

# Electronic Flow Switches

## Industries

Petrochemical

Refining

Oil Production

Water Treatment

Pharmaceutical

Food and Beverage

Pulp and Paper

Power Production

Gas Processing

Mining

Biotechnology

Semiconductor

Ships/Marine

Defense Contractors

Pipelines



FX Series

**Ameritrol, Inc.**  
**Instruments and Controls**

## Features

- No Moving Parts
- 316L Stainless Steel Sensor
- Temperatures to 900F
- Pressures to 10,000 PSIG
- Field Programmable for Relay Energization
- Explosion Proof Enclosures
- Low Flow Rate Detection
- Threaded, Flanged, Retractable Probes
- Exotic Alloys for Corrosion Resistance
- Reliable and Cost Effective



Optional Remote Mounted Electronics



Optional Extended Sensor Head



Optional Flanged Sensor Head



Optional Retractable Sensor Head  
(Isolation Ball Valve Not Shown)

## Specifications

### Sensor Head

Material of Construction:	316L Stainless Steel Standard Optional Exotic Alloys
Operating Temperature:	-50 to +350F (-46 to +177C) Standard Option -100 to +900F (-73 to +482C) Option -200 to +500F (-129 to +260C)
Operating Pressure:	Vacuum to 4000 PSIG (275 Bar) Option to 10,000 PSIG ( 689 Bar)
Response Time:	From 3 Seconds
Repeatability	± 0.5% of Range at Constant Conditions
Process Connection:	¾" MNPT, 1" MNPT Standard Option Flanged, Retractable Probes, and ½", 1-¼", 1-½", 2" MNPT
Probe Length:	1.8", 1.2"; Option Customer Specified

### Electronics

Housing:	Powder Coated Explosion Proof, Nema 4X, UL/CSA Rated to Class 1, Div. 1 & 2, Group B,C,D; Class II, Div. 1 & 2, Group E,F,G; Class III. Option FM and Cenelec/ATEX
Temperature:	-50 to +150F (-46 to +65C)
Power Input:	120 VAC, 50/60 Hz, 4 Watts; Options: 12 VDC, 24 VDC/VAC, 240VAC
Relay Output:	SPDT 3 Amps Resistive Standard See page 4 for options
Electrical Connection:	1" FNPT
Shipping Weight:	5 lbs

# Operation

The FX series flow switch is the most reliable flow switch available. The thermal dispersion principle of operation features no moving parts and provides an extremely reliable and repeatable switch for the most demanding industrial applications.

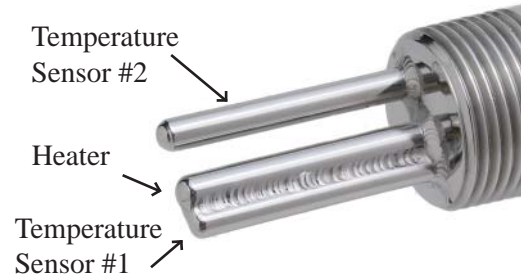
The sensor head employs two temperature sensors with a constant very low power heating source physically attached to one of the temperature sensors. The second temperature sensor is isolated from the heating source and provides compensation for changing process temperatures (see figure 1). As flow changes so does the temperature differential. This allows the device to be used as a flow/no flow sensor and to be used to switch at any velocity shown in the flow switch range chart.

Extremely low flow rates can be detected with rangeability up to 300:1. These devices are ideal for use in virtually all liquids, gases, and slurries. With no moving parts exposed to the process end users are provided an

extremely reliable and repeatable instrument even in viscous or corrosive applications.

The electronics are available with single or dual switch points. Temperature monitoring is also available with either a switch output or a linear 4-20 mA output.

