INTRODUCTION

This application note provides information for using the Delta T SPN1 pyranometer with NRG Symphonie loggers. The Delta-T SPN1 Thermopile based pyranometer provides signals for Global Horizontal Irradiance (GHI), Diffuse Irradiance (DIF) and Sunshine Duration (SUN). The GHI and DIF outputs are proportional to the solar radiation, measured in Watts per square meter (W/m^2 or w/sqm). The Sunshine Duration output is a switch, which closes when the WMO 120 Watt /m^2 sunshine threshold has been met.

These instructions are split into two sections- one for Symphonie, SymphoniePLUS, and SymphoniePLUS3 and one for the SymphoniePRO logger. This is due to the differences in programming and platforms of each type of logger.

SYMPHONIE CLASSIC, PLUS, & PLUS3 LOGGERS

SCM Selection
NRG provides SCM cards compatible with the SPN1 analog outputs. A separate SCM card is required for each output (GHI, DIF, and SUN) and must be installed in the slot corresponding to the channel that the sensor is connected to.

See the table on the following page for the appropriate SCM part numbers for each output.

Pyranometer Calibration and Scale Factor
Each SPN1 sensor is factory calibrated and internally trimmed such that 1 mV = 1 W /m^2. The Symphonie logger samples the sensor output voltage and converts it to a raw value in counts. The real-time display and the scaled data generated by SDR require a scale factor be applied to the raw value to obtain values in meaningful units (such as in W/m^2 or minutes).

Measurement	SCM #	Logger Channel Type (Symphonie Classic, PLUS, PLUS3)	Slope	Offset	Units
Global Horizontal Irradiance (GHI)	7757	Analog or flex	1.467	0	W/m^2
Diffuse Irradiance (DIF)	7757	Analog or flex	1.467	0	W/m^2
Sunshine Duration (SUN)	7759	Analog or flex	0.009775	0	Minutes

Entering Sensor Information into the Logger

As with all sensors, the Symphonie logger calculates and stores pyranometer data in raw units; no scaling is applied to the data in the logger. The logger uses the descriptive and scaling information that you enter to display present values, and stores the information in the data file headers for later use. Refer to your logger's User Guide for more details on entering values into the Symphonie logger.

1. Insert the appropriate SCM into the slot in the logger that corresponds to the desired channel.

2. Activate the logger screen and navigate to the HOME screen. From there, press [4][2] to bring you to the analog channel settings.

3. Select the channel that you wish to use for the SPN1 measurement. For example, press [9] to program the settings on channel 9.
   Note: An analog channel will only show up in the settings screen if there is an SCM card inserted into the slot for that channel. It will default to "NRG 110S Temp C."

4. Press [↓] and select "custom"; press [SET] to accept, and then edit the sensor description.
5. Press [SET] to see the current scale factor setting; enter the Scale Factor 1.467.
6. Press [SET] to see the current Offset, 0.0; leave this unchanged.
7. Press [SET] to see the current Units setting, and enter "W/sqm".
8. Press [SET] to see and change the sensor mounting height, if desired.
9. Press [SET] to see and change the sensor serial number.
10. Press [SET] to complete the settings and save them to the logger.

Once these parameters are entered, press [Home][1], then use the [↓] key to display instantaneous sensor readings.

Data Processing

When importing data into Symphonie Data Retriever (SDR) software for the first time, the site parameters entered at the logger will be imported automatically. If the calculated scale factor was not entered into the logger, you should enter the scale factor for your sensor into the Site Information Editor before importing the site data.

Wiring

SPN1 sensors are equipped with a multi-conductor cable, which both powers the sensor and brings the output signals back to the logger. Please consult the documentation which came with the pyranometer to ensure that the wires are correctly identified and connected to the logger's wiring panel.

Note that wire colors vary between manufacturers and can change sometimes over time. Remember to cross-check the information in the table below with the SPN1 manual. The wiring below assumes the sensor is wired on channels 9 through 11. The sensor outputs can be placed on any Flex or Analog channel with the proper SCM card.

