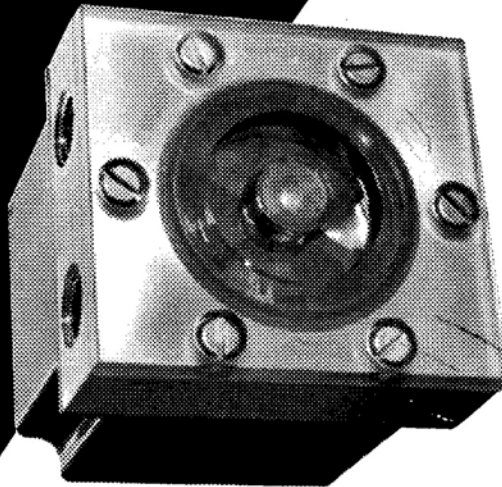


Proteus
300 Series Sensors
100xT Series
Transducers
User Manual



Proteus 300 series sensors and 100xT transducers use a turbine principle to generate a pulsed voltage that varies with flow. Magnets in alternate spokes of a rotor induce a voltage in a pickup coil when flow turns the rotor. The variable frequency output from this simple and reliable sensor may be read by your electronics to determine flow rate.

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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

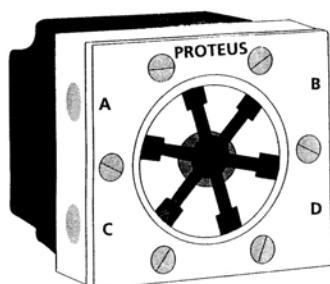
Section 1: Overview

These products are NOT recommended for inclusion in new designs! Flow sensors with Hall Effect sensors are better suited for interfacing with current electronic devices. Refer to the PS600 Series for information or contact Proteus for assistance in selecting a sensor best suited to your application.

300 & 100XT Series flow sensors provide an output frequency proportional to the flow rate of the liquid passing through the sensor.

300 Series Flow Sensors include a plastic back cover to enclose the sensing induction coil and provide two wires for connection to the user's control circuit.

100xT Flow Transducers are the flow-sensing portion of the 100 Series Flow Switch. The 100XT flow sensor has no protective cover, and provides 2 spade connectors for quick electrical connection.



300 Series 1/4" NPT

300	MODEL	FLOW RANGE		INLET PORT	OUTLET PORT	PIPE SIZE
		GPM	LPM			
304L	100L	0.08 - 0.8	0.3 - 3.0	A	B	1/4" NPT
301	100	0.1 - 1.0	0.4 - 3.8	A	B	1/4" NPT
303	100	0.8 - 6.0	3.0 - 22.7	D	C	1/4" NPT
350	150	1.5 - 12.0	5.7 - 45.4	D	C	1/2" NPT
355	155	4.0 - 20.0	15.1 - 75.7	D	C	1/2" NPT
360	160	6.0 - 30.0	22.7 - 113	D	C	3/4" NPT
370	170	10.0 - 60.0	37.8 - 227	D	C	1" NPT

Table 1 Flow Ranges & Connections

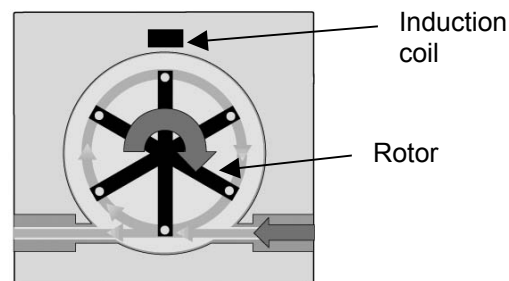
How do they work?

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.

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

The amplitude of the voltage generated in the induction coil is a more reliable indicator of flow rate than frequency.



Section 2: Physical Installation

CAUTION!

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

WARNING!

If the 300 or 100XT Series flow sensor is mounted in a vertical pipeline, any leakage from the topmost connection could enter the unit and cause permanent damage to the induction coil.

Pipe or tubing mounting

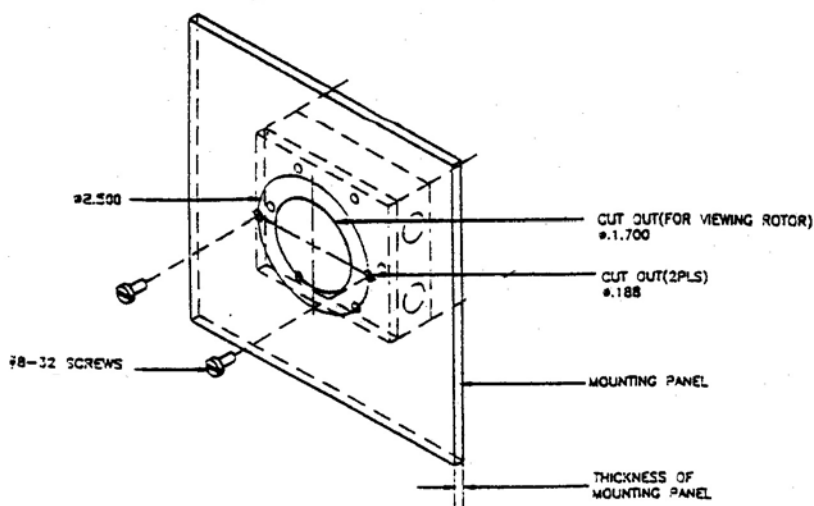
If rigid piping or tubing is used, the 300 and 100XT flow sensor may be supported by direct connection to the pipe or tubing.

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 1 $\frac{3}{4}$ " 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 sensor 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, calibration values may be invalid.

