

**MODEL 020D
WIND DIRECTION SENSOR**

OPERATION MANUAL
Document No 020D-9800



Met One Instruments, Inc

Corporate Sales & Service: 1600 NW Washington Blvd. Grants Pass, OR 97526

Tel (541) 471-7111 Fax (541) 471-7116

www.metone.com - www.service@metone.com

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Voice: (541) 471-7111

Fax: (541) 471-7116

E-Mail: service@metone.com

Mail: Technical Services Department
Met One Instruments, Inc.
1600 NW Washington Blvd
Grants Pass, OR 97526



020D WIND DIRECTION SENSOR OPERATION MANUAL

1.0 GENERAL INFORMATION

- 1.1 The Model 020D Wind Direction Sensor uses a lightweight, vane and a micro torque potentiometer to produce an analog voltage output proportional to wind direction. An internal heater reduces moisture for extended bearing life. The sensor mounts in a crossarm assembly, such as the Met One Instruments' Model 191-1.
- 1.2 The sensor cable has a quick-connect connector with vinyl-jacketed, shielded cable. Cable length is given in-XX feet on each cable part number. A 1957-XX cable is supplied for translators and data loggers having terminal strip connections. (Color code, Figure 2-1).

Model 020D Wind Direction Sensor Specifications

Performance

Azimuth	Electrical 0-356°, Mechanical 0-360°
Threshold	0.6 mph
Linearity	± ½% of full scale
Accuracy	±3°
Damping Ratio	0.4
Delay Distance	Less than 3 feet
Temperature Range	-50°C to +85°C

Electrical Characteristics

Input Power	9-18 VDC, 10 mA
Output*	a. 0-5 volts for 0-360° (default setting) b. 0-2.5 volts for 0-360° (user selectable)
Output Impedance	100 Ohms maximum
Maximum Cable Length	300 feet

Physical Characteristics

Weight	1.1 pounds
Finish	Anodized Aluminum
Mounting	Use with Crossarm Model 191 or equivalent
Cabling	1957-XX Cable (XX is cable length in feet)

Optional Accessories

- A. External heater and power supply for extreme low temperature operation.
- B. Aluminum vane assembly.
- C. Model 040 Degree Wheel Calibrator.
- D. Model 042 Telescopic Orientation Fixture.

2.0 INSTALLATION

2.1 Model 020D Wind direction Sensor Installation

- A. Select output voltage range. Slide outer cover down to expose circuit board. Connect the Yellow connector wire to J2-2 for 0-5v output, or J2-3 for 0-2.5v output.
- B. Check to see that the vane assembly rotates freely.
- C. Makes sure that the vane assembly is properly balanced and that the balance counterweight is tight. With the vane mounted, hold the sensor horizontal. Verify balance.
- D. Install the sensor in the crossarm with the keyed bushing. The orientation screw in the stem of the wind direction sensor will fit through the hole in the mounting bushing.
- E. Connect the cable assembly to the keyed sensor receptacle and secure it to the mounting arm using cable ties.

2.2 Model 020 Wind Direction Sensor Alignment

(Refer to Figure 2-1 "Typical 020D Installation"). The Orientation screw located on the stem of the sensor is to be oriented so that it points south. Proceed as follows:

- A. Tape the sensor hub and column together so that the notches on each part are exactly aligned.
- B. Loosen the two set screws in the alignment bushing so that the sensor and bushing may be rotated.
- C. Rotate the sensor so that vane (counterweight end) points directly south.
- D. A transit located either directly south or directly north will facilitate the alignment process; merely rotate sensor until vane and sensor column merge completely, then tighten the set screws into the mounting bushing.
- E. Optional alignment accessories are available:
 1. A telescopic orientation device, which is inserted into alignment bushing until alignment is achieved. Bushing is locked and orientation device is removed and wind direction sensor installed.
 2. A compass orientation device operates in similar manner, but is not suitable for steel towers or poles.

2.3 Wiring

The cable assembly contains five wires. Typical wiring hookup is shown in Figure 2-1.

2.4 Lightning Protection

Weather sensors are sensitive to direct or nearby lightning strikes. A well-grounded metal rod or frame should be placed above the sensor installation. In addition, the shield on the signal cable (white/brown wire) must be connected to a good earth ground at the translator end, and the cable route should not be vulnerable to lightning.

