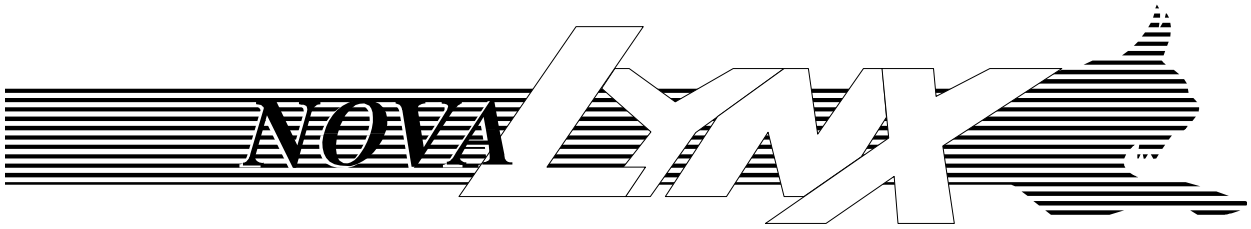
NOVALYNX CORPORATION

MODEL 110-WS-16TH
TEMPERATURE AND RELATIVE HUMIDITY SENSOR

INSTRUCTION MANUAL



REVISION DATE: NOV 2005

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.

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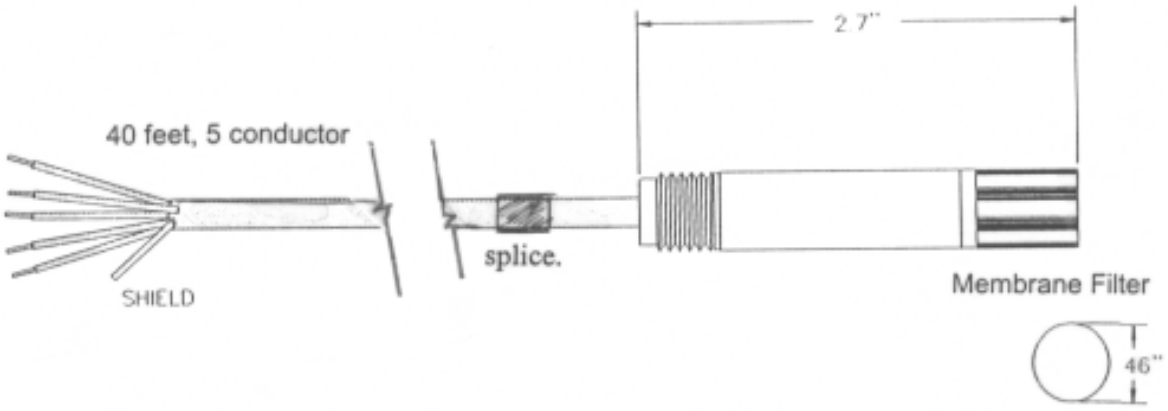


NovaLynx Corporation

Model 110-WS-16TH Temperature and Relative Humidity Sensor
Instruction Manual

1.0 INTRODUCTION

The Model 110-WS-16TH Temperature and Relative Humidity Sensor is a solid-state, fully electronic instrument that provides measurement of air temperature and relative humidity. The solid-state sensing elements and built-in signal conditioning circuitry produces linear output signals that are compatible with a variety of electronic monitoring and recording instruments. The combination sensor is designed for use in industrial environment and may be installed into tower mounted shields for outdoor applications.

Relative humidity is measured through the use of a thin film capacitive sensing element. The sensor causes changes to occur in the electronic circuitry that are translated into a linear 0 to 1 Vdc output equivalent to 0 to 100% RH.

Temperature is measured by a thermistor. The miniature element is attached onto the end of the sensor, adjacent to the RH sensor. The changes in the sensor's resistance is translated into a resistance output that is equivalent to a range of -40 to +60°C.

The electronic circuitry of the 110-WS-16TH is protected inside an IP 65 class housing. The end of the sensor assembly holds the two sensing elements. The humidity element is plugged onto mounting pins through the use of a plastic holder. The mounting pins are also the electrical contacts. The temperature sensor is plugged onto two pins adjacent to the humidity pins.

