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Find the *Delta-T Devices SPN1* at our website: *Click HERE*

# **SPN1** Sunshine Pyranometer

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

# ***Quick Start Guide*** *version 3.0*




**AT** ***Delta-T Devices Ltd***

## *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

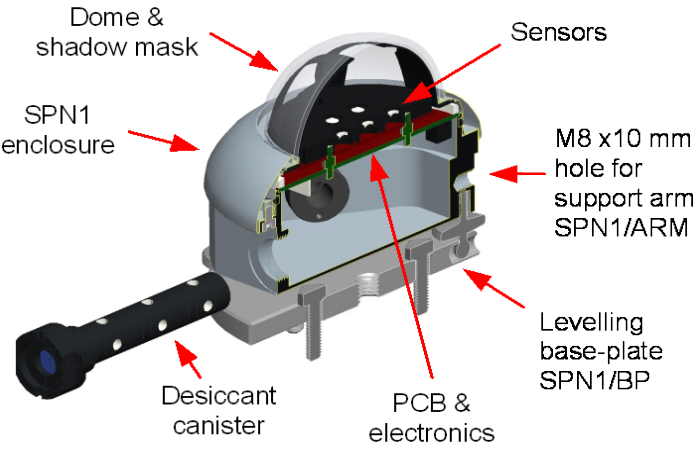
- Serial cable **SP-BF-RS01**
- Analogue cable **SP-BF/w-05**
- User Manual and this Quick Start Guide
- Calibration certificate

### *Optional accessories*

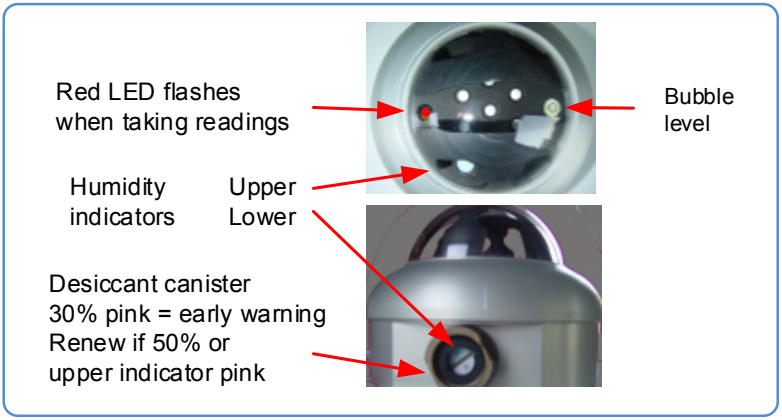
- Levelling baseplate **SPN1/BP**
- Support arm **SPN1/ARM**
- Spare desiccant canisters **SPN1-SD**

