



LINEAR AIR FLOW STATION START-UP AND TROUBLE SHOOTING GUIDE

FLOW MEASUREMENT TECHNOLOGIES, INC.

SM01/97

GENERAL START-UP INSTRUCTIONS

1. Install and wire the air flow station components as shown in the supplied instructions.
2. The linear air flow station requires a 24 VDC power supply. This power supply may be supplied by FMT or by the installing contractor. Refer to the submittal data to verify source of supply.
3. Be certain that the polarity of the power supply and output signal connections are correct. The linear transmitter circuit board is protected against reverse polarity damage by a diode on the positive power input terminal. The red LED labeled " POWER " lights when the supply voltage is correctly connected.
4. Turn on the power and verify that an output signal is present.
5. The flow station should operate properly without any further testing or verification. If the unit does not provide an output signal or the output signal is determined to be incorrect, proceed to the trouble shooting section.

TROUBLE SHOOTING

Before proceeding with specific tests to determine the source and remedy of system malfunctions, a brief over view of a typical flow station will be given.

LINEAR SYSTEM DESCRIPTION

Each linear flow station consists of one or more duct air flow probe assemblies and an output transmitter which converts the probe velocity signals into a properly scaled, linear output as required by the building control system. See Figure 1 for a system description.

Duct Mounted Flow Probe - Each flow probe consists of between 1 and 8 individual flow sensors which are mounted in an extruded aluminum strut. Each flow sensor is wired to a summation circuit board located in the NEMA 4 junction box located on the strut. Each flow sensor consists of a circuit board, plastic spacer and an aluminum snap on cover. The flow sensor circuit board has a 3 position pin connector mounted on the underside to allow simple installation and removal from the support strut. The three conductor wire used to connect each flow sensor to the summation circuit board is color coded as follows:

| <u>WIRE COLOR</u> | <u>ELECTRICAL CONNECTION</u> |
|-----------------------|----------------------------------|
| BROWN | System Ground |
| RED | Velocity Signal (Volts DC) |
| ORANGE | Supply Voltage (24 VDC) |

The three wires are connected to the junction box circuit board through the use of insulation displacement pins. Once the wire is inserted into the pin, a white protective cap is placed over it to prevent accidental short circuits.

The junction box circuit board sums and averages the velocity signal from the flow sensors (up to eight) mounted on the support strut and outputs a single average signal to the linear transmitter.