MODEL 300	100xT	INLET PORT	BODY TYPE	INSIDE DIAMETER
301	100	1/4"	Plastic/Metal	Not Sensitive
303	100	1/4"	Plastic Metal	0.280" 0.355"
304L	100L	1/4"	Plastic/Metal	Not Sensitive
350	150	1/2"	Plastic Metal	0.540" 0.605"
355	155	1/2"	Plastic Metal	0.540" 0.605"
360	160	3/4"	Plastic Metal	0.730" 0.815"
370	170	1"	Plastic Metal	0.900" 1.050"

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

Note

The flow response of 300 Series flow sensor and the 100XT flow transducers 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 sensor and any up-stream devices to minimize these effects.

Note (continued)

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.

The 300 and 100XT Series sensors are typically unaffected by the form or proximity of devices on their downstream side.

Sensor Orientation

For the best results, 300 Series flow sensors and 100XT flow transducers 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 polarity of the output voltage is dependent on flow direction. Some sensors can be operated in only one direction, as shown below.

Model #		Flow Path Direction
304L	104XT	A to B only
301	101XT	A to B only
303	103XT	D to C or C to D
350	150XT	D to C only
355	155XT	D to C or C to D
360	160XT	D to C or C to D
370	170XT	D to C or C to D

Table 2: Allowed flow directions

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 3: 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.

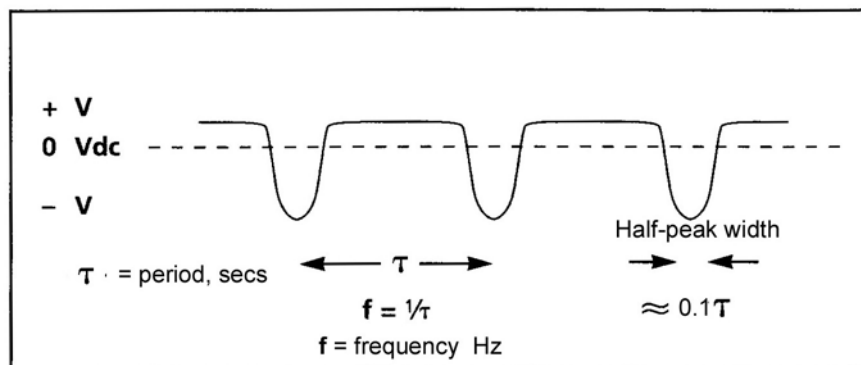
The 100XT transducer provides two male spade-type quick disconnects to connect to the coil output. Two matching female connectors (Panduit P/N DNF1 8-206FI B-M) are shipped with each transducer.

300 Series Flow Sensors have a 2 wire cable connecting to the coil output. The signal wire color codes are clear and black.

Output Signal

The output signal is the voltage generated by the magnets in three spokes of the rotor passing by the pickup coil.

The waveform varies somewhat with flow rate. It is similar, but not identical to a rectified sine wave. A typical waveform is shown below.



Technical Reference Manual for 300 & 100XT Flow Sensors

NOTE

The electrical polarity of the coil output is sensitive to the direction of flow through the sensor body. Some user-designed electronics may be sensitive to the polarity.

The polarity of the output signal can be reversed by reversing the connections at the induction coil of the 100XT transducer, or reversing the wire connections of the 300 Series Flow Sensor.

Output Amplitude

The amplitude of the output signal increases with frequency. A typical output response is shown below.

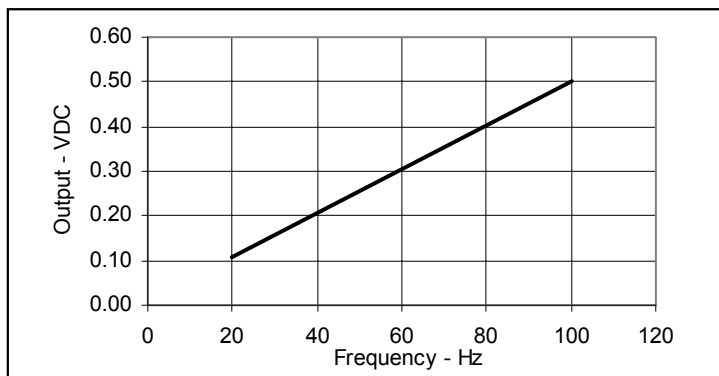


Figure 1: Typical output response

Section 4: Flow Response

The typical response curves for 300 and 100XT Series sensors are illustrated.

