

SOILING MEASUREMENT KIT: PSM1 INSTRUCTIONS



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INTRODUCTION

The Pulsed Soiling Module (PSM1) measures the Open Circuit Voltage and Short Circuit Current of a clean and soiled solar panel in accordance with IEC 61724-1. The equipment is intended to be used outdoors and is mounted on or near a solar panel array. Equipment is intended to be used with NRG data loggers.

Throughout these instructions and on NRG's website, you will see the PSM1 referred to as Soiling Measurement Kit or PSM. Please note that these refer to the same product and are used interchangeably throughout this document.

The PSM1 works with Crystalline solar panels.

- Crystalline
 - Holds panels in open circuit.
 - Pulses short circuit current – 50 milliseconds every two seconds.
 - Intended for low to medium voltage and high currents.
 - High and low power Crystalline PV panels

Manufacturer not responsible for device malfunction if device is not used as intended.

SENSOR/PRODUCT IDENTIFICATION

PSM labels identify company, product, input and output values, and shock hazards. Examples of labeling below.



PSM1 Solar Kits:

**#19045 High Current PSM Kit, Crystalline: Parts**

NRG Part Number	Part Description	Part Specification	Qty
18872	Pulsed Soiling Module	Crystalline, High 1, Assembly	1
18888	Cable	30m cable	1
18890	DC Isolator (Disconnect) Sub-Assembly	64 Amp	1
18904	Solar Button	3m, Array Mounted	1
9424	PVT1 BoM Temp Sensor	50m cable	2

#19047 30W PSM Kit: Parts

NRG Part Number	Part Description	Part Specification	Qty
18872	Pulsed Soiling Module	Crystalline, Low V, Assembly	1
18888	Cable	30m cable	1
18887	PV Panels	30W, MC4 connectors	1
18904	Solar Button	3m, Array Mounted	1
9424	PVT1 BoM Temp Sensor	50m cable	2

#19048 30W PSM Kit: Parts

NRG Part Number	Part Description	Part Specification	Qty
18872	Pulsed Soiling Module	Crystalline, Low V, Assembly	1
18889	Cable	2m cable	1
18887	PV Panels	30W, MC4 connectors	1
18904	Solar Button	3m, Array Mounted	1
9424	PVT1 BoM Temp Sensor	3m cable	2
18900	Soiling Station Mount	Tube mount bracket, U-bolt	1



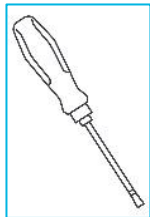
Sensors | Pulsed Soiling Module (PSM1)

Additional Parts Necessary for Symphonie PRO (if installing on Channels 20-26)

NRG Part Number	Part Description	Part Specification	Qty
9132	P-SCM Card	PCBAssy, P-SCM, 0 to 5 V Input, Constant 12V Exc,	2

#18244: Assembly Tools

- Ethernet Cable (LOGR-S)
- Computer with ethernet port or local network connection and USB port
- USB Type B to Type A cable (SymPRO)
- You may need pliers to disconnect the MC4 cable





#18890 Subassembly: DC Isolator or “Solar Disconnect”

NRG Part Number	Part Description	Part Specification	Qty
18623	Solar Disconnect	64 A, SRM	1
11044	Outdoor Label	CLEAN	1
11046	Outdoor Label	DIRTY	1
18718	Mount	Solar Disconnect	2
18695	Label	Solar Disconnect	1
19156	MC4 cable	Solar Ext. Cable Pair, 10ga., 5'	4
19157	MC4 cable	Solar Ext. Cable Pair, 10ga., 10'	4
2703	Hose Clamp	#164, 2.0"-10.75", 9/16 Hex/Slotted Screw, SS	2

SAFETY CONSIDERATIONS / WARNINGS

Warning symbols:

	This universal symbol represents a general warning and is marked on the unit and included in this manual.
	This universal symbol represents an electrical hazard and is marked on the unit and included in this manual. Care should be taken to avoid coming into contact with electricity.



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	This universal symbol signifies that the user manual must be read and is marked on the unit.
--	--

	WARNING: Observe safety precautions: Failure to observe precautions may result in bodily injury and/or damage to the product or interconnected equipment.
	WARNING: Follow directions: Operate this equipment only as directed in these instructions.
	WARNING: Inspect before using: Inspect the equipment and note any damage or defects, including in wiring. Do not use the equipment if damaged or defective.
 	WARNING: Hazardous voltages: PV modules may produce hazardous voltages and currents. Hazardous voltages may be present within the product or its connections. Improper use risks fire or electric shock which could cause bodily injury.
 	WARNING: Qualified personnel only: The product should only be installed and serviced by trained and qualified personnel.
	WARNING: DO NOT CONNECT OR DISCONNECT PV MODULES UNDER LOAD: PV modules must be disconnected through a DC Isolator / Switch or otherwise prevented from producing power during installation or servicing of this product.
	WARNING: Do not exceed module voltage or current ratings: To prevent damage to the product, ensure that the PV module connected to the inputs never exceeds the product's listed voltage and current ratings.
	WARNING: Secure PV module connections: PV module connections must be properly mated and secured.
 	WARNING: Do not open the enclosure: There are no user-serviceable parts inside the product enclosure. Do not open it. Opening the enclosure may damage the product and/or interconnected equipment and risks bodily injury.
	WARNING: Follow standard safety rules: Follow all other standard safety rules for your PV array installation, in addition to the specific precautions listed here.
	WARNING: Protective Conductor must be connected: The products protective conductor must be connected before PV modules are installed. Disconnection of protective conductor while product is connected to PV modules risks bodily injury.



OPERATING ENVIRONMENTAL CONDITIONS

The Pulsed Soiling Module is designed for outdoor use. Detailed operating conditions are tabulated in the Technical Specifications section, p.26.

INSTALLATION

Crystalline PSM1 installation

The following are step-by-step instructions for installing NRG Solar Kit **19045**. **This kit requires a DC disconnect or “isolator” (see image below)**. The NRG kit number is #18890. The DC disconnect item number is #18623.



Figure 1. Item #18623 Solar Disconnect.

1. Begin by loosely outlining where the various components will be installed and check cable lengths.
2. The **#18890 – Solar Disconnect**, should be mounted onto the torque tube near the two Soiling PV panels. Use the two provided #2703 – hose clamps.

