Required supplies

Hot wire anemometer (electronics box w/ sensing probe)

The FRL owns three different model hot wire anemometers manufactured by Omega Engineering Inc., FMA-901-I, FMA-904-I-R, and FMA-1001R-VI, shown in Figure 1 through Figure 3. The 900 series anemometers have a range of 10-200 FPM (Feet per minute). The 1000 series unit has a range of 0-1000 FPM.

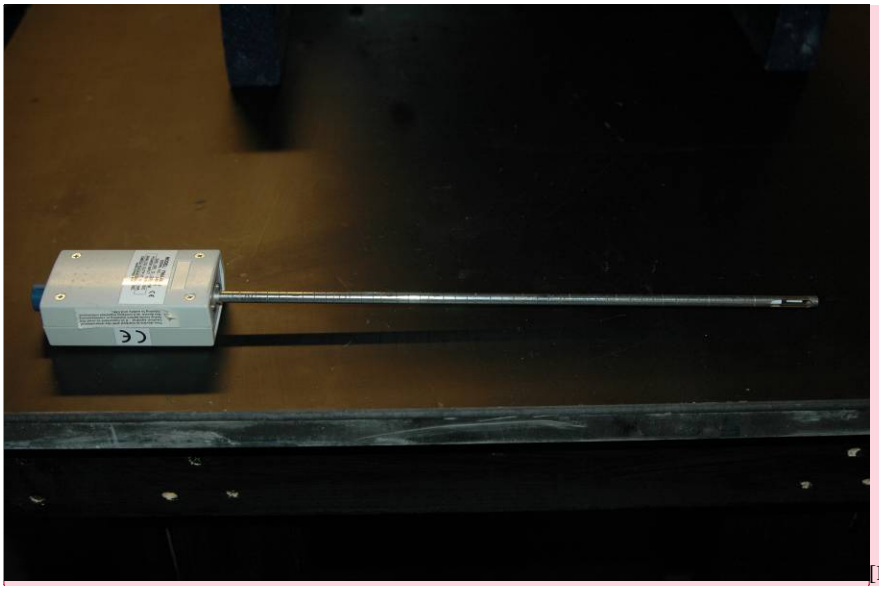
 [FAN(1]

Figure 1. FMA-901-I

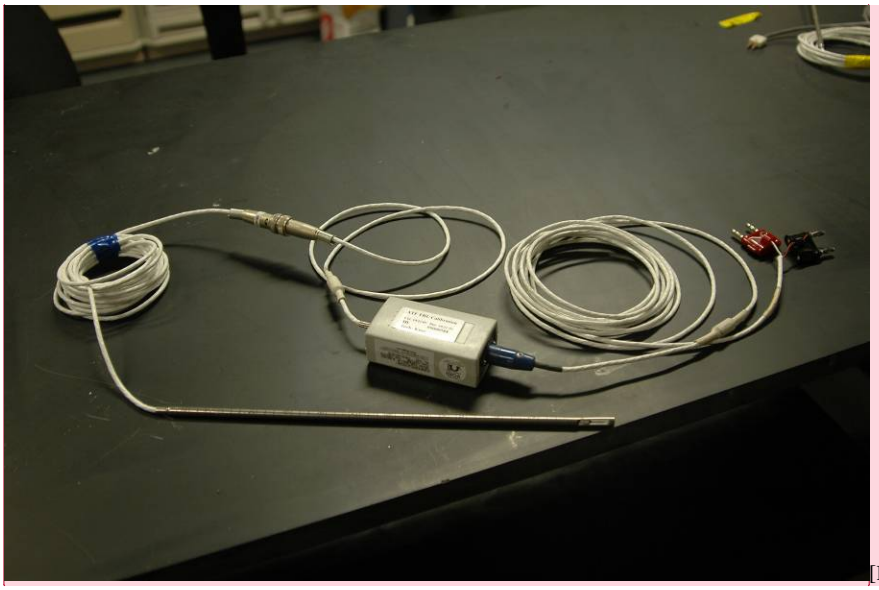
 [FAN(2]

