

270-WQ101x

User Manual

270-WQ101 Water & Soil Temperature Sensor



Phone (530) 823-7185

Email nova@novalynx.com **Website** www.novalynx.com

Receiving and Unpacking

Carefully unpack all components and compare to the packing list. Notify NovaLynx Corporation immediately concerning any discrepancy. Inspect equipment to detect any damage that may have occurred during shipment. In the event of damage, any claim for loss must be filed immediately with the carrier by the consignee. Damages to equipment sent via Parcel Post or UPS require the consignee to contact NovaLynx Corporation for instructions.

Returns

If equipment is to be returned to the factory for any reason, call NovaLynx between 8:00 a.m. and 4:00 p.m. Pacific Time to request a Return Authorization Number (RA#). Include with the returned equipment a description of the problem and the name, address, and daytime phone number of the sender. Carefully pack the equipment to prevent damage or additional damage during the return shipment. Call NovaLynx for packing instructions in the case of delicate or sensitive items. If packing facilities are not available take the equipment to the nearest Post Office, UPS, or other freight service and obtain assistance with the packaging. Please write the RA# on the outside of the box.

Warranty

NovaLynx Corporation warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from the date of shipment from the factory. NovaLynx Corporation's obligations under this warranty are limited to, at NovaLynx's option: (i) replacing; or (ii) repairing; any product determined to be defective. In no case shall NovaLynx Corporation's liability exceed product's original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by NovaLynx Corporation, or that has been subjected to misuse, negligence, or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability.

Address

NovaLynx Corporation
431 Crown Point Circle, Suite 120
Grass Valley, CA 95945-9531 USA
Phone: (530) 823-7185
Email: nova@novalynx.com
Website: www.novalynx.com

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AVAILABLE CABLE LENGTHS

270-WQ101	25 feet	7.62 meter
270-WQ101/50	50 feet	15.24 meter
270-WQ101/75	75 feet	22.86 meter
270-WQ101/100	100 feet	30.48 meter
270-WQ101/125	125 feet	38.10 meter
270-WQ101/150	150 feet	45.72 meter
270-WQ101/200	200 feet	60.96 meter
270-WQ101/500	500 feet	152.40 meter

OPTIONAL PVC HOUSING

270-WQ101-O	25 feet	7.62 meter
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1 FORWARD


Thank you for purchasing NovaLynx products. NovaLynx has been designing and manufacturing weather instruments since 1988. NovaLynx represents several well-known brands of quality manufacturers, including Gill Instruments, RM Young, Kipp & Zonen, and Vaisala. It is our hope that our products will meet all your monitoring requirements.

2 INTRODUCTION

The **270-WQ101 Water & Soil Temperature Sensor** is a rugged and reliable device for highly accurate submersible water or soil temperature measurement. The sensor's probe is molded to 25' of marine grade cable, with lengths up to 500' available upon request. The 270-WQ101 has a two-wire configuration for minimum current draw. The unit's electronics are completely encapsulated in marine grade epoxy within a 304 Stainless Steel housing (not for saltwater), or optional PVC housing.

The 4-20 mA output is compatible with many industrial monitoring systems and loggers. The output signal can be easily converted to voltage by connecting a resistor (e.g., a 250 ohm resistor converts the signal to 1 to 5 volt output). The sensor may be operated continuously or in switched-mode as long as the 5-second warm-up time is observed. *Note: Self-heating in continuous mode is negligible when the sensor is immersed in water.*

3 SPECIFICATIONS

270-WQ101 Temperature Sensor	
Output	4-20 mA, two-wire loop configuration
Range	-50 °C to +50 °C (-58 °F to 122 °F)
Accuracy	± 0.1 °C (± 0.2 °F)
Maximum Pressure	Open water: 1380 kPa (200 PSI)
Operating Voltage	10 to 36 Vdc
Current Draw	Same as sensor output
Warm-up Time	5 seconds minimum
Response Time	5 minutes (approx.)
Operating Temperature	-50 °C to +100 °C (-58 °F to 212 °F)
Construction	Marine grade epoxy encapsulated electronics in 304 Stainless Steel tube
Marine Grade Cable	Yellow polyurethane jacket, UV resistant, 0.216" ±0.010" diameter 25' std (7.6 m), 500' max (152 m)
Probe Dimensions	Stainless Steel housing: 3/4" Diameter x 4.5" Long (19 mm x 115 mm)
	Sch 80 PVC housing: 1-3/4" Diameter x 8.0" Long (43 mm x 200 mm)
Weight	Stainless Steel housing: 8 ounces (227 g)
	Sch 80 PVC housing: 9.4 ounces (272 g)
	The CE Marking identifies this product as complying with all relevant directives in the European Union (EU).

4 SENSOR INSTALLATION

The 270-WQ101 is fully submersible and may be suspended by its waterproof cable in the water to be monitored. Do not install the sensor in applications that contain solvents. Over time, many solvents can deteriorate the cable and the sensing element.