 **WARNING:** Ensure 18623 Solar Disconnect is turned to the OFF position.

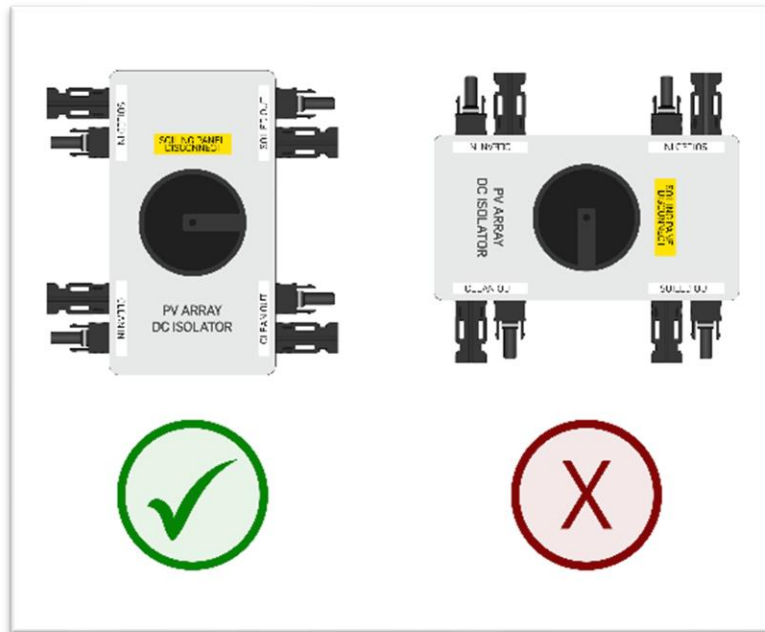
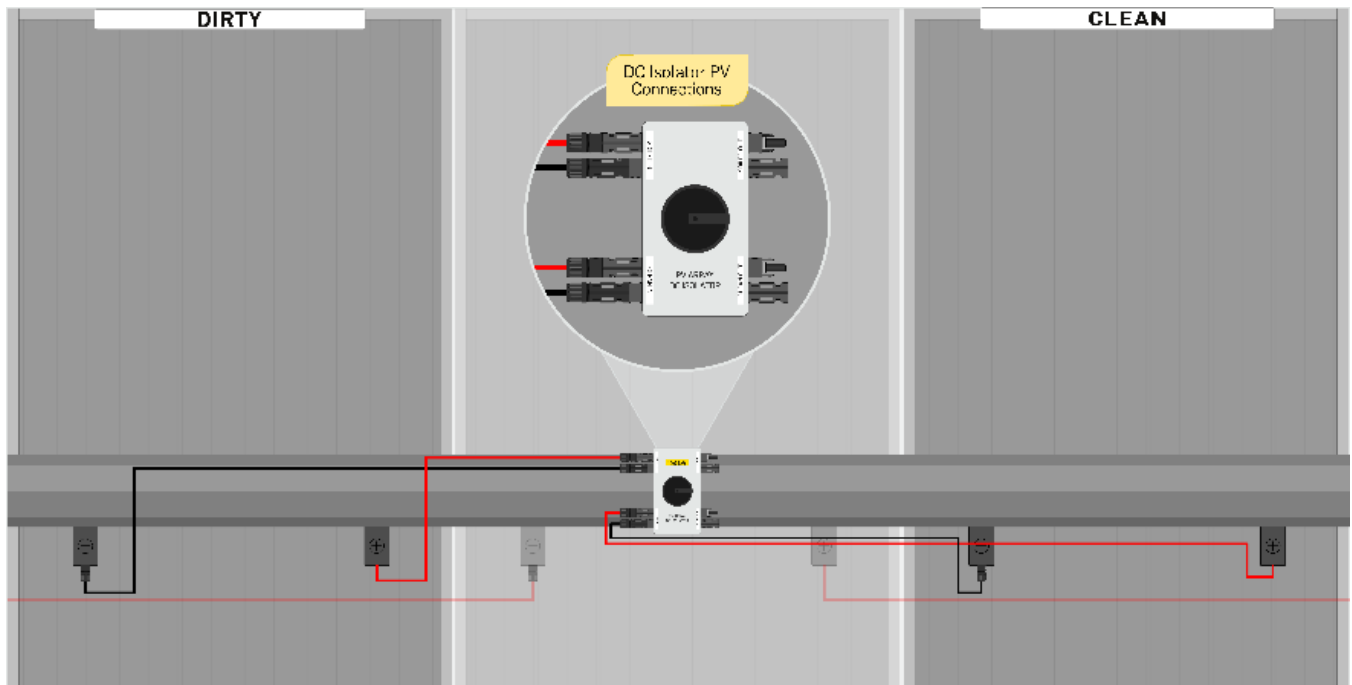


Figure 2: DC Isolator - Acceptable Mounting Orientations

3. Connect the “Soiled” and “Clean” PV panels to the 18623 - *Solar Disconnect* using the *MC4 cables*.



4. Figure 3: Example DC Isolator Location



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4. Mount the PSM onto the pile nearest to the DC Isolator, again using the provided hose clamps. The PSM may also be mounted to the Torque tube if there are cabling restrictions, be mindful of the suggested orientation.

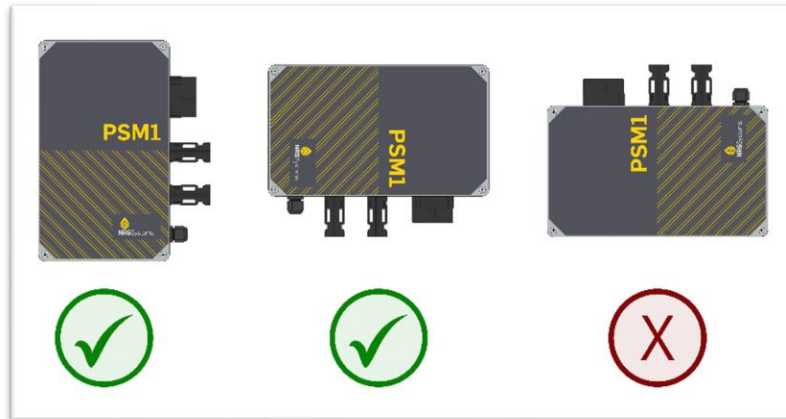


Figure 4: Pulse Soiling Module - Mounting Orientations



Figure 5: PSM - Pile Mounted with Hose Clamps



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- Next, make sure that the grounding cable is affixed to chosen earth ground. You may need to drill a hole in the pile or grounding structure to attach the ground cable.

⚠ WARNING: This is a safety critical step. Not connecting the PSM1 to earth ground may cause the PSM1 to be a shock hazard.

