

MIR-900E Series - Flexible Dual Rod

- ▶ Highly Repeatable
- ▶ Lengths to 3.65m
- ▶ Tefzel® Wave Guide Encapsulation
- ▶ Ideal for Coating/Viscous Liquids

MIR-900E Series sensors handle tank depths to 3.65m, but more important for some will be the ability of this series to deliver dependable sensing in fluids that coat and build up on the sensor wave guide. The flexible dual rod is completely encapsulated with a low-dielectric bridge between the rods that facilitates accurate wave reflection, even when coated with media.

Two standard lengths are available, which may be trimmed to size to fit tanks 3.65m deep or less. A stainless steel weight, fitted at the guide's end, maintains guide rigidity. OEM versions are sized and calibrated at the factory and supplied with fitted Ryton® end weights. With zero deadband at the top, MIR-900E is capable of measuring tank contents right up to the bottom of its mounting.

Specifications

General	
Model	MIR-900E
Wave guide configuration	Flexible, Dual Rod
Technology	Micropower Impulse Radar
Operating frequency	2.5 GHz
Mechanical	
Enclosure material	304SS
Enclosure height	110mm
Probe material	Tefzel® over-moulded 304SS
Probe dimensions	13.6mm width x 2.13mm thickness
Other wetted materials	Thermal plastic polyurethane, Viton®, 304SS, Silicone, Ryton®
Mountings	1" & 2" BSPs (NPT also available)
Indication range	102mm to 3.65m
Electrical	
Supply voltage	8-36 VDC
Output	4-20mA (2-wire)
Approvals	UL & CSA Intrinsically Safe (Pending), CE
Termination	1/2" NPT conduit with cable gland
Environmental	
Temperature range	-18°C to +65°C
Maximum pressure	6.9 bar @ 65°C
Dielectric range	≥3.0
Enclosure rating	IP67
Electromagnetic compatibility	CE EN 50081-1 Emissions; CE EN 50082-1 Immunity
Performance	
Resolution	0.25mm
Repeatability	0.25mm
Accuracy	1-2% full scale
Linearity	1-2% full scale
Response time	2 seconds
Warm-up time	15 seconds

MIR-900E: Cut & Calibrate



Gems Sensors stocks standard sensors that you cut to length and calibrate. And to simplify the calibration, a display and two pushbuttons are included.

1. Order sensors from stock - ship same day.
2. Cut the rods to suit your tank.
3. Simple three step calibration; no need to fill and drain your tank.
4. Install the sensor.

How to Order

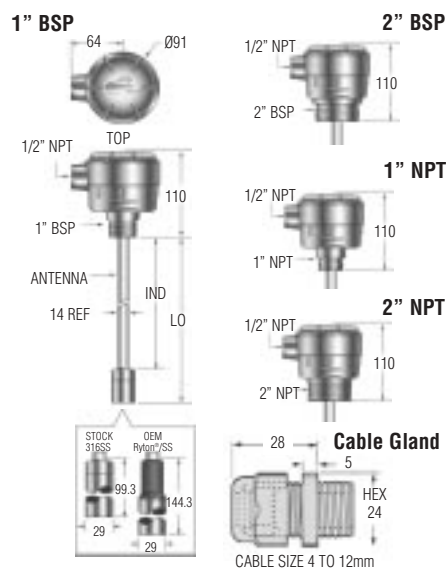
Select by mounting size and wave guide length suitable for tank depth

Mounting Size	Wave Guide Length (See Cut & Calibrate above)	Configurable Length of Indication	Part Number
1" BSP	3500mm	102mm to 3.65m	041-1023
2" BSP	3500mm	102mm to 3.65mm	041-1024
NPT Sizes		Contact a Gems Specialist	



Dimensions (in mm)

Except for mounting sizes, all types share equivalent dimensions



Applications

- 1. Use in deeper tanks**
MIR-900E measures fluids to 3.65m. (Use MIR-800E up to 2m)
- 2. Roll Out Installation for Tight Spaces**
Tanks will often find their tops very close to ceilings. Flexible rods make installation a snap where tight headroom would render a long length sensor impractical. Use MIR-900E wherever space above the tank is at a premium.
- 3. Zero Deadband**
Sense liquids right up to the bottom of the sensor head. With MIR-900E sensors there is no dead band at the high level point.
- 4. Over-moulded Rods for Coating, Crystallisation, and product build-up**
Inks, paints, honey, syrups and other coating fluids will not stop the MIR-900E from maintaining accurate level sensing.
- 5. Roll Up for Easy Transport and Handling**
Moving a 3.65m long sensor has never been this easy. The MIR-900E saves storage space and reduces shipping costs.

