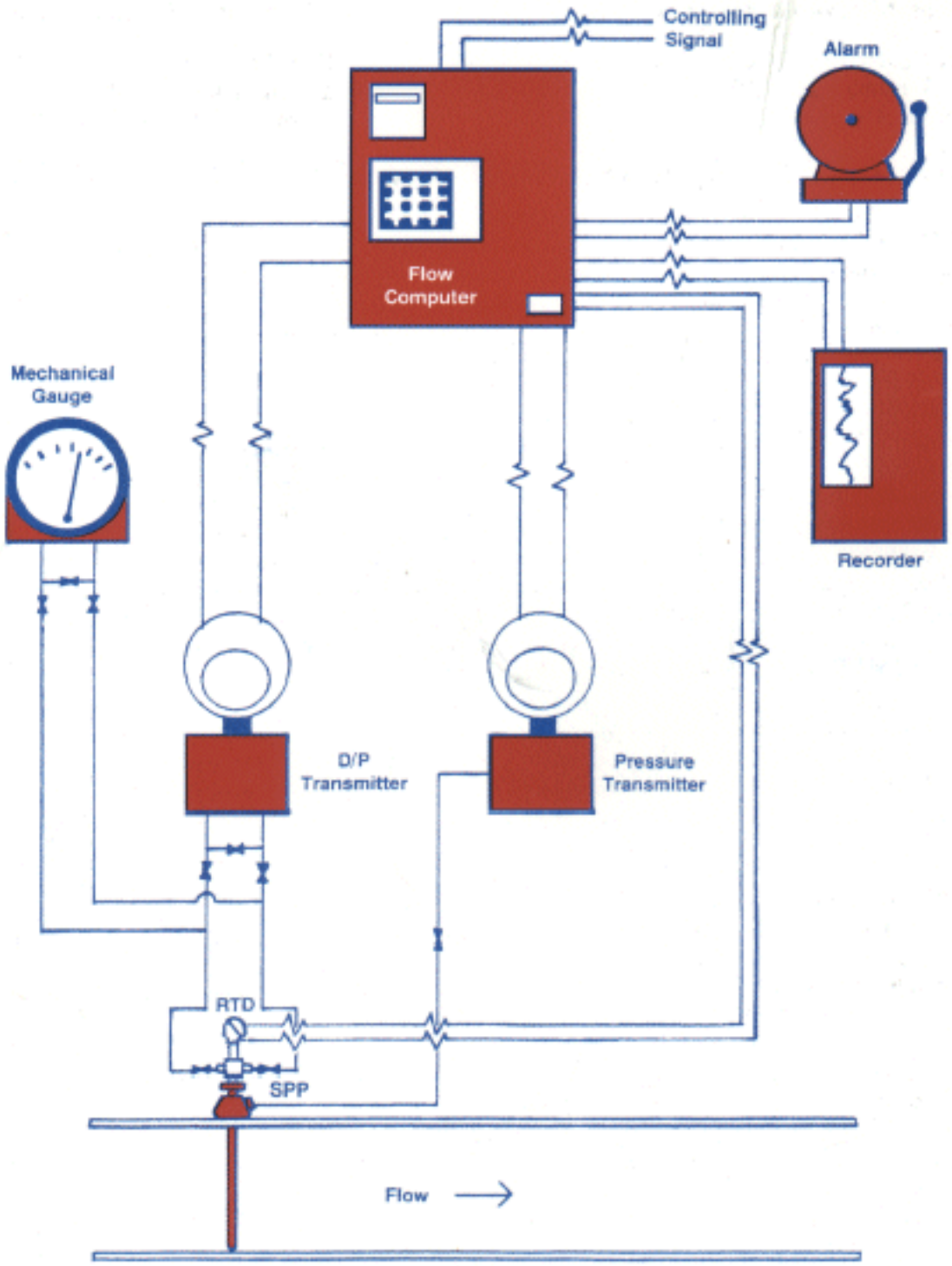
Tri-Flo Tech, Inc.

Custom Flow Elements - Rapid Delivery at Competitive Prices

PITOT TUBES
D/P & G/P TRANSMITTERS
FLOW COMPUTERS
CONDENSATE POTS
3-VALVE MANIFOLDS
D/P GAUGES
EASY MOUNTS
HAND CRANK RETREATABLES
BY-PASS SYSTEMS
Multivariable MASS FLOW



Tri-Flo Tech, Inc.

Custom Flow Elements - Rapid Delivery at Competitive Prices

would like to express our thanks to the companies listed below for their permission to reprint some of their literature and drawings.

ENDRESS & HAUSER CO.
2350 Endress Place
Greenwood, Indiana 46143

MUELLER CO.
500 West Eldorado Street
Decatur, IL 62525-1808

TYLOK INTERNATIONAL, INC.
P.O. Drawer 924130
Euclid, Ohio 44132

UTAH STATE UNIVERSITY
Utah Water Research Laboratory
Logan, Utah 84322-8200

TABLE OF CONTENTS LISTED IN ALPHABETICAL ORDER

THE ROUND SENSOR AND HOW IT PERFORMS

Headmeter Type Flow Meters like the averaging pitot tubes built by **Tri-Flo Tech** base their readings on * Bernoulli's Theorem & Chebychef Calculus. Put into easy terms, differential pressure has a direct mathematical relationship with the true amount of flow in a given system.

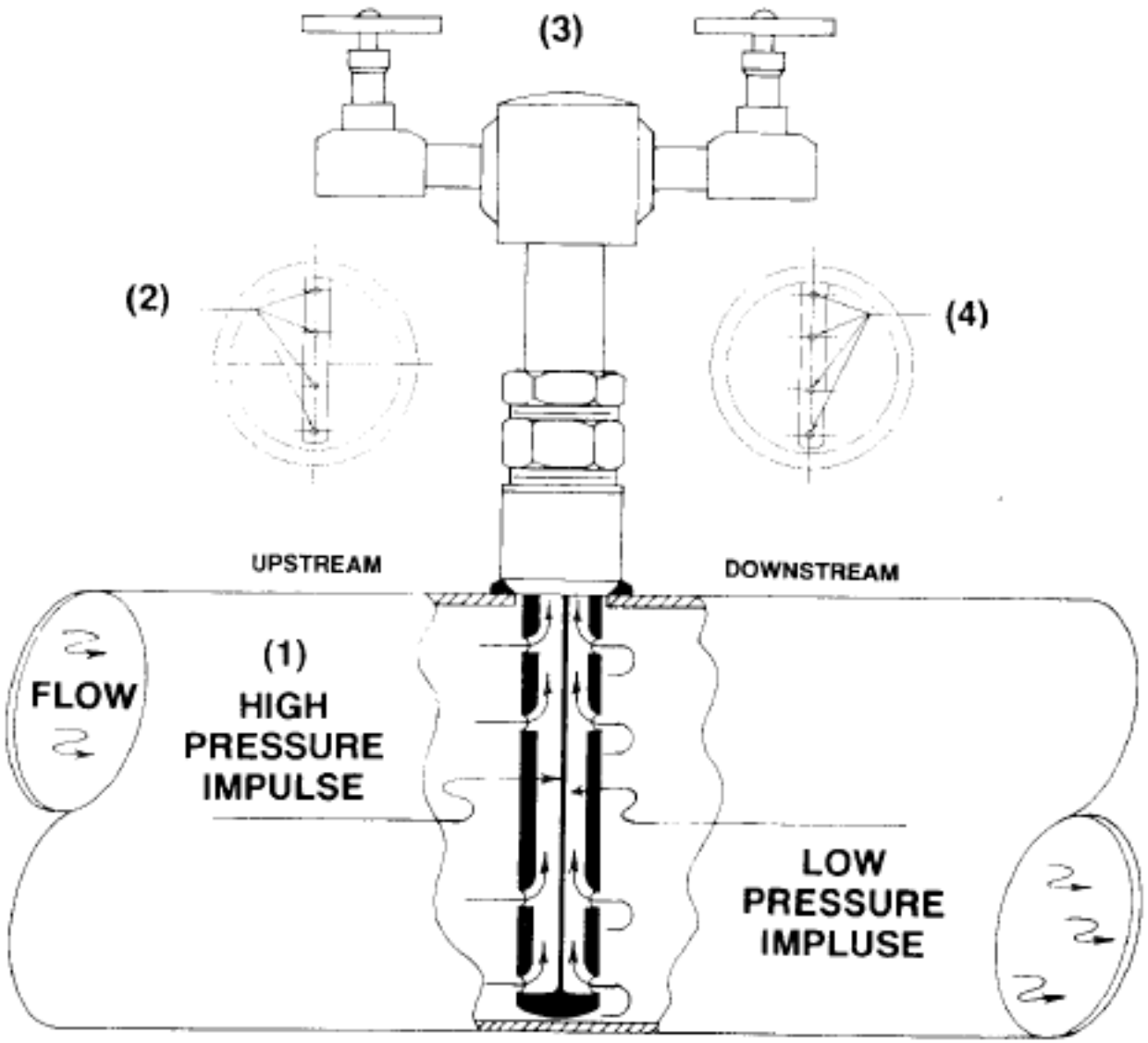
The * (1) High Pressure Impulse is developed from either four or six holes (depending upon the size of the sensor). Hole placement is determined by computer at **Tri-Flo Tech**. Each sensor has it's own work sheet print out to document performance. Location of the holes provides an average of the differential pressure across the flow stream.

Tri-Flo Tech's simple basic design allows large internal openings to pick up the pressure and transfer it into the impulse line without fear of plugging. The upstream * (2) (High Pressure Impulse) consist of a signal tube which is free of curves. This simplicity reduces the chance of any type of particulate accumulation.

The * (3) instrument connections are designed to make it easy to hook-up to any of the many readout devices. For example: D/P transmitters, recorders, direct reading equipment or others as dictated by your particular instrument application.

The locations of the down steam holes * (4) (Low Pressure Impulse) are directly behind the upstream hole.

Tri-Flo Tech also averages the low pressure for a more accurate signal. We have found this bimodal method gives a more stable signal over a wider range of flow.



We are pleased to have this opportunity to introduce our company to you. **Tri-Flo Tech** provides the industrial and commercial industries with products that perform equal or exceed the performance of any similiar flow measuring head meters that are currently used to measure differential pressure.

Whether you are a large engineering firm or you are a smaller commercial operation we have a sensor for your application. Specifying engineers can be assured of support for their special application problems (we will provide adequate assistance over the phone or in person to keep your problems to a minimum). Our standard unit (Model 140) uses a packing gland for easy installation, the Model 205 is our low pressure hot tap sensor, the 310 can be inserted into very high temperature and pressure application, the flange unit gives the maximum temperature pressure rating depending upon the rating of the flange. Of course for the small line sizes we have a complete selection of inline models. If the flow is too great for the standard model then we provide the super duty which will withstand much higher dynamic forces created by the higher volume of the moving media.

The simple ease of operation make the averaging pitot tube the best choice for a very wide range of process flow applications.

Listed below are just a few of the many reasons why **Tri-Flo Tech** sensors work excellent in air, gas, water and stream applications.

When you compare installing one of our sensors to an orifice plate you will find the following:

INSTALLATION COST

1. **Tri-Flo Tech** sensors take less than 10% of the time.
2. There is usually only 10% of the welding required.
3. **Tri-Flo Tech** sensors can be installed under operating conditions with a minimum effort.

MAINTENANCE COST

Maintenance Cost are negligible as there are no moving parts and the round sensor is not subject to the type of wear that affects orifice plates.

NON-CLOGGING

Systems for Industry sensors have a large internal signal area which prevents clogging in steam and high particulate flow condition. EX: Coke Oven Gas.

1. Non-clogging reduces the cost of purging equipment.
2. Due to the round design, dirt build-up is minimal, hence there is no change in coefficients needed.
3. 316 stainless steel construction provides very long life.
4. Systems for Industry sensors produce very low permanent pressure loss

ACCURACY

We provide precision flow measuring products which will provide an accuracy within ±1% of the true flow.

REPEATABILITY

Lab testing shows 99.99% under similar conditions.

The range of pipe and duct applications are from 1/2" to 240". So you can see Systems for Industry has a product that will fill most industrial and commercial flow conditions.

The range of products vary from the Std. Packing Gland Model up to the large Pipe Hot-tap Models. Systems for Industry also wants to provide the Test and Balance Market with an accurate, inexpensive test probe.

Tri-Flo Tech will be very receptive to your special needs, as we are aware that many times the location of the sensor may require special mounting hardware which we will be glad to provide.

TYPICAL USE APPLICATION

Absorbers
Aeration
Air Monitoring
Boilers
Burners
Coke Over Gas
Compressor Performance
Condensors
Cooling Systems
Cooling Towers
Custody Transfer
Drying Towers
Efficiency Rating of Equipment
Emission Volume
Fan Performance
Filter Plugging
Fuel Conservation
Heat Exchangers
Heating Systems
Input Volume
Load Balancing
Multi-Directional Control
Output Volume
Process
Safety
Smoke Stacks
Steam
Steam Towers
Test and Balance
Valve Throttling
Waste Management
Water Measurement

On the proceeding pages you will find a complete description of the flow measuring products we have to offer.

ACCURACY & REPEATABILITY

There is much concern in the flow measurement industry about accuracy. This concern is very well justified as the accuracy of the information is only as good as the reading from the final readout device. So accuracy is one of the more important factors to consider in flow measurement.

ACCURACY is a term defined as how well a certain device produces a signal that is in mathematical proportion to the true amount of flow.

Tri-Flo sensors installed under the proper conditions will give a reading of ±1% of the total flow. Independent testing has confirmed this range. Field calibration can correct most deviation from the standard. Such calibration is sometimes valuable in installation when the necessary upstream and downstream requirement; cannot be met by the customer.

Tri-Flo Tech selected **Utah State University,** Utah Water Research Laboratory, Logan, Utah to test our sensors results below.

TESTS FOR REPEATABILITY were performed on the

Tri-Flo sensors using the media of clean water at ambient temperature. The test equipment used was a digital electronic stopwatch accurate to within 1/100th of a second. A digital weight scale was connected to a mechanical switch nozzle to assure consistent results. Flow was established to fill the test container in exactly two minutes. Readings were taken on an electronic micromanometer with a full sweep needle. A pre-set needle and a 10X magnification viewing dial reduced the chance of human error. Twenty-one tests were conducted on the same day, under the same conditions, and on the mathematical average the total results demonstrated less than ±0.099 error over 2 std. deviations.

ACCURACY & REPEATABILITY -

Tri-Flo sensors do not have any moving parts. When the same theoretical flow conditions exist, the sensors will give the same reading. In the real world it is very difficult to duplicate anything.

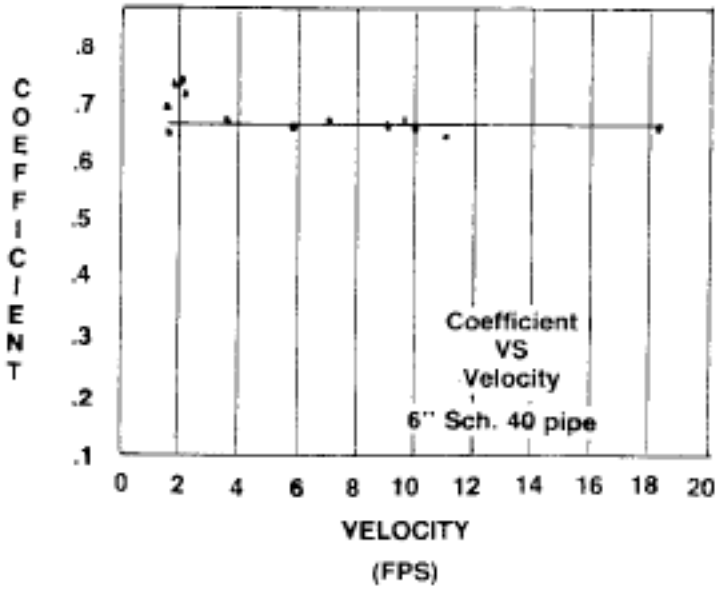
Tri-Flo has achieved (and surpassed) the difficult task of repeatability.

LONGEVITY is another consideration for flow meters and test devices. The orifice plate has been used a very long time and is considered the standard in flow measurement.

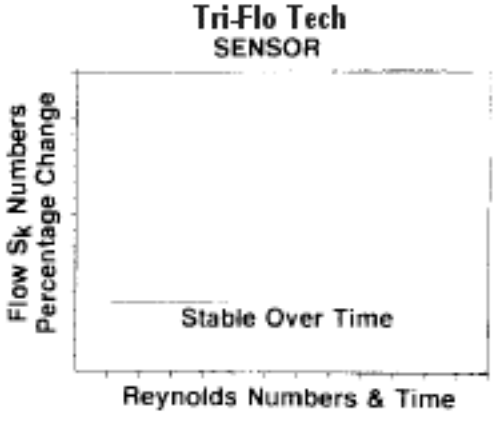
Tri-Flo Tech sensor will perform with repeated accuracy for many years. An orifice plate is accurate the day it is installed but from then on it will have a decrease in accuracy.

