Proteus Industries Inc.

700 Series FluidVision™

Metering Flow, Temperature & Pressure Switches

Installation & Operating Instructions

Contents: **Page**

CAUTION Notes are important – SAVE TIME AND MONEY!

Taking proper precautions to avoid damage to the WeldSaver during installation helps ensure consistent, error-free installations, lowering costs and assisting on-time completion of contracted work.

The Caution notes inserted in the following instructions provide an alert to installers and operators to take sensible steps to allow the WeldSaver to operate correctly the first and every time it is tested.

Product Warranty does NOT cover the repair of Installation Errors

The 9WS1WR-AA3 is warranted to be free of material or workmanship defects. The full text of the warranty is available on the Proteus Industries Inc. website at www.proteusind.com/warranty.

The costs of cleaning flow sensors, recalibration or repair of mechanical damage incurred during installation of the product are NOT covered by warranty. A Purchase Order will be required to allow recovery of such service costs.

Section 1 Introduction

FluidVision sensors measure flow rate, temperature and pressure of water, water/glycol mixtures, Galden®, Fluorinert® and other liquids. All sensors are combined in one unit for an easy and compact installation.

FluidVision sensors provide accurate and precise measurement of these parameters, providing 5VDC or 4 -20 mA outputs. Trip points for all three parameters can be linked to a switching relay.
This manual provides information to help you install FluidVision Sensors in your fluid system

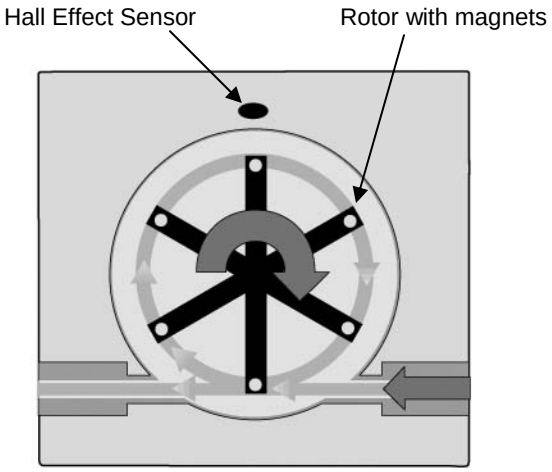
Installation of this product should be performed by a qualified service person.

How do they Work?

Flow Rate

A rotor spins when liquid flows through the meter. Magnets in the rotor switch a Hall-effect sensor mounted in the sensor body. The resulting pulse train is converted by the electronics to a flow rate, which is output as 0-5 VDC or 4-20 mA current loop signals depending on model selection.

User-adjustable flow, temperature and pressure trip points can be linked to a relay output. If the polysulfone faceplate is selected, the spinning rotor gives a visual indication of flow. Flow ranges are shown in the data sheet. User-adjustable flow, temperature and pressure trip points can be linked to the relay output.



Temperature

An electronic transducer embedded in a stainless steel probe senses the temperature of the flowing liquid over the range of -40 to 100¡C. Temperature output is available as 0-5 VDC or 4-20 mA current loop signals depending on model selection.

User-adjustable flow, temperature and pressure trip points can be linked to the relay output.

Note

FluidVision sensors formed from polypropylene are rated for operation to 70ºC.

FluidVision sensors formed from brass and stainless steel are rated for operation to 100ºC.

Pressure

This optional transducer measures pressure to the maximum rating of the selected flow sensor material, generally 100 psi (700 kPa) with polysulfone faceplates and 250 psi (1750 kPa) with metal face plates. Pressure output is available as 0-5 VDC or 4-20 mA current loop signals depending on model selection.

User-adjustable flow, temperature and pressure trip points can be linked to the relay output.

Note

FluidVision sensors formed from polypropylene are rated for operation to 75 psi (10.5kPa).

FluidVision sensors formed from brass and stainless steel with polysulfone or polycarbonate faceplates are rated for operation to 100 psi (700kPa).

FluidVision sensors formed from brass and stainless steel with brass and stainless steel faceplates are rated for operation to 250 psi (1750kPa)**.**

Relay and LED Output

A relay allows the user to set alarm levels for low flow rate, high temperature and high pressure. The single relay will trip if any alarm level is detected. Three bright LEDs are green for a normal condition, or red for an alarm condition for each flow parameter. The relay allows a local safety alarm and switching independent of your controller or PLC.