# Overview

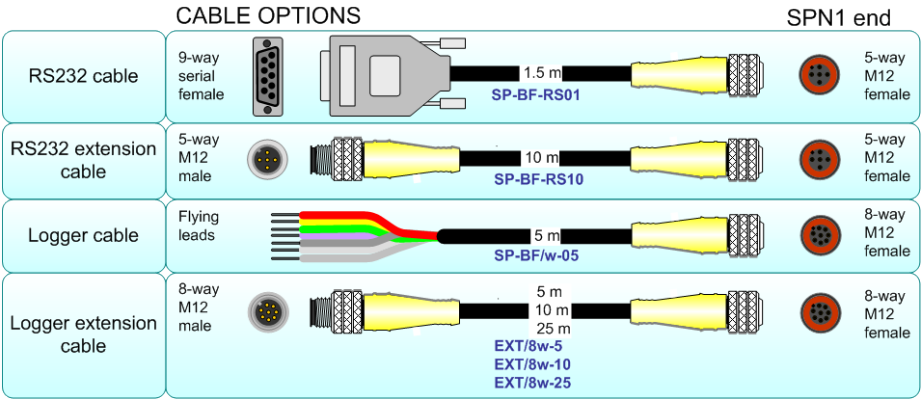
## *Construction*




## *Indicators*



# Cabling Options

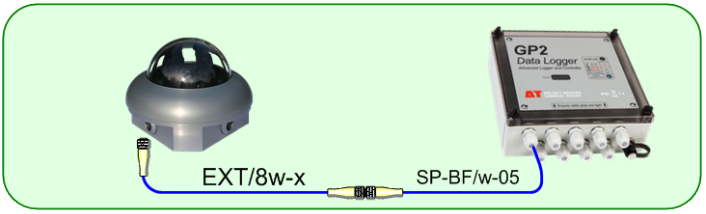



## *Maximum Cable Lengths*

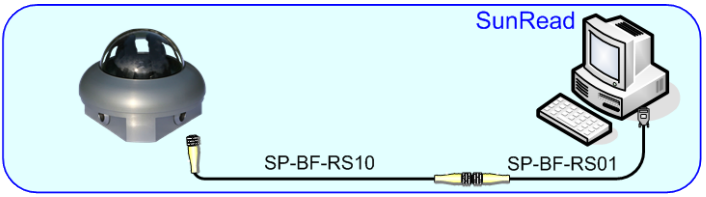
**Serial cable**: the maximum length usually depends on how good the line driver is in the PC, and can typically vary from 5 to 100m.

**Analogue cable**: 100m - provided the power supply at the SPN1 exceeds 5V at 2mA for sensor alone, or 12V at up to 1.5A for heater.
**Power:** Don't exceed the maximum specified supply voltage of 15V.
For a 15V supply, the heater will work as intended up to 50m cable length, and with a reduced effectiveness for longer cable lengths.
Note: **Always use differential sensor measurement when using data loggers**.
(The heater return current can cause large single-ended measurement errors).