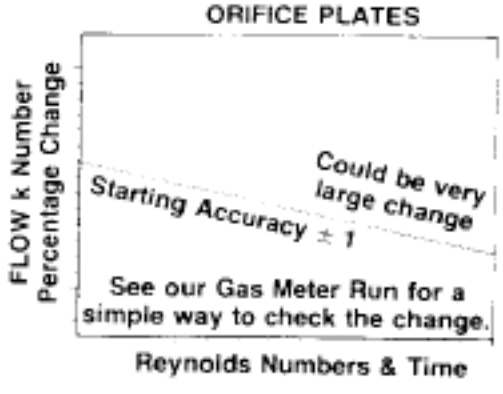
Tri-Flo Tech has solved the problem of guessing when is the orifice plate is not performing the same as new. Turn to page 17 for our ASME calibrated meter run.

Edge wear, physical damage to the surface, dirt, or grease buildup can cause the flow coefficients to vary as much as 15 to 18% over a short period of time.



You will notice that we have a very straight line coefficient existing over a very wide range of flows.



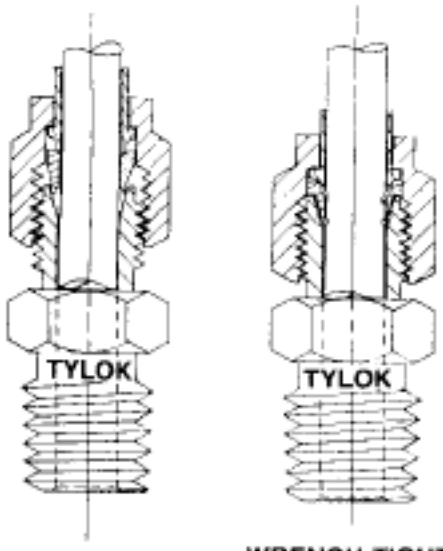


STANDARD SENSORS

The **Model 140** is our most basic sensor. It is simple to install. All that is needed is to determine the proper location for the sensor. (See chart in back of book). Then burn or drill a hole in the pipe or ductwork (1/4" metal or thicker) weld the fitting to the pipe, install the packing gland, slide in the sensor, turn the valves parallel to the flow stream and tighten the packing gland.

Model 140

We selected *Tylok Int. as our supplier of packing glands. In the drawing below you can see how easy it is to tell when you have the sensor properly tightened.

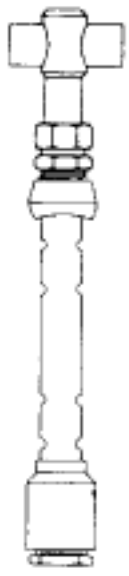


FINGER TIGHT WRENCH TIGHT

TIGHTEN UNTIL THREADS ARE COVERED

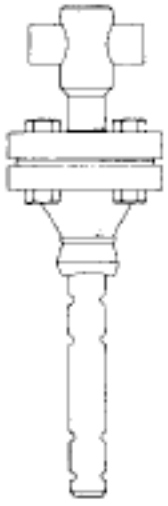
The **Model 172** is the double mounted version of our basic sensor but it will allow a much greater amount of flow without damage to the sensor.

Model 172



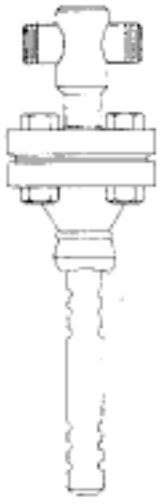
The above sensors are well suited for low to medium pressure and temperature in all of the major areas of flow (Air, Gas, Steam & Water).

When pressure or temperature exceeds the rating of the basic sensors **Tri-Flo Tech** provides a full range of flange mounted sensors from 150 # to 2500 # rating. When these are combined with the double mount options they can be used in very extreme conditions of flow volume, temperature and pressure.



Model 401

Model 600



Model 737

The **Model 401** sensor is our standard flanged unit that will allow much higher temperature and pressure based upon the flange rating. Not shown but this unit could be double mounted (See Model 421)

The **Model 600** Inline can be used under very extreme conditions and the ease of a complete meter run or a ready to install section is required.

The **Model 737** sensor is our super duty flanged unit that will accept much higher flows and severe service. This sensor diameter is 2½" which gives it much greater strength than our standard sensor. It can also be double mounted. (See Model 747)

*** Tylok Int., 1601 East 260th St., Euclid, Ohio 44132.**

HOT-TAPPING MADE EASY
INSTALL WITHOUT SYSTEM STOPPAGE OR SHUTDOWN
REMOVE WITHOUT SYSTEM STOPPAGE OR SHUTDOWN

Tri-Flo Tech provides many types of hot-tap sensors.

The model shown below is our low-pressure model which allows insertion of the sensor under the following conditions of:

160 PSIG at 200° F

Maximum flow is based on single mount service standard duty.

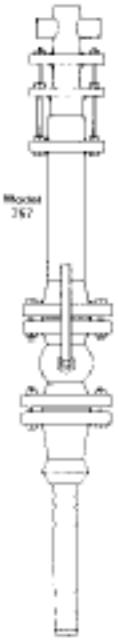
Note: Sensor shown without valves.

Model 205

The model below allows insertion of the sensor into very large pipes and under very extreme flow conditions.

Pressure and temperature based on rating of isolation valve.

Maximum flow is based on single mount service super duty.



Model 757

HOT-TAPPING OUR SENSORS

Easy as counting to five

(1) Select the proper place on pipe and install weld fitting. Make sure fitting is 90 degrees to the center line of the pipe.

(2) Attach nipple and isolation valve.

(3) When attaching hot-tap drilling equipment we suggest you use the Mueller equipment shown here. Drill through pipe, retract hot tap drill, close isolation valve, and remove drilling equipment.

(4) Install **Tri-Flo Tech** sensor. Make sure instrument valves are closed. Install isolation nipple and hardware. Use proper sealant on threads.

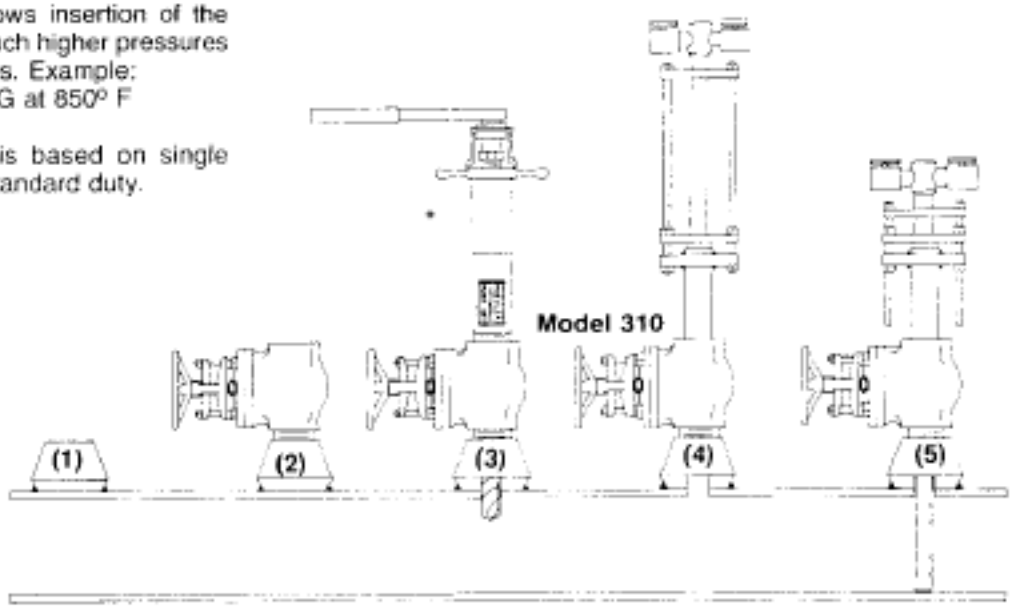
(5) Open isolation valve and insert **Tri-Flo Tech** sensor through valve until it touches the back of the pipe. Check to make sure the tie rod or chain is in proper placement depending upon type of sensor.

This completes the installation, you are ready for many years of trouble free service.

The 310 model shown at the bottom of this page allows insertion of the sensor under much higher pressures and temperatures. Example:

800 PSIG at 850° F

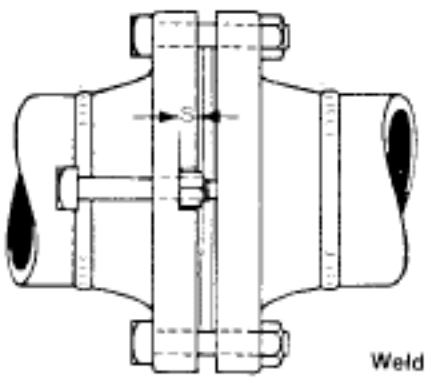
Maximum flow is based on single mount service standard duty.



OTHER SAVINGS ARE AVAILABLE

A good welder could cut the hole in the pipe and weld on the fitting in just about 45 minutes. Then the instrument personnel could install the sensor and hook up the signal lines and be operational in under an hour (depending how much impulse line must be run).

If one compares this to an orifice plate, it could realistically be up to 90% savings in time and labor.



Twice around a six inch pipe will equal about 42 inches of welding.

Once around a weld fitting that would fit a sensor into a six inch pipe is 4½ inches of welding. That fitting is a savings of 37½ inches of welding.

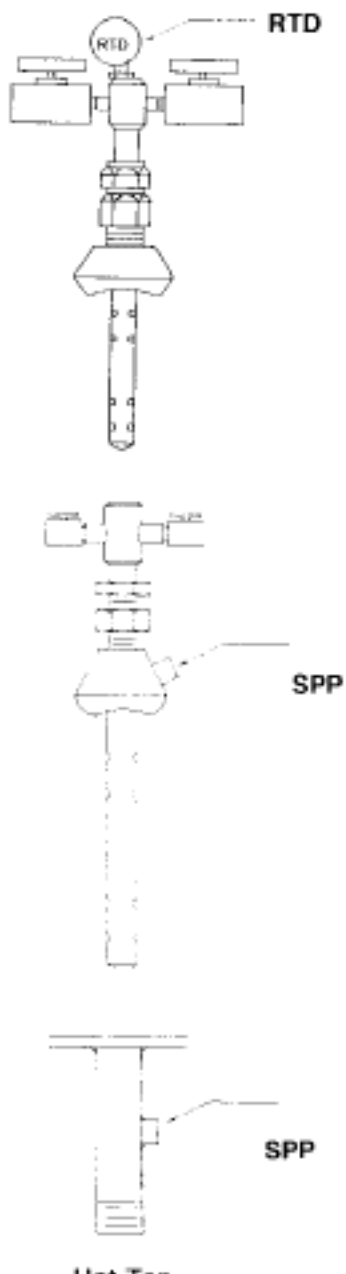
Pipe Size 6" Sch 40.
Labor based on 12.50&Hr.

	Sensor	Orfice Plate
Price	$330.00	$ 950.00
Labor	9.37	125.00
Total	$339.37	$1,075.00

Add the continuing saving of up to 72% based on the Beta-Ratio of the plate. Remember, if the restriction is removed from the pipe the easier it is to move the fluid. **Tri-Flo Tech** sensors have about a 3% permanent pressure loss compared to 50 to 70 percent permanent pressure loss for an orifice plate. **WHY** build a large line if you are going to choke it down to half its size just to get a measurement.

Dual Point Insertion

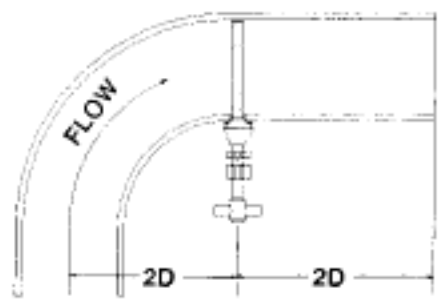
With Tri-Flo Tech you can achieve total readout information: Differential Pressure and Static Pressure. This can be achieved in one of our compact units for most line sizes. This will save your company the time and trouble of cutting one additional holes in the line and the expense of the welding on an additional fitting. Combine this with our flow computer and transmitter and you can achieve total measurement control under a changing pressure and temperature. For the temperature compensation we offer both RTD or TCH sensors.



FIELD CALIBRATION

This procedure allows you to monitor many flow conditions that before were impossible because of flow disturbing devices such as elbows, tees, valves and throttling devices.

Tri-Flo Tech sensors have a very repeatable signal so that a field reading may be converted into a usable signal by our computers. A good example of this is shown by the drawing of the sensor being placed very close to a elbow-yet this can be corrected by our established procedure of field calibration.



SPP Option

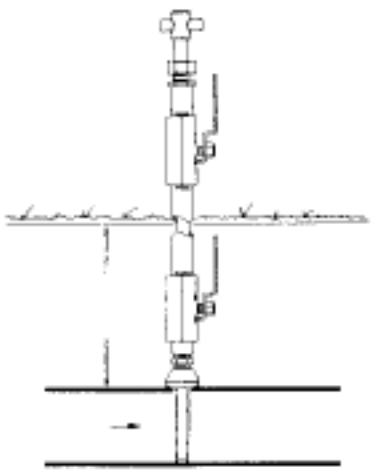
The SSP Option shown to the left is very useful when you need to get a static pressure reading and you do not want to add more welding to the pipe or you simply want to reduce the cost of installation.

This option is available on all of our sensors. The location of the SSP position will vary with the type of sensor or can be positioned to meet the customer needs.

Typically the SSP option is placed at the thread-o-let on the packing gland models, at the isolation nipple on the hot-tap models, and at the weld neck on the flanged models.

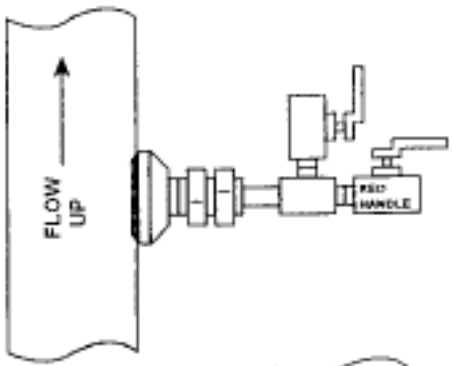
MEASUREMENT FOR SPECIAL APPLICATIONS

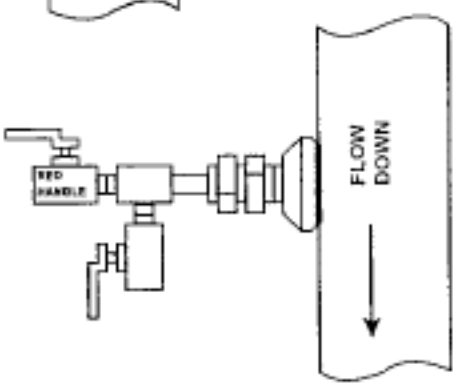
Tri-Flo Tech manufacturers an underground service sensor which has two isolation valves. This has many applications in buried lines which require hot-tapping the sensor.



VERTICAL PIPES

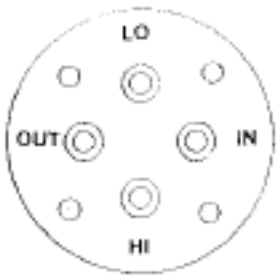
When you are working with a vertical pipe it is always a problem unless you can provide a level head signal. We have solved that problem for you by providing at no extra cost to the customer a head that has one valve parallel to the sensor and one at 90 degrees. The 90 degree valve may point up or down depending upon whether the flowing media is gas/air/stream or liquid.