Operating Principle of Gems Flow Switches

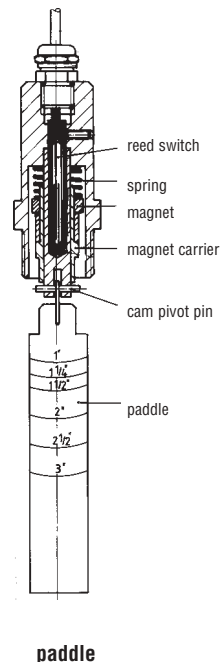
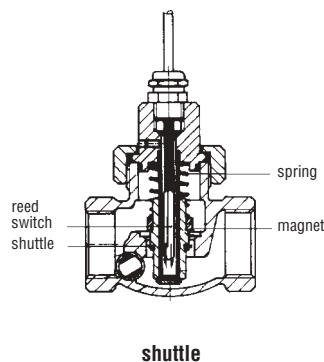
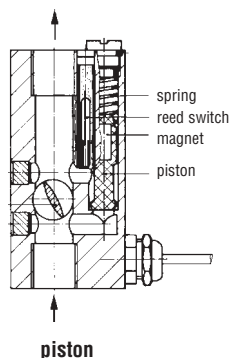
GEMS flow switches work according to the principle which is shown in the simplified diagrams on this page.

One can differentiate between two main operating principals:

1. A magnet-equipped piston or shuttle, displaced by the pressure differential (>350mb) from fluid flow, magnetically actuates a hermitically sealed reed switch within the unit.
2. Liquid flow deflects a paddle, which - with a pivoting cam - moves a magnet-equipped shuttle along the unit stem.

With both operating principles, if a pre-defined flow rate is achieved, a hermetically sealed reed switch is actuated by the magnetic field, resulting in the opening or closing of an electric circuit.

Operating principle



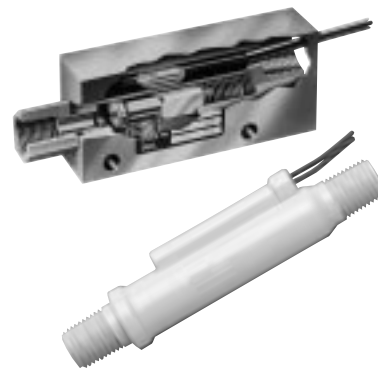
Flow Switches

Unique Designs ... For use in Liquids or Gases

GEMS line of flow switches features a broad range of configurations for use in liquids or gases. At preset ranges, ranging from 50 cc/min to 375 l/min, GEMS switches will initiate alarm actuation to automatic shut-down of a system.

These switches feature high quality, corrosion-resistant materials for use in the toughest environments. Material choices, ranging from stainless steel to Ryton®, offer vast chemical compatibility. Versions include switches with fixed or adjustable actuation settings, models for viscosity compensation or high pressures, in-line models and designs to satisfy any mounting or space requirement.

Piston Types



Selector Guide

The versatile GEMS Flow Switch line utilises four basic operating principles. This flow section is organised into four operational types: Piston, Shuttle, Paddle and Electronic. The Shuttle models are for use with high flow rates; the Piston types are designed for low flow rates; the Paddle for large line sizes and the Electronic switches encompass state-of-the-art electronics and positive visual indication.

Shuttle Types



Variety of Operating Principles

You can quickly pinpoint the GEMS Flow Switch that best meets your requirements using the Selection Chart on page 49. It directs you from the most general criteria of your application ... through key design choices ... to the specific switch series suitable for use. The Selector Guide also provides an excellent overall view of the full scope of the GEMS Flow Switch line and options detailed in this catalogue.

Notes:

For correct operation all piston and shuttle types require at least 350mb line pressure.