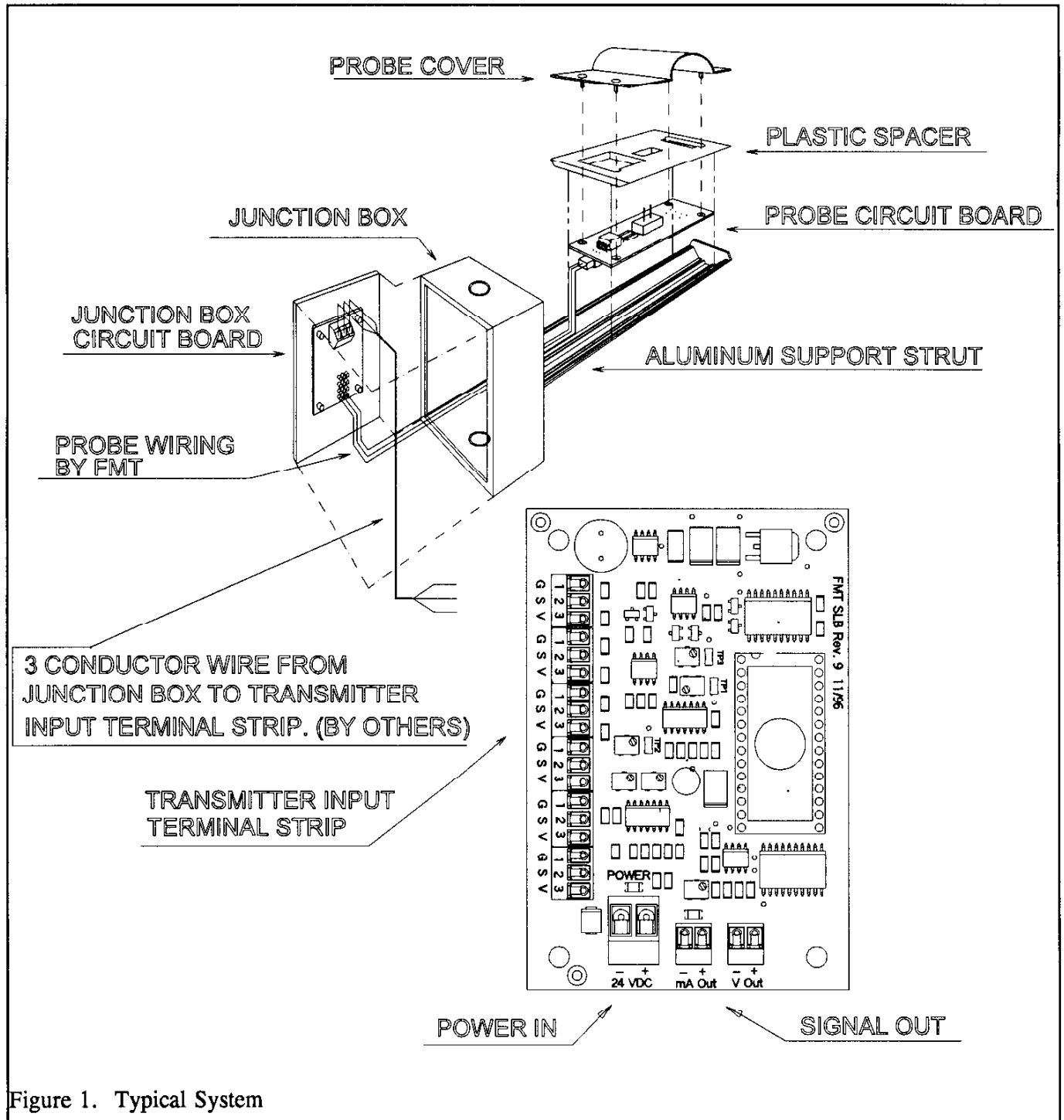


Figure 1. Typical System

LINEAR TRANSMITTER

The linear transmitter takes the output signals from up to six junction box circuit boards and averages these signals to determine an overall probe signal based on all the sensors in the entire flow station. This average signal is then linearized and scaled accordingly to provide either a 0-5 VDC, 0-10 VDC or 4-20 MA linear output signal.

There are up to 6 adjustment trimmers located on the linear transmitter. The first 5 are designated as follows and they perform the following functions:

| TRIMMER DESIGNATION | FUNCTION | TEST POINT# |
|---------------------|---|----------------|
| T1 | Sets the zero value of the averaged probe signals. | 1 |
| T3 | Used by the digital circuitry as a voltage reference. It should be set at 2.50 VDC. | 3 |
| T2 | Sets the span of the unit | 2 |
| T5 | Voltage out signal adjust. | Terminal strip |
| T4 | 4-20 MA output signal adjust. | Terminal Strip |

Trimmer number T6 is for the LCD display option and is not to be field adjusted. The other 5 trimmers can be field adjusted by a qualified service technician if required. Refer to the specific sections covering trouble shooting before attempting to change the factory settings.

On 4-20 MA output models, a red LED located above the MA OUT terminal strip will light when a proper current loop is operating.

FIELD TROUBLESHOOTING

The field trouble shooting of the linear flow station will be divided into two categories. First, problems where there is no output signal present and problems where an incorrect output signal is present.

NO OUTPUT SIGNAL PRESENT

1. Disconnect the linear transmitter output from the DDC or building control system. Verify that all wiring has been done as shown in the installation instructions. Refer to Figure 2 for Linear Transmitter drawing.

2. Confirm that there is air flow in the duct. Measure the voltage present at TP2. With air flowing in the duct, the signal at TP2 should be between .2 - 5.0 VDC.

