Instruction Manual

A70-DL Kit with A75-302
Wind Vane

PRODUCTS COVERED:

A70-DL0-T
A70-DL0-N12
A70-DL0-N4XFG
A70-DL1-T
A70-DL4-T
A70-DL4-T/M
A70-DV[5]4-T
A70-DL6-T
A70-DL7-T

INTRODUCTION:

The A70 Wind Direction Transmitter monitors wind direction and produces a electrical output signal proportional to wind direction (azimuth). The wind vane is balanced to prevent “parking” should the mounting not be level. The signal may be monitored by a computer, instrumentation or displayed on a meter.

The Transmitter converts the information from the sensor to a 4-20 ma signal proportional to wind direction. An external source of excitation in the range of 12 - 24 VDC is required.

DESCRIPTION:

The A75-302 Wind Vane is injection molded of black ultraviolet stabilized Lexan. The wind vane shaft is supported by two shielded stainless steel precision ball bearings. All materials are corrosion resistant. The sensor mounts on a .50” diameter mast. The sensor is supplied with an S- shaped aluminum mast and 60 feet of cable.

The wind vane is directly coupled to a precision conductive plastic potentiometer located in the main body. An analog voltage linearly proportional to wind direction is produced when a constant excitation voltage is applied to the potentiometer.

The Transmitter converts the output voltage from the wind vane, which is proportional to azimuth, to a DC current. The current varies linearly from 0-360 degrees. The Transmitter provides a regulated DC voltage for excitation of the wind direction potentiometer.

The Transmitter is loop powered and protected from damage by reverse polarity. All circuits are protected from damage by high voltage transients such as lightning by metal oxide varistors.

The Translator may be in one of several packages. It may be track mounted for installation in an existing enclosure. It may be supplied in a steel NEMA 12 JIC box for inside deployment or in a fiberglass or steel NEMA 4X box when a weather proof box is required.

A70-D

Wind Azimuth Transmiter

FEATURES

-Can be mounted in NEMA4X and NEMA 12 enclosures
-4-20 mA output

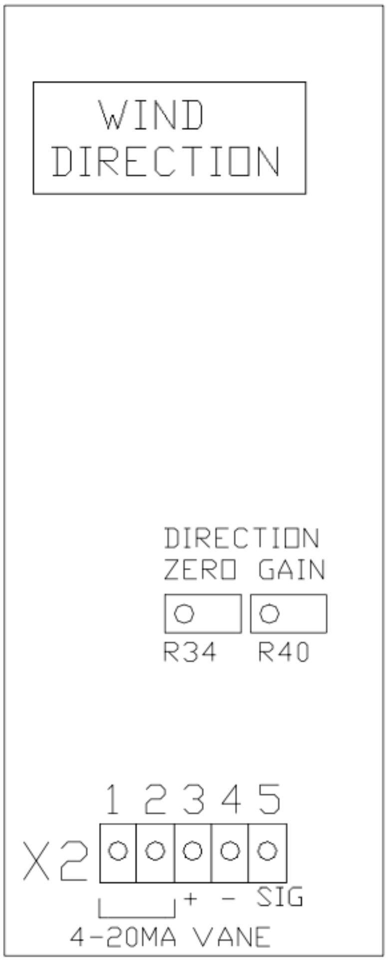
APPLICATIONS

-Wind Resource Assessment
-Building Automation and Controls
-Environmental Research