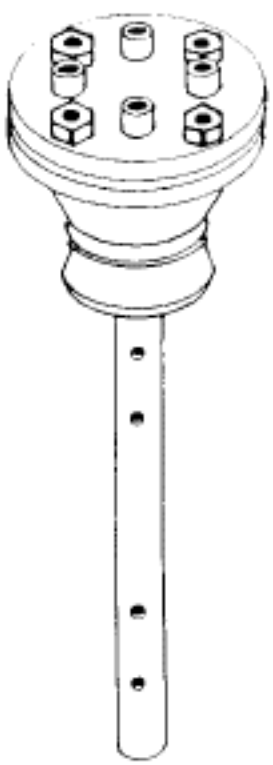




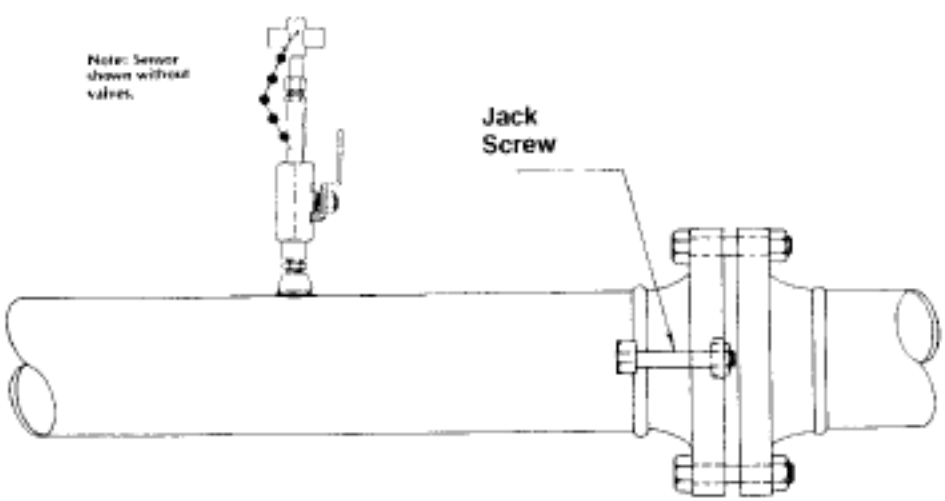
SENSOR FOR THE EXTREME HOT AND COLD

The water cooled super duty sensor allows you to monitor flows of extreme temperature conditions. We accomplish this by circulating water inside the sensor. When the conditions are very cold the same sensor can circulate warm water and prevent frost from forming on the sensor and blocking the sensing ports.





Tri-Flo Tech now supplies a solution to the problem of checking the calibration of the orifice plate after it has been in service for some time. By installing our calibrated meter run with our hot tap sensor already mounted on it gives you the best of both worlds. An ASME orifice meter run with a simple and cost effective way of checking the accuracy at a later date.



STANDARD MODELS

Model
140

MODEL 140 SENSOR. Single Mount Packing Gland Thread-o-let Installation. It has a very simple and easy weld fitting with packing gland type of insertion. This basic sensor can be used on pipe from 1/2" to 48 inches, as long as the flowing pressure does not exceed the design limitations. (See Chart 1 on Page 32)

For higher flow conditions and larger pipes see Model 172 below.

SPECIFICATIONS:

Sensor	316 Stainless steel is standard. Monel, Hastelloy, and C-20 are available.
Weld fitting	3000# carbon steel is standard. 316 stainless steel and others are available.
Packing gland	316 stainless steel is standard. Monel, Hastelloy, and C-20 available.
Pressure Rating	500 PSIG
Temperature Rating	325° F - Higher temperature can be used at lower pressure if high temp valves are used.
Mounting	Round pipes, round or square ducts, saddle clamps, carbon steel, PVC or stainless steel
Instrument Valves	1/4" NPT brass standard. See back cover for options.

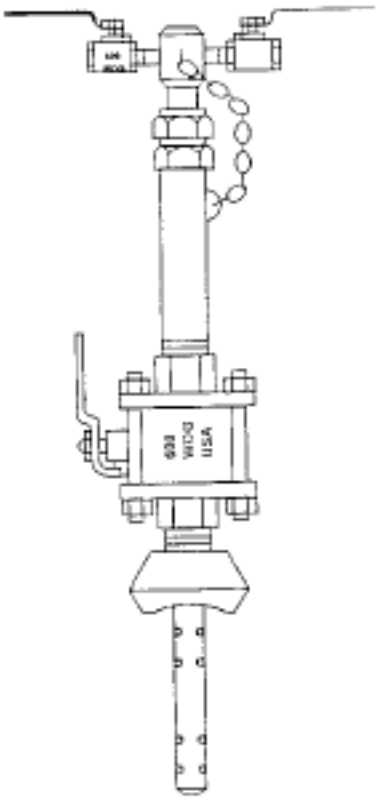
MODEL 172 SENSOR. Double Mount Packing Gland Thread-o-let Installation. This basic sensor can be used on pipe from 4" to 96" as long as the flowing pressure does not exceed the design limitations. (See Chart 2 on Page 32). It has a very simple and easy weld fitting with packing gland type of insertion with stainless sleeved double mount.

SPECIFICATIONS:

Sensor	316 Stainless steel is standard. Monel, Hastelloy, and C-20 are available.
Weld fitting	3000* carbon steel is standard. 316 stainless steel and others are available.
Packing gland	316 stainless steel is standard. Monel, Hastelloy, and C-20 available.
Pressure Rating	500 PSIG
Temperature Rating	325° F - Higher temperature can be used at lower pressure if high temp valves are used.
Mounting	Round pipes, round or square ducts, saddle clamps, carbon steel, PVC or stainless steel
Double Mount	Carbon steel with special s.s. liner and plug
Instrument valves	1/4" NPT brass standard. See back cover for options.

Model
172

STANDARD HOT-TAP MODEL



Model
205

MODEL 205 SENSOR. Low to Medium Pressure Hot Tap. This sensor makes it possible to install and remove without shutting down the system. This model has a safety chain to prevent the pressure from pushing it out of the isolation section of the hot tap mounting device **Tri-Flo Tech** hop tap sensors are all 316 stainless except isolation valve, close nipple, weld fitting, and safety chain, other options are available. (See Chart 1 for flow limitations. Page 32)

SPECIFICATIONS:

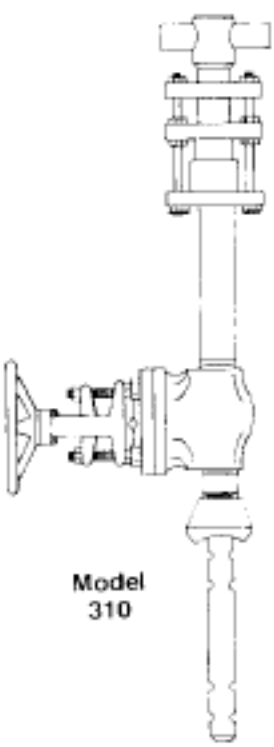
Sensor	316 stainless steel is standard. Monel, Hasteiloy, and C-20 are available.
Weld fitting	3000# carbon steel standard. 316 Stainless steel and others available.
Support nipple	Schedule 160 carbon steel or hex nipple.
Isolation valve	Bronze is standard. Carbon steel or 316 stainless steel optional.
Isolation Nipple	Carbon steel seamless pipe sch. 80 is standard. 316 S.S. seamless pipe sch. 80 is optional.
Packing gland	Must match the type of steel in isolation nipple. C.S. Packing Gland has a S.S. Nut. Choice of nylon, zytel or teflon compression ring.
Pressure Rating	160 PSIG ***DO NOT EXCEED!!**
Temperature Rating	200 F ***DO NOT EXCEED!!**
Mounting	Round pipe; round or square duct (thick wall); saddle clamps of stainless steel or carbon steel.
Instrument Valves	1/4" NPT brass standard. See back cover for options.

MODEL 310 SENSOR. High pressure, hot tap. This sensor can be installed under high pressure without shutting down the system.

Tri-Flo Tech has corrected the common problem of the single nut tightening, by using the heavy duty tie rods system of tightening the packing gland. No extra tools needed. The stainless steel tie rods assure easy insertion or retraction. **Tri-Flo Tech** Hot-Tap Model are all stainless steel except isolation valve close nipple and weld fitting. (See Chart 1 for flow limitations. Page 32)

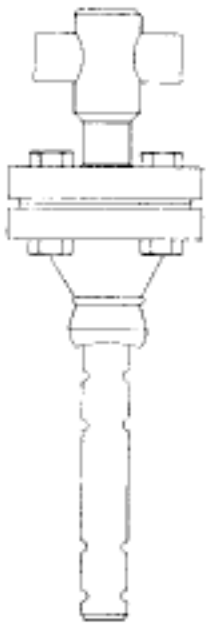
SPECIFICATIONS:

Sensor	316 stainless steel is standard. Monel, Hastelloy, and C-20 are available.
Weld fitting	3000# carbon steel standard. 316 Stainless steel and others available.
Support nipple	Schedule 160 carbon steel.
Isolation valve	Forged steel OS & Y gate valve. 316 stainless steel optional.
Packing gland	H.T. steam valve packing.
Pressure Rating	800 PSIG.
Temperature Rating	850° F.
Mounting	Round pipe; round or square duct (thick wall); saddle clamps of stainless steel or carbon steel.
Instrument Valves	1/4" NPT brass standard. See back cover for options.



Model
310

STANDARD FLANGED MODEL



Model 401
Single Mount

MODEL 401 SENSOR. Standard Flanged unit. For high temperature and pressure. This sensor is designed for use in high temperature and high pressure conditions where conventional type of mounting would be unsafe or would not fit the existing pipe code. The "T" design of the sensor head allows for easy connections to the instrument signal lines. Weld fitting and weld neck are position welded to avoid problems for the installer. (See Chart 1 for flow limitations. Page 32)

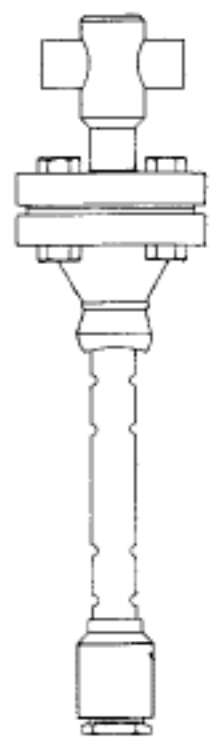
SPECIFICATIONS:

Sensor	316 stainless steel is standard. Monel, Hastelloy, and C-20 are available.
Sensor flange	316 stainless steel, 150# R.F. standard, 300# to 2500# available.
Mounting Weld Neck	150# carbon steel, R.F. sized to fit pipe and sensor. 300# to 2500# available.
Weld Fitting	3000# carbon steel standard. 316 Stainless steel and others available.
Gasket	Appropriate to application.
Pressure rating	Limitation of flange.
Temperature rating	Limitation of flange.
Instrument valves	1/4" brass standard. Others available appropriate to application. See back cover for options.

MODEL 421 SENSOR DOUBLE MOUNT. Standard Flanged unit. For high tmperature and pressure. This sensor is designed for use in high temperature and high pressure conditions where conventional type of mounting would be unsafe or would not fit the existing pipe code. The "T" design of the sensor head allows for easy connections to the instrument signal lines. Weld fitting and weld neck are position welded to avoid problems for the installer. Also has a double mount support for extra strength. (See Chart 2 for flow limitations. Page 32)

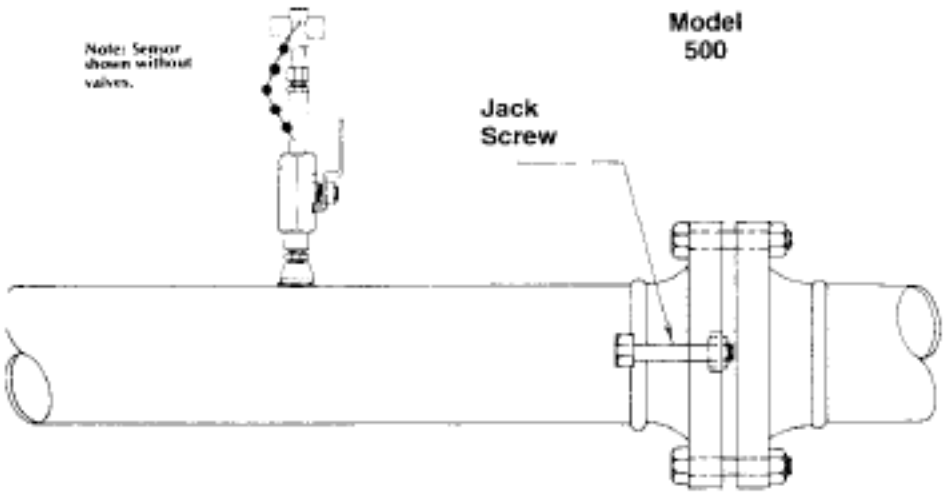
SPECIFICATIONS:

Sensor	316 stainless steel is standard. Monel, Hastelloy, and C-20 are available.
Sensor flange	316 stainless steel, 150# R.F. standard, 300# to 2500# available.
Mounting Weld Neck	150# carbon steel, R.F. sized to fit pipe and sensor. 300# to 2500# available.
Weld Fitting	3000# carbon steel standard. Stainless steel and others available.
Double Mount	Carbon steel with special s.s. liner and plug.
Gasket	Appropriate to application.
Pressure rating	Limitation of flange.
Temperature rating	Limitation of flange.
Instrument valves	1/4" Brass std. Others available appropriate to application. See back cover for options.



Model 421
Double Mount

ASME CALIBRATED METER RUN



Tri-Flo Tech is very pleased to introduce a solution to a problem that is of much concern to companies that must use orifice plates as a measuring equipment. It is a well known fact that orifice plates are very, very accurate on the day they are installed but are subject to wear and a changing coefficient as they are in service. This has been of great concern to companies that are selling gas and other fluids based upon the impulse signal of the orifice plates. As the plate wears the selling company must increase its flow so that the same signal will appear on the orifice plate.

We have solved this problem by placing our hot-tap unit upstream from the orifice plate. Because the averaging pitot tube is not subject to the same wear characteristics of the orifice plate it can be used to standardize a signal that can be tested at a later time.

The procedure that we recommend is as follows:

1. Select the orifice plate meter run based upon the piping code.
2. Do you want the meter run bored or will standard piping be acceptable.
3. Install the **Tri-Flo Tech** meter run.
4. Take a reading at normal flow from the orifice plate with the sensor retracted from the flowing media. Record this reading.
5. Insert the sensor and then take a second reading from the orifice plate. This becomes the orifice standardization reading. Record in a safe place for future reference.
6. Take a reading from the sensor and record and keep in a safe place for future reference. Then retract the sensor.
7. Some time in the future when you want to check the accuracy of the orifice plate simply insert the sensor and take a reading from the sensor which then become the standard and the orifice plate then can be recalibrated based upon the reading of the sensor. (Contact factory for specifications)

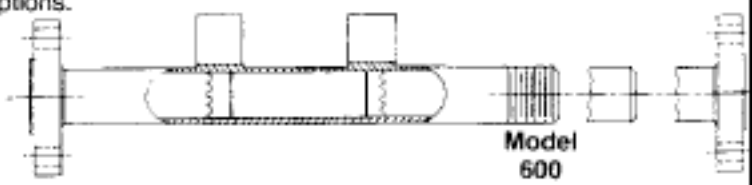
INLINE MODEL 600

MODEL 600 Inline. This type of sensor is especially useful in the small pipe size of 1/2" to 3" where **Tri-Flo Tech** uses two small independent sensor tubes placed so that pressure loss will be at a minimum, and will withstand extremely high flow rates.

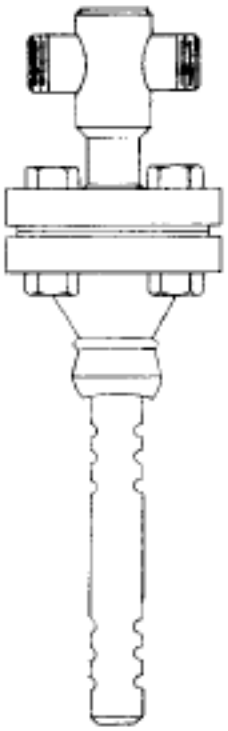
This type of sensor application is used when you want the accuracy and convenience of a ready to install meter section of high quality seamless pipe with the sensor installed to **Tri-Flo Tech** high quality standards. Meter runs are provided in carbon steel, stainless steel, copper, aluminum, CPVC, or others.

SPECIFICATIONS:

Pipe size	1/2" to 6", schedule 40 or 80.
Pipe length	8". Other length available. 10 times pipe diameter minimum recommended.
Pipe material	Carbon steel, stainless steel, copper, aluminum, CPVC or others.
Sensor	316 stainless, choice of permanent installation or removeable.
Instrument Valves	1/4" Brass std. Others available appropriate to application. See back cover for options.
Ends	Threaded, flanged, or weld cut.
Pressure	Limitation of system.
Temperature	Limitation of system.



SUPER DUTY FLANGED MODEL



Model 737
Single Mount

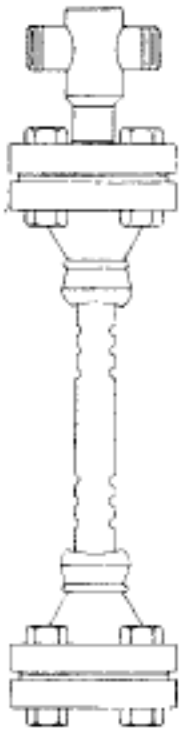
MODEL 737 SENSOR. Super duty flanged unit, Single Mount. This sensor is used in large line sizes where additional strength is needed due to high flow conditions or the inside of the pipe is too large for the smaller diameter sensors. **Tri-Flo Tech** builds these sensors out of 2⅜" O.D. stainless steel to assure strength, long life, and trouble free operations. (See Chart 3 for flow limitations. Page 32)

SPECIFICATIONS:

Sensor	316 stainless steel, 2⅜" O.D. is standard. Monel, Hastelloy, and C-20 are available.
Sensor flange	316 stainless steel, R.F. 150# 3" is standard. Other material and ratings available, 300# to 2500#.
Weld Neck	150# R.F. carbon steel is standard. Other material and ratings available, 300# to 2500#.
Weld Fitting	3000# carbon steel is standard. Other material available.
Gasket and Bolts	Flexitallic gasket is standard. Bolts and other material available appropriate to application.
Pressure	Flange limitation.
Temperature	Flange limitation.
Instrument Valves	1/2" brass valve std. Others available appropriate to application. See back cover for options.