The relay circuit can provide a redundant safety circuit. If a relay is not needed, it may be omitted on the 0-5 VDC output models.

Certifications

FluidVision is CE marked for compliance with the EU Directive 89/336/EEC for electromagnetic compatibility. It has been Safety Certified by RWTUV as a low voltage, Class III device.

LCD Displays

Digital panel display meters are available to display a single 0-5 VDC output for flow rate, temperature or pressure in engineering units. Each unit has a 3-1/2 digit LCD display with 0.6 inch high digits and a DIP switch selectable decimal point.

Part numbers for Digital Display units are shown in Tables x to y on page of this manual.

Section 2 Specifications and Performance

The most current information on the performance capability of these sensors is accessible on the Proteus website at www.proteusind.com.

Flow Ranges		Connection	Part Numbers		
GPM	LPM		Brass	Polypropylene	Stainless Steel
0.1 – 1.0	0.4 – 3.8	¼" NPT	0701B24XXX	0701P24XXX	0701SS24XXX
0.25 –2.5	0.9 – 9.5	¼" NPT	0705B24XXX	0705P24XXX	0705SS24XXX
0.8 – 6.0	3.0 - 22	¼" NPT	0703B24XXX	0703P24XXX	0703SS24XXX
1.5 – 12	5 – 45	½" NPT	0750B24XXX	0750P24XXX	0750SS24XXX
4 – 20	15 – 75	½" NPT	0755B24XXX	0755P24XXX	0755SS24XXX
6 – 30	23 –115	¾" NPT	0760B24XXX	0760P24XXX	0760SS24XXX
10 – 60	38 –230	1" NPT	0770B24XXX	0770P24XXX	0770SS24XXX

Specifications and Performance (cont)

Liquid operating Limits	
Temperature	0 to 85°C (32 to 185 °F) with standard polysulfone faceplate. ***Electronics must be thermally isolated from flow sensor at temperatures above 85°C and below dew point.*** *Contact Proteus Applications for information on operating from –40 to 125 °C.*
Pressure	Fluid pressure may be measured from 0 psi to the maximum allowable pressure , 100 psi (700kPa) for polysulfone and polycarbonate faceplates, 250 psi(1750 kPa) for metal
Kinematic Viscosity	To 120 centipoise.
Wetted Materials	
Flow Sensor Body	Brass, 316 Stainless Steel or polypropylene
Faceplate	Polysulfone, brass or 316 stainless steel. Metal faceplates are available for 70x, 750, 755 and 760 series with metal sensor bodies.
Sealing O-ring	Silicone Rubber. Other materials are available.
Rotor	Carbon fiber-filled Nylon. Other materials area available.
Rotor Shaft	316 Stainless Steel. Other materials are available.
Meter Performance	
Voltage Output	0 - 5 VDC or 4-20 mA output for each of flow, temperature and pressure.
Accuracy	Device accuracy is the measurement capability of the sensor. This information should be read in conjunction with the Calibration information below: Improved accuracy and linearity performance over smaller flow ranges can be achieved by specialized NIST-traceable calibration procedures.
Linearity	Flow: ± 1.5% of full scale. Temperature: ± 1°C (0-100°C) Pressure: ± 1 PSI (0 – 100 PSI) ± 3 PSI (0-250 PSI)
Repeatability	Flow: ± 0.5% of full scale Temperature: ± 0.3°C (0-100°C)
Calibration	A statement of Conformance is provided for all 700 Series sensors. The standard flow rate and pressure calibration is based on water at ambient temperature Our calibration accuracy is maintained by statistical comparison with NIST-traceable standards.

Switch Performance	
Trip Point Selection	Continuous 20 turn potentiometers are provided for each measured parameter.
Switch type	Relay Closure, NO or NC provided.
Relay rating	3A at 30 VDC
Electrical	
Power Requirements	24 VDC, 100 mA
Electrical Connection	Plug type EDZ1550/8 with screw fastening of 8 conductors up to #16 gauge.
Relay Connections	Riacon type 31249103.
Remote Electronics	Optional mounting locates electronics up to 30 ft from flow sensor. Required for operation above 85°C.

