

# SENSORS

## MANUAL - F460 WIND SPEED SENSOR P/N M100075 Rev D

### 1.0 INTRODUCTION

The F460 Wind Speed Sensor, P/N 100075, is designed to provide low starting threshold, wide dynamic response and high accuracy over a wide range of wind speeds and a variety of environmental conditions.

### 1.1 SPECIFICATIONS

**Accuracy:**  $\pm 0.07$  m/s (0.15 mph) or  $\pm 1.0\%$ ,  
whichever is greater

**Threshold:** 0.22 m/s (0.5 mph)

**Distance Constant:**

Lexan: <1.5 m (4.9 ft) of air maximum

Heavy Duty: <4 m (13.1 ft.) of air maximum

**Operating Range:** 0-56 m/s (0-125 mph)

**Operating Temp:** -40° to 60°C (-40° to 140°F)

**Power Requirement:** +12 Vdc @ 4.5 mA  
or +5 to +7.5Vdc @ less than 1 mA

**Signal Output:** 2 Vpp freq. proportional to WS

**Output Impedance:** 4.7K Ohm

**Dimensions:**

Diameter: 5.7 cm (2.25 inch)

Height: 29.2 cm (11.50 inch)

Weight: less than 2 lbs. (0.9 kg)

Turning Radius: 3.75 inch (9.5 cm)

**Anemometer Cup Transfer Functions:**

Lexan:  $\text{Freq(Hz)} = (\text{mph} - 0.3) \times 9.511$

Heavy Duty:  $\text{Freq(Hz)} = (\text{mph} - 0.5) \times 9.511$

SS:  $\text{Freq(Hz)} = (\text{mph} - 0.5) \times 10.425$

### 2.0 INSTALLATION

The sensor mounts to the Prewired F460 Crossarm, P/N 101994. Refer to the 101994 manual for proper installation instructions. Be sure the Sensor is located in a clear, unobstructed area to minimize any turbulent effects caused by obstructions (e.g., - trees, buildings, etc.)

The sensor mounts on the Crossarm by matching the connector keys and the notch on the lower part of the Sensor body to the alignment pin of the Crossarm. Secure the Sensor by tightening the two set screws located at the base of the Sensor. The cup set attaches to the Sensor by matching the groove in the cup assembly hub to the shaft hub and lightly tightening the set screws.

Note: Some Anti-Seize compound on the set screws will facilitate disassembly if it becomes necessary.

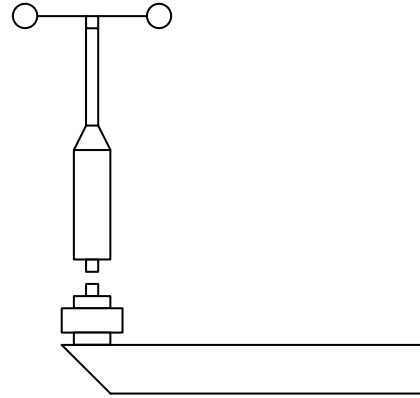


Figure 1

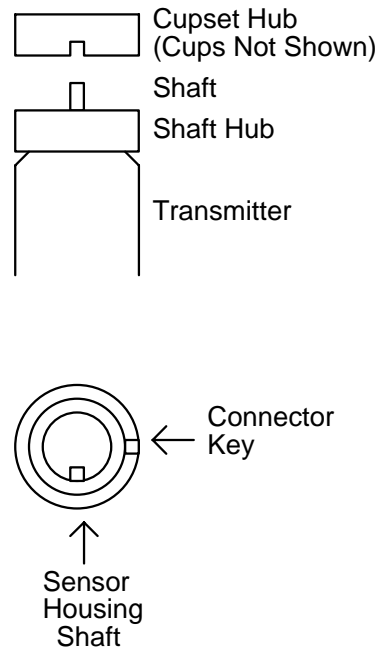


Figure 2

### **3.0 INPUT/OUTPUT CONNECTIONS**

<u>PIN</u>	<u>FUNCTION</u>
A	WS Frequency Output
B	+V In
C	Ground
D	Not Used
E	Not Used
F	Not Used

### **4.0 USER DEFINED OPTIONS**

Both internal and external sensor heaters are available. The internal heater is a continuously operating device which consumes 2W per sensor of the 12 Vdc sensor power. This heater option is designed to minimize internal moisture buildup and requires factory installation. The external heater is thermostatically controlled and is designed to minimize sensor freeze-up in cold environments. This heater option is powered by 110 Vac, requires approximately 20W per sensor, and may be added by the user as a field modification.

