Summary of differences between The SPN1 Sunshine Pyranometer and BF5 Sunshine Sensor

Delta-T Devices

The SPN1 is an advanced version of the BF5 and so the two instruments have many features in common. There are, however, some important differences, as summarised in the table below.

Function / Feature	BF5	SPN1
Pyranometer	*Accuracy (hourly averages)* *Total(Global):* ±12% ±10 μmol.m^{-2}.s^{-1} Diffuse: ±15% ±10 μmol.m^{-2}.s^{-1} *Range*: 0 to 1250 W.m^{-2} *Spectral response:* 400-700 nm	WMO Good Quality Pyranometer classification (apart from spectral response). *Accuracy*: *Total(Global)and Diffuse* ±5% Daily integrals ±5% ±10 W.m^{-2} Hourly averages ±8% ±10 W.m^{-2} Individual readings: *Range*: 0 to >2000 W.m^{-2} *Spectral response:* ±10% 400-2700 nm
Construction	Moulded acrylic dome, ABS body, photodiode sensors.	Meteorological grade instrument, precision ground glass dome, solid aluminium body, high quality connectors, thermopile sensors.
Output units	Choice of units: PAR (μmol.m^{-2}.s^{-1}), Energy (W.m^{-2}), or Lux. *The BF5 measurement is in molar units, other outputs are derived from this.*	Energy (W.m^{-2}) units only
Use with SunScan	Designed for use with Delta-T SunScan Canopy Analysis System	Unsuitable for use with SunScan
Other applications	The SPN1 is designed primarily for collecting high quality meteorological and solar radiation data whereas the BF5 is designed primarily as a PAR reference sensor for the SunScan System. The BF5's alternative outputs (Lux and Energy) enable it to be used in the study of photosynthesis, illumination and solar energy, subject to a wider tolerance on accuracy.	
Cost	The SPN1 is a high specification, meteorological grade instrument with a price that reflects its quality. The BF5 is more affordable and well suited to many less demanding research applications.	

Please note that the above table only compares the points of difference – it is not intended to be a complete product comparison. See also below

BF5 and SPN1 Specifications

		BF5			SPN1
	Reading	PAR	Energy	Illuminance	Energy
	Units	µmol.m^{-2}.s^{-1}	W.m^{-2}	klux	W.m-2
Accuracy	Overall accuracy: Total	±10 µmol.m^{-2}.s^{-1} ±12%	±5 W.m^{-2} ±12%	±0.600 klux ±12%	±5% Daily integrals ±5% ±10 W.m^{-2} Hourly averages ±8% ±10 W.m^{-2} Individual readings
	Overall accuracy: Diffuse	±10 µmol.m^{-2}.s^{-1} ±15%	±20 W.m^{-2} ±15%	±0.600 klux ±15%	±5% Daily integrals ±5% ±10 W.m^{-2} Hourly averages ±8% ±10 W.m^{-2} Individual readings
	Resolution	0.6 µmol.m^{-2}.s^{-1}	0.3 W.m^{-2}	0.060 klux	0.6 W.m^{-2}
	Range	0-2500 µmol.m^{-2}.s^{-1}	0-1250 W.m^{-2}	0-200 klux	0- to >2000 W.m^{-2}
	Analogue output sensitivity	1 mV =	1 mV =	1 mV =	1 mV = 1 W.m^{-2}
		1 µmol.m^{-2}.s^{-1}	0.5 W.m^{-2}	0.100 klux	0-2500mV
	Analogue output range	0-2500 mV	0-2500 mV	0-2000 mV	120 W.m^{-2} in the direct beam
	Sunshine hours	±10%			±10%
	Cosine reponse	±10% over 0-90° Zenith angle			±2% over 0-90° Zenith angle
	Azimuth angle	± 5% over 360° rotation			± 5% over 360° rotation
	Spectral Response	400-700 nm			400-2700 nm
Temperature	Tempco	± 0.15 % /°C typical			± 0.02 % /°C typical
	Range	-20 to + 50°C with Alkaline batteries			-20 to + 70°C
		-20 to + 70°C with Lithium batteries			
	Stability	Recalibration recommended every 2 years.			Recalibration recommended every 2 years.
	Response time	< 250 ms			100 ms (typical)
	Latitude capability	-90° to + 90°			-90° to + 90°
	Environmental sealing	IP65			IP67
	Sunshine status : contact closure	No sun = open circuit			No sun = open circuit
		Sun = short circuit to ground			Sun = short circuit to ground
Power	Internal Battery	2 x 1.5 V AA Alkaline batteries, 1.4 to 3.6 VDC			No internal battery
	Current	2 mA, (awake, excluding heater) <30 µA (asleep)			2 mA, (awake, excluding heater) <30 µA (asleep)
	Battery Lifetime	1 year typical			No internal battery
	External power	5 to 15 VDC			5 to 15 VDC
	Fuse trip point, on sunshine status signal, (when in switch-closure mode)	0.5 A, 30 V (self resetting)			0.5 A, 30 V (self resetting)
	Max applied voltage to sunshine status output, in contact closure mode	0 to 24 V.			0 to 24 V.
Heater	Heater output below 0°C	15 W reducing to 2 W between 0° and 5°C			15 W reducing to 2 W between 0° and 5°C
	Heater output above 5°C	2 W reducing to 0 W at 35°C			2 W reducing to 0 W at 35°C
	Lowest snow & ice-free temperatures	-20°C at 0 m/s wind speed -10°C at 2 m/s wind speed			-20°C at 0 m/s wind speed -10°C at 2 m/s wind speed
	Heater : max power	15 W at 12 VDC			15 W at 12 V DC
	Heater : max current	1.5 A at 15 V			1.5 A at 15 V
	Fuse: max voltage, current	24 V, 1.6 A (self resetting)			24 V, 1.6 A (self resetting)
	Heater input voltage range	12 to 15 VDC			12 to 15 VDC
Cabling	Serial (RS232) output & power-in connector	5-pin M12			5-pin M12
	Analogue signal output & power-in	8-pin M12			8-pin M12
Mounting options:		Camera tripod socket (¼inch Whitworth)			3 x M5 tapped holes in base at 108 mm dia, 120°spacing
		Holes for 4 x M4 bolts at corners of box.			
Size & Weight		120 mm x 122 mm x 95 mm, 635 g			126 mm dia. x 94 mm high, 786 g