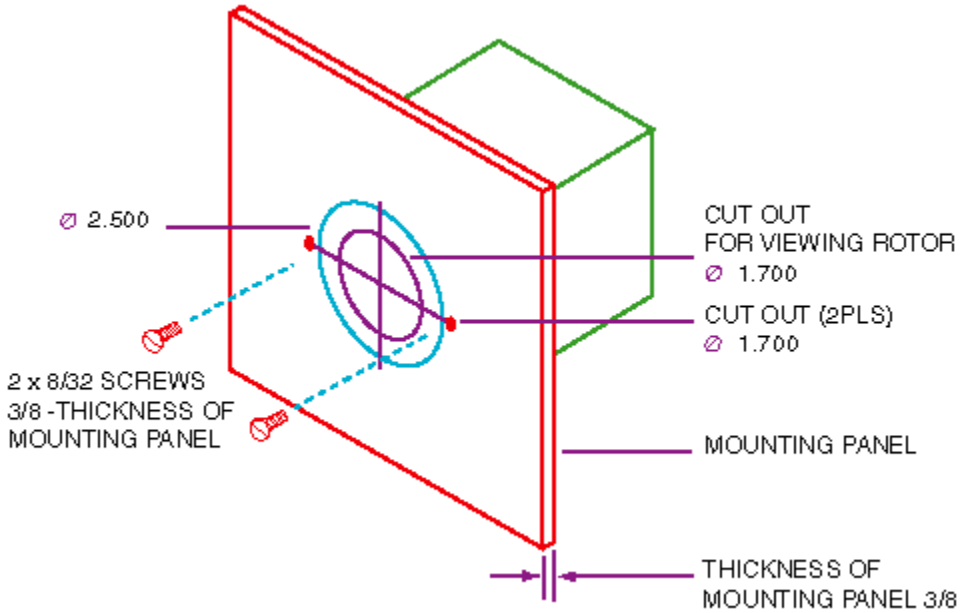
Section 3 Installing FluidVision Sensors

Mounting

For the best results, FluidVision sensors should be mounted with the faceplate in the vertical plane. In general, it is undesirable to mount any plumbing directly over electronic controls or instruments, as leaks could cause damage. If rigid piping is used, the plumbing may support the sensor.
Panel Mounting

To mount the sensor behind a panel, the face plate screws (8-32 X 3/8) will need to be replaced with longer screws to compensate for the thickness of your panel. Ensure that the screws are not so long as to hit the back of the tapped hole or rip through the back if over-tightened on a polypropylene body.

To mount behind the panel, evenly space six holes for 8-32 screws on a 2-1/2" bolt circle as shown in the diagram on Page 12. Two of the holes are on the horizontal plane if the label is right side up. If you wish to view the rotor of sensors with clear faceplates, cut a 1-3/4" diameter with the same center as the bolt circle. Remove the screws holding the face plate to the sensor body and, placing the sensor behind the panel, insert the longer screws you have selected through the panel and face plate and screw into the flow switch body. The screws should be tightened to a torque of 10 inch-lbs.



Plumbing Connections

Note

Before connecting a sensor into your fluid line, verify that the normal flow rates expected in that line are within the operating range of the sensor.

Extended use above the rated maximum flow rate of the sensor will reduce its useable life.

Note

It is recommended that connections to the stainless steel flow sensor be made with stainless steel or materials of similarly chemical inertness to minimize potential corrosion damage.

CAUTION

Do NOT use anaerobic pipe sealants such as LOCTITE brand sealants or SWAK with the FluidVision sensors.

The aggressive chemical nature of these materials can cause cracking of the polysulfone faceplate.

Use Teflon (PTFE) tape or PTFE-based liquid sealants to provide leak-tight and lubricated junctions at all connection points.

Real-Tuff and Hercules are two of many suitable brands of PTFE-based sealants.

Note

The flow response of the sensor, and thus its calibration may be dependent on the internal diameter (ID) of an incoming pipe, or the ID of a tube connection.