3. If the voltage at TP2 is as indicated in step 2 and there is no output, contact the factory for further instructions.

INCORRECT OUTPUT SIGNAL PRESENT

If an output signal is present but is not correct as determined by field measurements with a pitot tube traverse or other reliable method, proceed as follows:

1. Confirm that the flow station is installed as shown in the installation drawings and that the probe struts are correctly orientated with respect to the direction of air flow. Also be sure that there are no

obstructions blocking the free flow of air over the velocity sensors.

2. Using an accurate volt meter, determine that the individual flow sensors are operating properly. This is accomplished by measuring the individual voltage output of each flow sensor at the junction box circuit board. Refer to Figure 3 for component locations on the junction box circuit board. Each flow sensor is wired to the junction box board through a three conductor ribbon cable that is terminated at the sensor wiring posts. The output signal in VDC from each flow sensor can be measured individually at the input buffer resistors. Each set of sensor wiring posts is numbered and corresponds to the buffer resistor of the same number. Measure the voltage at the right hand (numbered) end of the buffer resistor to determine each sensors output. The number of sensors on each strut may vary from 1 to 8.

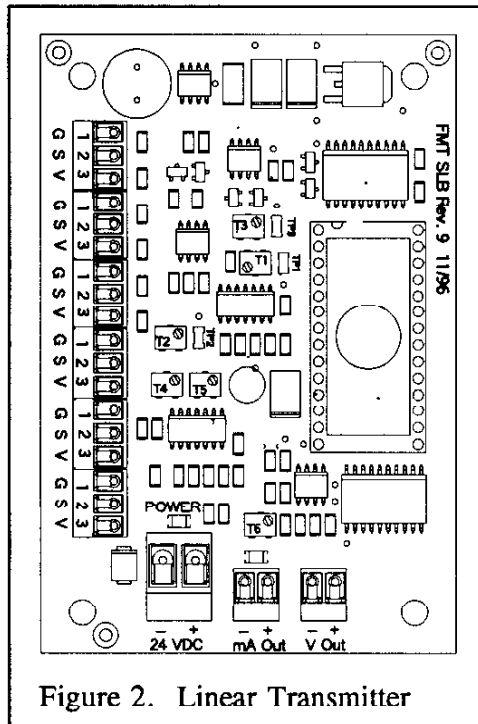


Figure 2. Linear Transmitter

3. Record the sensor voltages. As a general rule, the FMT thermal flow sensor outputs a signal over the range of 3.0 to 9.0 VDC depending on the air velocity in the duct. A sensor problem is indicated when the measured voltage falls significantly below or above this range. If all the sensors appear to be working correctly, the unit may require a field calibration. Proceed to the Field Calibration section.

4. If a sensor is found to be incorrectly operating, it can be temporarily removed from the rest of the flow station by disconnecting the signal wire at the sensor wiring posts. The signal wire is always the center post, marked as " S ". This wire is colored red. To disconnect it from the wiring post, pry up the white cap and pull the red wire out of the post. The junction box board will then automatically recalculate the average output signal from the remaining sensors. This procedure is not intended as a permanent fix but rather a way to quickly get the flow station back on line until a replacement sensor can be installed.

5. Sensor replacement can be done by removing the strut from the duct and disassembling it on a test bench or it can be replaced with the strut still installed in the duct as long as access is provided to the flow sensors. Before a replacement sensor can be installed, the defective sensor must be located on the strut. On multi-sensor struts, this is done by reading the averaged junction box output at the input terminal strip and one by one blowing air over each sensor. A significant increase in the output signal will occur when air is blown across the operating sensors. When air is blown across the non-operative sensor, there will not be any change in the output since the signal wire should still be disconnected.

6. Remove the aluminum probe cover and plastic spacer from the non-operative sensor circuit board. Using a small screw driver or needle-nose pliers, pry the probe circuit board out of the slot in the support strut. The circuit board will be damaged by this procedure but the sensor boards are non-serviceable and will be thrown away. Once the circuit board is out of the support extrusion, disconnect the 3 position pin connector.

