METER A
Insertion Style

METER A Smart Mass Flow Meter provides a reliable solution for inert gas flow measurement applications. Low-flow sensitivity, fast response and outstanding range-ability have made this model the instrument of choice for many critical gas flow applications.

The Smart microprocessor-based transmitter integrates the functions of flow-range adjustment, meter validation and diagnostics in a probe-mounted NEMA 4X (IP65) housing. Mass flow rate and totalized flow, as well as other configuration variables can be displayed on the meter's optional 2 x 12 backlit LCD panel. The meter provides an optical/galvanic isolated flow output, two alarm outputs and one contact input for range or gas selection. The programmable transmitter is easily configured through three push buttons built into the device.

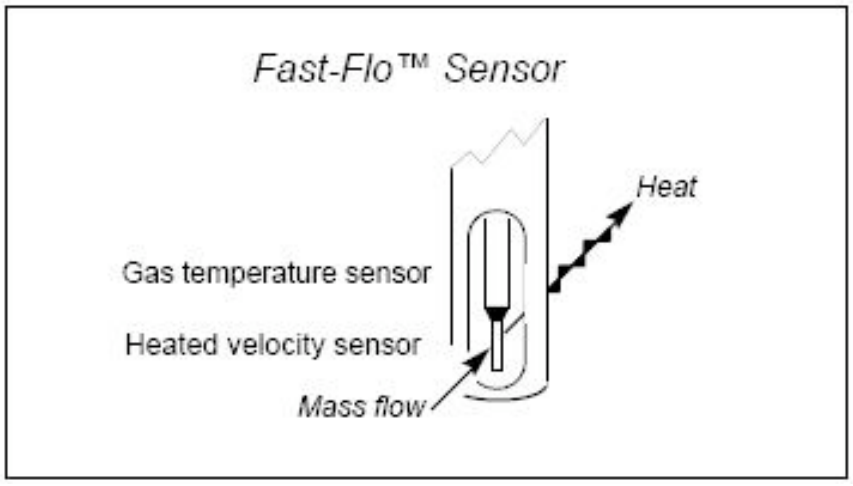
TheDryerGuy.com **METER A** is suitable for pipes or ducts from 1 1/4 inches up to 2 1/2 inches. The simple installation combines with an easy-to-use interface that provides quick setup, long term reliability and accurate mass flow measurement over a wide range of conditions.

METER A
Insertion Style

The unique Fast-Flo™ sensor probe is responsible for the unsurpassed accuracy and reliability of the METER A mass flow meters. The sensor consists of two sensing elements–a velocity sensor and a temperature sensor, which automatically corrects for changes in gas temperature. When power is applied to the flow meter, the transducer electronics heats the velocity sensor to a constant temperature differential above the gas temperature and measures the cooling effect of the gas flow. The electrical power required to maintain a constant temperature differential is directly proportional to the gas mass flow rate. The meter electronics measure this power and convert it into a linear 0-5 VDC (0-10 VDC optional) and 4-20 mA output signal.

The Fast-Flo sensors are reference-grade platinum resistance temperature detectors (RTD) encapsulated in glass. The platinum RTD wire is wound on a rugged ceramic mandrel for strength and stability.

The sensor is located at the tip of a 0.375 inch (3/8”) diameter, 304 stainless steel probe which is inserted in the gas stream. The Smart electronics are packaged in a weatherproof NEMA 4X (IP65) enclosure mounted either directly on the sensing probe.



METER A
Insertion Style

Instrument Validation
Two simple tests offer full “field-validation” of your Smart mass flow meter. The first test checks the system electronics, linearization and microprocessor functionality. This is performed by injecting a known input value and confirming that the flow meter outputs the expected value. The second test verifies that the instrument’s primary sensing elements have not drifted or shifted from their original calibration. This is accomplished by measuring the resistance of the velocity and temperature sensors and comparing the results to the NIST-traceable calibration data provided with the flow meter. Together, these tests confirm that your meter is working correctly and the calibration variables did not drift, shift or change values.

K-Factor Correction
Change the calibration correction factor to compensate for flow profile disturbances or specific application conditions. The K-factor is a multiplication factor applied to the linearized flow signal. You may set the K-factor individually for each flow range.

Dual Output Signals
Smart flow meters offer two separate linear output signals proportional to flow, 0-5 VDC (0-10 VDC optional) and 4-20 mA. The 4-20 mA output can be field-configured as an active loop powered by the flow meter or an optically isolated passive loop requiring an external power supply.

Totalizer
With the optional LCD display, actual mass flow appears on line 1 and the totalized flow on line 2 both in the user-specified engineering units. The totalizer counts only the selected range and when ranges are switched, the value of the non-selected range is stored in memory. You may reset the totalizer using the 3 function buttons mounted on the PCA or by using a hand-held magnet.