Install your sensor so that it is easily accessible for calibration purposes. You may need to remove and reinstall it in the future, so plan ahead! It is recommended to protect the sensors inside a 4" PVC drainpipe that will act as a protective stilling well. Put a cap on the bottom end of the pipe, but drill large holes along the sides to allow water exchange. Lower the sensor until it touches the bottom of the stilling well and then pull it up slightly and secure the cable.

The 270-WQ101 may also be used as a soil temperature sensor. In this application, operating in switched-mode (i.e., power the sensor for a minimum of 5 seconds before taking the measurement) is preferred. Otherwise, in continuous mode, self-heating may cause the temperature readings to be skewed because the soil may not carry away the heat as well as water does.

5 WIRING

CAUTION: Make all connections with the power turned off. Doing this will help prevent permanent damage to the sensor.

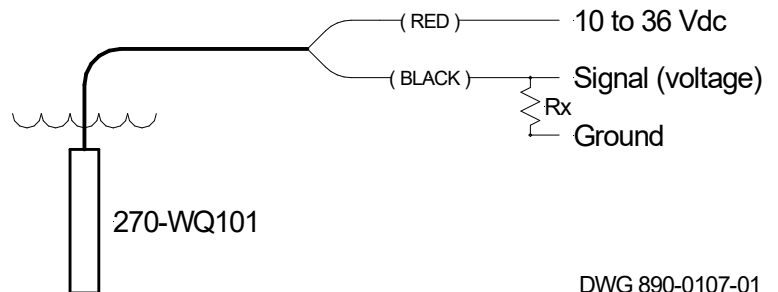
5.1 4-20 mA Loop Connections

Red Wire	10 to 36 Vdc Power Source
Black Wire	4-20 mA output signal

5.2 Voltage Output Connections

Where R_x is a precision resistor
(Resistor not supplied.)

$R_x = 100$ ohms:	0.4 to 2.0 Volts
$R_x = 125$ ohms:	0.5 to 2.5 Volts
$R_x = 250$ ohms:	1.0 to 5.0 Volts



DWG 890-0107-01.

6 CALIBRATION

Each 270-WQ101 sensor is individually factory-calibrated and supplied with a Certificate of Quality sheet that states the range and sensor output. The calibration is also printed on a label attached to the sensor cable. The calibration factors must be used when setting up the monitoring equipment in order to obtain the specified accuracy.

The output range is constant:

Sensor minimum	-50 °C	or	-58 °F
Sensor maximum	+50 °C	or	+122 °F

The sensor electrical output varies according to the individual sensor, as stated on the Certificate:

Sensor minimum	4.07 mA	(example)
Sensor maximum	19.89 mA	(example)

In many cases, the logger or PLC can be calibrated directly given the range and output calibration numbers on the Certificate of Quality. In some cases the electrical output must be expressed as a voltage. The milliamp output can be converted to volts using Ohm's law and the value of the resistor chosen:

Ohm's Law	$E_{(volt)} = I_{(amp)} * R_{(ohm)}$
Example	$E = 4.07 \text{ mA} * 250 \text{ ohms}$ $E = 1.0175 \text{ Volts}$

In some cases it is not possible or may not be desirable to enter the electrical output numbers as stated. For these situations, the output range can be made the variable while the electrical output is made the constant (i.e. exactly 4 mA and 20 mA).

Example for Celsius Calibration

Specified Range	-50 °C to +50 °C (100 °C range)
Output Span (example)	19.89 mA – 4.07 mA = 15.82 mA
mA per °C	15.82 mA / 100 °C range = 0.1582 mA per °C
Sensor Minimum at 4.00 mA:	
Calculate the variance	4.00 mA – 4.07 mA = -0.07 mA
Convert the variance to °C	-0.07 mA / 0.1582 mA per °C = -0.4425 °C
Calculate the new minimum	-0.4425 °C + (-50 °C) = -50.44 °C at 4.00 mA
Sensor Maximum at 20.00 mA:	
Calculate the variance	20.00 -19.89 mA = 0.11 mA
Convert the variance to °C	0.11 mA / 0.1582 mA per °C = 0.6953 °C
Calculate the new maximum	0.6953 °C + (+50 °C) = 50.70 °C at 20.00 mA

Example for Fahrenheit Calibration

Specified Range	-58 °F to +122 °F (180 °F range)
Output Span (example)	19.89 mA – 4.07 mA = 15.82 mA
mA per °F	15.82 mA / 180 °F range = 0.0879 mA per °F
Sensor Minimum at 4.00 mA:	
Calculate the variance	4.00 mA – 4.07 mA = -0.07 mA
Convert the variance to °F	-0.07 mA / 0.0879 mA per °F = -0.7965 °F
Calculate the new minimum	-0.7965 °F + (-58 °F) = -58.80 °F at 4.00 mA
Sensor Maximum at 20.00 mA:	
Calculate the variance	20.00 mA - 19.89 mA = 0.11 mA
Convert the variance to °F	0.11 mA / 0.0879 mA per °F = 1.252 °F
Calculate the new maximum	1.252 °F + (+122 °F) = 123.25 °F at 20.00 mA

