NRG R1 PYRANOMETER
INSTRUCTIONS

NRG Systems®

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INTRODUCTION

The NRG R1 Series Pyranometers (introduced November 2022) are high performing sensors for utility grade solar resource assessment (pre-solar farm construction) and solar performance monitoring (post-solar farm construction). Available in both analog (R1) and digital (R1-D) versions, these spectrally flat thermopile pyranometers meet Class A (Secondary Standard) per ISO 9060:2018.

For traceability, sensors are individually serialized and an ISO 9060 compliant calibration report (including sensitivity, temperature, and directional response characterization) is provided for each individual sensor.

The NRG R1 and NRG R1-D are compatible with NRG LOGR-S and NRG SymphoniePRO data loggers.

NRG R1 Pyranometer

NRG R1-D Pyranometer

SENSOR IDENTIFICATION

The NRG R1 (item 9450) is a passive sensor with millivolt output signal proportional to irradiance. The sensor can be identified by the body label, which contains the “R1” model name and serial number (9450NNNNNN.)

The NRG R1-D (item 9451) is a digital sensor with modbus RTU signal output including irradiance and body temperature.The sensor can be identified by the body label, which contains the “R1-D” model name and serial number (9451NNNNNN).

NRG R1 Pyranometer
9450

NRG R1-D Pyranometer
9451

The NRG R1 and NRG R1-D are compatible with the following cables which affix to the sensor with an M12 connector and to the logger with bare leads.

NRG Item Number	Cable Description
14236	5m
14239	10m
14240	20m
14241	30m
14242	50m

POWER REQUIREMENTS

R1 (Analog)

The NRG R1 Pyranometer is a passive instrument which generates its own signal based on the Seebeck effect. No excitation source is required.

For optimal performance, deploy the R1 on a logger channel configured for bipolar differential signals with ability to handle small signals (mV).

R1-D (Digital)

The NRG R1-D Pyranometer is an active instrument requiring a (5 to 30) V DC excitation source. A nominal 12 V excitation is provided by NRG loggers.

PRE-INSTALLATION CONSIDERATIONS

The sun shield is held in place with three (3) Phillips head screws. It may be removed to allow users to use the spirit level and the adjustable feet to level the pyranometer.

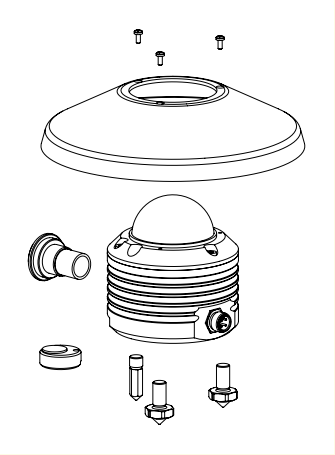


Figure 1. NRG R1 Pyranometer with user-accessible parts removed.

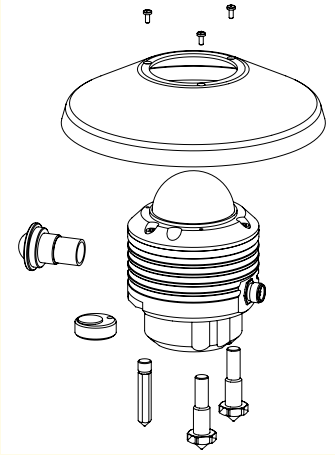


Figure 2. NRG R1-D Pyranometer with user-accessible pats removed.

Desiccant

For best performance in humid climates or condensing conditions, use the desiccant provided with the pyranometer in sealed foil packs. Remove the sun shield to access the desiccant cartridge. Remove the desiccant cartridge from the body of the NRG R1 using a coin or large screwdriver to turn the cartridge. Fill the cartridge with silica gel. Carefully re-install the cartridge making sure the O-ring is clean and well seated.

The silica gel is yellow when fresh; and should be inspected periodically. It will need to be replaced when it turns white or translucent.

Figure 3. Load desiccant cartridge.

