

# SPN1 Sunshine Pyranometer

*Total (Global) and Diffuse Radiation and Sunshine Duration sensor. WMO "Good" Quality Pyranometer with thermopile sensors and precision glass dome needing no routine adjustment or polar alignment.*

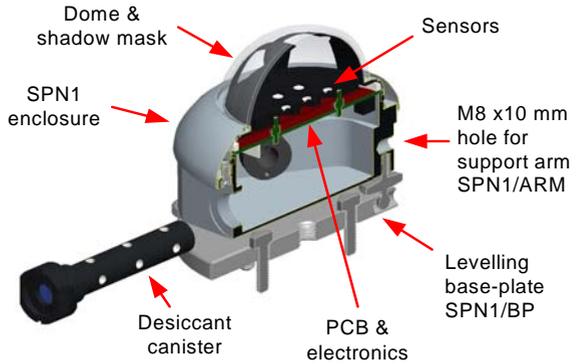
## *Quick Start Guide* version 2.0



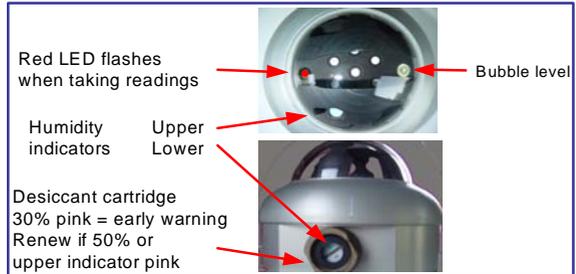
**AT** Delta-T Devices Ltd

# Overview

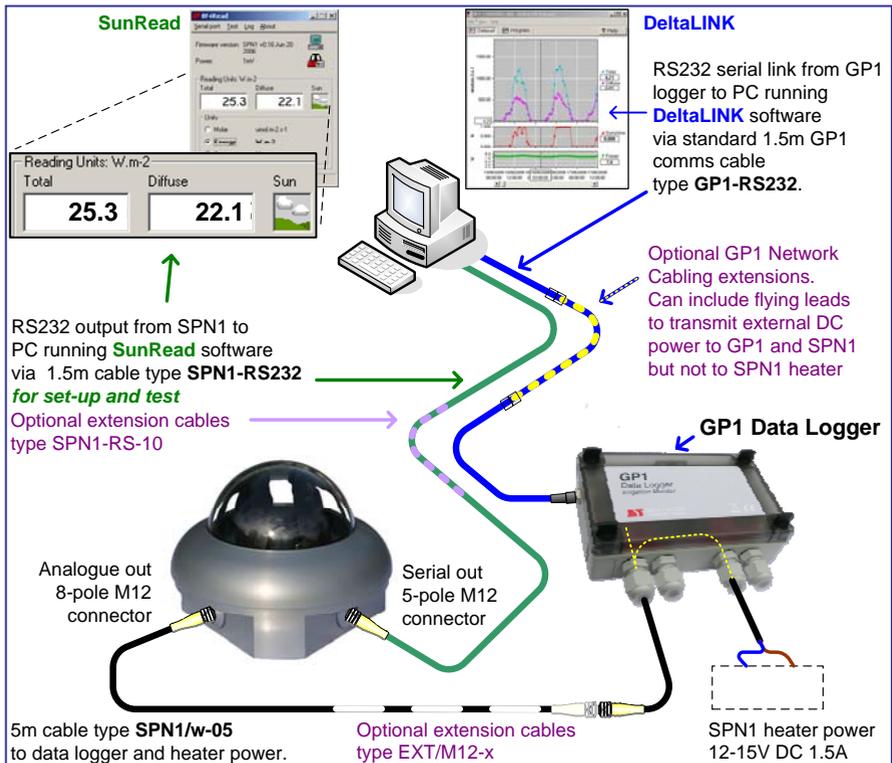
## Construction



## Indicators



## System



## Summary

This guide explains how to use the SunRead PC software to check the SPN1 is working, and how to connect to and program a GP1 data logger.

