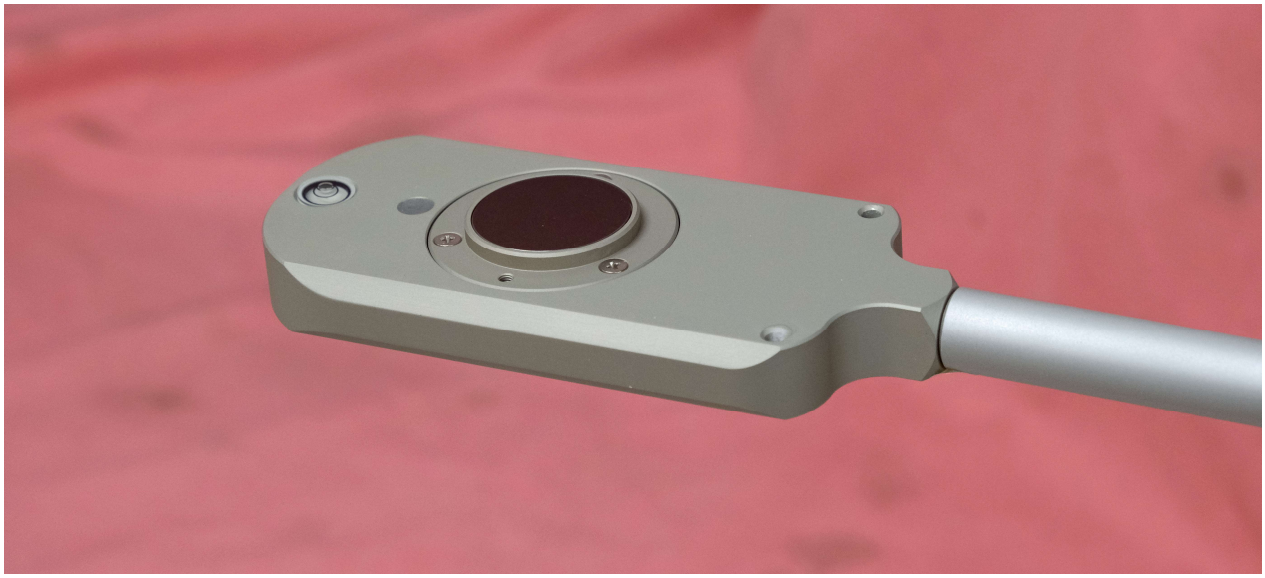
MIDDLETON SOLAR

CE 2022

NSK2 NET PYRGEOMETER

APPLICATION NOTE – DUAL OUTPUT



The Middleton Solar **NSK2 is a 2-component Net Pyrgeometer** to measure thermal radiation downward and upward, through a horizontal plane. It has two thermoelectric sensors shielded by solar-blind silicon windows. The windows are transparent to longwave (LW) radiation emitted by the atmosphere or the Earth surface. Each output signal is a passive analogue voltage representing the downward hemispherical LW irradiance (top sensor) and upward hemispherical LW irradiance (bottom sensor). The net LW irradiance can be calculated as the difference between the top and bottom signals (the body temperature signal can be disregarded for net measurement).

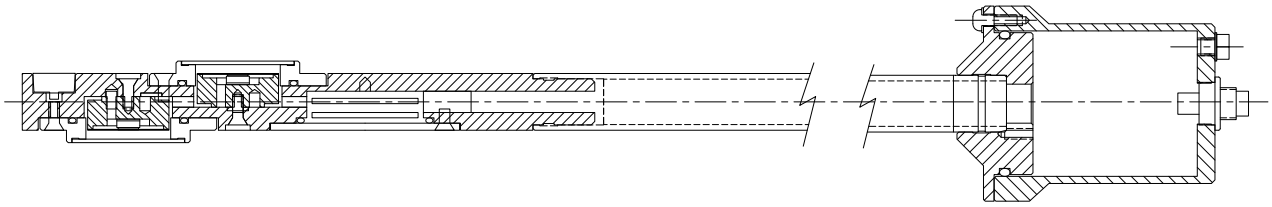
Installation

Select a site that has an unobstructed view of the sky and the ground. Secure the output end of the handle and adjust so the instrument is horizontal, approximately 1m to 2m above the ground, with the bubble level facing upwards. Water on the silicon windows (rain or dew) is a strong absorber of near IR radiation and can cause temporary errors to the LW radiation measurement.

The available *3-Axis Clamp* can facilitate mounting to a flat plate.

Connect the NSK2 output lead to a data acquisition system; use differential inputs.
Use a 3-wire connection for the body temperature sensor.

output lead cores	LW top sensor, signal +ve	red
	LW top sensor, signal –ve	blue
	LW bottom sensor, signal +ve	yellow
	LW bottom sensor, signal –ve	green
	body temperature; Pt100, 3-wire	
	+ve	white
	-ve	black, brown



Maintenance

Keep the windows of the NSK2 clean and free from debris; use water and mild detergent only.

Longwave irradiance

$E_l = U_l / C_l + \sigma T_B^4$, in W.m^{-2}.

Where U_l is the top or bottom LW output in µV, and is typically negative;

C_l is the LW sensitivity in µV/W.m^{-2}; T_B is body temperature in Kelvin;

$\sigma = 5.6704 \cdot 10^{-8}$ is the Stephan-Boltzmann constant.

Net irradiance

E_{net} = E_l down - E_l up

Note: for E_{net} the σT_B^4 temperature component cancels out, and net E_l is typically negative.

Technical Specification

sensitivity	4-7 µV/W.m^{-2} x 2 outputs
calibration traceability	WISG (World Infrared Standard Group)
spectral range	4.5 to 42µm
field of view	2 x 170°
response time (95%)	7s (typical)
irradiance	±1,000 W.m^{-2}
impedance	20Ω x 2 outputs
operating temperature	-40 to +60°C
non-stability (1 year interval)	< ±1%
non-linearity	< ±1%
temperature dependence of sensitivity	< ±2% (-10 to +40°C)
window heating offset	< 10 W.m^{-2}, shaded
directional response	not relevant to isotropic IR
level accuracy	0.4°
desiccant (in endcap)	orange silica gel (non-toxic)
sensors	thermopile x 2
window	solar-blind silicon
temperature sensor (body)	Pt100 platinum resistor; DIN IEC 751, Class A
output lead	6m, with connector at instrument end
construction	anodized aluminium; stainless steel
IP rating	sealed to IP66
dimensions & weight	head 66x40x130mm; handle Ø16x640; 0.5kg
shipping size & weight	Ø90 x 850mm; 1kg

Available Options

- 3-Axis Clamp (for mounting to a flat plate), P/N 123.9100