diffuse radiation Zenith angle can be adjusted from 0° to 90° with graduated scale
0367713	Tilted Radiometer Mounting Kit * To mount a CMP/SMP series pyranometer to a side plate of a SOLYS
0367710	Pyrheliometer Mounting Kit * To fit a second CHP1/SHP1 pyrheliometer
0367714	PGS-100 Mounting Kit * To fit 1 x Prede PGS-100 Spectral Sun Photometer
0367704	PMO6 Mounting Kit * To fit 1 x PMOD-WRC PMO6 absolute cavity pyrheliometer
0367705	SPO2 Mounting Kit * To fit 1 x Middleton Solar SPO2 (-L) sun photometer
0367706	HF/AHF Mounting Kit * To fit 1 x Eppley HF or AHF absolute cavity pyrheliometer
0367717	NIP Mounting Kit To fit 1 x Eppley NIP pyrheliometer, either as an extension to the standard CHP1/SHP1 mountings, or directly to a side plate
* Note: This mounting kit also requires a side mounting plate (0367708)	

Albedometer Kits

For global and reflected radiation measurement

The albedo of a surface is the extent to which it diffusely reflects short-wave radiation from the sun in the wavelength range from 300 nanometers (nm), or less, to 3000 nm. It is the ratio of the reflected radiation to the incoming radiation and varies from 0 (dark) to 1 (bright). As an indication, albedo is about 0.15 for grass, 0.5 for dry sand and 0.8 for fresh snow.

An albedometer consists of two identical pyranometers that measure the incoming global solar radiation and the radiation reflected from the surface below. The two signal outputs are used to calculate the albedo and the net short-wave radiation.

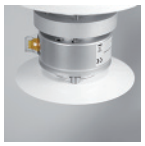
Kipp & Zonen albedometers are installed around the world for meteorology, hydrology, climate research, and agriculture. A particular use is for measuring the albedo of glaciers, snow and ice fields in climate change research.

Our albedometer kits are designed for a long operating life with simple maintenance. The two pyranometers are fitted to the plate of a mounting fixture that has a rod for easy attachment to a mast. The white sun shield of the lower pyranometer is removed and replaced by a glare screen that prevents direct illumination of the domes at sunrise and sunset.

The kits featured cover the most popular configurations, but other CMP and SMP pyranometers can be used. By changing the mounting fixture from a CMF1 to a CMF4, the CVF4 ventilation unit can be fitted.

Entry-level albedometers can be configured by using two SP Lite2, CMP3 or SMP3 pyranometers with the accessory mounting rod.

CMP6 Albedometer Kit



This ISO 9060:1990 First Class albedometer kit is a replacement for the CMA6 integrated albedometer that is now out of production. By using two separate pyranometers with a mounting fixture (plate and rod) and glare screen for the pyranometer there is a choice of configurations available. The CMB1 mounting bracket can be used to fix the rod to a pole or wall.

If the CMF1 mounting fixture is replaced by the CMF4 model, the CVF4 ventilation unit can be used with the upper and/or lower pyranometers. When a lower ventilation unit is used, the glare screen cannot be fitted.

Its good quality and cost-effectiveness make the CMP6 albedometer kit ideal for meteorology, hydrology and agricultural applications.

Specifications	
Classification to ISO 9060:1990	First Class
Sensitivity	5 to 20 µV/W/m²
Impedance	20 to 200 Ω
Expected output range (0 to 1500 W/m²) Expected output range (0 to 1000 W/m²)	0 to 30 mV (upper) 0 to 20 mV (lower)
Maximum operational irradiance	2000 W/m²
Response time (63 %)	< 6 s
Response time (95 %)	< 18 s
Spectral range (20% points)	270 to 3000 nm
Spectral range (50 % points)	285 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 10 W/m² < 4 W/m²
Non-stability (change/year)	< 1 %
Non-linearity (100 to 1000 W/m²)	< 1 %
Directional response (up to 80 ° with 1000 W/m² beam)	< 15 W/m²
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0 ° to 90 ° at 1000 W/m²)	< 1 %
Temperature response	< 4 % (-10 °C to +40 °C)
Field of view	180 ° (upper) 170 ° (lower)
Accuracy of bubble level	< 0.1 °
Temperature sensor output	
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

Part number	Instrument
0362955-002	CMP6 Albedometer Kit • 2 x CMP6 • CMF1 • Glare Screen Kit • 2 x 10 m cable
0362955-000	CMP6 Albedometer Kit • 2 x CMP6 • CMF1 • Glare Screen Kit • no plug, no cable

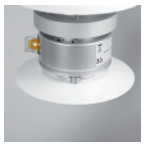
Part number	Options (configured/adjusted to suit instrument)
0365901	AMPBOX signal amplifier • gain adjusted
Note: CMP6 Albedometer Kit can be used with the AMPBOX but it has two individual outputs, so 2x AMPBOX are required	
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 1600 W/m²	

Ventilated CMP6 First Class Albedometer Kit
A ventilated ISO First Class Albedometer Kit can be assembled by ordering: 2x CMP6 Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

CMP11 Albedometer Kit



The CMP11 albedometer kit is a replacement for the CMA11 integrated albedometer that is now out of production. This CMP11 kit complies with the highest level of ISO pyranometer classification, Secondary Standard.

Using the CMF4 mounting fixture instead of the CMF1, the CVF4 ventilation unit can be used with the upper and/or lower pyranometers. When a lower ventilation unit is used, the glare screen cannot be fitted.

The CMP11 albedometer kit is a step up in performance from CMP6 kit and is recommended for scientific applications, for which accuracy needs to be according to the highest standards.

Specifications	
Classification to ISO 9060:1990	Secondary Standard
Sensitivity	7 to 14 µV/W/m²
Impedance	10 to 100 Ω
Expected output range (0 to 1500 W/m²) Expected output range (0 to 1000 W/m²)	0 to 20 mV 0 to 13 mV
Maximum operational irradiance	4000 W/m²
Response time (63 %)	< 1.7 s
Response time (95 %)	< 5 s
Spectral range (20% points)	270 to 3000 nm
Spectral range (50 % points)	285 to 2800 nm
Zero offsets (unventilated) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 7 W/m² < 2 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (100 to 1000 W/m²)	< 0.2 %
Directional response (up to 80 ° with 1000 W/m² beam)	< 10 W/m²
Spectral selectivity (350 to 1500 nm)	< 1 %
Tilt response (0 ° to 90 ° at 1000 W/m²)	< 0.2 %
Temperature response	< 1 % (-10 °C to +40 °C)
Field of view	180 ° (upper) 170 ° (lower)
Accuracy of bubble level	< 0.1 °
Temperature sensor output	
Detector type	Thermopile
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
MTBF (Mean Time Between Failures)	> 10 years
Ingress Protection (IP) rating	67

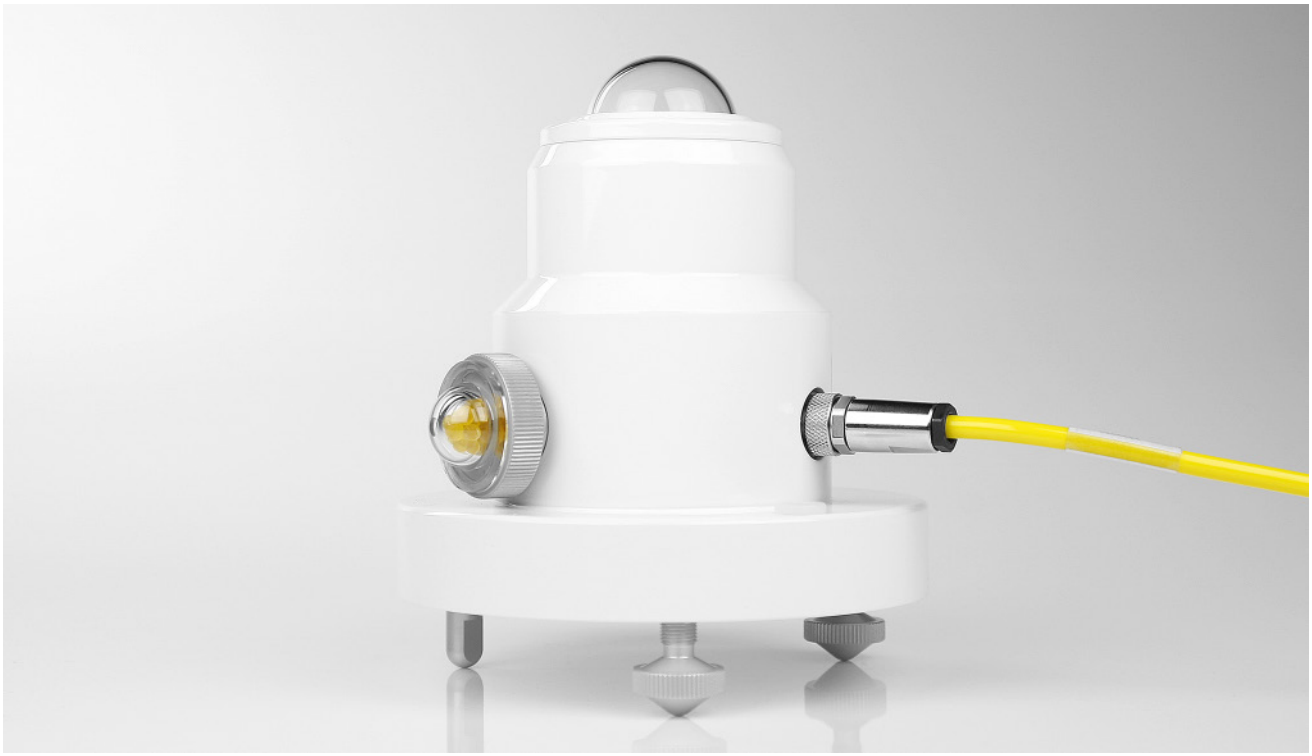
Part number	Instrument
0362965-002	CMP11 Albedometer Kit • 2 x CMP11 • CMF1 • Glare Screen Kit • 2 x 10 m cable
0362965-000	CMP11 Albedometer Kit • 2 x CMP11 • CMF1 • Glare Screen Kit • no plug, no cable

Part number	Options (configured/adjusted to suit instrument)
0365901	AMPBOX signal amplifier • gain adjusted
Note: CMP11 Albedometer Kit can be used with the AMPBOX but it has two individual outputs, so 2x AMPBOX are required	
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 1600 W/m²	

Ventilated CMP11 First Class Albedometer Kit
A ventilated ISO Secondary Standard Albedometer Kit can be assembled by ordering: 2x CMP11 Pyranometer + 1x CMF4 Mounting Fixture + 2x CVF4 Ventilation Unit

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.



UV Radiometers

For solar ultraviolet radiation measurement

The Ultraviolet (UV) part of the solar spectrum has several beneficial effects for human biology, but too much can be very harmful. The UV region covers the wavelength ranges 100-280 nm (UVC), 280-315 nm (UVB) and 315-400 nm (UVA). Almost all UVC, and approximately 90% of UVB, from the sun is absorbed by the Earth's atmosphere. UVA radiation at the Earth's surface is normally 15-20 times greater than UVB.

UV radiation helps to produce Vitamin D, but it can also burn the skin and cause cancers, melanoma and cataracts. UV radiation measured with a similar response to the human skin is termed Erythemally Active UV irradiance (UVE) and must be used to calculate the Global Solar UV Index (UVI) for public health information. Our UVS range measures solar ultraviolet radiation with specific models for UVA, UVB and UVE. Dual-band models are available to measure two components in one convenient instrument.

UVIATOR

People are very sensitive to small changes in the amount of UVB/UVE radiation and this depends upon altitude, the height of the sun in the sky, the amount of Ozone in the atmosphere and cloud cover. UVS radiometers are calibrated for a typical air-mass (solar zenith angle) and Ozone column concentration.

Kipp & Zonen UVIATOR is a unique Windows™ software programme that imports the calibration and data files for UVS radiometers. It works out the solar zenith angle from the date, time and location information and goes online to find the relevant Ozone Monitoring Instrument (OMI) satellite data. The corrected output file has the best accuracy available for a broadband UV radiometer.

For many applications it is only necessary to monitor the 'total UV' irradiance, which represents the combined UVA and UVB components. CUV5 is a passive radiometer optimised for the measurement of total UV outdoors from natural sunlight. The Smart SUV5 has temperature correction and linearization, for measurement of high intensity artificial UV light sources.

For the ultimate in direct and global solar ultraviolet radiation measurements there is the Kipp & Zonen Brewer MkIII Spectrophotometer.

CUV5

CUV5 shares features with the CMP range of pyranometers and can be used with the same accessories. It measures the total UV irradiance of the UVA and UVB components.

It is suitable for use in all environments. Adjustable feet and a bubble level are used to ensure that the radiometer is horizontal and a snap-on sun shield provides protection. The instrument is kept dry internally by an easily removable desiccant cartridge.

CUV5 has a glass dome with very good UV transmission and a specially shaped diffuser to provide excellent directional response. The waterproof connector has gold-plated contacts and is fitted with 10 m of high quality signal cable as standard. The detection system includes optical filters and a photo-diode and CUV5 does not require power to operate.

CUV5 is optimised for the measurement of total UV outdoors, under natural sunlight, where the irradiance is not likely to exceed 100 W/m². It is not possible to derive the separate components of UVA and UVB from CUV5 measurements, for this the UVS models are required.

