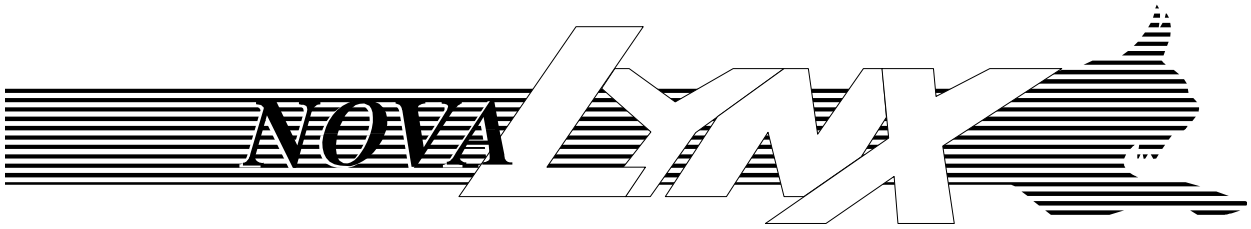
# NOVALYNX CORPORATION

## MODEL 200-WS-22 & 200-WS-22A
## CURRENT LOOP WIND SENSOR

## INSTRUCTION MANUAL




REVISION DATE: 05/20/2004

# 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

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# NovaLynx Corporation

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**Instruction Manual**

## 1.0 INTRODUCTION

The NovaLynx Model 200-WS-22 Current Loop Wind Station measures wind speed and direction and converts each measurement into a 4-20 mA output signal for use by process controls or monitoring systems. External power is not required since the encoding electronics for wind speed and for wind direction are isolated and powered from their respective 2-wire current loops. NovaLynx offers two versions of the Wind Station; the 200-WS-22 measures both wind speed and direction, while the 200-WS-22A measures only wind speed. Both models contain two subassemblies: the wind sensor and the signal conditioning electronics assembly.

The wind sensor used in both versions of the Wind Station includes a three cup anemometer and a wind vane. The sensor is ruggedly constructed using UV resistant ABS plastic and anodized aluminum parts. The cable connecting the pole-mounted wind sensor to the encoder electronics package is typically 40 feet in length but may be extended for a total length of 250 feet. The encoded current loop signals are capable of being transmitted over distances of up to several miles. The electronics package, typically mounted indoors, is supplied installed inside a gasketed NEMA-4X enclosure.

The measurement time base for the wind speed-to-current conversion in the encoder is crystal controlled for stable, long-term accuracy. Ratiometric signal conditioning is used in the direction measurement circuitry to minimize drift and non-linearity.

### 1.2 Physical Description

#### 1.2.1 The Wind Sensor

The wind sensor is the rotating assembly with the three cup anemometer and wind vane for measuring wind speed and wind direction. The wind vane is mounted onto a common axis with the anemometer and includes a tail fin with a nose weight that provides balance. The wind vane is coupled to an angular encoder that is housed within the sensor's cylindrical weather skirt.

#### 1.2.2 The Encoder

The encoder electronics package is housed within a sealed, NEMA enclosure. The circuitry contains two independent 4-20 mA data channels, one for wind speed and the one for wind direction. Each channel receives its power from its respective 2-wire measurement loop.

# 2.0 SPECIFICATIONS

## SENSOR

### Wind Speed

| | |
|---|---|
| Measurement range | 0-100 mph, (0-50 m/s for WS-22M) |
| Speed constant | 1.25 mph = 1 pps<br>75 mph = 60 Hz (pps) |
| Transducer type | Reed switch |
| Speed threshold | 1.2 mph |
| Accuracy | 1 mph or ± 3% |

### Wind Direction

| | |
|---|---|
| Range | 0-360 Deg Az |
| Transducer type | Potentiometer, 20 k ohms, conductive plastic |
| Potentiometer gap | 5° |
| Azimuth accuracy | ± 3° |
| Threshold | 1.2 mph |
| Bearings | Bushing |