If the ID of your pipe or tube fitting where it connects to the inlet port is LESS than the value shown in Table 2, calibration values may be invalid.

Appropriate calibration procedures can be applied to allow the 800 Series flow sensor to be used with pipes and connections with ID's smaller than those shown in Table 2. Contact Proteus for assistance.

Model #	Flow Range GPM	Flow Range LPM	Orifice ID inches
0701	0.1 – 1.0	0.4 – 3.8	0.19
0705	0.25 –2.5	0.9 – 9.5	0.36
0703	0.8 – 6.0	3.0 - 22	0.36
0750	1.5 – 12	5 – 45	0.61
0755	4 – 20	15 – 75	0.61
0760	6 – 30	23 –115	0.82
0770	10 – 60	38 –230	1.05

Table 2: Minimum ID of pipe or connection for calibrations to be valid.

Note

The flow response of 700 Series sensors and thus their calibration may be dependent on the form of the device attached to the inlet connection and other closely located up-stream devices.

Elbows, T-pieces, valves and filters located immediately up-stream from the flow sensor can introduce swirling motion to the liquid flow. The swirling motion reduces the linear velocity of the flow stream.

We recommend that a straight run of pipe of more than 10 x pipe ID be used between the flow sensor and any up-stream devices to minimize these effects.

Appropriate calibration procedures must be used to provide an accurate flow measurement with elbows or T-pieces that must be attached directly to the inlet connection.

700Series sensors are typically unaffected by the form or proximity of devices on its downstream side.

Sensor Orientation

For the best results, 700 Series sensors should be mounted with the faceplate in the vertical plane.

Mounting the device with the flow connections uppermost can help eliminate entrained air from your system.

Flow Direction

The 700 Series Metering Flow Switch is not sensitive to flow direction. Flow can be introduced to the sensor from either side.

Making NPT pipe thread connections

Pipe threads seal by making metal-to-metal contact between male and female components. Consequently they are particularly prone to the damaging effects of galling, which occurs when two surfaces move against each other under pressure. When installing pipe threads it is essential to use a high quality lubricating and sealing material.

Use Teflon tape or a PTFE-based liquid sealant to provide lubrication for the junction and a leak-tight connection at both input and output connections. Real-Tuff and Hercules are two of many suitable brands of PTFE-based sealants.

Do not over-tighten the connection. Refer to instructions for installation of the mating fittings for information on torque requirements.

Leak testing of all connections in your flow circuit is recommended. Pressurizing the system with air and external testing with a dilute soap solution can help identify leaking connections.

Filtering

Your circulating fluid may contain particles. While not essential to the operation of the flow sensor, it is good practice to filter your fluid. A 100-micron filter is often used to remove rust and other particles from the fluid. This can increase the lifetime of pumps and other fluid system components as well as reducing wear in the sensor.

Note

Your FluidVision sensor may provide the only view you have of the cleanliness of your circulating fluid. Protection of the proper operation of your FluidVision sensor is also providing an additional level of protection to the more expensive equipment being cooled!

Fluid Temperature Range & Remote Mounting Electronics

If fluid temperatures will be below dew point or above to 85°C, the electronics package must be mounted remotely from the sensor. Remote mounting requires customized changes to the sensors. Please contact Proteus Applications for additional information.

Section 4 Electrical Installation

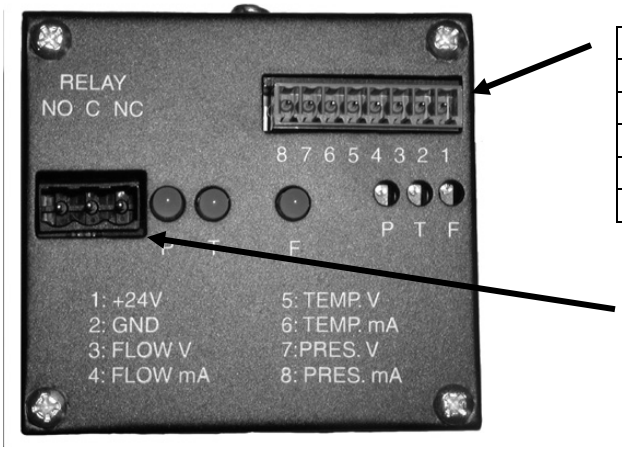
Sensor Outputs

Depending on the model selected, flow rate, temperature and pressure outputs will be expressed as a voltage or as a current.