Paddle Types



Flow Switch Selection Chart

Type	Standard-range (l/min)	Adjustment/output	Ports	Housing material	Page	*Max Temp °C	*Max Pressure (bar)
FS-3	0.2 _____ 3.8	pre-adjusted setpoints	R1/4", 1/4" NPT	Noryl®	52	100	10
FS-4	0.4 _____ 6.0	pre-adjusted setpoints	G1/4" with Adapter	Ryton	54	107	20
FS-6	0.4 _____ 6.0	pre-adjusted setpoints	G1/4"	Delrin	55	85	30
FS-100E	2.0 _____ 15.0	pre-adjusted setpoints	G3/8"	Brass	56	90	50
FS-100E-A	1.0 _____ 16.0	adjustable	G3/8"	Brass	56	90	50
FS-105E	0.005 _____ 150	adjustable	G1/4" ... G1"	Brass	59	120	250
FS-107E	0.10 _____ 90	adjustable	G1/2" ... G1"	Brass	59	120	250
FS-150	2.0 _____ 18.5	pre-adjusted setpoints	1/2" NPT	Polypropylene	53	100	14
FS-200	2.0 _____ 190.0	pre-adjusted setpoints	1" ... 2" NPT	Bronze / SSteel	61	150	27
FS-200E	2.0 _____ 30.0	pre-adjusted setpoints	G1"	Bronze	60	150	27
FS-200E-A	3.0 _____ 57.0	adjustable	G1"	Bronze	60	150	27
FS-360	1 _____ 7.6	pre-adjusted set points	3/8" NPT or fitting	Brass / SSteel	57	135	70
FS-360P	1 _____ 7.6	pre-adjusted set points	3/8" NPT or fitting	Brass / Polypropylene	58	100	7.6
FS-400	3.0 _____ 37.5	pre-adjusted setpoints	3/4" NPT	Bronze	62	150	27
FS-400-A	3.0 _____ 53.0	adjustable	3/4" NPT	Bronze	62	150	27
FS-925E	0.4 _____ 6.0	pre-adjusted setpoints	G1/4"	Brass / SSteel	64	150	68
FS-926E	0.05_ 0.3	pre-adjusted setpoints	G1/4"	Brass / SSteel	64	150	68
FS-10798E	2.0 _____ 75.0	adjustable	G1/2"	Brass / SSteel	65	150	68
FS-500	1 _____ 18.5	pre-adjusted setpoints	R3/4" NPT	Polypropylene	63	100	7
FS-550E	15.0 _____ 125.0	pre-adjusted setpoints	R1"	Brass / SSteel	66	150	55
FT-110	0.5 _____ 30.0	pulsed output	G3/8", 3/8" NPT	Nylon 12	72	100	14
RFI	0.4 _____ 225	visual indication	1/4" ... 1" NPT/BSP	Polypropylene / Metal	68	100	14
RFO, RFA	0.4 _____ 225	pulsed/analogue output	1/4" ... 1" NPT/BSP	Polypropylene / Metal	69	100	14
RFS	0.4 _____ 225	adjustable	1/4" ... 1" NPT/BSP	Polypropylene / Metal	70	100	14

*Some material / media combinations will result in reduced specification. Please refer to Full Product Specifications.

FS-3 0.2 - 3.8 (l/min) pre-adjusted set points

PISTON TYPE

These ultra compact switches have been specially designed for reliable operation in clean-post-filtered water. They are made primarily of Noryl®, with all other wetted materials are FDA or NSF compliant. FS-3 switches are instrument quality, yet affordably priced for pure water equipment from UV lamp switching to filter life monitoring. Also well suited to some chemical applications and a variety of cooling applications: lasers, welders, etc.

Specifications (all data related to water at +20°C)

Operating pressure	10 bar at 20°C; 3.4 bar at 100°C
Operating temperature	max. 100°C
Switch	SPST, NO, 20 VA, 120...240 V AC/DC
Inlet / outlet ports	1/4" NPT, R 1/4"
Electrical connection	AWG 22 PVC-lead wires, Length appr. 0.3m
Mounting orientation	Any position
Approvals	U.L. approved file No. E91926

*Materials of construction are either FDA or NSF compliant.

Notes:

1. NO switches in No Flow condition are standard; please contact us for NC models.
2. The device is designed to provide Flow/No Flow sensing. Tabulated set points specify maximum contact closure thresholds on increasing fluid flow. Re-establishment of a Normally Open contact occurs on decreasing fluid flow between set point and no flow.
3. Flow settings are based on a vertical position (inlet port down), using water at +20°C on increasing flow. Some variation in set point actuation will occur in other mounting orientations.
4. Use of 50 micron, or better, filtration is required.
5. Not recommended for use with oils.