Zero and Span Outputs
Validate and adjust the settings to ensure output circuits are correct.

METER A
Insertion Style

Time Response Delay
Select from a low response for faster tracking to a high response for a smoother output.

Installation Overview

The METER A flow meter is factory calibrated to the specific pipe size shown on the meter's Certificate of Calibration. The factory calibration eliminates the task of calculating the average flow across the pipe to determine the correct insertion depth. Simply insert the flow meter sensor to the centerline position of the pipe. (If the pipe size differs from the meter's calibrated size, return the meter to the factory for re-calibration.)

When selecting an installation site, make sure that:

1. Line pressure and temperature will not exceed the flow meter rating. Temperature should not vary more than 120°F (50°C) from the calibration temperature. Line pressure should not vary more than 50 psi (3.4 bar) around the calibrated pressure.

2. The location meets the required minimum number of pipe diameters upstream and downstream of the sensor head.

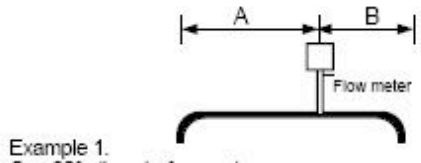
3. Safe and convenient access with adequate clearance. Also, verify the meter is located where the gas is clean and dry and the meter is calibrated for the gas to be measured.

Also, before installation check your flow system for anomalies such as:
· leaks
· valves or restrictions in the flow path that could create disturbances in the flow profile that might
  cause unexpected flow rate indications
· heaters that might cause rapid excursions in the measured temperature

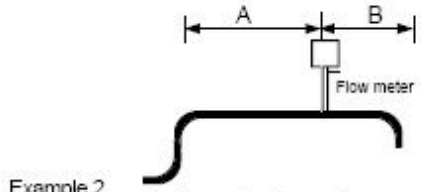
METER A
Insertion Style

Unobstructed Flow Requirements

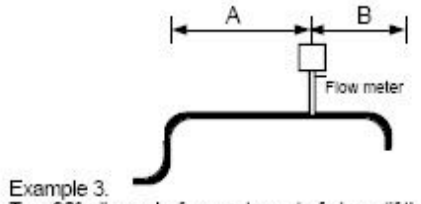
Select an installation site that will minimize possible distortion in the flow profile. Valves, elbows, control valves and other piping components may cause flow disturbances. Check your specific piping condition against the examples shown below. In order to achieve accurate and repeatable performance install the flow meter using the recommended number of straight run pipe diameters upstream and downstream of the sensor.



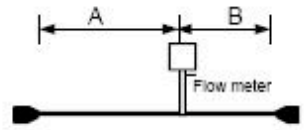
Example 1.
One 90° elbow before meter



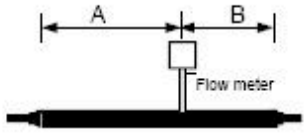
Example 2.
Two 90° elbows before meter in one plane



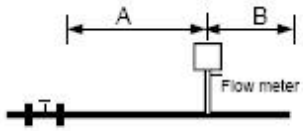
Example 3.
Two 90° elbows before meter out of plane (if three 90° bends present, double recommended length)



Example 4.
Reduction before meter



Example 5.
Expansion before meter



Example 6.
Regulator or valve partially closed before meter (If valve is always wide open, base length requirements on fitting directly preceding it)

Example	A Upstream(1) Requirements	B Downstream(2) Requirements
1	10 D	5 D
2	15 D	5 D
3	25 D	10 D
4	10 D	5 D
5	20 D	5 D
6	25 D	10 D

(1) Number of diameters (D) of straight pipe required between upstream disturbance and the flow meter.
(2) Number of diameters (D) of straight pipe required downstream of the flow meter.

Figure 2-1. Recommended Pipe Length Requirements for Installation

METER A
Insertion Style

Installation

Use the following data as a guide to prepare the pipe for flow meter insertion. Refer to a standard code for all pipe tapping operations. The following instructions are general in nature and intended for guideline purposes only.

1. Turn off the flow of process gas. Verify that the line is not pressurized.

2. Confirm that the installation site meets the minimum upstream and downstream pipe diameter requirements.

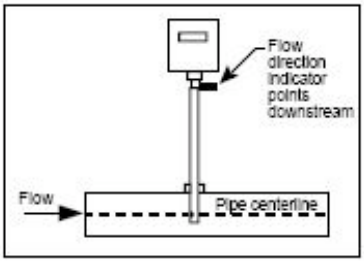
3. Use a cutting torch or sharp cutting tool to tap into the pipe. The pipe opening must be at least .375 inches in diameter. (Do not attempt to insert the sensor probe through a smaller hole.)

4. Remove all burrs from the tap. Rough edges may cause flow profile distortions that could affect flow meter accuracy. Also, obstructions could damage the sensor assembly when inserting into the pipe.

