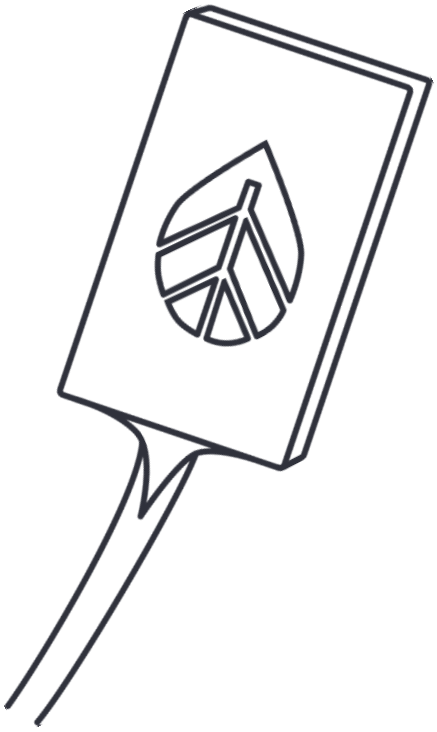
PT1000 | PV Module Temperature Sensor Instructions

INTRODUCTION

The NRG PT1000 Back of Module Temperature Sensor utilizes a Class A platinum sensing element for highly accurate measurements. This model is specifically designed to be affixed to the back of a PV module to measure solar cell surface temperatures for system performance monitoring. Each unit includes an adhesion kit containing the necessary materials to prepare the panel surface and securely mount the probe. The NRG PT1000 supports 2, 3, and 4-wire configurations and is compatible with NRG LOGR Series data loggers.



ITEM NUMBERS

NRG Item Number	Item Description
20817	Sensor, Back of Module Temperature, PT1000, 3m Cable Length
20820	Sensor, Back of Module Temperature, PT1000, 35m Cable Length
20821	Sensor, Back of Module Temperature, PT1000, 50m Cable Length
20822	Sensor, Back of Module Temperature, PT1000, 100m Cable Length

THEORY OF OPERATION

The sensor utilizes a Class A PT1000 sensing element, connected using a 4-wire configuration. The RTD's resistance changes with temperature according to the **Callendar–Van Dusen** equation. This equation is valid for temperatures above 0 °C. For temperatures below freezing, more complex methods are required to calculate resistance manually; however, lookup tables can provide a rough estimate.

$$T = -A + \frac{\sqrt{A^2 - 4B\left(1 - \frac{R_T}{1000}\right)}}{2B}$$

Coefficient	Value
A	3.9083^{-3}
B	-5.775^{-7}
R_T	PT1000 Resistance

A constant current source is externally applied to the sensor, and the voltage drop across the PT1000 is then measured by the data acquisition system. Using Ohm's Law, the sensor's resistance can be calculated as:

Resistance = Voltage / Current

The sensor may be connected to equipment compatible with either a 3-wire or 4-wire topology. To meet demanding accuracy specifications, it is recommended to operate the sensor in a 4-wire configuration, especially for extended cable runs.

In a 4-wire configuration, the **Red** and **Black** wires are used to supply current to the sensor, while the **Green** and **White** wires are used to measure the voltage drop across the PT1000.

