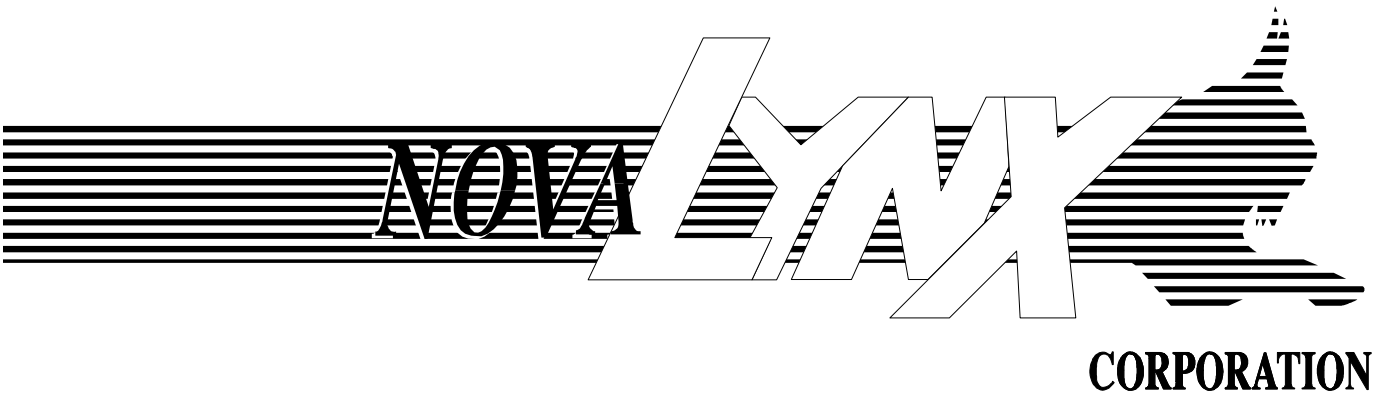
NOVALYNX CORPORATION

MODEL 200-WS-03D
WIND & TEMPERATURE SENSOR

INSTRUCTION MANUAL



Receiving and Unpacking

Carefully unpack all components and compare to 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 and 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 in 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 Parcel Post, UPS, or freight service and obtain assistance with the packaging. 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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MODEL 200-WS-03D
WIND & TEMPERATURE SENSOR

1.0 INTRODUCTION

This manual contains information to aid in the design of custom interface circuits for use with the NovaLynx Model 200-WS-03D combination Wind and Temperature Sensor. This information is supplied to systems integrators with the express understanding that NovaLynx Corporation assumes no responsibility or liability for the operation of the sensor as a part of any equipment that has been designed or furnished by any organization other than NovaLynx.

The Model 200-WS-03D Wind and Temperature Sensor assembly consists of three major parts: an anemometer for measuring wind speed; a wind vane for measuring horizontal wind direction; a thermistor temperature sensor. The complete sensor assembly has been designed with the wind vane mounted on top of the anemometer for stability and ease of signal transmission. A small white shield protects the thermistor from direct solar heating and is located on the side of the sensor where the thermistor passes through the sensor housing. Output signal transmission is accomplished through a forty-foot length of six-conductor, twenty-six gauge, flat cable. The cable has been terminated by a six-pin RJ-11 connector. Monitoring equipment supplied by NovaLynx will be equipped with a matching connector receptacle.

1.1 ANEMOMETER

The anemometer uses a three-cup hub and cup assembly to sense wind velocity. As the wind blows past the cups, the pressure of the wind against the insides of the cups causes them to rotate. There are three permanent magnets embedded in the hub that holds the cups. Each magnet, as it rotates past a fixed point on the sensor base, activates a magnetic reed switch mounted in the base. Three closures of the reed switch will be produced for each revolution of the cup assembly. The contacts of the magnetic reed switch capsule are normally open; the contact will close each time a magnet passes over it. The ratio of closed-to-open time is nominally 1/10 of the total period for a revolution of the wind cups. This duty cycle may change slightly as the sensor ages and with exposure to temperature extremes.

The anemometer is rated for wind speeds up to 125 miles per hour and has a starting threshold of approximately 1 mile per hour. The magnetic reed switch capsule is rated to carry a maximum current of 10.0 milliamperes with an applied voltage of no more than 50 volts AC or DC. The approximate speed constant for the anemometer is 1.25 mph/Hz.