5. Mount the 3/8 inch compression fitting on the pipe. Make sure this connection is within ± 5° perpendicular to the pipe centerline.

6. When installed, cap the fitting. Run a static pressure check on the connection. If pressure loss or leaks are detected, repair the connection and re-test.

7. Insert the sensor probe through the compression fitting into the pipe. The correct insertion depth places the larger hole in the probe at the pipe's centerline. Do not force into the pipe.



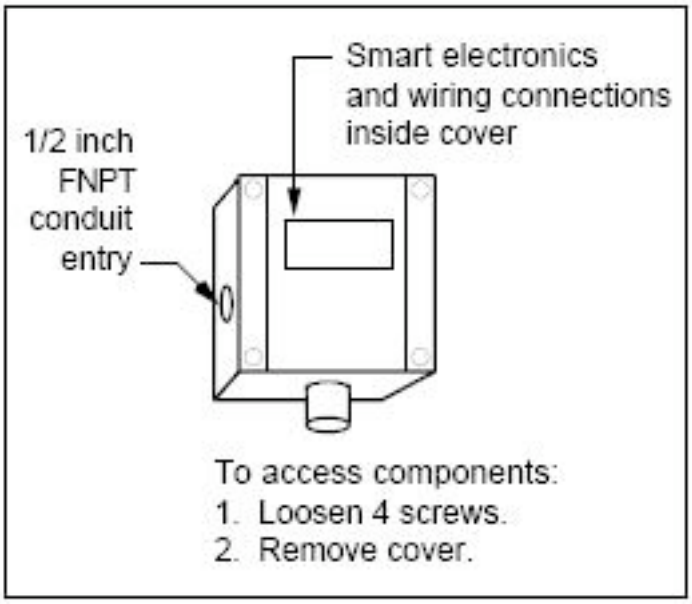
8. Align the sensor head using the flow direction indicator. Adjust the indicator parallel to the pipe and pointing downstream in the direction of flow.

9. Tighten the compression fitting to lock the flow meter in position. When the compression fitting is tightened, the position is permanent (unless using Teflon ferrules).

METER A
Insertion Style

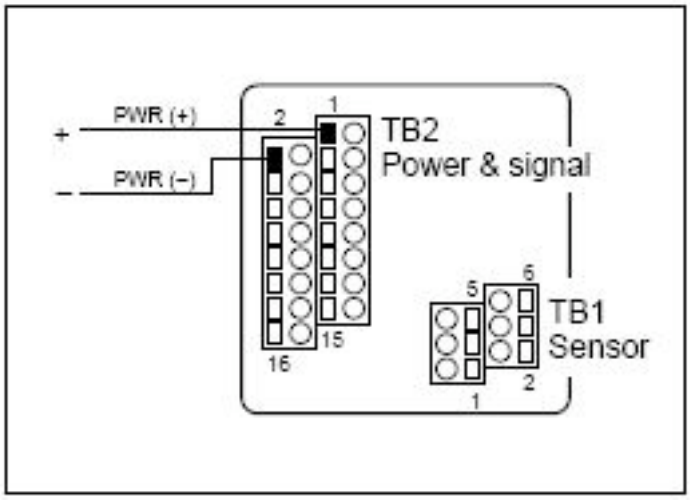
Wiring Connections

The NEMA 4X enclosure contains an integral wiring compartment with one dual strip terminal block for power and signal connections and one dual strip terminal block for sensor connections. The enclosure has one 1/2 inch female NPT conduit entry. The terminal designations are labeled inside the enclosure cover.

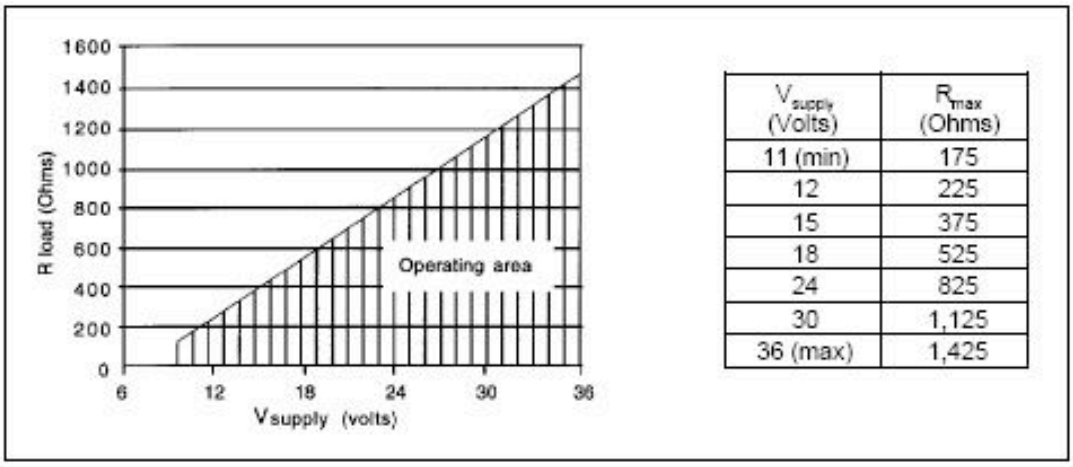


Input Power Wiring

Depending on the flow meter configuration, connect 11 to 18 VDC or 18 to 30 VDC (625 mA load, maximum) as shown below. Confirm power configuration **before** applying power. See the flow meter nameplate for input power rating.