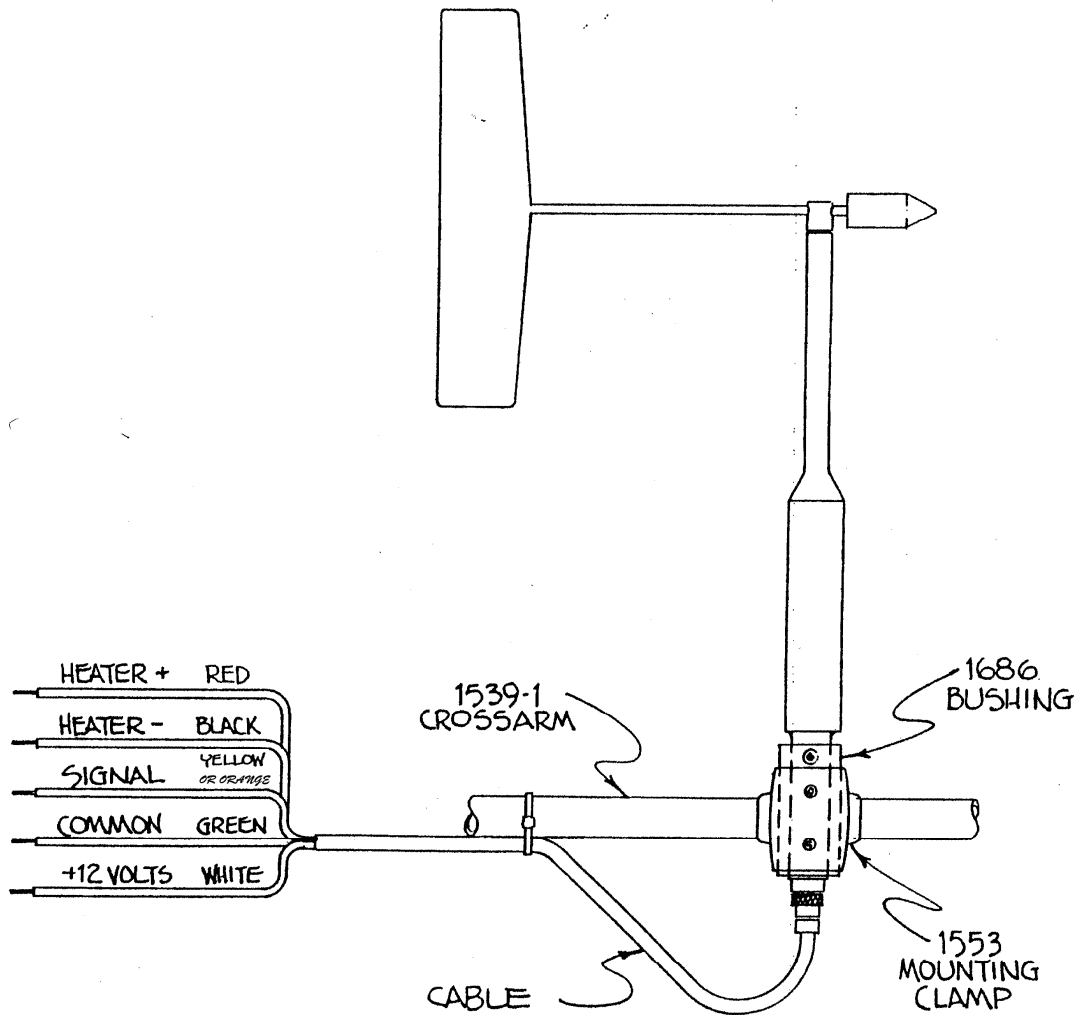


FIG. 2-1
TYPICAL O2OD INSTALLATION

3.0 OPERATIONAL CHECK-OUT

3.1 020D Wind Direction Sensor Check-Out (standard 360° operation)

A. With the sensor connected to the input, upon movement of the sensor's vane in a clockwise direction (as seen from above), the module's output will move up-scale. Movement of the module's output will progress up-scale until the 360° (full scale) mark has been reached; then output will drop to 0°. When the notches on the rotating hub and the column of the sensor are exactly aligned, the output signal will correspond to 180°.

3.2 020D Wind Direction Sensor Check-Out (with 540° conversion electronics)

A. With the sensor connected to the input, upon movement of the sensor's vane in a clockwise direction (as seen from above), the module's output will move up-scale. Movement of the module's output will progress up-scale until the 540° (full scale) mark has been reached, and then the output will drop to 180°. Continued clockwise rotation will again bring the module's output up-scale to 540° and the action is repeated. When the notches on the rotating hub and the column of the sensor are exactly aligned, the output signal will correspond to 180° (or 540° on the expanded scale).

3.3 If the sensor heater is used, then check internal heater operation by sliding sensor cover down and touching the housing behind the printed circuit board. The housing should feel warmer than the adjoining metal parts. The sensor has a built-in heater that is designed to provide a raise in the internal temperature, providing a small positive pressure. This heater requires an external 12V (@ 350 ma) power supply.

