Proteus Industries Inc.

“Short Profile” Series Flow Switches

Technical Reference Manual

Can we Improve? Tell our President!

Can we improve our product, our support or this manual?

We are committed to continuous improvement and welcome your help. Fax, mail or e-mail your ideas to me, Jon Heiner.

If you include your phone number, I will give you a personal reply. Or if you prefer, call me on my direct line.

Phone: (650) 943-4102 Fax: (650) 965-9355 E-mail: Jon@proteusind.com

Proteus 5-Year Warranty

A full statement of our Warranty is available at our website, www.Proteusind.com .

Contents

Section 1: Overview

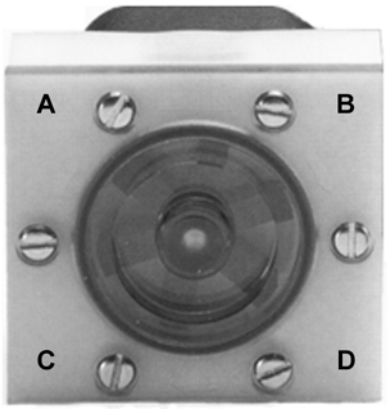
These products are NOT available for inclusion in new designs! Metering flow switches such as the Proteus 500 and 800 Series with Hall Effect sensors are better suited for interfacing with current electronic control systems. Please contact Proteus for assistance in selecting a sensor best suited to your application.

Proteus Short Profile Fluid Flow Switches are designed to monitor the flow and fluid through a line. They are frequently used to assure that water is flowing in a cooling circuit, however they may be used in a wide variety of applications with many different fluids.

Section 2: Flow Ranges and Pipe Connections

Table 1 lists the model numbers and flow ranges. Model 100XSP can be configured in one of three different ranges, depending on the placement of blanking plugs.

- To operate across the A to B flow path, blanking plugs must be placed in ports C and D.
- To operate across the B to C flow path, blanking plugs must be placed in ports A and D.
- To operate across the D to C flow path, blanking plugs must be placed in ports A and B



		Water Connection		Flow Range – GPM	
Model	Pipe Size	Inlet Port	Outlet Port	Low Limit	High Limit
100LSP	¼" NPT	A	B	0.08	0.8
100*SP	¼" NPT	A	B	0.1	1.0
100*SP	***¼" NPT***	***B***	***C***	***0.5***	***2.5***
100*SP	¼" NPT	D	C	0.8	6.0
150*SP	½" NPT	D	C	1.5	12
155*SP	½" NPT	D	C	4	20
160*SP	¾" NPT	D	C	6	30

Table 1: Flow Ranges and Pipe Connections

NOTE!

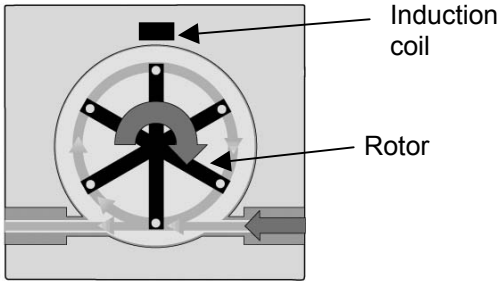
When the flow direction is from B to C or from D to C it is necessary to reverse the connections to the induction coil for proper operation of the flow switch.

To reverse these connections:

1. Remove the four screws securing the electronics unit to the flow sensor body.
2. Gently remove the electronics unit from the sensor body to locate the spade black and white wires connected to the induction coil by spade electrodes.
3. Disconnect the spade connectors from the induction coil.
4. Reconnect the White wire to the spade terminal B
5. Reconnect the Black wire to the spade terminal W.
6. Reposition the electronics unit to align with the screw holes in the corner of the flow sensor body.
7. Insert and tighten the four screws to secure the electronics unit to the flow sensor body.
8. Check electrical functionality to ensure the flow sensor is operating correctly.

Section 3: How do they work?

The rotor spins when liquid flows through the sensor body.



Magnets in the rotor create a voltage in an induction coil mounted in the sensor body. The amplitude of the induced voltage is at a maximum when the magnet is immediately adjacent to the coil.

The amplitude of the induced voltage is proportional to the to the rotational velocity of the rotor and the linear velocity of the liquid as it passes through the sensor body.

This amplitude of the induced voltage is measured by a simple electronic circuit that compares it to a user-set trip (reference) voltage. When the induced voltage is above the set point a transistor is turned ON. If it falls below the set value, or the fluid stops flowing, the transistor will turn OFF. The change is state of the transistor is interpreted by the user-supplied interface to control other system functions.