NOTE

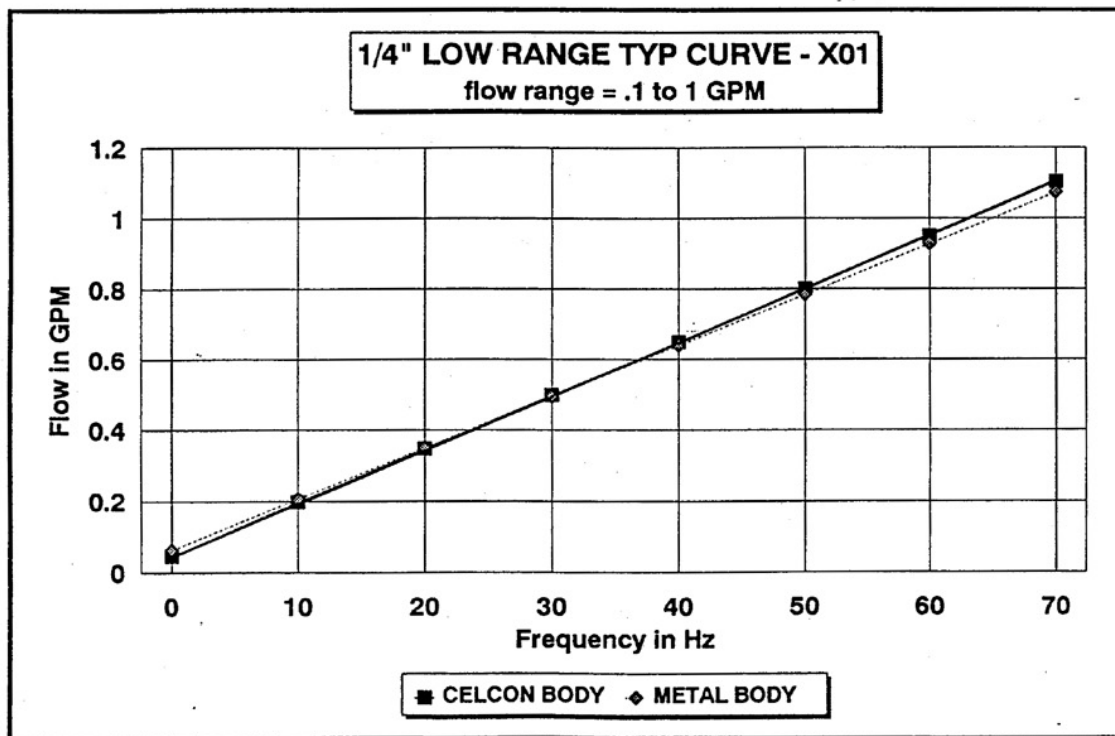
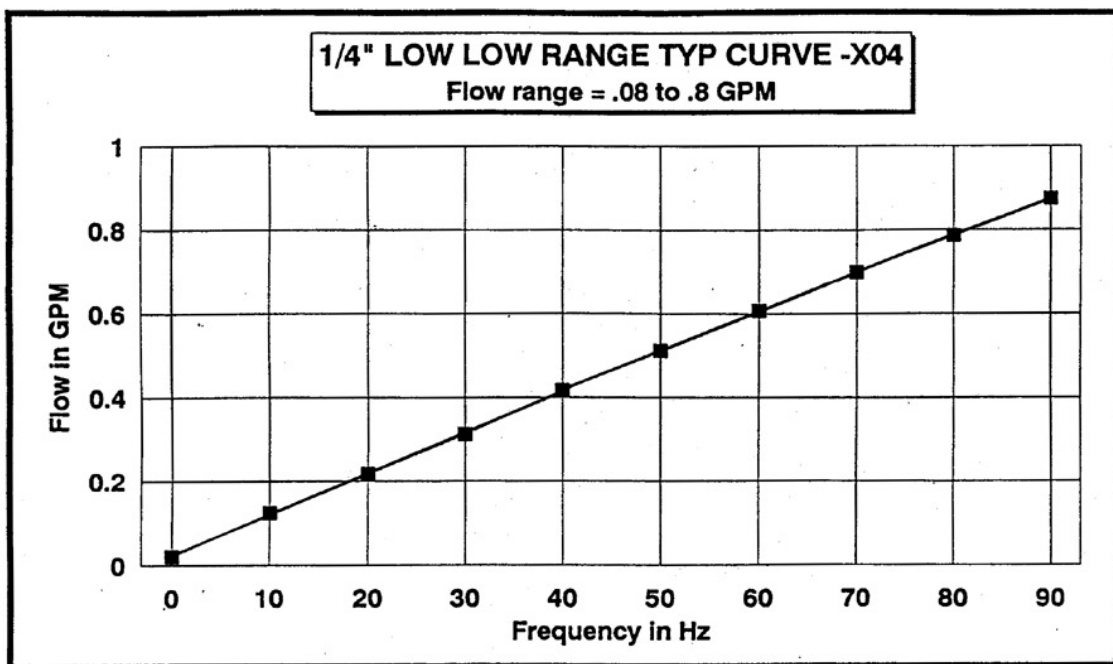
These response curves were collected with Schedule 40 brass or polypropylene pipes threaded directly into the appropriate inlet ports. Table 2 above shows the ID's of pipes used to obtain the reference flow response data.

Proteus sensors are sensitive to the internal inside diameter (ID) of the pipe or hose connection at the inlet port.