Specifications	
Spectral range (50 % points)	300 to 385 nm
Spectral range (overall)	280 to 400 nm
Spectral selectivity (312 to 382 nm)	< 20 %
Sensitivity	300 to 500 µV/W/m²
Impedance	Typically 10 KΩ
Expected output range (0 to 100 W/m²)	0 to 50 mV
Maximum UVA/UVB irradiance	400 W/m²
Response time (95 %)	< 1 s
Non-stability (change/year)	< 5 %
Non-linearity (0 to 100 W/m², ref. 50 W/m²)	< 1 %
Directional response (up to 70 ° with 100 W/m² UV beam)	< 5 %
Temperature response	< 0.3 %/°C
Field of view	180 °
Accuracy of bubble level	< 0.1 °
Detector type	Photo-diode with filter
Operational temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

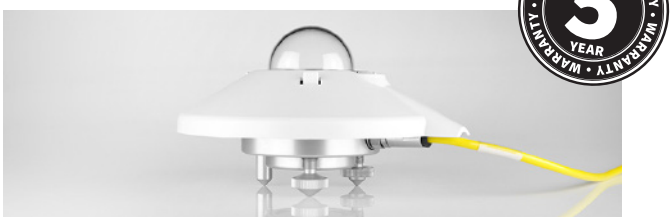
Part number	Instrument
0364910-002	CUV5 Broadband UV Radiometer • 10 m cable
0364910-000	CUV5 Broadband UV Radiometer • no plug, no cable
0364910-702	CUV5 Broadband UV Radiometer • METEON • 10 m cable
0364910-700	CUV5 Broadband UV Radiometer • METEON • no plug, no cable
0364910-802	CUV5 Broadband UV Radiometer • AMPBOX • 10 m cable
0364910-800	CUV5 Broadband UV Radiometer • AMPBOX • no plug, no cable

Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 100 W/m²
For measurements in test chambers, 0 - 240 W/m² can be specified

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ø
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ø
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Mounts the radiometer at the correct height when used with a CVF4

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

SUV5



SUV5 is the Smart version of CUV5. Internal temperature correction gives the SUV5 better performance than the CUV5 and linearization allows monitoring of the high UV irradiances used in material stress and ageing tests, and in solar simulators.

The high quality dome and diffuser give optimized directional response. An optical filter provides sensitivity to combined UVA and UVB irradiance, as shown in the graph below. The photodiode generates a voltage output linearly proportional to the UV intensity.

SUV5 is not suitable for the measurement of specific parts of the UV spectrum such as UVA, UVB or UVE / UV Index. For measurement of these individual parameters our UVS Series is required.

A waterproof plug and socket cable connection facilitates easy installation. The snap-on sun shield protects the connector and allows viewing of the integrated bubble level.

The SUV5 has Modbus® interface, amplified analogue output, fast response time and temperature corrected measurement data. The wide and low power supply range from 5 to 30 VDC makes integration in meteorological and industrial application easy. The SUV5 is extremely robust and comes with 5 years warranty (*).

Thanks to standardised output and connections of every SUV5, exchanging instruments for recalibration is easy. SmartExplorer Windows™ software for data logging, display of data and Modbus® address setting is provided as standard.

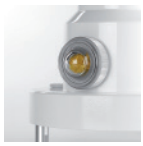
Specifications	
Analogue output • V-version	0 to 1 V
Analogue output range	-100 to 400 W/m²
Analogue output • A-version	4 to 20 mA
Analogue output range	0 to 400 W/m²
Serial output	RS-485 Modbus®
Serial output range	0 to 400 W/m²
Response time (95 %)	< 1 s
Spectral range (50 % points)	300 to 385 nm
Spectral range (overall)	280 to 400 nm
Spectral selectivity (312 to 382 nm)	< 20 %
Non-stability (change/year)	< 5 %
Non-linearity (0 to 400 W/m², ref. 100 W/m²)	< 1.5 %
Directional response (up to 70 ° with 1000 W/m² beam)	< 5 W/m²
Temperature response	< 2 % (-20 °C to +50 °C)
Field of view	180 °
Accuracy of bubble level	< 0.1 °
Power consumption (at 12 VDC)	V-version: 55 mW A-version: 100 mW
Software, Windows™	Smart Sensor Explorer Software, for configuration, test and data logging
Supply voltage	5 to 30 VDC
Detector type	Photodiode with filter
Operating temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 %
Ingress Protection (IP) rating	67

Part number	Instrument
0377900-102	SUV5-V Smart UV Radiometer • 0 to 1 V version • 10 m cable
0377900-100	SUV5-V Smart UV Radiometer • 0 to 1 V version • no plug, no cable
0377900-202	SUV5-A Smart UV Radiometer • 4 to 20 mA version • 10 m cable
0377900-200	SUV5-A Smart UV Radiometer • 4 to 20 mA version • no plug, no cable

Part number	Accessories
See accessories	CVF4 Ventilation Unit Recommended to reduce offsets and frequency of dome cleaning
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers (1 upper / 1 lower) Diameter 88 mm. Mounting rod 350 mm long x 16 mm ø
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ø
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0346900	CM121B Shadow Ring for unventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Note: CM121B can not be used with CVF4 Ventilation Unit
0346901	CM121C Shadow Ring for ventilated radiometers Manually adjusted device provides diffuse sky irradiance measurement Mounts the radiometer at the correct height when used with a CVF4

(*) This product will need to be registered by the end-user within 6 months of purchase to activate the warranty extension.

UVS-A-T



UVS instruments have a precision quartz dome and specially shaped diffuser to provide class-leading directional response. The detection system includes optical filters, a very sensitive phosphor and a photo-diode. The system is temperature stabilised at +25 °C (±2 °C) to prevent changes in spectral response and sensitivity with variations in the ambient conditions. The signal output is amplified and the internal stabilisation temperature can be monitored.

Power and signal connections are via a waterproof plug with high quality UV resistant cable and the instrument is kept dry internally by an easily removable desiccant cartridge. UVS radiometers are supplied with comprehensive calibration files and the unique Kipp & Zonen UVIATOR software.

UVIATOR software is included as standard and increases the accuracy of UV measurements by correcting error sources. When the calibration file for a particular UVS is imported, along with correctly formatted measurement data, UVIATOR automatically makes corrections for total column Ozone concentration (using online satellite data) and for air-mass.

UVS-A-T Radiometer
UVS-A-T has a spectral response optimised for precise measurements of atmospheric UVA irradiance.

Specifications	
Spectral range	315 to 400 nm
Sensitivity	30 ±3 W/m²/V
Maximum operational irradiance	90 W/m²
Analogue output range	0 to 3 V
Response time (63 %) (95 %)	< 0.6 s < 1.8 s
Non-linearity (100 to 1000 W/m²)	< 1 %
Directional response (up to 70 ° solar zenith angle)	< 2.5 %
Temperature response	Temperature stabilized at +25 °C, ±2 °C
Field of view	180 °
Accuracy of bubble level	0.5 °
Temperature sensor output	2.5 V @ +25 °C
Supply voltage	7 to 18 VDC
Power consumption	8 W
Detector type	Photo-diode
Windows™ compatible software	UVIATOR, corrects for air-mass and Ozone column
Operational temperature range	-40 °C to +50 °C
Storage temperature range	-40 °C to +50 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

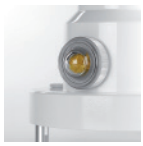
Part number	Instrument
0354920-002	UVS-A-T UV Radiometer • 10 m cable
0354920-000	UVS-A-T UV Radiometer • no plug, no cable
Note: Cable length is limited to 25 m because of voltage drop on the temperature stabilisation power supply wires	

Part number	2 single band instruments
0354950-002	UVS-A-T + UVS-B-T • 2 x 10 meter cable
0354950-000	UVS-A-T + UVS-B-T • no plug, no cable

Part number	2 single band instruments
0354955-002	UVS-A-T + UVS-E-T • 2 x 10 meter cable
0354955-000	UVS-A-T + UVS-E-T • no plug, no cable

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ø
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0349401	CVP2 Power Supply 115 / 230V AC Power adaptor with 12 VDC output
Note: CVP2 is not suitable for unprotected outdoor use	

UVS-B-T



UVS-B-T Radiometer

UVS-B-T has all the features of the UVS range and a spectral response optimised for precise measurements of atmospheric UVB irradiance.

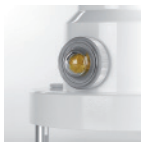
Specifications	
Spectral range	280 to 315 nm
Sensitivity	2 ±0.2 W/m²/V
Maximum operational irradiance	6 W/m²
Analogue output range	0 to 3 V
Response time (63 %) (95 %)	< 0.6 s < 1.8 s
Non-linearity (100 to 1000 W/m²)	< 1 %
Directional response (up to 70 ° solar zenith angle)	< 2.5 %
Temperature response	Temperature stabilized at +25 °C, ±2 °C
Field of view	180 °
Accuracy of bubble level	0.5 °
Temperature sensor output	2.5 V @ +25 °C
Supply voltage	7 to 18 VDC
Power consumption	8 W
Detector type	Photo-diode
Windows™ compatible software	UVIATOR, corrects for air-mass and Ozone column
Operational temperature range	-40 °C to +50 °C
Storage temperature range	-40 °C to +50 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

Part number	Instrument
0354925-002	UVS-B-T UV Radiometer • 10 m cable
0354925-000	UVS-B-T UV Radiometer • no plug, no cable
Note: Cable length is limited to 25 m because of voltage drop on the temperature stabilisation power supply wires	

Part number	2 single band instruments
0354950-002	UVS-A-T + UVS-B-T • 2 x 10 meter cable
0354950-000	UVS-A-T + UVS-B-T • no plug, no cable

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ⌀
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0349401	CVP2 Power Supply 115 / 230V AC Power adaptor with 12 VDC output
Note: CVP2 is not suitable for unprotected outdoor use	

UVS-E-T



UVS-E-T Radiometer

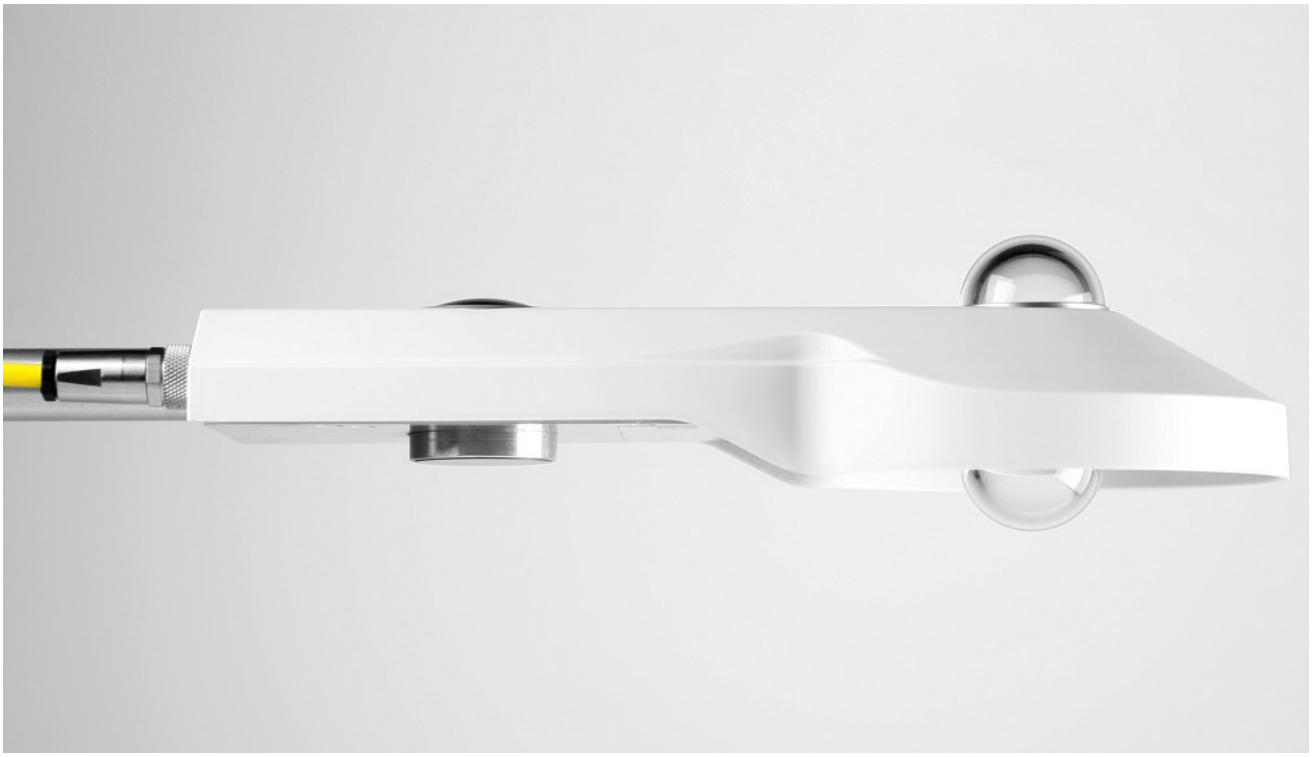
UVS-E-T has a spectral response function close to the Erythemal (sunburn) action spectrum of the human skin (ISO: 17166:1999 / CIE S 007/E-1998). UVE includes some UVA radiation and a high response in the UVB band. For this reason a UVB radiometer should not be used to measure UVE and to calculate the Global Solar UV Index.