SPN1 Signal	Color	Symphonie and SymphoniePLUS Logger	SymphoniePLUS3 Logger	Channel
Total (GHI)	White	Connect to "sig" terminal	Connect to "SIG" terminal	**Channel 9 SCM #7757**
Signal Ground	Green	Connect to "-" terminal	Connect to "GND" terminal	
Diffuse (DIF)	Brown	Connect to "sig" terminal	Connect to "SIG" terminal	**Channel 10 SCM #7757**
Logger Ground	Grey	Connect to "-" terminal	Connect to "GND" terminal	
Logger Power	Pink	Connect to "+" terminal	Connect to "EXC" terminal	
Sunshine Duration	Yellow	Connect to "sig" terminal	Connect to "SIG" terminal	**Channel 11 SCM #7759**
Heater (-)	Blue	Not used	Not used	**NA**
Heater (+)	Red	Not used	Not used	
Shield / Screen	Screen	Logger ground stud	Logger ground stud	**NA**

SYMPHONIE PRO LOGGERS

Because they use a different platform for operation and programming, the SymphoniePRO loggers use different steps and settings than the Classic, PLUS, and PLUS3. The SymphoniePRO Desktop Application is a good guide to users on how to correctly connect the SPN1 and program the SymphoniePRO.

Consult the product manual for more imformation.

Channel Options

The SPN1 can be used on SymphoniePRO channels 16-26. This gives the user a wide array of options when connecting a suite of sensors to the logger. When using the smaller 16-channel wiring panel, channels 16-17 & 20-22 are available.

P-SCM Selection

When connecting the SPN1 to channels 20-26, use P-SCM #9132 in the corresponding channel slot.

Note: The SymphoniePRO logger uses P-SCM cards, much in the same way that SCM cards are used in the older Symphonie loggers. The two types of cards are not interchangeable nor compatible with each other.

Programming the SymphoniePRO

Programming can be done by connecting directly to the logger's USB-B port, or by creating a new .LGR file and loading it onto a logger at a later time.

1. Open the Desktop Application. With the logger connected to the computer, open the site from the Fleet View page.
    If you are just creating a new .LGR file to be loaded to a logger later on, select File>Create Instrument Configuration File (*.LGR).

2. Navigate to the Channels tab, located in the Instruments sidebar.
    If there is no Instruments sidebar available, then you are not connected to the logger and will need to do so before continuing.

3. In the Channels tab, expand the analog channel you wish to program. Using the "Load From Defaults" dropdown menu, select "Delta-T SPN1 GHI" or "Delta-T SPN1 DIF" to load the sensor's default settings.

4. Edit the description and complete the fields for serial number, height, and boom bearing if desired.

5. The scale factor, offset, and units are already pre-filled to the appropriate values and do not need to be edited.
   Scale Factor: 1000 W/sqm per V
   Offset: 0 W/sqm
   Units: W/sqm

6. The Excitation defaults to constant 12V and does not need to be changed.

7. Repeat steps 3-6 for the other output on a different channel, if desired.

8. Save the changes to the logger. Save a copy of the .LGR file to your desired location.

Wiring

Wire the sensor according to the table below. Note that the colors indicated in the table may be subject to change at any time. Consult Delta-T for more information.

SPN1 Signal	Color	SymphoniePRO Logger
Total (GHI)	White	Connect to "SIG" terminal
Signal Ground	Green	Connect to "GND" terminal
Diffuse (DIF)	Brown	Connect to "SIG" terminal
Logger Ground	Grey	Connect to "GND" terminal
Logger Power	Pink	Connect to "EXC" terminal
Sunshine Duration	Yellow	Connect to "SIG" terminal
Heater (-)	Blue	Not used
Heater (+)	Red	Not used
Shield / Screen	Screen	Wiring panel ground stud