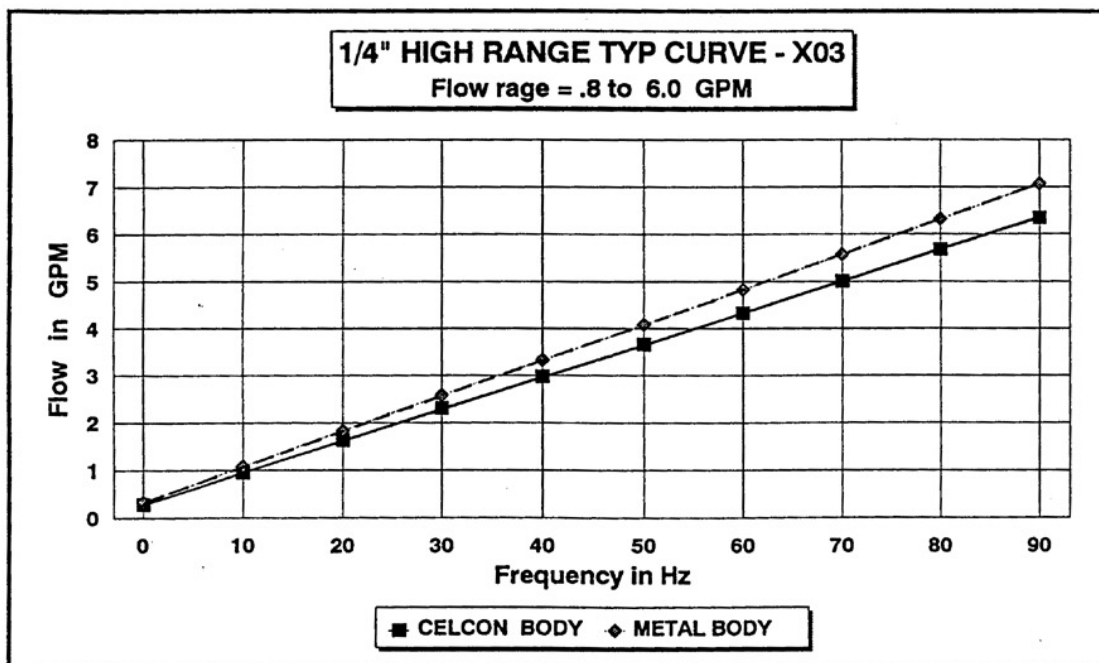
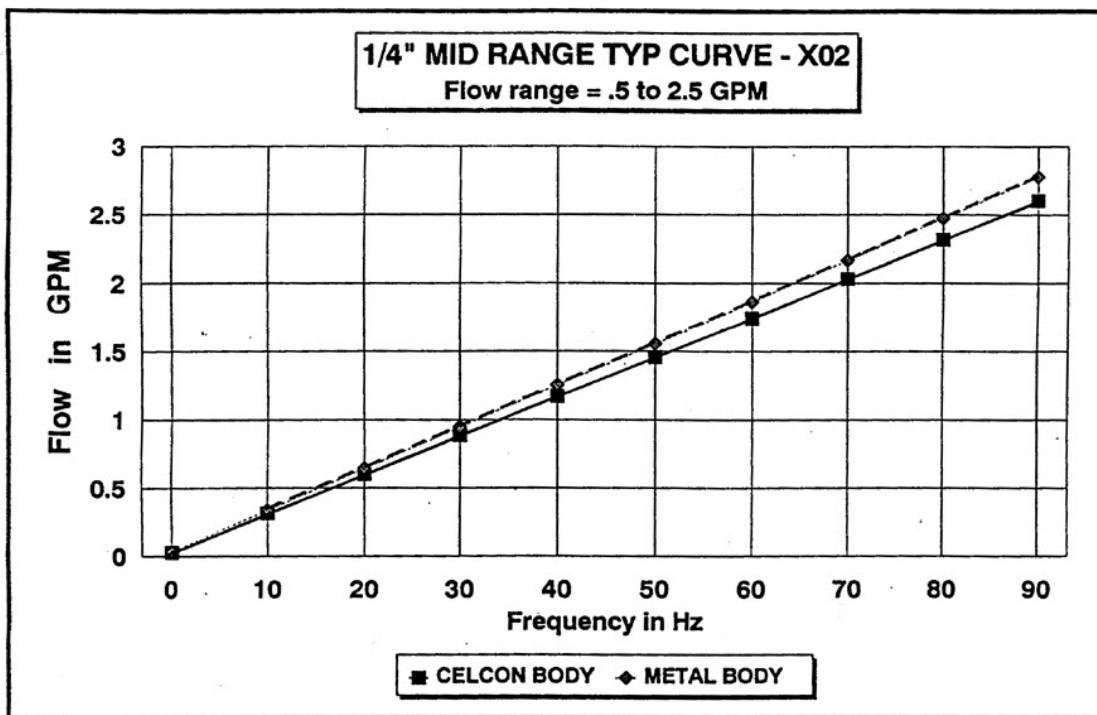
Connections that have ID's less than that of Schedule 40 pipe will provide a HIGHER response.