1.2 WIND VANE

The wind vane is coupled to a 20K ohm, ±20%, single turn potentiometer. The linearity of the potentiometer is ±1%. Maximum power dissipation should be limited to 1/4 watt. Resolution is infinite over potentiometer's 355 degree arc. There is a gap ("dead band") of approximately 5 degrees between the ends of the resistive media. As the wind blows past the vane, the design of the counter-weight and the tail fin align the point of the counter-weight into the wind. Fluctuations in the wind direction are measured by the sensor as the aerodynamics of the counter-weight and the tail try to keep aligned to the path of the wind. The motion of the wind vane is translated to the potentiometer shaft causing a change in the potentiometer's resistance. Connecting the potentiometer wires to a voltage source allows easy measurement of the wind direction as a change in voltage.

1.3 TEMPERATURE

The ambient air temperature is measured by using a thermistor that is mounted inside the protective shield located on the side of the sensor base. The thermistor exhibits rapid changes in its resistance in response to temperature changes. The resistance change is inversely proportional to the temperature. By using precision scaling and linearization resistors in a bridge circuit, the resistance changes of the thermistor can be converted into a voltage that can be easily calibrated and monitored. The thermistor's resistance vs. temperature data can be found in Table 1.

2.0 SPECIFICATIONS

Anemometer:

Turning Radius:	3" to center of cup
Speed Threshold:	1.2 mph
Transducer Type:	Reed Switch, Magnet Activated
Speed Constant:	1.25 mph = 1 Hz
Measurement Range:	0-100 mph
Accuracy:	1 mph or ±3%

Wind Vane:

Azimuth Accuracy:	±3°
Bearing Type:	Bushing
Potentiometer Gap:	5° Approximately
Distance Constant:	1.5'
Damping Ratio:	0.4
Vane Threshold:	1.2 mph
Measurement Range:	0-360 Degrees Azimuth
Turning Radius:	10 1/2"

TEMPERATURE:

Accuracy:	±0.4F (0.2° C)
Dissipation:	2.5mW
Dissipation Factor:	7mW/°C
Operating Temperature:	-40° to +150°F (-40 to +60° C)
Thermal Time Constant:	11 seconds in still air (approx)

COMPLETE SENSOR:

Total Size:	12" H x 17" W
Cable:	40' - 6 Cond 26 AWG
Connector:	6-Pin RJ-11
Mounting:	1-1/16"O.D. pipe (standard 3/4" pipe)
Total Weight/Shipping:	2 lb / 4 lbs

3.0 INSTALLATION

3.1 LOCATION

Choose a mounting location for the wind sensor assembly that is free of obstructions. Nearby objects can create eddy currents that will seriously affect the wind measurements. Try to locate the wind sensors so that the nearest object is 10 x **T** away from the wind sensor mast. **T** is the height of the object. If the sensors are located on top of a building, the sensor height should be 1.5 x H, where H is the height of the building. Avoid overhead power lines whenever possible. If there are overhead power lines, use extreme care to prevent contact with the power lines while installing the equipment. Roof mounted sensors should be placed on the upwind side of the building and away from all exhaust vents. In all cases, if the wind sensor data is to be correlated to National Weather Service data or World Meteorological Organization data, then the standard exposure is 33 feet (10 meters) above the ground.

WARNING: Use extreme caution to avoid contacting overhead electrical power lines during the anemometer installation. NovaLynx recommends using only experienced equipment installers to avoid injury and serious problems.

3.2 Mounting

Typically, the Model 200-WS-03D sensor is mounted onto a pipe or a mast. A mast size of 1" to 1-1/16" outside diameter works best. If the pole is metal it should be properly grounded to minimize lightning damage. It may be necessary in some locations to contact a local contractor to ensure that local electrical codes have been met by the installer. The mast should be easy to reach for servicing the sensor and should be properly anchored and grounded. Position the sensor onto the end of the mast. Secure the sensor to the mast using the set screws provided in the sensor base. At this point leave the base set screws loose until after the sensor has been aligned to North. Do not use excessive force when tightening the screws. Simply tighten the screws until the sensor base can no longer be manually rotated.