METER A
Insertion Style



V_{supply} (Volts)	R_{max} (Ohms)
11 (min)	175
12	225
15	375
18	525
24	825
30	1,125
36 (max)	1,425

Figure 2-5. Load Resistance Versus Input Voltage

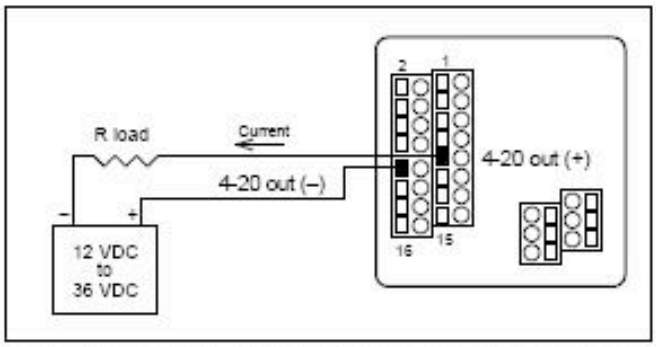
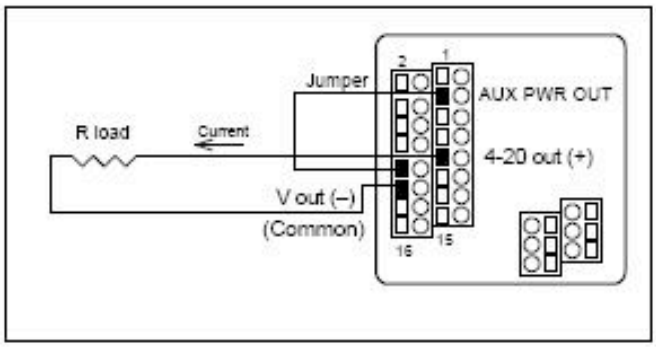


Figure 2-6. Isolated 4-20 mA Current Loop Connections



METER A
Insertion Style

Alarm Output Wiring

Two alarm outputs (Low Alarm and High Alarm) are included on the flow meter terminal block. The alarm outputs relays are normally-open single-pole relays with one common connection.

There are two connection options for alarm outputs–the first with a separate power supply (isolated) and the second using the flow meter power supply (non-isolated). Use a separate power supply if a specific voltage is needed for the alarm output. Use the second (non-isolated) configuration if the voltage at the flow meter's power supply is an acceptable driver voltage for the load connected. (Take into account that the current used by your alarm loads have to come from the flow meter's power supply.) In either case, the voltage of the alarm output is the same as the voltage supplied to the circuit.

To use an external power supply for an isolated alarm output, connect as shown in Figure 2-8. To use the internally powered, non-isolated alarm output connect as shown in Figure 2-9. For a window alarm connect both outputs together.

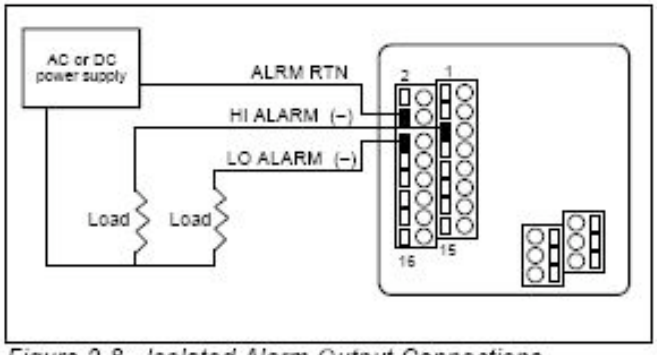


Figure 2-8. Isolated Alarm Output Connections

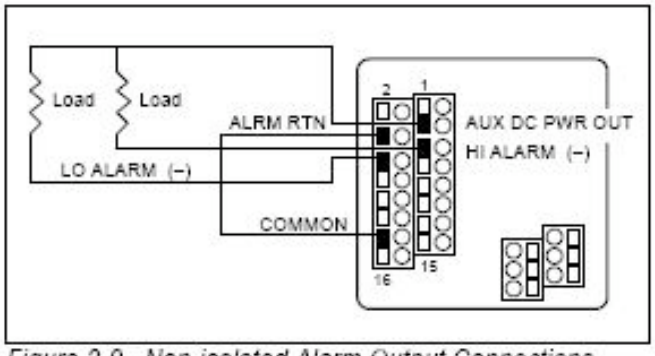


Figure 2-9. Non-isolated Alarm Output Connections

METER A
Insertion Style

Operation

Using the Smart Electronics Basic Features

Three push buttons allow selection and adjustment of the basic user functions. Use the push buttons to enter:

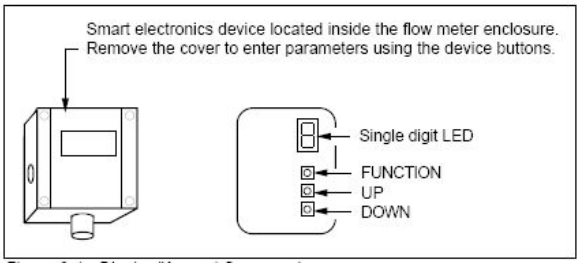
- alarm parameters
- change the user full scale
- adjust the K-factor
- adjust the time response speed
- reset the totalizer

You may view parameters using the optional LCD front panel display or by selecting functions on the single-digit LED and viewing the meter's 0-5 VDC output with a digital voltmeter (DVM).

Before making changes or adjustments:

For meters with LCD display, remove the enclosure cover to access the Smart electronics device. Press the FUNCTION key to view and record the factory settings. When pressing FUNCTION the optional LCD display prompts for a password, press FUNCTION again to skip the password and review the current settings. (To make changes, at the password prompt press the UP arrow until 11 is displayed, press FUNCTION to continue.) For flow meters without the display, remove the enclosure cover to access the Smart electronics device. Connect the DVM as described on the following pages and record the factory-set parameters. After 12 seconds of non-activity during programming, the meter returns to the Run Mode with any new settings immediately in effect.

For units without a LCD front panel display: if the unit "times-out" when entering a new parameter, press the FUNCTION button *only* to resume adjustments.