A protective membrane inside a plastic shield encloses the sensing elements in the end of the probe. The membrane allows moisture to pass through its walls to reach the humidity element while at the same time restricts particulate material from contaminating the sensor. The membrane and shield are non-metallic to prevent delays in the temperature measurement.

Power for the sensor assembly is provided externally by a DC source with a range of 7 to 28 Vdc. For most NovaLynx system configurations, the power will be +12 Vdc. A 40-foot length of cable is provided with the sensor, unless additional cable was ordered.

For outdoor and tower mounted sensors, NovaLynx recommends using a 110-WS-16THS Solar Radiation Shield to house and protect the 110-WS-16TH sensor. Instrument shields are used to provide correct exposure of the sensor to the atmosphere while at the same time preventing direct solar heating and precipitation contact of the sensing elements. Several styles of shields are available. Most use a clamping style u-bolt to attach the shield onto a tower leg or vertical mast of 1" outside diameter. For best results, a fan aspirated shield can be used. A separate manual is provided for the solar radiation shield.

2.0 INSTALLATION

2.1 Unpacking

Carefully unpack all of the components of the instrument and inspect them for any damage that may have occurred during shipment. In the event of damage, refer to page i of this manual for instruction.

For equipment shipped as a complete set with the sensor installed into the solar radiation shield, inspect the wiring to ensure none of the wires have been pulled from the sensor. Remove any packing materials that may have become lodged in the sensor's plastic shield.

2.2 Sensor

The sensor assembly is calibrated at the factory and is ready for immediate use. Power can be applied to the sensor and measurements can be made immediately.

Make any necessary wiring connections to monitoring or recording instruments before applying power.

If it has been set up as a separate item, remove the sensor from its shipping carton and install the sensor into the solar radiation shield. The sensing element is located at the end of the probe with the smaller diameter and it is covered by a protective membrane. Place the sensing end of the probe into the shield first and slide it into the shield as far as possible but one inch away from the top edge. A cable clamp is used to secure the sensor and its cable to the shield housing.

2.3 Wiring

The electrical connections of the 110-WS-16TH sensor are presented below. The standard wire colors presented refer to the wire supplied with the sensor whenever the sensor is ordered by itself. The NovaLynx output wire colors refer to the extension cable added by NovaLynx. Refer to the system wiring diagram for exact connections.

Table 1

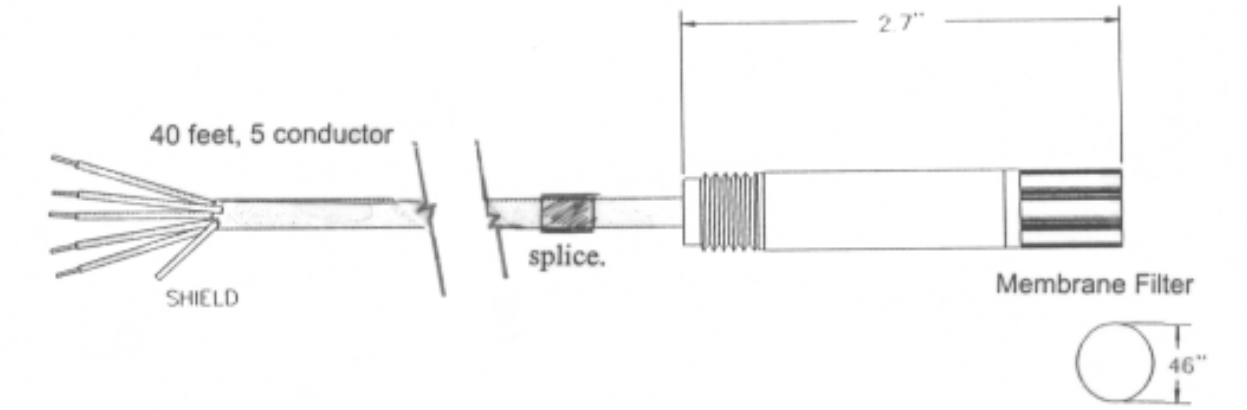
NovaLynx Output Signal Wire Colors 5-Conductor