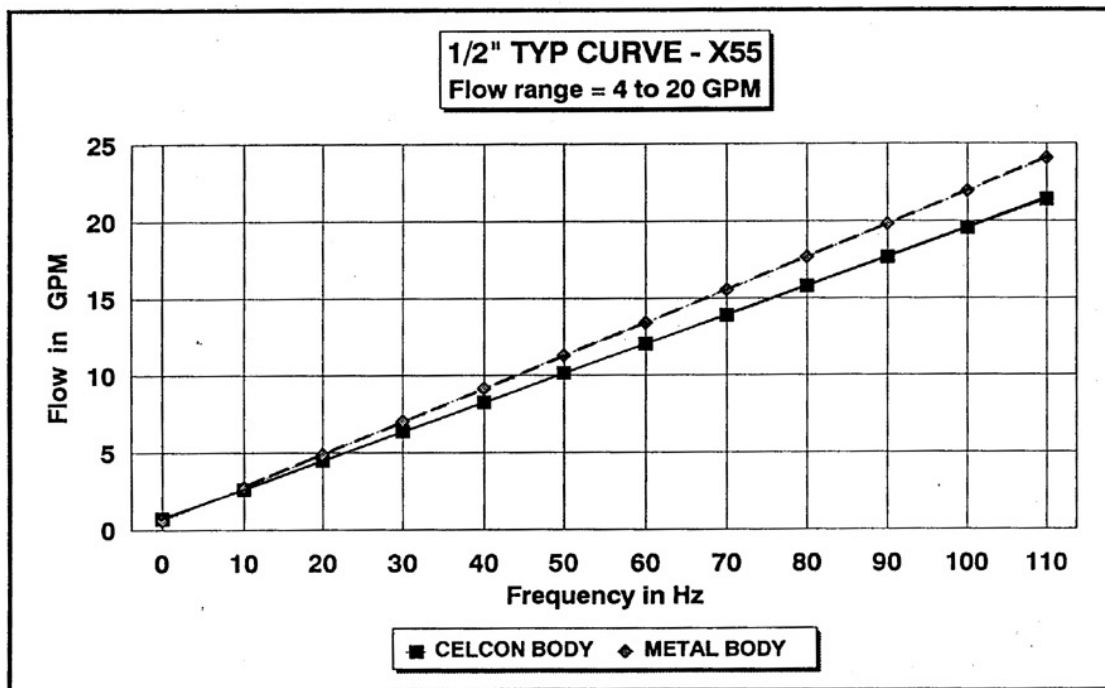
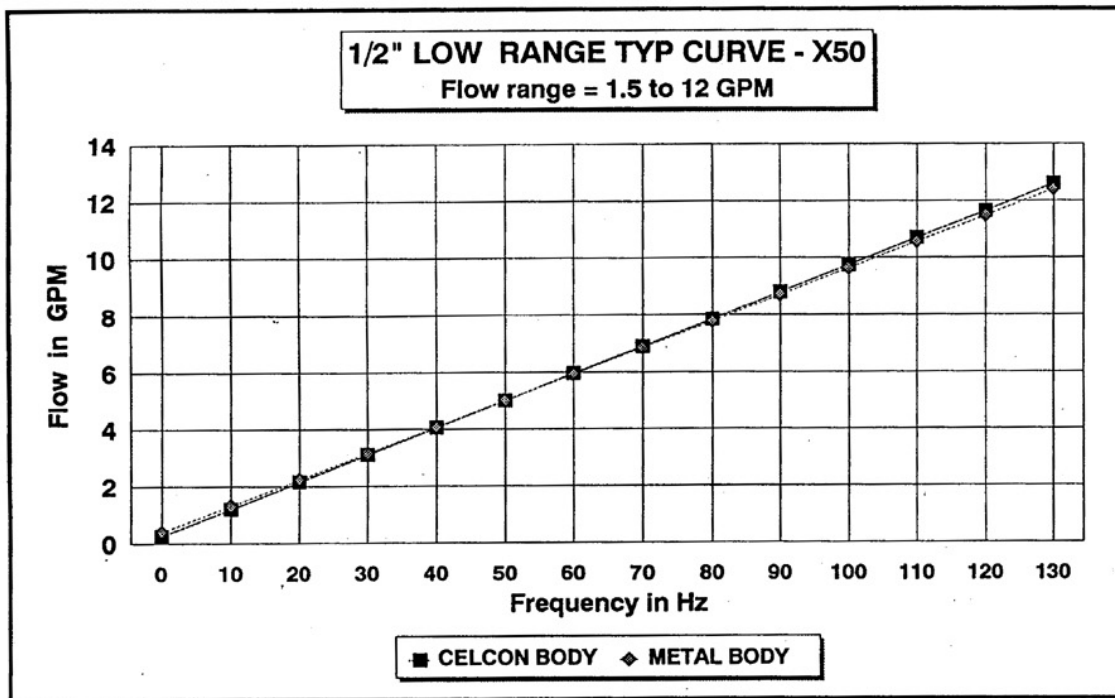
Connections that have ID's greater than that of Schedule 40 pipe or introduce swirling motion into the liquid stream will provide a LOWER response.