7. Disassemble the replacement probe by removing the aluminum probe cover and plastic spacer. Connect the 3 position wiring connector to the new circuit board. Snap the replacement probe into the support strut by placing one side of the circuit board into the slot in the extrusion. Press down on the remaining side to snap it into the slot in the opposite side of the extrusion. Be sure that the connector overhang is first inserted into the strut assembly before installing the replacement circuit board into aluminum strut.

8. Re-assemble the probe cover and plastic spacer.

9. Reconnect the red signal wire at the junction box circuit board by inserting the end of the wire into the wiring post and pressing the white cap back on using a phillips screw driver. Be sure the wire is oriented in the same direction as the other two wires connected to the probe. The wiring post is an insulation displacement type and will automatically strip the insulation if properly installed.

10. Check the output signal from the replaced sensor by measuring the voltage at the corresponding buffer resistor. If all checks out, the unit is ready to be put back in service. If the strut was removed from the duct, re-install.

FIELD CALIBRATION

If all the flow sensors are found to be operating within the given parameters but the flow station output is still incorrect, a field calibration can be used to correct the output signal. If the flow station is located in an area of high turbulence or wide variations in air velocity, a field calibration can increase the accuracy of the unit.

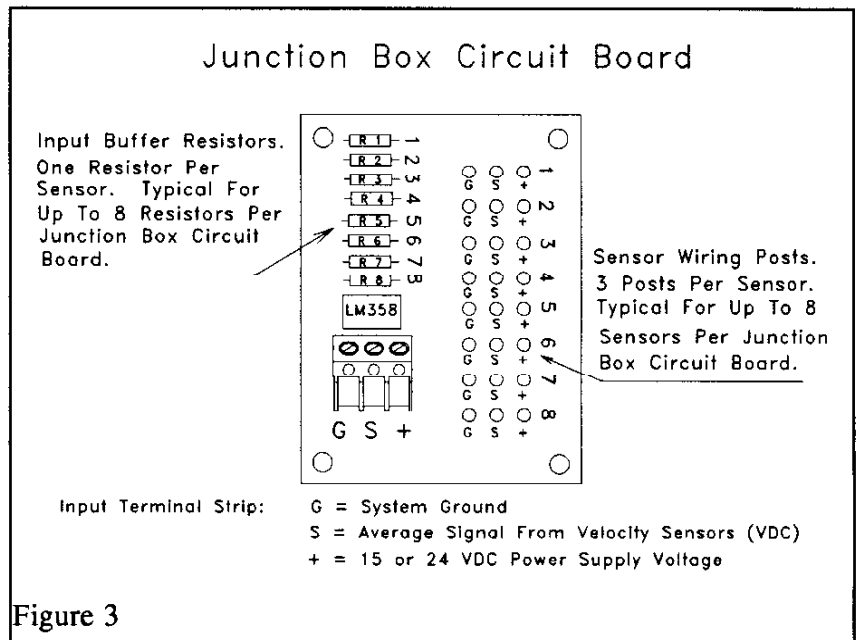
1. Set the fan to a high flow rate at the upper end of its anticipated operating range. Be sure that the fan speed will not change during the test. Also be certain that any VAV boxes are wide open or disabled to prevent fluctuations in the duct velocity.

2. Determine the actual flow rate through the use of a multi-point traverse. It must be stressed that an accurate measurement of the actual flow rate is essential if the recalibration is to be successful.

3. Using the adjustment trimmer labeled "T2" shown in figure 2, adjust the span of the unit up or down to change the output to the desired output signal. Clockwise increases the span and counter-clockwise reduces it. There is a time delay built into the output circuitry so make span changes slowly to avoid overshooting the target value.

4. Change the fan speed to a minimum value and check that the air flow station is correct at this point. If a significant error is still found, consult the factory for further instructions.

5. **DO NOT** adjust the "T1" trimmer as this is set at the factory and controls the zero value of the averaged probe signals. It does not act as a typical zero trimmer. The actual zero adjustments are made in the pre-programmed EPROM and should not be changed in the field. If this trimmer is adjusted, consult the factory for information on how to set it back to original specifications.