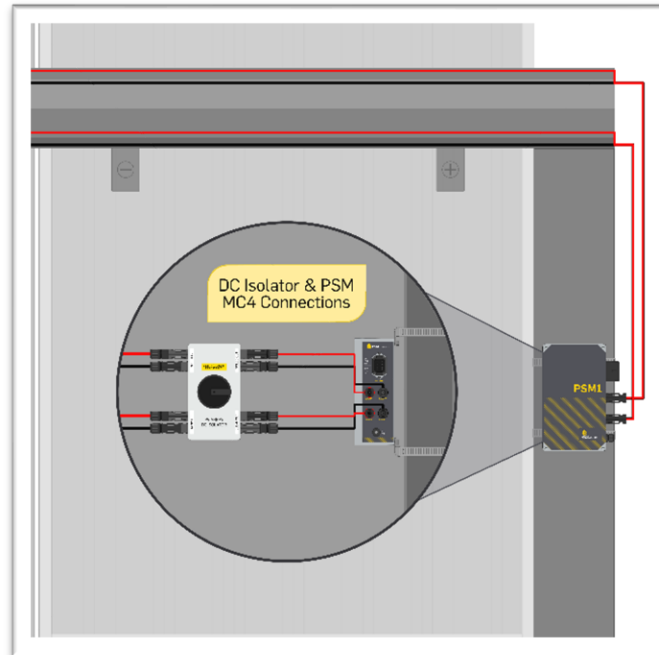
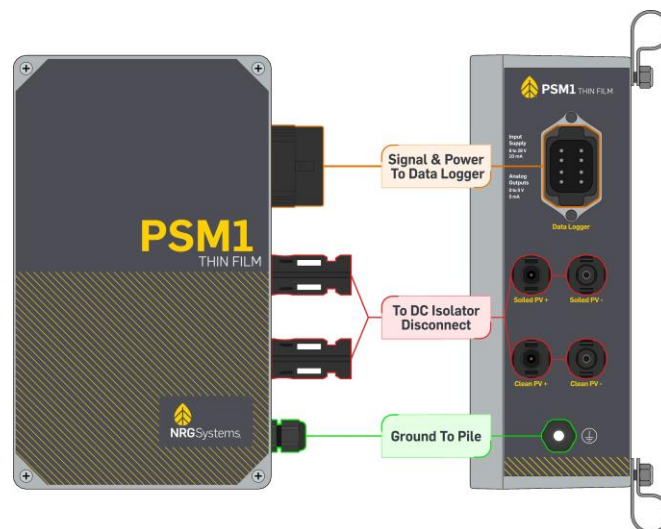


Figure 6: Connect the DC Isolator to the PSM



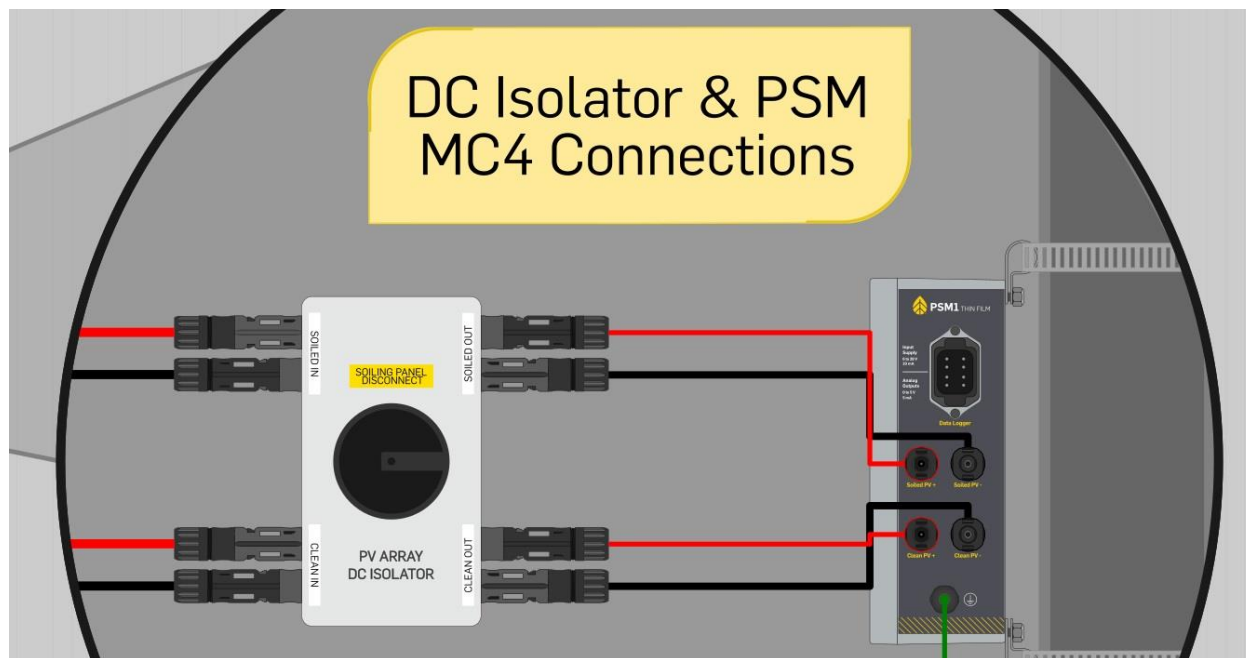
⚠ WARNING: Hazardous voltages: PV modules may produce hazardous voltages and currents. Hazardous voltages may be present within the product or its connections. Improper use risks fire or electric shock which could cause bodily injury.

- ⚠ WARNING:** Ensure 18623 Solar Disconnect is turned to the OFF position



Sensors | Pulsed Soiling Module (PSM1)

2. Connect PSM to the **18623 - Solar Disconnect** utilizing **MC4** cables.
 - o Ensure “Soiled” and “Clean” output from the disconnect are going to the corresponding PSM ports.



3. Connect PSM to the LOGR-S using 18647 - **30-meter Power & Signal Cable**.



Figure 7. Close up of 8-pin connector. Please note: when unplugging connector, the orange seal may come off. **If this comes off after disconnection, make sure to re-attach this piece.**



WARNING: Seal provides ingress protection. If liquid water or conductive contaminates gets inside the PSM1, it may cause arcing across terminals not designed to handle high voltages (e.g. sending 450 V to the attached logger to ground).

4. Connect “Soiled” and “Clean” PV modules to the Solar Disconnect utilizing **MC4 cables**. Ensure “Soiled” and “Clean” output from the disconnect are going to the corresponding PSM ports.
5. Turn the **#18623 Solar Disconnect** to ON.