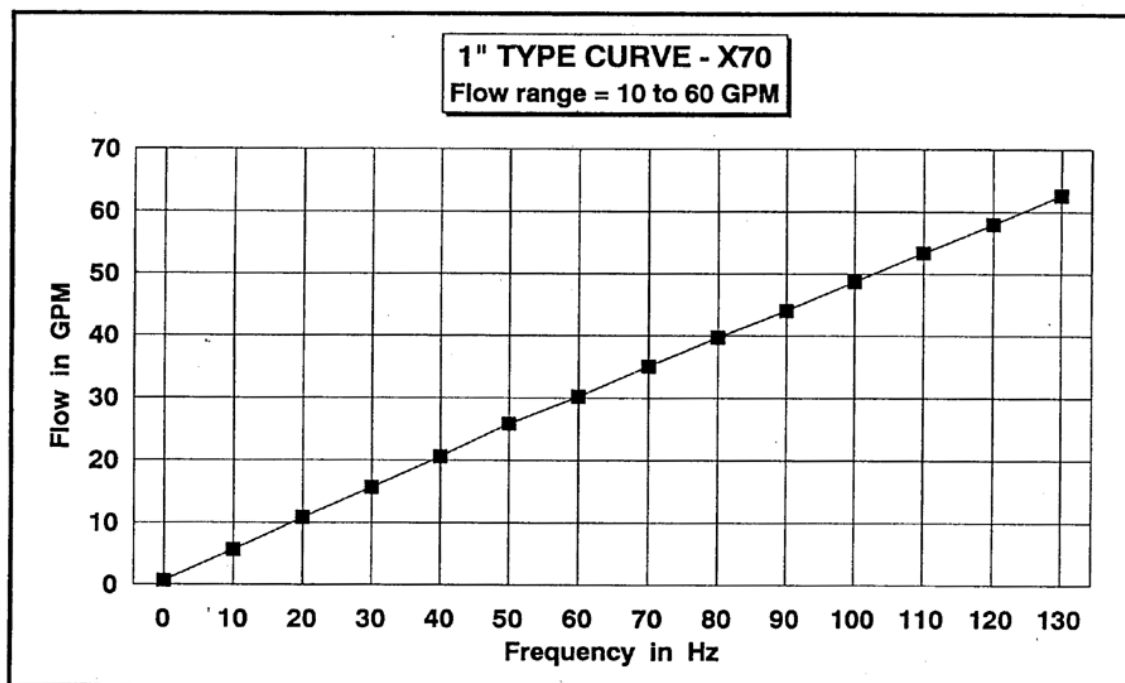
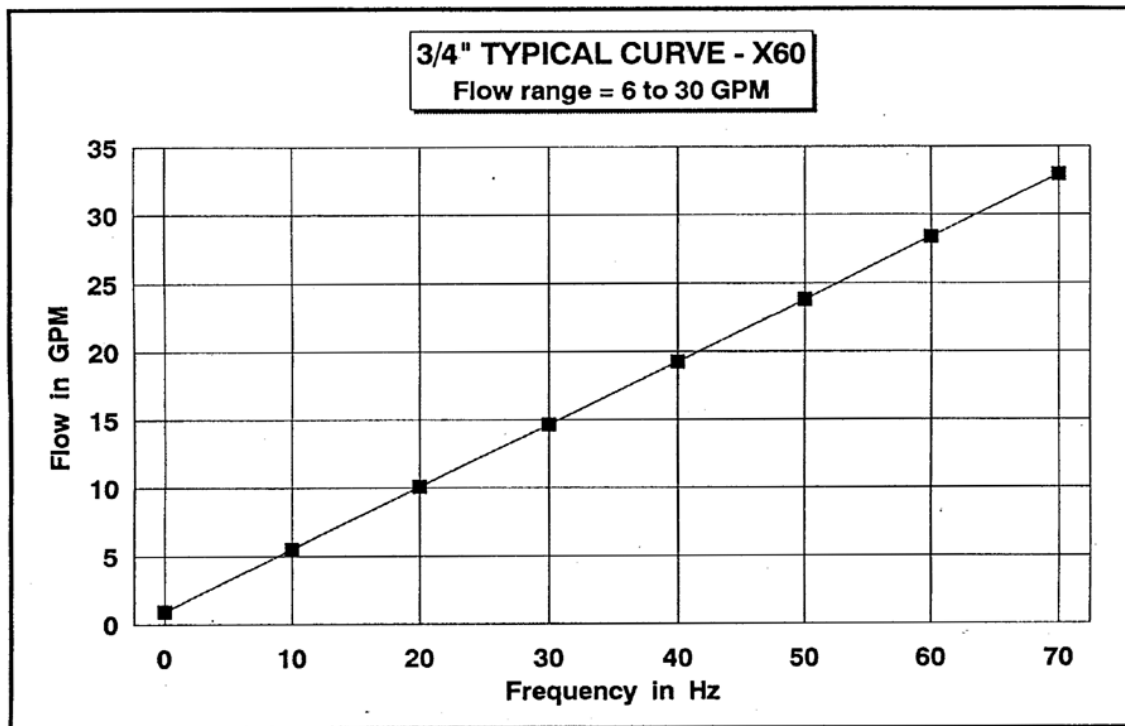
Technical Reference Manual for 300 & 100XT Flow Sensors



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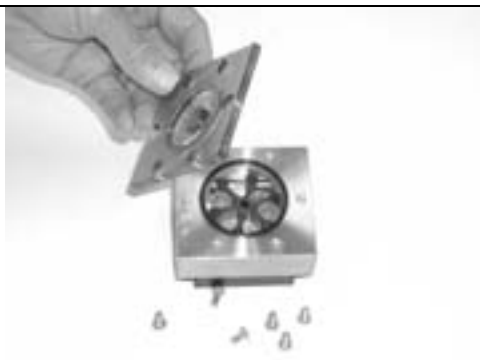
Calibration

Measurement of the actual response from an installed sensor is necessary to achieve an accurate response curve. Calibration by Proteus is available for devices with simple, small connections. Contact Proteus Applications for assistance.




Section 6: 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 300 Series Flow Sensor & 100XT Flow Transducers	
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.	

Technical Reference Manual for 300 & 100XT Flow Sensors

Cleaning the 300 Series Flow Sensor & 100XT Flow Transducers	
<p>4. Remove the rotor and stainless steel shaft from the flow cavity.</p> <p>Remove the O-ring from the faceplate</p>	
<p>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</p>	
<p>6. Inspect the bearing surface of the rotor. If the bearing surface is worn or not round, replace the rotor.</p> <p>Inspect the stainless steel shaft. If the shaft shows signs of scoring or other wear, replace the shaft or the whole faceplate assembly.</p>	
<p>7. Inspect the O-ring to ensure that it is not brittle, cracked or otherwise damaged.</p> <p>If necessary replace with a #132 O-ring of a material compatible with the liquid being passed through the flow meter.</p> <p>Position the O-ring on the inner rim of the faceplate.</p>	
<p>8. Place the rotor in the flow cavity.</p> <p>Position the shaft (or the faceplate) to locate the shaft in the rotor.</p>	

Technical Reference Manual for 300 & 100XT Flow Sensors

Cleaning the 300 Series Flow Sensor & 100XT Flow Transducers	
<p>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.</p> <p>Replace the 6 securing screws.</p> <p>Tighten the screws to a torque of 10 in-lbs (hand tighten with a normal screwdriver).</p>	
<p>11. Install the flow meter in your system.</p> <p>Turn on liquid flow and check for leaks at the faceplate and connecting ports.</p> <p>Tighten all connections as required to eliminate leaks.</p>	

Section 7: General

Proteus 5-Year Warranty

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

Certifications

300 & 100XT Series products are rated under the German Bauart standards as
Installation Category 11, not for Heavy Industrial installation.
They are Class 11 devices, no earth ground provided.

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.