Wire Function	Signal Value	Wire Color	Normal	Connection
+Power Input	+12 Vdc	Red	+12	WS-16D
-Power	0 Vdc	Black	GND	
RH Signal	0-1 Vdc	Brown	A4	
Temp Signal	Thermistor	White	A5	
Temp Signal	Thermistor	Green	GND	

Table 2

Sensor Signal Wire Colors Before Splice

Wire Function	Signal Value	Wire Color	
+Power	7-28 Vdc	Yellow	NOTE: These colors are not visible. There is an in-line waterproof splice.
RH Signal	0-1 Vdc	Brown	
-Power	0 Vdc	Green	
Temp	Therm	White	
Temperature	Therm	Violet	
Shield	0 Vdc	Bare	



3.0 OPERATION

3.1 Relative Humidity Sensor

The relative humidity sensor in the 110-WS-16TH uses a solid state, thin film, multiple layered device that senses relative humidity. The sensing element acts as a capacitor that changes with respect to the vapor pressure of the air. The sensor's capacitance electrically changes the frequency of an electronic circuit. The sensor signal conditioning circuitry converts the frequency change into an analog voltage. The output signal is a linear DC voltage with a range of 0 to 1 Vdc corresponding to 0 to 100% RH. The excitation to the RH sensor circuitry is +12 Vdc.

3.2 Temperature Sensor

The temperature probe uses a precision thermistor as its sensing element. Thermistors are semiconductors that exhibit rapid and extremely large changes in resistance for relatively small changes in temperature. The change in resistance is inversely

proportional to the temperature change. Temperature value vs. resistance is shown in Table 3.

Table 3

Sensor Output Resistance

Temperature (Celsius)	Thermistor Resistance (K Ohms)
-40	337,400
-35	257,350
-30	177,300
-25	137,235
-15	76,280
-10	55,390
-5	44,030
0	32,670
5	25,410
10	19,900
15	15,720
20	12,490
25	10,000
30	8,057
35	6,531
40	5,327
45	4,370
50	3,640
55	2,986
60	2,486

4.0 CALIBRATION

4.1 Sensor Calibration

The 110-WS-16 Combination Temperature/Humidity Sensor does not require calibration and has no calibration adjustments available to the user.

The calibration can be checked and compared to standard sensors to ensure that the sensor is working properly and that the sensing elements have not changed. To

maintain accurate readings the sensor calibration should be checked at least annually. For sensors located in areas where there is severe dust and atmospheric pollutants, it is recommended that the sensor be checked more often.

4.2 Field Checking Relative Humidity

If the sensor to be checked is located in a remote area, NovaLynx recommends taking along a second RH sensor element to replace the original sensor element in case it is out of the specific accuracy range. Due to the stability of the sensor design, it is not necessary to perform an actual calibration adjustment to the sensor electronics. Replacement of the sensing element is recommended every two years for best results.

If a second RH sensor is unavailable, the next easiest way to check the probe operation in the field is to compare the relative humidity sensor output against an accurate psychrometer. If the humidity readings are within ± 4% RH the sensor is good and does not need to be replaced. If the reading error is greater, then the decision must be made whether to replace the sensor or to use it for a longer period of time. Remember to include the accuracy of the test instrument (psychrometer) in the decision process. Most often the accuracy of the test instrument or psychrometer will be less than the accuracy of the electronic sensor.

For best test results, the Assmann style psychrometer, NovaLynx Model 225-5230, is recommended. The Assmann psychrometer uses a spring-driven fan and has precision thermometers. An easier method is to check the sensor operation using a second electronic sensor such as Model 225-HM34-C. The 225-HM34-C uses the same sensing elements and allows quick and easy checking of the humidity and temperature. Reading of the 225-HM34-C is direct using the built-in LCD display.