4.0 MAINTENANCE AND TROUBLESHOOTING

4.1 General Maintenance Schedule

6-12 Month Intervals:

- A. Inspect Sensor for proper operation per Section 3.1 or 3.2.
- B. Calibration as required per Section 4.4.

12-24 Month Intervals:

- A. Replacement of sensor bearings as per Section 4.5.
- B. Replacement of potentiometer as per Section 4.6

Table 4-1
020D Wind Direction Sensor Troubleshooting

<u>Symptom</u>	<u>Probable Cause</u>	<u>Solution</u>	<u>Refer to</u>
No wind direction output	Loss of supply voltage	Check +12V supply and connecting cables	Figure 2-1
	Faulty circuit amplifier (output often will be steady 5.0V)	Replace 2840-2 PCB	Section 4.8
	Faulty potentiometer	Replace potentiometer	Section 4.6
No change in wind direction output below 2-5 mph	Bad bearings	Replace bearings	Section 4.5

4.2 020D Wind Direction Sensor: 6-12 Month Periodic Service (Refer to Assembly Drawing)

- A. At the crossarm assembly, disconnect the quick disconnect plug from the sensor (leave the cable secured to the crossarm). Remove the sensor from the crossarm assembly bushing. Leave the bushing secure in the fitting.
- B. Loosen the set screw on the bottom edge of the vane hub. Support the rotating hub of the sensor with one hand and pull the vane assembly free.
- C. Visually inspect the wind vane assembly to ensure that the wind vane and counterweight are securely attached to the wind vane rod, and that the set screw in the top edge of the rotating hub holds the rod in place.
- D. Slide the sensor cover down to expose the potentiometer assembly and signal conditioning module.
- E. Inspect the interior of the sensor for any signs of corrosion.
- F. Inspect the potentiometer for loose wires, cracks, and corrosion.
- G. Inspect the shaft coupler for proper position. Make sure that the marks on the rotating hub and the column assembly are aligned, and that all special set screws are tight.
- H. Inspect the circuit board assembly for cracks and corrosion. See Section 4.6 B.
- I. Rotate the sensor hub assembly to make sure that it turns freely, and that the sensor bearings are not damaged.
- J. Make sure that the potentiometer assembly is rigid in its holder.
- K. Apply a small amount of silicone lubricant (Dow Corning DC-33 or equivalent) to the sensor O-ring seals. Slide the cover up over the sensor and wipe off any excess lubricant.
- L. Support the rotating hub of the sensor with one hand and mount the wind vane assembly on the hub. The wind vane assembly is keyed to fit the pin on the hub. Tighten the set screw in the bottom edge of the vane hub.
- M. A moisture vent is located on the base of the sensor. Make sure that this vent is clear.
- N. Reinstall sensor according to installation procedure (Section 2.1); verify proper operation using procedures in Section 3.1 and 3.2.

4.3 020D Wind direction Sensor Maintenance (Refer to 020D drawing for assembly information)

The following procedures require a relatively clean, dry work area, a source of 12 VDC power at approximately 20 mA, a Model 040 Degree Wheel, and a 4-1/2 digit or better digital voltmeter.

4.4 020D Wind Sensor Calibration

Any time the bearing, shaft, hub or potentiometer is removed and replaced, the alignment of the potentiometer must be reestablished. Perform the following steps for calibration:

A. Connect the sensor to a 12-volt power supply:

Pin A	+12V
Pin B	Common

B. Connect a high impedance digital (4-1/2 digit or better, see above) voltmeter between common and Pin C (signal output).

C. Slide the Model 040 Degree Wheel onto the column of the wind direction sensor. Install the 040 Pointer Assembly onto the rotating hub. Tape sensor hub and column together so that the notches on both parts are exactly aligned.

D. Slide the degree wheel up to the pointer, allowing clearance space, and rotate the degree wheel until the pointer is at exactly 180° on the wheel. Tighten the degree wheel to the column, checking to ensure that it does not interfere with the rotation of the pointer.

E. Remove tape and rotate the pointer, then recheck the alignment of the two notches with the 180° mark on the degree wheel. Readjust if necessary.

F. Loosen the set screws in the shaft coupler (#21).

G. Place the pointer at 180° and rotate the potentiometer shaft coupler so that an output of $2.500 \pm 0.005V$ (1.250V with a 2.5V output range) is measured. Tighten set screws in the drive coupler (#21) and recheck at 180°. Readjust if necessary.

H. Reconnect digital voltmeter to Pin C of the sensor connector and rotate the pointer to 180°. The output reading should be $2.500V \pm 40mV$ ($1.25V \pm 20mV$ with 2.5V output range).