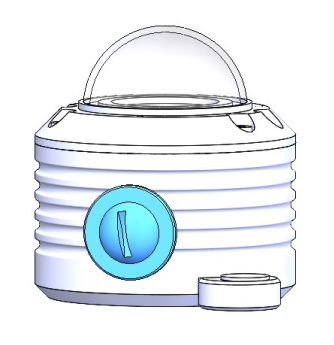


Figure 4. The desiccant cartridge should be inspected periodically.

Location

The R1 should be mounted above all nearby obstructions, in an accessible location. Orient the pyranometer with the cable facing north if the installation is in the northern hemisphere. Orient the cable to the south in the southern hemisphere. A drip loop should be left in the sensor wire to allow water to run off the cable.

WMO-No. 8 (Guide to Meteorological Instruments and Methods of Observation) provides other helpful guidance on mounting location.

The feet of the NRG R1 may be removed to permit mounting in plane of array (POA) applications. The sun shield and feet may be removed for albedo applications. The NRG Pyranometer is supplied with mounting screws and nuts.

Mounting Fasteners

The NRG R1 Pyranometer includes the following fasteners:

Quantity	Fastener	Purpose
1	Screw, M2.5-0.45 x 6, Phillips, SS	Spare for securing sun shield
2	Screw, M5-0.8 x 60, Socket Head Cap, SS	For albedo and POA mounting
2	Screw, M5-0.8 x 85, Socket Head Cap, SS	For mounting with leveling feet
3	Nut, M5-0.8, SS	For NRG mounting brackets

The NRG R1-D Pyranometer includes the following fasteners:

Quantity	Fastener	Purpose
1	Screw, M2.5-0.45 x 6, Phillips, SS	Spare for securing sun shield
2	Screw, M5-0.8 x 85, Socket Head Cap, SS	For albedo and POA mounting
2	Screw, M5-0.8 x 100, Socket Head Cap, SS	For mounting with leveling feet
3	Nut, M5-0.8, SS	For NRG mounting brackets

Tools

The following tools will be helpful in installing the NRG R1.

- Phillips head screwdriver (No. 1) for removing the sun shield
- 4-mm hex key (for installing mounting screws)
- 7-mm wrench (for removing fixed foot of pyranometer)
- 8-mm wrench (for mounting nuts)
- Coin (for desiccant cartridge)

BRACKETS

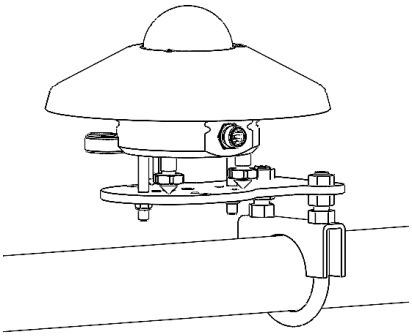


Figure 5. Mounting bracket assembly 14357 allows mounting on SRA or SRM towers.

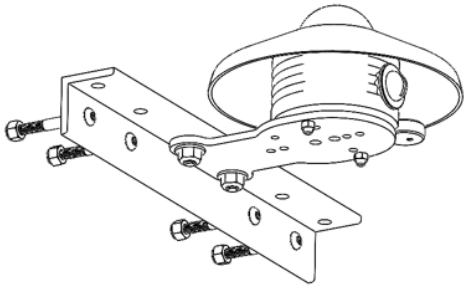


Figure 6. Bracket assembly 14983 permits mounting in the plane of a fixed PV array.

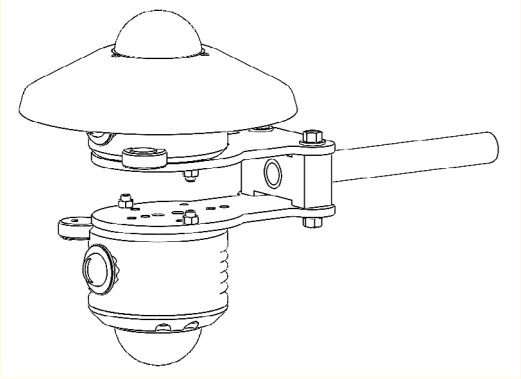


Figure 7. Bracket assembly 14396 permits two NRG R1 Pyranometers to measure albedo.