For the voltage option, zero volts represent zero and five volts represent the top of the parameter range. If current output mode is selected, 4 mA represents zero and 20 mA represents the top of the parameter range.

Electrical Connections

Electrical input and outputs are provided on an eight-pin socket. The NC or NO output of the relay is provided on a three-pin socket. Mating plugs with wire terminals are included with your FluidVision sensor. Pin assignments are noted on the back of the cover of the electronics unit.



Assignments for 8-pin Connector			
Pin	Function	Pin	Function
1:	+24 V input	5	Temperature voltage out
2	Ground	6	Temperature current output
3	Flow voltage output.	7	Pressure voltage output
4	Flow current output	8	Pressure current output

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Assignments for 3-pin Connector	
Pin	Function
1	Normally Closed relay contact
2	Common relay contact
3	Normally Open relay contact

Connection instructions:

1. Strip connecting wire leaving approximately ¼" bare wire exposed. Stranded wire should be tinned with solder.

2. Insert the wire into the screw-clamp terminal and tighten the wire until the wire is clamped tightly. Each terminal will accept up to two #14 AWG wires.

Section 5 Digital Displays

Digital panel display meters are available to provide a direct local display of flow rate in selected engineering units. Each unit has a 3½ digit LCD display with 0.6 inch high digits and a DIP switch-selectable decimal point. The digital display unit requires 4 mA at 9 to 28VDC.

Part Numbers for Flow Meters

Flow Range – GPM	Part Number	Flow Range - LPM	Part Number
0.1 – 1.0 GPM	0G201D	0.4 – 4.0 LPM	0L201D
0.3 – 2.5 GPM	0G205D	1.0 – 9.5 LPM	0L205D
0.8 – 6.0 GPM	0G203D	3 – 27 LPM	0L203D
0.06 – 0.6 GPM	0G204D	0.2 – 1.9 LPM	0L204D
1.5 – 12 GPM	0G250D	6 – 45 LPM	0L250D
4 – 20 GPM	0G255D	15 – 75 LPM	0L255D
6 – 30 GPM	0G260D	22 – 110 LPM	0L260D
10 – 60 GPM	0G270D	35 – 225 LPM	0L270D

Part Numbers for Temperature Meters

Temperature Range	Model	Temperature Range	Model
For Brass & Stainless Steel Versions		For Polypropylene Versions	
32 – 175°F	0F700D	32 – 160°F	0F700DP
0 – 80°C	0C700D	0 – 70°C	0C700DP

Part Numbers for Pressure Meters

Pressure Range	Model	Pressure Range	Model
For Brass & Stainless Steel Versions		For Polypropylene Versions	
0 – 100 PSI	0P700D	0 – 75 PSI	0P700DP
0 – 690 kPa	0K700D	0 –520 kPa	0K700DP

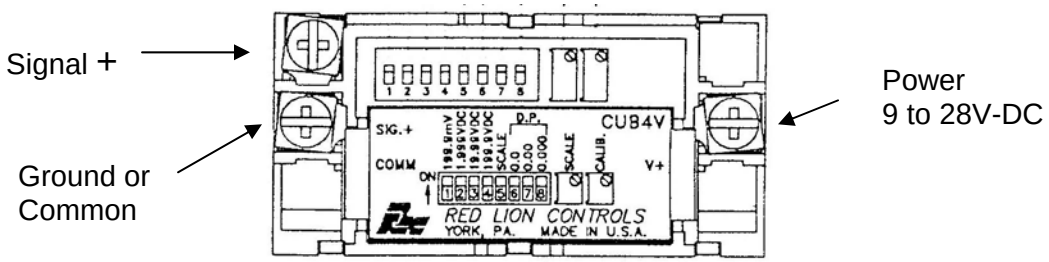
Note

Switches and potentiometers have been set on the meters to fit the range of your devices.

Changing these settings may invalidate the calibration!

Connecting the Digital Display Unit

The electrical connections are made via screw-clamp terminals located on the back of the Digital Display unit.