Figure 2. FMA-904-I-R

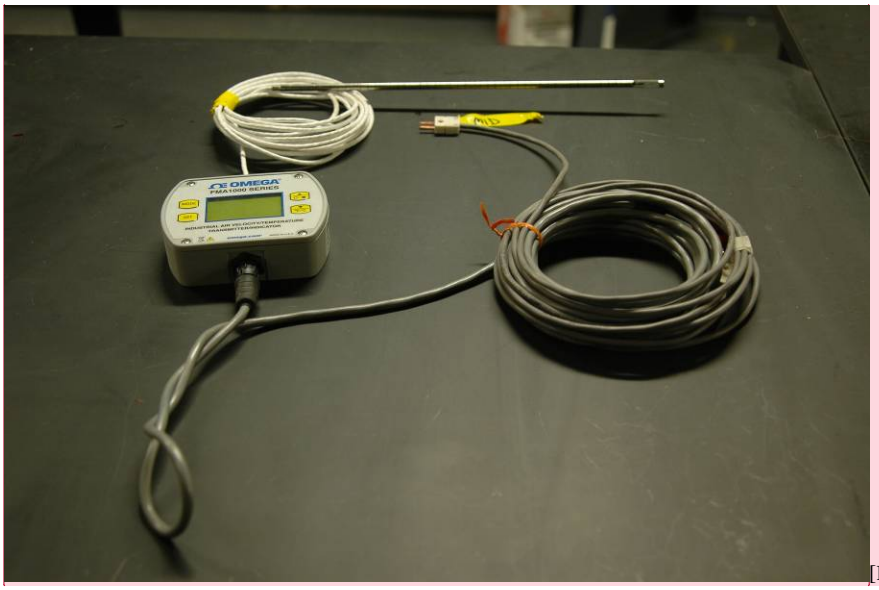
 [FAN(3]

Figure 3. FMA-1001R-VI

DAQ/Power Supply Patch Panel


[FAN(4]

Figure 4. DAQ/power supply patch panel for hot wires

Signal/power connector cable with banana plug connectors or voltage wire connectors where applicable

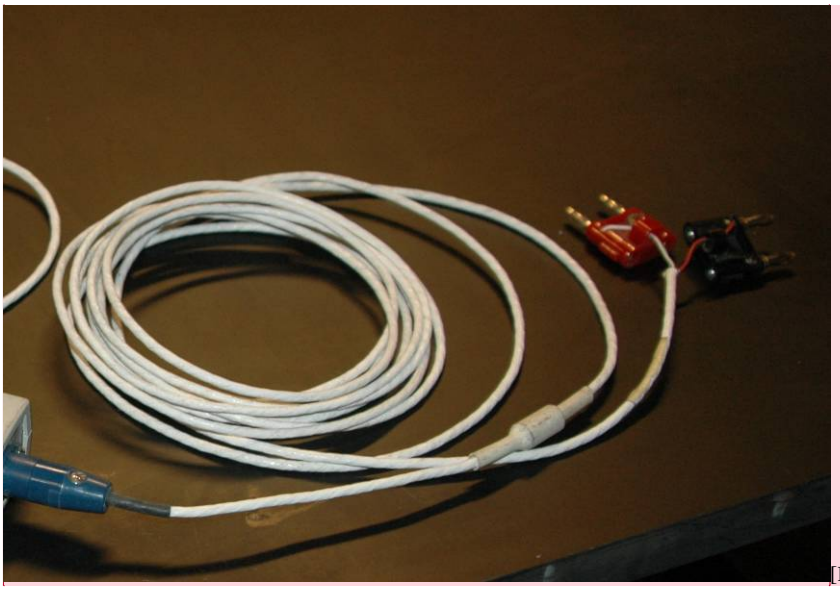

[FAN(5]

Figure 5. Signal/power cable

Type-K, 24 awg SLE thermocouple

Data acquisition system w/ power and communication cables

Yokagowa main unit (any)

Yokagowa sub unit (5 box)

Voltage Module (0-6 volt range, 1 channel per unit)

Thermocouple module (1 channel per unit)

Start-Up Procedures

Mounting considerations

Hot wire anemometers are intended to be used in clean air or nitrogen environments. Care should be taken to mount the hot wires away from flammable or hazardous gases such as combustion byproducts.