Note: Water Cooled or Heated Option available on Model 737 & 747. See Page Number 7.

MODEL 747 SENSOR. Super duty flanged unit. Double Mounted. This sensor is used in large lines where the need for a double mount is necessary due to severe conditions or large diameter pipe, ducts, smoke stacks, sewer lines, or waste water plants. This **Tri-Flo Tech** sensor will accept very high differential pressures. (See Chart 4 for flow limitation. Page 32)



Model 747
Double Mount

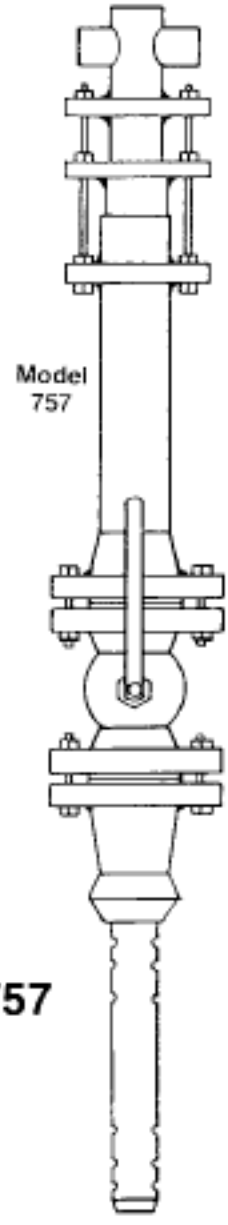
SPECIFICATIONS:

Sensor	316 stainless steel, 2⅜" O.D. is standard. Monel, Hastelloy, and C-20 are available.
Sensor flange	316 stainless steel, R.F. 150# 3" is standard. Other material and ratings available, 300# to 2500#.
Weld Neck	150# 3" R.F. carbon steel is standard. Other material and ratings available, 300# to 2500#.
Weld Fitting	3000# 3" carbon steel is standard. Other material available.
Double Mount	3000# weld fitting with a 150# weld neck with a special stainless steel liner. Gasket and 150# blind R.F. flange.
Gasket and Bolts	Flexitallic gasket is standard. Bolts and other material available appropriate to application.
Pressure	Flange limitation.
Temperature	Flange limitation.
Instrument Valves	1/2" brass valve std. Others available appropriate to application. See back cover for options.

SUPER DUTY HOT-TAP MODEL

MODEL 757 SENSOR. Super duty, hot tap. This sensor is ideally suited for line size from 16" to 60" when very high differentials are present, or large line sizes which require more strength than can be provided by the standard sensor. This sensor can be installed or retracted under pressure or without shutting down the system. The 5/8" diameter tie rod made of stainless steel will give service without rusting. (See Chart 3 for flow limitations. Page 32)

Note: Water Cooling & Heating are available on this model.

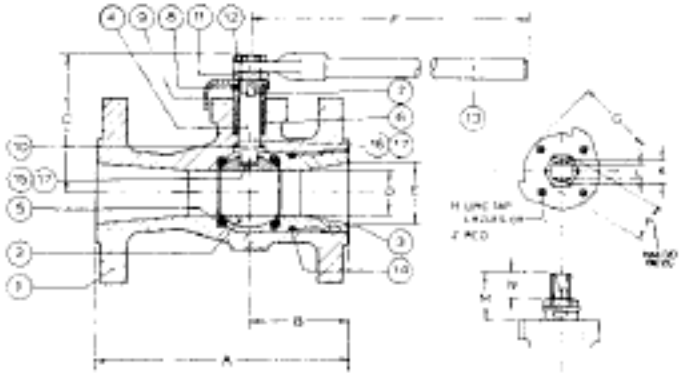

Model 757

SPECIFICATIONS:

Sensor	316 Stainless steel. 2⅜" O.D. Monel, Hastelloy and C-20 available.
Sensor flanges	Std. 316 stainless steel. Others available.
Mounting	3" 3000# carbon steel weld fitting with 150# weld neck std. Others available to match isolation valve.
Packing seal	H.T. steam valve packing.
Isolation valve	3" 150# carbon steel ball valve. R.F. flanged or others.
Isolation nipple	3" 316 stainless steel. Schedule 40
Gasket & Bolts	Flexitallic gasket is standard. Bolts and other material available appropriate to application.
Pressure	Rating of isolation valve is ANSI 150# Std. 300# available.
Temperature	Rating of isolation valve is ANSI typical at 400° F.
Instrument Valves	1/2" brass valve is standard. Others available appropriate to application. See back cover for options.

ISOLATION VALVE FOR MODEL 757

Type	Model	Size
Std. Carbon Steel Flange Ball Valve #150	757	3"
Std. 316 Stainless Steel Flange Ball Valve #150	757SS	3"
XH Carbon Steel Flange Ball Valve #300	757XH	3"
XH 316 Stainless Steel Flange Ball Valve #300	757XHSS	3"



Dimensions
A = 8"
B = 3⅛"
C = 6"

Pressure/Temp.
ANSI Class 150/300
Typical 150# at 400° F

Note:
1. For valve rating or material not shown, consult factory.
2. All dimensions and drawings are typical for reference only. At our option we will supply material other than that shown of equal or higher quality with applicable dimensional differences.
3. All flanged valves (Model 310, 757) face to face dim. comply to ANSI B16.5 and B.S.10.

TEST AND BALANCE

Model 800

MODEL 800 Multi-port **MODEL 900 Single Point**

These sensors are a very useful and economical way of flow testing when you do not want a permanent installation. The multi-port is used on the ***same size*** pipe or duct. The single point is used when you are ***traversing*** many different pipe or duct sizes. The multi-port will give you test signal +/-1% of total flow. The single point will give you +/-2% of total flow.

SPECIFICATIONS:

Sensor:	316 Stainless Steel or 6063 Aluminum
Sensor diameter:	Depends on length of the test sesor
Instrument Connection:	1/4" Brass male hose barbs standard. 1/4" Brass Ball Valves available
Mounting:	Weld fitting and plug Carbon Steel or others (usually hand held) Model 140 mounting available
Pressure:	N/A
Temperature:	N/A

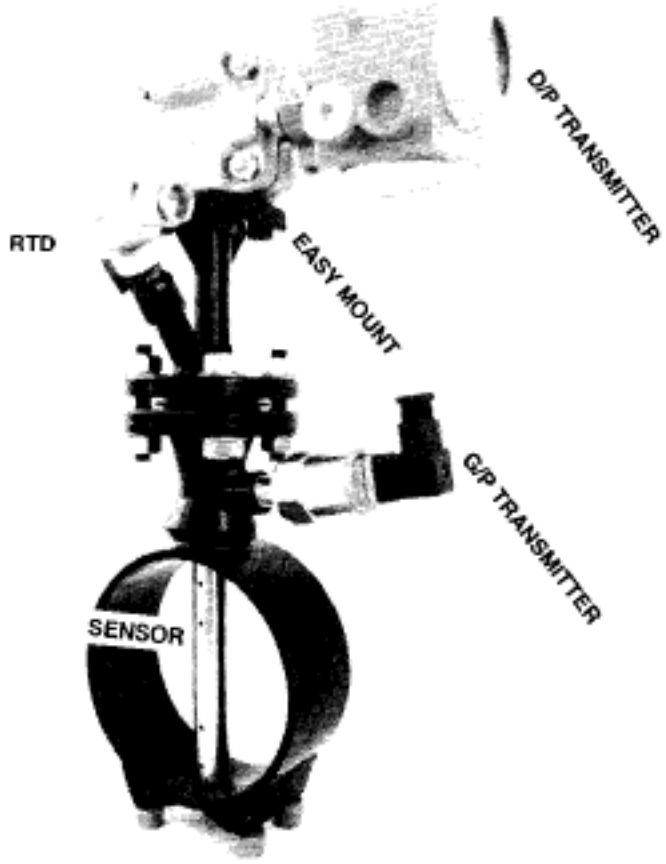
Model 900

Multivariable TRUE MASS FLOW SYSTEM

This system consists of a Pitot tube flowmeter, a D/P transmitter, a G/P transmitter mounted on the static pressure port, and a RTD which is inserted in the high side of the sensor. The D/P signal comes from the Pitot tube. The true G/P static pressures come from the static port not electronically determined by the high or low side of the sensor. The RTD gives a signal from within the center of the flow stream.

All three signals are sent into a separate Multivariable flow computer. This will give you a true mass flow compensated signal. All of the inputs come from only one hole in the pipe. The D/P transmitter may be mounted on top of the sensor or mounted remotely for easy access to the instrument technician. The signal coming from the computer is a true mass 4 to 20 ma compensated signal. When you have compressible gases or stream you must have all three signals. The flow computer will calculate rate and total flow and display it. Multivariable computer specifications on page 17.

SHOWN WITHOUT 3-VALVE MANIFOLD



SCEL - LOW PRESSURE 4-20MA TRANSMITTER

Low cost 2-wire differential pressure transmitter for low and very low flow clean air and gas measurements.

Applications:

Filter Conditions
Safety Valves
Low Pressure Alarms
Pitot Tubes and Orifice Plates
Air Velocity
OEM Requirements

Specifications:

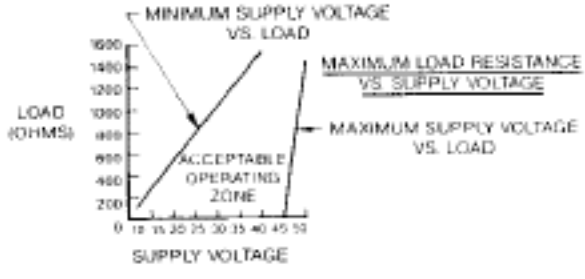
D/P Range	.1 to 400 W.C.
Line Pressure	30 PSIA
Proof Pressure	150% of Range
Over Pressure	300# of Range
Media	Clean Air/Gas
Weight	16 oz. Max.
Input Voltage	15 to 45 VDC
Output	4-20ma
Accuracy	+/- 1.0%

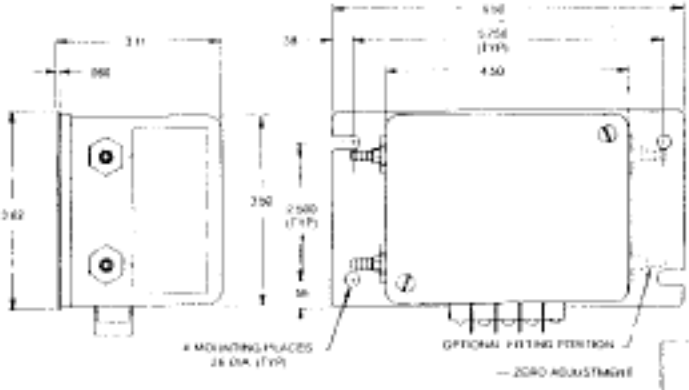
SPAN +/- F.S. ZERO +/- 5% F.S.
Mounts in any position
Two wire powered
Moist gas or air will not reduce performance

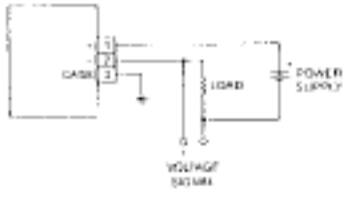
Model No.	Range (W.C.)
SCEL- .75	0.75"
SCEL-2	2"
SCEL-4	4"
SCEL-8	8"
SCEL-20	20"
SCEL-40	40"
SCEL-80	80"
SCEL-200	200"
SCEL-400	400"

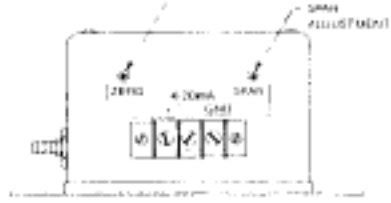
Features:

- Lightweight Construction
- Popular 4-20 MA Output
- Easy To Install
- Two Wire Pair and a Basic 12-45 VDC Power
- Mount in Any Position
- No Positional Errors
- Withstand Reasonable Shock and Vibration
- Moist Gas or Air Will Not Reduce Performance
- A Small Compact System at Very Affordable Prices





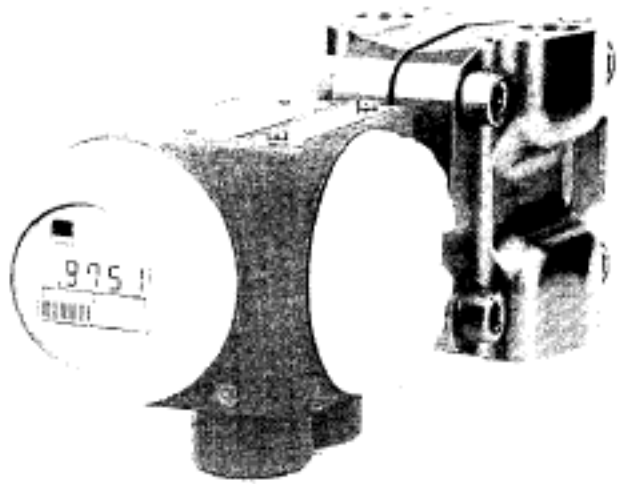




MODEL 2300 DIFFERENTIAL PRESSURE TRANSMITTER

Smart differential pressure transmitter with HART® for measurement of flow, level or differential pressure of gases, vapors and liquids up to 1200 in H_2O

Tri-Flo Tech has a complete differential pressure offering for all types of applications, including level and flow applications. The most demanding part of any measuring instrument is the measuring cell since it plays the most important role in process safety. The Model 2300 differential pressure transmitters feature a single-chamber ceramic measuring cell that ensures excellent temperature compensation and resistance to aggressive environments. Accuracy of 0.1% and 20:1 turn-down make this transmitter ideal for numerous applications.



Specifications:

Housings:	Two compartment aluminum NEMA-4X
Process Connections:	1/4-18 NPT (wetted part) oval flange with 7/16-20 UNF carbon steel or 316 L SS
Electrical Connections:	1/2" NPT conduit
Process Seal:	FPM (Vitron, Fluoroelastomer) or Kalrez
Sensor:	Ceramic (wetted ceramic diaphragm)
Power Input:	12 to 45 VDC
Output:	4 to 20ma HART® Protocol
Approvals:	FM approved intrinsically safe, C1, 1, 11, 111: Div. 1: Grps A-G
Temperature Range:	-40° F. to 185° F.
Pressure:	0" to 1200" H20
	Continuously self-monitoring (detects diaphragm leakage & over range limits)
Turn-Down:	20 to 1
Accuracy:	0.1% of full scale

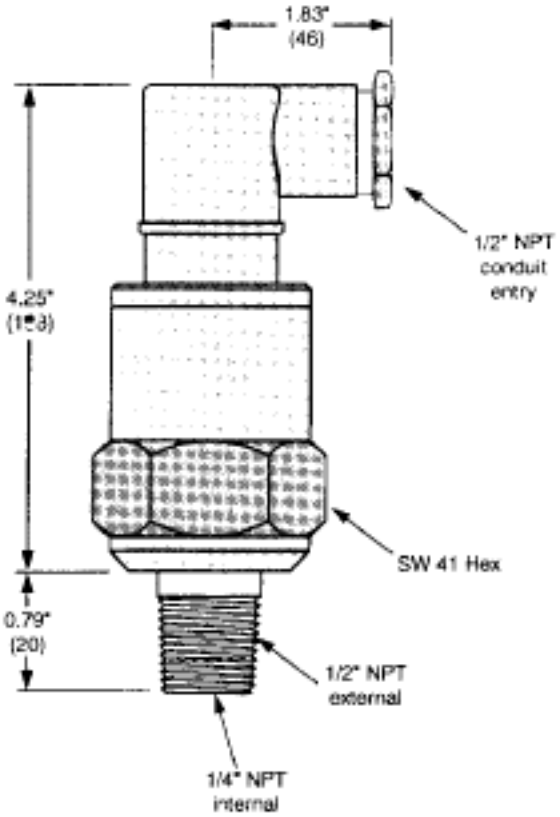
Unique Feature:

- Can change electronics without recalibration.

MODEL 1310 G/P TRANSMITTER

Low cost and high quality gauge/pressure transmitter useful on compressible gases and steam flow applications

Tri-Flo Tech pressure transmitter is suitable for a wide variety of industrial pressure processes of liquids, gases or vapors. It is a compact, economical system that provides measurement in gauge or absolute pressures from full vacuum to 500 psig.