## TRANSMITTER UNIT

| | |
|---|---|
| Current loop output span | 4 to 20 mA, Proportioned to 0-100 mph & 0-360°<br>(Proportioned to 0-50 m/s & 0-360° for WS-22M) |
| Supply voltage range | 10 to 48 Vdc |
| 2-wire loop interface | Screw terminal block |
| Interface power | Derived from current loop |
| Dimensions | |

## GENERAL

| | |
|---|---|
| Mounting | 1" o.d. pipe |
| Cable | 5 Conductor, 24 AWG, Shielded, 40' standard |
| Dimensions | |
| 200-WS-22 (WS/WD) | 12" H x 10" W |
| 200-WS-22A (WS) | 4.5" H x 8.5" W |
| Electronics enclosure | 4.7" H x 7.8" W x 3.5" D |
| System weight/shipping | 5 lbs/7lbs |

# 3.0 THEORY OF OPERATION

## 3.1 Wind Speed Measurement

The Model 200-WS-22 wind sensor has been designed to provide measurement of wind speed and wind direction. Wind speed is measured by a rotating assembly of three cups. The three cups are attached onto a central shaft that supports the cups as well as provides a mounting point for the sensor's ball bearing. The ball bearing provides smooth rotation of the cups and helps produce an accurate measurement.

The anemometer's precision ball bearing is protected from the weather and has lifetime lubrication. The rotation of the cups is sensed by a magnetically activated switch. The switch is in a fixed position while three magnets are fastened to the rotating cup housing. The number of switch closures per rotation is converted into a frequency that is proportional to the wind speed in miles per hour. The full-scale (20 mA) output of the wind speed channel represents a measurement of 100 mph.

### 3.2 Wind Direction Measurement

Wind direction is measured by a rotating device as well. The wind vane rotates about its central shaft in response to changes in the wind's direction. The counterweight at the end of the wind vane nose balances the weight of the moving mass over its supporting bearing. It is important that the wind sensor be installed in a location free from any obstructions that would distort the natural flow of air across the sensor. The vane's rotation is transmitted to a stationary potentiometer located inside the sensor housing. As the shaft rotates, the resistance of the potentiometer at its wiper changes. The sensor has been designed to produce an increasing resistance as the wind direction increases from zero to 360 Degrees Azimuth. From above the sensor this increase in direction will appear as a clockwise rotation of the vane. The opposite is true for a decreasing wind direction. A wind changing from 360 towards zero degrees results in a decrease in resistance and a counterclockwise rotation.

Application of a voltage across the potentiometer allows measurement of the wind direction as a changing voltage. The voltage changes are converted by the encoder circuitry into a proportional 4 to 20 milliampere signal with 4 mA equal to zero degrees and 20 mA equal to 360 degrees. The full-scale span of the direction channel means that the vane nose is pointing toward 360 degrees or North.

The potentiometer used as a direction sensor for wind direction has an arc of resistance discontinuity or "deadband" (typically 5-10°). The deadband is located between the 360 degree and the 0 degree points (North is indicated by the set screw in the mounting base). Typically, the deadband is centered on the North point. This means that the sensor really does not measure zero degrees but instead starts measuring at 2 to 5 degrees. Similarly, the end of the direction measurement occurs at 355 to 357 degrees and not exactly at 360. When the wind vane is pointing in this region the loop current will be encoded as an under-scaled value of approximately 3.6 mA.

## 4.0 INSTALLATION

### 4.1 Unpacking

Empty the loose packing material from the corrugated shipping container and carefully lift out the wind sensor assembly. Refer to the warranty page at the front of the manual for information regarding returning damaged or incorrect equipment.

The following items should be included in the shipping container for Model 200-WS-22:

1. Wind Speed & Wind Direction sensor, with 40 feet of cable
2. Transmitter Housing Assembly
3. Instruction Manual

### 4.2 Wind Sensor Installation

Choose the mounting location for the wind sensor that is free from obstructions. Use extreme care to prevent contact with electrical power lines while erecting the unit. A typical installation will position the wind sensor approximately 33 feet (10 meters) above the highest obstacle within a 990 foot (300 meter) radius of the mounting location. Position the Model 200-WS-22 sensor onto the end of a 1" o.d. TV mast tubing or a 3/4" Schedule 40 pipe. If the pole is metal it should be electrically grounded to minimize the probability of any lightning damage. Rotate the anemometer on the pole so that the two set screws on the anemometer base are facing North. Magnetic North is adequate for most installations. Should a True North alignment be required, the magnetic declination at the sensor location must known and applied to the compass reading. Tighten the bottom set screw to fix the directional orientation.