# System Cabling Options

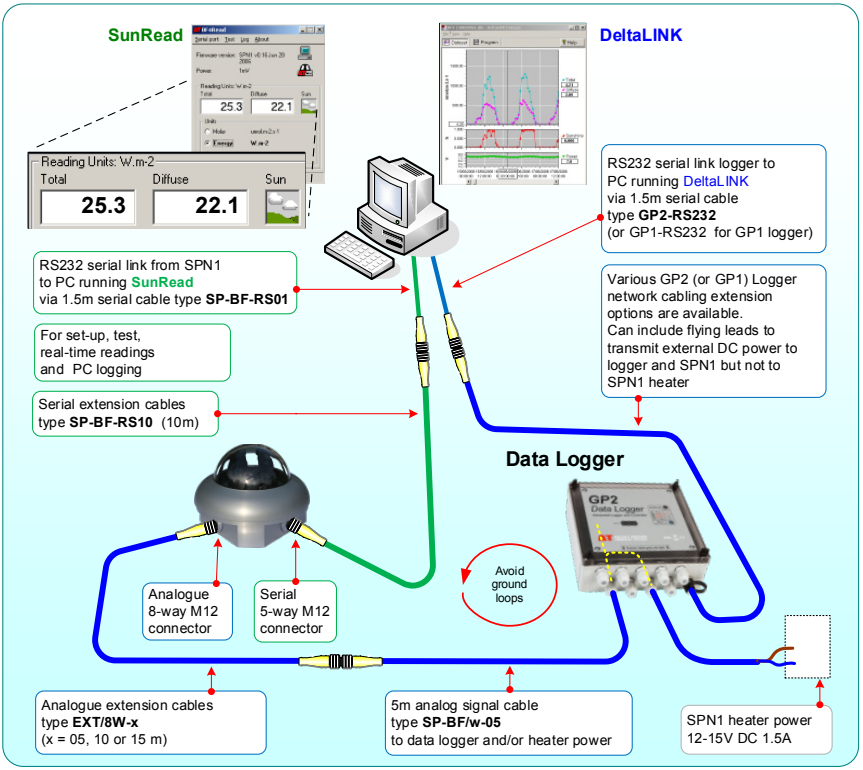



SPN1 analogue port to a data logger
e.g. GP1, GP2 or DL2e

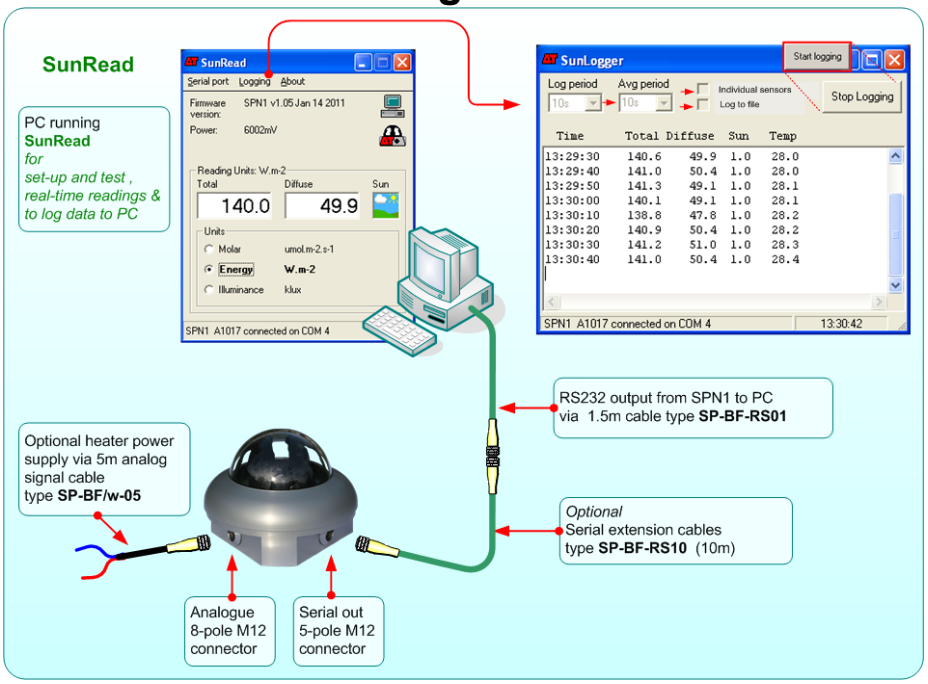



SPN1 serial port to PC running SunRead

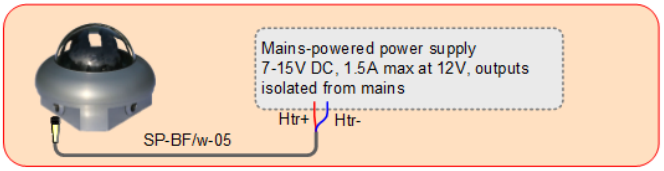
# System Overview



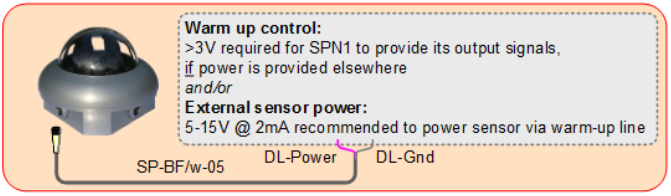
# Use with a PC running SunRead



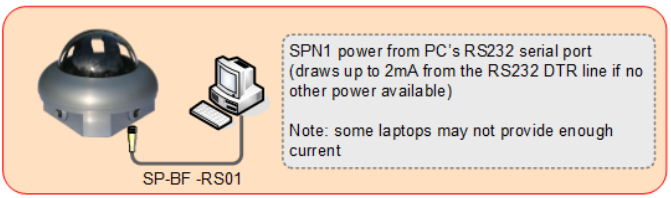

# Power connection options




Heater power
(To enable analogue outputs connect the separate logger warmup line - see below)




Power via logger warmup.
Analogue outputs enabled.
No heater.




Power from PC

# 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 **SP-BF-RS01** cable
- Simple logging capability

## Installation Requirements:

- PC running Windows XP, 7 or 8
- One free RS232 serial port, or USB-RS232 adapter
- DVD drive for software installation
- Cable SP-BF-RS01 (not intended for outdoor use)
- Delta-T Software and Manuals DVD
- Acrobat Reader for reading documentation (free download from www.adobe.com)

## Installation

1. Install the DVD 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 DVD. This will display an index of software and also of documents.
2. Click on **Install SunRead software**.
3. Check the DVD 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.

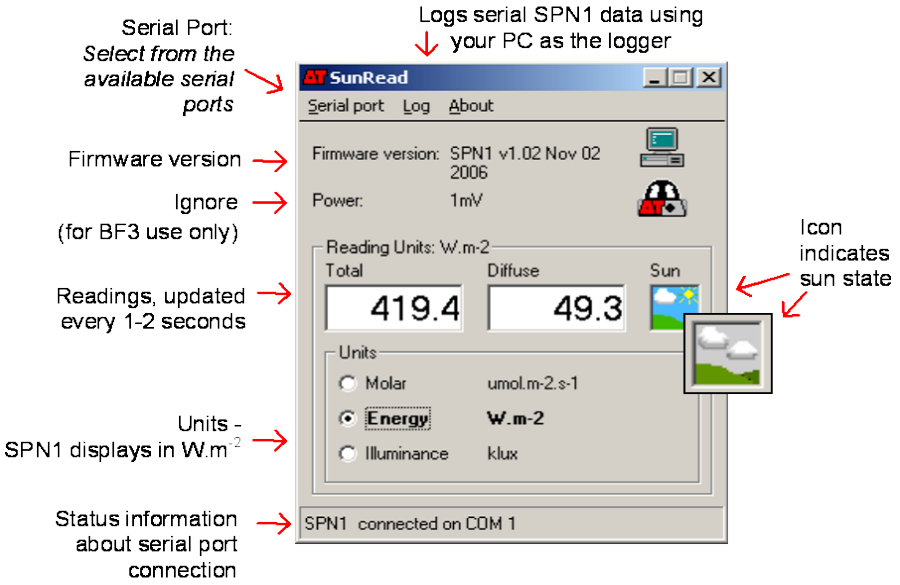
For further installation information see SunRead Release Notes on the DVD.