Should the RH probe appear to be out of calibration even after changing the sensing element, contact NovaLynx for instructions. For best results, the RH sensor should be tested in an accurate RH calibration chamber (such as the Model 220-HMK11) under controlled conditions.

Any signal conditioning provided for use with the sensor has been adjusted at the factory by simulating the sensor with a precision DC voltage source. Verify that the signal conditioning or monitoring equipment is operating correctly and make any necessary adjustments before testing the sensor. Retest the sensor with the signal conditioning or monitoring equipment after making any adjustments to determine whether or not the sensor is correctly calibrated.

NovaLynx offers the Model 220-HMK11 for checking the calibration of electronic RH sensors by the user. The calibration chamber uses saturated salt solutions to check the %RH at 75% and at 12%. The calibration chamber works best in stable temperature conditions such as those found indoors or in laboratories, but can also be used to make quick and accurate field tests of an electronic humidity sensor calibration since the chamber is always at the indicated humidity. Sensor readings can be taken within 5 minutes. The chamber humidity reading is corrected according to the temperature

readings of the built-in thermometer. The chamber is a good test device to check to overall operating range of the humidity sensor. Spot checking at ambient conditions may not always detect a marginally defective sensing element.

4.3 Field Checking Temperature

Field testing of the temperature sensor can be performed using methods similar to those used to test the humidity. As with the RH sensor, there are no user adjustments available for the temperature sensing portion of the 110-WS-16TH.

If a psychrometer, such as the Assmann type, is used to check the humidity sensor, the dry temperature thermometer can be used to verify the temperature readings of the 110-WS-16TH. The same is true of the electronic psychrometer, Model 225-HM34-C, as it incorporates a direct reading thermometer.

Warning: If it becomes necessary to perform an ice bath test of the 110-WS-16TH temperature sensor, it is important to note that the sensor must be covered by a water proof barrier in order to protect the RH sensing element. Placing the end of the sensor into water with power applied will damage the RH sensor.

For both RH and temperature testing, it is important to remember to place the test instrument sensing element into close proximity with the end of the 110-WS-16TH sensor. If this task is difficult to accomplish due to site configuration, remove the 110-WS-16TH from its shield, and place it into an insulated box or bag alongside the test instrument.

Return the sensor and mounting hardware to its original configuration upon completion of the testing. Verify that the equipment is operating correctly before leaving the site.

5.0 MAINTENANCE

The Model 110-WS-16TH sensor assembly requires little or no maintenance. The only recommended maintenance is a general cleaning of the outer case and routine testing of the sensor's operation.

Regular inspections of the sensor should be made to detect problems with the cable and to prevent build-up of dirt, dust, and atmospheric pollutants.

Routine care and maintenance of the exterior of the instruments, housings, and shields will increase the life of the equipment. Inspections of the fasteners and mounting hardware should also be performed regularly. Look for loose or missing nuts and bolts that may vibrate loose during high winds due to movement of the tower or mast.

For critical situations, NovaLynx recommends keeping spare sensors or sensor components on hand for immediate replacement of the primary equipment should

severe damage occur. Spares kept using this method will help decrease down time during emergencies.

5.1 Cleaning the RH Sensor

The humidity sensor element is a thin film polymer plastic that is very sensitive to oils from human skin. **Do not touch the sensor element with your fingers**. There is no method for cleaning the element, however it may be rinsed using clean de-ionized water should the sensor become extremely dusty or dirty. Power should always be removed from the sensor before rinsing the element. The plastic protective membrane located on the end of the sensor must be removed to expose the sensing elements. The plastic guard is threaded and must be carefully unscrewed for removal. The element may be left attached to the end of the sensor or it may be removed. To remove the element, grasp the plastic protective housing along the edges and slide the element upward, away from the body of the probe. Allow the element to thoroughly dry before reapplying power to the probe. Replace the membrane filter if it appears to be frayed or cut. The filter may be cleaned with a soft bristle brush to remove any loose dust or dirt.