Section 4: Physical Installation

CAUTION!

It is generally undesirable to mount any plumbing connections directly over electronic controls or instruments.

WARNING!

If the 100 Series Short Profile Flow Switch is mounted in a vertical pipeline, any leakage from the topmost connection could enter the unit and cause permanent damage to the electronics..

Pipe or tubing mounting

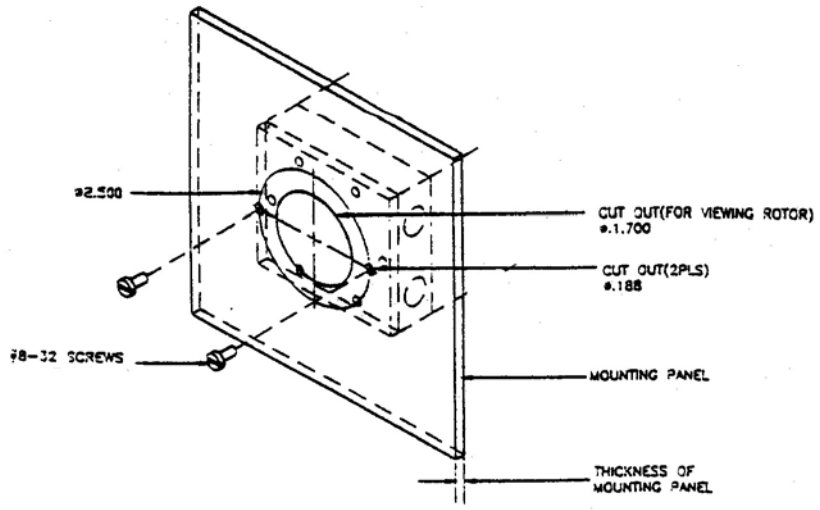
If rigid piping or tubing is used, the flow switch may be supported by direct connection to the pipe or tubing.

Panel mounting

To mount the sensor behind a panel, two of the faceplate securing screws will need to be replaced with longer screws to compensate for the thickness of the panel. Ensure that the screws are not so long that they will touch the bottom of the tapped hole, or rip through the back of a plastic body if over-tightened.

Evenly space up to six holes for 8-32 screws on a 2.5” circle. Using the two holes on the horizontal plane is usually sufficient to support smaller flow sensors and all plastic sensors. If you wish the rotor to be visible, cut a 1¾” diameter hole with the same center.

Panel Mounting of 300 & 100XT Series Sensors



1. Remove screws holding the faceplate to the sensor body.
2. Place the sensor behind the panel and insert the longer screws you have selected.
3. Secure the screws in the body with a torque of ~ 10 in-lb. (Finger tight with a flat-blade screwdriver.).

Plumbing Connections

Note

Before connecting a flow switch into your fluid line, verify that the normal flow rates expected in that line are within the operating range of the sensor as shown in Table 1

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.

Note

The flow response of the sensor, and thus its output response 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, pre-calibrated trip points may be invalid.

		Water Connection		Minimum ID of pipe or connection	
Model	Pipe Size	Inlet Port	Outlet Port	x = C or x = L	x = B or x = SS
100LSP	¼" NPT	A	B	Not Sensitive	Not Available
100xSP	¼" NPT	A	B	0.28	0.28
100xSP	¼" NPT	B	C	0.28	0.28
100xSP	¼" NPT	D	C	0.28	0.35
150xSP	½" NPT	D	C	0.54	0.60
155xSP	½" NPT	D	C	0.54	0.60
160xSP	¾" NPT	D	C	Not Available	0.81

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

Note

The flow response of a 100 Series Short Profile Flow Switch may be dependent on the form of a 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 switch and any up-stream devices to minimize these effects.

Appropriate calibration procedures must be used to provide an accurate trip point settings in systems in which elbows or T-pieces that must be attached directly to the inlet connection.

100 Series Short Profile Flow Switch are typically unaffected by the form or proximity of devices on their downstream side.

Sensor Orientation

For the best results, 100 Series Short Profile Flow Switches 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.

NPT pipe thread connections

Pipe threads seal by making metal-to-metal or plastic-to-plastic 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.

WARNING

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

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

- 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.

Fluid Temperature Range

Flow sensors with plastic bodies should not be used above 75°C. Metal bodies with metal faceplates may be used with liquids to higher temperatures. The induction coil should not be used for temperatures above 110°C.