Specifications	
Spectral rangex	ISO 17166:1999 CIE S007/E-1998 Erythemal repsonse spectrum
Sensitivity	0.2 ±0.02 W/m²/V
Maximum operational irradiance	0.6 W/m²
Analogue output range	0 to 3 V
Response time (63 %) (95 %)	< 0.6 s < 1.8 s
Non-linearity (100 to 1000 W/m²)	< 1 %
Directional response (up to 70 ° solar zenith angle)	< 2.5 %
Temperature response	Temperature stabilized at +25 °C, ±2 °C
Field of view	180 °
Accuracy of bubble level	0.5 °
Temperature sensor output	2.5 V @ +25 °C
Supply voltage	7 to 18 VDC
Power consumption	8 W
Detector type	Photo-diode
Windows™ compatible software	UVIATOR, corrects for air-mass and Ozone column
Operational temperature range	-40 °C to +50 °C
Storage temperature range	-40 °C to +50 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

Part number	Instrument
0354930-002	UVS-E-T UV Radiometer • 10 m cable
0354930-000	UVS-E-T UV Radiometer • no plug, no cable
Note: Cable length is limited to 25 m because of voltage drop on the temperature stabilisation power supply wires	

Part number	2 single band instruments
0354955-002	UVS-A-T + UVS-E-T • 2 x 10 meter cable
0354955-000	UVS-A-T + UVS-E-T • no plug, no cable

Part number	Accessories
2643960	Desiccant Refill Pack Contains 10 sachets
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ø
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0349401	CVP2 Power Supply 115 / 230V AC Power adaptor with 12 VDC output
Note: CVP2 is not suitable for unprotected outdoor use	



Net Radiometers

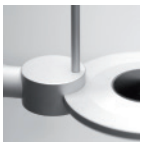
For the measurement of the balance of incoming and outgoing radiation

The combination of short-wave radiation from the sun and long-wave (far infrared) radiation from the atmosphere and ground are the driving forces for many of the dynamic atmospheric processes at the Earth's surface. In the short term they directly influence weather systems and in the long term they are key parameters driving the climate systems around the world.

Commonly, four separate components are monitored; incoming and reflected short-wave solar radiation, plus down-welling and up-welling long-wave radiation. The sum of the incoming and outgoing components is called the net radiation balance (sometimes termed the 'radiation budget'). This balance is used as a parameter in meteorological, climatological and hydrological research.

Kipp & Zonen offers net radiometers that are robust, light in weight and do not require power to operate. These features make them ideal for portable use in many types of field studies. The CNR4 is the only integrated four component net radiometer available with a ventilation unit, to maximise the time that good quality data is available.

NR Lite2



NR Lite2 is a single-component net radiometer widely used in agriculture and hydrology. The thermopile detector is fitted with a black conical absorber on each side that has a very wide spectral response from the Ultraviolet (UV) to the far infrared (FIR). The black surface is protected by an environmentally resistant anti-stick coating.

The signal output is the difference between the sun / sky radiation and the ground radiation and can be positive (day time) or negative (night time) depending upon the conditions. This single output provides a direct measurement of the total net radiation balance.

There is an integral mounting rod for fitting to masts and poles, a bubble level, 15 m long signal cable, and a stick to prevent birds settling on the instrument.

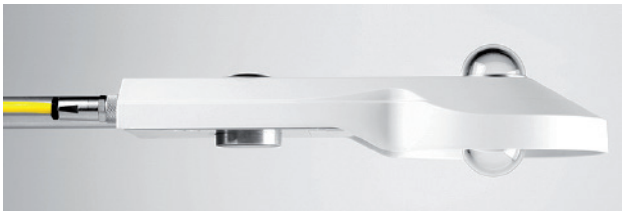
For the measurement of all four radiation components separately; upwards and downwards, short-wave and long-wave radiation, please use the CNR4 net radiometer.

Specifications	
Spectral range (50 % points)	0.2 to 100 µm
Sensitivity	10 µV/W/m² (nominal)
Operational irradiance (net)	-2000 to 2000 W/m²
Response time (63 %) (95 %)	< 20 s < 60 s
Non-linearity (-1000 to 1000 W/m²)	< 1 %
Directional response (up to 60 ° solar zenith angle)	< 3 %
Temperature response (-10 °C to +40 °C)	< 6 %
Field of view (upper / lower)	180 °
Accuracy of bubble level	< 0.2 °
Sensitivity asymmetry (upper / lower)	< 15 %
Mounting rod (fixed)	800 mm long x 20 mm ⌀
Detector type	Thermopile
Operational temperature range	-30 °C to +70 °C
Storage temperature range	-30 °C to +70 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

Part number	Instrument
0344920-003	NR Lite2 Net Radiometer • single-component • 15 m cable
0344920-703	NR Lite2 Net Radiometer • METEON • 15 m cable
0344920-803	NR Lite2 Net Radiometer • AMPBOX • 15 m cable
Note: AMPBOX is adjusted so that 4 mA output = -400 W/m², 8 mA = 0 W/m² and 20 mA = 1200 W/m²	
Note: NR Lite2 will not fit in the METEON carrying case	

Part number	Accessory
0369701	CMB1 Mounting Bracket To enable easy attachment of the mounting rod to a pole or a wall

CNR4



CNR4 is a four-component net radiometer for accurate and reliable measurements and can be used as the reference instrument for a network of lower performance net radiometers.

The instrument combines two ISO 9060:1990 Second Class pyranometers for short-wave solar radiation measurement with two pyrgeometers for long-wave radiation, all integrated into the slim body. There are four separate signal outputs and either of the integrated 10 K thermistor and Pt-100 temperature sensors can be used to calculate the FIR radiation.

CNR4 does not require power to operate; and the bubble level, screw-in mounting rod and cables with waterproof connectors, ensure that installation is quick and easy.

The white sun shield also acts as a glare screen to prevent direct illumination of the lower pyranometer at sunrise and sunset. The upper pyrgeometer has a silicon meniscus dome so that water rolls off and the field of view is 180°. The lower pyrgeometer has a flat window with 150° view.

A heated ventilation unit, the CNF4, is available to minimize offsets, maximize stability, remove precipitation and reduce the deposition of dirt and dust.

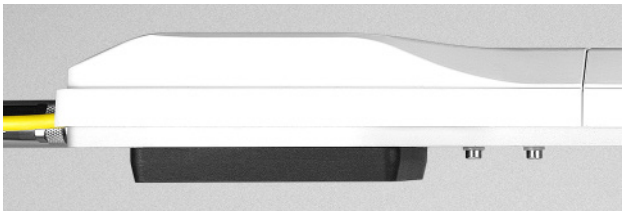
CNF4 can be purchased together with the CNR4 or added at a later date if required.

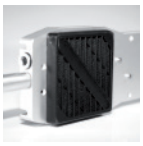
Specifications	
Spectral range (overall)	4.4 to 50 µm (long-wave)
Spectral range (50 % points)	300 to 2800 nm (short-wave) 4.5 to 42 µm (long-wave)
Sensitivity	5 to 20 µV/W/m² (short-wave) 5 to 15 µV/W/m² (long-wave)
Impedance	20 to 200 Ω
Expected output range (0 to 1500 W/m²) Expected output range (0 to 1000 W/m²) Expected output range (-200 to 200 W/m²)	0 to 30 mV upper sensor (short-wave) 0 to 20 mV lower sensor (short-wave) -3 to 3 mV (long-wave)
Maximum operational irradiance	2000 W/m² (short-wave)
Operational irradiance (net)	-250 to 250 W/m² (long-wave)
Response time (63 %) (95 %)	< 6 s < 18 s
Zero offsets (short-wave) (a) thermal radiation (at 200 W/m²) (b) temperature change (5 K/h)	 < 15 W/m² < 3 W/m² (< 1 W/m² with CNF4)
Zero offset (long-wave) (b) temperature change (5 K/h)	 < 5 W/m²
Window heating offset upper sensor (with 1000 W/m² direct solar radiation) Window heating offset lower sensor (with 1000 W/m² direct solar radiation)	< 6 W/m² (long-wave) < 15 W/m² (long-wave)
Non-stability (change/year)	< 1 %
Non-linearity (100 to 1000 W/m²)	< 1 % short-wave (upper and lower sensor)
Non-linearity (-250 to 250 W/m²)	< 1 % long-wave (upper and lower sensor)
Directional response (up to 80° with 1000 W/m² beam)	< 20 W/m² (short-wave)
Spectral selectivity (350 to 1500 nm) (8 to 14 µm)	< 3 % (short-wave) < 5 % (long-wave)
Temperature response (-10 °C to +40 °C)	< 5 %
Tilt response (0° to 90° at 1000 W/m²)	< 1 %
Field of view	180° upper sensor (short-wave) 170° lower sensor (short-wave) 180° upper sensor (long-wave) 150° lower sensor (long-wave)
Accuracy of bubble level	< 0.2°
Pyrgeometer temperature sensor output	10 K thermistor and Pt-100
Mounting rod (screw-in)	350 mm long x 16 mm ⌀
Detector type	Thermopile
Operational temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

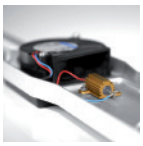
Part number	Instrument
0369900-032	CNR4 Net Radiometer • four-component • 10 m cable
0369900-030	CNR4 Net Radiometer • four-component • no plug, no cable

Part number	Accessories
4250024	Drying Cartridge (minimum order 5 cartridges)
See next page	CNF4 Ventilation Unit
0369701	CMB1 Mounting Bracket To enable easy attachment of the mounting rod to a pole or a wall

CNF4







CNF4 is the ventilation and heating unit for the Kipp & Zonen CNR4 net radiometer. The CNF4 minimizes the effects of precipitation, condensation and frost on your radiometer measurement data, improving the CNR4 accuracy and reliability even further; as well as minimizing the need for cleaning and maintenance.

CNF4 provides a clean air flow over all four of the CNR4 radiometer domes and windows and is designed to operate under all weather conditions. The only part that needs maintenance is the air inlet filter, which should be checked at regular intervals and cleaned or replaced when necessary.

The integrated 10 W heating can be switched on externally by the operator when required. This raises the temperature of the domes and windows slightly above ambient to prevent the formation of dew and frost and to disperse precipitation.

The ventilation fan and heater run from 12 VDC and can be operated by the accessory CVP2 universal AC-DC power adaptor. A pulse output allows the fan speed to be monitored and there is a waterproof connector for the cable.

CNF4 can be integrated at production. But it can also be bought as an accessory kit for retro-fitting to a CNR4 that was purchased without it.

Specifications	
Supply voltage	8 to 13.5 VDC
Cable voltage drop	0.07 V/m (with heater)
Tacho output	5 V, 2 pulses per revolution 8800 pulses per minute (nominal)
Power consumption ventilator	5 W continuously
Power consumption heater	10 W (to be externally switched)
Operational temperature range	-40 °C to +70 °C
Storage temperature range	-40 °C to +70 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	55

Part number	Instrument
0369710-002	CNF4 Ventilation Unit • 10 m cable
0369710-000	CNF4 Ventilation Unit • no plug, no cable

Note: Cable length is limited to 50 m because of voltage drop on the power supply wires

Part number	Accessories
2682047	Spare Filters pack of 5 fan inlet filters
0349401	CVP2 Power Supply 115 / 230V AC Power adaptor with 12 VDC output

Note: CVP2 is not suitable for unprotected outdoor use

Horticultural Sensor

For the measurement of photosynthetically active radiation

Exposure to light is essential for the growth of a plant. Under the influence of light from the sun, or from artificial sources, plants convert carbon dioxide and water into glucose and oxygen. This process is called Photosynthesis and occurs mainly under the influence of light in a number of discrete wavebands within the range between 400 nm (blue) and 700 nm (red). Light within this spectral region is referred to as Photosynthetically Active Radiation (PAR).

To monitor and optimize the development, quality and yield of plants, accurate determination of the amount of PAR radiation received is essential. In addition to high quality PAR radiation measurement durability is an important factor.

Especially in greenhouses conditions can be very harsh due to high temperature and humidity, artificial lighting, and possibly spraying with pesticides. For sensors to operate reliably they must be designed to resist the influences of these conditions.

Kipp & Zonen offers the PQS1 that is sensitive to light with a quantum response that matches the differing energies of photons within the PAR spectral region.

With an excellent price-performance ratio, and superior durability for virtually any environment, PQS1 is the ideal choice for greenhouse automation applications as well as for use outdoors in crop research and monitoring.

PQS1

PQS1 measures the Photosynthetically Active Radiation (PAR) from the sun, or artificial light sources, that produces chlorophyll and promotes growth in plants, and is a key input for agriculture, horticulture and greenhouse automation. PQS1 features optimised quantum response providing an excellent match with the ideal PAR spectrum.

The PQS1 PAR Quantum Sensor is designed to provide accurate, continuous measurement of PAR outdoors or indoors. The rugged construction makes it well protected from harsh weather conditions around the world and from exposure to pesticides and fertilisers.

No power is required; the detector generates a small voltage output proportional to the PAR received. Two PQS1 instruments can easily be bolted back-to-back to make a simple net PAR sensor. The standard cable length is 5m with an option of 15 m.

Specifications	
Spectral range (50 % points)	400 to 700 nm ±4 nm
Sensitivity	4 to 10 µV/µmol/m²·s
Impedance	240 Ω (typical)
Expected output range (0 to 3000 µmol/m²·s)	0 to 30 mV
Maximum operational irradiance	10,000 µmol/m²·s
Response time (95 %)	< 1 µs
Non-stability (change/year)	< 2 %
Non-linearity (0 to 10,000 µV/µmol/m²·s)	< 1 %
Directional response (up to 80° with 1000 µmol/m²·s beam)	< 30 µmol/m²·s
Temperature response	< -0.12 %/°C
Field of view	180 °
Accuracy of bubble level	< 0.2 °
Detector type	Photo-diode
Operational temperature range	-30 °C to +70 °C
Storage temperature range	-30 °C to +70 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

Part number	Instrument
0373900-001	PQS1 PAR Quantum Sensor • 5 m cable
0373900-003	PQS1 PAR Quantum Sensor • 15 m cable
0373900-701	PQS1 PAR Quantum Sensor • METEON • 5 m cable
0373900-703	PQS1 PAR Quantum Sensor • METEON • 15 m cable
0373900-801	PQS1 PAR Quantum Sensor • AMPBOX • 5 m cable
0373900-803	PQS1 PAR Quantum Sensor • AMPBOX • 15 m cable
Note: AMPBOX is adjusted so that 4 to 20 mA output = 0 to 3200 µmol/s.m²	

Part number	Accessories
0338720	Mounting Rod Screw-in 300 mm long x 12 mm ø
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall

Sunshine Duration Sensor

For the measurement of hours of sunshine

For weather reports (rather than weather forecasts) it is often interesting to know the actual duration of sunshine in a period of time. The World Meteorological Organisation (WMO) defines 'sunny' as when the direct solar irradiance exceeds the level of 120 W/m² and sunshine duration as the number of sunny hours per day.