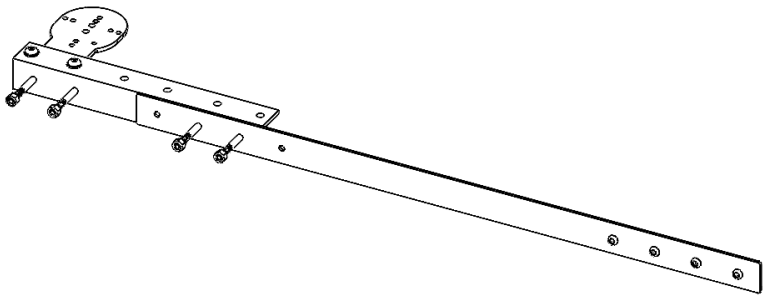


Figure 8. Inquire about other standard bracket sets, such as 17560 Assembly, POA Extension Arm, Panel Mount.

LOGR-S

Compatibility

The NRG R1 pyranometer defaults are available in LOGR-S with firmware 1.05.55 or higher. There are no additional logger firmware requirements.

NOTE: It is best practice to update your logger firmware before performing logger configuration and/ or data processing tasks. The latest versions of software, firmware and documentation can be downloaded from this page: https://www.nrgsystems.com/support/product-support/ .

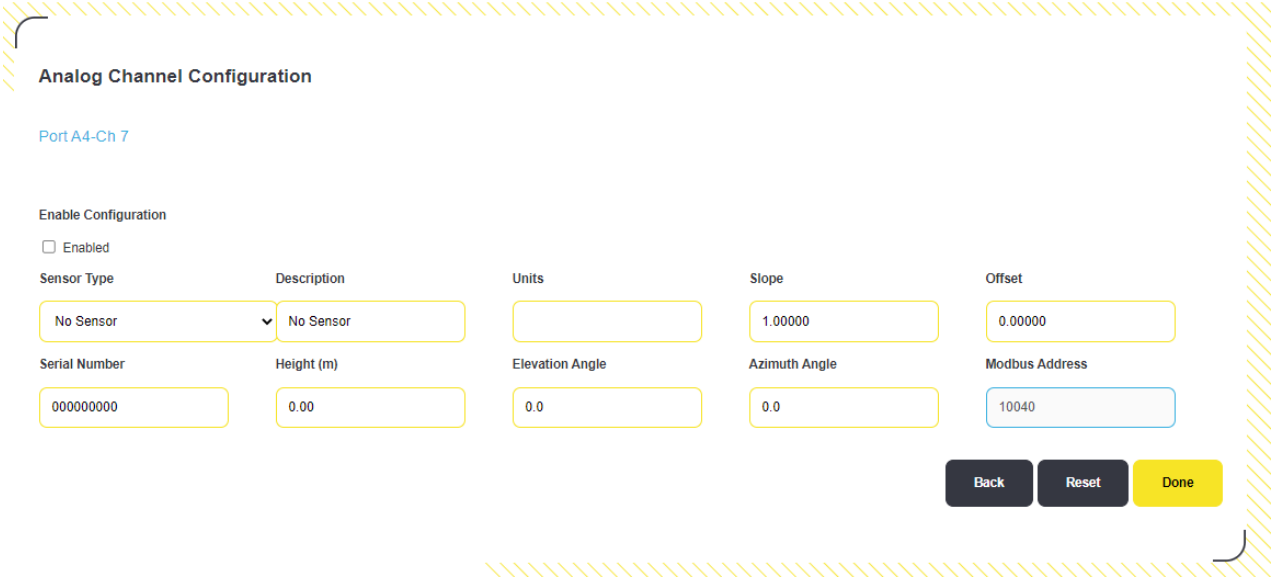
WIRING AND CONFIGURATION

NRG R1 to NRG LOGR-S

Wire the NRG R1 to the LOGR-S according to the table below.