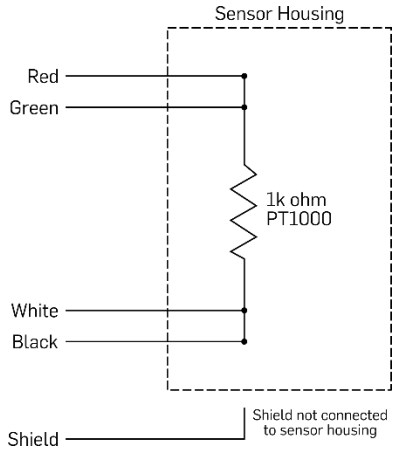
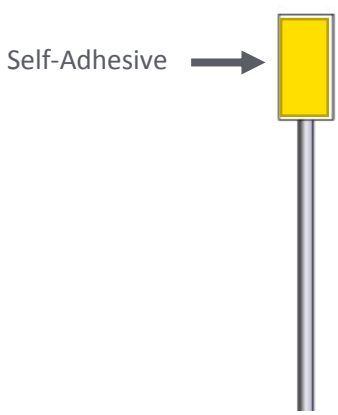
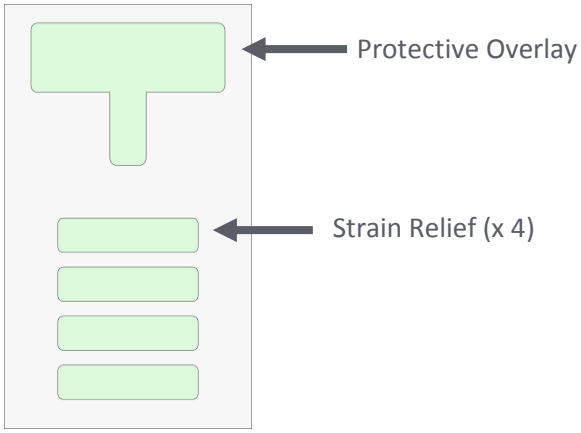


Figure 1: PT1000 Schematic

SENSOR MOUNTING

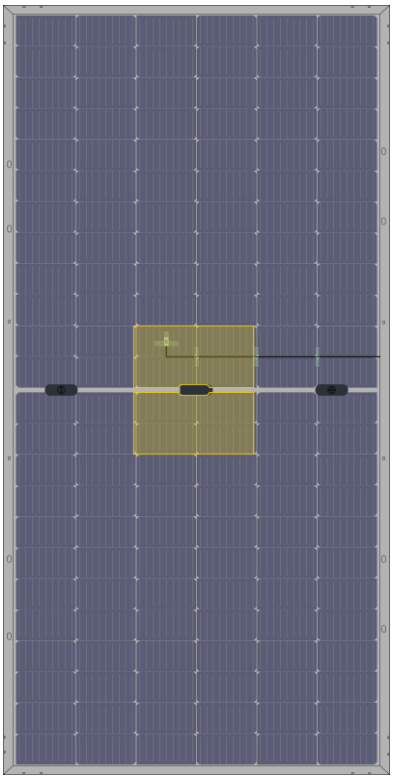
Sensor mounting and placement on the PV panel are both critical to ensure accurate data acquisition. The PT1000 comes with a self-adhesive backing as well as protective overlay and strain relief stickers.





Note: Failure to follow the installation steps may result in sensor failure or data loss.

Example PV Module (144 cells)

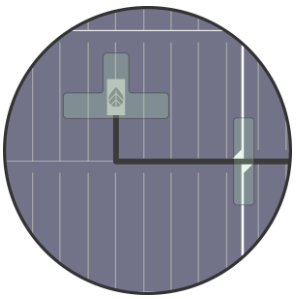


Step 1:
Locate the centermost cell(s) on the back of the selected PV module. For panels with multiple central cells, any are acceptable placement.

Step 2:
Prepare the mounting location by cleaning the selected cell with the provided alcohol wipes and allow to dry.

Step 3:
Peel off the adhesive tape cover from the PT1000 and affix it to the center of the cleaned cell. Apply firm pressure for at least 15 seconds.

Step 4:
Place the *Protective Overlay* sticker over the PT1000 and use the four *Strain Relief* stickers for cable routing. **Where possible, route the cabling between module cells.**



SETTING UP WITH LOGR SERIES LOGGERS

The ***PT1000*** has a differential output and can be configured on any *Analog Port*. As a differential sensor, it does require an entire port and cannot share a port with another sensor.

Programming LOGR

Connect the logger to a laptop or PC using an Ethernet cable, open a web browser and enter the static IP address of the logger. Alternatively, establish a secure wireless connection via a static IP address while connected to the same local network as the logger. For an unconfigured LOGR, enter the default IP address into the URL bar. Once connected, the browser will automatically redirect to the logger home page (**Status > Sensor Outputs**).