Technical Reference Manual for 300 & 100XT Flow Sensors

Section 7: Reference Data Sheets & Specifications

300/3000 Data Sheet & Specifications Display is no longer available. Do not include this in new designs.

Proteus Digital Display Flowmeter



The Proteus digital display flowmeter is an inexpensive, compact and accurate way of monitoring a Proteus 300 series flow sensor or 100 series flow switch. The flow switch must have a meter interface option specified at the time of order.

DIGITAL DISPLAY

1/2 inch characters are easy to read on the 3-1/2 digit LCD display. You will see a continuous display of flow rate (GPM/LPM—gallons or liters per minute) or frequency (Hz) on the LCD.

HOW IT WORKS

A flow sensor or flow switch is installed in the flow line to be monitored, and the electrical output is connected to the input of the meter. Flow passing through a sensor spins a magnetic rotor, which induces a pulsed voltage in the sensor's pickup coil. The voltage level is then converted to a digital signal to drive the 3-1/2 digit display.

UNIT SELECTABLE

A two-position switch, accessible through the back cover, selects the display units of flow rate or frequency. Frequency is useful for field calibration.

CALIBRATION

In the field, calibration is accomplished by a simple procedure of referencing a flow and adjusting two potentiometers. Alternatively, the meter can be calibrated by the factory. To calibrate in the field, you will need a reference meter or other method of determining the actual flow to be displayed on the Proteus flow meter.

SPECIFICATIONS

Input:

low-voltage two-wire sensor signal

Dimensions:

4.5 x 4.5 x 2.5 inches;
11.4 x 11.4 x 6.4 cm

Weight:

less than 1 pound (0.5 kg)

Case:

fire retardant, ABS plastic

Operating Voltage:

115/220 VAC + 10%, 50/60Hz
or 24VDC (20-30VDC)
current draw: 5 mA

Operating Temperature:

32°F to 95°F (0°C to 35°C)

Accuracy:

± 4% of reading + one least significant digit (system accuracy with 300 series flow sensor)

Humidity:

10% to 90% no-condensing

WARRANTY

Proteus Flow Meters are covered by our 5-year warranty.

MOUNTING

In a panel, cut a hole large enough to slip the back assembly through; and then drill 4 holes for the case screws to serve as mounting screws. Alternatively, the case screws may be used to mount the meter electronics off of a bracket.

OPTIONAL ANALOG OUTPUT

This analog output is proportional to a sensor's flow rate, and ranges from 0 to 5 volts. The analog output can be used for numerous applications including automatic feedback control, chart recording, and an alarm.

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Technical Reference Manual for 300 & 100XT Flow Sensors

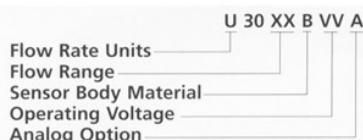
300/3000 Data Sheet & Specifications

CONNECTION TO THE FLOW SWITCH

When ordering the meter connection for a 100 series flow switch, add the letter M to the end of the flow switch model number. For example, 100C110M specifies the meter output on a 100C110 flow switch. See the flow switch data sheet and price list for more information on flow switches.

METER MODEL NUMBERS

Model numbers are in the form of:



U = G or L which signifies the flowrate units (GPM or LPM).

XX = the flow range:

Meter Display Model	FLOW RANGE		WORKS WITH	
	GPM	LPM	Sensor Model	Flow Switch
3001	0.1 - 1.0	0.38 - 3.8	301	100 (low range)
3002	0.5 - 2.5	1.9 - 9.5	302	100 (intermediate range)
3003	0.8 - 6.0	3.0 - 22.7	303	100 (high range)
3004	0.08 - 0.8	0.3 - 3.0	304L	100L
3050	1.5 - 12.0	5.7 - 45.4	350	150
3055	4.0 - 20.0	15.1 - 75.7	355	155
3060	6.0 - 30.0	22.7 - 113.6	360	160
3070	10.0 - 60.0	38.0 - 227	370	170

B = C or M which signifies the sensor body material type: C = Celcon body. M = any other body type.

VV = 24, 110 or 220 which signifies the operating voltage: 24VDC, 115 or 220 VAC.

A = Analog option
Blank = no analog output

For example, a flow meter model G3002C24 would display in GPM. It would monitor a Celcon body sensor (or flow switch) over a flow range of 0.5 to 2.5 GPM. The meter would be powered by 24 VDC. No analog option output is included.

Proteus Flow Sensor

- Pulsed Electrical Output
- Visual Flow Indication
- Models Span 0.08 to 60.0 GPM
- Use with Proteus Meter or Your Own Electronics

Proteus flow sensors use a turbine principle to generate a pulsed voltage that varies with flow. The output may be converted to flow rate by a Proteus flow meter, or may be used directly by the customer.

Magnets in alternate spokes of the rotor induce a voltage in a pickup coil when the flow turns the rotor.

Wetted Material:

Polysulfone, brass, or
316 stainless steel face plate
316 stainless steel pin
Buna-N O-ring
Carbon fiber filled nylon rotor
Celcon, brass, 316 stainless steel, or polypropylene body

Units with polypropylene bodies have carbon filled Kynar rotors and Viton O-rings.