Terminal Blocks A1 to A7		
R1 Connection	**Color**	**NRG LOGR-S**
mV output (+)	Brown	Connect “SIG” terminal
mV output (-)	White	Connect to “SIG-” terminal
Housing	Blue	no connection
Housing Diode	Black	no connection
no connection	Grey	no connection
Housing	Yellow	Connect to “SHD” terminal

Navigate to the Sensors > Analog Sensors web page and select the NRG R1 form the drop-down list. Note, if you do not see the R1 in the “Load From Defaults” drop-down menu, please update your software from the “Services and Support” section of our website (https://www.nrgsystems.com)



The LOGR-S contains default scaling information for the R1 Pyranometer sensor to achieve the units W/m^2.

- Slope: user calculated
- Offset: -0

* Refer to the sensor's calibration report for the calibrated sensitivity and convert to a scale factor.

$$Slope = \frac{1000000}{Sensitivity}$$

Example: Pyranometer sensitivity is 9.11 uV/W/m^2, the scale factor for the LOGR-S Analog channel will be

1000000/9.11 = 109769.484

Logger slope is in the units W/m^2/Volt, and recorded data is in the units W/m^2

NRG R1-D to NRG LOGR-S

Wire the NRG R1-D to the LOGR-S according to the table below.

Terminal Blocks A1 to A7		
R1-D Connection	**Color**	**NRG LOGR-S**
VDC+	Brown	Connect to Com A or B EXC
Data +	White	Connect to Com A or B Data +
Data Ground	Blue	Connect to Com A or B GND
VDC-	Black	Connect to Com A or B GND
Data -	Grey	Connect to Com A or B Data -
Housing	Yellow	Connect to "SHD" terminal

Navigate to the Sensors > Serial Sensors web page and select the NRG R1-D from the drop-down list. Click save. Note, if you do not see the R1-D in the "Load From Defaults" drop-down menu, please update your software from the "Services and Support" section of our website (https://www.nrgsystems.com)

Serial Channels

Enabled	Channel	Sensor	Measurand	Slope	Offset
☑	101	Hukseflux SR30_GHI_3	Irradiance	0.01000	0.00000
☑	102	Hukseflux SR30_GHI_3	Body Temp	0.01000	0.00000
☑	103	NRG R1-D_39	Irradiance	1.00000	0.00000
☑	104	NRG R1-D_39	Body Temp	0.10000	0.00000

Select the Measurands Irradiance and Body Temperature.

Compatibility

The NRG R1 Pyranometer defaults are available in SymphoniePRO Desktop Application SPD v3.13 and later. There are no additional logger firmware requirements.

NOTE: It is best practice to update your desktop software and logger firmware before performing logger configuration and/or data processing tasks. The latest versions of software, firmware and documentation can be downloaded from this page: https://www.nrgsystems.com/support/product-support/ .

Wiring and Configuration

NRG R1 to SymphoniePRO

Wiring the NRG R1 to the SymphoniePRO is straightforward and familiar. Please follow the table below.

Channels 20-26 (use P-SCM #9128)		
R1 Connection	**Color**	**SymphoniePRO Logger**
mV output (+)	Brown	Connect to 20-26 “SIG +” terminal
mV output (-)	White	Connect to 20-26 “SIG -” terminal
Housing	Blue	no connection
Housing Diode	Black	no connection
no connection	Grey	no connection
Housing	Yellow	Connect to 20-26 “SHD” terminal

NRG R1-D to SymphoniePRO

Wiring the NRG R1 to the SymphoniePRO is straight forward and familiar. Please follow the table below.

COM-A or COM-B		
R1-D Connection	**Color**	**SymphoniePRO Logger**
VDC+	Brown	Connect to aux power supply +
Data +	White	Connect to RS-485 “Rx+/Tx+” terminal
Data Ground	Blue	Connect to RS-485 “GND” terminal
VDC-	Black	Connect to aux power supply -
Data -	Grey	Connect to RS-485 “Rx-/Tx-”
Housing	Yellow	Connect to RS-485 “SHD” terminal

Channel Configuration

Create the following configuration in the SymphoniePRO Desktop Application (Version SPD v3.13 or later). Note, if you do not see the R1 in the “Load From Defaults” drop-down menu, please update your software from the “Services and Support” section of our website (https://www.nrgsystems.com).