TECHNICAL BRIEF SENSOR MAINTENANCE

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APP2

VELOCITY SENSOR CLEANING

The FMT air flow sensor will not require periodic cleaning when used in a filtered airstream. The small amount of dirt that may accumulate on the velocity sensor will not affect the signal output. If a significant accumulation of dirt does occur, the accuracy of the flow station will be reduced. In general, dirt accumulations lower the output signal from the sensor by reducing the heat transfer to the air. Thermal sensors determine air velocity by measuring the rate of heat dissipation. The calibration of the flow station is determined by air flowing over a clean sensor. If dirt build-up changes the heat dissipation, the accuracy of the station will suffer.

Applications where there will be significant particulate content such as exhaust or outside air systems will require periodic cleaning. The intervals between cleaning will have to be determined by experience. As a general rule, the sensors should be inspected every 3 months for the first year to determine the required cleaning schedule.

Depending on the type of contamination in the air, we recommend two approaches to sensor cleaning.

1. Dry Contaminants. An accumulation of dust or other dry particles can usually simply be brushed off through the use of a dry cotton swab. The sensors will not be damaged by contact with the cotton swab as long as excessive force is not used.

2. Wet Or Condensing Contaminants. Liquid or condensing contaminants that accumulate on the sensors will typically be harder to remove. We recommend using alcohol or a solvent spray to dislodge any accumulations that are firmly attached to the sensors. A commercially available product like WD-40 will loosen and wash away dirt accumulations. For heavy accumulations, the use of a soft brush will greatly aid the solvent in removing the dirt. The sensors are epoxy coated which permits the occasional use of solvents for cleaning without damaging the components.

Experience will determine the cleaning intervals required. The type of contaminant will determine which method will work best. Installation of an access door greatly reduces the amount of time required for inspection and cleaning

