NRG Systems

NRG INSTRUCTIONS
▶ T60 Temperature Sensor

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INTRODUCTION

The NRG T60 Temperature Sensor (introduced July, 2018) has the same form factor as the NRG 110S, and utilizes a new signal transducer which lowers uncertainty. Sensors are individually serialized, and compatible with NRG SymphoniePRO and SymphoniePLUS3 loggers. For traceability, a manufacturing quality certificate is available for each individual sensor. A calibrated version of the sensor is available which includes a calibration certificate from an ISO 17025 accredited laboratory.

SENSOR IDENTIFICATION

The T60 can be identified by the label on the cable, which contains the "T60" model name, serial number (9400NNNNNN), wiring information, and barcode. Additionally, the T60 probe is potted into the aluminum housing using a blue epoxy (whereas the previous model 110S used black epoxy).

The T60 is available with the following cable lengths:

NRG Item Number	Sensor Description
9400	Sensor, T60 Temperature, 4.6m Cable
9402	Sensor, T60 Temperature, 67 m Cable
9403	Sensor, T60 Temperature, 90 m Cable
9404	Sensor, T60 Temperature, 110 m Cable
9411	Sensor, T60 Temperature, 13 m Cable

POWER REQUIREMENTS

The T60 requires an excitation voltage of (5 to 15) V DC and has an average current consumption of 1.25 mA. The sensor has a start-up time of 25 mSec and can be operated using a 5V pulsed excitation voltage source (natively supported by SymphoniePRO and SymphoniePLUS3 loggers), further reducing overall power consumed. When using a third party logger capable of pulsed excitation operation, please allow a minimum of 25 mSec settling time between the initial power-up and reading the sensor output voltage.

For optimal performance, deploy the T60 on a logger channel configured for 5V pulsed excitation.

MOUNTING

The T60 radiation shield and probe should be mounted above vegetation and expected snow fall.

The radiation shield is held in place with two hose clamps that can be tightened with a flat head screw driver or a 5/16" nut driver.

A drip loop should be left in the sensor wire to allow water to run off the cable.
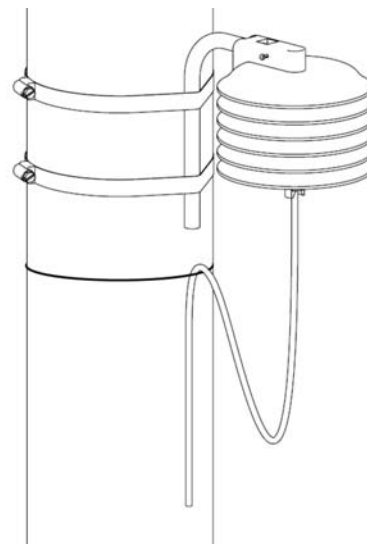
SYMPHONIEPRO

Compatibility

The NRG T60 temperature sensor defaults are available in SymphoniePRO Desktop Application 3.5.X 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

Wiring the NRG T60 to the SymphoniePRO is straight forward and familiar. Please follow the table below.

Sensors | T60 Temperature Sensor

Built in Channels 13-15 and 16-19

Channels 13-15 and 16-19 (no SCM required)		
T60 Connection	**Color**	**SymphoniePRO Logger**
+	Red	Connect to 13-19 "EXC" terminal
Signal	Clear	Connect to 13-19 "SIG" terminal
-	Black	Connect to 13-19 "GND" terminal
Shield	Braid	Connect to 13-19 "SHD" terminal

P-SCM Channels 20-26

Channels 20-26 (use P-SCM #9130)		
T60 Connection	**Color**	**SymphoniePRO Logger**
+	Red	Connect to 20-26 "EXC" terminal
Signal	Clear	Connect to 20-26 "SIG +" terminal
-	Black	Connect to 20-26 "GND" terminal
Shield	Braid	Connect to 20-26 "SHD" terminal

Channel Configuration

Create the following configuration in the SymphoniePRO Desktop Application (Version 3.5.X or later). Note, if you do not see the T60 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 T60 temperature sensor in Degrees Celsius (C).

- Scale Factor: 44.74364
- Offset: -40.85555
  *If using the calibrated version of the T60 Temperature Sensor, refer to the sensor's calibration report for the calibrated scale factor and offset.

Sensors | T60 Temperature Sensor

Built in Channels 13-15, and 16-19

The T60 can be installed on logger channels 13-15 and 16-19 without the need for a P-SCM. Choose "NRG T60 Temp" from the "Load From Defaults" drop down menu.

P-SCM Channels 20-26

The T60 can be used on channels 20-26 when the logger is equipped with P-SCM item #9130 [P-SCM #9130, (0 to 5) V, SE Input, Pulsed 5V EXC]. This is useful if Channels 13-19 are already in use for other sensors. Choose "NRG T60" from the "Load From Defaults" drop down menu.