Analog Sensor Configuration

Navigate to the **Sensor** tab at the top of the page and select **Analog Channels** from the drop-down menu.

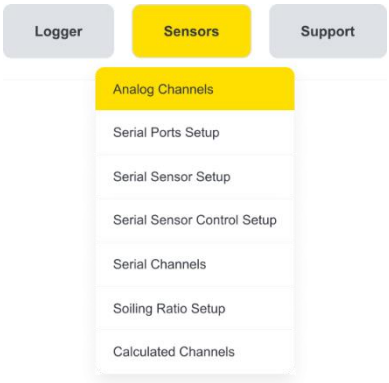


Figure 2: LOGR – Sensors > Analog Channels

Click the **Configure** button next to the desired channel and configure as follows. Do not neglect updating the serial number:

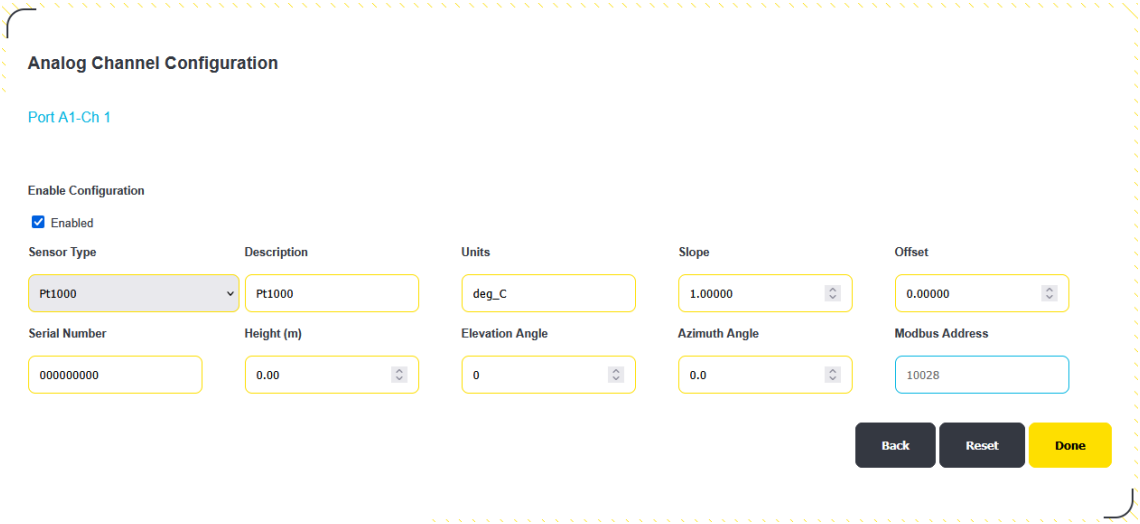


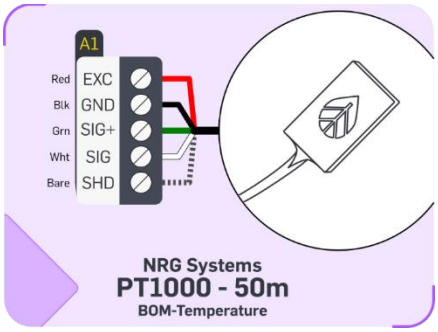
Figure 3: LOGR – Analog Channel Configuration

Once all desired analog channels have been configured, ensure the settings are saved by scrolling to the bottom of the **Analog Channels** page and clicking the yellow **Save** button. The page will then redirect to the **Sensor Outputs** home page, where all active, configured channels can be viewed along with live data values.

Sensor Connection to LOGR Analog Ports

Match the logger analog terminal port to the channels configured in the LOGR web UI. For example, if analog channel 5 was configured in the web UI, the sensor should be wired to LOGR analog port A3.

Wire Color	Function	Termination
Red	Feed +	EXC
Black	Feed -	GND
Green	Read +	SIG+
White	Read -	SIG
Shield	Cable Shield	SHD



Final LOGR Checks:

Pull-test all wires to ensure proper connection. If any wires disconnect, reseat them and hand-tighten.