Rear view of Digital Display Unit

Note

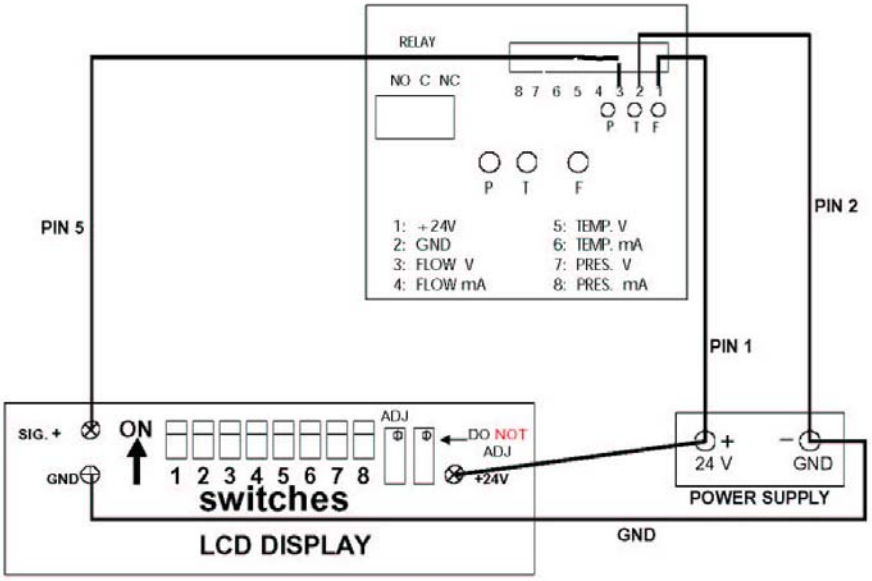
When wiring the unit check the wiring label on the back of the flow meter to ensure you connect to the proper terminals.

Connection instructions:

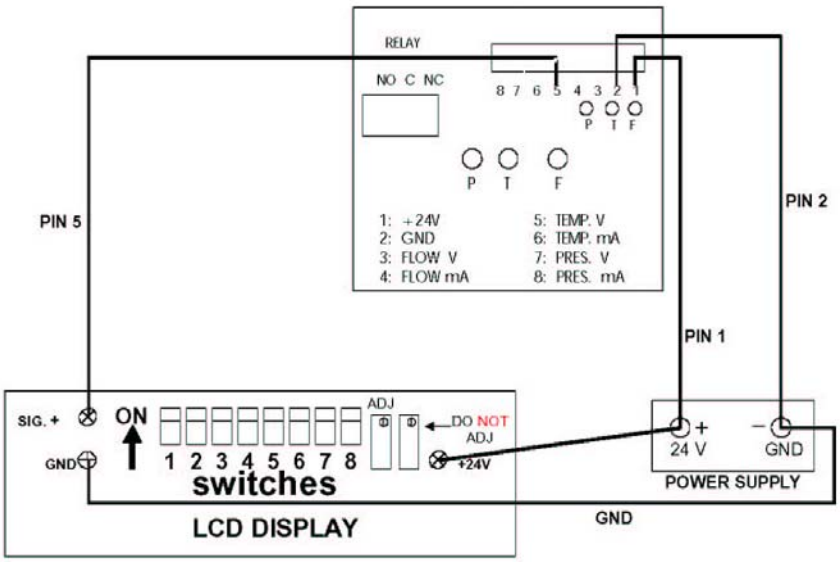
3. Strip connecting wire leaving approximately ¼" bare wire exposed. Stranded wire should be tinned with solder.

4. Insert the wire into the screw-clamp terminal and tighten the wire until the wire is clamped tightly. Each terminal will accept up to two #14 AWG wires.