How to Order

Set points (Fluid) (l/min)	Order numbers for Fluid	
	1/4" NPT	R 1/4"
0.2	165840	166701
1.0	165841	166702
2.0	165842	166703
3.8	165843	166704

GAS/AIR

Set Points	(l/min)(air)	Order numbers for Gases	
0.35 bar	6.9bar	1/4" NPT	R1/4
12	28	165840-AIR	166701-AIR
28	74	165841-AIR	166702-AIR
70	158	165842-AIR	166703-AIR
140	340	165843-AIR	166704-AIR

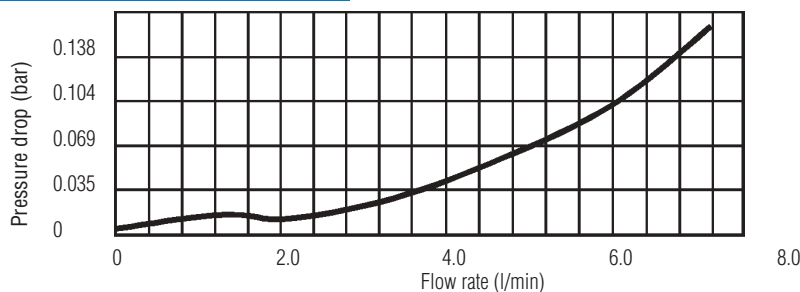
Standard Models (Medium: water)

Specify the FS-3 flow switch using part numbers tabulated column above.

Special Requirements

GEMS caters to OEM needs with special configurations, including Gas (Air) flow and customer specified electrical terminations.

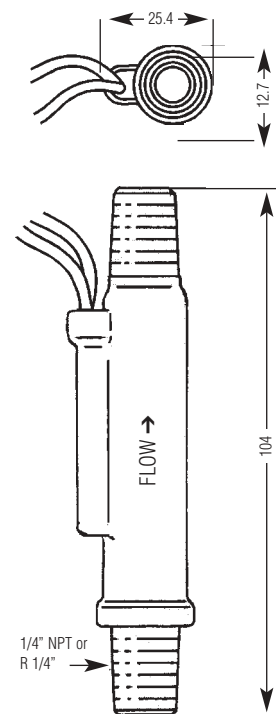
Pressure Drop Diagram



Standard Products in **bold**



Dimensions (in mm)



Housing: Noryl®
 Piston: Noryl®
 Spring: Stainless Steel

FLOW SWITCHES

FS-150 2.0 - 18.5 (l/min) with pre-adjusted set points

Straight flow path with low pressure drop

The FS-150 slim, inline switches reduce pressure drop to a minimum. They incorporate a unique, dual-diameter, internal bore and piston configuration to minimise flow constriction. Liquids are able to smoothly pass around the piston and flow through the switch with little pressure loss to the down stream line.

Specifications

(all pressure data related to water at +20°C)

Operating pressure	14 bar
Operating temperature	-17 °C to +100 °C
Set point accuracy	±15%
Set point differential	20% max.
Switch	SPST, 20 VA
Inlet / outlet ports	1/2" NPT male
Electrical termination	6.3 mm (1/4") spade terminals (2)
Mounting orientation	Any position

How to Order

Standard models (medium: water)

Specify part number based on flow setting and switch operation (see chart next column).

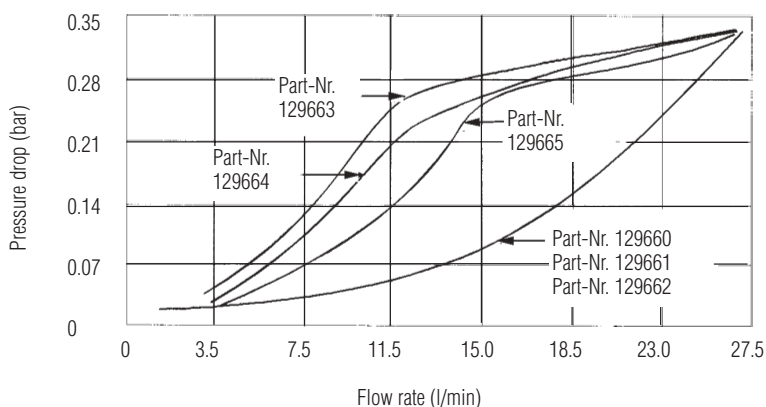
For liquids other than water

Special calibration is available from GEMS for media other than water. Please consult factory with your requirements, including flow media, operating pressure, flow set point and liquid viscosity (SSU).