Specifications:

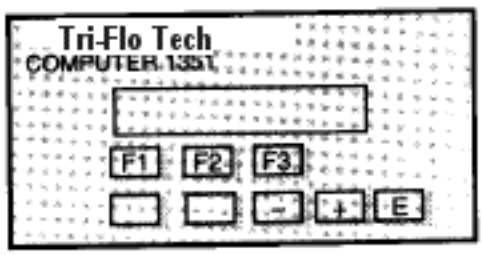
Housing:	304 Stainless Steal with Plastic Plug Type Writing
Connector:	NEMA - 4 Housing
Process Connection:	1/4 FNPT or 1/2 MPT.
Electrical Connections:	1/2 NPT Conduit
Process seal:	FPM-Viton
Sensor:	Ceramic Aluminum Oxide
Input Power:	11 to 30 VDC
Input Measured Variables:	Gauge or Absolute
Output:	4 to 20ma VDC
Range:	0 to 500 PSIG
Accuracy:	0.5% of full scale 0.8% for 6 PSIG to 580 PSIG
Long Term Stability:	0.15 per Year

Multivariable MODEL 1351 FLOW COMPUTER

The 1351 flow computer combines signals from D/P transmitters, Pressure, Temperature and/or Density transmitters

Specifications:

Housing	Panel mount with NEMA 4x front panel
Display	Two lines 20 characters per line LCD backlit
Temperature	+32 Deg. F to +122 Deg. F.
Power Supply	110 or 220 VAC
Flow Input	Analog (4 to 20 ma, 0 to 10 V, 0 to 5 V, or 1 to 5 V) or pulse (PFM)
Multivariable Inputs	Temperature, Pressure or Density 4 to 20 ma or PT 100 3 wire
Output	Relays 2-flow alarms, temperature alarm, pressure alarms. Compensated 4 to 20 ma RS-232 Serial port interface.
Steam	Mass, Heat, Net heat, Delta heat
Gas	Corrected volume, True Mass, Combustion heat
Liquid	Corrected volume, Mass, Combustion heat, Sensible heat, Delta heat
Panel Mount cutout	2.7" by 5.4" Wiring from back of unit.



HOW TO SIZE A PITOT TUBE FLOW METER for

AIR * GAS *LIQUIDS * SATURATED & SUPERHEATED STEAM & WATER

THE CORRECT CHOICE OF A SENSOR WILL PROVIDE YOUR CUSTOMER WITH A FLOWMETER THAT WILL GIVE MANY YEARS OF SATISFACTORY PERFORMANCE. THERE ARE MANY FACTORS THAT ENTER INTO THIS DECISION PROCESS. EACH ITEM IS VERY IMPORTANT AND NECESSARY BEFORE THE FINAL SELECTION CAN BE MADE.

HERE IS A LIST OF THE QUESTIONS THAT NEED TO BE ANSWERED, THEY ARE NOT LISTED IN ANY PARTICULAR ORDER AS ALL OF THIS INFORMATION IS NEEDED.

1. WHAT IS FLOWING IN THE PIPE OR DUCT?
2. WHAT IS THE STATIC PRESSURE IN THE PIPE OR DUCT?
   PSIG, PSIA, KPA OR Kg/CM2
3. WHAT IS THE TEMPERATURE? DEG. F. OR DEG. C.
4. WHAT IS THE PIPE OR DUCT MATERIAL? THIS WILL AFFECT HOW THE METER IS MOUNTED.
   FIBERGLASS, DUCTILE IRON AND PVC REQUIRES A SERVICE SADDLE.
   COPPER OR BRASS PIPE REQUIRES A BRAZE-O-LET OR A SERVICE SADDLE. YOU CANNOT WELD TO COPPER OR BRASS.
5. WHAT IS THE MINIMUM FLOW? IS THERE ENOUGH TO MAKE A D/P SIGNAL THAT CAN BE READ BY YOUR TRANSMITTER OR GAUGE?
6. WHAT IS THE MAXIMUM FLOW? LOOK ON **PAGE 32** FOR MAXIMUM FLOW CHART. THIS CHART SHOWS HOW MUCH FLOW THE SENSOR WILL WITHSTAND. THE FLOW RATE IS GIVEN IN INCHES WATER D/P.
   THE MAXIMUM FLOW WILL DETERMINE WHETHER YOU NEED A **DOUBLE MOUNT** OR A SUPER DUTY SENSOR.
7. DOES THE CUSTOMER WANT A HOT-TAP? THESE UNITS CAN BE INSTALLED WITH PRESSURE AND TEMPERATURE IN THE SYSTEM.
8. DOES THE CUSTOMER REQUIRE A FLANGE MOUNT? SOME PIPING CODES REQUIRE FLANGE MOUNTS ON SOME APPLICATIONS. ONLY THE CUSTOMER WILL KNOW THIS!
9. HOW IS THE CUSTOMER GOING TO READ THE SIGNAL?
   WILL THEY USED A D/P TRANSMITTER OR MECHANICAL GAUGE?
10. DOES THE APPLICATION REQUIRE ANY SPECIAL ALLOYS? WE PROVIDE SENSORS IN MANY EXOTIC ALLOYS

CONVERSIONS

ACFM to SCFM **see page 31**
Bars x 14.5 = PSI
Cubic Feet Liquid x 7.481 = US Gallons
Cubic Meters (Liquid) x 264.2 = US Gallons
Cubic Meters x 35.31 = Cubic Feet
Density (#/cu. ft) = Specific Gravity x .0764
Imperial Gallon x 1.201 = US Gallons
Inches of Water x .036 = PSI

Kg/cm2 x 14.22 = PSI
Kilopascal (KPA) x .145 = PSI
Liter/MIN x .2642 = GPM
Liter/Sec x 15.85011 = GPM
Millimeters / 25.4 = Inches
NM3/Hr (Gas) x .622 = SCFM
Pounds of Water x .1198 = US Gallons
Square to Round Equivalent **see page 31**

Tri-Flo Tech

FLOW DATA SHEET

1. What is flowing? _____
2. What is the static pressure? _____ Circle unit below.
   Units of pressure (PSIG) (PSIA) (Inches of Vacuum) (Inches of Water) (Kpa)
3. What is the temperature? _____ Deg. F. or Deg. C. Mark one.
4. Nominal pipe size? _____
5. Pipe schedule? _____ **Every pipe is not schedule 40.**
6. Pipe I.D.? _____ This is important; make sure to get this.

7. Pipe material? _____ Select one from below. Place on line.
   (**C.S.** = Carbon Steel) (**S.S.** = Stainless Steel) (**PVC** = Plastic) (**CO** = Copper)
   (**FRP** = Fiberglass) (Others not listed spell out name of material)
   Note: **PVC** and **FRP** require a service saddle. **CO** requires a Braze-O-Let or a Bronze Service Saddle.
   CIRCLE ONE OF THE UNITS BELOW!
8. ***GAS or AIR:***
   SCFM = Standard Cubic feet per minute. **ACFM** = Actual Cubic feet per minute.
   SCFH = Standard Cubic feet per hour. **ACFH** = Actual Cubic feet per hour.
   NH3/Hr = Normal cubic meters per hour.
9. ***STEAM*** **= PPH** (Pounds per hour) or **Kg/Hr** (Kilograms per hour)
10. ***LIQUID*** = **GPM** (Gallons per min.) or **NH3/Hr** = Normal cubic meters per hour.
11. Flow rate:
    Maximum _____ Normal _____ Minimum _____

Pipe Codes and Installation: Select one.

Select one: Is the pipe horizontal _____ or vertical _____?

A. Standard unit: Packing gland installation? _____ (Yes)_____ (No)

B. Do you want a hot-tap unit? _____ (Yes)_____ (No)
   A hot-tap is used when the flow cannot be stopped.

C. Flange unit? _____ (Yes)_____ (No) Select rating below:
   150#_____ 300#_____ 600# _____ 900# _____
   1500# RTJ _____ 2500# RTJ _____

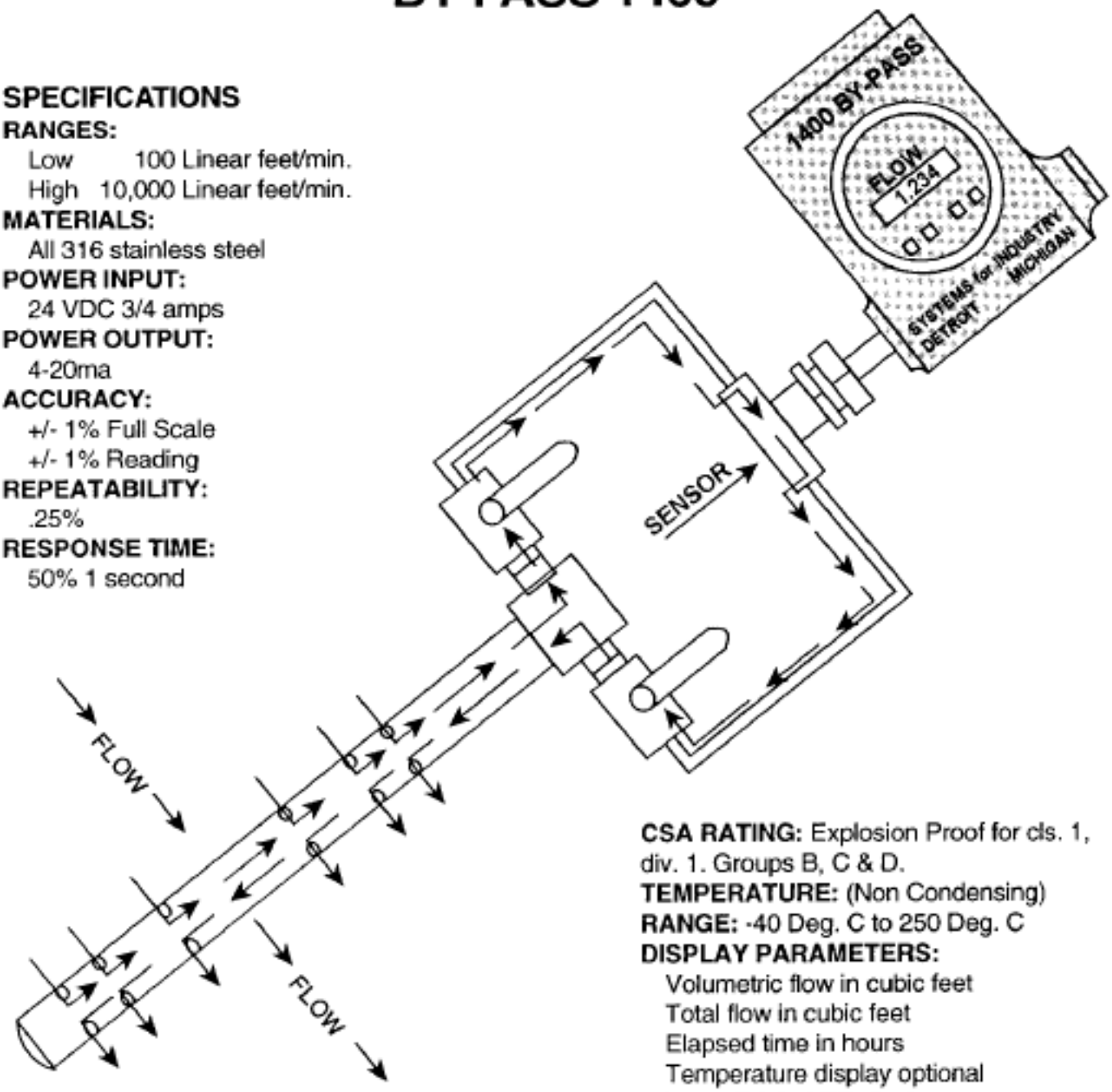
D. Do you want us to quote D/P transmitter? _____ (Yes)_____ (No)

E. Do you want us to quote D/P gauge? _____ (Yes)_____ (No)

F. Do you want us to quote Flow Computer? _____ (Yes)_____ (No)

E. Do you want us to quote a 3-Valve Manifold? _____ (Yes)_____ (No)
   Select a manifold _____ **C.S.** = Carbon Steel _____ **S.S.** = Stainless steel

BY-PASS 1400



SPECIFICATIONS

RANGES:
Low 100 Linear feet/min.
High 10,000 Linear feet/min.

MATERIALS:
All 316 stainless steel

POWER INPUT:
24 VDC 3/4 amps

POWER OUTPUT:
4-20ma

ACCURACY:
+/- 1% Full Scale
+/- 1% Reading

REPEATABILITY:
.25%

RESPONSE TIME:
50% 1 second

CSA RATING: Explosion Proof for cls. 1, div. 1. Groups B, C & D.
TEMPERATURE: (Non Condensing)
RANGE: -40 Deg. C to 250 Deg. C

DISPLAY PARAMETERS:
Volumetric flow in cubic feet
Total flow in cubic feet
Elapsed time in hours
Temperature display optional
Large Bright LED display

CALIBRATION: NIST traceable
MEDIA: Clean air and gas

OUTSTANDING FEATURES:

- ✦ Averages the flow signal
- ✦ No need for three valve manifold
- ✦ Can read a very low flow
- ✦ May be hot-tapped into lines
- ✦ May be used on small and large ducts
- ✦ Compensates for temperature & pressure

MODEL 1400 BY-PASS SENSOR

Simply the best way to measure low flows and many other clean air and gas flows.

This technology takes advantage of the averaging effect of the Pitot Tube and combines it with a BP-Pass Flow Sensor. This very sensitive technology can detect flow as low as 100 linear feet/min and the reverse is also true. This same sensor can detect flows up to 10,000 feet/min.

By-Pass Technology - VS-D/P Technology

- We can measure flows lower than can be done successfully with D/P technology.
- Flow as low as 100 feet per minute (typical D/P range is 700 to 1000 feet per minute).
- True Mass Flow without the need for Multivariable inputs of pressure, temperature or density.
- Displays output in (lbs min or SCFM)
- NIST traceability for each individual sensor.
- Minimum turndown of 20/1 versus 7/1 for most D/P transmitters.
- Eliminates the need for a three or five valve manifold. No balancing needed.

By-Pass Technology - VS-Single Point Mass Flowmeter

Multipoint averaging versus single point measurement.

- The sensor is remote from process pipe allowing recalibration of sensor without having to remove the primary sensor from the flow stream.
- Because the By-Pass Sensor is remote from the flow stream it can be mounted away from destructive high temperatures.

By-Pass Technology - VS-Multi Thermal Mass Flow Meters

Mechanically averages velocity versus electrically averaged. (True Average)

- Requires only one sensor to be calibrated.
- Simplified electronics due to only one sensor.
- Lower cost and maintenance.

BY-PASS SENSOR TECHNOLOGY

Typical Applications

Automotive paint make up air
Chemical
Combustion Air
Digester Off gas flows
Environmental
Gas flow in Petroleum Industries
Large ducts
Power & Power houses (make up air)
Sanitary air
Stack Emissions Monitoring

BY-PASS SENSOR TECHNOLOGY

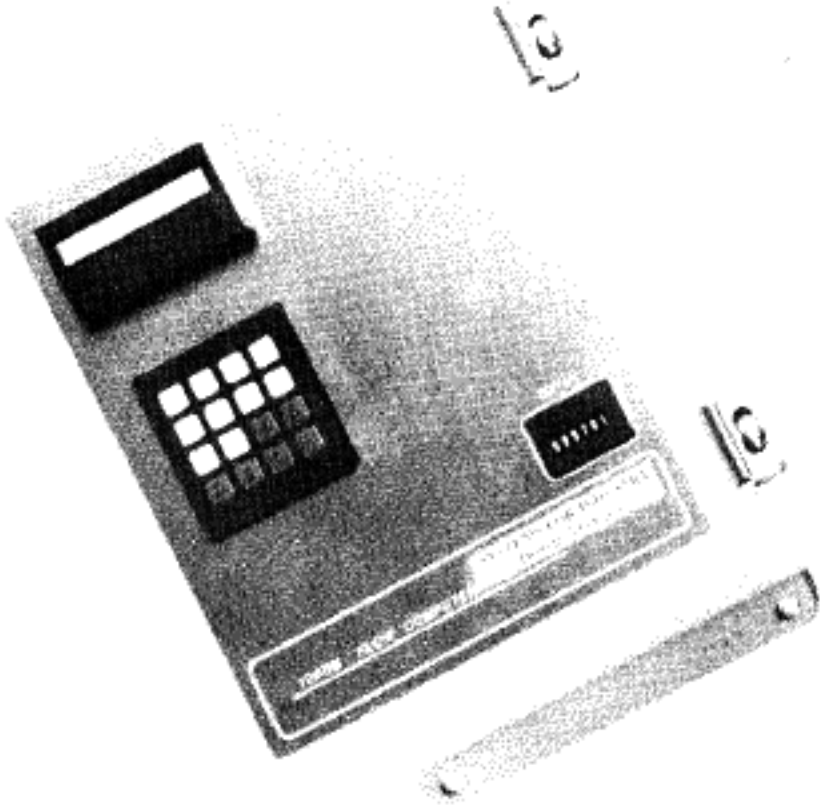
Very Simple:

Turn key installation (unit calibrated at factory before shipping)
Four buttons fully program the unit in the field
Trouble Free Solid Microprocessor Electronics
Menu access to All Information
One Enclosure reduces wires and connections

BY-PASS SENSOR TECHNOLOGY

Reliable

FLOW & BTU ENERGY MANAGEMENT
Model 1000
Microprocessor Flow Computer
Four Input: (1) Differential Pressure D/P
(2) Static Pressure
(3) Temperature
(4) Optional



The use of the differential pressure drop across a restriction in the pipe regardless of the type has been the most popular method of volumetric flow rate metering for several years. This fine microprocessor based flow computer is designed specifically for use with differential pressure type flowmeter such as orifice plates, pitot tube, venturi tubes, elbow taps, and many others. This model features powerful resident, non-volatile programs to automatically correct volume at flowing conditions to volume at standard conditions.