Comparison of SPN1 with WMO and ISO Pyranometer standards

		ISO: Secondary Standard WMO: High Quality	ISO: First Class WMO: Good Quality	 SPN1	See Note	ISO: Second Class WMO: Moderate Quality
Response time	ISO & WMO	< 15 s	< 30 s	0.1 s	1	< 60 s
Zero offset response:	ISO & WMO	7 W/m^2	15 W/m^2	<3 W/m^2	2	30 W/m^2
Zero offset response:	ISO & WMO	±2 W/m^2	±4 W/m^2	<3 W/m^2	3	±8 W/m^2
Resolution	WMO	±1 W/m^2	±5 W/m^2	0.6W/m^2	4	±5 W/m^2
Non-stability:	ISO & WMO	±0.8%	±1.5%	<1.0%	5	±3%
Non-linearity:	ISO & WMO	±0.5%	±1%	<1%	6	±3%
Directional response:	ISO & WMO	±10 W/m^2	±20 W/m^2	±20 W/m^2	7	±30 W/m^2
Spectral selectivity	ISO (0.35–1.5 µm) WMO (0.30–3.0 µm)	±3% ±2%	±5% ±5%	±10% (0.4-2.7 µm)	8	±10% ±10%
Temperature response:	ISO & WMO	±2%	±4%	±1%	9	±8%
Tilt response:	ISO & WMO	±0.5%	±2%	See note	10	±5%
Achievable uncertainty:	WMO hourly totals WMO daily totals	3% 2%	8% 5%	5% ±10 W/m^2 5%	11	20% 10%

SPN1 Notes

Note 1: To 95% of final value (actual response time is 100ms)

Note 2: To 200 W/m^2 net radiant loss to sky (ventilated)

Note 3: For 5°C/hr change in ambient temperature

Note 4: Smallest detectable change

Note 5: Change in sensitivity per year

Note 6: Deviation from sensitivity at 500 W/m^2 over 100 to 1000 W/m^2 range

Note 7: Error due to assuming that the normal incidence response at 1000 W/m^2 is valid for all directions

Note 8: Deviation of the mathematical product of spectral absorptance and transmittance from the mean

Note 9: Error due to 50°C ambient temperature change

Note 10: Deviation from horizontal responsivity due to tilt from horizontal to vertical at 1000 W/m^2
Believed to be <2%, not yet clearly measured.

Note 11: 95% confidence level

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