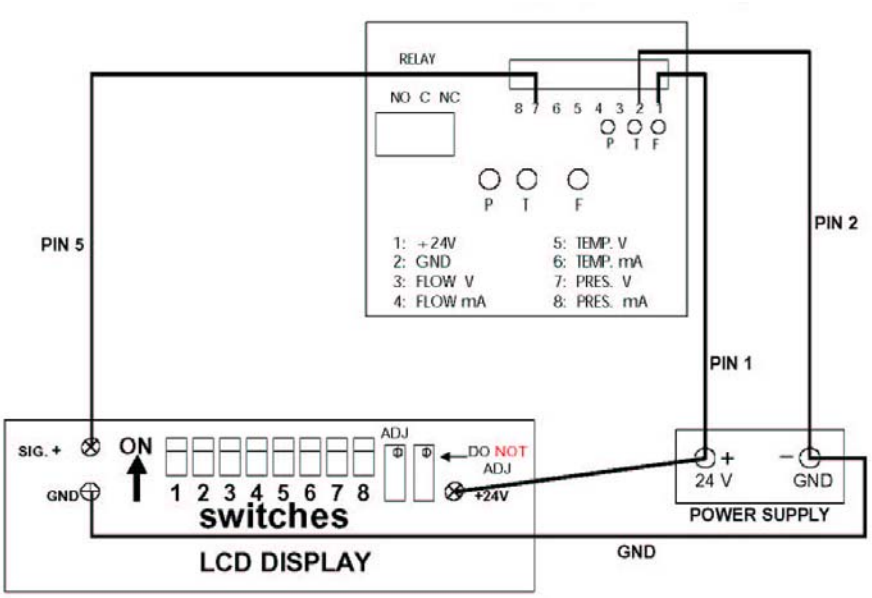
Connecting a Flow Meter



Connecting a Temperature Meter



Connecting a Pressure Meter

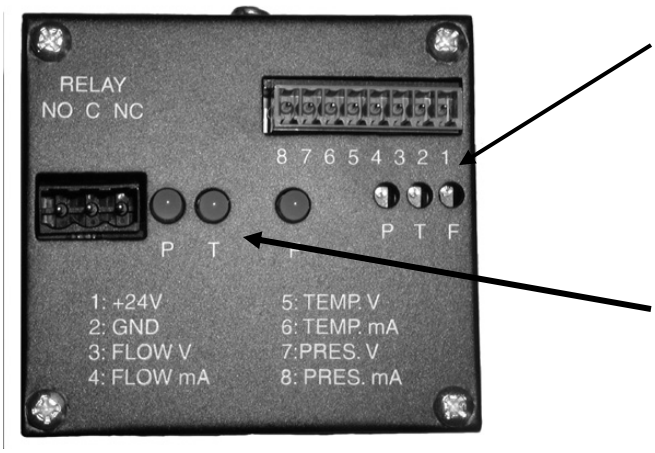


Section 6 Selecting Trip Points and LED Status Indicators

A single relay provides a trip point for an alarm created by low flow rate, high temperature or high pressure.

The trip point for each parameter is set using a potentiometer accessible through the back cover.

If the temperature or pressure sensor was not ordered, the potentiometer for that function will not be present!



Trip Point Adjustment Potentiometers

Trip point values are INCREASED by turning the potentiometer CLOCKWISE

Trip point values are DECREASED by turning the potentiometer ANTI-CLOCKWISE

LED Status Indicators

When a trip point is crossed, the relay trips and a bi-color LED changes color.

LED Status Indication

The color of the LED status indicators changes depending on the relationship between the measured parameter value and that parameter's selected Trip Point value

LED is **GREEN** when	LED is **RED** when
Flow is **ABOVE** trip point level	Flow is **BELOW** trip point level
Temperature is **BELOW** trip point level	Temperature is **ABOVE** trip point level
Pressure is **BELOW** trip point level	Pressure is **ABOVE** trip point level

Setting Relay Trip Points

The trip points may be adjusted at the factory when the sensor is ordered, or by the user.

1. Set the flow rate, temperature and pressure in the system to the desired trip levels.
2. Adjust the trip point potentiometer for each parameter until the point at which the LED switches color is found.

Disabling Trip Points

If you do not want to trip an alarm on a particular parameter, its potentiometer should be turned to an extreme value that will never be reached.

For flow, the potentiometer should be turned **all the way counter-clockwise** to set the trip point below the bottom of the flow range.

For pressure and temperature, the potentiometer should be turned **all the way clockwise** to set the trip point above the top of the temperature or pressure range.