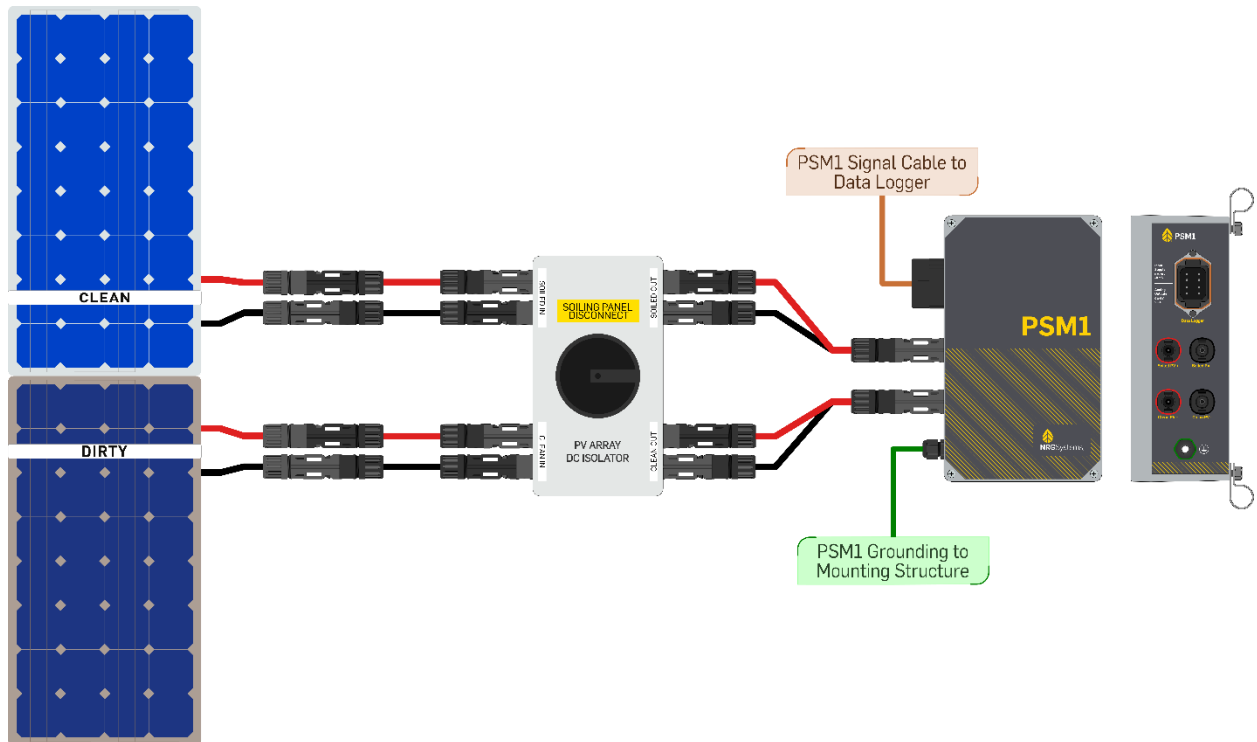


Figure 8: Complete assembly of PSM1 for Crystalline Configurations.

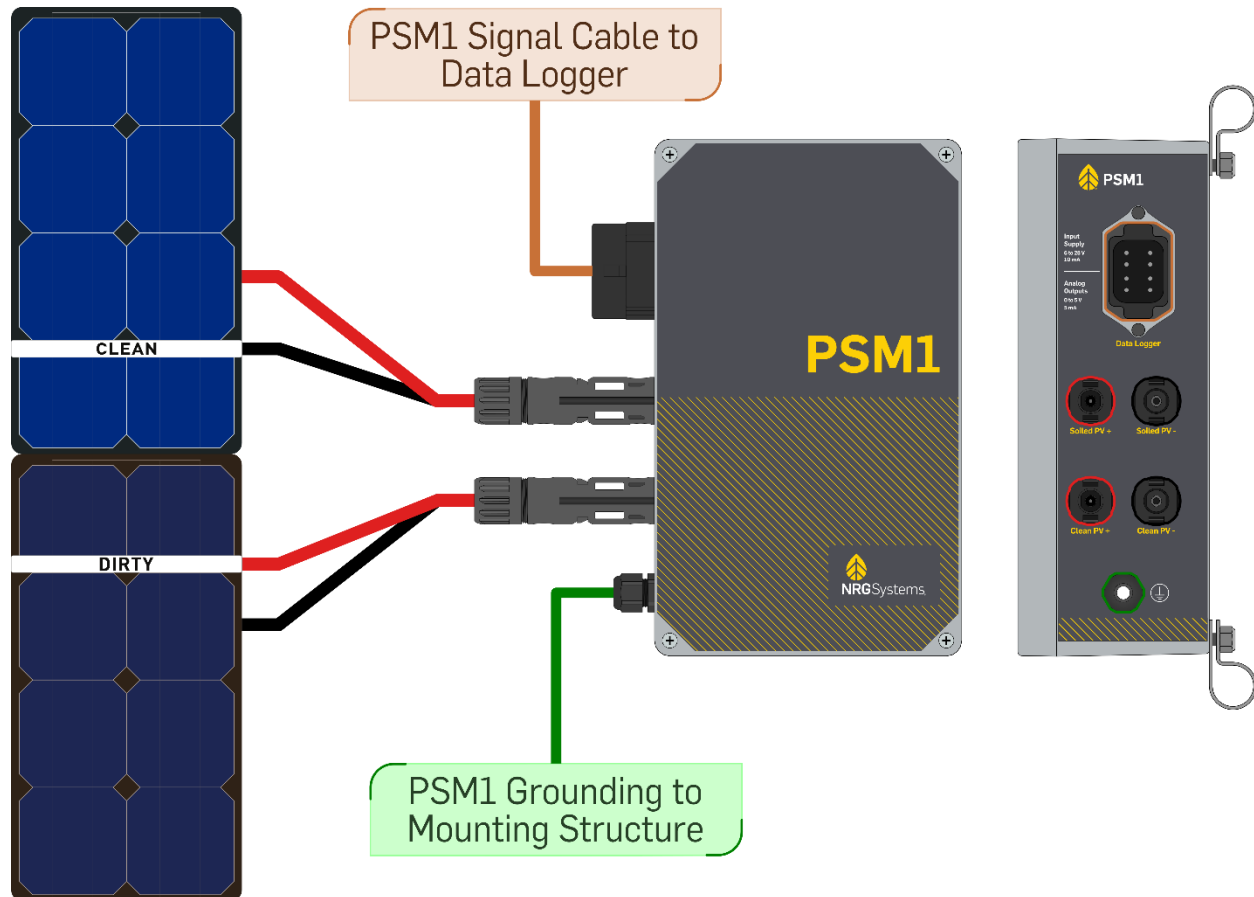
NRG 30 W PSM installation

The following are step-by-step instructions for installing NRG Solar Kit **19048**. This kit does not require a **Solar Disconnect (18623)** or corresponding sub-assembly (**#18890**).

1. Attach PSM to chosen location using the provided **NRG #2703 hose clamps**.
 - a. Attach grounding cable to chosen earth ground.
2. Connect PSM to the low power solar panels utilizing **MC4 cables**.
 - a. Ensure “Soiled” and “Clean” labeling are correctly connected between the two units.



Sensors | Pulsed Soiling Module (PSM1)



3. Connect the PSM to the LOGR-S using **18647 – 30-meter Power & Signal Cable**. Please note: when unplugging connector, the orange seal may come off. **If this comes off after disconnection, make sure to re-attach this piece.**



WARNING: Seal provides ingress protection. If liquid water or conductive contaminates gets inside the PSM1, it may cause arcing across terminals not designed to handle high voltages (e.g. sending 450 V to the attached logger to ground).

