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Instrument Expert
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BF5 Sunshine Sensor

Delta-T Devices

The BF5 Sunshine Sensor measures Global and Diffuse radiation and sunshine duration

- **No routine adjustment or polar alignment**
- **No moving parts, no shade rings**
- **Outputs can be set to Energy ($W.m^{-2}$), PAR ($\mu mol.m^{-2}.s^{-1}$) or Lux**

Unique design

The Sunshine Sensor is a patented design*. It uses an array of photodiodes with a unique computer-generated shading pattern to measure incident solar radiation. A microprocessor calculates the Global and Diffuse components of the radiation and determines the sunshine status. A built-in heater keeps the BF5 clear of dew, ice and snow down to -20°C.

** The Sunshine Sensor is protected by patents EP 1012633 & US 6417500*

Outputs

Two analogue voltage outputs are provided for the Global and Diffuse radiation. The sunshine state is represented by a digital output (contact closure). The three outputs can be connected to appropriate channels on data loggers *e.g.,* the Delta-T GP2, or other loggers commonly used for environmental monitoring.

Meteorology

The BF5 sensor can be used as an additional sensor with a conventional Met Station. The weather station logger is used to record Global (Total) and Diffuse radiation and the sunshine state (or duration). Power for the sensor comes from its internal alkaline batteries or alternatively from the weather station logger battery. Typically the data will be used for Global and Diffuse radiation, and the sunshine hours during the day (see chart opposite). Direct beam radiation is calculated from Total minus Diffuse. Radiation output units can be preset to energy or PAR or illuminance.

BF5 improvements

The BF5 has replaced the BF3 model. Its advantages include an integrated heater as standard plus superior connectors and cabling.

Applications

- **Meteorology**
  - Solar radiation studies
  - Sunshine duration
- **Agronomy and plant science**
  - PAR measurement
  - Canopy analysis & modelling
- **Architecture and building design**
  - Building energy management systems
  - Heat balance and natural light studies

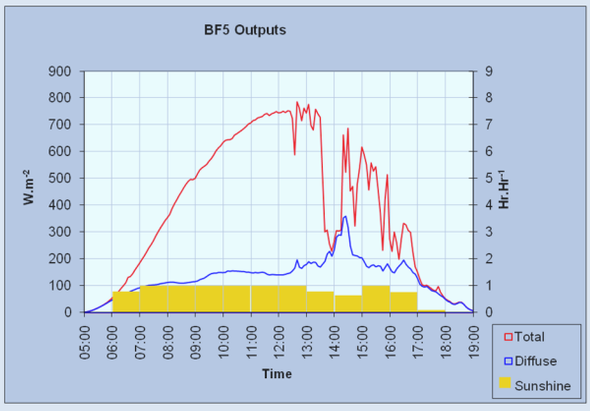

Illustration of BF5 output showing Total and Diffuse radiation and Sunshine status (hours/hour).

BF5 Specifications

The BF5 is intended for use outdoors in natural daylight, with an unobstructed view of the horizon. Significant errors may be produced by artificial light, or if the BF5 is shaded from direct sunlight by buildings, or if there are strong reflections, from windows, for example.

The following accuracy figures give 95% confidence limits, i.e. 95% of individual readings will be within the stated limits under normal climatic conditions.

	Accuracy and Resolution of analogue radiation outputs		
	PAR	***Energy***	***Illuminance***
Units	*µmol.m^{-2}.s^{-1}*	*W.m^{-2}*	*klux*
Overall accuracy: Total	±10 µmol.m^{-2}.s^{-1} ±12%	±5 W.m^{-2} ±12%	±0.600 klux ±12%
Overall accuracy: Diffuse	±10 µmol.m^{-2}.s^{-1} ±15%	±20 W.m^{-2} ±15%	±0.600 klux ±15%
Resolution	0.6 µmol.m^{-2}.s^{-1}	0.3 W.m^{-2}	0.060 klux
Range	0 - 2500 µmol.m^{-2}.s^{-1}	0 - 1250 W.m^{-2}	0 - 200 klux
Output sensitivity	1mV = 1 µmol.m^{-2}.s^{-1}	1mV = 0.5 W.m^{-2}	1mV = 0.100 klux
Output range	0 – 2500 mV	0 – 2500 mV	0 – 2000 mV

Accuracy: Sunshine hours	±10% (WMO definition)
Accuracy: Cosine correction	±10% of incoming radiation over 0 - 90° Zenith angle
Accuracy: Azimuth angle	± 5% over 360° rotation
Temperature coefficient	± 0.15 % /°C typical
Temperature range	-20 to + 50°C, Alkaline batteries -20 to + 70°C, Lithium batteries
Recommended recalibration interval	2 years
Response time	< 250ms
Spectral response	400 - 700nm
Latitude capability	-90° to + 90°
Environmental : Sealing	IP65 (shower and dust proof)
Sunshine status : contact closure	No sun = open circuit Sun = short circuit to ground
Internal battery	2 x 1.5V AA Alkaline batteries
Power requirement	2mA, (awake), <30µA (asleep)
Battery lifetime	1 year typical

Input voltage range	1.4 - 3.6V DC, internal battery 5.0 - 15V DC, external power
Fuse trip point, on sunshine status signal	0.5A, 30V self resetting (switch-closure mode)
Max applied voltage to sunshine status output	0 to 24V (contact closure mode)
RS232 connector	5 pin M12
Signal output & power-in connector	8 pin M12
Mounting options:	Camera tripod socket, ¼" Whitworth Holes for 4 x M4 bolts at box corners
Size & Weight	120mm x 122mm x 95mm, 635g
Heater output below 0°C	15 W
Heater output above 5°C	2W reducing to 0W at 35°C
Lowest snow & ice-free temperatures	-20°C at 0 m/s wind speed -10°C at 2 m/s wind speed
Heater: max power	15 W at 12V DC
Heater: max current	1.5A at 15V
Fuse: max voltage, current	24V, 1.6A (self resetting)
Heater Input voltage	12 to 15V DC

Ordering Information

Sunshine Sensor type BF5 includes built-in heater, user manual, RS232 cable and sensor configuration software.

Note: BF5 requires connecting cables for use with SunScan Probe or data logger.

BF5 cables

SP-BF/w-05 (5m cable BF5 to bare wire).
Connects BF5 outputs to a data logger.

SP-BF-RS10 (10m RS232 extension cable).
10m weatherproof RS232 cable. IP68 M12 5-pole connector (f) to IP68 M12 5-pole connector (m). Can be connected to other SP-BF-RS10 cables.

Note: the final SP-BF-RS10 has to be connected to an SP-BF-RS01 RS232 cable.

SP-BF-RS01 (1.5m RS232 cable).
IP68 M12 5-pole connector (f) to 9-way D-connector (f). Connects BF5 to PC. Supplied as standard with BF5.

Extension cables for analogue output

EXT/8W-05 (5m extension cable) 8-way M12.
EXT/8W-10 (10m extension cable) 8-way M12.
EXT/8W-25 (25m extension cable) 8-way M12.

BF5 accessories

Cross arm type BF5-M 1m length cross arm with pole mounting bracket and BF5 levelling device. For mounting Sunshine Sensor onto weather station mast M2 or M2-Min.

For SunScan Probe accessories see SunScan data sheet.

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