SPECIFICATIONS

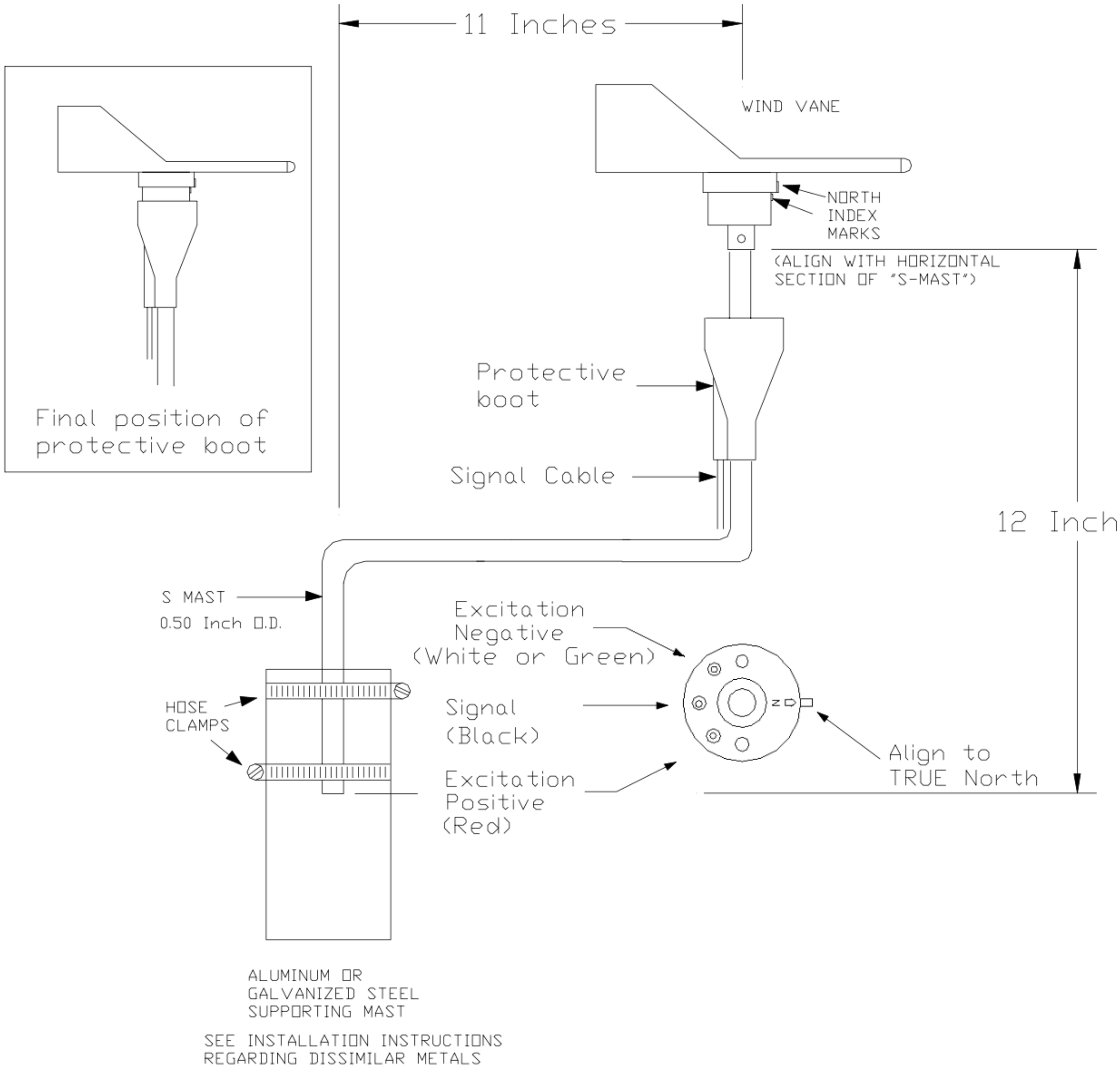
Operating Power: 12-24 VDC, 24 VAC, 120 VAC, 230 VAC
Input Device: Comptus A75-104 3-Cup Anemometer
Range: /E - 0-100 MPH
/M - 0-50 m/s
/K - 0160 KPH
/K2 - 0-100 KPH
Accuracy: 2-10 MPH (±1%)
11-100 MPH (±5%)
Electronics - ±1%
Anemometer - See Comptus A75-104 Anemometer Spec Sheet
Electrical: Terminals - Accept AWG #12-#22 Wire
Environmental: Temperature - Electronics - 0°C to 70°C (-20°C to 70°C Available)
Sensor - -40°C to 60°C
Dimensions: 6.25″ x 4.05″ x 2″
Weight: 3.6 kg (8 lbs)