### 4.3 Transmitter Installation

Mount the transmitter enclosure in a location where it can be conveniently connected to the wind sensor.

Route the sensor signal cable in the most direct manner possible. Avoid sharp corners and edges. Do not crease or fold the cable. The cable must be protected from high winds. Use an appropriate fastener (plastic cable ties, staples, etc.) to secure the cable to its support structure. Use care to avoid puncturing the cable jacket if staples are used to attach the cable to a wooden support.

The standard wind sensor is supplied with 40 feet of cable. In the event that the interconnecting cable needs to be extended, use good splicing techniques and waterproof the splice if it will be exposed to the weather. The 5-conductor cable to the wind sensor may be extended to up to 250 feet in length without degrading the accuracy of the sensor's measurements. The output cable running from the transmitter enclosure for the current loop is not provided with the equipment. The current loop power supplies are also not furnished with the standard unit. The cable and power supplies are required for operation of the equipment and are generally customer furnished items.

I/O connection terminal strips are located at the edge of the printed circuit board. Terminal functions along with the corresponding colors of the wind sensor interconnecting cable are shown in the table below. The cable supplied is a 5-conductor outdoor grade cable.

| | | | |
|---|---|---|---|
| ●1 | ○ | J1 | Speed Input **+** White |
| ●2 | ○ | | Speed Input **-** Black |
| ●3 | ○ | | Direction Excit **+** Green |
| ●4 | ○ | | Direction Sensor **+** Red |
| ●5 | ○ | | Direction Return **-** Brown |
| ●6 | ○ | | Unused - |
| ●1 | ○ | J2 | Wind Speed pcl Loop **+** |
| ●2 | ○ | | Wind Speed pcl Loop **-** |
| ●1 | ○ | J3 | Wind Direction pcl Loop **+** |
| ●2 | ○ | | Wind Direction pcl Loop **-** |

## 5.0 OPERATIONAL TESTING

Connect the speed and wind direction process control (pcl) to the appropriate locations of the terminal strip of the printed circuit board as shown in the above chart. For test purposes, you may wish to use an unregulated but filtered source of 10 to 24 volts DC power having a precision 100 ohm resistor (preferably ±1% accuracy) connected in series with the supply. The loop powered encoding circuits require the proper polarity of loop current; however diodes are included to protect the circuitry against reversed polarity connections.

Connect the test leads of a digital voltmeter across the resistor to measure the plc loop current. The measured wind speed and direction at several cardinal calibration points are shown in the following table:

| **Wind Direction (Deg Az)** | **Wind Speed (mph)** | **Loop Current (mA)** | **$V_{100\Omega}$ (Volts)** |
|---|---|---|---|
| N+ | 0.0 | 4.0 | 0.4 |
| NE = 45° | 12.5 | 6.0 | 0.6 |
| E = 90° | 25 | 8.0 | 0.8 |
| SE = 135° | 37.5 | 10.0 | 1.0 |
| S = 180° | 50 | 12.0 | 1.2 |
| SW = 225° | 62.5 | 14.0 | 1.4 |
| W = 270° | 75 | 16.0 | 1.6 |
| NW = 315° | 87.5 | 18.0 | 1.8 |
| N- | 100 | 20.0 | 2.0 |

### 5.1 Circuit Board Adjustments

Multiple turn potentiometers located on the printed circuit board are provided for independent gain and offset adjustment for both the speed and direction channels as shown in the table below:

| | Offset | Span |
|---|---|---|
| **Wind Speed** | R-7 | R-5 |
| **Wind Direction** | R-25 | R-24 |