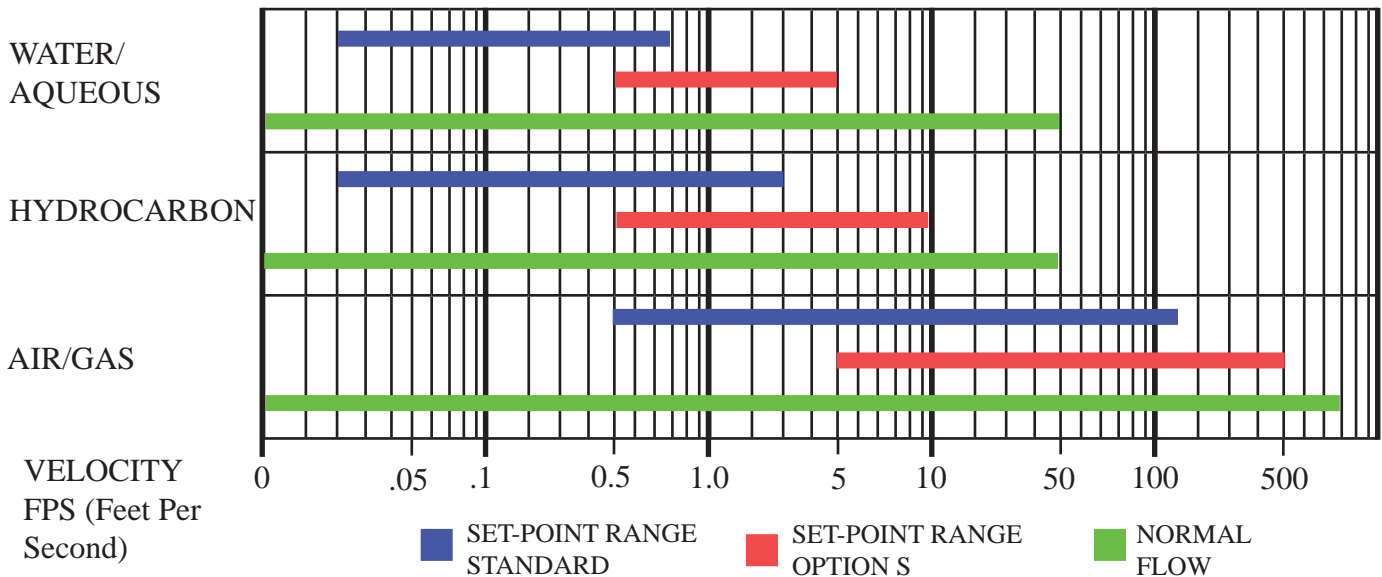
Relay outputs are standard and are offered with several different configurations and contact ratings. Remote mounting of the electronics is also available.



Temperature Differential = Temperature Sensor #1 Minus Temperature Sensor #2

Figure 1

## Flow Switch Set-Point Range



## Conversion Table

Volumetric (GPM or CFM) to Velocity (Feet per Second - FPS)

Line Size	1/8"	1/4"	3/8"	1/2"	3/4"	1"	1.25"	1.5"	2"	2.5"	3"	3.5"	4"	5"	6"
Liquid Multiplier	5.65	3.08	1.68	1.06	.602	.371	.215	.158	.096	.067	.0434	.0325	.0252	.0160	.0111
Air Multiplier	42.19	23.06	12.57	7.91	4.50	2.78	1.61	1.18	.716	.502	.325	.243	.188	.120	.083

Line Size	8"	10"	12"	14"	16"	18"	20"	24"
Liquid Multiplier	.0064	.00407	.00287	.00237	.00182	.00143	.00115	.000798
Air Multiplier	.0480	.0304	.0209	.0177	.0136	.0107	.00863	.00597

Examples:

- 1) 100 CFM in 3" Line = 100 x .325 = 32.5 FPS
- 2) 10 GPM in 3" Line = 10 x .0434 = .434 FPS

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# Circuit Board Options

## Standard Single Switch Point Electronics

- SPDT relay output with 3 or 10 amp contacts
- DPDT relay option with 3 or 10 amp contacts
- Wide selection of power inputs including 12 VDC, 24 VAC or VDC, 120 VAC, or 240 VAC

This circuit board is the standard used in the FX series flow switches. The electronics offer constant current sensor excitation, precision signal amplification, and highly repeatable switching circuitry for reliable operation in even the most demanding applications.



## Optional Dual Switch point Electronics

- Two separately adjustable switch points
- SPDT relay output for each set point with 3 or 10 amp contacts
- Power inputs include 12 VDC, 24 VAC or VDC, 120 VAC, or 240 VAC

The optional dual switch point electronics provide two independently adjustable switch points that can be used to detect any two combinations of decreasing and/or increasing flow.