Location

- Product is intended to be mounted to the pile, with the Solar Disconnect (if applicable) on the torque tube.
- The standard 18634 MC4 cables that run from the PV modules to the Solar Disconnect to the PSM are 2 meters long.
 - These can change by up to 0.5 m in length. To ensure that cable runs will reach the Solar Disconnect and PSM, lay the cables out roughly where they will be permanently installed. Once you've ensured cable length is correct, plug cables in to the PSM and Solar Disconnect and manage cables as necessary.



Sensors | Pulsed Soiling Module (PSM1)

- The Solar Disconnect shall be mounted in full view of the PSM and in a location where the ON/OFF dial on the front can be accessed.

Brackets / Mounting Fasteners

- All brackets are provided in the standard kits assuming the system is mounted as designed.
- Technicians may want to bring cable management accessories (e.g. zip ties) to keep cable routing organized.

Tools

- Both power and hand screw drivers will be required.
 - Both flathead and Phillips heads may be required.
- Grounding screw is a self-drilling #10 screw but may still require a pre-drilled hole for some materials/thicknesses. A drill bit size of 1/8th inch can be used.
- 3 mm nut driver for tightening of #2703 Hose Clamps

Compatibility

- Data Logger Compatibility
 - NRG LOGR-S
 - NRG SymphoniePRO Logger
 - Any Data Logger which supports:
 - 12 VDC, 10 mA Excitation
 - Four 0 to 5 V Analog Inputs
- PV Module Compatibility
 - Crystalline PV Modules (including bifacial modules)
 - Maximum Open Circuit Voltage of 450 VDC
 - Maximum Short Circuit Current of 30 ADC

Wiring and Configuration

Setting Up with LOGR-S:

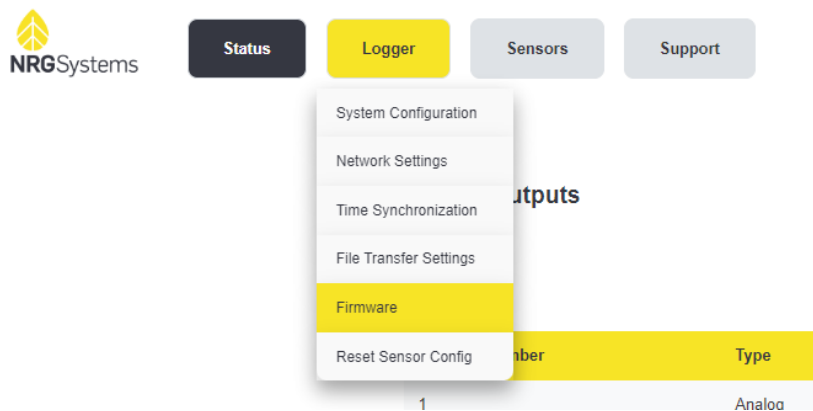
LOGR-S: Wiring Table - Analog		
Wire Color	Function	Termination
Red	Power Excitation	1 st Port - EXC
Black	Power Ground	1 st Port - GND
Blue	Soiled Isc	1 st Port - SIG+
Green	Soiled Voc	1 st Port - SIG
Shield	Cable Shield	1 st Port - SHD
Yellow	Clean Isc	2 nd Port - SIG+
Brown	Clean Voc	2 nd Port - SIG



Figure 9: LOGR-S, Analog, Sensor Wiring

Programming the LOGR-S:

Open a web browser and connect the logger using an Ethernet cable directly to the laptop or secure a wireless connection via static IP address while connected to the same local network as the logger. Enter the static IP address in the browser URL bar. If this is an unconfigured LOGR-S, the default IP address is **192.168.1.110**. When connected, the browser will direct to the home Sensor Output page of the specified logger.



Go to **Logger > Firmware** to ensure that the latest firmware is installed, 1.07.20 or greater.

Go to **Sensors > Analog** channels to configure Isc and Voc Soiled and Clean and associated PVT1 channels.

Configuring Analog Channels:

30 W PV module:

1st channel: Soil Isc

- Sensor Type: *PSM NRG-30W IscSoil*
- Description: *“PSM NRG-30W IscSoil”*
- Units: Amps
- Slope: 6.07790
- Offset: -0.00212



Sensors | Pulsed Soiling Module (PSM1)

- **Input Serial Number**

2nd channel: Soil Voc

- Sensor Type: *PSM NRG-30W VocSoil*
- Description: *"PSM NRG-30W VocSoil"*
- Units: Volts
- Slope: 101.58049
- Offset: 0.22394
- **Input Serial Number**

3rd channel: Clean Isc

- Sensor Type: *PSM NRG-30 W IscClean*
- Description: *"PSM NRG-30W IscClean"*
- Units: Amps
- Slope: 6.07790
- Offset: -0.00212
- **Input Serial Number**

4th channel: Clean Voc

- Sensor Type: *PSM NRG-30W VocClean*
- Description: *"PSM NRG-30W VocClean"*
- Units: Volts
- Slope: 101.58049
- Offset: 0.22394
- **Input Serial Number**

Crystalline module:

1st Channel: Crystalline Soil Isc

- Sensor Type: *PSM c-Si Isc Soil*
- Description: *"PSM c-Si Isc Soil"*
- Units: Amps
- Slope: 6.05892
- Offset: 0.00525
- **Input Serial Number**

2nd Channel: Crystalline Soil Voc

- Sensor Type: *PSM c-Si Voc Soil*
- Description: *"PSM c-Si Voc Soil"*



Sensors | Pulsed Soiling Module (PSM1)