Transmitter Component Layout
Figure 3



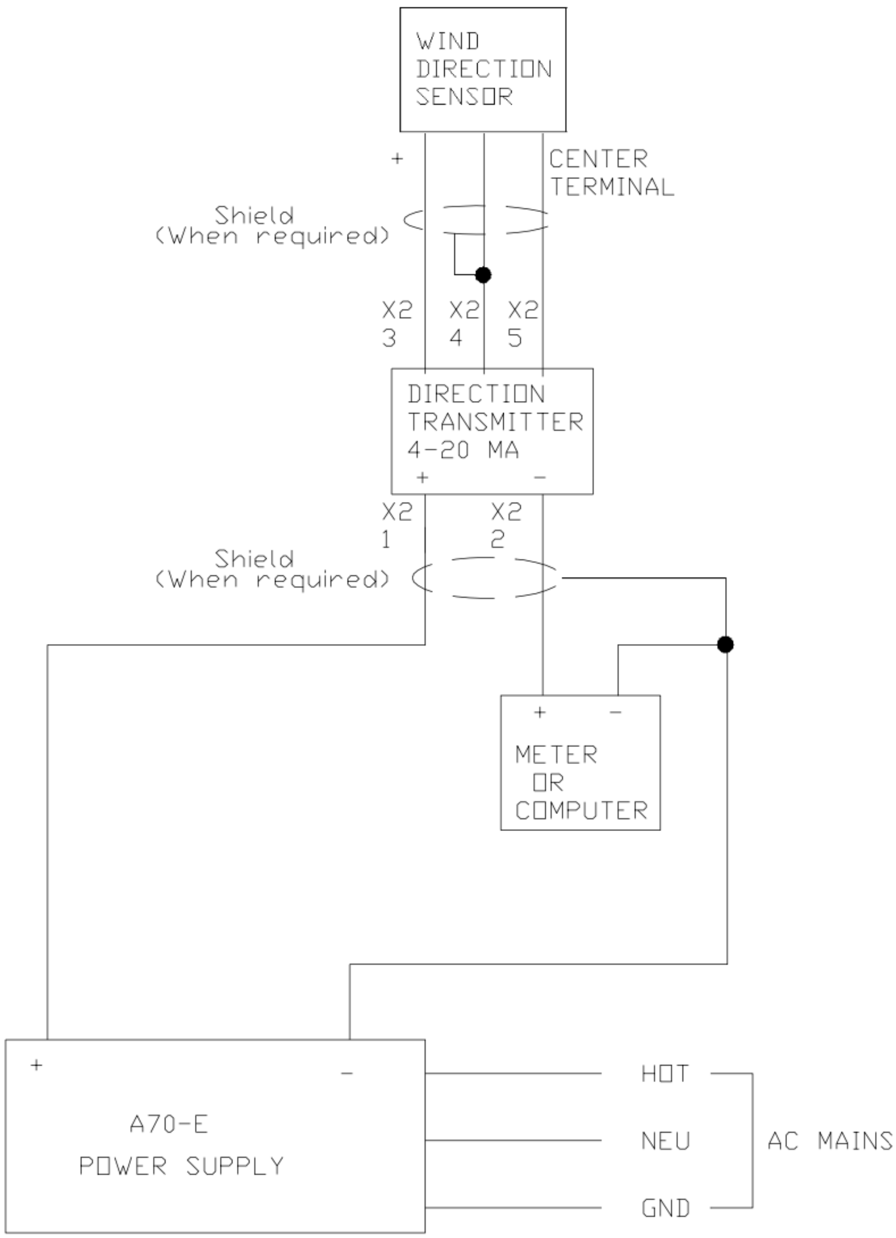
Wind Vane Terminals
Figure 4

Direction Vane Mounting Diagram
Figure 5

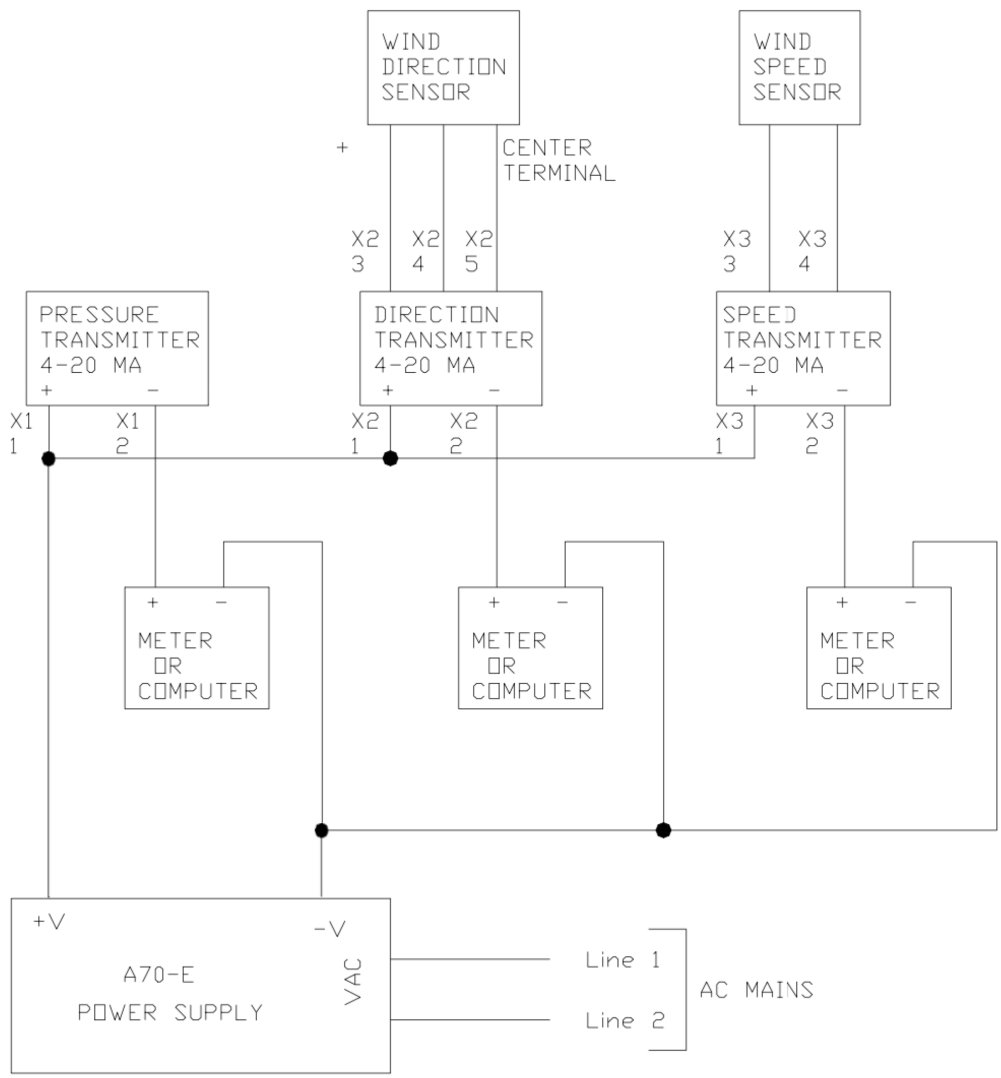


Transmitter Connection Diagram

Figure 6



Multiple Transmitter on
One Power Supply
Figure 7



INSTALLATION:

The wire type is noncritical for most applications. If the wiring is located in an electrically noisy environment, or longer than 60 feet, a twisted pair with shield is recommended. Connect the shield to ground at one end only, see Figure 6. The insulation should be sunlight resistant. Polyethylene or polyvinyl chloride insulation is recommended.

Before proceeding verify that the maximum resistance of the current loop including the wiring and sensing element does not exceed the maximum given by Formula 1. If this resistance is exceeded the loop current will not attain full scale.

Maximum Loop Resistance

Formula 1

R - Maximum Loop Resistance in Ohms
V - DC Excitation Voltage

R = (V - 10 Vdc) X 50

The resistance of various gages of copper wire is given in Table 1.