### **5.0 USER INTERFACE**     N/A

### **6.0 THEORY OF OPERATION**

A lightweight, chemically etched disk divided into 30 sections rotates with the cup set. As the disk rotates, the light path between an IR LED and a phototransistor is alternately blocked and left clear. In order to keep power consumption to a minimum, the power to the LED is turned on for only 10  $\mu$ secs every 0.25 msecs as described below. The Wind Speed Amplifier, P/N 101080, is located in the main body of the Sensor. To gain access to the Amplifier, the cover must be removed by pulling it toward the base with a slight twisting motion. Drawing No. 400811 (Section 9.0) is a schematic diagram of the Amplifier. U2 turns on the LED (CRI) for a period of 10  $\mu$ secs every 0.25 msecs. If the chopper is positioned such that it does not obstruct the light path, then the energy emitted by LED strikes Q1, causing it to turn on whenever the LED is pulsed. When Q1 is turned on, Q2 is turned off and the voltage at Pin 5 of U1 rises to +V. When the LED is turned off, the voltage at the clock input (Pin 3 of U1) rises to +V, causing the Q output (Pin 1) to rise to +V.

As long as the energy from the LED strikes Q1, the output of U1 will remain high. When the chopper blocks Q1, the phototransistor will not turn on, causing the collector of Q2 to remain low. When the LED is turned off, the D input of U1 will be low and a zero will be clocked into U1. The output of U1 will remain low as long as the energy from CR1 does not strike Q1. Resistors R5, R6, R9, R10 and varistors VR1 and VR2 protect the circuit from voltage transients. Zener diode CR3 limits the circuit voltage to 8.2 volts.

### **Circuit Adjustment**

A potentiometer (R2) is provided on the WS Amplifier to allow adjustment of the output duty cycle. The duty cycle has been set at the factory and should not require readjustment except if either the LED (CR1) or the phototransistor (Q1) are replaced, or if the supply voltage is dropped below 8.0 vdc. In this case, view the output waveform and adjust R2 for a 50 % duty cycle. (CCW increases duty cycle).

### **7.0 CALIBRATION**

The sensor by itself does not require calibration. However, Climatronics can provide NIST traceable calibration in our wind tunnel for your sensor and cup assembly combination. Please contact the factory for further details.

### **8.0 MAINTENANCE**

The only maintenance required is to periodically check the bearing wear. This is easily done with Climatronics' Wind Speed Sensor Torque Meter, P/N 101257. Should it become necessary to replace the bearings, proceed as follows. Both bearings should be replaced if replacement is necessary. Drawing No. 100075 (Section 9.0) will help in locating the parts described below. Read through the whole procedure before starting.

1. Remove the cup assembly, by loosening the 2 set screws which holds it to the sensor shaft.
2. Remove the 2 screws holding the PCB, and move it away from the shutter.

3. Remove the two flat head screws holding the column assembly to the support and remove the column assembly.
4. Loosen the two set screws that hold the cap in place and remove the cap. Replace worn set screws, lubricate with anti-seize compound.
5. Remove the retaining ring from the top of the shaft with retainer ring pliers or a small pen knife. If the ring is bent, it must be replaced.
6. Allow the shaft to slide out through the open end of the column, being careful not to damage the shutter.
7. Remove and discard the old bearings.. It may be necessary to push the bearings out from the bottom of their sets with a long thin rod such as the shaft assembly. Pushing lightly all around the bearing is better than putting too much pressure on one side of the bearing.
8. Replace the spacer that was closest to the shutter on the shaft.
9. Place a new bearing on the shaft and guide the shaft back into its hole from the bottom until the bearing is seated. When the bearing is seated, the retainer ring groove will be visible at the top of the transmitter.

10. Hold the shaft in place from the bottom, being careful not to damage the shutter, and place a new bearing over the top of the shaft and press it down into its seat.

11. Replace the spacers on top of the bearing and then replace the retainer ring. If retainer ring pliers are not available, a small knife can be used to expand the retainer ring.

12. Replace the cap and screw the column back onto the transmitter. (Use thread locking compound under the flat head screws).

If the shaft assembly is to be replaced, the procedure is the same as outlined above, except that the spacers cannot necessarily be replaced as above. The lower spacer (one next to shutter) is always a 0.010 inch thick spacer (P/N SS1-7). The upper spacers are selected to allow 0.005 to 0.010 inches of shaft end play.

If the end play measurement cannot be made, it can be assumed to be correct if the shaft has some end play, and the shutter is free to rotate. In all cases, a minimum spacer of 0.010 inches is required at the top of the shaft.