- Units: Volts
- Slope: 101.40736
- Offset: 0.25663
- **Input Serial Number**

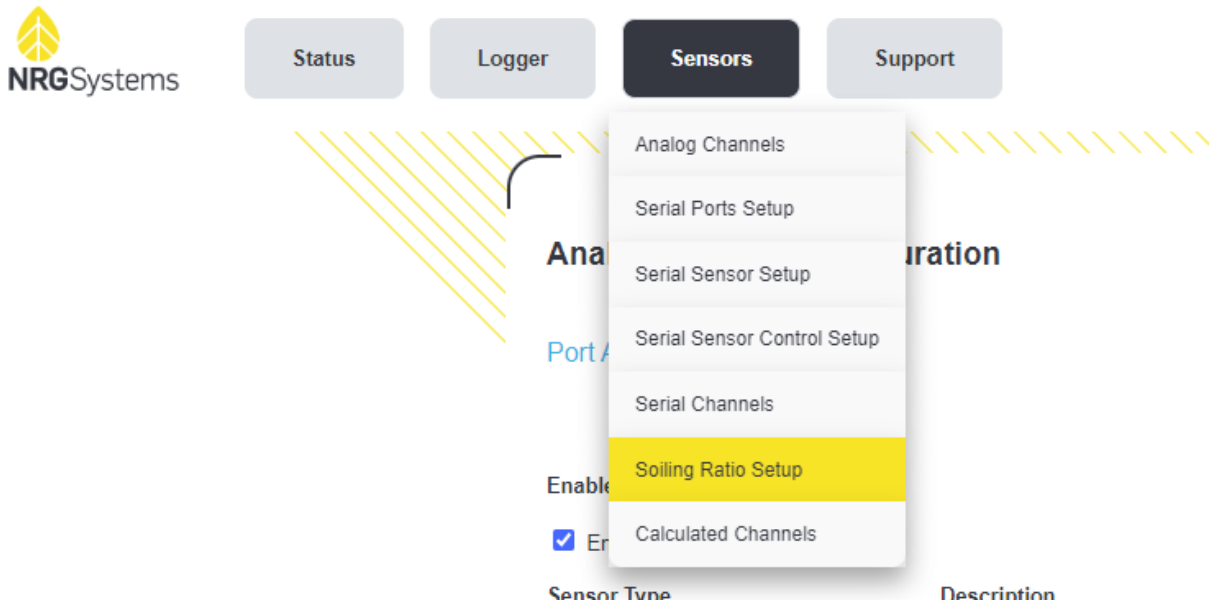
3rd Channel: Crystalline Clean Isc

- Sensor Type: PSM c-Si Isc Clean
- Description: "PSM c-Si Isc Clean"
- Units: Amps
- Slope: 6.05892
- Offset: 0.00525
- **Input Serial Number**

4th Channel: Crystalline Clean Voc

- Sensor Type: PSM c-Si Voc Clean
- Description: "PSM c-Si Voc Clean"
- Units: Volts
- Slope: 101.40736
- Offset: 0.25663
- **Input Serial Number**

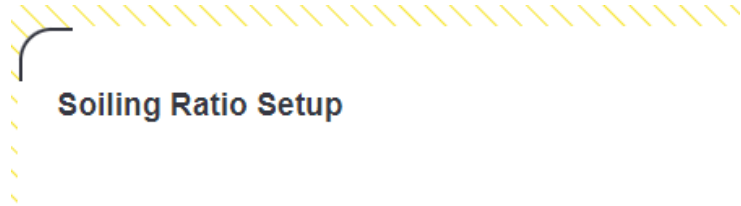
Go to **Sensors > Soiling Ratio Setup**



Check box **Compute** under Compute Soiling Ratio.



Sensors | Pulsed Soiling Module (PSM1)



Soiling Ratio Setup

Compute Soiling Ratio

Compute

Soiling Method

Irradiance Corrected IEC 61724 Annex C

Standard Test Conditions for PV Modules should be 25.0 degrees C and 1000 W/m².

Standard Test Conditions STC for PV Modules

Temperature (deg_C)

deg_C

Irradiance (W/m²)

W/m²

The information outlined in red below can be found on the back of the PV module.

Clean PV Module		Soil PV Module	
Isc at 1000 W/m ²	<input type="text" value="1.820000"/> A	Isc at 1000 W/m ²	<input type="text" value="1.820000"/> A
Voc at 1000 W/m ²	<input type="text" value="21.600000"/> V	Voc at 1000 W/m ²	<input type="text" value="21.600000"/> V
Temperature Coefficient for Isc alpha	<input type="text" value="0.050000"/> %/deg_C	Temperature Coefficient for Isc alpha	<input type="text" value="0.050000"/> %/deg_C
Temperature Coefficient for Voc	<input type="text" value="-0.280000"/> %/deg_C	Temperature Coefficient for Voc	<input type="text" value="-0.280000"/> %/deg_C
Description	<input type="text" value="Clean PV"/>	Description	<input type="text" value="Soiled PV"/>
PSM Isc Input Channel	<input type="text" value="5-PSM NRG-30W IscClean"/>	PSM Isc Input Channel	<input type="text" value="7-PSM NRG-30W IscSoil"/>
PSM Voc Input Channel	<input type="text" value="6-PSM NRG-30W VocClean"/>	PSM Voc Input Channel	<input type="text" value="8-PSM NRG-30W VocSoil"/>
PV Temperature Input Channel	<input type="text" value="9-NRG PVT1_clean"/>	PV Temperature Input Channel	<input type="text" value="11-NRG PVT1_soil"/>



Sensors | Pulsed Soiling Module (PSM1)

This information can vary from panel to panel. Make sure that this captured information is saved for future reference.

IEC 61724 Soiling Calculation Filter

Include data where irradiance G is greater than

500.000000 W/m²

Include data within this many hours of solar noon

2.000000 Hours

IEC Soiling Calculation Filters should be 500 W/m² and 2.0 hours. Hit Save in the lower right-hand corner of the browser. Check sensor outputs to verify data. Daily Soiling Ratio data should start as close to 1.0 as possible when both modules are cleaned.

209	PV_JEC	Effective Irradiance Clean (G)	913.410 W/Sqm
210	PV_JEC	Soiling Ratio Isc Index (SRIsC)	0.999
211	PV_JEC	Daily Soiling Ratio	0.000

Figure 10: Daily Soiling Ratio would follow the above format in your LOGR-S Sensor Outputs page.

Final LOGR Checks:

Pull-test all wires to ensure proper connection. If any of the wires come out of the terminal block during pull-test: loosen the screw, insert the cable, and hand-tighten with a mini flathead screwdriver.

View live data in the right column (**Data**) of the **Sensor Outputs** home page on the web UI and verify that the sensor output is producing reasonable values, and that the units are labeled correctly. If possible, check both ends of the sensor output limits.

NRG PSM Isc_Clean	3.81 A
NRG PSM Voc_Clean	5.02 V
NRG PSM Isc_Soil	3.78 A
NRG PSM Voc_Soil	5.03 V

Figure 11: 35Watt - Crystalline - Setting Sun



Sensors | Pulsed Soiling Module (PSM1)

Setting Up with SymphoniePRO logger:

This PSM requires four channels to be fully functional. It can be installed on *Analog 5V or 12V Excitation* channels 16-19, or on *Analog P-SCM* channels 20-26. If installed on channels 20-26, it will need the #9132 P-SCM.

SymphoniePRO: Wiring Table - Analog		
Wire Color	Function	Termination
Red	Power Excitation	EXC
Black	Power Ground	GND
Blue	Soiled Isc	Analog SIG(+) 1
Green	Soiled Voc	Analog SIG(+) 2
Shield	Cable Shield	SHD
Yellow	Clean Isc	Analog SIG(+) 3
Brown	Clean Voc	Analog SIG(+) 4

Programming the logger:

Open the SymphoniePRO Desktop App and connect the logger using a USB cable directly to the laptop or secure a connection via remote Metlink with the iPack static IP address. From the *Fleet View*, enter the logger and navigate to the *Channels* tab located on the left side of the window. Scroll down to the desired channel and begin configuration.