For higher temperature situations, contact Proteus Applications for assistance in selecting the flow sensor best suited to your application.

Section 5: Electrical Connections

Note
Only personnel familiar with the electrical circuit and control functions of the system in which the sensors are to be included should perform installation of this product.

The 100 Series Short Profile Flow Switch is shipped with a four-core cable for connection to the user's control system. Color codes and wiring connections are shown in Table 4. Typical wiring diagrams for connection to resistive and reactive loads are shown in Figure 2.

Wire Color	Function
Red	+ DC Input 13 – 28 VDC
Black	- DC Input (Ground)
Green	Load Input
White	Load Ground

Table 4: Wiring Diagram for Short Profile Flow Switch

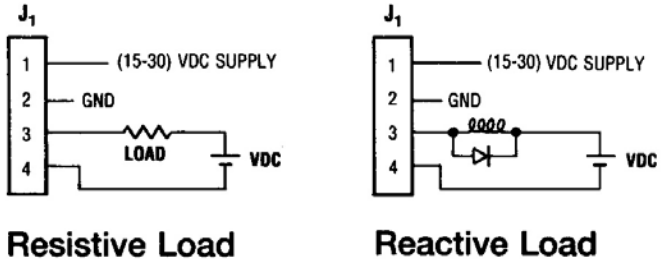
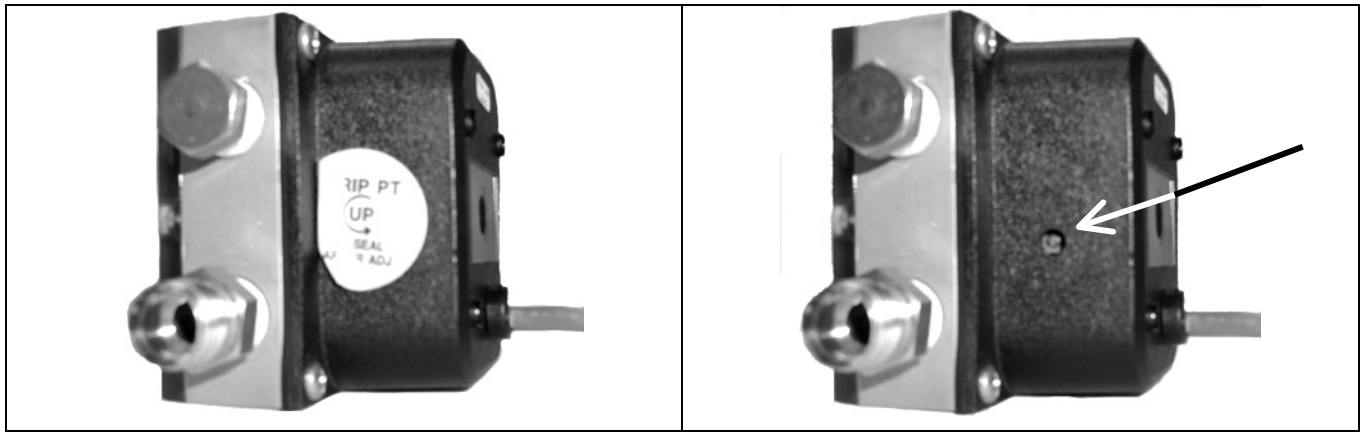


Figure 2: Connecting Resistive & Reactive Loads

Section 6: Setting the Trip Point

Adjusting a 20-turn potentiometer sets the flow rate at which the transistor turns OFF. The potentiometer is reached by inserting a small screwdriver through a hole on the side of the electronics rear of the flow switch.



- Turning the potentiometer CLOCKWISE will LOWER the trip point setting.
- Turning the potentiometer ANTICLOCKWISE will RAISE the trip point setting.

1. Install the switch in the fluid circuit and adjust the fluid flow to the level at which the transistor is to turn OFF.
2. Peel back the label covering the trip point access hole.

Note:

Ensure that the flow rate is steady and that all air has been purged from the flow sensor.

3. Connect an ohm-meter between the green and white wires. If the transistor is ON, the ohm-meter will indicate 0 ohms. If the transistor is OFF, the ohm-meter will indicate infinite resistance.
4. Adjust the potentiometer until the transistor turns OFF at the selected trip point, indicated by the ohm-meter displaying infinite resistance.
5. Replace the label over the trip point access hole.

Note:

The actual trip point flow is different for rising and falling flows.
For applications in which an exact setting is required, be sure to test the trip point by reducing flow through the trip point or increasing flow to rise through the trip point as required by your particular application.