Wire Gauge and Resistance

Table 1

AWG	Resistance in Ohms/foot
12	.0016
14	.0024
16	.0041
18	.0065
20	.0103
22	.0165
24	.0262

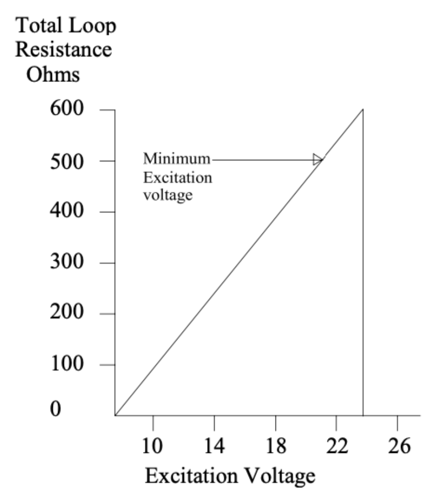
A70-D Power Supply

Proper operation of the Transmitter requires that the power supply provide a voltage in the range of 12-24 VDC. Voltage ripple must be less than 100 volts per second for proper operation. The Transmitter is designed so that the loop current will not exceed approximately 30 mA under any circumstances.

A 12 volt power supply can drive a current loop with a total resistance of 150 ohms. A 16 volt power supply can drive a current loop with a total resistance of 450 ohms.

Graph of Maximum Loop Resistance

Figure 8



LOCATION:

Do not install this equipment in the same enclosure with a liquid electrolyte battery unless ventilation is provided. Various gasses emitted from the battery will cause both premature and intermittent circuit failure. Choose a protected mounting location for the Transmitter enclosure. Attach it to a back plane or other supporting structure. Special consideration must be given to installations where the sensors or electronics will be exposed to strong radio frequency radiation or strong magnetic fields. Contact the factory for applications assistance.

The wind vane should be mounted at the point at which it is desired to sample the wind. Typically, it is located as high as feasible and well clear of obstructions. Do not mount the wind vane directly above a vertical wall as this location often has turbulent air flow.

It may be mounted on an existing structure, on a natural formation, or on a mast or tower. It is desirable to mount the vane so that the supporting structure will not influence the wind characteristics in its immediate vicinity. If the sensor is mounted above a roof top or similar building structure, it should be high enough so that the wind deflected off the structure will not affect it, typically 5 to 10 feet or more.

If mounted to the side of a supporting structure it should be mounted at least ten structure diameters away from the structure in order to take the sensor out of the disturbed air around the structure. It should be mounted toward the prevailing wind, and be positioned so that the influence of structural members is minimized.
A preferred mounting which is commonly used is a telescopic tower for installations up to forty or fifty feet high; a tower commonly used for TV antenna support, consisting of concentric pieces of tubing approximately ten feet long, guyed at each section, is suitable. Above this height self-supporting or guyed lightweight structural towers can be used.

If the “S” mast is to be mounted on a metallic tower consideration must be given to galvanic corrosion which occurs between dissimilar metals. Attachment to galvanized steel towers using stainless steel hose clamps is acceptable.

For other combinations of metals recommended practice is to electrically insulate the “S” mast from the tower with a plastic bushing or sheet. Alternatively, fabricate a “S” mast from the same material as the tower. This consideration is especially important in locations exposed to salt spray and air.

LIGHTNING PROTECTION:

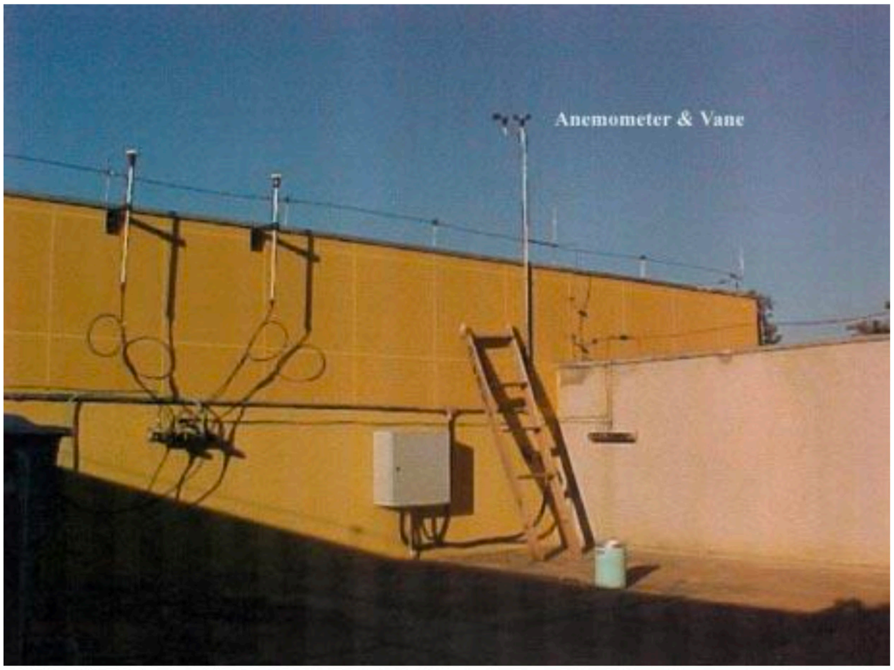
The Transmitter electronics has integral metal oxide varistors for protection from lightning induced surges, electrostatic discharge and other atmospheric discharges. Wind blown aerosols such as sand and snow can generate electrostatic charges with consequences similar to lightning discharges. The A96 Series of gas tube surge arrestors can safely dissipate much higher energy discharges than the internal varistors.

A consequence of the rapid rise time of electrostatic discharges is the inductance of the grounding system and interconnecting wiring is generally of more concern than resistance. Gas tube surge arrestors should be placed as close to the device they are intended to protect to minimize the inductance in the wiring.

In highly exposed systems, the sensors should be protected by gas tube surge arrestors located as closely as possible to them, typically 12 inches or less. The Transmitter electronics can benefit from another set of gas tube surge arrestors located where the sensor wiring enters the control building. Gas tube surge arrestors are recomended for any system with underground wiring.

Poor Wind Sensor Placement over Vertical Wall

Figure 9



North Alignment Mark

Figure 10

ORIENTATION:

It is usually desirable to relate the wind direction readings to True North. If a magnetic compass is used, the deviation from True North must be determined. A topographical map contains this information. For example, if the deviation is 15 degrees West, a magnetic compass will indicate 15 degrees when pointed at True North. If the deviation is East, then subtract it from 360 to obtain the reading for True North.

The housing of the wind vane has a North alignment mark molded into it. Refer to Figure 10. This must be oriented so that it is toward the North. The vane's mounting holes are oriented such that the "S" mast is on a North - South line with respect to the vane. For installations using large, climbable towers, the vane may be oriented by pivoting the "S" mast in the hose clamps. For smaller towers, pivot the entire tower until the "S" mast is properly aligned.

Do not press on the top of the vane as it may damage the bearings. To install the wind vane, grasp it about its lower body and press it with a twisting motion onto the mast. Align the 1/8" holes in the base of the wind vane with the holes in the "S" mast. Secure the vane to the mast by passing the cotter pin through the holes and tightening the set screw. Slide the protective boot over the base of the wind vane after wiring is complete. Tape its base to the mast to secure it in place

WIRING:

Connect the end of the cable with the spade lugs to the sensor using a #4 nut driver. There are three brass studs with 4-40 thread that extend from the bottom of the wind vane housing. Attach the sensor cable to these studs being careful to tighten only the outer #4 hex nut to 3 inch-pounds torque. If the inner nut is loosened or the nuts are tightened simultaneously the stud may rotate. This may result in a poor electrical connection inside the wind vane. See Figure 10.

We recommend the system be assembled and tested on the ground before final installation.