This model requires very few input "keyed" data in order to be put into operation. Since D/P calculations are generally done by others for the purpose of sizing the unit to the pipe there is no need for the Model 1000 to repeat the same calculations. The user simply enters the input ranges for differential pressure, static pressure and temperature. If this is to be used on an orifice plate or pitot tubes then the flowing temperature and pressure points used in the calculation are keyed into the unit. All necessary numbers are prompted on the LCD display and data is entered via a 16 position keypad on the front of the unit. The LCD also displays volumetric and percentage flow rates, totalized flow time and date.

A counter in the totalizer section of the computer converts the corrected flow rate to pulses which are accumulated on a front panel display providing continuous readout of total flow.

The model 1000 features EE prom, not requiring battery backup to retain entered constants. On power failure (loses time and internal counts).

SPECIFICATIONS

INPUTS

DP1 Input: High flow signal (if dual DP cells are used). Must be square of the flow. Do not include sq. rt. extractor with DP cell.

DP2 Input: Used only when two stacked DP cells are used. This is the lower range of the two DP cells. Do not include sq. root extractor with DP cell.

All Analog Inputs: 1-5 VDC: input impedance = 1 megphm minimum.
Note: For 4-20 mA inputs, 250 ohm precision resistors are installed across input screw terminal on field wiring back plate. If the unit is removed from its case loop integrity is maintained.
100 OHM resistor for 10-50 ma available.

Maximum Flow Range: 0-300,000 units per minute.

Pressure Inputs: From a gauge pressure transmitter. Maximum pressure range = 0-9,999 PSIG.

Temperature Inputs: From thermocouple or RTD Transmitter. Input signal corresponds to and is assumed to be linear to Deg. F Maximum Temperature Range = -100 to + 999.9 Deg. F

OUTPUTS

Analog Output: 4-20 into 800 ohms max., proportional to the corrected flow rate.

Contact Output
SPST contract output normally open, closing for 20 msec when the electromechanical counter counts.
Contract Rating = 1A at 30 VDC or AC. 0.5A at 120 VAC.

Temperature Range
0-50 Deg. C Ambient; 10-80 non-condensing Rel. Humidity.

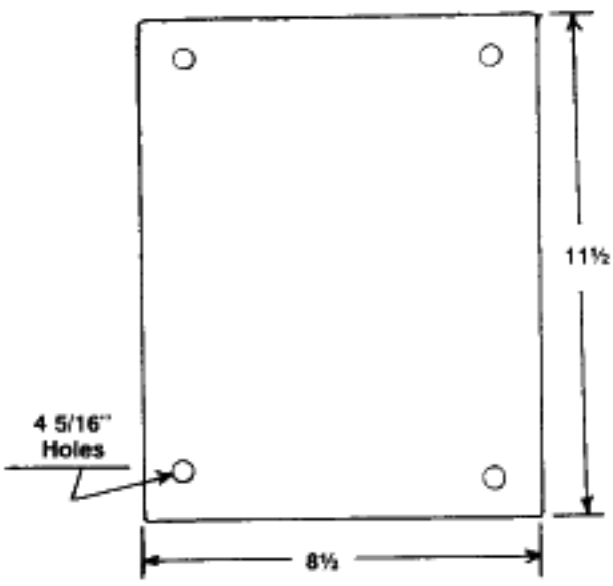
Display
5 x 7 Dot Matrix; 16 character alphanumeric LCD; character height = 3/16"

Counter
6-digit, non-reset electromechnical accumulator (in addition to the LCD Display).
Six-digit resettable, or LCD 8 digit electric reset available in NEMA 4 enclosures.

Power
117 VAC, ± 10 , 50-60 Hz, 15 VA max.; 220 optional.

Case Dimensions
Height = 11.5 inches
Width = 8.5 inches
Depth = 4.5 inches
Surface Mounted

Optional housings available:
1. NEMA 4 waterproof
2. 24 VDC power supply
3. RS-232 Digital Interface for Hardcopy Readout on Remote CRT Terminals
4. RS-485 for long distance
5. Totalizer in metric units
6. Resettable mechanical totalizer
7. Explosion-Proof

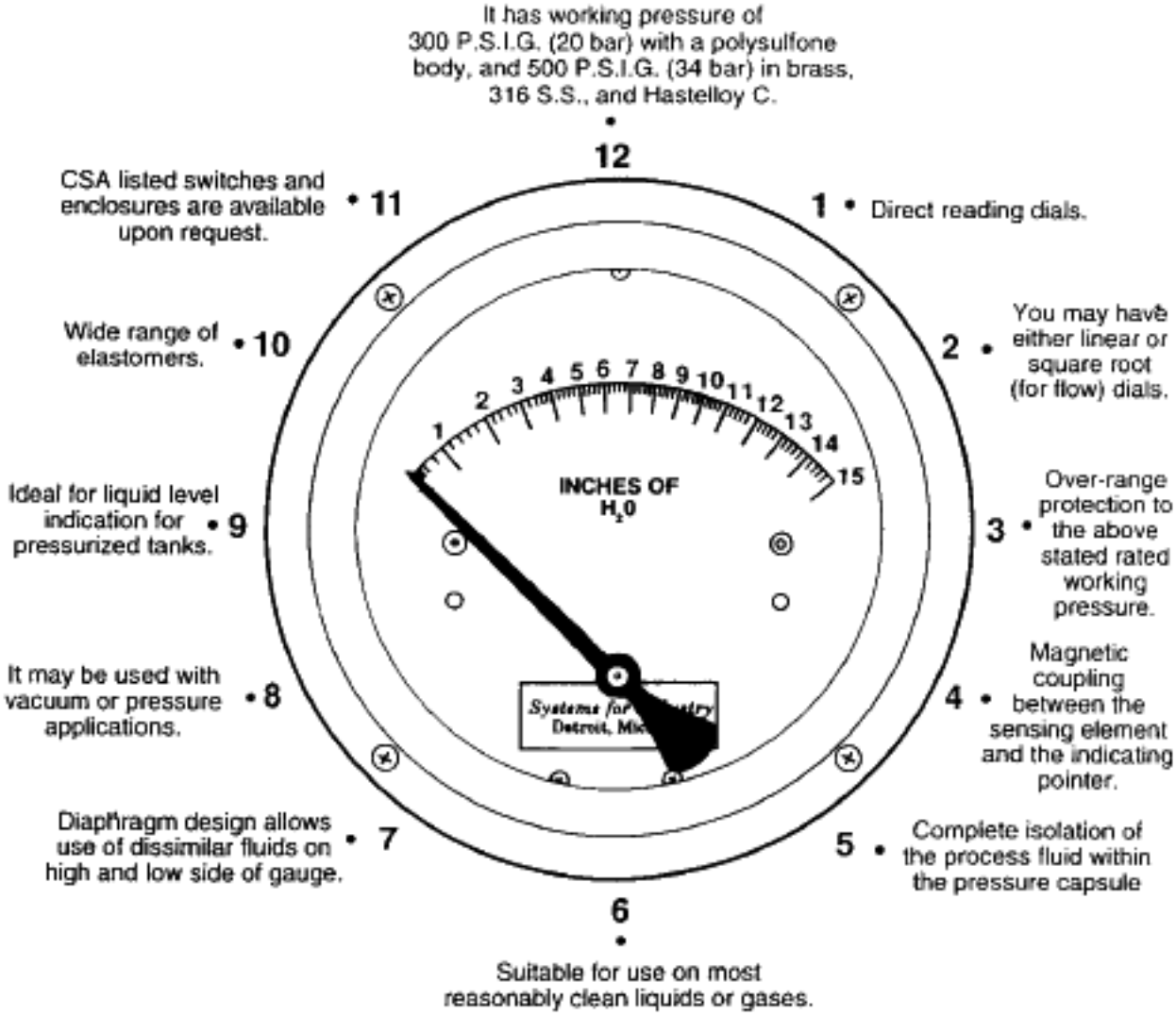


MODEL 1300

Diaphragm Type Differential Pressure Gauge

LOW RANGE: 0 - 5" **HIGH RANGE: 0 - 400"**
0 - 12.1 mbar **0 - 1 bar**

The Model 1300 is a very dependable general purpose gauge. It has a 4½" round dial with black letters on a white background.



It is time to change to a SFI Gauge.

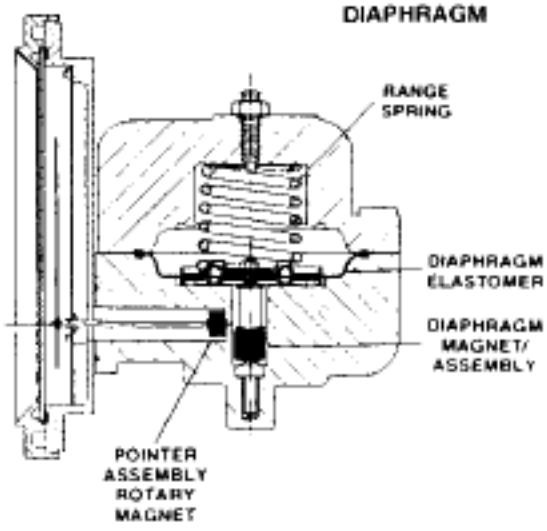
MODEL 1300 GAUGE CHARACTERISTICS

A high quality calibrated spring and a flexible elastomer sense the differential pressure (D/P). The elastoner diaphragm allows complete separationof the low and high sides of the gauge. The diaphram is supported at both ends of the travel. This feature provides over range protection up to the rated working pressure of the gauge.

A magnetic coupling transmits the sensing element movement to the indicating pointer while assuring isolation of the process fluid within the pressure capsule. This prohibits the possibility of process fluid leaking into the gauge case.

The internal metal parts are 316 Stainless Steel Standard, or Hastelloy C as an option.

MODEL 1300 SIDEVIEW DIAPHRAGM



Special Enclosures:

NEMA Type 4X Enclosure

The Model 1300 with CSA listed control switching is available in non-corrosive molded plastic enclosures. These are oiltight, dustfree and watertight per NEMA Type 4X standards. Dimensions approximately 6"x6"x7". Weight approximately 5 to 11 lbs. (2.3 to 5.0 Kilos).

Explosion-proof CSA Listed

The Model 1300 with CSA listed control switching is available in an explosion-proof enclosure which complies with NEC Class 1, Group D; Class II Groups E, F, and G; NEMA 7 and 9 standards. These are machined cast-aluminum enclosures with ½" FNPT conduit connection and 18" wire leads. Dimensions approximately 8"x8"x9". Weight approximately 20 to 26 lbs. (9.0 to 11.7 Kilos).

STANDARD MODEL NUMBER

P-00-00-1300

300 P.S.I.G. Working Pressure, 40% Glass filled Polysulfone Capsule; Buna N Diaphragm; 316 Stainless Steel Internal Metal Parts: Ceramic Magnet and Acetal Guide Bushing, 4½" Round Dial in Corrosion Resistant Engineering Plastic Case with Shatter Resistant Acrylic Lens, ¼" Steel Compression Tube Fittings. (Metal Bodies - Dual ¼" FNPT Top and Bottom)

DIFFERENTIAL RANGE (IN. H_2O) OR EQUIVALENT & ACCURACY	
0-5 to 10.0"	0-10 thru 0-400"
±5% Full Scale (Ascending)	±3-2-3% Full Scale (Ascending)

PART NUMBERING SYSTEM

P - 0 0 - 0 0 - 1 3 0 0

1 BODY MATERIAL
- B. Brass
- H. Hastelloy C
- P. Polysulfone, 40% Glass Fill (STD)
- S. 316 Stainless Steel

2 SEALS
- 0. Buna N (STD)
- 1. Viton
- 2. Silicone (0-20" H2O and Above)
- 3. Ethylene Propylene (0-20" H2O and Above)

3 CONNECTIONS
- 0. ¼" Steel Comp. Tube Ftgs. (2) (Model P) (STD) ¼" FNPT (4) Brass, 316 S.S. & Hastelloy
- 1. ¼" 316 S.S. Comp. Tube Ftgs. (2)
- 2. ¼" FNPT Brass Adaptors (2) (Model P Only)
- 3. ¼" FNPT 316 S.S. Adaptors (2) (Model P Only)
- 4. .0189" FNPT (2) Brass, 316 S.S. Bodies Only)

4 ELECTRICAL
- 0. None (STD)
- H. (1) Reed Switch with Conduiet Enclosure
- I. (2) Reed Switches with Conduiet Enclosure
- L. (1) Reed Switch in NEMA 4x Enclosure
- M. (2) Reed Switches in NEMA 4x Enclosure
- N. (1) Reed Switch in NEMA 7 Enclosure
- P. (2) Reed Switches in NEMA 7 Enclosure

5 OPTIONS
- 0. None (STD)
- B. Drain & Bleed Plugs, 316 S.S. (2) (Model P Only)
- D. Drain & Bleed, for Model 130 PC in NEMA 4x Enclosure
- E. Drain and Bleed, for all other Model 130's in NEMA 4x Enclosure
- F. Pipe Mounting Kit
- H. Hastelloy C Internal "Wetted" Metal Parts
- M. Maximum Indicator Follower Pointer
- P. Panel Mounting Kit (4 Studs, Lock Washers & Nuts)

SENSOR AND THREAD-O-LET SIZES

ALL VALUES ARE IN INCHES

Line Size	140 T-O-L	140 Sensor	172 T-O-L	172 Sensor	172 Double Mount	205 T-O-L **	205 Sensor	310 T-O-L **	310 Sensor
1/2	1/2	5/16	*	*	*	3/4	5/16	3/4	5/16
3/4	1/2	5/16	*	*	*	3/4	5/16	3/4	5/16
1	1/2	5/16	*	*	*	3/4	5/16	3/4	5/16
1-1/4	1/2	1/2	*	*	*	3/4	1/2	3/4	1/2
1-1/2	1/2	1/2	*	*	*	3/4	1/2	3/4	1/2
2	1/2	1/2	*	*	*	3/4	1/2	3/4	1/2
2-1/2	1/2	1/2	*	*	*	3/4	1/2	3/4	1/2
3	1/2	1/2	*	*	*	3/4	1/2	3/4	1/2
4	1/2	1/2	1/2	1/2	1/2	3/4	1/2	3/4	1/2
5	1/2	1/2	1/2	1/2	1/2	3/4	1/2	3/4	1/2
6	1/2	1/2	1/2	1/2	1/2	3/4	1/2	3/4	1/2
8	1/2	1/2	1/2	1/2	1/2	3/4	1/2	3/4	1/2
10-48	1	1	1	1	1/2	1-1/4	1	1-1/4	1
48-96	*	*	1	1	1	*	*	*	*

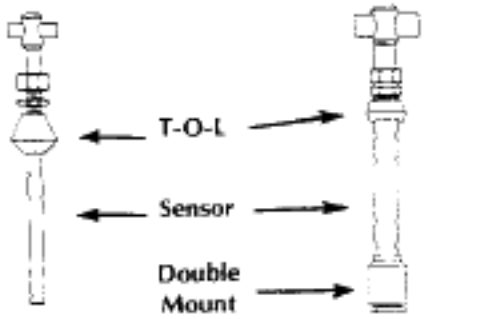
* Denotes that size does not apply.

** Denotes that isolation valve and nipple are the same size.

OPERATIONS AND INSTALLATION INSTRUCTIONS

MODEL 140
SINGLE MOUNT

MODEL 172
DOUBLE MOUNT



VERIFY PRESSURE & TEMPERATURE

is within the operating range of this sensor and that the maximum flow range has not been exceeded. See Page 28.

MOUNTING LOCATION SELECTION

It is very important that the proper location be selected as with all differential instruments, for the correct signal to be obtained.