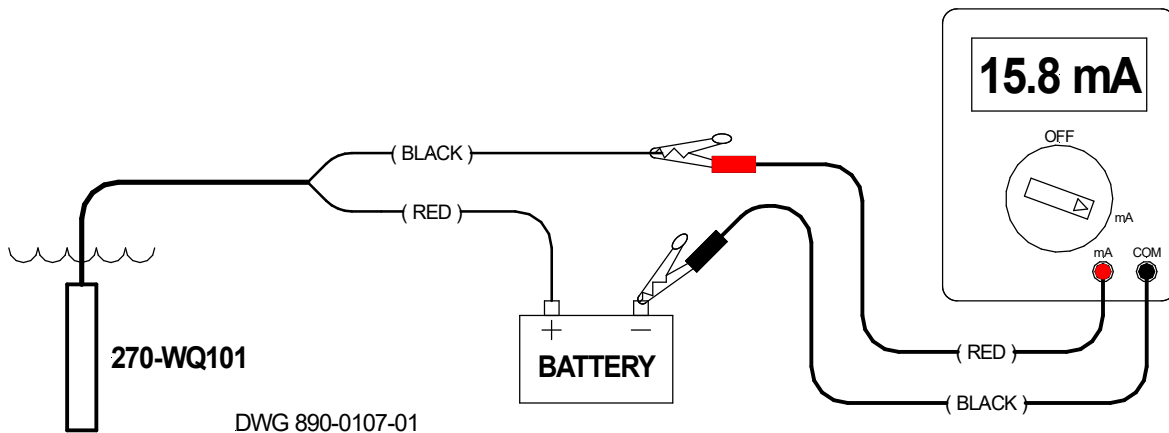
7 MAINTENANCE

Do not leave the sensor exposed to direct sunlight, as it could cause overheating. Do not allow water to freeze around the sensor in a confined space. The expansion of the ice could create enough pressure to damage the sensor.

Clean the sensor periodically, as required. Wipe off any dirt or algae using a damp cotton cloth. Do not use solvents, as they could degrade the cable jacket or epoxy potting compound.

Check the calibration annually by comparison with a quality reference temperature sensor. If there is any indication the sensor has drifted, consider doing a two-point calibration (Appendix A) or return the sensor for calibration service (fee applies).

8 CONNECTIONS FOR TESTING THE SENSOR



APPENDIX A: TWO-POINT CALIBRATION

The **270-WQ101** may be field-calibrated using an ice bath as one reference point, and a warm water bath for the high reference point. The container used must hold enough water to ensure the temperature can stabilize long enough for each reading to be valid. The quality of the reference temperature sensor and the multimeter used to take the readings will affect the results.

The 270-WQ101 experiences a small amount of self-heating while in operation. For best results, take readings using the same mode of operation as will be used when deployed, i.e., if the sensor is run continuously when connected to the logger, then power the sensor continuously while doing the following tests.

Ice Bath Measurements

Place the 270-WQ101 and the reference thermometer in the container with sufficient water and ice to last for more than ½ hour. Connect the meter and turn on power to the sensor (if it is to be used in continuous mode). Allow the temperature to stabilize for 20 minutes, and during the next 10 minutes stir the ice water frequently. Read and record the following:

Reference Temperature Sensor: _____ A °C or °F (circle one)
 270-WQ101 Output: _____ B mA

Warm Water Bath Measurements

Dump out the ice water and refill the container with sufficient warm water to last for more than ½ hour. Connect the meter and turn on power to the sensor (if it is to be used in continuous mode). Allow the temperature to stabilize for 20 minutes, and during the next 10 minutes stir the warm water frequently. Read and record the following:

Reference Temperature Sensor: _____ C °C or °F (circle one)
 270-WQ101 Output: _____ D mA

Calculations

- | | |
|--|---------------------------|
| 1. Temperature Differential ΔT | $\Delta T = C - A$ |
| 2. Current Differential ΔI | $\Delta I = D - B$ |
| 3. Slope(m) | $m = \Delta I / \Delta T$ |
| 4. Intercept(b) | $b = D - (m * C)$ |
| 5. Low Current (mA @ -50 °C) | $(m * -50) + b$ |
| High Current (mA @ +50 °C) | $(m * 50) + b$ |
| 6. Low Current (mA @ -58 °F) | $(m * -58) + b$ |
| High Current (mA @ +122 °F) | $(m * 122) + b$ |

Results for Celsius

Results for Fahrenheit

APPENDIX B: TROUBLESHOOTING GUIDE

TROUBLESHOOTING MATRIX	
No output	Check the power source and all connections. Test the sensor independently of the monitoring equipment (Section 8).
Incorrect readings	If the power to the sensor is switched, ensure the sensor is powered for a minimum of 5 seconds before the logger takes a reading.
Sensor reads consistently too high or too low.	The sensor should be compared to a quality reference annually. Be sure the sensor and reference have come to an equilibrium temperature (1/2 hour in an ice water bath, for comparison at the freezing point. Stir the ice/water mixture for the last few minutes before taking the comparison readings.) If the readings indicate an error, do a two-point calibration (Appendix A).