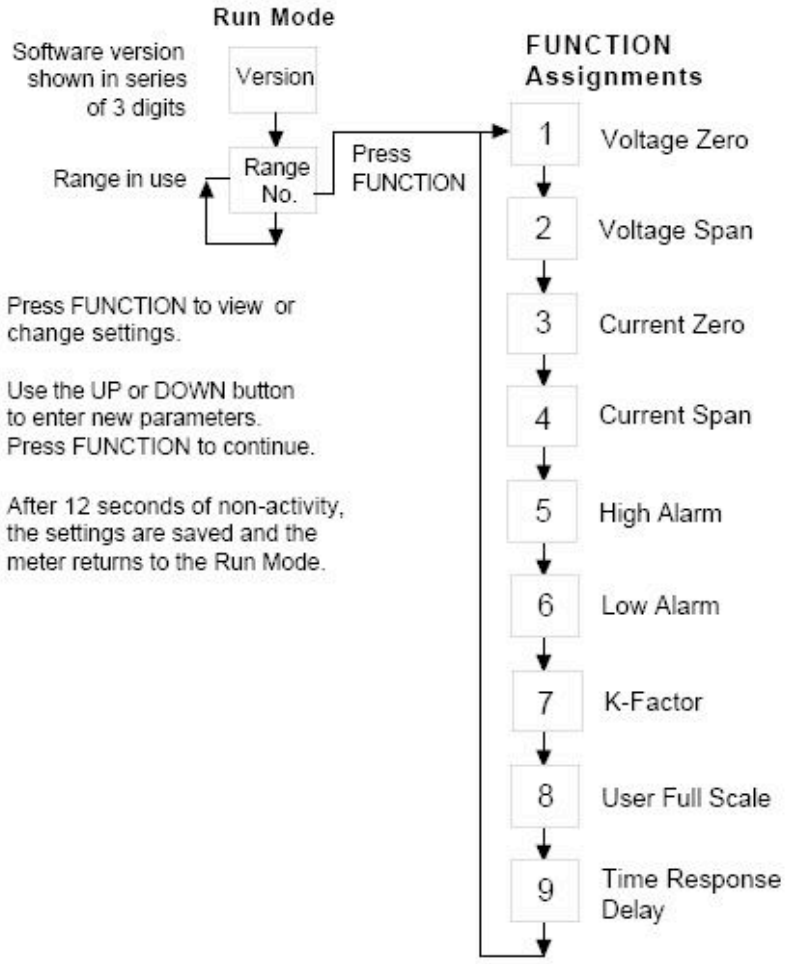


METER A
Insertion Style

Flow Meter Start Up

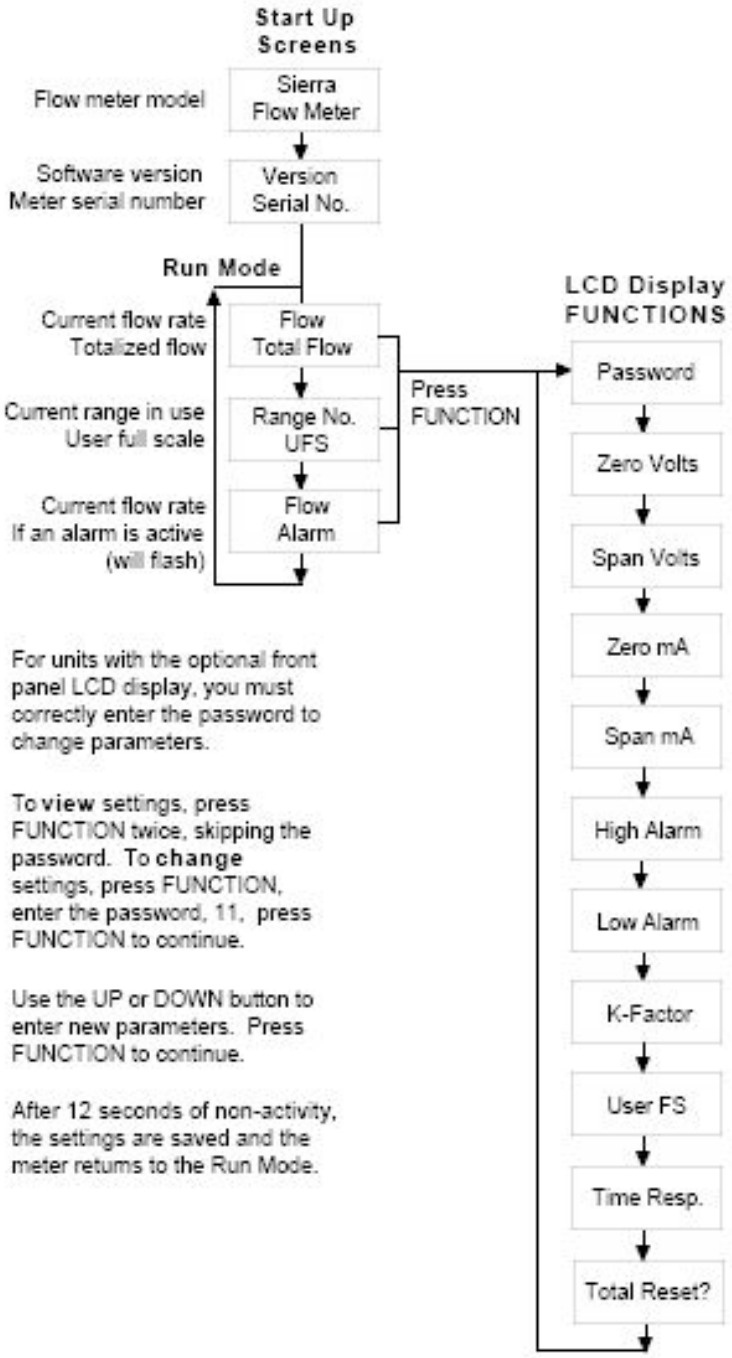
When applying power to a flow meter equipped with the optional LCD display you will see the product name, the software version, unit serial number, the range number, the user full scale (UFS), the current flow rate and the totalized flow. Any active alarm will flash on the screen every few seconds. For meters without the optional display, when power is applied the on-board single-digit LED flashes the revision number of the software in a series of 3 digits, followed by the range number; the range number continues to flash every 3 seconds thereafter.

Using the Single-Digit LED for Programming



METER A
Insertion Style

Using the LCD Display for Programming



For units with the optional front panel LCD display, you must correctly enter the password to change parameters.

To **view** settings, press FUNCTION twice, skipping the password. To **change** settings, press FUNCTION, enter the password, 11, press FUNCTION to continue.

Use the UP or DOWN button to enter new parameters. Press FUNCTION to continue.

After 12 seconds of non-activity, the settings are saved and the meter returns to the Run Mode.

METER A
Insertion Style

Totalizer Reset
Reset the totalizer using the keypad. If you are unable to open the flow meter enclosure, use a magnet to reset the totalizer as shown below.

1. Select the desired range. Enter the password. Press FUNCTION until *Total Reset?* appears on the display.

2. Press the UP button and then the DOWN button until the display reads "Resetting Totalizer."

Instrument Validation
System electronics are verified by injecting a known input value and confirming that the flow meter outputs the expected value. This test confirms that the microprocessor, analog to digital and digital to analog converters, the linearizer and the display are working properly. Sensor validation is accomplished by measuring the resistance of the velocity and temperature sensors and comparing the results to the NIST-traceable calibration data provided with the flow meter.