Hot wires can be mounted vertically or horizontally in open air or within pipes/ducts.

If mounting the hot wire within a duct or pipe, run a length of straight pipe before and after the hot wire. Consult manufacturer documentation for specific length requirements which depend on the configuration of the piping system.

Align the sensor with the air flow. Make sure the air flow is perpendicular to the sensor window

Power requirements

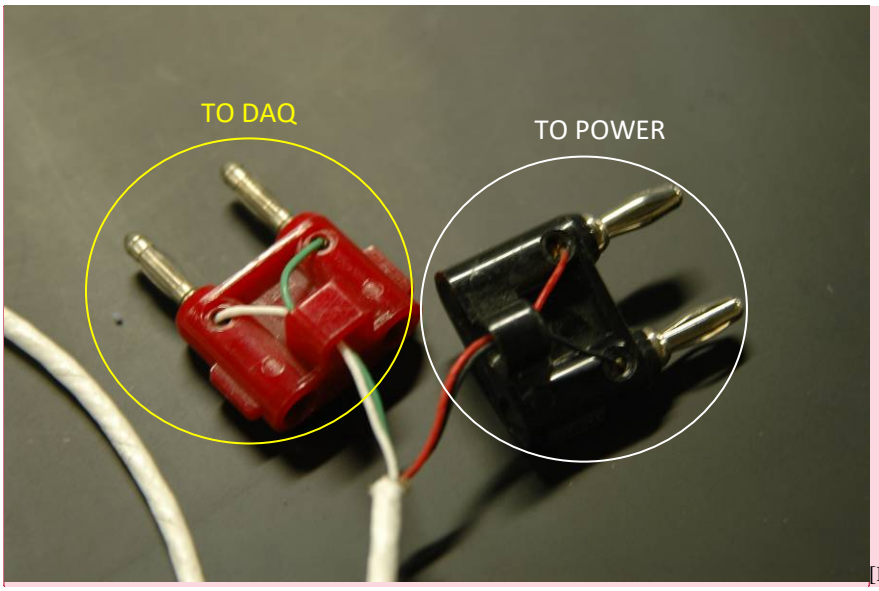
The 900 series hot wires require 15 to 24 VDC @ 300 mA and the 1000 series hot wires require 15-24 VDC @ 150 mA. The FRL uses an unregulated linear power supply Omega model U24Y101 with a output rating of 24 VDC @ 1000 mA. Dedicated power supplies are installed in the patch panel shown in Figure 4.

Data acquisition/power supply connections

Hot wires are purchased with a detachable signal cable that connects to the hot wire's electrical housing. The signal cable has four conductor stranded signal wires on one end; red, black, white, and green as shown in Figure 6. The red and black wires are used to supply the power (red to positive, black to negative) to the hot wire. The white and green wires are used to carry the hot wire's data signal from the electrical box to the data acquisition equipment (white to positive, green to negative). The hot wires attach to the data acquisition system differently, depending if the signal output is current or voltage. Check the output specifications of the hot wire on the label attached to each unit. If the signal output is current, the signal must first pass a resistor to convert the signal to a voltage before the signal is sent to the data acquisition system. All hot