## Unpacking

The SPN1 is supplied with

- Serial cable **SPN1-RS232**
- Analogue cable **SPN1/w-05**
- User Manual and Quick Start Guide
- Calibration certificate
- Delta-T Software and Manuals CD

### *Optional accessories*

- Levelling baseplate **SPN1/BP**
- Support arm **SPN1/ARM**
- Spare desiccant canisters **SPN1-SD**

## Use SunRead to check the SPN1

### About SunRead

- **Displays Total (global) and Diffuse radiation and sunshine status**
- **Use for *setting up and testing* SPN1**
- Runs on your PC, connected directly to SPN1 via **SPN1-RS232** cable
- Simple logging capability

### Installation Requirements:

- PC running Windows 98, 2000, XP or later
- One free RS232 serial port, or USB-RS232 adapter
- CD-ROM drive for software installation
- Cable SPN1-RS232 (not intended for outdoor use)
- Delta-T Software and Manuals CD
- Acrobat Reader for reading documentation (free download from [www.adobe.com](http://www.adobe.com))

### Installation

1. Install the CD in the PC. On most PCs, installation will start automatically. If it does not, run the file setup.exe in the root folder of the CD. This will display an index of software and also of documents.
2. Click on **Install SunRead software**.
3. Check the CD and also our website at <http://www.delta-t.co.uk/support.html> for the latest documentation and copy it to your PC if you wish.

For further installation information see SunRead Release Notes on the CD.

Note 1: Most PCs, but not all, can power the SPN1 via the serial port. If not, power the SPN1 via the analogue cable – see the analogue cable wiring diagram.

# Start SunRead

1. Connect your SPN1 to a spare serial port or via a USB-RS232 adapter to your PC, using cable **SPN1-RS232** plugged into the 5-pole connector- see **Overview** diagram.
2. Run **SunRead** to display the screen shown below.

Serial Port: Select from the available serial ports

Firmware version

Ignore (for BF3 use only)

Readings, updated every 1-2 seconds

Units - SPN1 displays in  $W.m^{-2}$

Status information about serial port connection

Logs serial SPN1 data using your PC as the logger

## Logging with SunRead

1. Select **Log** to display the logging window.
2. Enter the logging options (see below)
3. Click **Start Logging**.

Logged data is displayed in real-time, and can be saved to file as .csv files which can be analysed in Excel.

Time	Total W.m-2	Diffuse W.m-2	Sunshine status	SPN1 Temperature
13:17:40	83.9	23.5	1.0	27.9
13:17:50	127.8	31.9	1.0	27.9
13:18:00	122.9	32.2	1.0	27.9
13:18:10	42.2	22.3	1.0	27.9

### Logging options

**Log period:** sets logging frequency.

**Avg period:** sets averaging period.

**Log to file:** saves each reading to file as it is logged.

**Individual sensors:** records all 7 individual thermopile sensors.

See also RS232 Commands in **SPN1 User Manual**

# Set up Data Logger

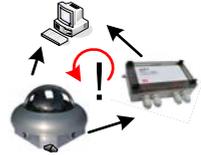
## Outputs

The analogue connector provides voltage outputs for Total (global) and Diffuse radiation, plus a digital output for sunshine state.

It is suitable for recording by many data loggers via cable [SPN1/w-05](#).

The GP1 Logger is particularly suitable for this task.

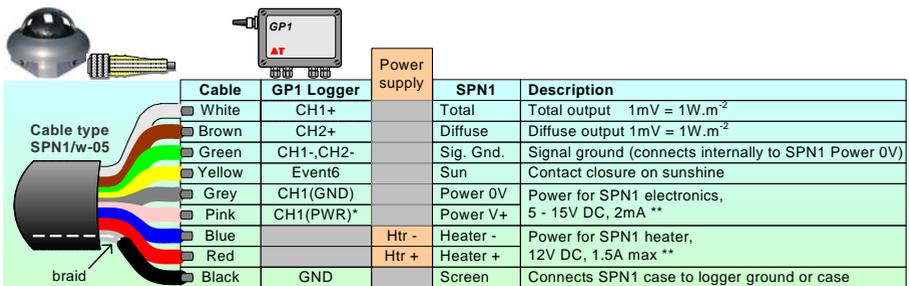
Note : Avoid simultaneous connection of serial cable to a PC and analogue outputs via a logger to a PC - it may create an earth loop which may reduce signal accuracy.



## Connect analogue cable to logger

Connect the colour coded flying leads on the analogue output cable [SPN1/w-05](#) to a data logger such as the GP1 - as indicated in Fig 1.

DL2e logger users: see the online [SPN1 sensor help](#) in Ls2Win service release 5.



**Figure 1 Wiring to a GP1 data logger and to external power for heater**

\* Note: Analogue cable SPN1/w-05 and serial cable SPN1-RS232 braids are both earthed via the connector shells to the SPN1 case and terminate at the datalogger or PC case or ground. To avoid ground loops do not interconnect braids elsewhere.

\*\* Note: SPN1 draws power from Power V+, CTS (PC serial port), or Heater +, whichever voltage is highest. Most PCs can power the SPN1 via the serial port.