Viscosity:

Low to moderate viscosity (up to 120 centistokes or 30 weight oil)

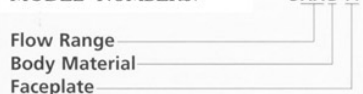
Pressure Drop:

3 psi maximum for all models except Models 304L and 301: 6 psi maximum

Weight:

1 to 2 lbs. (0.6 to 1 Kg)

MODEL NUMBERS:



3XX signifies flow range:

Model	Pipe Fitting	FLOW RANGE	
		GPM	LPM
301	1/4" NPT	0.1 - 1.0	0.38 - 3.8
302	1/4" NPT	0.5 - 2.5	1.9 - 9.5
303	1/4" NPT	0.8 - 6.0	3.0 - 22.7
304L	1/4" NPT	0.08 - 0.8	0.3 - 3.0
350	1/2" NPT	1.5 - 12.0	5.7 - 45.4
355	1/2" NPT	4.0 - 20.0	15.1 - 75.7
360	3/4" NPT	6.0 - 30.0	22.7 - 113.6
370	1" NPT	10.0 - 60.0	38.0 - 227

*The 304L is available only in Celcon, and the 370 is only available in brass and stainless steel. All the other models are available in either Celcon, brass or stainless steel. 1/4" (except 304L) and 1/2" models are available in polypropylene.

B signifies body material type: C for Celcon, B for brass, SS for 316 stainless steel, and P for polypropylene.

FF signifies faceplate material: blank for standard polysulfone, F2 for brass, and F3 for 316 stainless steel.



Proteus Industries Inc.

340 Pioneer Way, Mountain View, CA 94041, Telephone

Celcon, Nylon, and Kynar are registered trademarks of Celanese Plastics, Dupont, and Elf-Atochem respectively

Technical Reference Manual for 300 & 100XT Flow Sensors

100 & 100XT Data Sheet & Specifications (220 volt is no longer available)

Proteus Flow Switch

- Active Design Assures Reliability
- Cannot Jam in "Flow OK" Position
- Models Span 0.08 to 60.0 GPM
- Adjustable Trip Point
- Optional Metering Output



Model 100B110 Flow Switch
(actual size)

Proteus Flow Switches monitor cooling fluids or other liquid flows and trip an internal relay if the flow rate falls below an adjustable trip point. The relay 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.

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 relay is held in its active position. If it falls below the set value or fluid stops flowing, the relay

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 shows you 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 60.0 GPM (0.4 to 230 LPM) are available. The range of each model is shown in the model numbering section.

Body Materials

Brass, Celcon and 316 stainless steel bodies are available. For polypropylene bodies, call the factory.

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 Nylon based composite rotor. Please call the factory for applications which require FDA approved materials, or have special chemical requirements.

Temperature

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

Technical Reference Manual for 300 & 100XT Flow Sensors

100 & 100 XT Data Sheet

Viscosity

To 120 centistokes (about 30 weight oil at room temperature).

Pressure

100 psi (6.9 bar) maximum with polysulfone face plate.

250 psi (17.3 bar) maximum with metal face plate.

Pressure Drop

3 psi (0.2 bar) maximum except for the low flow range on the Model 100, which has a 6 psi (0.4 bar) maximum.

Weight

2 to 6 lbs. (1 to 3 Kg.) depending on model and materials.

Electrical Requirements

Three options are available for input power:

110 VAC, single phase, 50/60 Hz, 30 mA

20-30 VDC, 30 mA (nominal 24 VDC).

Relay Switching

SPDT, with contact rated at

30 VDC, 3.0 Amp. for a non-inductive load. With inductive load, maximum surge must not exceed 3.0 Amp. Mechanical rating above one million cycles.

Maximum Distance to Electronics

30 feet (10 meters) from transducer portion of switch.

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.

Ordering Information

Flow switch model numbers are in the form 1XXBVV-FF-M where:

1XX designates the flow range, as shown in the table to the right.

B designates the body material: C for Celcon, B for Brass and SS for 316 stainless steel.

VV designates the input voltage: 110 for 110 VAC, or 24 for 20-30 VDC.

FF designates the face plate material: Blank for standard polysulfone, F2 for brass (available with brass bodies only) and F3 for 316 stainless steel (available with stainless steel bodies only.)

tronics. It includes the body, face, rotor and coil. The electrical output is a very low voltage pulse whose frequency varies with flow. Model numbers are in the form 1XXBT-FF. "XX", "B" and "FF" have the same meaning as in the flow switch model numbers shown above. "T" designates Transducer.

Flow Switch Transducers

The transducer is the sensing portion of the flow switch without the elec-

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FLOW RANGE TABLE

Model	Pipe Connection	Flow Range	
		GPM	LPM
100*	1/4" NPT	0.1 - 1.0	0.38 - 3.8
" "	1/4" NPT	0.5 - 2.5	1.9 - 9.5
" "	1/4" NPT	0.8 - 6.0	3.0 - 22.7
104	1/4" NPT	0.06 - 0.5	0.3 - 1.9
150	1/2" NPT	1.5 - 12.0	5.7 - 45.4
155	1/2" NPT	4.0 - 20.0	15.1 - 75.7
160	3/4" NPT	6.0 - 30.0	22.7 - 114
170	1" NPT	10.0 - 60.0	38.0 - 227

* 100 Series flow switches include all three flow ranges which are selected by plumbing connection to appropriate ports. The 100L low flow range is shifted down as shown in the chart, the middle and upper flow ranges are the same as for the 100.

DIMENSIONS

Model	Units	Height	Width	Depth	
				With Electronics	Without Electronics
100	inches	2.75	3.0	2.7	0.9
	cm	7.0	7.6	6.9	2.3
150/155	inches	2.75	3.0	2.8	1.0
	cm	7.0	7.6	7.1	2.5
160	inches	2.75	3.0	3.2	1.4
	cm	7.0	7.6	8.1	3.5
170	inches	3.15	3.6	3.7	1.9
	cm	8.0	9.2	9.4	4.8

Bolt circle for six face plate screws (all models): 2.5 inches, 6.4 centimeters.