On the **Sensor Outputs** home page of the LOGR UI, verify that the sensor is producing reasonable live data values and that the units are labeled correctly.

Sensor Outputs

Active

Channel Number	Type	Description	Data
1	Analog	Pt1000 - Cold Water	10.93 deg_C
3	Analog	Pt1000 - Room Temp	22.80 deg_C
5	Analog	Pt1000 - Hot Water	61.38 deg_C

Figure 4: Bench Test

SETTING UP WITH ADAM-4015 MODULE

This module can support up to six individual PT1000 sensors, in 3-wire configuration.

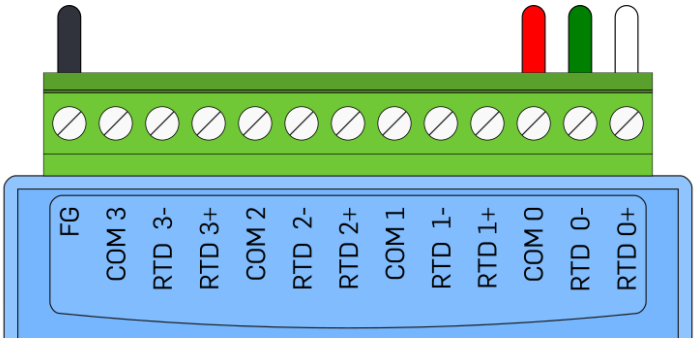
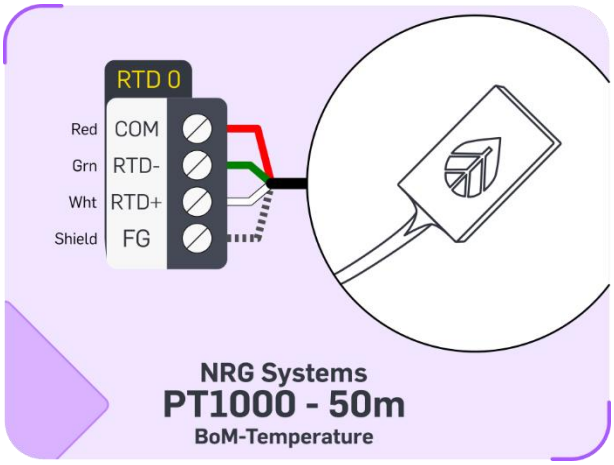


Figure 5: ADAM-4015 - PT1000 Wiring

Wire Color	Function	Termination
Red	Feed +	COM
Black	NO CONNECTION	NO CONNECTION
Green	Read +	RTD-
White	Read -	RTD+
Shield	Cable Shield	SHD



SPECIFICATIONS

Please see nrgsystems.com for up-to-date product specifications.

Description	Sensor Type	Class A PT1000
	Applications	PV Module Surface Temperature Measurements
	Sensor Range	-40 °C to 105 °C (-40 °F to 221 °F)
	Instrument Compatibility	LOGR Series
Output Signal	Accuracy	±(0.15 + 0.002T)°C
Power Requirements	Supply Current	0.1 to 0.3 mA - Constant 0.5 mA - Pulsed
Installation	Mounting	Adhere to back of PV module (adhesive tape included)
Environmental	Operating Temperature Range	-40 °C to 105 °C (-40 °F to 221 °F)
	Operating Humidity Range	0 to 100% RH
Physical	Connections	Wire leads: - Excitation (red wire) - Ground (black wire) - Signal + (green wire) - Signal - (white wire) Drain wire for earth ground
	Cable Length	3m , 35m, 50m, 100m
	Weight	Varies with model
	Dimensions	Probe only: 25 mm (1") long x 12.7 mm (0.5") width x 6.2 mm (.25") thick
	IP Rating	IP67
Materials	Cable	4 conductor 28 AWG ferruled, with foil shield and drain wire, PUR jacket
	Probe	Anodized Aluminum, epoxy filled