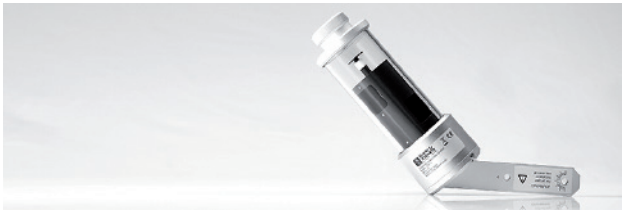
This information is useful for holiday resort daily reports, tourism marketing, health spas and clinics. In agronomy the amount of sunshine received by crops can be used to help forecast yields.

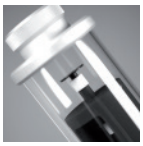
Traditionally, sunshine duration is monitored using a Campbell-Stokes recorder, where a glass sphere focuses the sun onto a marked card and burns it when it is sunny.

However, the burn marks vary depending upon the paper of the card, dampness of the card (high humidity or after rain), and the card must be changed every day. The marks must be analysed manually, and the results are highly subjective. Meteorological agencies want to automate this process and to reduce the variability of results. A very accurate solution is to use a sun tracker and a pyrheliometer, but this is relatively expensive.

Therefore, Kipp & Zonen developed the CSD3 Sunshine Duration Sensor. It is designed for continuous outdoor use and is easy to install and maintain. It is used by major national weather networks across Europe, and elsewhere.

CSD3





CSD3 measures sunshine duration through a high quality glass tube. It has no moving parts and uses 3 photo-diodes with specially designed diffusers to make an analogue calculation of when it is sunny. The output is switched high or low to indicate sunny or not sunny conditions. The calculated direct irradiance value is also available.

The waterproof plug-and-socket cable connection enables easy installation and servicing. The standard cable is 15 m long, 25 m is an option. The large drying cartridge with screw-on cap gives extended change intervals, and a humidity indicator shows clearly when this is necessary. A robust mounting arm is fitted to the base of the instrument.

CSD3 operates from 12 VDC power and has two levels of built-in heating to dissipate rain, snow and frost. These are normally switched externally, but an optional internal thermostat control is available. This switches on the 10 W heater at a housing temperature <6 °C ±3 °C and off at a temperature >14 °C ±3 °C.

Specifications	
Spectral range (overall)z	400 to 1100 nm
Uncertainty (monthly sunshine hours) (direct signal for clear sky)	< 10 % < 10 %
Analogue output Analogue output range (direct radiation)	0 to 1.5 V 0 to 1500 W/m²
Switched output (direct radiation) Switched output (direct radiation)	0 V for < 120 W/m² (not sunny) 1 V for > 120 W/m² (sunny)
Response time (95 %)	< 1 ms
Non-stability (change/year)	< 2 %
Temperature response	< 0.1 %/°C
Supply voltage	9 to 15 VDC
Power consumption (heaters)	1 W and 10 W (to be externally switched) Optional internal thermostat
Detector type	Photo-diode (3x)
Operational temperature range	-40 °C to +70 °C
Storage temperature range	-40 °C to +70 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	67

Part number	Instrument
0342901-003	CSD3 Sunshine Duration Sensor • 15 m cable
0342901-000	CSD3 Sunshine Duration Sensor • no plug, no cable
0342901-033	CSD3 Sunshine Duration Sensor • thermostat • 15 m cable
0342901-030	CSD3 Sunshine Duration Sensor • thermostat • no plug, no cable

Note: Cable length is limited to 25 m because of voltage drop on the heater power supply wires

Part number	Accessories
4250024	Drying Cartridge (minimum order 5 cartridges)
0369701	CMB1 Mounting Bracket To enable easy attachment to a pole or a wall

Laboratory Thermopile

For the measurement of radiant fluxes in laboratory environments

There are many situations in laboratory environments, both in education and research where it is necessary to measure radiant fluxes with high accuracy. Typically this is an optical laboratory or a physics department where the equipment is mounted onto optical benches or tables.

For this application a thermopile is the ideal type of detector because of its wide spectral response and good linearity. Because the laboratory environment is stable and clean, it does not need temperature correction or weather protection and can be used without a window for the widest measurement range.

The radiometer should have a restricted field of view so that it only sees the radiation required to be measured and not the other sources of radiation in the environment around it. The thermopile detector generates a small voltage proportional to the radiation received.

The Kipp & Zonen model CA2 radiometer is widely used in optical and physics laboratories around the world and is supplied with a mounting rod suitable for use with standard optical bench fixing clamps. The signal voltage is usually displayed using a high accuracy digital voltmeter and can be converted into irradiance values in W/m², using the sensitivity supplied on the calibration certificate.

CA2

CA2 is based on the same type of thermopile detector as our CMP3 and CMP6 pyranometers. Because it has a limited field of view it can be used to measure the intensity of radiant fluxes coming from a specific location or a specific source.

CA2 is sensitive to radiation from 0.2 to 50 µm, and has a field of view of 20 ° for 90 % of the received radiation. This is determined by cylindrical brass housing that contains a conical reflector. The removable glass window reduces convection effects and radiation losses but restricts the spectral range to 0.3 to 3 µm.

The thermopile is ideal for control purposes (such as ovens), demonstration purposes in schools and technical institutes or to be used for reference measurements in optical laboratories. The mounting rod allows easy fixing to standard optical bench fixing clamps. The terminals allow simple connection of bare wires or 4 mm banana plugs.

Specifications	
Spectral range (without window) (with window)	0.2 to 50 µm 0.35 to 2.8 µm
Sensitivity (Parallel beam on front window)	7 to 20 µV/W/m²
Impedance	20 to 200 Ω
Expected output range (0 to 1500 W/m²)	0 to 30 mV
Maximum operational irradiance	2000 W/m²
Response time (63 %)	< 6 s
Response time (95 %)	< 18 s
Non-linearity (100 to 1000 W/m²)	< 1.5 %
Field of view	20 ° (for 90 % of the received radiation)
Mounting rod	170 mm long x 10 mm ⌀
Detector type	Thermopile
Operational temperature range	-40 °C to +80 °C
Storage temperature range	-40 °C to +80 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	For use in clean indoor conditions only

Part number	Instrument
1311907	CA2 Laboratory Thermopile

Part number	Options (configured/adjusted to suit instrument)
0365911	METEON irradiance meter and data logger • configured
0365901	AMPBOX signal amplifier • gain adjusted

Data Loggers

To record and display data from instruments

Finding the right data acquisition system for your valuable measurement data can be very time consuming. The system needs to be able to accurately read the output signals from our instruments, apply calibration factors, convert measurements to 'engineering units' store the results and offer protection from varying environmental conditions.

Kipp & Zonen has made this task easy for you by offering a wide range of data acquisition solutions. They are designed to work with our instruments and offer the functionality you need for virtually any type of installation.

Kipp & Zonen data loggers and display units have very sensitive inputs with high resolution and use the instrument sensitivity (calibration factor) to convert the input voltage into radiation values in W/m², or other units appropriate to the type of radiometer. They all have software for configuring the logging functions and for download and storage of the data on a Windows™ computer. The data files are in ASCII format and can be easily read as text and exported to spreadsheets.

METEON is a single-channel hand-held data logger with built in display. It is supplied in a rugged carry case with all accessories and space for a pyranometer, making it ideal for use as field test equipment.

LOGBOX SD is a rugged multi-channel, weatherproof data logger for outdoor use that can also handle temperature sensors and other signal types. It can run for several months on its internal batteries.

Kipp & Zonen Smart Radiometers do not require a conventional data logger with analogue-to-digital input conversion. They are designed for connection to digital data acquisition systems using the industry standard Modbus® protocol.

METEON

METEON is an accurate hand-held display unit and data logger for the measurement of solar irradiance. Its small size, long battery life and universal input make it an ideal tool for many test and field applications.

METEON is delivered in a tough carrying case together with:
- USB interface cable
- Software and manual on CD-ROM
- 2 x AA alkaline batteries

The carrying case also has space for a pyranometer.

METEON can be used with all our single output pyranometers plus the CUV5, NR Lite2, PQS1 and CA2. It is primarily intended to display real-time radiation values in Watt per square meter or PAR in micro-mol per square meter per second.

Configuration with a computer is simple, using the supplied software and USB interface cable. Just select the radiometer type from a list, enter its sensitivity, and the correct measuring range is automatically selected. Once METEON is configured, connect the radiometer, switch on, and the large 4-digit display directly shows the correct values. This makes it a perfect tool for convenient use in the field.

The great advantage of the METEON is the integrated data logging function that can store data for up to 3500 samples. It stores minimum, maximum and average values per logging interval. The low power consumption allows the METEON to record at least 50 days of data on 2x AA type batteries.

The terminals allow simple connection of radiometers with bare wires or 4 mm banana plugs.

The METEON is also available ready to go as a kit supplied with a radiometer and is pre-programmed to show the measured radiation value when the instrument is connected and the METEON switched on

Specifications	
Analogue inputs	1
AD conversion resolution	16 bits
Temperature coefficient	< 0.5 % over range
Uncertainty	< 0.1 %
Input ranges	± 6.25 to ± 200 mV
Display	4 digits with polarity
Communication interface	USB 1.1/2.0 cable included
Data logger memory	3518 samples
Logging interval	2 to 65535 seconds
Logged information	data samples, minimum, maximum, average
Supply voltage	2 x AA battery included
Windows™ compatible software	Configuration, data download, graphical display
Operational temperature range	-10 °C to +40 °C
Storage temperature range	-10 °C to +40 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	40

Part number	Article
0365910	METEON irradiance meter and data logger
0365911	METEON irradiance meter and data logger • Configured
Note: Specify type and serial number of radiometer for use with METEON	

Part number	METEON Irradiance Measurement Kits
0339920-701	METEON + SP Lite2 Silicon Pyranometer • 5 m cable
0356900-722	METEON + CM4 High Temperature Pyranometer • 10 m cable
0338920-702	METEON + CMP3 Pyranometer • 10 m cable
0362900-702	METEON + CMP6 Pyranometer • 10 m cable
0379900-702	METEON + CMP10 Pyranometer • 10 m cable
0362910-702	METEON + CMP11 Pyranometer • 10 m cable
0362920-712	METEON + CMP21 Pyranometer • 10 m cable
0362930-712	METEON + CMP22 Pyranometer • 10 m cable
0364910-702	METEON + CUV5 Broadband UV Radiometer • 10 m cable
0344920-703	METEON + NR Lite2 Net Radiometer • 15 m cable
0373900-701	METEON + PQS1 PAR Quantum Sensor • 5 m cable

LOGBOX SD

LOGBOX SD is an 8 channel data logger that allows connection to multiple instruments at the same time. Each input can convert measured values into the correct engineering units. The data is stored on the internal 128 kB memory or the 512 MB SD memory card that is included as standard.

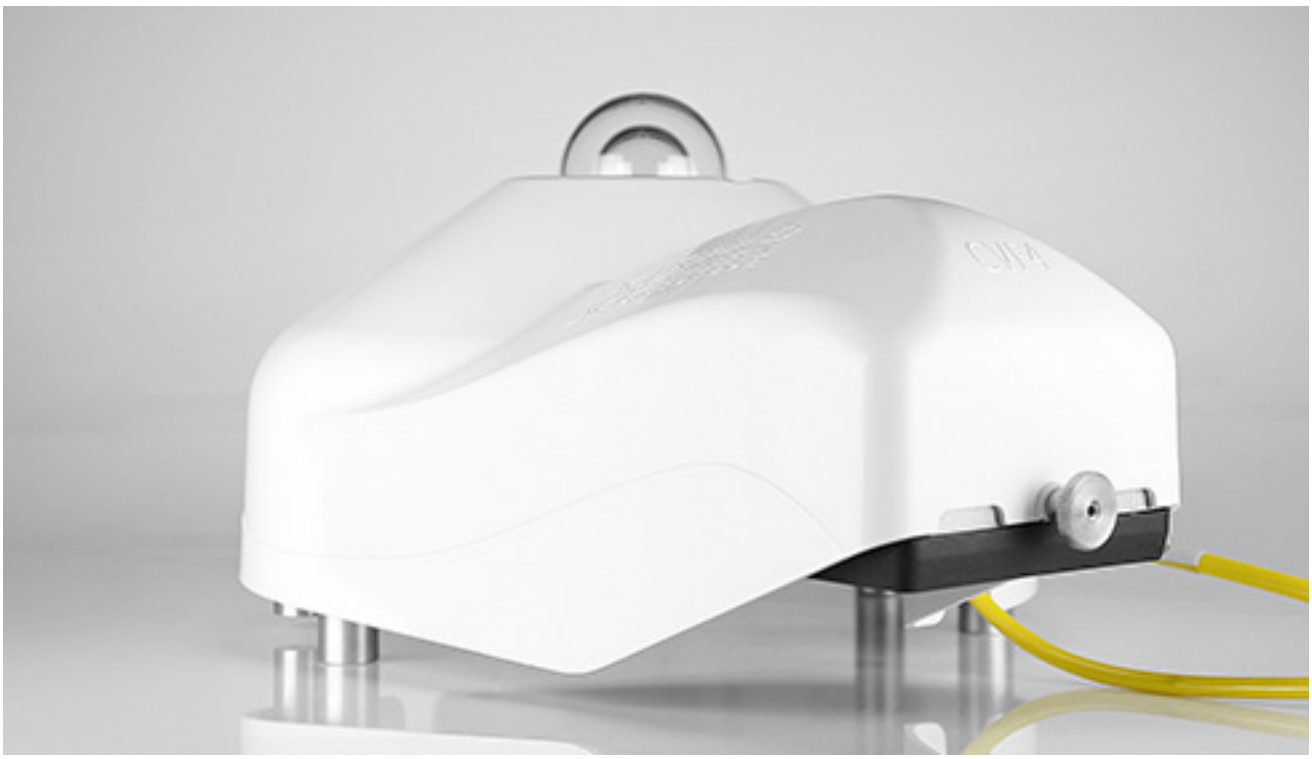
The 24 bits, high resolution, differential analogue inputs can be easily configured for all our instruments, including the Pt-100 and 10K thermistor temperature sensors fitted to many of our models. Four digital inputs are available for measuring time or frequency, or as counter inputs.