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 **SP-BF-RS01** plugged into the 5-pole connector- see ***Overview*** diagram.

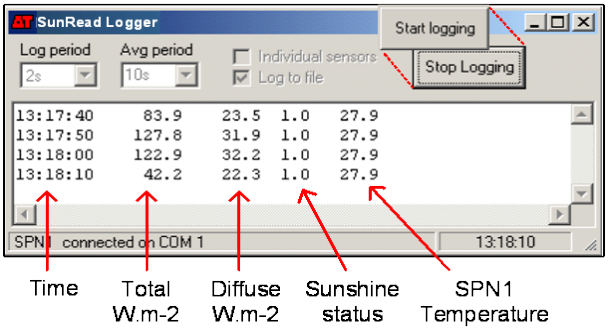
2. Run **SunRead** to display the screen shown below.




## 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 analysed in Excel.




### *Logging options*

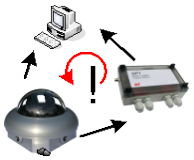
**Log period:** sets logging frequency.
**Avg period:** sets averaging period.
**Log to file:** saves each reading to file as it is logged.
**Individual sensors:** records all 7 individual thermopile sensors.

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

# Set up Data Logger

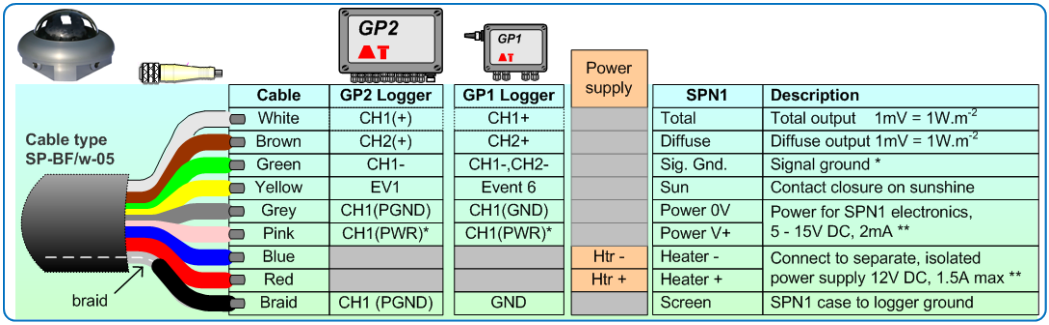
## *Outputs*

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 **SP-BF/w-05**.
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*

GP2: see SPN1 Info Panel in DeltaLINK, and also the GP2 User Manual.
GP1: see ***SPN1 Sunshine Recorder Program*** in DeltaLINK Help.
DL2e: see SPN1 sensor Help in Ls2Win (service release 5).




| Cable | GP2 Logger | GP1 Logger | Power supply |
|---|---|---|---|
| White | CH1(+) | CH1+ | |
| Brown | CH2(+) | CH2+ | |
| Green | CH1- | CH1-,CH2- | |
| Yellow | EV1 | Event 6 | |
| Grey | CH1(PGND) | CH1(GND) | |
| Pink | CH1(PWR)* | CH1(PWR)* | |
| Blue | | | Htr - |
| Red | | | Htr + |
| Braid | CH1 (PGND) | GND | |

| SPN1 | Description |
|---|---|
| Total | Total output 1mV = 1W.m$^{-2}$ |
| Diffuse | Diffuse output 1mV = 1W.m$^{-2}$ |
| Sig. Gnd. | Signal ground * |
| Sun | Contact closure on sunshine |
| Power 0V | Power for SPN1 electronics, |
| Power V+ | 5 - 15V DC, 2mA ** |
| Heater - | Connect to separate, isolated |
| Heater + | power supply 12V DC, 1.5A max ** |
| Screen | SPN1 case to logger ground |

**Figure 1: Wiring to GP1 and GP2 data logger and to heater power supply**

* Note: Connected internally in the SPN1 to Power 0V
** Note: Analogue cable SP-BF/w-05 and serial cable SP-BF-RS01 braids are both earthed via the connector shells to the SPN1 case and terminate at the data logger 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.