3.3 SENSOR ALIGNMENT TO NORTH

The Wind Vane requires alignment of the "dead band" or potentiometer gap to North, either magnetic or True North, to obtain valid measurements. Alignment can be done at ground level allowing easier installation of the sensor, but it must be checked again after the sensor has been fully installed. The Wind Sensor base is used to orient the wind vane to North. Normally, wind direction sensors are aligned to True North, rather than Magnetic North. True North is usually found by reading a magnetic compass and applying the correction for magnetic declination, where magnetic declination is the number of degrees between True North and Magnetic North.

Wind Vane alignment can be performed using a compass. Alignment involves creating an imaginary line running through the wind sensor from North to South. When this line has been established, the mounting base of the sensor is rotated until the screw head in the base and the screw hole that is just above it in the sensor body both point toward North.

Rotate the sensor housing until the two screw holes point toward the North. Rotate the vane tail until the counter-weight nose also points to North and is in line with the two screw holes. Check the output signal of the direction sensor. If the alignment is correct, the output signal should indicate North (355.0 or 0.00 Degrees). Correct the sensor base rotation to bring the reading into agreement with the compass. When the alignment appears to be good, secure the sensor base set screws to the mast.

3.4 SIGNAL CABLE INSTALLATION

The sensor signal cable is routed down the mast and to the monitoring equipment in the most direct manner. Fasten the cable to the mast to protect the cable from damage during high velocity winds. For best results, use plastic cable ties that are resistant to ultra-violet radiation and place them at two foot intervals. Along areas where there is no mast or there is some other type of support structure, use the most appropriate method available to fasten the cable to the support. Use care when installing the cable to avoid sharp bends, excessive twisting, scrapes and nicks. Additional cable protection can be provided by using plastic or metal conduit.

4.0 SENSOR CALIBRATION

Calibration of the Wind & Temperature Sensor is limited to checking of the three sensors' performance. Contact NovaLynx for assistance whenever a sensor appears to be out of its specified calibrated range.

4.1 ANEMOMETER CALIBRATION

Spin the cups by hand and monitor the output signal wires using an ohmmeter. There should be three switch closures for each revolution of the cups. The ohmmeter should show transitions from infinite resistance to zero resistance during each switch closure. If the ohmmeter is equipped with an audible cable test function, use the cable test mode and count the beeps per revolution.

Anemometer calibration can be checked by comparing the anemometer's output signal to that of an anemometer that has recently been calibrated or used as a testing standard. An anemometer can also be checked by placing it into a wind tunnel and comparing the wind tunnel velocity against the anemometer's output signal. A non-contacting tachometer can also be used to verify anemometer performance.

4.2 WIND VANE CALIBRATION

Wind Vane calibration involves checking the potentiometer output and verification of the sensor alignment to North.

NovaLynx recommends that the sensor alignment be verified before attempting the sensor calibration testing. Use the procedure described in step 3.3 to verify sensor alignment to North. After doing the alignment check and making any necessary adjustments, test the sensor potentiometer. The potentiometer test may be done with the sensor installed on the mast or with the sensor removed.

To test the Wind Vane potentiometer, monitor the sensor output wires using an ohmmeter, or use the data logging equipment to record the sensor output during the test. If the ohmmeter is used, disconnect the sensor signal wires from the monitoring or data logging equipment. Starting at the North point, slowly rotate the sensor in a clockwise direction as viewed from above the sensor. Looking at the potentiometer with an ohmmeter, the readings should start at or near zero resistance and increase to 20,000 ohms as the sensor is rotated. The resistance changes should be smooth and gradual without any discontinuities. The sensor output should be approximately 56 ohms per degree of horizontal wind. The maximum resistance reading should appear at 355 degrees azimuth. After 355 degrees, the potentiometer's dead band is entered by the wiper and the ohmmeter reading should float and not read any specific resistance. After 5 degrees of motion, the readings should begin at zero again.

Correction of the wind direction potentiometer setting involves disassembly of the sensor and rotation of the potentiometer shaft from inside the sensor housing. Do not attempt to make this adjustment unless the correct tools and test equipment are available. Please contact NovaLynx for assistance before attempting to adjust the sensor.