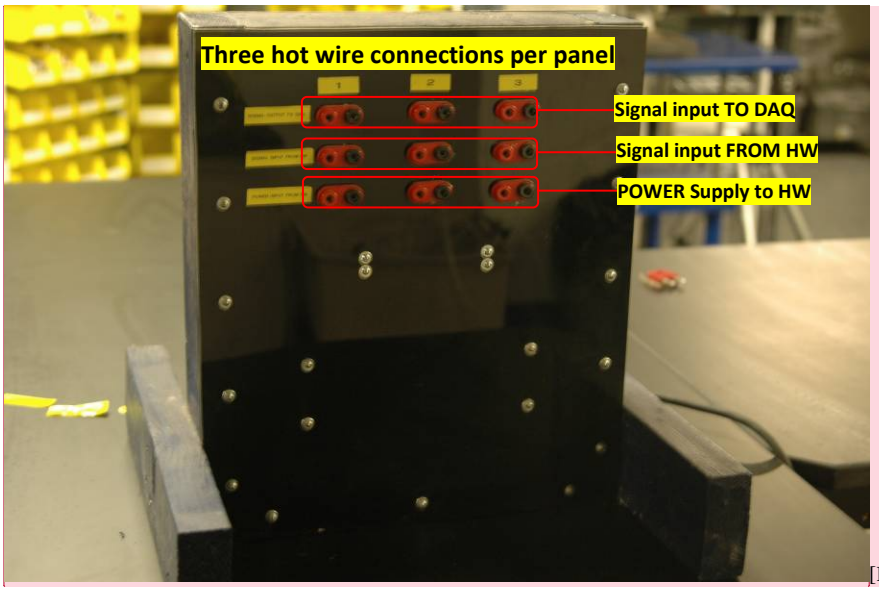
wires with a current output in use at the FRL have a 4 to 20 mA output signal therefore a 250 ohm resistor is used to convert the signal to a 1-5 volt output.

Three hot wires can be connected to each patch panel. The bottom row of connections is used to supply power to the hot wires. The first and second rows of connections are ONLY used if the hot wire is a current output. If the hot wire is a voltage output the signal wires can be connected directly to the DAQ. If the hot wire has a current output, the signal from the hot wire is connected to the middle row of connections. The signal is then converted to a voltage within the panel using a 250 ohm resistor as shown in Figure 8. The signal is then passed through the top row of connections to the DAQ.



[FAN(6]

Figure 6. Wire connections on signal cable



[FAN(7]

Figure 7. Patch panel connections

 [FAN(8]

Figure 8. 250 ohm resistors used in patch panels

Thermocouple

A single Type-K 24 awg SLE thermocouple must be installed near the hot wire sensor to monitor the surrounding air temperature. According to manufacturer literature, the temperature may not exceed 121 C at the sensor probe and may not exceed 50 C at the electronics box. For units that have remote sensing probes, the upper limit must be set to 121 C. If the probe and electronic box are connected, the upper limit is 50 C. If the surrounding air temperature exceeds the limit, the instrument must be taken out of service.

Ambient Environment Exposure

Hot wire must be installed in the environment at least five minutes prior to testing to allow for ambient temperature compensation

Calibration Check

Check calibration label on electronics box to ensure the instrument is calibrated.

Experiment Procedures

Monitor temperature

The temperature of the surrounding air must be monitored during the entire test. If the surrounding air temperature exceeds 121 C, for remote sensing probes, or 50 C, for attached probes, the hot wire must be taken out of service.

Shutdown/Post Test Procedures

Inspection

Check the hot wire sensor tip, shown in Figure 9, for soot, debris, and damage. If soot, debris or damage is found, the test data will be reviewed for irregularities and taken out of service if necessary. Refer to maintenance section if cleaning or repair is required.

[OJP9]

Figure 9. Hot wire sensor

Maintenance

Except for the intermittent cleaning of the sensor probe, there is no routine maintenance required. If soot and/or debris are found, the component must be cleaned prior to testing. If the probe becomes coated with dust, blow the dust away with clean air. If the probe is coated with sticky material, clean it with solvent which is compatible with epoxy, glass, and 304SS, and which will not leave a residue on the sensor. You may clean the sensor with water or alcohol (Ethanol) and an artist's brush. If unit needs to be repaired, send back to manufacturer.

Calibration

Hot wires are calibrated annually in a NIST-traceable wind tunnel.