The Model 200-WS-22 normally should not require adjustment of these controls. An exception occurs if for any reason the wind sensor is changed or if the cabling to the wind sensor exceeds 200 feet in length. In these cases the span control of the direction channel may require a slight adjustment. A movable jumper is included on the PC board direction channel to facilitate checking its offset and span adjustments. To use this feature, with the sensor wired in place, remove the jumper normally in place at the "JW" position and move it to the "JO" position. This should force the wind direction loop current to its zero scale or 4 mA level. If necessary, adjust R-25 to obtain this value, noting that counterclockwise rotation of its adjustment screw will cause the offset value to increase. Moving the jumper position to the "JF" location will cause the loop current to its full scale value of 20 mA. If necessary, adjust R-24 to obtain this value noting that counterclockwise rotation of its adjustment screw will cause an increase in the span. If either the span or offset trim are changed, it is suggested that both values be checked, since there is some slight interaction between the two adjustments. Be sure to return the jumper to the JW position at the conclusion of this adjustment procedure.

The wind speed channel does not normally require any adjustments in the field.

The wind sensor output signal is a reed switch closure. There are three switch closures for each revolution of the cup assembly. Rotating the cups by hand and using a swift spin will produce a wind speed output of 10 to 20 miles per hour.

## 6.0 MAINTENANCE

Maintenance of the wind sensor assembly is limited. Periodic but regular inspections of the equipment is necessary to prevent damage due to loose or missing hardware. Wind 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.

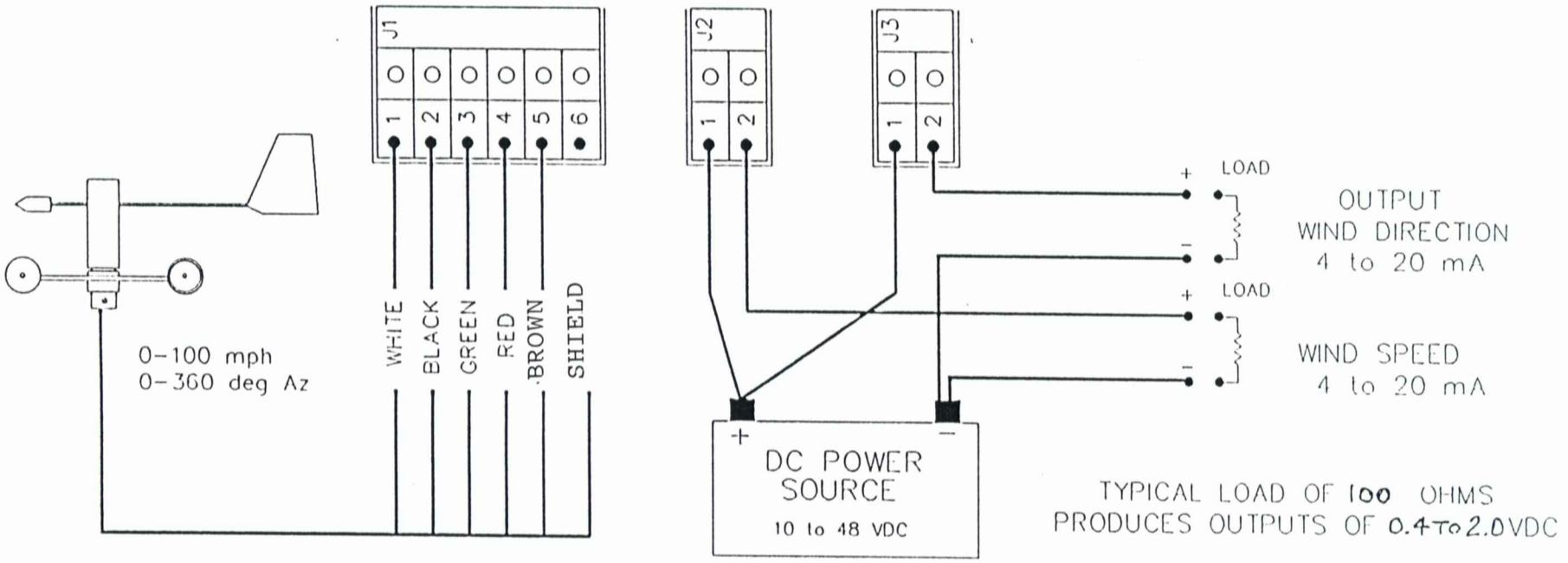
Check for damage to the anemometer cups and the vane tail. Replace any cup assembly that has been damaged.