1. Select a suitable mounting location for the Transmitter.
2. Mount the instrument to a wall or other suitable panel using screws or bolts.
3. Refer to Figures 3 & 4. Connect the Red wire of the signal cable to the Direction Vane Positive "+" terminal. Tighten wind vane terminal to 3 inch pounds.
4. Connect the Green (or White) to the Direction Vane Negative "-" terminal. Tighten wind vane terminal to 3 inch pounds.
5. Connect the Black wire of the signal cable to the Direction Vane Signal center terminal. Tighten wind vane terminal to 3 inch pounds.
6. Connect the Red wire from the wind vane to terminal #3 marked "WIND VANE +".
7. Connect the Black lead from the wind vane to the terminal #5 marked "WIND VANE SIG".
8. Connect the Green (or White) lead from the wind vane to terminal #4, the remaining wind vane terminal.
9. Connect the Wind Direction current loop to terminals 1 & 2 in the DIRECTION section marked 4-20 mA. See Figures 5 & 6. Observe polarity as marked.

Should additional cable be required, up to 1000 feet may be carefully spliced into the existing cable. Take care to preserve the color code. AWG #18 - #22 stranded copper wire with shield is recommended.
Secure the sensor cable to the supporting structure at intervals of four feet or less. If the cable is allowed to vibrate in the wind a broken cable may result.

OPERATION:

Operation of the system is fully automatic and commences when loop power is supplied. The Wind Direction vane has an 8 degree dead band cenetered around North. When in the dead zone, the output signal will be at its minimum.

Formula 2

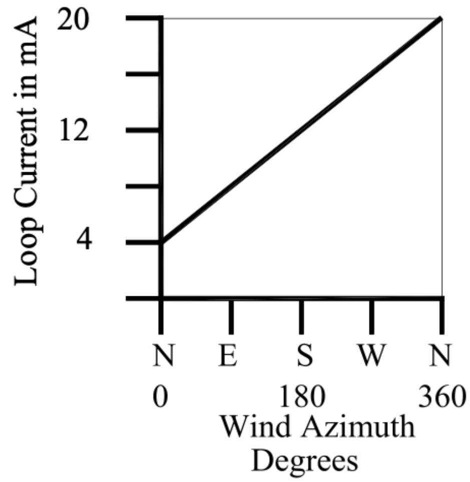
The wind direction may be determined from the output current.

D - Wind Azimuth in Degrees
I - Loop Current in mA

D = (I-4) x 360/16

Graph of Wind Direction Transfer Function

Figure 11



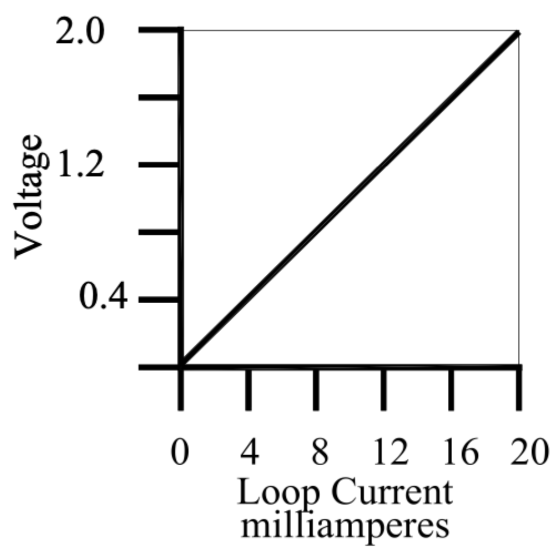
Voltage Across Sensing Resistor

L - Loop Current in mA
R - Resistance in Ohms
V - Voltage in Volts

V = I x R / 1000

Current to Voltage Transfer Function for 100 Ohm Resistor

Figure 12



ICING:

Under some conditions operation of the wind vane will be degraded by the presence of ice. This most often occurs as the result of freezing rain. The condition quickly clears when sunshine heats the wind vane causing the ice to melt. The condition may persist for hours or days in the absence of bright sunshine. No permanent damage is done to the wind vane.

MAINTENANCE:

TRANSMITTER

It is recommended that the Transmitter be checked for calibration each year. Refer to Calibration section for details.

CALIBRATION

The instrument is fully calibrated at the factory before shipment. The following procedure is provided should adjustment be necessary in the future.

Gain & Zero Adjustments:
Potentiometer R34 sets the wind direction zero. Potentiometer R40 sets the wind direction gain.