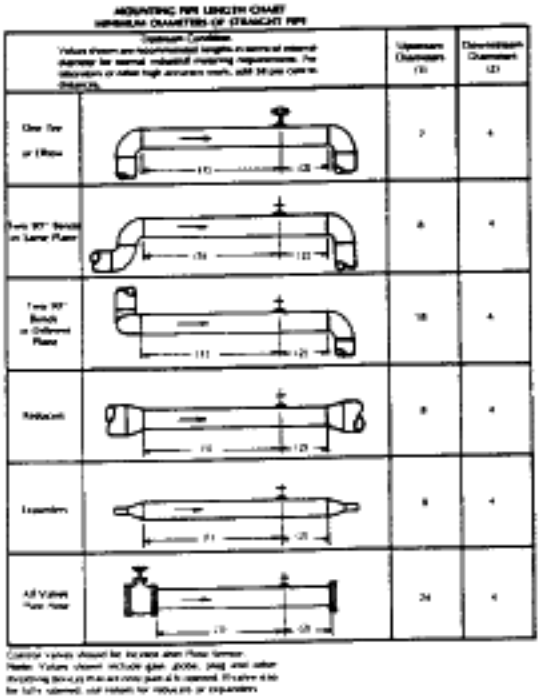
The first consideration is the amount of upstream and downstream pipe length available. (See chart about pipe length)

When the preferred pipe lengths cannot be provided, to locate the optimal position for placement, take the total available length and divide it into ten equal parts and put seven parts upstream and three parts downstream.

This method will provide a repeatable signal, however accuracy will not be within published ranges. To acquire a corrected signal relative to accurate volume readings, field calibration is necessary.

When the sensor is to be installed in pipes or ducts that are running horizontal they must be positioned according to the type of media that is being measured.

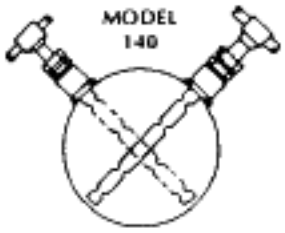
If the service is Water or Steam the Sensor must be mounted so the head is positioned in the lower quadrant of the pipe or duct. This will keep the impulse lines full of liquid up to the lowest sensing port and prevent air entrapment.

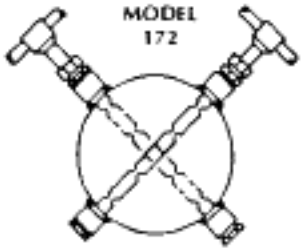


WATER OR STEAM SERVICE

Note: This mounting for steam is only useful on low pressure saturated steam with **uninsulated** lines. Preferred method is shown on Page 22 and 24.

If the service is Gas or Air then the Sensor must be mounted so the head is positioned in the upper quadrant of the pipe or duct. This will allow the condensation to flow out of the lowest hole in the Sensor and prevent moisture accumulation.





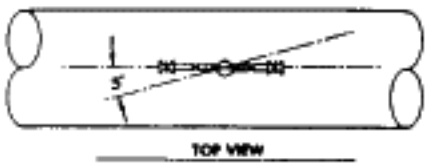
GAS OR AIR SERVICE

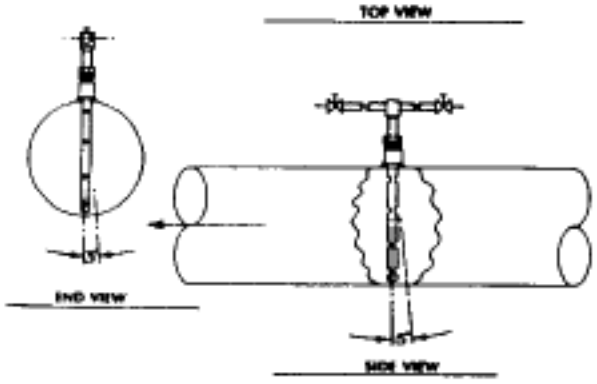
For vertical pipes the Sensor will be installed horizontial in any quardant of the pipe. A special 90 head provides a level valve head arrangement.

MOUNTING THE SENSOR

WARNING WARNING

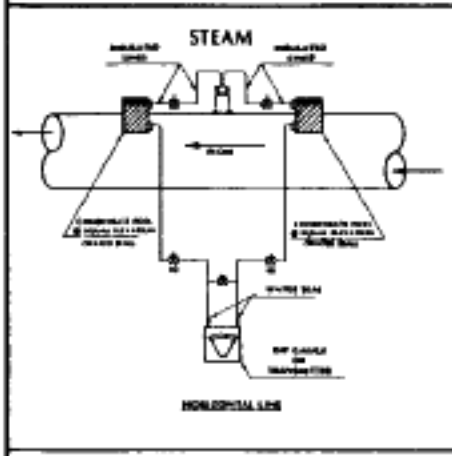
Before drilling into any pipe make sure that all pressure has been relieved and all the media has been removed. Uncontrolled or unexpected process pressure and media may cause bodily injury and damage to the equipment.

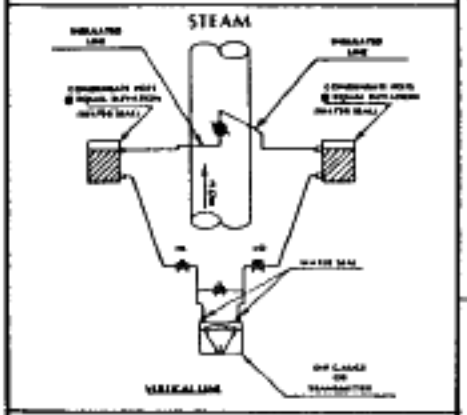


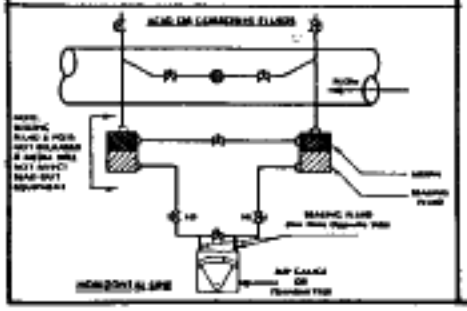


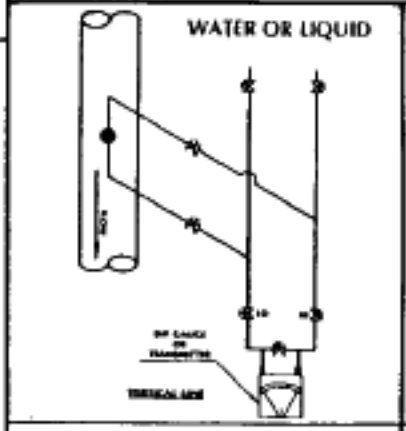
-ALLOWABLE MISALIGNMENT-

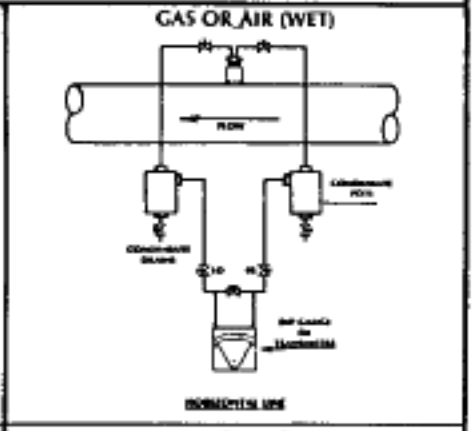
PREFERRED INSTALLATION FOR SYSTEMS FOR INDUSTRY

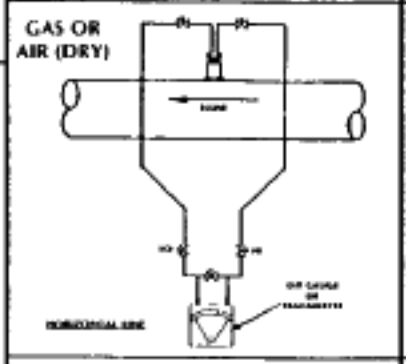


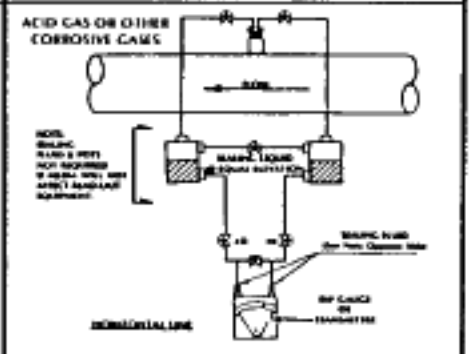


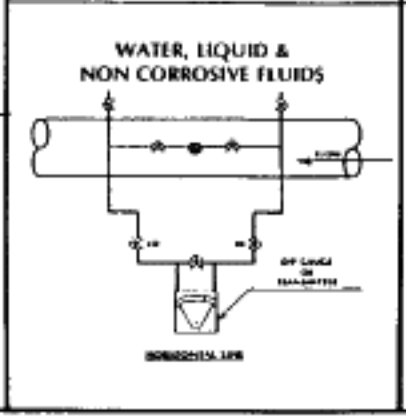


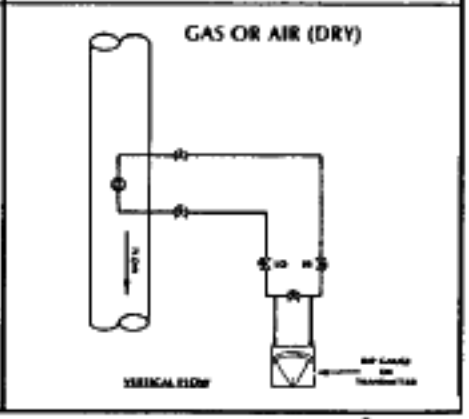












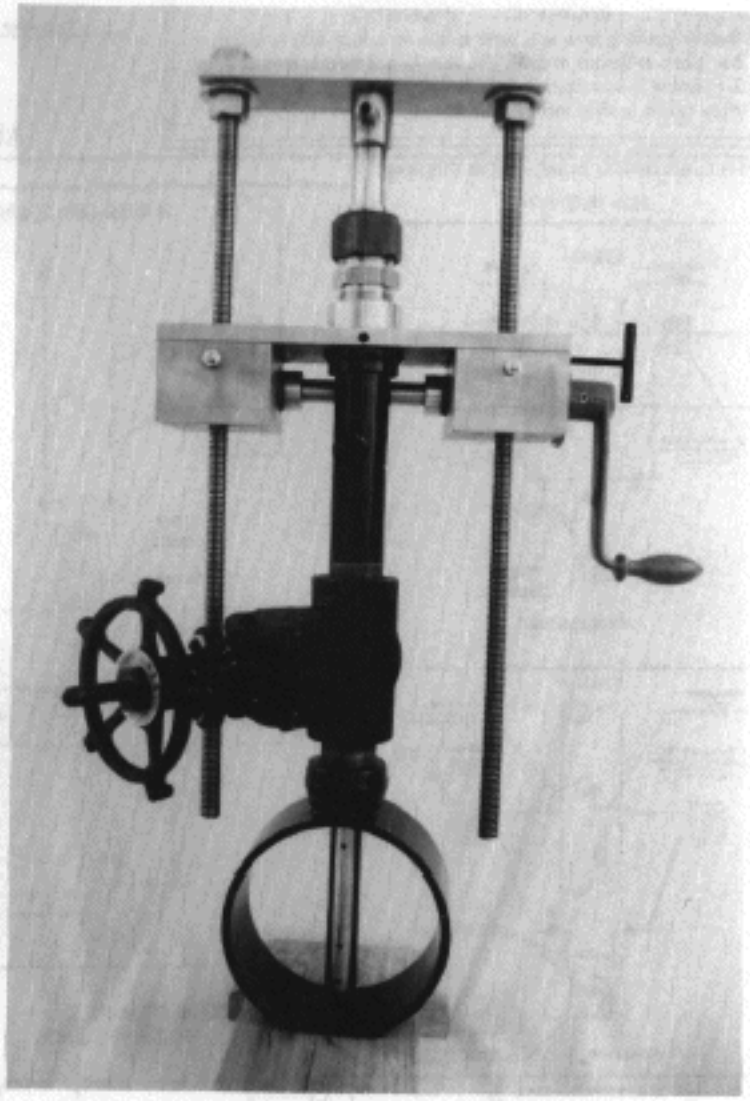
HAND CRANK RETRACTABLE MODEL HC

This option allows simple and easy installation of our hot-tap units.

This unit can be used on our Model 310's and our heavy-duty Model 757's

This unit comes equipped with a hand crank, but it could be powered by the use of a heavy duty electric drill.

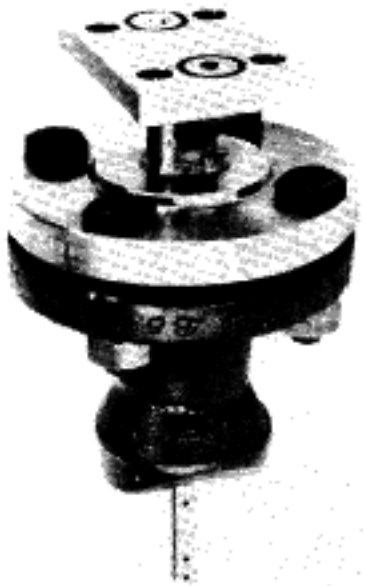
***Shown without instrument valve.**



OUTSTANDING FEATURES:

- Lightweight
- Dual lead screws for balanced alignment
- Factory installed on sensor
- Can be rotated to allow rods to pass by isolation valve
- Heavy duty internal bearings used on all rotating parts
- Stainless steel acme threaded rods
- Treaded rods are protected from damage by PVC covers
- This is a time saving device

EASY MOUNT FOR D/P TRANSMITTER MODEL EM



This patented Easy Mount option for our sensors allows the convenience of attaching the D/P Transmitter on top of the pitot tube. This eliminates the need for threaded connections and tubing. It also reduces the number of leak possibilities. The Easy Mount option is designed with 2-1/8" centers. This is the standard mounting on D/P Transmitters. You can mount the transmitter directly on the mating flange, or you can put a flange to flange three valve manifold between the Easy Mount and the D/P Transmitter. When you include the SPP Option (Static Pressure Port) and the RTD (Temperature Sensor) you can have a truly multi-input signal. Please ask about our multivariable system for compressed gases and steam.

Material Specifications:

Patent #4,373,195

Sensor Tube:	316 S.S. Standard. Other alloys available
Sensor Flange:	1-1/2 150# R.F. 316 S.S. standard. Other alloys available.
Mounting Weld Neck:	1-1/2" 150# R.F. Carbon Steel standard. Others available.
Weld-O-Let:	1-1/2" 3000 Carbon Steel standard. Others available.

Pressure/Temperature Rating - Limitation of Flanges.

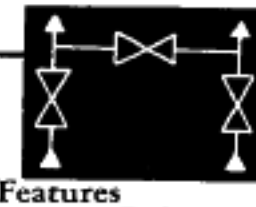
SERVICE SADDLE OR SADDLE CLAMP MODEL SC

Service Saddles are quick and dependable ways of providing female national pipe threads (FNPT) to the surface of pipes and ducts that cannot be welded.

Service Saddles come standard in ductile iron with a stainless steel attaching strap. They can also be provided in stainless steel and bronze.

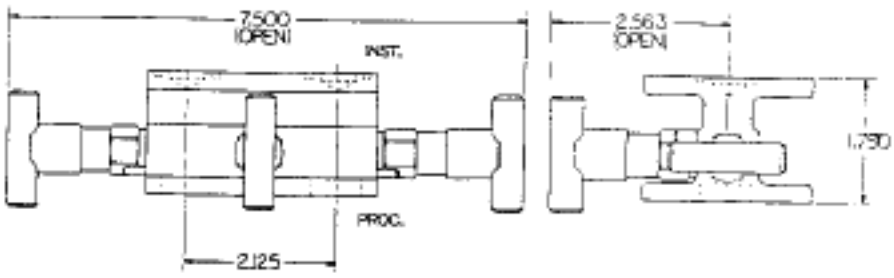
These are commonly used on Brass, PVC, Copper, Ductile Iron, Fiberglass Pipes or Thin Wall Ducts.

PRESSURE: 150 PSIG is standard. Higher pressure ratings are available depending upon the application.
TEMPERATURE: Maximum of 200 Deg. F
GASKET: Compounded for use with water, salt solution, mild acid. Bases: Oil and Hydrocarbons.
FINISHES: Standard shop coat primer or fusion plastic coating.
NOTE: The O.D. of the pipe or duct must be submitted with the purchase order.