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.

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

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



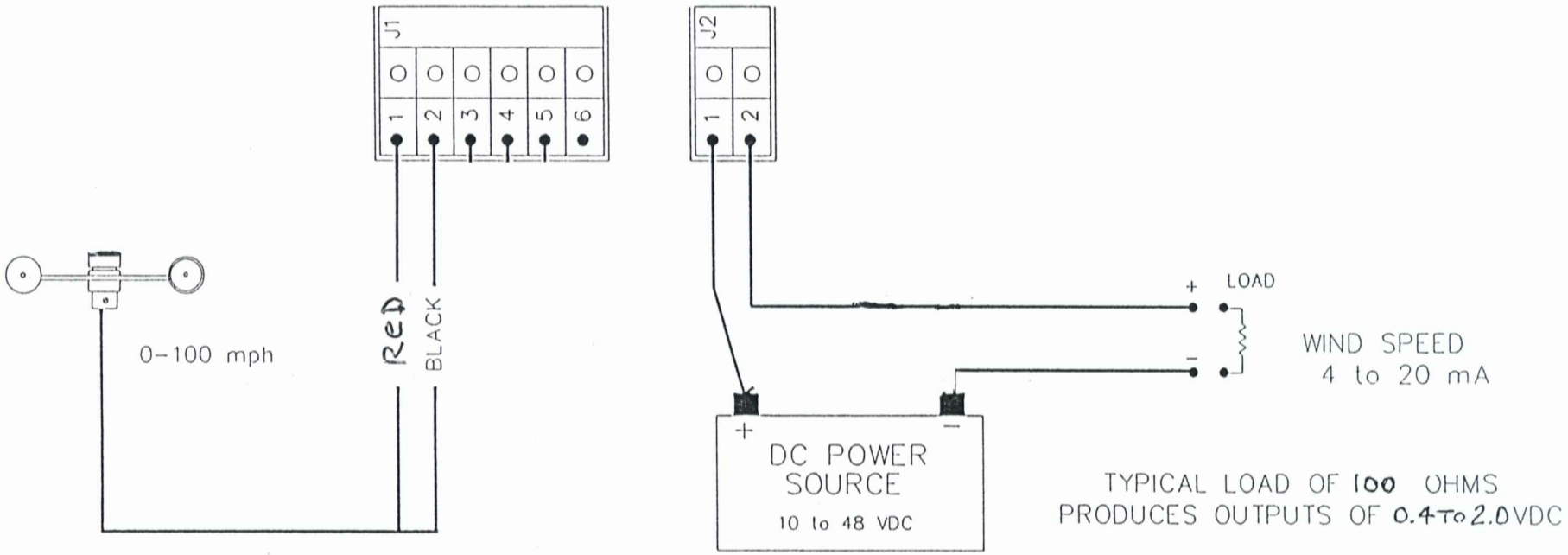

# MODEL 200-WS-22
# CURRENT LOOP WINDSTATION
## TYPICAL WIRING WITH A SINGLE POWER SOURCE

NOVALYNX CORPORATION

C

TITLE
SCHEMATIC, TYPICAL WIRING WITH SINGLE POWER SOURCE

| | | | |
|---|---|---|---|
| MODEL 05ACE 200-WS-22 | | | SHEET 1 OF 1 |
| BY RGN | SCALE NONE | DWG NO 10000338 | |
| DATE 11-5-97 | | | |




# MODEL 200-WS-22A
## CURRENT LOOP WINDSTATION
### TYPICAL WIRING WITH A SINGLE POWER SOURCE

| | | | |
|---|---|---|---|
| NOVALYNX CORPORATION | | | C |
| TITLE: SCHEMATIC, TYPICAL WIRING WITH SINGLE POWER SOURCE | | | |
| MODEL USAGE 200-WS-22 | | | SHEET 1 OF 1 |
| BY RGN | SCALE NONE | DWG. NO. 10000338-A | |
| DATE 11-5-97 | | | |