WIND DIRECTION TRANSMITTER

The adjustments may be sealed with electronic grade silicon rubber to prevent tampering by unauthorized personnel.

1. Connect a jumper between terminals 4 & 5 of the terminal strip marked “WIND VANE”. This simulates a signal corresponding to zero degrees of azimuth.
2. Adjust the potentiometer marked “DIR. ZERO” to produce a 4 mA loop current.
3. Connect a jumper between terminals 3 & 5 of the terminal strip marked “WIND VANE”. This simulates a signal corresponding to 359 degrees of azimuth.
4. Adjust the potentiometer marked “DIR. GAIN” to produce 20 mA of loop current.

TROUBLESHOOTING:

Effective trouble shooting requires that problem locations be systematically eliminated until the problem is found. There are four basic questions to answer when trouble shooting (Ref. #1):

1. Did it ever work right?
2. What are the symptoms that tell you it's not working right?
3. When did it start working badly or stop working?
4. What other symptoms showed up just before, just after, or at the same time as the failure?

It is best to write down any clues you may obtain. Be sure to write down anything unusual.

The response to question #3 should probably not be 3:04 P.M.. A useful response might be, "Just after an electrical storm." or, "Just after it fell off the shelf." Double check all the simple solutions to the problem before searching for complex ones. If the problem occurs right after installation, it probably has a simple solution. If an automobile engine cranks, but doesn't start, make sure there is fuel in the tank before replacing the engine. If the electronic equipment doesn't function verify that it has power and is turned on.

Systems containing parts which can be quickly interchanged are easy to trouble shoot. Swap parts until the problem moves. The location has then been narrowed to the part that caused the problem to move. Sometimes there are multiple problems. These reveal themselves in layers much like peeling an onion.

It often helps to explain the problem to another person, even if that person is not knowledgeable about the particular piece of equipment. This does two things. First it requires you to organize the situation so it can be explained to another. Secondly, it may turn out that you are so familiar with the situation that you have overlooked the obvious. Another person unfamiliar with the equipment may be able to help. If you are unable to solve the problem, put it aside until the next day. Some new thoughts will probably occur while working on another project.

TROUBLESHOOTING:
(Continued)

INCORRECT DIRECTION INDICATION
Check the response with wind vane orientations of North, South, East and West. The Northern orientation is produced when the vane is aligned with the mark on the edge of the housing. If the output is correct for the Southern orientation, but incorrect for East and West, then the positive and negative excitation terminals are interchanged.

If the output signal is active for only half of the range, then the signal terminal and one of the excitation terminals are interchanged.

If the output constantly indicates just West of North, then the negative excitation connection is open or the signal terminal is short circuited to the positive excitation terminal.

If the output is constantly just East of North then the positive excitation terminal is open or the signal terminal is short-circuited to the negative excitation terminal.

Loop Current Failure Description
0 mA (constant): Current loop polarity reversed
Open circuit in cable Power supply failure
4 mA (constant): Open in Positive or Signal wire connecting wind vane to transmitter
Wind vane potentiometer open
20 mA (constant): Open in Negative wire connecting wind vane to transmitter
Less than 4 mA: Low power supply voltage Loop resistance too high
Greater than 20 mA: Short circuit in cable
Does Not Reach 20 ma, otherwise operates properly:
Low power supply voltage Loop resistance too high
Output Jumpy: Input & output cables interchanged

DIRECTION VANE TESTING
The potentiometer in the direction vane has a nominal resistance of 10000 (10K) ohms. With the signal cable to the direction vane disconnected from the transmitter an ohm meter may be used to measure approximately 10000 (10K) ohms resistance between the (+) & (-) excitation terminals.

The resistance between the direction vane signal lead and either of the excitation terminals should be less than 10000 (10K) ohms. If the resistance values differ radically from the above then the vane or the signal cable likely contains a fault. The signal lead of the wind vane will indicate an open circuit if the vane is positioned in the dead band which is centered about North.

DIRECTION VANE SIMULATION
The wind vane may be simulated using a potentiometer with a nominal resistance of 10000 (10K) ohms.