Configuring Analog Channels 16-19 & 20-26:

Crystalline PV Module

1st Channel: Soiled Isc

- Data Logging Mode: *Statistics*
- Channel Type: *Analog*
- Description: “NRG PSM Soil Isc”
- **Input Serial Number**
- Scale Factor: *6.0503*
- Offset: *0.03525*
- Units: *Amps*
- Excitation Mode: *Constant On*
- Voltage: *12V*
- **P-SCM: 9132 (Ch20-26 only)**

2nd Channel: Soiled Voc

- Data Logging Mode: *Statistics*
- Channel Type: *Analog*
- Description: “NRG PSM Soil Voc”



Sensors | Pulsed Soiling Module (PSM1)

- **Input Serial Number**
- Scale Factor: 101.4066
- Offset: 0.2561
- Units: Amps
- Excitation Mode: Constant On
- Voltage: 12V
- **P-SCM: 9132 (Ch20-26 only)**

3rd Channel: Clean Isc

- Data Logging Mode: Statistics
- Channel Type: Analog
- Description: "NRG PSM Clean Isc"
- **Input Serial Number**
- Scale Factor: 6.0503
- Offset: 0.0352
- Units: Volts
- Excitation Mode: Constant On
- Voltage: 12V
- **P-SCM: 9132 (Ch20-26 only)**

4th Channel: Clean Voc

- Data Logging Mode: Statistics
- Channel Type: Analog
- Description: "NRG PSM Clean Voc"
- **Input Serial Number**
- Scale Factor: 101.4066
- Offset: 0.2561
- Units: Volts
- Excitation Mode: Constant On
- Voltage: 12V
- **P-SCM: 9132 (Ch20-26 only)**

30 W PV Module

1st Channel: Soiled Isc

- Data Logging Mode: Statistics
- Channel Type: Analog
- Description: "NRG PSM Soil Isc"
- **Input Serial Number**



Sensors | Pulsed Soiling Module (PSM1)

- Scale Factor: 6.0779
- Offset: -0.0021
- Units: Amps
- Excitation Mode: Constant On
- Voltage: 12V
- **P-SCM: 9132 (Ch20-26 only)**

2nd Channel: Soiled Voc

- Data Logging Mode: Statistics
- Channel Type: Analog
- Description: "NRG PSM Soil Voc"
- **Input Serial Number**
- Scale Factor: 101.5806
- Offset: 0.2233
- Units: Amps
- Excitation Mode: Constant On
- Voltage: 12V
- **P-SCM: 9132 (Ch20-26 only)**

3rd Channel: Clean Isc

- Data Logging Mode: Statistics
- Channel Type: Analog
- Description: "NRG PSM Clean Isc"
- **Input Serial Number**
- Scale Factor: 6.0779
- Offset: -0.0021
- Units: Volts
- Excitation Mode: Constant On
- Voltage: 12V
- **P-SCM: 9132 (Ch20-26 only)**

4th Channel: Clean Voc

- Data Logging Mode: Statistics
- Channel Type: Analog
- Description: "NRG PSM Clean Voc"
- **Input Serial Number**
- Scale Factor: 101.5806
- Offset: 0.2233
- Units: Volts



Sensors | Pulsed Soiling Module (PSM1)

- Excitation Mode: *Constant On*
- Voltage: *12V*
P-SCM: 9132 (Ch20-26 only)

Analog 5V or 12V Excitation										
+	16	🟢 Statistics	🔌 Analog	Soil Isc	0.00m	0.0° (N)	6.0606	0	A	1.02 A
+	17	🟢 Statistics	🔌 Analog	Soil Voc	0.00m	0.0° (N)	101	0	V	14.84 V
+	18	🟢 Statistics	🔌 Analog	Clean Isc	0.00m	0.0° (N)	6.0606	0	A	1 A
+	19	🟢 Statistics	🔌 Analog	Clean Voc	0.00m	0.0° (N)	101	0	V	14.76 V

Figure 12: SymPRO - 12V Analog - Ch16 – 19

Analog (P-SCM)										
+	20	🟢 Statistics	🔌 Analog	Soil Isc	0.00m	0.0° (N)	6.0606	0	A	1.02 A
+	21	🟢 Statistics	🔌 Analog	Soil Voc	0.00m	0.0° (N)	101	0	V	14.76 V
+	22	🟢 Statistics	🔌 Analog	Clean Isc	0.00m	0.0° (N)	6.0606	0	A	0.99 A
+	23	🟢 Statistics	🔌 Analog	Clean Voc	0.00m	0.0° (N)	101	0	V	14.73 V

Figure 13: SymPRO - P-SCM 9132 - Ch20 – 23

Connecting to Analog Channels 16-19 & 20-26:

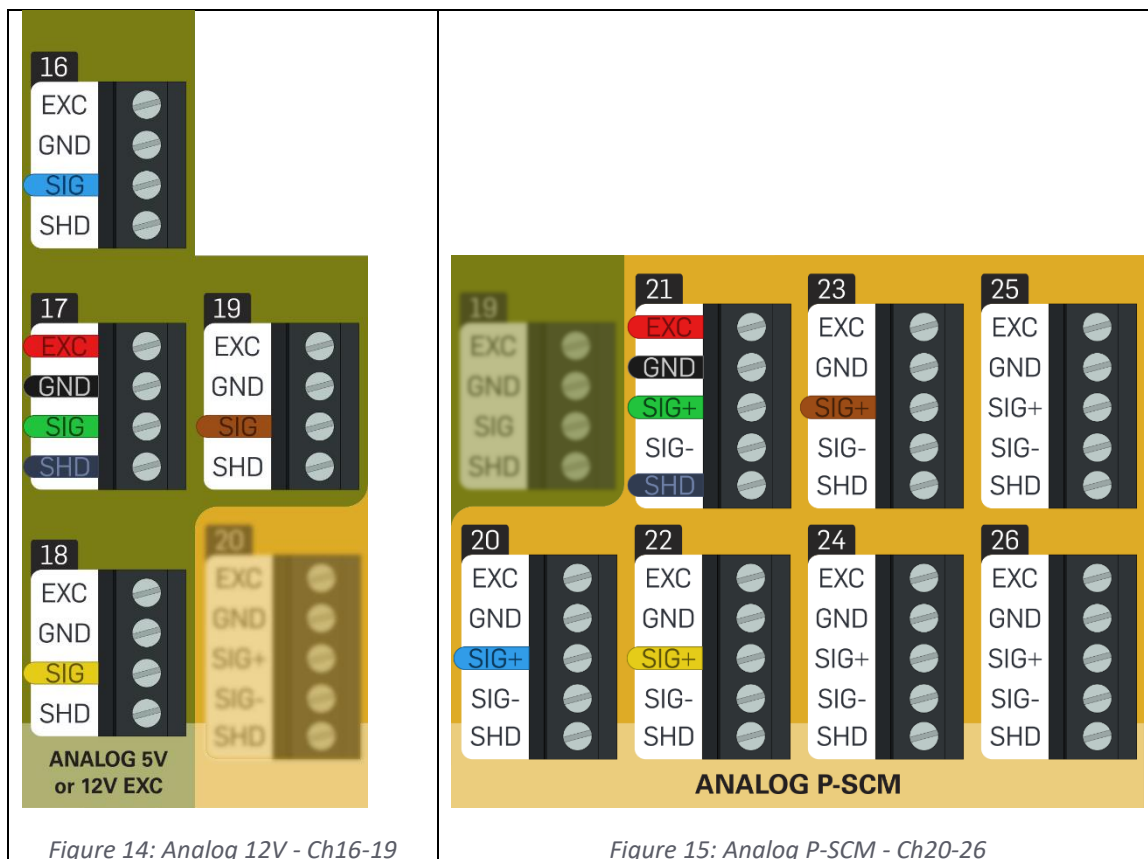


Figure 14: Analog 12V - Ch16-19

Figure 15: Analog P-SCM - Ch20-26

Final SymPRO Checks:

Pull-test all wires to ensure proper connection. If any of the wires come out of the wiring panel during pull-test: loosen the screw, insert the cable, and hand-tighten with a mini flathead screwdriver.