I. Remove 040 Degree Wheel and pointer. This completes the alignment procedure.

4.5 Sensor Bearing Replacement (Refer to 020D Sensor Assembly drawing)

- A. Remove sensor from tower and remove vane assembly. Refer to Section 4.2.
- B. Disassemble sensor and remove old bearing. (#6)(Refer to Assembly Drawing)
 - 1. Slide the sensor cover (18) down to expose the potentiometer assembly (23) and circuit board assembly (15).
 - 2. Make sure that the two (lower) special set screws on the COUPLER (21) next to the potentiometer are tight, and then loosen the two (upper) special set screws.

NOTE: Any time the shaft coupler assembly is removed, the potentiometer alignment procedures outlined in Section 4.3 must be performed.
 - 3. Slowly pull the rotating hub/shaft assembly (7) out of the column (8).
 - 4. Remove the shield (4) and slinger (5) from the column.
 - 5. Insert a right-angle type of tool, such as an Allen wrench, into the bearing; cock it slightly to one side and remove the bearing (6).
 - 6. Clean dirt from bearing bore, using a cotton swab and alcohol.
- C. Install the new bearing and assemble the sensor.
 - 1. Install new upper bearing in the column assembly. Bearing should slide easily into bearing bore.

CAUTION: Do not lubricate bearing. Do not force.
 - 2. Install slinger (4) and shield (5) on the column (8).
 - 3. Insert the rotating hub/shaft assembly (7) into the column (8), through the shield (4), slinger (5), and bearing (6).
 - 4. Support the drive coupler (21) with one hand and slowly push the rotating hub/shaft assembly (7) into it until the shaft bottoms.
- D. Recalibrate sensor in accordance with Section 4.3.
- E. Replace vane assembly and reinstall (refer to Section 2.1).

4.6 Potentiometer Replacement (Refer to 020D Sensor Assembly drawing)

- A. Remove sensor from tower and vane assembly. Refer to Section 4.2.
- B. Disassemble sensor:
 - 1. Slide the sensor cover (18) down to expose the potentiometer assembly (23) and circuit board assembly (15). Loosen the 3 terminal block screws on the 2840-2 circuit board, and disconnect the potentiometer wires.
 - 2. Loosen the two set screws in coupler holding potentiometer.
 - 3. Remove the three recessed Phillips head screws from the top housing and remove the column and pot assembly.
 - 4. Remove three screws (22) to separate potentiometer from column.
- C. Install New Potentiometer by following above instructions in reverse order.
- D. Recalibrate sensor as per Section 4.4.
- E. Replace vane assembly and reinstall (refer to Section 2.1).

4.7 2840 Circuit Board Assembly replacement. (Refer to 020D Assembly drawing)

- A. Remove sensor from tower and remove vane assembly (refer to Section 4.2).
- B. Slide the sensor cover down to expose the sensor interior.
- C. Remove two screws (14) holding circuit board assembly (15). Note color of wires.
- D. Loosen all terminal block wires to potentiometer assembly and note color and position of wires.
- E. Loosen all terminal block wires to connector and note color and position of wires.
- F. Install new circuit board assembly by reversing above procedure.
- G. Adjust potentiometer R7 or R6 according to procedure of Section 4.5.
- H. Replace vane assembly and reinstall (refer to Section 2.1).

4.8 020D Wind Direction Sensor Repair and Recalibration Service

The factory provides fast, economical service for the user. This repair and calibration service includes disassembly and detailed inspection of all moving mechanical parts and electronic components.

Service includes replacement of bearings, regardless of apparent condition, calibration, and functional test of sensor. Replacement of the following items, if necessary, is also included: O-rings, shield and slinger, shaft, set screws. Charges for any additional materials will be added to the basic service charge.

Table 4-2
020D Replaceable Parts List

ITEM #	PART #	DESCRIPTION
1	10296	Magnesium Vane Assembly, or
	2755	Alum Vane Assembly
4	1009	Shield
5	1010	Slinger
6	1055	Bearing
7	2658	Hub/Shaft Assembly
9	720120	O-ring
10	805080	Resister 5W, 35Ω
12	480100	Cable Clamp
13	860050	Standoff
14	601240	Screw, PH 4-40x1/4
15	2840-2	PCBA Assembly
18	2675	Cover
21	2727	Coupler, Direct
22	601070	Screw PH 2-56 x 1/8
23	10889	Potentiometer Assembly
27	601330	Screw, FH 82° 4-40 x 3/8
28	600400	Nut, Hex, Kep 4-40
29	601850	Screw, Soc. Hd Cap 10-32x5/8
30	601240	Screw, FH 82° 4-40x1/4
31	601251	Set Screw 4-40x1/8

