



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 ($4\ \mu\text{m}$) 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 $4.5\ \mu\text{m}$ to beyond $40\ \mu\text{m}$.

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 $\mu\text{V}/\text{W}/\text{m}^2$
Impedance	20 to 200 Ω
Expected output range (-200 to 200 W/m^2)	-3 to 3 mV
Operational irradiance (net)	-250 to 250 W/m^2
Response time (63%)	< 6 s
(95%)	< 18 s
Zero offset	
(b) temperature change (5 K/h)	< 5 W/m^2
Window heating offset	< 15 W/m^2
(with 1000 W/m^2 direct solar radiation)	
Non-stability (change/year)	< 1%
Non-linearity (-250 to 250 W/m^2)	< 1%
Spectral selectivity (8 to 14 μm)	< 5%
Temperature response	< 5% (-10 $^{\circ}\text{C}$ to +40 $^{\circ}\text{C}$)
Tilt response (0 $^{\circ}$ to 90 $^{\circ}$ at $\pm 250 \text{ W}/\text{m}^2$)	< 3%
Field of view	150 $^{\circ}$
Accuracy of bubble level	< 0.2 $^{\circ}$
Temperature sensor output	10 K Thermistor (optional Pt-100)
Detector type	Thermopile
Operational temperature range	-40 $^{\circ}\text{C}$ to +80 $^{\circ}\text{C}$
Storage temperature range	-40 $^{\circ}\text{C}$ to +80 $^{\circ}\text{C}$
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/m^2 , 16 mA = 0 W/m^2 , 20 mA = +200 W/m^2

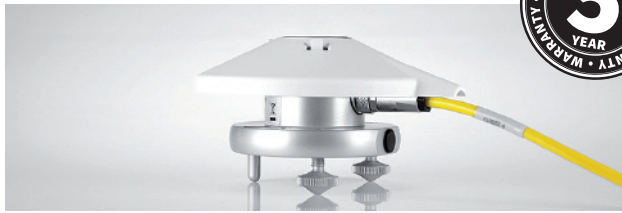
CGR3 Net Pyrgeometer	
A Net Pyrgeometer can be self-assembled by ordering: 2x CGR3 Pyrgeometer + 1x Mounting Rod	
Note: CGR3 Net Pyrgeometer can be used with the AMPBOX but it has two individual outputs, so 2x AMPBOX are required	

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 \varnothing
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 \varnothing
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.

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

Specifications	
Analogue output • V-version	0 to 1V
Analogue output range ⁽¹⁾	0 to 1000 W/m ²
Analogue output • A-version	4 to 20 mA
Analogue output range ⁽¹⁾	0 to 1000 W/m ²
Serial output	RS-485 Modbus®
Serial output range ⁽¹⁾	0 to 1000 W/m ²
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/m ²
Non-stability (change/year)	< 1%
Non-linearity (-250 to 250 W/m ²)	< 1%
Window heating offset (with 1000 W/m ² direct solar radiation)	< 15 W/m ²
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/m ²)	< 3%
Field of view	150°
Accuracy of bubble level	< 0.2°
Power consumption (at 12VDC)	V-version: 55 mW A-version: 100 mW
Software, Windows™	Smart Sensor Explorer Software, for configuration, test and data logging
Supply voltage	5 to 30VDC
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

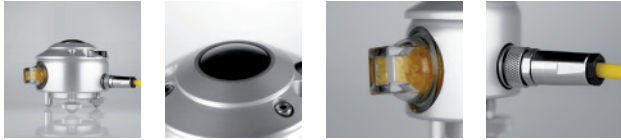
⁽¹⁾ Longwave down radiation

Part number	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 ø
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
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/m ²
Impedance	20 to 200 Ω
Expected output range (-200 to 200 W/m ²)	-3 to 3 mV
Operational irradiance (net)	-250 to 250 W/m ²
Response time (63% (95%))	< 6 s < 18 s
Zero offset (b) temperature change (5 K/h)	< 2 W/m ²
Window heating offset (with 1000 W/m ² direct solar radiation)	< 4 W/m ²
Non-stability (change/year)	< 1%
Non-linearity (-250 to 250 W/m ²)	< 1%
Spectral selectivity (8 to 14 µm)	< 5%
Temperature response	< 1% (-20 °C to +50 °C)
Tilt response (0° to 90° at ±250 W/m ²)	< 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 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
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.

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	

Specifications	
Analogue output • V-version	0 to 1 V
Analogue output range ⁽¹⁾	0 to 1000 W/m ²
Analogue output • A-version	4 to 20 mA
Analogue output range ⁽¹⁾	0 to 1000 W/m ²
Serial output	RS-485 Modbus®
Serial output range ⁽¹⁾	0 to 1000 W/m ²
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/m ²
Non-stability (change/year)	< 1%
Non-linearity (-250 to 250 W/m ²)	< 1%
Window heating offset (with 1000 W/m ² direct solar radiation)	< 4 W/m ²
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/m ²)	< 1%
Field of view	180°
Accuracy of bubble level	< 0.1°
Power consumption (at 12VDC)	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	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
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