## Single Switch Point Electronics with Additional Temperature Transmitter

- Temperature transmitter (3 wire 100 Ohm platinum RTD sensor) with loop powered 4-20 mA output
- SPDT relay output for flow switch with 3 or 10 amp contact rating
- Flow switch power inputs include 12 VDC, 24 VAC or VDC, 120 VAC, or 240 VAC

This option provides the user with a highly reliable flow switch with an accurate temperature transmitter. The temperature transmitter provides a industry standard linearized 4-20 mA signal. The temperature output is loop powered and can operate from 8-36 VDC.



## Single Switch Point Electronics with Additional Temperature Switch

- Temperature switch point available from -50F to +350F, with options to 900F
- SPDT relay output for flow and temperature with 3 or 10 amp contact rating
- Customer specified power inputs include 12 VDC, 24 VAC or VDC, 120 VAC, or 240 VAC

This optional circuit board monitors two process variables, flow and temperature, with one instrument. Cost savings are realized by the user since the instrument has only one process connection and one conduit run. Applications include monitoring cooling water and all other applications shown on page 5 of this brochure.



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# Calibrator

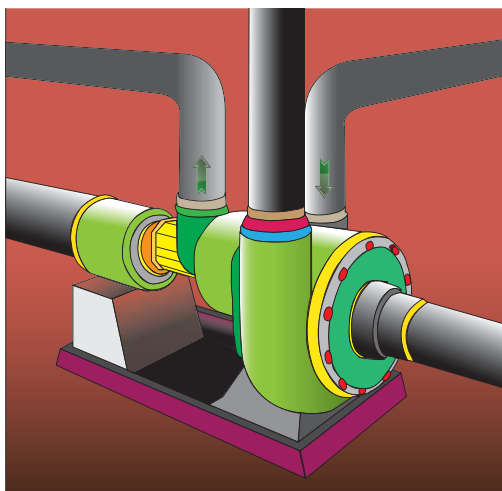
## Flow Switch Calibrator Model MC-5

- Displays mV output which is proportional to flow
- Induces signal to electronics for setting specified switch point
- Allows periodic switch point verification

This easy to use hand held, self powered instrument can be used in conjunction with all single or dual switch point circuit boards. By simply plugging this instrument into the circuit board, the user can interrogate all functions of the flow switch.

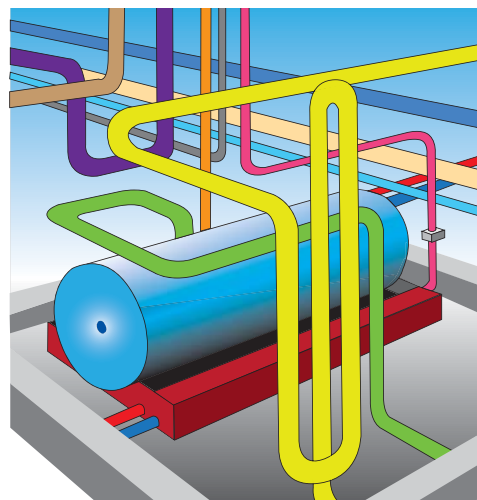


## Flow Switch Applications



- Pump Protection: Automatic shut down on low or no flow
- Bearing Lubrication: Detects loss of lubricant flow
- Seal Leakage: Verifies positive seal flow or detects excessive leakage indicating maintenance requirement
- Chemical Feed and Metering Pumps: Indicates low or no flow of chemical additives to process
- Safety Shower/Eye Wash Station: Automatic annunciation of potential danger to plant personnel
- Analyzer/ Gas Chromatographs: Confirms continuous sample flow to instruments
- Control Rooms: Verifies flow when fans, pumps or valves are energized

- Purge Air: Detects loss of flow for process or plant safety
- Spray Nozzles: Detects nozzle blockage in coating applications
- Relief Valve/Rupture Disks: Alarms on flow or leakage of safety relief valves or rupture disks
- Chiller Lines: Automatic shut down of chillers on low or no flow
- Heater Burnout Prevention: Heater shutdown on loss of flow to prevent overheating of elements
- Tank Car Loading: Senses dry line or phase change from liquid to nitrogen gas flow
- Drain Line Sensor: Capable of detecting flow in partially filled lines
- Agitation Monitor: Positive indication of agitation in tanks