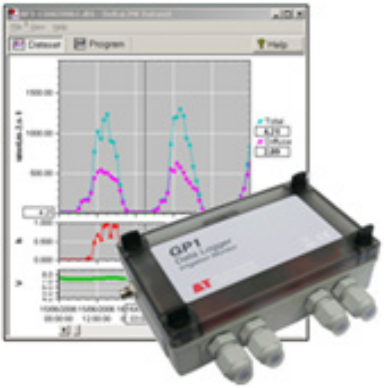
### *Analogue cable wiring for loggers and heater*

**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 (see also SPN1 User Manual).
**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 separate, isolated 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 a GP1 Logger*

## 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 GP1-RS232 cable
- Includes an SPN1 logging program

You need DeltaLINK 3.0 or later installed along with the Excel Dataset Import Wizard (see Software and Manuals DVD)

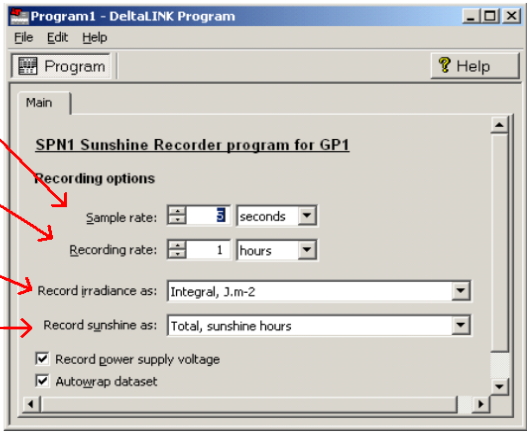
## Run DeltaLINK-PC

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.**
5. Define the logging program you require, from the options as shown.