Section 7 Cleaning and Maintenance

Maintenance of the FluidVision Flow Sensor is normally limited to cleaning the chamber in which the rotor spins and, annual recalibration.

Cleaning FluidVision Sensors

The frequency of cleaning will vary with the type of fluid being run and the cleanliness of the fluid. In most cases, annual cleaning immediately prior to recalibration is sufficient.

Tools required:

Wrenches to disconnect the flow meter from your flow circuit
Flathead screw driver
Soft cleaning cloth
Alcohol, water or a diluted detergent solution

Cleaning the 700 Series Flow Sensor	
1. Turn OFF the liquid flow in your flow circuit and remove the 800 Series sensor from your system. Place the sensor on a clean surface.	
2. Remove the 6 screws securing the faceplate.	
3. Remove the faceplate from the flow meter.	
4. Remove the rotor and stainless steel shaft from the flow cavity. Remove the O-ring from the faceplate	
5. Using a soft cloth dampened with water, alcohol or a light detergent solution, clean debris and dirt from the rotor, the stainless steel shaft, the inside surfaces of faceplate and the surfaces of the flow cavity	

Cleaning the 700 Series Flow Sensor (cont)

6. Inspect the bearing surface of the rotor.
   If the bearing surface is worn or not round, replace the rotor.

   Inspect the stainless steel shaft.
   If the shaft shows signs of scoring or other wear, replace the shaft or the whole faceplate assembly.

7. Inspect the O-ring to ensure that it is not brittle, cracked or otherwise damaged.

   If necessary replace with a #132 O-ring of a material compatible with the liquid being passed through the flow meter.

   Position the O-ring on the inner rim of the faceplate.

8. Place the rotor in the flow cavity.

   Position the shaft (or the faceplate) to locate the shaft in the rotor.

9. Position the faceplate so that the holes in the faceplate are aligned with the screw holes in the front of the flow sensor body.

   Replace the 6 securing screws.

   Tighten the screws to a torque of 40 in-lbs (hand tighten with a normal screwdriver).

11. Install the flow meter in your system.
    Turn on liquid flow and check for leaks at the faceplate and connecting ports.
    Tighten all connections as required to eliminate leaks.

Section 8 Calibration and Recalibration

Note

700 Series sensors are calibrated at Proteus with water at temperatures ranging from 22 to 28C.

Changes in fluid type can alter the calibrated response of the sensor.
Large changes in liquid temperature can alter the calibrated response of the sensor.

Please contact Proteus Technical Support if a specialized calibration is needed.

Note

As described in the Plumbing Connections section on page 7, the response of the 700 Series flow sensor may be affected by the way in which the sensor is connected to your system.

The 700 Series metering flow switch has been calibrated during manufacture to provide an output of 5.0 VDC or 24 mA at the maximum flow rate of each sensor. This calibration is made with straight pipe connections..

Customized calibration procedures can be performed to change the flow rate corresponding to 5.0 VDC, for fluids other than water and with connections with internal diameters less than those used in the flow sensors. (See Table 2, page 7).

Recalibration

The calibration of the 700 flow, temperature and pressure switches should be checked at 12-month intervals, and recalibrated as required. Re-calibration may be accomplished in either of two ways:

Calibration by Proteus

To obtain a price quotation and a Return Material Authorization number for recalibration of your flow meter, contact sales@proteusind.com or call (650) 964-4163. When received at Proteus, your flow meter will:

- Have its output measured and recorded in the as-received state.
- The rotor, stainless steel shaft and sealing O-ring will be replaced.
- The flow cavity will be cleaned and the device reassembled.
- The unit will be recalibrated to its original specification against reference standards whose calibrations are statistically controlled against NIST-traceable standards.
- A new calibration certificate will be issued.
- A new calibration label will be attached to the flow meter.

Calibration by another laboratory

The calibrating laboratory will issue certificates and labels identifying the calibration status of your metering flow switch. Recalibration of each function is performed by adjusting two potentiometers, one for slope and one for offset. Please contact Proteus Applications for details for calibration procedures.

FluidVision electronics are sensitive to Electro Static Discharge. There is normally no need to open the electronics case, but if it is opened, proper ESD precautions should be taken.