LOGBOX SD has an IP 65 weatherproof enclosure and wide operating temperature range from -40 °C to +60 °C. The state of the art design consumes so little power that it will run for months on the four internal AA type batteries. The wide power supply operating range makes it possible to use solar panels or other external DC power sources.

The included user-friendly computer software makes configuration and data download fast and simple, using RS-232 serial communication. All Kipp & Zonen radiometer settings are pre-defined and can be selected from a pull-down list. LOGBOX SD is supplied with a mounting bracket for easy fixing to masts up to 50 mm diameter.

Specifications	
Analogue inputs	8 single-ended, or 3 differential + 2 single-ended, or combinations
Uncertainty	< 0.05 % for 24 bits resolution
Input ranges	± 20 mV to ± 2.5 V (24 bits) 0 to 3 V (12 bits)
Digital inputs	4, maximum input 15 Volt
Communication interface	RS-232, cable included
Data logger internal memory	128 kB
Memory card	SD, 512 MB (included)
Logged information	Data samples, polynomial functions
Supply voltage	4 x AA type bateries (included) or 4 to 20 V DC/7 mA
Power consumption	1.7 mA typical during measurement
Mounting bracket	Included, for masts up to 50 mm ⌀
Windows™ compatible software	Configuration and data download
Operational temperature range	-40 °C to +60 °C
Storage temperature range	-40 °C to +60 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	65

Part number	Article
3303090	LOGBOX SD Data Logger
0372910	LOGBOX SD Data Logger • Configured



Solar Accessories

Specially designed for our solar instruments

Ventilation Units
Ventilation of radiometers improves the stability and quality of measurements and decreases the frequency of cleaning the domes. Our ventilation units also include heaters that can be externally switched on to clear frost and snow.

Shadow Rings
To make measurements of diffuse solar radiation a pyranometer has its dome shaded from the direct solar irradiance. An alternative to an automatic sun tracker is to use a shadow ring. This does not need power, but requires regular manual adjustment to keep the dome correctly shaded.

Power Supplies
Some of our instruments and accessories operate from 12 VDC power and for these we have power supply units available.

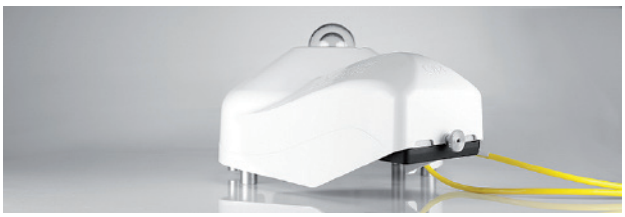
Amplifier
For customers who require an industry standard output, or to use long cables, we have the AMPBOX signal amplifier which converts the low level instrument output to a 4 to 20 mA current loop signal.

Mountings
Several of our instruments are supplied with a mounting rod, others have a rod available as an accessory. For instruments without these features we have mounting fixtures available which incorporate a rod and a plate to mount a radiometer on one side only, or on both sides (facing upwards and downwards). We also have a bracket available to enable easy attachment of a mounting rod to a pole or a wall and a kit to mount pyranometers at an adjustable angle.

Glare Screen
For some types of radiometers, when used facing downwards, it is advisable to fit a glare screen to prevent the instrument seeing radiation from below the horizon of the detector.

Instrument Cables and Plugs
For instruments with connectors, high quality cables in a range of lengths are available, pre-wired with a waterproof plug. Plugs are also available separately for the user to fit their own cable.

CVF4 Ventilation Unit



CVF4 is a low power, low maintenance ventilation unit. The only part that needs maintenance is the removable air inlet filter, which should be checked at regular intervals and cleaned or replaced when necessary. The cover is easily removed without tools to check the radiometer desiccant.

Ventilation of radiometers improves the reliability and accuracy of the measurement by reducing dust, raindrops and dew on the dome. With thermopile-based instruments ventilation stabilises the temperature of the radiometer and suppresses thermal offsets.

The integrated heater can be used to disperse precipitation and melt frost, or even melt snow and ice in cold climates. The heater power must be switched externally.

The flow that the CVF4 creates is unique. At the top of the pyranometer dome the flow is very high and it swirls to improve the air distribution over the dome. The position of the heaters and the new cover material ensures that only half the heating power is needed to melt frost and snow compared to older ventilation units.

A pulse output allows the fan speed to be monitored and there is a waterproof connector for the cable. The accessory CVP2 universal AC-DC power adaptor can operate up to three CVF4 ventilation units with the heaters on.

Specifications	
Air temperature rise caused by CVF4	< 0.25 K with ventilator fan only < 1 K with fan and heater
Tacho output	5 V, 2 pulses per revolution 8800 pulses per minute (nominal)
Supply voltage	8 to 13.5 VDC
Power consumption ventilator	5 W continuously
Power consumption heater	5.5 W (to be externally switched)
Cable voltage drop	0.075 V/m (with heater)
Operational temperature range	-40 °C to +70 °C
Storage temperature range	-40 °C to +70 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	55

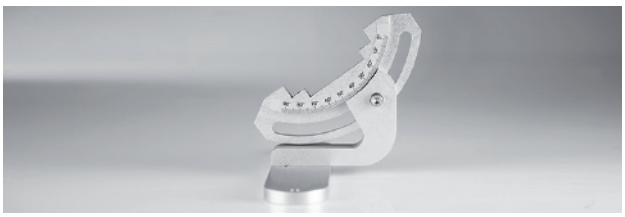
Part number	Instrument
0378910-002	CVF4 Ventilation Unit • 10 m cable
0378910-000	CVF4 Ventilation Unit • no plug, no cable

Note: Cable length is limited to 50m because of voltage drop on the power supply wires

Part number	Accessories
2682916	Spare Filters pack of 5 fan inlet filters
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ø
0369701	CMB1 Mounting Bracket In combination with mounting rod for easy attachment to a pole or a wall
0349401	CVP2 Power Supply 115 / 230V AC Power adaptor with 12 VDC output

Note: CVP2 is not suitable for unprotected outdoor use

Adjustable Tilt Radiometer Mounting Kit



Adjustable Tilt Radiometer Mounting Kit
In solar energy applications it is often desirable to measure the 'tilted' global solar radiation at the angle of non-tracking (fixed) photovoltaic panels, in addition to the horizontal global radiation.

Adjustable Tilt Radiometer Mounting Kit is designed to be installed on a horizontal surface and allows a CMP, SMP, CGR or CUV series instrument to be mounted at zenith angles from 0° to 90°, using a graduated scale.

The kit can also be installed using a CMF4 Mounting Fixture and CMB1 Mounting Bracket.

It is not possible to use a ventilation unit with the kit.

Part number	Article
0367718	Adjustable Tilt Radiometer Mounting Kit for mounting a tilted global radiometer at a zenith angle from 0° to 90°

Mounting Accessories

A range of mounting accessories enables the attachment of Kipp & Zonen radiometers to poles, masts or walls.

Mounting Rod
For the SP Lite2, PQS1, CMP3, SMP3 and CGR3 a mounting rod is available, which screws into the instrument housing.
Rod diameter 12 mm, length 300 mm.

CMF1 Mounting Fixture
For the CMP, SMP, CGR and CUV series of instruments without ventilation units. It can take one upwards and/or one downwards facing radiometers.
Plate diameter 88 mm. Rod diameter 16 mm, length 350 mm.

CMF4 Mounting Fixture
For the CMP, SMP, CGR and CUV series of instruments with or without ventilation units. CMF4 can also be used to mount the UVS ultraviolet radiometer series. It can take one upwards and/or one downwards facing radiometer.
Plate length 375 mm, width 280 mm. Rod diameter 20 mm, length 350 mm

CMB1 Mounting Bracket
For attaching mounting rods of 12 to 20 mm diameter, or the CSD3 to poles, masts or walls. The radiometer can be levelled by rotating and tilting the rod. The bracket includes u-bolts for fixing to poles and masts from 22 to 60 mm diameter.

CLF4 Levelling Fixture
For the CM4 high temperature pyranometer. Baseplate for CM4 with three adjustable height screws and removable cap with bubble level.

Part number	Article
0338720	Mounting Rod For SP Lite2, PQS1 , CMP3, SMP3 and CGR3
0356700	CLF4 Levelling Fixture For CM4 high temperature pyranometer
0362700	CMF1 Mounting Fixture For 1 or 2 unventilated radiometers
0362703	CMF4 Mounting Fixture For 1 or 2 ventilated or unventilated radiometers (1 upper / 1 lower) Length 375 mm, width 280 mm. Mounting rod 350 mm long x 20 mm ø
0369701	CMB1 Mounting Bracket

CVP1 and CVP2

CVP1 is a weatherproof heavy duty power supply with wide-range AC input and a fully protected 12 VDC output at up to 3.5 A. It is suitable for powering ventilation units and other equipment, such as data loggers, and is supplied pre-wired with 5 m AC cable.

CVP1 LAS MkII is a special version for use with Kipp & Zonen Large Aperture Scintillometer (LAS). It is pre-wired with 10 m cable fitted with the waterproof connector for the LAS MkII transmitter or receiver.

CVP2 is a universal AC power adaptor with 12 VDC output. It operates from 115 or 230 VAC and can power up to four CVF4 ventilation units with heating. It can also be used to power the UVS series of UV radiometers.

Please note that CVP2 is not suitable for unprotected outdoor use.

Specifications CVP 1	
Supply voltage	100 to 240 VAC, 50/60 Hz
Power consumption	120 to 170 W
Output voltage	12 VDC
Output current	3.5 A
Line regulation	±0.2 % maximum
Load regulation	±1 % maximum
Operational temperature range	-20 °C to +50 °C
Storage temperature range	-20 °C to +50 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	65

Specifications CVP2	
Supply voltage	100 to 240 VAC, 50/60 Hz
Output voltage	12 VDC
Output current	2.5 A
Plug type	European, UK, USA and Australian plug adapters
Operational temperature range	0 °C to +40 °C
Storage temperature range	0 °C to +40 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	For indoor use only

Part number	Article
0357700	CVP 1 power supply 12 VDC output
0371701	CVP1 LAS MkII power supply 12 VDC output
0349401	CVP2 power supply 12 VDC output

AMPBOX

AMPBOX is a digital amplifier perfectly suited to combine with our instruments. Most Kipp & Zonen solar radiation radiometers are passive instruments that do not require any power to operate. The output signal is generated by the thermopile or photo-diode detector. However, the output is a very low voltage, typically in the region of 10 mV on a bright sunny day.

AMPBOX can be used to provide a 4 to 20 mA current loop signal for applications where longer cables are required, or the low signal outputs cannot be handled. AMBOX is fully waterproof and can be installed outdoors close to the radiometer and connected by several hundred metres of cable to the data acquisition system. The amplifier is 'current-sink' (powered by the current loop). The power for the loop must be supplied from the data acquisition system.

AMPBOX is a programmable digital amplifier and the input and output are isolated to minimize feedback and to protect the data collection equipment. As standard the amplifier is delivered with an input signal of 2 mV producing an output of 1 mA, so that 4 to 20 mA represents 0 to 32 mV.

AMPBOX can be adjusted to suit the sensitivity of a particular radiometer to provide a defined radiation output range, for instance 4 to 20 mA represents 0 to 1600 W/m² of radiation. For radiometers that can produce a negative output the zero point is offset.

Specifications	
Input impedance	10 MΩ
Output range	4 to 20 mA
Supply voltage	35 VDC maximum
Voltage drop to power amplifier	7.2 VDC
Input range	-12 to +150 mV
Standard gain	2 mV / mA
Gain range	0.1 to 4 mA / mV
Zero adjustment	Up to 12 mA
Operational temperature range	-40 °C to +85 °C
Storage temperature range	-40 °C to +85 °C
Humidity range	0 to 100 % non-condensing
Ingress Protection (IP) rating	66

Part number	Article
0365900	AMPBOX signal amplifier standard gain setting
0365901	AMPBOX signal amplifier gain adjusted
0365903	AMPBOX signal amplifier gain adjusted for pyrgeometers

Note: For an existing radiometer please specify the model, serial number and sensitivity when ordering

CM121B/C Shadow Ring

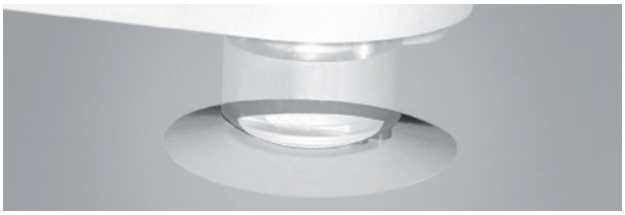
CM121 is a shadow ring that does not require power and can be used with all the Kipp & Zonen CMP, SMP, CGR and CUV series of instruments. It is used for measurements of the diffuse sky radiation or to shade a pyrgeometer from the direct solar radiation. CM121B is for unventilated radiometers and CM121C is for ventilated instruments.