Order Numbers

set points (l/min)	NO	NC
2.0	129660	129666
3.5	129661	129667
7.5	129662	129668
11.5	129663	129669
15.0	129664	129670
18.5	129665	129671

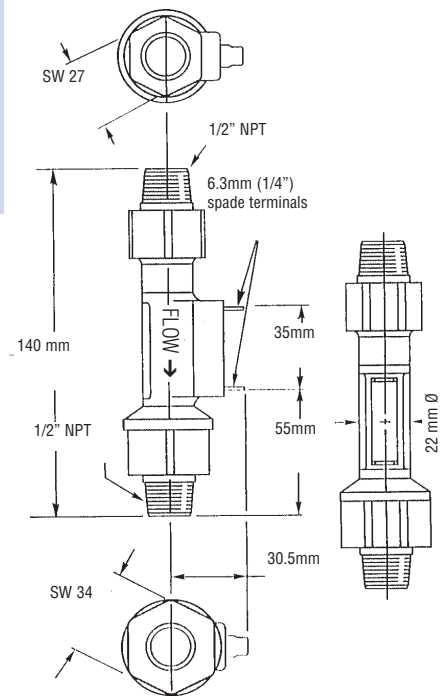
Pressure drop - typical



Test conducted with units in a horizontal position (terminals upwards), with water at 20°C



Dimensions (in mm)



Housing: Polypropylene (hydrolytically stable)
 Piston: Ryton®-R4 316 Stainless Steel
 O-Ring: Viton®
 Spring: 316 Stainless Steel

PISTON TYPE

FLOW SWITCHES

FS-4 0.4 - 6.0 (l/min)

PISTON TYPE

Pre-adjusted set points

The FS-4 Series makes flow protection economical for a broad range of industrial applications such as business machines, heavy duty floor cleaners, commercial dishwashers and beverage dispensing equipment.

Specifications

(all data related to water at +20°C)

Max. flow	12 l/min
Max. operating pressure	20 bar
Proof pressure	30 bar
Max. temperature	+107 °C (Ambient +80°C for cable)
Set points	see order number
Switching function (related to increasing flow)	NC, NO, SPDT
Factory calibration position	vertical, inlet port down
Mounting orientation	Any position
Repeatability	± 1%
Adjustment accuracy	±15%
Hysteresis	max. 20%
Mounting	9/16"-18 UNF-2B, with adapter: G1/4"
Electrical connections	— lead wire: TPE, 18 AWG x 0.6m approx — cable: PVC, 0.34 mm ² x 1m approx
Enclosure	IP 65
Electrical data contact rating	NC/NO: 100 VA; 3 A; 220 V~ SPDT: 20 VA; 0.5 A; 220 V~
Weight	0.1 kg

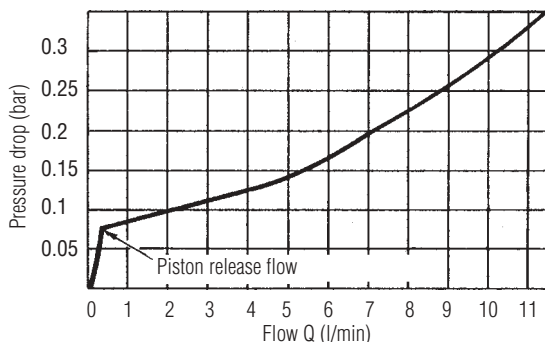
How to Order

set points (l/min)	order number lead wire		
	NO	NC	SPDT
0.4	122340	122346	122352
1.0	122341	122347	122353
2.0	122342	122348	122354
3.0	122343	122349	122355
4.0	122344	122350	122356
6.0	122345	122351	122357

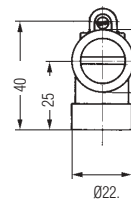
set points (l/min)	order number cable		
	NO	NC	SPDT
0.4	020-0242	020-0248	020-0254
1.0	020-0243	020-0249	020-0255
2.0	020-0244	020-0250	020-0256
3.0	020-0245	020-0251	020-0257
4.0	020-0246	020-0252	020-0258
6.0	020-0247	020-0253	020-0259

Pressure drop diagram

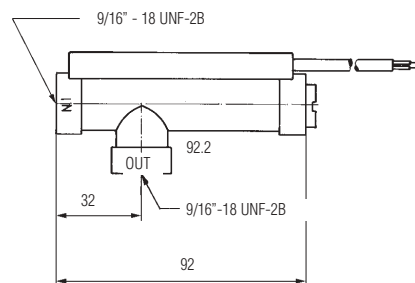
(at min. set point adjustment)



Dimensions (in mm)



