



Net Radiometers

For the measurement of the balance of incoming and outgoing radiation

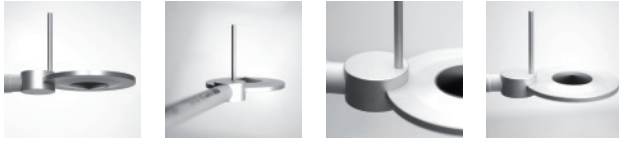
The combination of short-wave radiation from the sun and long-wave (far infrared) radiation from the atmosphere and ground are the driving forces for many of the dynamic atmospheric processes at the Earth's surface. In the short term they directly influence weather systems and in the long term they are 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 $\mu\text{V}/\text{W}/\text{m}^2$ (nominal)
Operational irradiance (net)	-2000 to 2000 W/m^2
Response time (63%)	< 20 s
(95%)	< 60 s
Non-linearity (-1000 to 1000 W/m^2)	< 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 \varnothing
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/m^2 , 8 mA = 0 W/m^2 and 20 mA = 1200 W/m^2	
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 pyrgometers 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 pyrgometer has a silicon meniscus dome so that water rolls off and the field of view is 180°. The lower pyrgometer 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.

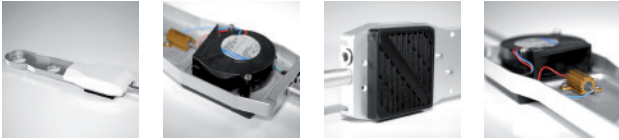
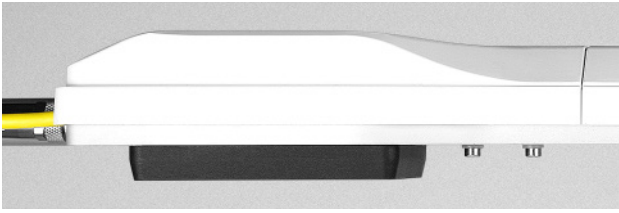
CNF4 can be purchased together with the CNR4 or added at a later date if required.

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/m ² (short-wave) 5 to 15 µV/W/m ² (long-wave)
Impedance	20 to 200 Ω
Expected output range (0 to 1500 W/m ²)	0 to 30 mV upper sensor (short-wave)
Expected output range (0 to 1000 W/m ²)	0 to 20 mV lower sensor (short-wave)
Expected output range (-200 to 200 W/m ²)	-3 to 3 mV (long-wave)
Maximum operational irradiance	2000 W/m ² (short-wave)
Operational irradiance (net)	-250 to 250 W/m ² (long-wave)
Response time (63%)	< 6 s
(95%)	< 18 s
Zero offsets (short-wave)	
(a) thermal radiation (at 200 W/m ²)	< 15 W/m ²
(b) temperature change (5 K/h)	< 3 W/m ² (< 1 W/m ² with CNF4)
Zero offset (long-wave)	
(b) temperature change (5 K/h)	< 5 W/m ²
Window heating offset upper sensor (with 1000 W/m ² direct solar radiation)	< 6 W/m ² (long-wave)
Window heating offset lower sensor (with 1000 W/m ² direct solar radiation)	< 15 W/m ² (long-wave)
Non-stability (change/year)	< 1%
Non-linearity (100 to 1000 W/m ²)	< 1% short-wave (upper and lower sensor)
Non-linearity (-250 to 250 W/m ²)	< 1% long-wave (upper and lower sensor)
Directional response (up to 80° with 1000 W/m ² beam)	< 20 W/m ² (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/m ²)	< 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°
Pyrgometer temperature sensor output	10 K thermistor and Pt-100
Mounting rod (screw-in)	350 mm long x 16 mm ø
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	