## Analogue cable wiring for loggers and heater

**White** (Total output) and **Brown** (Diffuse output): connect to data logger voltage inputs. The normal range of this output is 0V – 1.3V

**Green**: connect to data logger signal ground or –ve input terminal.

**Yellow**: connect to a data logger digital input. It gives a short circuit to ground when sunshine is present, and open circuit with no sunshine.

Alternatively, connect to a resistance input, with a precision resistor in parallel.

**Grey 0V** and **Pink V+** (SPN1 power): apply >5V to power the SPN1 and enable the sensor output signals.

**Red Htr+** and **Blue Htr-** (heater power): connect to a 12V DC 1.5A power supply. The actual heater current depends on the temperature. In cold climates a 40Ah battery would only last one day, so use a mains-powered regulated 12V DC power adaptor.

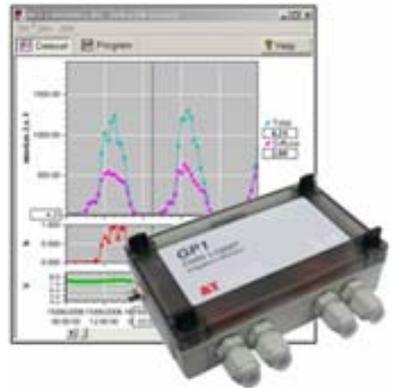
Do not apply AC mains power to the SPN1.

# Program Logger: Example using a GP1

## About DeltaLINK-PC software

- Programs the GP1 logger, starts and stops logging, displays real-time graphs, retrieves, graphs and displays logged SPN1 data.
- Runs on your PC, connected to GP1 via GPI-RS232 cable
- Includes an SPN1 logging program
- Also available as a Pocket PC version.

You need DeltaLINK version 2.2 or later installed along with the Excel Dataset Import Wizard: (see Software and Manuals CD)



## Run DeltaLINK-PC

1. Connect PC to the GP1 with cable **GP1-RS232**, either using a spare serial port or USB-RS232 adapter.
2. Run **DeltaLINK**. The GP1 should respond, populating the DeltaLINK **Logger** page with status information about the logger.
3. Click on **Program** and then **Change** to create a new logging program.
4. Select **Edit, New Program** and select **SPN1 Sunshine Recorder** from the list of available program types.
5. Define the logging program you require, from the options as shown.

The image shows a screenshot of the 'Program1 - DeltaLINK Program' window. The window title is 'Program1 - DeltaLINK Program'. The main area is titled 'SPN1 Sunshine Recorder program for GP1'. Under 'Recording options', there are two dropdown menus: 'Sample rate' set to '3 seconds' and 'Recording rate' set to '1 hours'. Below these are two more dropdown menus: 'Record irradiance as' set to 'Integral, J.m-2' and 'Record sunshine as' set to 'Total, sunshine hours'. At the bottom, there are two checked checkboxes: 'Record power supply voltage' and 'Autowrap dataset'. Three red arrows point from text labels on the left to the 'Sample rate', 'Recording rate', and 'Record sunshine as' dropdown menus.

**Sample Rate:** *the interval between sensor readings.*

**Recording rate:** *the interval between recorded values, i.e. the integration period.*

**Record sunshine as:** *select the method of recording sunshine duration.*

6. Click **Apply** to install the program in the GP1.
7. Click on the **Sensors** page and **Refresh** to show a real-time graph of Total (Global), Diffuse and sunshine status – to check everything seems to be working.
8. On the **Logger** tab select **Start** to start logging.
9. Periodically in the **Dataset** tab select **Refresh** to inspect logged data.
10. **Save** it to file and in Excel use **File, Import** to run the **Dataset Import Wizard** to import and graph your data.

# Install the SPN1 on site

It may be installed at any latitude.