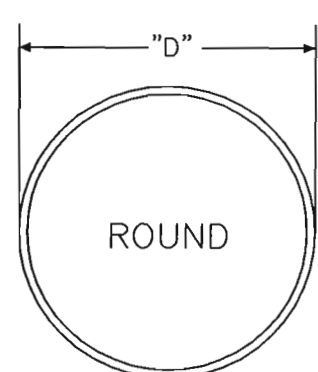
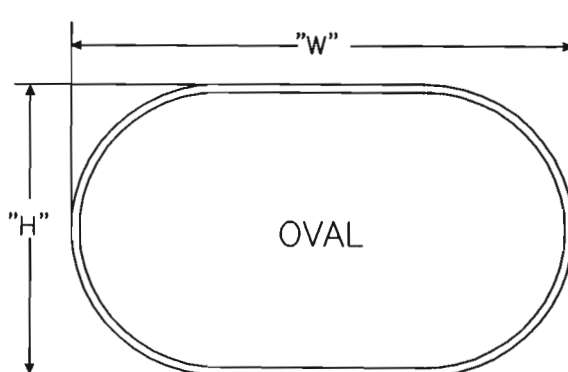
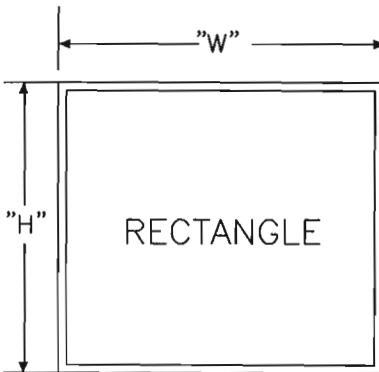
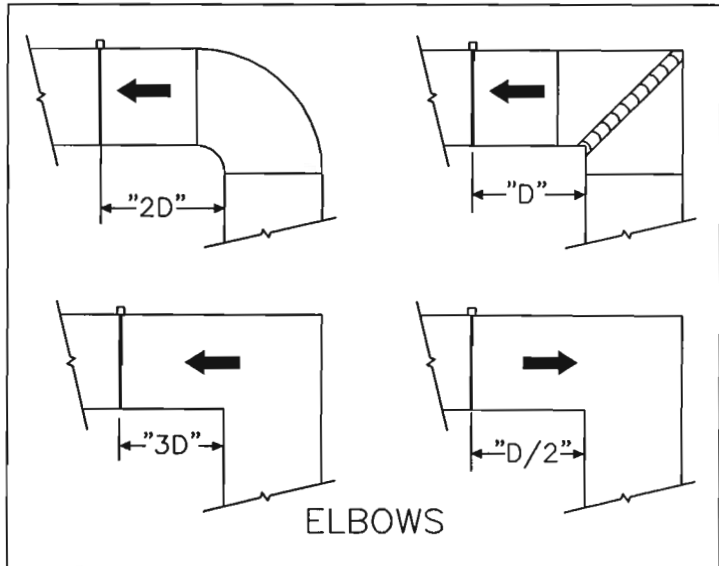
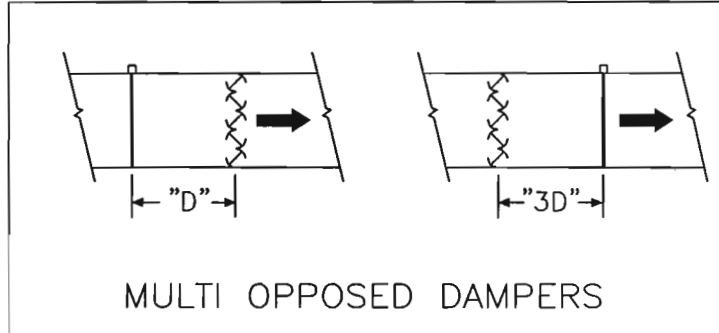
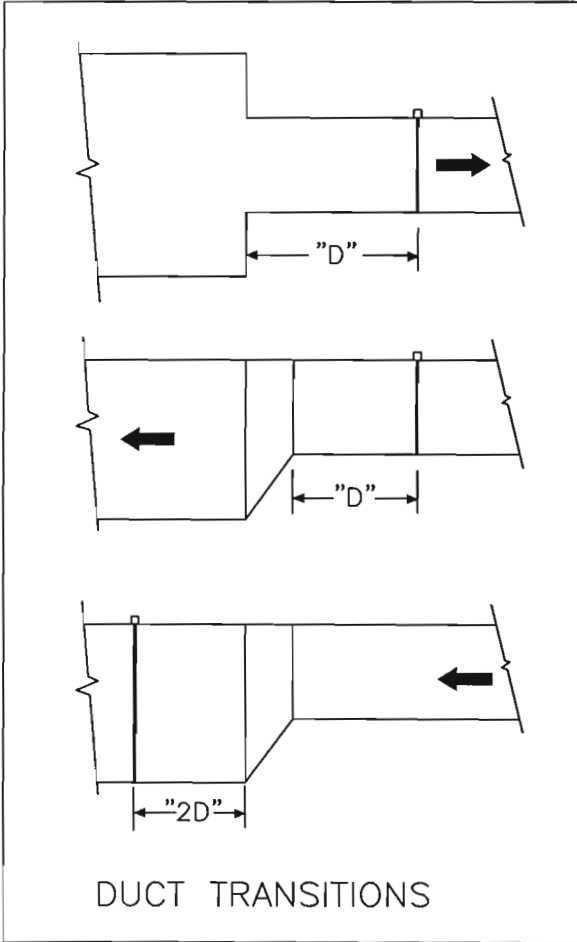
FLOW MEASUREMENT TECHNOLOGIES INC.
855 EAST JAMES STREET, LEHIGHTON, PA 18235
(610) 377-6050 Fax (610) 377-2658

MINIMUM INSTALLATION REQUIREMENTS

Airflow station accuracy is dependent on the upstream and downstream flow disturbances caused by changes in the duct size or direction. The following examples are intended as a guide to the minimum straight length of duct required to maintain stated flow station accuracy. For duct velocities in excess of 2500 fpm, multiply the straight duct requirements by 1.7.

Note:

Outdoor air intake applications requires the flow probes to be mounted far enough downstream of the intake louver to eliminate water accumulation.



$$D = \frac{H+W}{2}$$

H = DUCT HEIGHT
W = DUCT WIDTH



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