# PART NUMBER/ ORDER ENTRY SPECIFICATION

## FX SERIES FLOW SWITCH

OPTIONS - NO ENTRY REQUIRED FOR BOXES WITH X

FX - 

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PROCESS CONNECTION  
THREADED

1/2" MNPT	0	5	0	0
3/4" MNPT	0	7	5	0
1" MNPT	1	0	0	0
1-1/4" MNPT	1	2	5	0
1-1/2" MNPT	1	5	0	0
2" MNPT	2	0	0	0

PROCESS CONNECTION  
FLANGED

1" FLANGE	1	0
1-1/4" FLANGE	1	2
1-1/2" FLANGE	1	5
2" FLANGE	2	0
3" FLANGE	3	0
4" FLANGE	4	0
6" FLANGE	6	0

150# RATING	1
300# RATING	2
600# RATING	3
900# RATING	4
1500# RATING	5

RAISED FACE 316L SS	1
RAISED FACE CS	2
FLAT FACE 316L SS	3
FLAT FACE CS	4
SPECIAL	5

<b>INSERTION LENGTH</b>				
• 1.8" STANDARD				X
• 1.2" OPTIONAL	1	.	2	
• SPECIAL - SPECIFY LENGTH IN INCHES				
<b>POWER INPUT</b>				
• 117 VAC (90-132VAC)				X
• 12 VDC (+30%, -10%)				B
• 24 VDC or VAC (+/- 10%)				D
• 200-240 VAC				E
<b>PROCESS TEMPERATURE</b>				
• -50F TO +350F				X
• -200F TO +500F				F
• -100F TO + 900F				G
<b>REMOTE ELECTRONICS</b>				
• CABLE TYPE PVC (200F)				H
• CABLE TEFLON (500F)				I
• CABLE LENGTH FT.				
<b>RELAY OUTPUTS</b>				
• SPDT 3 AMP RESISTIVE				X
• SPDT 10 AMP RESISTIVE				J
• DPDT 3 AMP RESISTIVE				K
• DPDT 10 AMP RESISTIVE				L
<b>DUAL SWITCH POINTS</b>				
• SPDT 3 AMP RESISTIVE				M
• SPDT 10 AMP RESISTIVE				N

<b>ADDITIONAL TEMPERATURE SWITCH</b>		
• SPDT 3 AMP RESISTIVE	T	1
• SPDT 10 AMP RESISTIVE	T	2
<b>ADDITIONAL TEMPERATURE TRANSMITTER</b>		
• MEASURED TEMPERATURE RANGE		
T	T	-
• FAHRENHEIT (F) OR CELSIUS (C)		
<b>SENSOR HEAD MATERIAL</b>		
• 316L STAINLESS STEEL		X
• HASTELLOY C-276	A	D
• MONEL / ALLOY 400	A	M
• TITANIUM	A	T
• CARPENTER 20 / ALLOY 20	A	P
• OTHER ALLOYS CONSULT MANUFACTURER		
<b>HOUSINGS</b>		
• UL/CSA APPROVED EXPLOSION PROOF		X
• FM APPROVED EXPLOSION PROOF		P
• CENELEC/ATEX APPROVED		Q
<b>HIGH FLOW OPTION - CLEAN LIQUIDS/ GASES 1" MNPT OR 1 1/4" FLANGE OR LARGER</b>		
		S
<b>HIGH PRESSURE OPTION 10,000 PSIG</b>		
		U
<b>RETRACTABLE PROBE 50 PSIG</b>		
		V
<b>RETRACTABLE PROBE 500 PSIG</b>		
		W
<b>STAINLESS STEEL TAG</b>		
		T
<b>MILLIVOLT OUTPUT</b>		m
		V

Note Only one of these options can be selected.

Example 1: FX-1000

FX Series flow switch with 1" MNPT process connection, 1.8" insertion length, 117 VAC power input, -50 to +350F process temperature, single switch point with SPDT 3 amp contact rating, 316L stainless steel sensor head.

Example 2: FX-1511-6DFRH10J

FX Series flow switch with 1-1/2" 150 # raised face 316L SS FLANGE process connection, 6" insertion length, 24 VDC or VAC power input, -200 to +500F process temperature, remote electronics, 10' teflon cable, single switch point with SPDT 10 amp contact rating, 316L stainless steel sensor head.

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