These tests confirm that your meter is working correctly and the calibration variables did not drift, shift or change values. To perform the instrument validation procedures you will need these items:

· certified digital multimeter with minimum 4 character resolution, accuracy of at least ± 0.1% of range
· Calibration Certificate supplied with the flow meter
· small pot adjusting tool (screwdriver)

METER A
Insertion Style

Electronics Validation Procedure

1. Verify the flow meter is off line from any remote communications. Make sure the meter's user full scale setting is the same as the factory full scale setting. If not, adjust the user full scale value as needed.

2. Locate the Calibration Certificate supplied with the flow meter. Record in Table 3-1 the five bridge voltage values, the output (VDC or mA) values and the indicated flow values.

3. Remove power from the flow meter. Remove the cover(s) of the flow meter enclosure to access the wiring terminal block andthe Smart electronics device.

4. Set the multimeter to the 20 volt range. Connect to BV(+) and BV(–) terminals on the flow meter terminal block.

5. Move the J1 Cal/Run jumper on the Smart electronics device to the CAL position. Locate potentiometer VR3 on the Smart electronics device. Turn on power to the flow meter.

6. Adjust potentiometer VR3 until the multimeter matches the first bridge voltage point (the value must be ± 0.002 VDC of the bridge voltage point).

7. Record the resulting flow shown on the optional LCD display in Table 3-1. If not using a display or if you prefer to validate one of the analog output signals, move the multimeter + connection to Vout (+). Record the resulting output voltage in Table 3-1. If using a 4-20 mA calibrated meter, set the multimeter to read current and connect the meter to read the mA signal in your connected loop. Record the resulting current output in Table 3-1.

8. Repeat Step 6 and Step 7 to record the results of the remaining four bridge voltage validation points in Table 1. Compare the values recorded in Table 3-1. Indicated values must be within the
flow meter's stated accuracy shown on the Calibration Certificate.

9. When data collection is complete, turn off power to the flow meter. Disconnect the multimeter from the flow meter terminal block.

10. Place the J1 Cal/Run jumper in the RUN position. Make sure the jumper is securely in place before resuming flow meter operation. Replace the flow meter cover(s).

Product Specifications

Operating Specifications

Gases	Air, nitrogen and other non-combustible, non-corrosive gases
Mass Flow Rates	0 to 200 sfpm (0 to 1 nmps) minimum, 0 to 20,000 sfpm (0 to 100 nmps) maximum for air and nitrogen (maximum full scale varies with gas)
Dual Calibration	User-selectable dual ranges or two different gases (the user full scale For Range 2 two cannot be less than 10% of the full scale for Range 1)
Gas Pressure	150 psig (10 barg) at 80°C (176°F)
Pressure Drop	Negligible
Gas & Ambient Temperature	Gas…….....14° to 176°F (–10° to 80°C) Ambient....32° to 122°F (0° to 50°C)
Power Requirements	11 to 18 VDC (regulated), 625 mA maximum 18 to 30 VDC (regulated), 625 mA maximum
Output Signal	Linear 0-5 VDC (0-10 VDC optional) proportional to point mass flow rate or velocity, 1000 Ohms minimum load resistance, and linear 4-20 mA proportional to point mass flow rate or velocity, 700 Ohms maximum resistance (power supply dependent), optically isolated (isolation is an input-to-output isolation of 1500 VAC for 1 minute)
Alarms	User-adjustable low, high or window alarms Deadband adjustable with Smart Interface™ software Relay rating.....Maximum 42 VAC or 42 VDC, 140 mA, 27 Ohm Maximum on-resistance, optically isolated (isolation is an input-to-output isolation of 1500 VAC for 1 minute)

METER A
Insertion Style

Display	Alphanumeric 2 x 12 digit backlit LCD Adjustable variables via on-board membrane buttons or with Smart Interface software Adjustable variables.....Full scale adjustment (50 to 100%) Time delay response (0.1 to 7.2 seconds) Correction factor setting (0.5 to 5) Zero and span adjustments
Totalizer	Eight digits (99,999,999) in engineering units, re-et-able by user

Performance Specifications

Accuracy	± 1% of full scale + 0.5% RDG
Repeatability	± 0.24% of full scale

Temperature Coefficient

± 0.02% of reading per °F within ± 50°F of customer specified conditions
± 0.03% of reading per °F within ± 50°F to 100°F of customer specified conditions
±0.04% of reading per °C within ± 25°C of customer specified conditions
±0.06% of reading per °C within ± 25°C to 50°C of customer specified conditions

Pressure Coefficient	0.02% per psi
Response Time	250 milliseconds to 63% of final velocity value