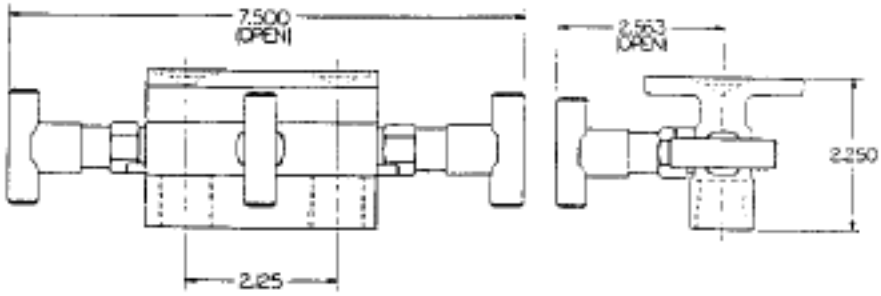


Three Valve Manifold For Transmitters & Gauges

Flange to Flange



Flange to Pipe Thread



Features

Body

- 2⅛" Connection centers
- Metal seats
- ⅜" Porting
- No body plugs
- Mounting bolts and gaskets included

Stem & Bonnet

- *Differential Hardness In Seating*
  316 SS stem in CS body
  Nitronic 60 stem in SS body
- Rolled stem threads
- PTFE coated stem threads
- Viton O-ring
- Threads above seal
- Back-seated stem
- SS bonnet locking pin
- Cap rises w/stem for visual open/close

Working Pressure

- 6,000 PSI @ 400°F

Condensate and Seal Pots

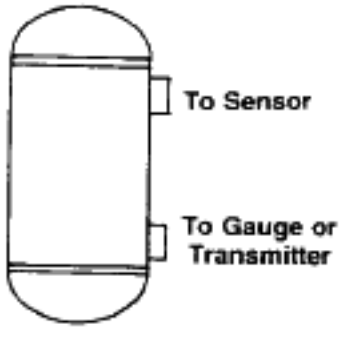
These units are available in carbon steel to meet A.S.T.M. 106-GR.B piping code or stainless steel A.S.T.M.-A-312.

These pots are made from seamless pipe with the inside cleaned and checked to assure equal volume.

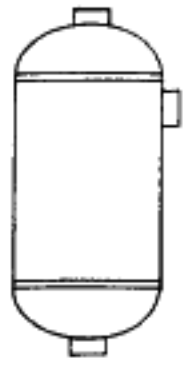
The half coupling pipe connections are jig welded inside and out at 90 degrees to assure safety, provide proper alignment and ease the task of installing.

Condensate Pots: They are used to catch and hold condensate and foreign material. This will prevent damage to the metering system and or manifold. The condensate may be drained from the bottom valve connection. We recommend OS&Y gate or ball valves be used as the drain port.

Seal Pots: They are used to allow a liquid seal on top of the meter when the flowing gases or liquid is acid or caustic. They can also be used on steam when the impulse line are insulated from the main pipe to the seal pots. When the application is outside and antifreeze is used as a liquid they can be used to prevent freezing.

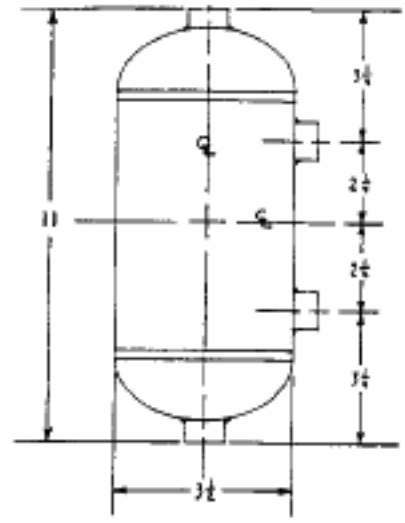


Model 1020



Model 1030

Model 1040



Typical Drawing

SQUARE TO ROUND	CONVERT ACFM TO SCFM $SCFM = ACFM * \left(\frac{AP}{14.73}\right) \times \left(\frac{520}{AT}\right)$

All calculations for **Tri-Flo Tech** are based on round pipe. You must convert the rectangular pipe or duct to an equal round size using the formula below.

D = round diameter equal to the rectangular pipe or duct
L = Length of long side
W = Length of short side

$$D = \sqrt{\frac{L \times W \times 4}{3.1416}}$$

PERMANENT PRESSURE LOSS (PPL) Tri-Flo Tech VS ORIFICE PLATES

Unrecovered Pressure Loss as a Percent of D/P

Pipe Size	Sensor Size ⅜, ½, ¾, 1	Sensor Size 2⅜
84	1.52	3.60
72	1.77	4.20
60	2.12	5.04
48	2.65	6.30
42	3.03	7.20
36	3.54	8.40
30	4.24	10.08
24	5.31	12.60
20	6.37	15.12
18	7.07	16.80
16	7.96	
14	6.82	
12	7.96	
10	9.55	
8	7.96	

The above chart shows the amount of permanent pressure loss as a percent of the differential pressure. Most orifice plates have a pressure loss of about 50% of the differential pressure signal that it generates by restricting the line.

The following example will show how the **Tri-Flo Tech** sensor greatly reduces this pressure loss.

Tri-Flo Tech sensor operating in a 20 inch line has a loss percentage of .06. So let's assume that it is operating at 100" W.C.

Sensor D/P * (PPL) = Loss "W.C.
100" W.C. * .06 = 6" W.C.

Let's take the same pipe and place an orifice plate in it under the same 100" W.C. operating conditions and a loss factor of 50%.

Orifice Plate D/P * (PPL) = Loss "W.C.
100" W.C. * .50 = 50" W.C.

As you can see there is over 8 times the savings using the **Tri-Flo Tech** sensor.

AT =	Actual temperature of flowing conditions Degrees rankine 460 + °F)
Ap =	Actual pressure of flowing conditions = PSIA
ACFM =	Actual rate of flow in cubic feet per minute.
DP =	Differential pressure, inches of w.c.
D =	Inside diameter of pipe in inches.
d_f =	Flowing density in lbs/ft ³.
G_f =	Flowing liquid specific gravity density of flowing liquid relative to water sp.gr. = 1 at 60 °F.
GPM =	Gallons per minute.
PPH =	Pound per hour for air, water or steam.
PSIA =	Pressure. (Gauge + 14.73)
PSIG =	Pressure (Pound per square inch)
Q =	Flow in correct terms. Example: GPM for liquid; SCFH for Air/Gas; PPH for steam.
S_k =	Flow engineering number.
SCFM =	Standard cubic feet per minute.
SCFH =	Standard cubic feet per hour.
T =	Temperature in degree °F of flowing conditions.
$S\overline{v}$ =	Specific volume of steam cu ft/lb.

Standard Sensors

Liquid - @ 60ºF & 100 PSIG
Air/Gas @ 100ºF & 100 PSIG
Steam - @ 327ºF & 100 PSIA

Super Duty Sensors

Liquid - @ 60ºF & 100 PSIG
Air/Gas - @ 100ºF & 100 PSIG
Steam - @ 327ºF & 100 PSIA

MAXIMUM FLOW

CHART 1

Standard Duty Single Mount

Values Below Based on Sch. 40 Pipe

Line Size	D/P In H20	Liquid GPM	Gas/Air SCFM	Steam PPH
½	500	19	198	582
¾	475	35	368	1079
1	450	70	726	2127
1¼	425	121	1244	3646
1½	415	167	1719	5039
2	400	285	2931	8591
2½	380	420	4318	12656
3	360	635	6526	19128
3½	325	834	8563	25098
4	275	1019	10462	30665
5	265	1596	16383	48018
6	235	2128	21851	64044
8	200	3425	35165	103068
10	185	5361	55034	161302
12	175	7494	76927	225469

Values Below Based on Std. Wt Pipe
.375 Wall Thickness

14	150	8585	88133	258312
16	140	11001	112929	330990
18	130	13574	139341	408401
20	120	16472	169093	495602
24	88	20760	213106	624603
30	33	20150	206849	606264
36	20	22811	234157	686302
42	14	26173	268671	787460
48	6	22580	231785	679348

CHART 2

Standard Duty Double Mount

Values Below Based on Sch. 40 Pipe

Line Size	D/P In H20	Liquid GPM	Gas/Air SCFM	Steam PPH
4	600	1505	15454	45296
5	550	2299	23602	69177
6	500	3105	31873	93418
8	450	5138	52748	154602
10	400	7883	80924	237183
12	350	10598	108791	318862

Values Below Based on St. Wt. Pipe
.375 Wall Thickness

14	300	12142	124638	365309
16	290	15833	162533	476377
18	275	19742	202663	593994
20	250	23776	244064	715340
24	200	31297	321270	941625
30	150	42961	441004	1292559
36	105	52266	536522	1572517
42	60	54183	556202	1630198
48	35	54535	559814	1640785
60	15	56791	582973	1708662
72	10	67151	689317	2020351
84	6	71045	729292	2137513
96	4	75937	779502	2284676

CHART 3

Super Duty Single Mount

Values Below Based on St. Wt. Pipe
.375 Wall Thickness

Line Size	D/P In H20	Liquid GPM	Gas/Air SCFM	Steam PPH
16	400	18595	190886	559476
18	385	23360	239794	702823
20	375	29119	298917	876109
24	350	41402	425000	1245653
30	235	53773	551990	1617852
36	150	62470	641267	1879517
42	100	69951	718054	2104576
48	70	77125	791697	2320421
60	50	103687	1064359	3119575
72	25	106176	1089907	3194456
84	15	112333	1153112	3379706

CHART 4

Super Duty Double Mount

Values Based on St. Wt. Pipe
.375 Wall Thickness

Line Size	D/P In H20	Liquid GPM	Gas/Air SCFM	Steam PPH
16	800	26265	269616	790229
18	775	33143	340219	997164
20	750	41181	422732	1239006
24	700	58552	601041	1761619
30	500	78436	805160	2359880
36	350	95425	979551	2871010
42	250	110602	1135343	3327627
48	200	130365	1338213	3922228
60	160	185481	1903983	5580467
72	125	237417	2437106	7143021
84	80	259423	2662998	7805097
96	65	306113	3142274	9209827
120	35	352083	3614167	10592918

FLOW CALCULATIONS

LIQUID FLOW CHART

D = Inside pipe diameter in inches

DP = Differential pressure in inches of water column.

GPM = Flow in U.S. gallons per minute.

G_{60} = Liquid specific gravity @ 60°F.

G_f = Specific gravity @ flowing conditions.

Spec. gravity relative to water. Water at 60 °F = 1

S_k = Systems engineering numbers (see chart 105)

$$DP = \left(\frac{GPM \cdot G_{60}}{S_k \cdot D^2}\right)^2 \Big/ G_f$$

$$GPM = \frac{\sqrt{DP} \cdot (S_k \cdot D^2 \cdot \sqrt{G_f})}{G_{60}}$$

CHART (105) FOR LIQUID S_k NUMBERS

For pipe size 1/2" to 12" SCH 40 & 80

LINE SIZE	SCH 40	SCH 80
1/2	2.237	1.982
3/4	2.424	2.271
1	3.030	2.634
1 1/4	3.087	2.878
1 1/2	3.172	2.985
2	3.342	3.189
2 1/2	3.540	3.388
3	3.560	3.482
4	3.792	3.727
5	3.849	3.792
6	3.775	3.710
8	3.803	3.795
10	3.926	3.913
12	3.975	3.970

S_k NUMBERS BELOW ARE BASED ON STD. PIPE 14" TO 200"

14	3.993
16	3.998
18	4.001
20	4.058
24	4.094
30	4.100
36	4.105
42	4.111
48	4.129
60	4.177
72	4.183
84-200"	4.185

(GAS/AIR) FLOW EQUATION

A_p = Absolute pressure (guage + 14.73)

A_t = Absolute temperature rankine (460 + °F)

D = Inside pipe diameter in inches

DP = Differential pressure in inches of water column

G_s = Specific gravity @ standard conditions
Spec. gravity relative to air.
Air at std. cond. = 1

SCFH = Flow in standard cubic feet per hour.

S_k = Systems engineering number (see chart 106)

$$DP = \left(\frac{SCFH}{S_k \cdot D^2}\right)^2 \cdot \left(\frac{A_t \cdot G_s}{A_p}\right)$$

$$SCFH = \sqrt{DP} \cdot (S_k \cdot D^2 \cdot \sqrt{A_p/A_t \cdot G_s})$$

CHART (106) FOR GAS/AIR S_k NUMBERS

For pipe size 1/2" to 12" SCH 40 & 80

LINE SIZE	SCH 40	SCH 80
1/2	3049.004	2701.649
3/4	3303.731	3118.475
1	4129.664	3590.475
1 1/4	4206.854	3922.630
1 1/2	4322.639	4068.630
2	4554.209	4346.503
2 1/2	4824.374	4617.337
3	4851.391	4745.345
4	5167.869	5079.987
5	5245.059	5168.558
6	5145.484	5056.680
8	5183.307	5171.937
10	5350.810	5332.327
12	5417.193	5410.259

S_k NUMBERS BELOW BASED ON STANDARD PIPE 14" TO 200"

14	5438.034
16	5448.841
18	5453.472
20	5530.662
24	5579.292
30	5587.783
36	5594.730
42	5603.221
48	5627.150
60	5692.761
72	5700.480
84 to 200"	5703.568

(STEAM/AIR/WATER) MASS FLOW EQUATION

Use this equation when material is given in **PP** and the flowing **density** is given

D = Inside pipe diameter in inches

DP = Differential pressure in inches of water column

d_f = Density of flowing material (If only specific volume is known then you may find density by using this formula $d_f = 1/sv$)

PPH = Flow in pounds per hour

S_k = Systems engineering number. (see chart 107)

$$DP = \left(\frac{PPH}{S_k \cdot D^2 \cdot \sqrt{d_f}}\right)^2$$

$$PPH = \sqrt{DP} \cdot (S_k \cdot D^2 \cdot \sqrt{d_f})$$

CHART (107) FOR STEAM-AIR-WATER MASS FLOW EQUATION S_k NUMBERS

For pipe size 1/2" to 12" SCH 40 & 80

LINE SIZE	SCH 40	SCH 80
1/2	141.804	125.649
3/4	153.651	143.958
1	192.064	166.980
1 1/4	195.654	182.436
1 1/2	201.039	189.198
2	211.809	202.149
2 1/2	224.374	214.745
3	225.631	220.699
4	240.350	236.263
5	243.940	240.382
6	239.309	235.178
8	241.068	240.539
10	248.858	247.999
12	251.946	251.623

S_k NUMBER BELOW BASED ON STANDARD PIPE 14" to 200"

14	253.094
16	253.453
18	253.633
20	257.331
24	259.556
30	259.987
36	260.382
42	260.562
48	251.675
60	264.582
72	265.013
84 to 200"	265.121

MODEL NUMBERING SYSTEM

NOMINAL PIPE SIZE

PIPE SCHEDULE OR I.D. & WALL

PIPE MATERIAL

- AL = ALUMINUM
- CI = CAST IRON
- CS = CARBON STEEL
- CO = COPPER
- FRP = FIBERGLASS
- PVC = PVC PLASTIC
- SS = STAINLESS STEEL
- XX = SPECIAL CALL FACTORY

INSTRUMENT VALVES:

- BB4 = 1/4" BRONZE BALL
- BB2 = 1/2" BRONZE BALL
- CN4 = 1/4" CARBON STEEL NEEDLE
- CN2 = 1/2" CARBON STEEL NEEDLE
- FG4 = 1/4" OS&Y FORGED GATE CARBON STEEL
- FG2 = 1/2" OS&Y FORGED GATE CARBON STEEL
- SB4 = 1/4" STAINLESS STEEL BALL
- SB2 = 1/2" STAINLESS STEEL BALL
- SN4 = 1/4" STAINLESS STEEL NEEDLE
- SN2 = 1/2" STAINLESS STEEL NEEDLE
- SW2 = 1/2" SOCKET WELD
- XX = SPECIAL CONTACT FACTORY

SENSOR TYPE

- 140 = STD. PACKING GLAND
- 172 = STD. PACKING GLAND DOUBLE MOUNT
- 205 = LOW PRESSURE HOT-TA
- 310 = HIGH PRESSURE HOT-T
- 401 = FLG. SINGLE MOUNT
- 421 = FLG. DOUBLE MOUNT
- 500 = METER RUN
- 600 = INLINE
- 737 = FLG. SUPER DUTY SINGLE MOUNT
- 747 = FLG. SUPER DUTY DOUBLE MOUNT
- 757 = SUPER DUTY HOT-TAP
- 800 = EQUAL SPACED PORTS BALANCE & TESTING
- 900 = SINGLE POINT FOR TRAVERSING

OTHER OPTIONS:

- ASH = ALL STAINLESS HARDWARE
- AMH = ADDITIONAL MOUNTING HARDWARE
- EM = EASY MOUNT
- HC = HAND CRANK RETRACTABLE
- NSF = 300#, 600#, 900#, 1500# & 2500# RTJ
- RTD = TEMPERATURE SENSOR
- SC = SERVICE SADDLE CLAMP
- SPP = STATIC PRESSURE PORT
- 0 = NO OPTIONS
- ( ) = SPECIAL INSTRUCTIONS INSIDE THE ( )