SYMPHONIEPLUS3

Install SCM card

In order to use the T60 temperature sensor on the SymphoniePLUS3 logger, Symphonie SCM Card 110S #3153 is required.

This SCM can be installed in any of the 7 SCM slots which correspond to channel ranges 4-6 and 9-12.

Wiring

Channels 4-6 or 9-12

Wire the sensor according to the following table and diagrams.

Channels 4-6, 9-12 (requires SCM 3153)		
T60 Connection	**Color**	**SymphoniePLUS3 Logger**
+	Red	Connect to channel "EXC" terminal
Signal	Clear	Connect to channel "SIG" terminal
-	Black	Connect to channel "GND" terminal
Shield	Braid	Connect to channel "SHD" terminal

Channel Configuration

The T60 has a different default scaling than the 110S. *Do not use the 110S settings found in SDR!*

Sensors | T60 Temperature Sensor

Example

To configure the T60 on channel 4 (for example) do the following:

- On the logger keypad, press [Home > 4. Settings > 2. Analog Settings > Press "4" to configure channel 4 > Press the "↓" arrow to see the default list of sensors]
- Scroll down the list of default sensor settings and choose "NRG 110S Temp C" by pressing "Set".
  - Edit the name to "NRG T60 Temp C" by using the keypad. The ↑ arrow will capitalize the "T" and the "1" button will erase characters. Press "Set" when finished.
  - Enter the scale factor "0.1092" and press "Set" (unless using the calibrated scale factor)
  - Enter the offset "-40.8555" and press "Set" (unless using the calibrated offset)
  - Leave the units as "C" and press "Set".
  - Set the sensor height (in meters) and press "Set".
  - Enter the sensor's serial number (or the last 5 digits of it) and press "Set".
- With the sensor programmed and the wires connected to the logger, verify the sensor's functionality by pressing [Home > 1. Measurements > Press the "↓" arrow until you see the channel that the sensor has been installed on. Check the current temperature from a different source and confirm that the sensor is reading accurately.

Please refer to the SymphoniePLUS3 manual for more detailed information on entering information directly into the logger.

Instead, configure as follows:

- Scale Factor: 0.1092
- Offset: -40.8555
  *If using the calibrated version of the T60 Temperature Sensor, refer to the sensor's calibration report for the calibrated scale factor and offset.

SPECIFICATIONS

Description	Sensor type	Integrated circuit ambient temperature sensor with six plate radiation shield
	Applications	• Wind and solar resource assessment • Wind and solar plant operations • Meteorological studies • Environmental monitoring
	Sensor range	-40 °C to 70 °C (-40 °F to 158 °F)
	Instrument compatibility	All NRG loggers
Output signal	Signal type	Linear analog voltage
	Transfer function	Temperature (°C) = (Voltage x 44.743639) - 40.855549 °C Temperature (°F) = (Voltage x 80.53855) - 41.539989 °F Note: Transfer function above applies to 4.6-meter cable. For sensors with cable lengths longer than 4.6 meters, subtract 0.002922 °C (0.0052596 °F) per additional meter from the transfer function offset.
	Accuracy	Uncertainty (k=2): ±0.200 °C (±0.360 °F)
	Output signal range	0.020 to 2.480 V DC
	Turn on time	<20 ms
	Resolution	0.0025 °C (0.0045 °F)
Response characteristics	Thermal time constant	5.38 minutes
Power requirements	Supply voltage	5 to 15 V DC
	Supply current	• 1.2 mA max. (no load on output) • SymphoniePRO Pulsed: 0.85 mA average • SymphoniePLUS3 Pulsed: 0.43 mA average
Installation	Mounting	Attaches to tower with included hose clamps
	Tools required	• 8 mm (5/16 inch) nut driver or flat blade (-) screwdriver (to install hose clamps) • Sheet metal shears or similar (for trimming hose clamps)
Environmental	Operating temperature range	-40 °C to 70 °C (-40 °F to 158 °F)
	Operating humidity range	0 to 100% RH
	Lifespan	10 years +
Physical	Connections	Wire leads: • Signal (clear wire) • Ground (black wire) • Excitation (red wire) • Shield wire for earth ground
	Cable lengths	4.6 m (15 ft), 13 m (43 ft), 67 m (220 ft), 90 m (295 ft), 110 m (361 ft)
	Weight	4.6 m: 0.47 kg (1.04 lbs) 67 m: 2.53 kg (5.6 lbs) 90 m: 3.29 kg (7.2 lbs)

Materials		110m: 3.94 kg (8.7 lbs) 13m 0.75 kg (1.65 lbs)
	Dimensions	• Probe only: 51.6 mm (2") height x 12.7 mm (0.5") diameter • Radiation shield: 124 mm (4.9") height x 127 mm (5 inches) diameter
	Cable	3 conductor 22 AWG, with overall foil shield and drain wire, chrome PVC jacket
	Probe	Aluminum, epoxy filled
	Shield	UV-stabilized thermoplastic solar radiation shield