Warning: Never attempt to clean the sensor assembly by mechanical means such as brushing or wiping. The sensing element will be permanently damaged.

If you suspect the humidity element is defective, replace it immediately with a new element. The humidity element will deteriorate over a period of two to five years and should be replaced after it has been in service for that length of time. Replacement of the element usually does not affect the probe electronics. However, the probe operation should always be checked after replacing the sensing element.

5.2 Cautions

1 Do not insert any object into the sensor housing that could physically damage the sensing elements.

2 Do not expose the sensor probe to temperatures lower than -40° C or higher than 125° C.

3. Do not expose the sensor probe to strong acids or bases.

4. Do not operate the probe with the sensing elements in contact with water.

5. Do not expose the probe to high levels of sulphur dioxide.

6. Do not allow the RH sensing element come into contact with the human skin.

7. Do not operate the humidity probe for long periods with the protective membrane removed.

8. Do not attempt to clean the RH sensing element.

6.0 TROUBLESHOOTING

The Model 110-WS-16TH Temperature and Relative Humidity Sensor is a simple instrument to use and, except for possible contamination of the humidity sensing element, it should be virtually trouble-free.

Always disconnect the input power and begin to troubleshoot immediately whenever any of the following conditions occur: the instrument does not produce an output signal; the output signal appears to be missing; the output signal exhibits a marked change in performance; the instrument has been dropped or damaged; lighting has struck near the sensor; moisture has invaded the vapor membrane and plastic shield.

6.1 Power Problems

If the sensor's output signal appears to be in error or is absent, check the power connections. At the sensor cable, measure the battery or the input power source voltage with a voltmeter. Be sure that the instrument has been powered up correctly or wait for the next power ON cycle to occur. Check any batteries to be sure that they have sufficient charge and an adequate voltage level to power the instrument and that all connections are secure. Inspect the battery terminals to ensure that they are clean and solidly connected to the battery.

6.2 Determining the Source of a Failure

To determine whether the trouble is in the sensor or the electronics, try to manually operate the sensor by increasing the relative humidity or temperature near the sensor. Changing the humidity can isolate a defective RH sensing element quickly. Breathing heavily onto the humidity sensor should produce an immediate increase in the humidity output signal. Holding the end of the sensor tightly for a brief time should give an elevated temperature reading. If it is impossible to locate the problem, contact NovaLynx to return the unit to the factory. If the translator electronics respond properly to simulated sensor inputs then the trouble may be somewhere in the sensor. If there is no humidity sensor signal or if the humidity signal does not change with a change in the humidity, the sensing element may be defective. The same is true of the temperature sensor. The thermistor plugs into the two terminals next to the RH sensor. Inspect the thermistor leads for corrosion. Remove any corrosion or dirt between the leads. If spare sensing elements are not available, contact NovaLynx.

7.0 SPECIFICATIONS

Physical Properties

Body length	2.7" (69 mm)
Head diameter	0.46" (11.8 mm)
Lower body diameter	0.47" (12 mm)
Cable length	40 feet, 5 conductor
Weigh	6 oz (180g)
Case type	IP 65
Case material	ABS Plastic
Sensor protection	Membrane Filter, 0.2pm

Power Requirements

Supply voltage	7 to 28 Vdc (+12 Vdc typical)
Current consumption	2 milliamps

Operating Parameters

Operating temp range	-40° to +140° F (-40° to +60° C)
External output load	Greater than 100,000 ohms

Relative Humidity

RH sensor type	INTERCAP®
Range	10 to 90% RH at specified accuracy
Output signal range	0.0 to 1.000 Vdc, linear
Accuracy at +20ºC	± 3% RH
Operating range	0 to 100% RH
Temperature coefficient	< ± 1.5% RH from –10° to +60°C
Stability	± 2% RH over 2 years
Output signal	0-1 Vdc = 0-100% RH (10 mV = 1% RH)

Temperature

Range	-40° to +60° C
Absolute accuracy & interchangeability	± 0.5° C, ± 1° F
Time constant	25 sec
Active element size	0.125" dia bead (2 wire)