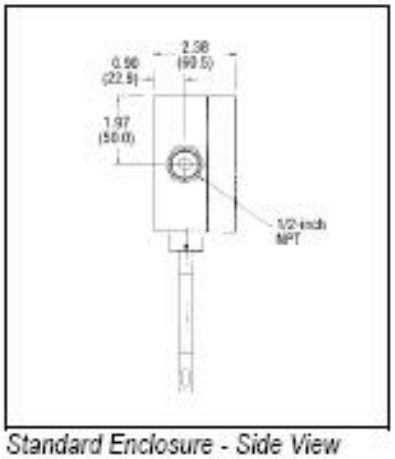
Physical Specifications

Wetted Materials Probe:	304SS, epoxy, ceramic, Viton
Enclosure	NEMA 4X (IP65) powder-coated cast aluminum enclosure
Mounting	3/8-inch tube compression fitting with 1/2-inch male NPT
Certifications	CE approved

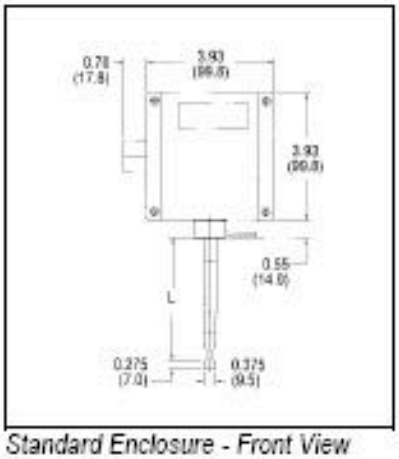
METER A
Insertion Style

Mounting Dimensions

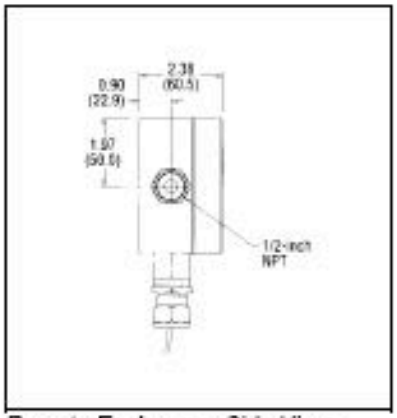
Length Chart for all Views	
Code	L
L04	4.0 (101.6)
L06	6.0 (152.4)
L09	9.0 (228.6)
L13	13.0 (330.2)
L18	18.0 (457.2)
L24	24.0 (609.6)



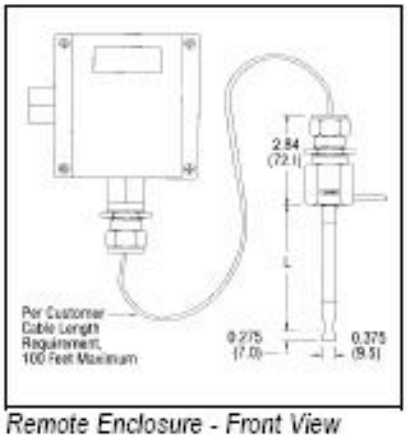
Standard Enclosure - Side View



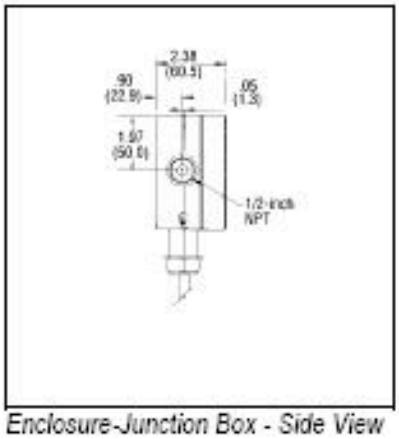
Standard Enclosure - Front View



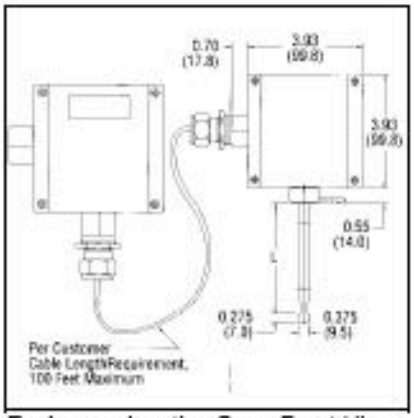
Remote Enclosure - Side View



Remote Enclosure - Front View



Enclosure-Junction Box - Side View



Enclosure-Junction Box - Front View

NOT SHOWN:

*Entering Alarm Parameters
*K-factor Adjustment
*User Full Scale Adjustment
*Advanced Features
*Voltage Zero Adjustment
*Voltage Span Adjustment
*Current Zero Adjustment
*Current Span Adjustment
*Sensor Validation Procedure
*Trouble Shooting / Repair

***WARNINGS

***Since this information is not complete and it does not include any of the manufacturers WARNINGS, this document should not be used for installation or set-up of your device. Please refer to the manual that is included with the product.