Sensors | Pulsed Soiling Module (PSM1)

View Live Data (either at the logger display, or via SymphoniePRO Desktop Application) and verify that the sensor output is producing reasonable values, and that the units are labeled correctly. If possible, check both ends of the sensor output limits. Export and view a sample of data to check data is being stored properly.

OPERATION OF THE SYSTEM

Cleaning the “Clean” panel

- The clean panel should be regularly cleaned thoroughly with deionized water and a soft, non-abrasive cloth (about once a week or as recommended by your analyst). Deionized water is free from calcium and salt so it will not leave deposits on your PV panels.
- Certain sites may have very abrasive mineral deposits, so be mindful of abrasion when cleaning the PV panels.
- Rainfall also has a natural cleaning effect and should also be recorded at the site with an instrument such as a tipping bucket rain gauge connected to the same data logger.

Data Processing – Soiling Calculation

- The measured values (Temp CLEAN, Isc CLEAN, Temp SOILED, Isc SOILED) can be used to determine a Soiling Ratio which compares the soiled PV output to the clean PV output. By monitoring the soiling ratio over time and using additional analysis techniques, the potential impact of soiling losses on a PV farm’s energy production can be characterized.
- If using the PSM1 with a SymphoniePRO, the calculation of the soiling ratio must be done in post-processing. Please reference IEC 61724-1 Annex C, method 2 for more information about how to proceed with the collected soiling data.
- For more information about how NRG calculates Effective Irradiance Clean (ch209), Soiling Ratio Isc Index (ch210), and Daily Soiling Ratio (ch211) in the LOGR-S, please refer to *“Accurately Measuring PV Soiling Losses with Soiling Station Employing Module Power Measurements”*.¹ If you are unsure how to process the data, please consult with your analyst, as there are various ways to handle the data. See IEC 61724-1 Annex C, method 2.

MAINTENANCE AND SERVICE

PSM1 Maintenance

The PSM1 should not require maintenance and there are no serviceable parts in the 18872/18860 PSM1. Should an issue occur, contact NRG Technical Services at support@nrgsystems.com.

¹ M. Gostein, T. Düster and C. Thuman, "Accurately measuring PV soiling losses with soiling station employing module power measurements," 2015 IEEE 42nd Photovoltaic Specialist Conference (PVSC), New Orleans, LA, USA, 2015, pp. 1-4, doi: 10.1109/PVSC.2015.7355993.



Sensors | Pulsed Soiling Module (PSM1)

⚠ WARNING: Should any part of the system need to be returned or replaced, ensure the **18623 Solar Disconnect** is turned to **OFF** prior to any additional work.

⚠ WARNING: Replace the 18890 Solar Disconnect unit with the NRG 18890 Solar Disconnect unit.

TECHNICAL SPECIFICATIONS

Absolute Maximum Ratings ^{1,2}			
	PSM1 (30W)	PSM1 (Crystalline)	Unit
Supply Voltage	28		V
Supply Voltage Fluctuation ³	±10		%
Supply Current	20		mA
Temperature	-40 to 65		°C
PV Input Voltage ²	0 to 450		V
PV Input Current ²	0 to 30	0 to 30	A
Clean VOC Out	0 to 5		V
Clean ISC Out	0 to 5		V
Soiled VOC Out	0 to 5		V
Soiled ISC Out	0 to 5		V
Recommended Operating Conditions			
Supply Voltage	12		V
PV Input Voltage	15 to 25	15 to 65	V
PV Input Current	0 to 3	0 to 30	A
Electrical Characteristics			
Supply Voltage	6 to 28		V
Supply Current	10		mA
PV Input Voltage	0 to 450		V
PV Input Current	0 to 30	0 to 30	A
Clean VOC Out	0 to 4.950		V
Clean ISC Out		0 to 4.950	V
Soiled VOC Out	0 to 4.950		V
Soiled ISC Out	0 to 0.495	0 to 4.950	V
Accuracy Specifications (k=2)			
Clean/Soiled VOC Slope	101.5805887	101.4066317	V/V
Clean/Soiled VOC Intercept	0.22330546	0.2561298	V
Clean/Soiled ISC Slope	6.0778972	6.0502922	A/V
Clean/Soiled ISC Intercept	-0.0021218	0.0352457	A



Sensors | Pulsed Soiling Module (PSM1)

Clean VOC Out	±1	%
Clean ISC Out	±1	%
Soiled VOC Out	±1	%
Soiled ISC Out	±1	%
Environmental Conditions		
Altitude ⁴	2000	m
Temperature	-40 to 65	°C
Relative Humidity	0 to 100	%
Ingress Protection Code	IP 65	
Pollution Degree	1	

- 1: Exceeding Absolute Maximum Ratings, even at short durations risks permanently damaging the product and may expose the operator to bodily harm
- 2: Operator must verify PV modules do not exceed equipment ratings under any operating conditions. PV modules Open Circuit Voltage and Short Circuit Current are normally specified at Standard Operating Conditions (STC) (1000 W/m², 25 °C). Absolute maximum Open Circuit Voltage and Short Circuit Current must be determined for operation outside STC and verified against products Absolute Maximum Ratings. Contact NRG Systems for more information and/or assistance.
- 3: Fluctuations (noise / ripple) on the power supply may reduce system accuracy
- 4: Product may be operated at higher altitudes with reduced ratings. Contact NRG Systems for more information.

Product is designed for outdoor use and in wet locations.

CONTACT INFORMATION

To return a defective product, request an RMA (return merchandise authorization) number by calling us at the number below or by emailing support@nrgsystems.com, or by submitting a request through our website's Technical Support area.

Please provide the serial number of the item as well as date of purchase. No products will be accepted for repair work without an RMA number. The product must be returned, postage prepaid, to NRG with a brief description of the problem, RMA number and a return address with phone number.

For complete information about returns and the RMA process, visit the Return Authorization Request page on our website, located in the Customer Support section.

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