



MIDDLETON SOLAR
NSR1 NET PYRRADIOMETER
APPLICATION NOTE – DUAL OUTPUT

CE 2017



The Middleton Solar NSR1 Net Pyrradiometer, dual output version, measures both solar and thermal wavelengths as a single sum of energy to give the total radiation flux, downward and upward, through a horizontal plane. The NSR1-dual has upper and lower thermoelectric sensors that are shielded by polythene dome windows. The domes are equally transparent to both shortwave radiation from the sun and long wave radiation emitted by the atmosphere or the Earth surface. The sensors have matched response times and balanced shortwave and longwave sensitivity.

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 1-2m above the ground, with the bubble level facing upwards. The available *3-Axis Clamp* can facilitate mounting to a flat plate.

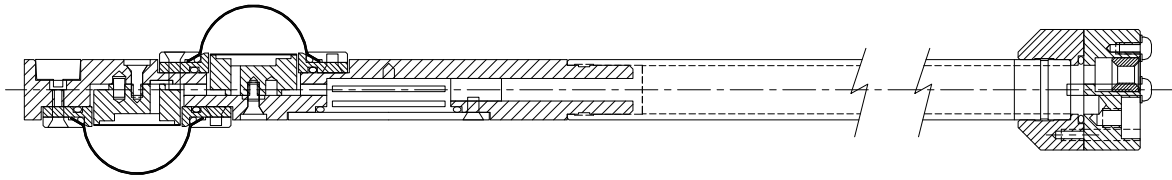
Connect the NSR1 output lead to a data acquisition system; use differential inputs.

output lead cores	top sensor, signal +ve	red
	top sensor, signal -ve	blue
	bottom sensor, signal +ve	yellow
	bottom sensor, signal -ve	green

Each output signal is a passive analogue voltage representing the total downward hemispherical irradiance (top sensor) and total upward hemispherical irradiance (bottom sensor). The nominal fullscale range is -2 to +10mV for the top sensor. The net irradiance can be calculated as the difference between the top and bottom signals.

Water on the domes (rain or dew) is a strong absorber of near IR radiation and can cause temporary measurement errors to the thermal component of the radiation.

Maintenance. Keep the polythene domes clean and free from debris; use water and mild detergent only. Replace the domes every six months, or sooner if they become discoloured. Annual calibration is recommended, at which time the desiccant should be replaced.



Technical Specification

sensitivity	6 $\mu\text{V}/\text{W}\cdot\text{m}^{-2}$ (nominal) x 2 outputs
calibration traceability	LW: WISG (World Infrared Standard Group) SW: WRR (World Radiometric Reference)
resolution	< 2 $\text{W}\cdot\text{m}^{-2}$
spectral range	0.3 to 60 μm
spectral selectivity	< 5%
field of view	2 x 180°
response time (95%)	7s (typical)
irradiance	-250 to +2,000 $\text{W}\cdot\text{m}^{-2}$
impedance	20 Ω x 2 outputs
operating temperature	-35 to +60°C
non-linearity	< 3%
temperature dependence of sensitivity	< 3% (-20 to +50°C)
temperature gradient offset (5°C /hr)	< 4 $\text{W}\cdot\text{m}^{-2}$
directional response (w.r.t 1,000 $\text{W}\cdot\text{m}^{-2}$)	SW: < 25 $\text{W}\cdot\text{m}^{-2}$ (0-80°) LW: not relevant to isotropic IR
uncertainty in daily total (95% level)	< 5%
level accuracy	0.4°
desiccant (in handle)	orange silica gel (non-toxic)
sensors	thermopile, flat white receiver with black center
windows	polythene dome, $\text{Ø}29 \times 0.4\text{mm}$
output lead	6m, with in-line connector at handle
construction	anodized aluminium; stainless steel
IP rating	sealed to IP66
dimensions & weight	head 66x40x130mm; handle $\text{Ø}16 \times 640$; 0.5kg
shipping size & weight	$\text{Ø}90 \times 850\text{mm}$; 1kg

Spare Parts & Available Options

Polythene Dome (pair), P/No 123.1066

Dome O-ring (pair), P/N 123.0080

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