The radiometer is installed on the mounting pedestal and after levelling and correct adjustment for the location and the sun declination the ring makes a shadow on the radiometer dome throughout the day. To maintain the shading accuracy it is necessary to adjust the position of the ring every few days to compensate for changes in the solar arc.

The ring has a width / diameter ratio of 0.185 and has a view of 10.6 ° seen from the radiometer. Because the ring intersects a part of the diffuse sky, a table is supplied to compensate the measured values.

Part number	Article
0346900	CM121B Shadow Ring for unventilated radiometers
0346901	CM121C Shadow Ring for ventilated radiometers

Glare Screen Kit



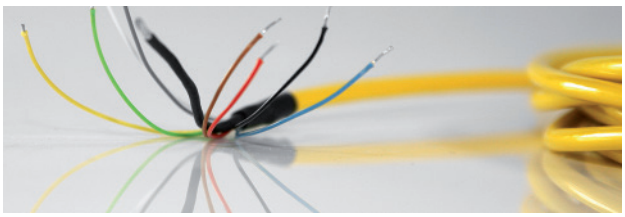
Glare Screen Kit
A downward facing radiometer should not see any radiation coming from the hemisphere above or from the first 5 ° below the horizon. Our albedometers and net radiometers have this feature integrated into the design.

An accessory glare screen kit is available for use with the CMP, SMP, CGR and CUV series of instruments (except the CMP3, SMP3 and CGR3).

Please note that the CVF4 ventilation unit cannot be fitted if the glare screen kit is used.

Part number	Article
0305722	Glare Screen Kit for downwards facing radiometers

Instrument Cables and Plugs



Many instruments are fitted with a socket in the housing. The matching plug is supplied pre-wired to a high quality, wide temperature range, UV-resistant yellow cable. The connectors allow easy installation and exchange of instruments during recalibration.

The plugs have metal housings to protect the signals from interference, are waterproof, and have gold-plated pins for reliability. Pre-wired cables are available in a range of lengths and plugs are available separately for the user to fit their own cable.

Instruments with heaters or temperature control systems have restrictions on the maximum cable length due to voltage drop in the wires that could prevent correct operation. This is noted below where applicable.

Part number	For CMP3, CMP6, CMP10, CMP11, CUV5
2523144	Waterproof 2-pin plug only
0362601	10 m cable • pre-wired with waterproof 2-pin plug
0362603	25 m cable • pre-wired with waterproof 2-pin plug
0362604	50 m cable • pre-wired with waterproof 2-pin plug
0362605	100 m cable • pre-wired with waterproof 2-pin plug

Part number	For CMP21 (10K), CMP22 (10K), CGR3 (10K), CGR4 (10K) CMA6, CMA11, CVF4*, CNF4*
2523145	Waterproof 4-pin plug only
0362611	10 m cable • pre-wired with waterproof 4-pin plug
0362613	25 m cable • pre-wired with waterproof 4-pin plug
0362614	50 m cable • pre-wired with waterproof 4-pin plug
0362615	100 m cable • pre-wired with waterproof 4-pin plug
*Note: 4-wire cable length for CVF4 and CNF4 is limited to 25 m of this type of cable because of voltage drop power supply wires	

Part number	For SMP3, SMP6, SMP10, SMP11, SMP21, SMP22, CMP21 (Pt-100), CMP22 (Pt-100), CGR3 (Pt-100), SGR3, CGR4 (Pt-100), SGR4, CHP1, SHP1, CNR4, CNF4[3], SUV5, UVS[1], CSD3[2], CVF4[3]
2523146	Waterproof 8-pin plug only
0362621	10 m cable • pre-wired with waterproof 8-pin plug
0362623	25 m cable • pre-wired with waterproof 8-pin plug
0362624	50 m cable • pre-wired with waterproof 8-pin plug
0362625	100 m cable • pre-wired with waterproof 8-pin plug
[1]Note: Cable length for UVS is limited to 25 m of this type of cable because of voltage drop on the temperature control power supply wires	
[2]Note: Cable length for CSD3 is limited to 25 m of this type of cable because of voltage drop on the heater power supply wires	
[3]Note: Cable length for CNF4 and CVF4 is limited to 50 m of this type of cable because of voltage drop on the heater power supply wires	

Atmospheric Science Instruments

Introduction

Our atmospheric science range of instruments includes both products manufactured by Kipp & Zonen and others that have been developed by specialist companies and are exclusively distributed by Kipp & Zonen worldwide. In general these are more complex instruments for scientific research and network use and are computer controlled with sophisticated data processing software.

Atmospheric science instruments include the Brewer spectrophotometer for stratospheric Ozone and high accuracy UV measurements, scintillometers, sky radiometers, and sun photometers. All can be found on the following pages.

For the latest product information, brochures, manuals and application information visit our website at **www.kippzonen.com**.

Brewer Spectrophotometer

For the highest accuracy observations of uv and ozone

A major health concern in many parts of the world is the amount of harmful ultraviolet radiation from the sun and sky that people are exposed to. 'Holes in the Ozone layer' are areas of stratospheric Ozone depletion and are not confined to the North and South Poles. They are indicators of the general health of the atmosphere, and a reduction in Ozone means that more harmful UV reaches the ground.

To accurately measure stratospheric Ozone, and solar UV radiation, requires a sophisticated instrument that can also act as a reference for networks of lower performance instruments.

In 1988 the 'Brewer' became the World Meteorological Organisation (WMO) Global Atmosphere Watch (GAW) standard for stratospheric Ozone measurement. Today, the Kipp & Zonen Brewer MkIII spectrophotometer is the only instrument in current production sanctioned by the WMO for making total column Ozone measurements and provides much of the data for the World Ozone and UV Data Centre (WOUDC).

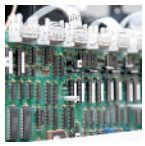
The Brewer is unique, designed by Environment Canada specifically for operating automatically with high accuracy over long periods of time, in all climates and environments from the tropics to Antarctica.

There have been several versions of the Brewer since its introduction in 1981, but the only model now in production is the MkIII 'double' Brewer because its two spectrometers in series provide superior UV measurement capability, compared to the single spectrometer MkII and MKIV. There are over 220 Brewers around the world, in more than 40 countries.

The Brewer MkIII is manufactured exclusively by Kipp & Zonen under licence of Environment Canada. We provide a full range of calibration, spares, repairs and support services for the MkIII and for older models.

More information about the Brewer can be found on the dedicated Brewer website at www.kippzonen-brewer.com.

Brewer MkIII



Brewer MkIII has a unique design of spectrometer that is self-compensating for the expansion and contraction of components caused by changes in temperature. This means that it can be used around the world outdoors without the need for complex temperature stabilisation. There are built-in wavelength and sensitivity check lamps, fan, heater and humidity sensor.

The MkIII 'double' Brewer uses two of these spectrometers in series for improved ultraviolet measurement accuracy, particularly when the sun is low. This gives the MkIII a significant advantage over the single spectrometer MkII and MkIV Brewers, which are no longer manufactured.

The Brewer is mounted on a dedicated azimuth tracker and makes measurements of the direct solar radiation at specific wavelengths to determine the total column Ozone and Sulphur Dioxide in the atmosphere. It also has the capability to make high resolution UV spectral scans of either the direct or global solar radiation. The software can accurately calculate UVA, UVB, UVE (Erythemal) and UVI (Index). The Brewer must be connected to a PC running the operating software in order to make measurements and store data.

Included with the Brewer is a desk-top computer (with a display, keyboard and mouse) that is designed for continuous operation. The computer is pre-loaded with the operating software, configuration files and calibration data for the specific Brewer. To avoid potential compatibility issues with the operating software, an English version of Windows™ is installed, with the regional formatting set for English.

The spectrophotometer is supplied in a foam-lined aluminium transit case, for protection when transporting the instrument. The azimuth tracker is shipped in a substantial wooden crate.

Regular use of the stability kit is recommended to check that the UV response is not changing. This is important to report UV irradiance in W/m². The kit is not a calibration standard as used in the factory and is not required for Ozone and Sulpur Dioxide measurements, which are ratiometric in nature.

Part number	Instrument
0361900	Brewer MkIII • 230 VAC
0361901	Brewer MkIII • 115 VAC

Specifications	
Measurement principle	Unique self-compensating dual Ebert spectrometers
UV measurement	Direct sun or global radiation, UVA, UVB, UVE and UVI
Sun Tracker	Integrated, includes heavy duty tripod stand
Spectral range	286.5 to 363 nm
Resolution	0.6 nm ±0.01 nm
Ozone and SO_2 measurement wavelengths	303.2 nm • 306.3 nm • 310.1 nm 313.5 nm • 316.8 • nm • 320.1 nm
Column Ozone measurement uncertainty	< 1%
Serial output	RS-422, Supplied with isolated RS-422 to RS-232C converter with AC power adaptor for connection to PC running operating software, PC included
Operational temperature range	-20 °C to +50 °C -50 °C to +50 °C (with optional insulated cold cover)
Storage temperature range	-20 °C to +40 °C
Supply voltage	115 or 230 VAC, 50/60 Hz
Detector type	UV-enhanced photo-multiplier tube (PMT)
Software, GW-BASIC	Operation of Brewer, data storage and analysis

Part number	Accessories
3315001	UV Stability Kit and Precision Power Supply Higher accuracy, with 3 x 200 W calibrated quartz halogen lamps mounted in adapters for accurate optical alignment. Ventilated lamp housing with mounting frame for precise location over Brewer dome Very stable AC-DC power supply can be remote controlled via USB
BA-C 210	Insulated Cold Cover For the spectrophotometer (not the azimuth tracker). Keeps optical and electro-mechanical parts warm to extend operation from -20 °C to -50 °C. For locations regularly below 0 °C and/or with high wind-chill factor.

Scintillometers

For the measurement of heat fluxes and evaporation at large scales

Heat fluxes and evaporation at the Earth's surface are of great importance to the fields of meteorology and hydrology. Accurate continuous measurement of these parameters is often required for research projects and monitoring applications. Where the measurements need to be done on a field or landscape scale, or for validating satellite data, the traditional in-situ point measurement techniques are not sufficient.

The Kipp & Zonen LAS MkII is a large aperture scintillometer (LAS) designed to provide continuous measurements of heat flux and turbulence statistics over long distances, for energy balance studies and evaporation monitoring. Thanks to the extended range, from 100 m up to 4.5 km, LAS measurements can be compared to the typical pixel sizes of satellite-based instruments, for ground validation.

The measurement technique is based on the scintillation phenomenon. Heat fluxes between the ground and the atmosphere cause variations in the refractive index of the air. The LAS detects these variations using a pulsed beam of infrared light which is emitted by the transmitter and detected by the receiver. From the measurements the LAS MkII receiver can calculate and store the path-averaged structure parameter of the refractive index of air (C_n^2).

When the accessory meteorological sensor kit is connected to the receiver it automatically recognizes the sensors and can calculate surface sensible heat flux (H). The LAS MkII can store more than a month of data. The raw data can also be exported to a PC where the supplied EVATION® software package can calculate (C_n^2), (H) and other parameters and display them graphically in real time or historically.

For more advanced applications Kipp & Zonen offers the LAS MkII ET system to measure latent heat flux (L_vE) and Evapotranspiration (ET). This is a turn-key system which provides all the instrumentation and software necessary to monitor C_n^2, H, L_vE and ET. Kipp & Zonen's ET system is specifically designed for Earth energy balance studies, water and crop management and for the ground-truth validation of satellite remote sensing measurements.

LAS MkII Scintillometer

LAS MkII provides measurements of the path-averaged structure parameter of the refractive index of air C_n^2 over path lengths from 250 m to 4.5 km, using the scintillometry technique. A pair of aperture restrictors is supplied to allow measurements down to 100 m. The durable design enables operation under almost any atmospheric condition and with very low maintenance. It also comes standard with a rugged transit case.

The internal digital processing unit automatically computes C_n^2 and other relevant parameters. Results are stored in the internal non-volatile data memory. Using the built-in display and control keys, real time measurement data, configuration and installation parameters can be read directly from the display receiver.

The digital output of the receiver can be connected to a PC for remote real time display of data and instrument control. Our EVATION® software suite is included as standard to view real-time data numerically and graphically as well as to post-process advanced data. In addition analogue voltage outputs of C_n^2 and signal strength are available at the receiver for connection to data loggers.

The transmitter, receiver, alignment telescopes, aperture restrictors and cables are supplied packed in a rugged, foam-lined aluminium case suitable for field-portable use.

The accessory meteorological sensor kit plugs into the receiver and provides live wind-speed, temperature and pressure data. This allows the LAS MkII to calculate and store the surface sensible heat flux (H) in real-time.

Other accessories include stands and power supplies.