**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.*

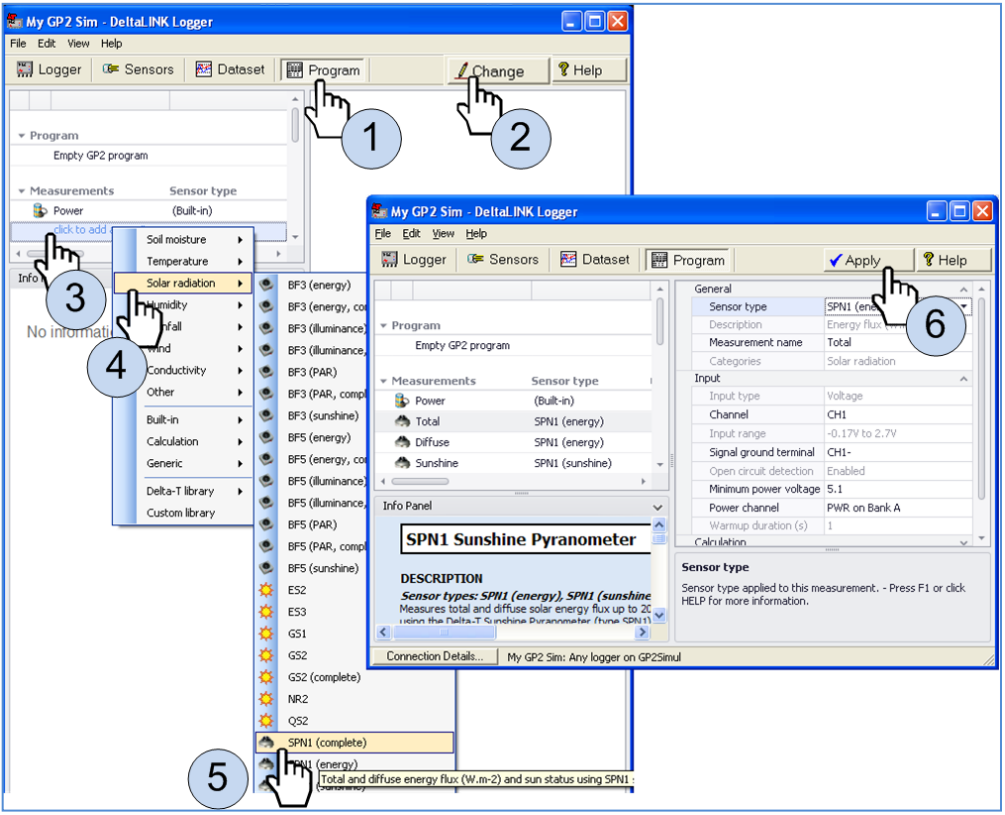



6. Click **Apply** to install the program in the GP1.
7. Click on the **Sensors** page and **Refresh** to show a real-time graph of Total (Global), Diffuse and sunshine status – to check everything seems to be working.
8. On the **Logger** tab select **Start** to start logging.
9. Periodically in the **Dataset** tab select **Refresh** to inspect logged data.
10. **Save** it to file.
11. To import data into Excel, install the **Dataset Import Wizard** from the Start Menu, Delta-T program group, then (in Excel 2010) select **Add Ins, Import Dataset(s).**

.

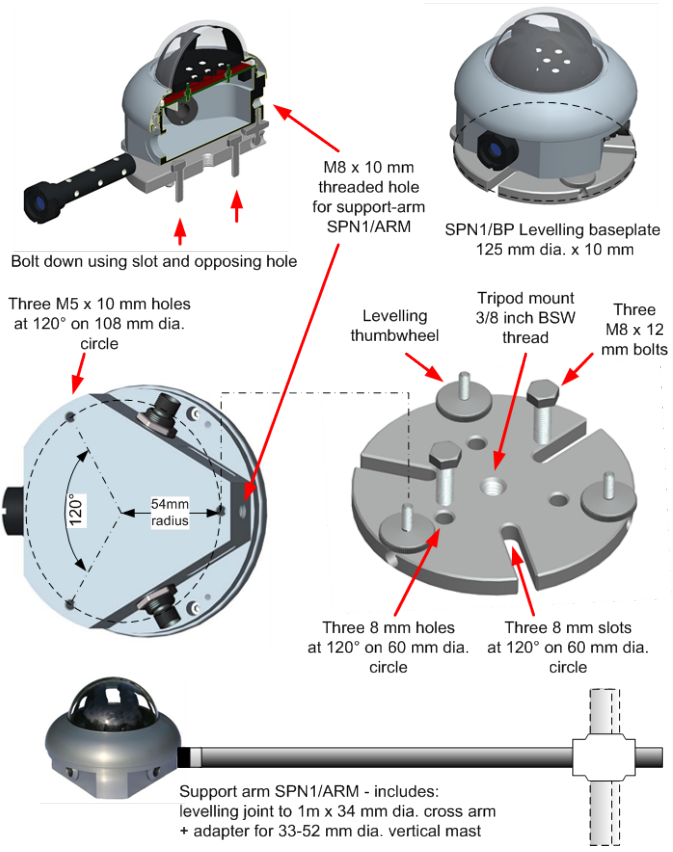
# *Program a GP2 Logger*

Before you start you need DeltaLINK connected to your GP2 or to the GP2 Simulator (see also the GP2 User Manual and/or DeltaLINK Help).



## *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 DVD

# 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 | ± 5% Daily integrals<br>± 5% ±10 $W.m^{-2}$ Hourly averages<br>± 8% ±10 $W.m^{-2}$ Individual readings |
| Resolution | 0.6 $W.m^{-2}$ = 0.6 mV |
| Range | 0 to >2000 $W.m^{-2}$ |
| Analogue output sensitivity | 1 mV = 1 $W.m^{-2}$ |
| Analogue output range | 0-2500 mV |
| Sunshine status threshold | 120 $W.m^{-2}$ in the direct beam |

Other specifications

| | |
|---|---|
| Accuracy: Sunshine status | ± 10% sun hours with respect to the threshold |
| Accuracy: Cosine Correction | ± 2% of incoming radiation over 0-90° Zenith angle |
| Accuracy: Azimuth angle | ± 5% over 360° rotation |
| Temperature coefficient | ± 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 $W.m^{-2}$ for a 5°C/hour change in ambient temperature<br>< 3 $W.m^{-2}$ dark reading |
| Latitude capability | -90° to + 90° |
| Environmental: Sealing | IP67 |
| Sunshine status output | No sun = open circuit.<br>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<br>-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)<br>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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