Default Scale Factors

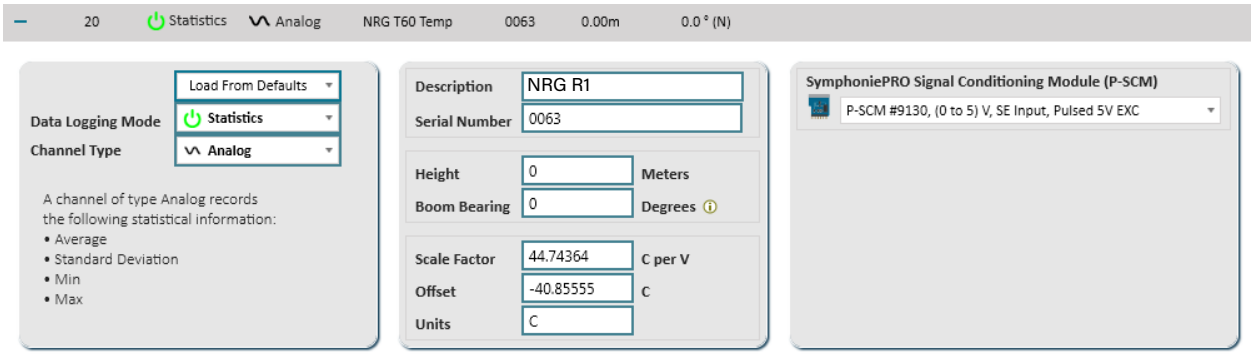
The SymphoniePRO Desktop Application contains default scaling information for the R1 Pyranometer sensor to achieve the units W/m^2.

- Scale Factor: Sensor specific scale factor from label/callibration.
- Offset: -0

* refer to the sensor's calibration report for the calibrated sensitivity and convert to a scale factor.

P-SCM Channels 20-26

The R1 can be used on channels 20 through 26 when the logger is equipped with NRG Part Number 9128 (P-SCM [-6 to 58mV Input no EXC]). Choose "NRG R1" from the "Load From Defaults" drop down menu.



RS485

The R1-D can be used on the COM-A and COM-B terminals. Configure the connected serial channels for Client ID and Measurand.

MAINTENANCE

Cleaning

For best performance, it is important to keep the outer glass dome of the pyranometer clean. A weekly cleaning with lens cleaner is suggested. Alternatively, alcohol may be used; followed by a wipe with distilled water.

Mount

The levelness of the mount should be checked seasonally or after high wind or snow events.

Desiccant

The desiccant cartridge is transparent, so the condition the silica gel can be inspected without disassembly. When fresh, the silica gel crystals are yellow; when they are whitish, they need to be replaced. Desiccant may need to be replaced as frequently as every two to six months, depending on local conditions. If condensation is observed on pyranometer domes after large temperature swings, desiccant will improve sensor accuracy.

Calibration

The instrument should be re-calibrated every one or two years when it is new. Older sensors may only require recalibration only every several years.

NRG R1 SPECIFICATIONS

DESCRIPTION	Sensor Type	Thermopile solar radiation sensor; ISO 9060:2018 'Class A' (Secondary Standard) compliant
	Applications	Meteorological studies
		Environmental monitoring
	Sensor Range	(0 to 2000) W/m^2
	Spectral Range	283 nm to 2800 nm
	Typical Sensitivity	(6 to 11) uV/(W/m^2)
	Instrument compatibility	NRG SymphoniePRO and LOGR-S Data Loggers
	Certifications	Class A classification per ISO 9060:2018
OUTPUT SIGNAL	Signal type	Microvolt analog signal proportional to total solar radiation (sensor specific sensitivity found on calibration report in units µV/Wm-2)
	Accuracy	Class A (Secondary Standard) per ISO 9060:2018
	Calibration	Characterization report included with each sensor; traceable to World Radiometric Reference (WRR)
		Calibration uncertainty < 2%
POWER	Power Required	Zero (passive sensor)
INSTALLATION	Mounting	Mounts to tower using NRG's Mounting Plate I Pyranometer, Gen II (14357); more mounting options available
	Accuracy of leveling device	< 0.1 Deg.
	Tools required	Phillips head screwdriver (No. 1) 4 mm hex key 7 mm wrench 8 mm wrench coin for removing desiccant cartridge
ENVIRONMENTAL	Operating temperature range	-40 °C to 80 °C (-40 °F to 176 °F)
	Operating humidity range	0 to 100%
PHYSICAL	Connections	4-pole M12 connector on sensor body Bare wire leads from cable connect directly to logger see also logger user's manual for wiring diagram
	Cable length	Sold separately; options include: 5 m (16.4 feet) 10 m (32.8 feet) 20 m (65.6 feet) 30 m (98.4 feet) 50 m (164 feet)
	Weight	1.65 lbs. 0.75kg
	Dimensions	160 mm diameter x 104 mm high (with feet) 160 mm diameter x 83 mm high (without feet)
MATERIALS	Detector	Thermopile
	Enclosure	IP67 weatherproof anodized aluminum enclosure and stainless steel hardware