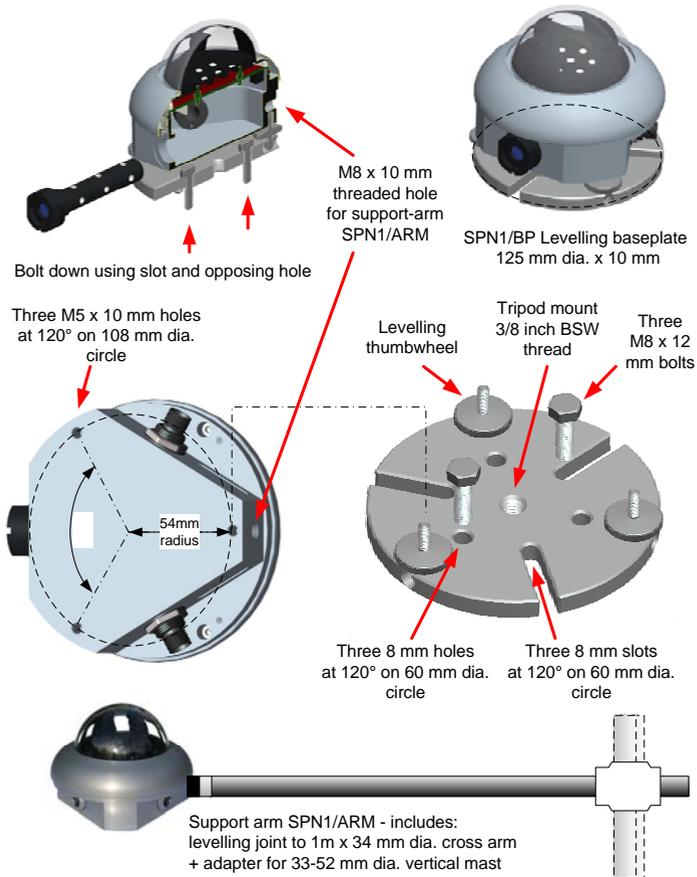
Mount the SPN1 horizontally and at any polar orientation i.e. relative to North.

Use either the **Levelling baseplate** type **SPN1/BP**, or **Support arm** type **SPN1/ARM**.

M8 attachment bolts are provided with both.

Do not touch any socket cap screws under the flange holding the dome. These are sealed during manufacture.

Connect the heater power, data logger, and serial port if required, using the cables shown in the **Overview** and the wiring connections shown in Fig 1.



## Maintenance

Keep glass dome clean using clean water with mild detergent or Isopropyl Alcohol.

If any two desiccant indicators turn pink, unscrew the desiccant canister from the indicator cap, and replace with a fresh one (type SPN1-SD).

**Notices:** The Sunshine Pyranometer is protected by patents EP1012633 & US 6417500. EMC certification: refer to the SPN1 Regulatory Information on the Delta-T Software and Manuals CD.

# Specifications

The following accuracy figures give 95% confidence limits, i.e. 95% of individual readings will be within the stated limits under normal climatic conditions. For full specs see SPN1 User Manual

Overall accuracy: Total (Global) radiation and Diffuse radiation	$\pm 5\%$ Daily integrals $\pm 5\% \pm 10 \text{ W.m}^{-2}$ Hourly averages $\pm 8\% \pm 10 \text{ W.m}^{-2}$ Individual readings
Resolution	$0.6 \text{ W.m}^{-2} = 0.6 \text{ mV}$
Range	0 to $>2000 \text{ W.m}^{-2}$
Analogue output sensitivity	$1 \text{ mV} = 1 \text{ W.m}^{-2}$
Analogue output range	0-2500 mV
Sunshine status threshold	$120 \text{ W.m}^{-2}$ in the direct beam

## Other specifications

Accuracy: Sunshine status	$\pm 10\%$ sun hours with respect to the threshold
Accuracy: Cosine Correction	$\pm 2\%$ of incoming radiation over 0-90° Zenith angle
Accuracy: Azimuth angle	$\pm 5\%$ over 360° rotation
Temperature coefficient	$\pm 0.02\%$ /°C typical
Temperature range	-20 to +70°C
Stability	Recalibration recommended every 2 years.
Response time	< 200 ms
Spectral Response	400-2700 nm
Spectral sensitivity	10% typical
Non-linearity	< 1%
Tilt response	Negligible
Zero Offsets	< $3 \text{ W.m}^{-2}$ for a 5°C/hour change in ambient temperature < $3 \text{ W.m}^{-2}$ dark reading
Latitude capability	-90° to + 90°
Environmental: Sealing	IP67
Sunshine status output	No sun = open circuit. Sun = short circuit to ground
Power requirement	2 mA (excluding heater power), 5 V – 15 V DC
Heater power	12 V – 15 V DC, up to 1.5 A
Heater control	Continuously variable up to 20 W output for external temperatures below 0°C
Lowest snow & ice-free temperatures (using heater)	-20°C at 0 m/s wind speed -10°C at 2 m/s wind speed
Mounting options:	3 x M5 tapped holes in base; 108mm pcd, 120° spacing. (takes optional Levelling baseplate SPN1/BP) M8 tapped hole on side (takes Support Arm SPN1/ARM)
Size & Weight	126 mm dia. x 94 mm high, 786 gm



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