Part number	Instrument
0371900	LAS MkII Large Aperture Scintillometer • Transit Case

Specifications	
Wavelength	850 nm
Scintillation bandwidth	0.2 to 400 Hz
C_n^2 range	10^{-17} to 10^{-12} $m^{-2/3}$
Path length / aperture diameter	100 m to 1 km / 100 mm (restrictors included) 250 m to 4.5 km / 150 mm
Analogue outputs	0 to 2 V (C_n^2) 0 to 2 V (signal strength)
Serial output	RS-232 or RS-422 (selectable)
Data processing	Internal processing of C_n^2, H_{free} (with meteorological sensor kit) and other parameters
Data logging	Integrated, minimum one month
Instrument control and data display	Built-in display and key-pad, or remotely via digital interface
External sensor connection	Wind speed, temperature and pressure kit
Supply voltage	9.6 to 18 VDC
Power consumption	6 W (heater off) / 54 W (maximum when heater on)
Pan and tilt adjustment	Built-in
Alignment telescopes	Included Adjusted to each transmitter and receiver
Windows™ compatible software	EVATION® instrument control and data analysis suite

Part number	Accessories
0371704	Meteorological sensor kit Wind speed, temperature and pressure sensors - pre-wired with cable and connector for LAS MkII receiver 2 m high mast for fixing in ground, with mountings for meteorological sensors
0371701	CVP1 LAS MkII Weatherproof heavy-duty AC-DC power supply unit for outdoor use For transmitter and receiver (one required for each) Wide AC input range, fully protected output 12 VDC at 3.5 A Operating temperature range -20 °C to +50 °C Pre-wired with 10 m ouput cable and connector for LAS MkII, 5 m AC power input cable with IEC female plug
0357703	Adjustable Heavy-Duty Tripod Package Aluminium folding tripod, adjusts up to 3 m height, includes base-frame for hard surfaces and fixing bolts for LAS MkII Two supplied, one each for transmitter and receiver, in a wood carrying case
0353710	Tripod Floor Stand For easy mounting and levelling of the LAS MkII, height 0.45 m Very stable and rugged As used with Kipp & Zonen Brewer and 2AP TrackerFor transmitter and receiver (one required for each)
0353750	Height Extension Tube Extends the tripod mounting height by 0.60 m to a total of 1.05 m
0357720	Service and Factory Test Excluding any replacement parts needed

LAS MkII ET System

LAS MkII ET System is a complete solution for monitoring the energy balance within the boundary layer, including latent heat flux (L_vE) and Evapotranspiration (ET). It is specifically designed for field scale observations of the path averaged energy fluxes using the scintillometry technique.

All the equipment of the ET system is selected and designed to offer easy installation and low maintenance operation. Our EVATION® software suite is included as standard to view real-time data numerically and graphically and to post-process advanced data. EVATION® reads the ET system measurement data but can also use files from other types of data acquisition systems.

The system features a LAS MKII scintillometer. The analogue outputs are connected to a COMBILOG data logger in a stainless steel weatherproof enclosure, which also houses the ambient pressure sensor. The data logger inputs have over voltage protection and there are mast mounting clamps for the enclosure. The COMBILOG requires 12 VDC power. A NR Lite2 net radiometer is also connected to the data logger.

Sensors for wind speed, wind direction, temperature at two heights and soil heat flux at two depths are also connected to the COMBILOG. A 4 m height telescopic mast has all the necessary mountings for the meteorological and net radiation sensors and includes guy wires and a lightning rod.

The COMBILOG can be ordered with an AC to 12 VDC power supply and backup battery fitted in the enclosure. A further option is a GSM modem for remote communication (a suitable SIM card and network access must be provided by the user). Software to configure the COMBILOG, manually download data and display it in real-time is included.

Specifications	
Scintillometer	LAS MkII
Meteorological sensors and mast	Wind speed Wind direction Atmospheric pressure Ambient temperature at two heights Soil heat flux at two depths 4 m high telescopic mast with mountings for meteorological and net radiation sensors, lightning rod, guys and baseplate
Net radiation sensor	NR Lite2
Data acquisition	COMBILOG data logger system in weather-proof stainless steel enclosure with over-voltage protection, requires 12 VDC power
Windows™ compatible software	EVATION® instrument control and data analysis suite

Part number	System
LAS MkII Evapo-Transpiration System comprises	
0371900	LAS MkII Large Aperture Scintillometer • Transit Case
3303094	Sensor Set LAS MKII ET System
0344920-003	NR Lite2 Net Radiometer • single-component • 15 m cable
0372900-100	COMBILOG in small IP65 enclosure (38 x 38 cm)
Options	
0372900-102	COMBILOG in small IP65 enclosure 12 V Power Supply • Backup Battery
0372900-112	COMBILOG in small IP65 enclosure GSM modem • Antenna • 12 V Power Supply • Backup Battery

Part number	Accessories
0371701	CVP1 LAS MkII Weatherproof heavy-duty AC-DC power supply unit for outdoor use For transmitter and receiver (one required for each) Wide AC input range, fully protected output 12 VDC at 3.5 A Operating temperature range -20 °C to +50 °C Pre-wired with 10 m ouput cable and connector for LAS MkII, 5 m AC power input cable with IEC female plug
0357703	Adjustable Heavy-Duty Tripod Package Aluminium folding tripod, adjusts up to 3 m height, includes base-frame for hard surfaces and fixing bolts for LAS MkII Two supplied, one each for transmitter and receiver, in a wood carrying case
0353710	Tripod Floor Stand For easy mounting and levelling of the LAS MkII, height 0.45 m Very stable and rugged As used with Kipp & Zonen Brewer and 2AP TrackerFor transmitter and receiver (one required for each)
0353750	Height Extension Tube Extends the tripod mounting height by 0.60 m to a total of 1.05 m
0357720	Service and Factory Test Excluding any replacement parts needed

Sky Radiometers

For studying the effects of stratospheric aerosols

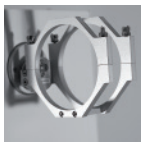
With the increasing interest in climate change and global warming research, the effects of stratospheric aerosols are being studied in greater detail. Primarily, this refers to water vapour and suspended particles such as smoke, dust, sand and ash. These absorb and scatter solar radiation, act as nuclei for the formation of clouds and promote atmospheric chemical reactions.

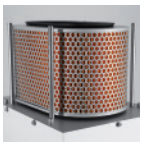
Understanding atmospheric aerosols is one of the most important ways that scientists can improve models for weather and air quality forecasting and for climate change prediction. In order to gather information on the size and shape of particles it is necessary to measure the characteristics of light directly from the sun and also light scattered and absorbed by the aerosols, at angles up to 90 ° away from the sun.

A radiometer with a narrow field of view makes measurements in several narrow wavebands in the ultraviolet, visible and near-infrared parts of the spectrum. It is mounted on a dedicated sun tracker that can follow the sun and also make scans across the sky at defined angles away from the sun.

One of the most widely used instruments for this purpose is the POM Sky Radiometer, manufactured by Prede Co. Ltd. in Tokyo and distributed by Kipp & Zonen. POM is used in the Asia-Pacific SKYNET network, the European SkyRad users network (ESR) and for aerosol monitoring and satellite ground-truthing around the world.

POM-01





POM-01 is a sky radiometer mounted on a dedicated sun tracker. It uses a single detector and rotating filter wheel to measure radiation in seven narrow wavebands, either directly from the sun or at user-defined angles away from the sun. The instrument has a base with levelling feet and a sun sensor for active tracking of the sun position. Installation is quick and simple and a precipitation sensor is included so that the radiometer is pointed downwards during rain to keep the optics clean.

POM-01 must be connected to a PC running the operating software in order to make measurements and store data. The supplied software allows comprehensive user selection of the scanning modes. The data can be post-processed to provide parameters including aerosol optical depth, scattering coefficients, aerosol distribution and energy distribution.

The low temperature option adds insulating covers around the radiometer and the sun tracker base to allow operation down to -30 °C.

The high temperature option adds heat shields and a refrigeration system to cool the radiometer and extends the operating range to +70 °C. Operation is from AC power only.

The dust protection system uses a high power fan to blow filtered air into the base of the optical tube to keep the input lens free of dust and dirt. Operation is from AC power only.

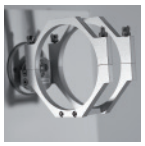
Specifications	
Measurement principle	Multiple band filter spectrometer
Wavelengths	315, 400, 500, 675, 870, 940 and 1020 nm
Wavelength uncertainty	< 2 nm
Half-power bandwidth	3 nm for 315 nm filter, 10 nm for other filters
Sun tracker	Integrated, with sun and rain sensors
Serial output	RS-232C for connection to PC running operating software (PC not included)
Field of view	1°
Operational temperature range	-10 °C to +45 °C -30 °C to +45 °C (with low temperature option) -10 °C to +70 °C (with high temperature option)
Storage temperature range	-10 °C to +45 °C
Supply voltage	115/230 VAC, 50/60 Hz (standard), 24 VDC (option)
Power consumption	200 W
Detector type	Silicon photo-diode
Windows™ compatible software	Configuration, operation, data storage

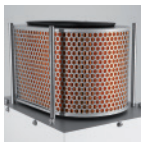
Part number	Instrument
3307001	POM-01 Sky Radiometer • 115/230 VAC
3307002	POM-01 Sky Radiometer • 24 VDC

POM is designed and produced by **Prede Co. Ltd** of Tokyo and is distributed exclusively by Kipp & Zonen worldwide (with the exceptions of China, Japan, Korea and India)

Part number	Accessories
3307011	POM-01 Low Temperature Option For operation down to -30 °C (insulating covers)
3307012	POM-01 High Temperature Option For operation up to +70 °C (cooling system - AC power only)
3307013	POM-01 Dust Protection System For optical windows (filtered air blower - AC power only)

POM-02





POM-02 has all the features of the POM-01, but with extended waveband ranges. There is growing interest in monitoring aerosols of larger size and this requires measurement at longer wavelengths. In addition to the optical system with silicon photo-diode detector of the POM-01, the POM-02 has a second optical system with an Indium Gallium Arsenide infrared detector.

The filter wheel has 11 wavebands, providing measurements to 2200 nm, and also has additional UV channels. POM-02 must be connected to a PC running the operating software in order to make measurements and store data. Like the POM-01, maintenance is minimal; consisting of regular cleaning of the optical windows and checking the desiccant in the radiometer.

The low temperature option adds insulating covers around the radiometer and the sun tracker base to allow operation down to -50 °C.

The high temperature option adds heat shields and a refrigeration system to cool the radiometer and extends the operating range to +70 °C. Operation is from AC power only.

The dust protection system uses a high power fan to blow filtered air into the bases of the optical tubes to keep the input lenses free of dust and dirt. Operation is from AC power only.

Specifications	
Measurement principle	Multiple band filter spectrometer
Wavelengths	315, 340, 380, 400, 500, 675, 870, 940, 1020, 1627 and 2200 nm
Wavelength uncertainty	< 2 nm
Half-power bandwidth	3 nm for 315 nm filter, 10 nm for other filters
Sun tracker	Integrated, with sun and rain sensors
Serial output	RS-232C for connection to PC running operating software (PC not included)
Field of view	1°
Operational temperature range	-30 °C to +35 °C -50 °C to +35 °C (with low temperature option) -30 °C to +70 °C (with high temperature option)
Storage temperature range	-30 °C to +35 °C
Supply voltage	115/230 VAC, 50/60 Hz (standard), 24 VDC (option)
Power consumption	200 W
Detector type	Silicon photo-diode and InGaAs photo-diode
Windows™ compatible software	Configuration, operation, data storage

Part number	Instrument
3307010	POM-02 Sky Radiometer • 115/230 VAC
3307020	POM-02 Sky Radiometer • 24 VDC

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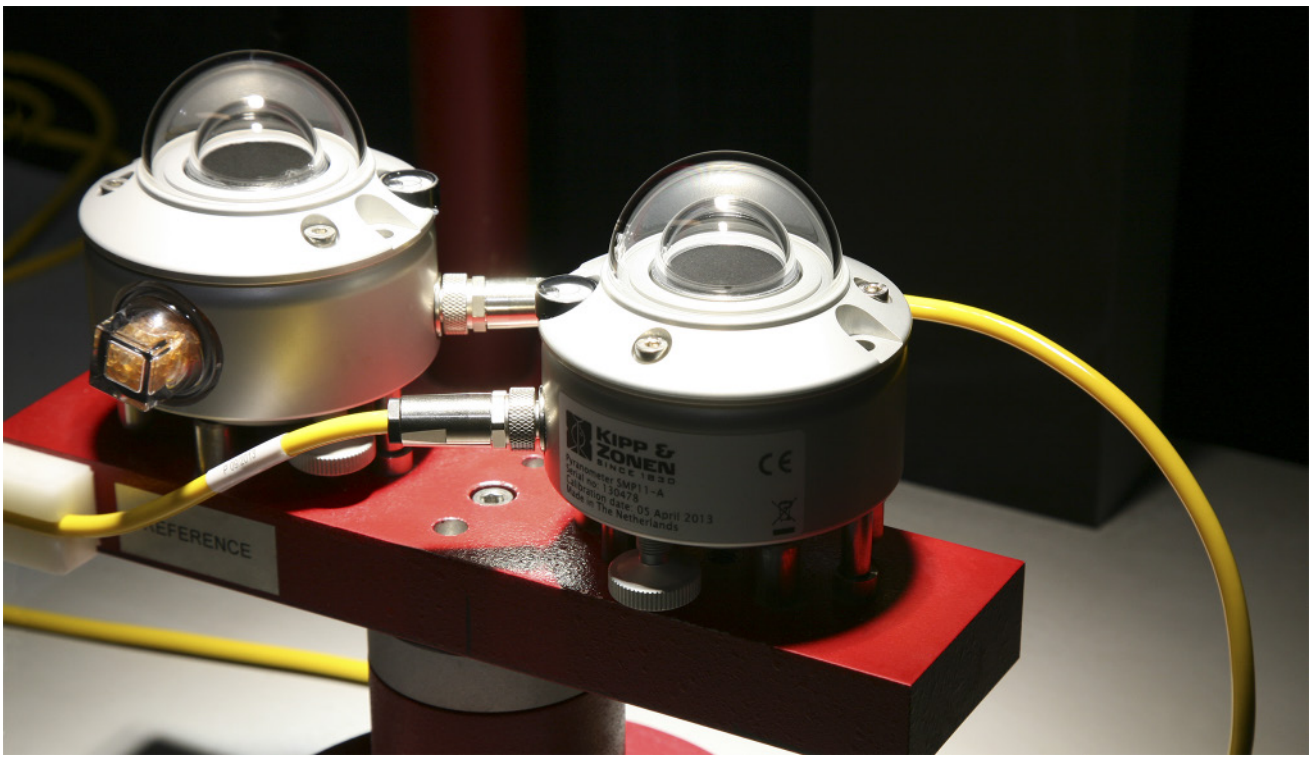
Part number	Accessories
3307018	POM-02 Low Temperature Option For operation down to -50 °C (insulating covers)
3307012	POM-02 High Temperature Option For operation up to +70 °C (cooling system - AC power only)
3307013	POM-02 Dust Protection System For optical windows (filtered air blower - AC power only)



Calibration Facility

For the calibration of field pyranometers and albedometers

A radiometer gives a voltage output that is proportional to the absolute irradiance level. This relationship can be expressed as a ratio called 'sensitivity'. The sensitivity of a particular radiometer is unique. It is determined by comparison against a reference radiometer of similar type under controlled standard test conditions.