NRG R1-D SPECIFICATIONS

DESCRIPTION	Sensor Type	Thermopile solar radiation sensor; ISO 9060:2018 'Class A' (Secondary Standard) compliant
	Applications	Meteorological studies
		Environmental monitoring
	Sensor Range	(0 to 2000) W/m^2
	Spectral Range	283 nm to 2800 nm
	Instrument compatibility	NRG SymphoniePRO and LOGR-S Data Loggers
	Certifications	Class A classification per ISO 9060:2018
OUTPUT SIGNAL	Signal type	RS485 Modbus RTU
	Accuracy	Class A (Secondary Standard) per ISO 9060:2018
	Calibration	Characterization report included with each sensor; traceable to World Radiometric Reference (WRR)
		Calibration uncertainty < 2%
POWER	Power Required	(5 to 30) V DC
INSTALLATION	Mounting	Mounts to tower using NRG's Mounting Plate I Pyranometer, Gen II (14357); more mounting options available
	Accuracy of leveling device	< 0.1 Deg.
	Tools required	Phillips head screwdriver (No. 1) 4 mm hex key 7 mm wrench 8 mm wrench coin for removing desiccant cartridge
ENVIRONMENTAL	Operating temperature range	-40 °C to 80 °C (-40 °F to 176 °F)
	Operating humidity range	0 to 100%
PHYSICAL	Connections	5-pole M12 connector on sensor body Bare wire leads from cable connect directly to logger see also logger user's manual for wiring diagram
	Cable length	Sold separately; options include: 5 m (16.4 feet) 10 m (32.8 feet) 20 m (65.6 feet) 30 m (98.4 feet) 50 m (164 feet)
	Weight	1.98 lbs. 0.90kg
	Dimensions	160 mm diameter x 118 mm high (with feet) 160 mm diameter x 106 mm high (without feet)
MATERIALS	Detector	Thermopile
	Enclosure	IP67 weatherproof anodized aluminum enclosure and stainless steel hardware

NRG R1 PYRANOMETER ASSOCIATED ITEMS LIST

These items are commonly used in conjunction with the NRG R1. Please contact NRG for further information.

NRG PART #	DESCRIPTION	NOTES
14357	Assembly, Pipe Mount, Pyranometer	Gen II plate accommodates most pyranometer brands
14983	Assembly, Fixed Array Pyranometer Mount	
14396	Assembly, Pipe Mount, Albedometer	Used with 14487 Albedo Tripod Kit
14487	Albedo Tripod Kit	
17560	Assembly, POA Extension Arm, Panel Mount	Mounts to PV panels
9128	P-SCM #9128 -6 to 58 mV Input, No EXC	For SymphoniePRO
15720	Assembly, Albedometer, 6-foot boom	Integrates albedo with SRA/SRM tower
14236	Cable, 5m	For SRM and SRA Towers
14239	Cable, 10m	
14240	Cable, 20m	
14241	Cable, 30m	
14242	Cable, 50m	
9452	Ventilator, NRG R1-HV	Heater / ventilator accessory for demanding climates
18366	Assembly, Boom Mount, R1-HV	For 9452 on SRA and SRM Towers