Section 7: Maintenance

Maintenance of the sensor is normally limited to cleaning the chamber in which the rotor spins and annual recalibration.

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

Cleaning the 100 Series Short Profile Flow Switch	
1. Turn OFF the liquid flow in your flow circuit and remove the flow sensor or transducer sensor from your system. Place the unit on a clean surface.	
2. Remove the 6 screws securing the faceplate.	
3. Remove the faceplate from the flow meter.	

Cleaning the 100 Series Short Profile Flow Switch

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

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.

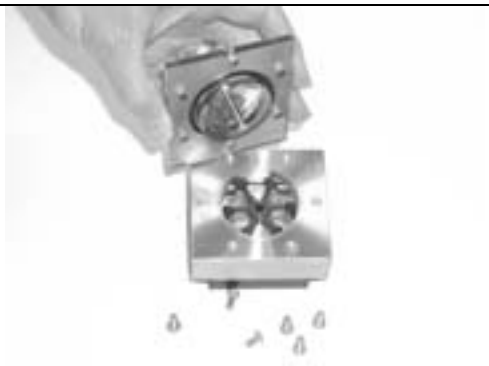
7. Inspect the O-ring to ensure that it is not brittle, cracked or otherwise damaged.

   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.



Cleaning the 100 Series Short Profile Flow Switch	
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 10 in-lbs (hand tighten with a normal screwdriver).	
11. Install the flow switch 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: General

Trademarks

Celcon, Nylon and Kynar are registered trademarks of Celanese Plastics, DuPont and Elf-Autochem. Real-Tuff, Hercules, Loctite and SWAK are trademarks of their respective holders.

Section 9: Reference Data Sheets & Specifications

DISCONTINUED - DO NOT USE IN NEW DESIGNS

Proteus "Short Profile" Flow Switches

- Active Design Assures Reliability
- Cannot Jam in "Flow OK" Position
- Models Span 0.08 to 30.0 GPM
- Adjustable Trip Point
- Five Year Warranty

Proteus SP series Short Profile Flow Switches are more compact and slightly lower cost than our standard series flow switches. Differences in electrical specifications will influence the selection. A chart summarizes the differences between the two series on the back of this data sheet. Standard series flow switches are described in a separate data sheet.

SP series Flow Switches monitor cooling fluids or other liquid flows and switch a power transistor if the flow rate falls below an adjustable trip point. They may be used to shut down equipment or sound an alarm before damage is done to equipment.

Unlike pressure sensors, the Proteus switch is a true flow interlock. It will not be fooled by downstream blockages that maintain pressure while stopping flow. The switch also differs from traditional flow switch designs because particle buildup cannot jam it in the "flow OK" position.

No other company comes close to matching the decade of leadership in rotary style flow switches that have made Proteus the overwhelming favorite. No other company of any style flow switch matches the Proteus five year warranty.

HOW IT WORKS
Fluid flowing through the switch spins a magnetic rotor to induce voltage in a coil. This voltage is measured by a simple electronic circuit which compares it to a user-set trip voltage. When the voltage is above the set point, a power transistor is switched on. If it falls below the set value or fluid stops flowing, the transistor is switched off and triggers your alarm system.

An active design combats the problem of particle buildup, which can jam many flow switches. Because the rotor is constantly spinning, it cleans itself of most buildup. In the very unlikely event that an object in the line did interfere with the rotor, the rotor would stop turning, and the switch would go to alarm condition. This assures you that when the switch shows fluid is flowing, there is always flow through the switch.

FLOW VISIBILITY
The clear polysulfone face plate displays the rotor to tell you at a glance if cooling water or other fluids are turned on. The speed of the rotor indicates the approximate rate of flow.

TRIP POINT
The trip point is set by adjusting a potentiometer which is mounted so that it cannot be turned accidentally.

ELECTRONIC MOUNTING
The switch comes with the electronics package mounted on the body of the switch. It may be removed and mounted remotely.

EASY MAINTENANCE
The face plate may easily be removed to clean the chamber if necessary. No other maintenance is normally needed.

SPECIFICATIONS

Flow Ranges
Models covering the range from 0.08 to 30.0 GPM (0.4 to 115 l/min) are available. The range of each model is shown on the price list.

Body Materials
Brass, Celcon and 316 stainless steel bodies are available.