To adjust the potentiometer gap position setting, first remove the vane tail and hub assembly from the sensor by removing the small set screw located on one side of the hub. With the screw removed, slide the hub up and off the potentiometer shaft. Note that the potentiometer body is bonded to the sensor body and should not move. Using an ohmmeter to monitor the potentiometer output, turn the potentiometer shaft until the center of the gap is obtained. At this point, carefully lower the hub back onto the potentiometer shaft. Try to avoid moving the shaft. With the hub in place reinstall the set screw. Do not over tighten the set screw. Check the sensor calibration after the hub has been reseated. One recommended method of calibrating and checking the calibration is to point the nose to South and measure 180° (approx. 10000 ohms). This method may be more accurate and easier to do for some technicians since there is a more stable reading available at 180° than there is when the potentiometer wiper is in the dead band. Several attempts may be necessary to get the exact results needed. Remember to check the calibration setting again after the hub has been reinstalled. Use care to avoid putting the hub on backwards.

4.3 TEMPERATURE SENSOR CALIBRATION

Calibration of the temperature sensor is limited to checking the operating range of the sensor. There are no user adjustments available for the temperature sensor.

Check the thermistor operation by comparing the signal at the monitoring equipment against the temperature readings of a precision thermometer. This procedure assumes that the monitoring equipment has already been properly calibrated and is working perfectly.

Ambient temperature readings should be taken by placing a precision thermometer next to the thermistor shield. Leave the thermometer next to the thermistor long enough for a stable reading to be made.

If ambient temperature readings are difficult to make right at the thermistor, place the thermometer at a point that is as close to the thermistor as possible. Try to shield the thermometer from direct solar heating during the readings. For readings made in this manner, an agreement of 1 to 2 degrees Fahrenheit would be acceptable.

Increased testing accuracy requires taking the sensor assembly down from its mast and placing the entire sensor into a chamber with a stable temperature. The chamber should be equipped with a precision temperature sensor or a thermometer must also be placed into the chamber next to the thermistor. Again, compare the temperature reading of the thermistor to that of the precision thermometer. Agreement between the two temperatures should be close to if not better than the specified accuracy of the thermistor (±0.4° F).

Any thermistor that appears to be out of calibration or that is inoperative must be replaced by NovaLynx. Contact NovaLynx to arrange for repair of the sensor.

Remember that when the Wind & Temperature Sensor assembly is reinstalled onto its mast that it should be re-aligned to North.

5.0 SENSOR MAINTENANCE

Maintenance of the Wind & Temperature Sensor assembly is limited. Periodic but regular inspections of the equipment is necessary to prevent damage due to loose or missing hardware. Tower and mast mounted sensors experience many vibrations due to high velocity winds blowing through the tower and mast support structure. These vibrations can cause mounting hardware to become loose and to fall out. Tighten any loose hardware and replace any missing hardware.

Inspect the sensor cable as well to detect any damage due to wind whipping. Replace any damaged cables immediately, especially if there are exposed wires. Cracked and weathered cable jackets are not usually a problem as long as the cable is securely fastened by wire ties. Check wire ties and replace any that have become loose or that are missing.

Check for damage to the anemometer cups and the vane tail. Replace any cup assembly that has been damaged.

Apply several drops of light weight (3 IN 1) machine oil or lightly spray WD40 onto the anemometer bearing located just below the cups.

Remove all dust, dirt, mud, bird droppings, etc. that may have been deposited onto the cups and vane tail. Repair or replace bent tails. Check the counterweight of the wind direction sensor. Repair the vane shaft if the counterweight is loose. The counterweight is held in place by epoxy.

Remove any debris that may become lodged inside the temperature shield. Rinse off the thermistor bead with clean water.

Always look at the Wind Vane alignment to North. If the alignment is critical, do the check with a compass. Make corrections to the alignment as needed. Always check the alignment after a severe storm with high velocity winds.

Check the equipment that the sensor assembly is connected into. Make sure that there are signals coming from the sensors. Test the signals to be certain that the measurements are accurate.

For critical measurements, a second sensor should be stored nearby for immediate replacement should the primary sensor become damaged or disabled.

Contact NovaLynx for assistance with sensor testing or for help with replacement sensors and spare parts.

TEMPERATURE VS. RESISTANCE DATA FOR THERMISTOR

TABLE 1

TEMPERATURE Degrees C	RESISTANCE Kohm
-40	328.4
-35	237.7
-30	173.9
-25	128.5
-20	95.89
-15	72.23
-10	54.89
-5	42.07
0	32.51
5	25.31
10	19.86
15	15.69
20	12.49
25	10.00
30	8.060
35	6.536
40	5.331
45	4.373
50	3.606
55	2.989
60	2.490
65	2.085
70	1.753