Kipp & Zonen supplies all new radiometers with a high quality factory calibration carried out by trained operatives. Calibrations are to World Meteorological Organisation (WMO) and International Standards Organisation (ISO) requirements and are traceable to the World Radiometric Reference.

We maintain at least two reference radiometers of each type. These are calibrated at the World Radiation Centre in Davos, Switzerland, and are fully characterized for linearity, temperature response and directional response.

The spectral content of the calibration lamp differs slightly from the outdoor solar spectrum at the World Radiation Centre, but this has no consequences for the transfer of calibration, provided that the reference and test radiometers have the same characteristics. A precisely controlled infrared heat source is used for laboratory pyrgeometer calibrations.

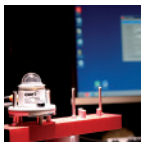
We advise recalibration of radiometers every two years. Over a two year period in the field the sensitivity of an instrument changes slightly. Most instruments can be recalibrated at our offices in France, Singapore and the USA. However, some types, such as pyrheliometers and UV radiometers, must be returned to the factory in Delft.

For customers who have a large number of radiometers, or who maintain a network of instruments, Kipp & Zonen offers the CFR Calibration Facility so that they can perform their own pyranometer and albedometer calibrations, saving time and money.

To ensure that customers carry out calibrations to Kipp & Zonen, WMO and ISO standards of quality, calibration facilities are only supplied complete with installation and training at the customer site by a Kipp & Zonen specialist. Appropriate new reference radiometers must be purchased, or existing customer instruments must be recalibrated by a suitable organisation before delivery.

For the above reasons specific terms and conditions apply to the purchase of calibration facilities, such as regular recalibration of the reference instruments and the precision voltmeter.

CFR

CFR Calibration Facility Radiometers is designed for the calibration of field pyranometers and albedometers by comparison to a reference instrument of similar type.

CFR offers a solution for quality control of the stability of the pyranometers that are used in a network. The procedure used complies with Annex A.3 of international standard ISO 9847 'Calibration of Field Pyranometers by Comparison to a Reference Pyranometer'. Annex A.3 refers to 'Calibration Devices Using Artificial Sources'. Our equipment and method is specifically referred to in ISO 9847 as the 'Kipp & Zonen Device and Procedure'.

The facility is manually operated and the time needed for each calibration is approximately 10 minutes. Preparation for a measurement session including warm-up and stabilisation of the calibration lamp will take about 30 minutes. The calibration transfer uncertainty between reference and test pyranometers of high quality, such as the CMP10, is estimated to be ± 0.5 %.

The turntable supplied with the CFR is suitable for calibration of CM 6, 11, 21, 22, 31 and CMP3, 6, 10, 11, 21, 22 pyranometers. Adaptors and alternative turntables are available to suit other pyranometers and albedometers. CFR is supplied without reference pyranometers. These must be of similar characteristics to the field radiometers under test and must be either purchased with the CFR, or existing customer instruments must be recalibrated before delivery. Kipp & Zonen can arrange for the reference pyranometers to be calibrated at the World Radiation Centre in Davos, Switzerland.

Calibration facilities are only supplied on the basis that they are installed by a Kipp & Zonen specialist, who will check the suitability of the laboratory and provide training to the customer staff. The laboratory must meet requirements for light shielding, temperature control, cleanliness, etc.

Part number	Facility
0341900	CFR Calibration Facility • 230 VAC for radiometers

Specifications	
Calibration procedure	ISO 9847, Annex A 3.1, the 'Kipp & Zonen Device and Procedure'
Calibration table	Rugged and stable workbench
Light source	Metal-Halide, low infrared output, precision stabilised, adjustable height
Measurement system	High accuracy, calibrated, 6½ digit programmeable voltmeter switchable to reference or test radiometer
Turntable	To interchange reference and test radiometer positions
Shading mechanism	Mounted on table to determine zero offsets
Supply voltage	230 VAC, 50 Hz
Power consumption	500 W
Calibration certificates	Windows™ compatible software to calculate sensitivity and uncertainty and to print certificates

Part number	Accessories
0341704	Turntable for Albedometers • CM 7B, 14, 14B / CMA6, 11
0341700	Turntable for Eppley PSP and 8-48 pyranometers Requires a CMP21 reference pyranometer and 10 m cable
0341701	Adaptor for CM 5 for test CM 5 + spacer for reference CMP6
0341702	Adaptor for CM 3, SP Lite, SP Lite2
Note: When used for SP Lite2 two adaptors are required, for test and reference	

Part number	Reference pyranometer
0339920-001	SP Lite2 • for calibrating SP Lite, SP Lite2
0338920-000 0362601	CMP3 • for calibrating CM 3 / CMP3 10 m cable • pre-wired with waterproof 2-pin plug
0362900-000 0362601	CMP6 • for calibrating CM 5, 6B, 7B / CMP6 / CMA6 10 m cable • pre-wired with waterproof 2-pin plug
0362920-010 0362611	CMP21 • for calibrating CM 11, 11B, 14, 14B, 21 / CMP10, 11, 21 / CMA11 10 m cable • pre-wired with waterproof 4-pin plug
0362930-010 0362611	CMP22 • for calibrating CM 22, 31 / CMP22 10 m cable • pre-wired with waterproof 4-pin plug
Note: The reference must be of similar type to the radiometer under test	
Note: An additional charge will be made for the reference calibration of CMP3, CMP6 CMP21 and CMP22 at the World Radiation Centre in Davos, Switzerland	
Note: An additional charge will be made for the reference calibration of SP Lite2 outdoors at the factory in Delft	

Glossary of Specifications

Specification	
Accuracy of bubble level	This is the angular deviation from horizontal when the 'bubble' is half in and half out of the marked circle.
Analogue output range	Some instruments have built-in amplifiers for the signal output, this may be as a voltage or as a 4 to 20 mA current loop.
Analogue output	The range of irradiances represented by the voltage or current output.
Classification to ISO 9060:1990	This is the International Standard for the 'specification and classification of instruments for measuring hemispherical solar and direct solar radiation' and it applies to pyranometers, albedometers and pyrheliometers. Classifications are Second Class, First Class and Secondary Standard, in order of improving measurement performance. At present only instruments based on thermal detectors, such as thermopiles, comply with the requirements of ISO 9060:1990.
Detector type	The main detection / measurement technology.
Directional response (up to 80° with 1000 W/m² beam)	Radiation incident on a flat horizontal surface originating from a point source with a defined zenith position (such as the sun) will have an intensity proportional to the cosine of the zenith angle of incidence. As the sun moves lower in the sky its beam spreads out and the amount of energy per unit area is reduced. This is sometimes called the 'cosine-law' or 'cosine-response'. When the sun is directly overhead the zenith angle is 0° and at the horizon it is 90°. Ideally a pyranometer has a directional response which is exactly the same as the cosine-law. The maximum deviation from the ideal is usually given up to 80° zenith angle with respect to 1000 W/m² irradiance at normal incidence (0° zenith angle). ISO 9060:1990 specifies the error in W/m², not as a percentage.
Expected output range (0 to 1500 W/m²)	For outdoor measurements under natural sunlight the irradiance will not exceed 1500 W/m². The expected output is that given by a radiometer of the maximum sensitivity for this irradiance.
Field of view	This is the unobstructed open viewing angle of a radiometer, what it can 'see'.
Humidity range	This is usually 0 to 100 % relative humidity, non-condensing.
Impedance	The electrical impedance at the connector fitted to the housing, or at the end of a captive radiometer signal cable.
Ingress Protection (IP) rating	The international standard for protection against the ingress of particles (dust) and water into the equipment.
Maximum operational irradiance	This is the irradiance level beyond which physical damage may occur to the instrument.
Mounting rod	Some instruments have a fixed mounting rod for attachment to masts and walls. Others have a screw-in mounting rod available as an accessory.
Non-linearity (100 to 1000 W/m²)	The non-linearity of a pyranometer is defined in ISO 9060:1990 as the percentage deviation in the sensitivity over an irradiance range from 100 to 1000 W/m² compared to the sensitivity at the calibration irradiance of 500 W/m². For other types of radiometers the linearity is quoted over the relevant irradiance range.
Non-stability (change/year)	This is the percentage change in sensitivity over a period of one year. For thermopile radiometers this is mostly due to degradation by UV radiation of the black absorber coating on the thermopile surface. For other detector types it is usually an ageing process.
Operational temperature range	Within the specified temperature range Kipp & Zonen equipment can be operated safely without damage.
Power consumption	The power in W or VA required to operate the equipment.
Required tracking pointing accuracy	Radiometers for measuring direct solar irradiance must be pointed at the axis of the sun by an automatic sun tracker. The required pointing accuracy is determined by the optical geometry of the radiometer.
Response time (63 % and 95 %)	A radiometer requires some time to respond to changes in the incident radiation. The response time is normally quoted as the time for the output to reach 95 % or 63 % (1/e) of the final value following a step-change in irradiance. ISO 9060:1990 specifies the 95 % response.
Sensitivity asymmetry (upper / lower)	This only applies to 'double-sided' radiometers, such as the NR Lite2.
Sensitivity	Radiometer sensitivity is mainly determined by the physical properties of the detector itself. The sensitivity is usually measured under defined conditions, by comparison to a reference radiometer of the same type, under a controlled light source. The calibration method and traceability are stated on the individual calibration certificate. For passive radiometers without amplification the sensitivity is normally expressed as µV (micro-volts) of output signal per W/m² (Watt per square metre) of irradiance. This is a value unique to each radiometer but is within a range given in the specifications.
Serial output range	The range of irradiances represented by the digital output.
Serial output	Some instruments have internal micro-controllers and operate in the digital domain. They have communication by a serial interface, typically to a computer or data acquisition system.
Spectral range (50 % points)	Radiometers have a maximum sensitivity at a specific wavelength, or within a specific waveband, that is a function of the optical materials and the detector type. The shorter and longer wavelengths at which irradiance is measured with 50 % of the maximum sensitivity define this spectral range. The total measurement range is broader than this.
Spectral selectivity (350 to 1500 nm)	Spectral selectivity is the variation of the radiometer sensitivity with wavelength. In ISO 9060:1990 it is specified as a percentage deviation from the mean value over the range from 350 to 1500 nm (0.35 to 1.5 µm).
Storage temperature range	Usually the unpowered storage temperature range that will not cause damage is the same as the operational temperature range.
Supply voltage	The AC or DC voltage required to operate the equipment. Passive radiometers do not require any power.
Temperature response	ISO 9060:1990 defines this as the percentage deviation due to change in ambient temperature within an interval of 50 K. For Kipp & Zonen instruments the deviation is referred to the sensitivity at the calibration temperature of approximately +20 °C. The temperature range given is often more than 50 °C.
Temperature sensor output	Some radiometers are fitted with an internal temperature sensor. This is a 10 K thermistor and / or a Pt-100 resistor. Sometimes both types are fitted, for convenience of interfacing to data loggers.
Tilt response (0° to 90° at 1000 W/m²)	ISO 9060:1990 defines this as the percentage deviation from the responsivity at 0° tilt (horizontal) due to change in tilt from 0° to 90° at 1000 W/m² irradiance.
Uncertainty (monthly sunshine hours and direct signal for clear sky)	Only applicable to measurement of sunshine duration by the CSD3.
Window heating offset (with 1000 W/m² direct solar radiation)	Pyrgeometers for the measurement of long-wave radiation use window materials that absorb a large part of the short-wave solar radiation. The window heats up and creates an offset.
Windows™ compatible software	Several products are supplied with software for setup, operation, or data storage / analysis.

Specifications	
Zero offset (a) thermal radiation (at 200 W/m²)	Any object having a certain temperature will exchange radiation with its surroundings. The domes of upward facing pyranometers will exchange radiation with the atmosphere. In general, the atmosphere will be cooler than the temperature at the Earth's surface, a clear sky can have an effective temperature up to 50 °C cooler. Due to this a pyranometer dome will 'lose' energy to the colder atmosphere by means of radiative transfer. This causes the dome to become cooler than the rest of the instrument. This temperature difference between the detector 'view' and the instrument housing will generate a small negative output signal which is commonly called Zero Offset Type A. This effect is reduced by using two domes, creating a 'radiation buffer'. Zero offset (a) is quantified in ISO 9060:1990 as the offset in W/m² for a thermal (Far Infrared) radiation exchange of 200 W/m² between the pyranometer and the atmosphere. The figures given for Kipp & Zonen pyranometers are without ventilation. The offset can be reduced by using a ventilation unit.
Zero offset (b) temperature change (5 K/h)	The radiometer temperature varies proportionally to variations in the ambient temperature and this creates thermal currents inside the instrument that take time to stabilise. This causes an offset commonly termed Zero Offset Type B. It is quantified in ISO 9060:1990 as the response in to a 5 K/hr change in ambient temperature.

Passion for Precision

Kipp & Zonen is the leading company in measuring solar radiation and atmospheric properties. Our passion for precision has led to the development of a large range of high quality instruments, from all weather radiometers to complete measurement systems.

We promise our customers guaranteed performance and quality in: Meteorology, Climatology, Hydrology, Industry, Renewable Energy, Agriculture and Public Health.

We hope you will join our passion for precision.

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