Wetted Materials
In addition to the body material selected, wetted materials include polysulfone, brass or 316 stainless steel for the face plate, 316 stainless steel for the shaft, a Buna-N O-ring, and a Celcon based composite rotor.

Temperature
The flow switches are suitable for use with fluid temperatures up to 100° C (212° F). Ambient temperature for the electronics should not exceed 50° C (122° F).

Viscosity
The flow switches are suitable for use with fluids compatible with the wetted materials and with low to moderate viscosities (up to 120 centistokes, or 30 weight oil at room temperature.)

Pressure
The fluid pressure should not exceed 100 psi (690 kN/m²) when the standard polysulfone face plate is used. If a metal face plate is specified, fluid pressure should not exceed 250 psi (1725 kN/m²).

Pressure Drop
Approximately equal to drop through 3" length of pipe with the same diameter as switch inlet port. An exception is the Model 100 series low flow range, which drops a maximum of 6 psi (42 kN/m²) at 1.0 GPM (3.8 l/min) due to an internal 1/8" orifice.

Weight
2 to 3 lbs. (1 to 1.5 Kg.) depending on model and materials.

Electrical Requirements
Input power may be anywhere in the range of 15 VDC to 30 VDC @ 30 mA.

Transistor Switching
The transistor output can switch from 12 to 50 VDC at up to 1 Amp.

Maximum Distance to Electronics
30 feet (10 meters) from transducer portion of switch.

Flow Rates and Pipe Connections

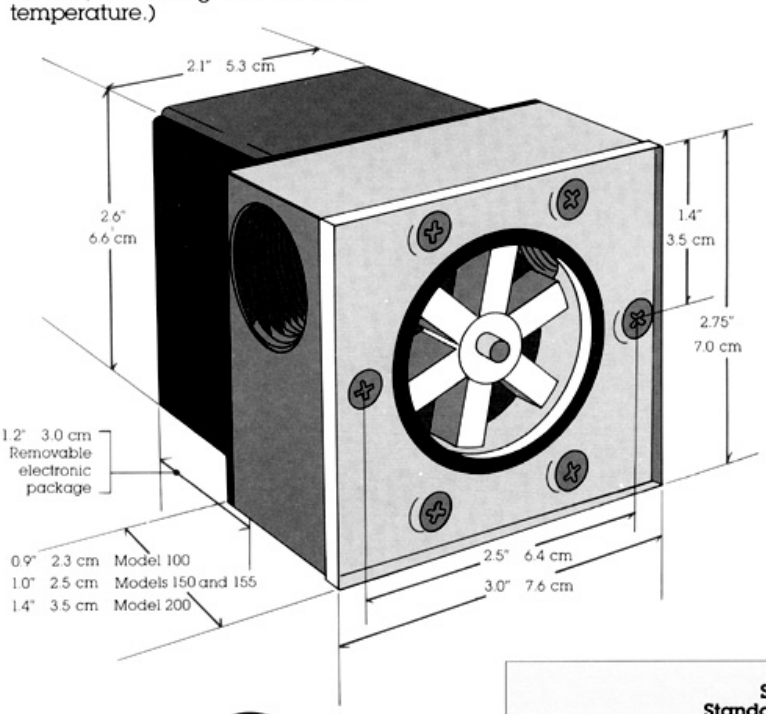
Model	Flow Range	Pipe Connection
100X-SP	0.1-6.0 GPM	1/4"
150X-SP	1.5-12.0 GPM	1/2"
155X-SP	4.0-20.0 GPM	1/2"
200B-SP	6.0-30.0 GPM	3/4"

X=B for brass, C for Celcon, or SS for stainless steel body. See price list for full model number information. All pipe connections are female NPT. Switch may be mounted in-line.

Hysteresis
15% typical. Hysteresis is the difference in the point the switch is tripped by rising flow and by falling flow. Some hysteresis is desirable since it inhibits cycling if flow is near the trip point.

FIVE YEAR WARRANTY
Flow switches are covered by our five year warranty. The full text is given in the price list.

Celcon is a registered trademark of Celanese Plastics



Proteus Industries Inc.

SELECTION CHART
Standard vs SP Series Switches

	STANDARD SERIES	SP SERIES
Depth*	4.4"	2.1"
Input Voltage	110 VAC 220 VAC 20-30 VDC	15-30 VDC
Switch Capability	3 Amp to 220 VAC 3 Amp to 28 VDC	1 Amp 5 to 50 VDC
Cost	SP Series is slightly lower cost.	

*Depth includes electronics mounted. Model 100 series used for comparison.

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