Housing: Ryton®
Piston: Ryton®
Spring: Stainless Steel
O-Ring: Viton®

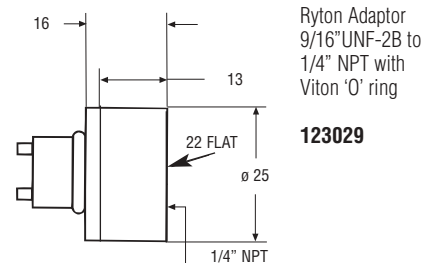
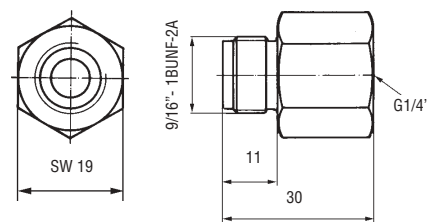


Adaptors

Please use adaptor only in connection with supplied Viton O-Ring.

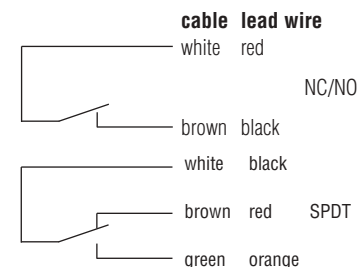
Brass Adaptor 9/16"-18UNF-2B to G 1/4" with Viton O-Ring

912-0616



123029

Wiring Diagram



Standard Products in **bold**

FLOW SWITCHES

www.gems-sensors.co.uk

FS-6 0.4 - 6.0 (l/min)

PISTON TYPE

Pre-adjusted set points

The FS-6 range of flow switches provides economical flow protection for a wide range of industrial applications such as photocopiers, heavy-duty floor cleaners and industrial dishwashers. The European integral G 1/4" connections obviate the need for additional adaptors and the design allows for easy mounting.

Specifications

(all data related to water at +20°C)

Max. flow	12 l/min
Max. operating pressure	30 bar at +20 °C 16 bar at +50 °C 13 bar at +70 °C 5 bar at +85 °C
Proof pressure	45 bar
Max. temperature	+85 °C
Set points	see order number
Switching function (related to increasing flow)	NC, NO, SPDT
Factory calibration position	vertical, inlet port down
Mounting orientation	Any position
Repeatability	±1%
Adjustment accuracy	±15%
Hysteresis	max. 20%
Mounting	G1/4"
Electrical connections	cable: PVC, 0.34 mm ² (length: approx. 1 m)
Enclosure	IP 65
Electrical data contact rating	NC/NO: 100 VA, 3 A, 220 V~ SPDT: 20 VA, 0.5 A, 250 VA
Weight:	0.16 kg

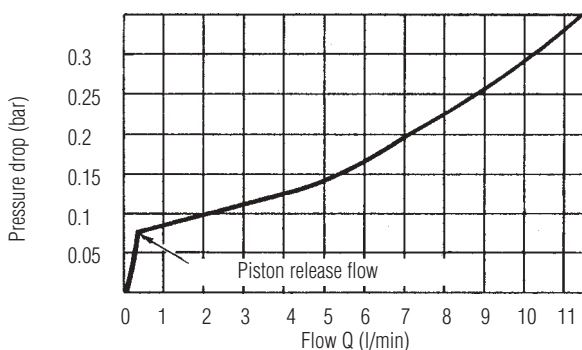
Please note: For mineral oil applications please order brass piston instead of polysulphone piston.
Add GE169 to order number e.g. 020-0290 - GE169

How to Order

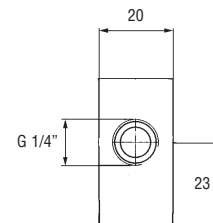
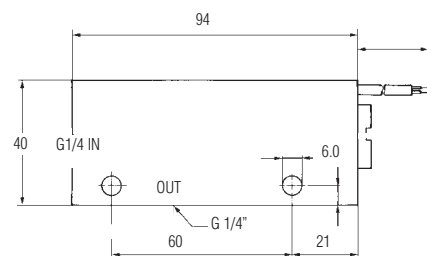
set points (l/min)	order number		
	NO	NC	SPDT
0.4	020-0290	020-0297	020-0304
1.0	020-0291	020-0298	020-0305
2.0	020-0292	020-0299	020-0306
3.0	020-0293	020-0300	020-0307
4.0	020-0294	020-0301	020-0308
6.0	020-0295	020-0302	020-0309

Pressure drop diagram

(at min. set point adjustment)



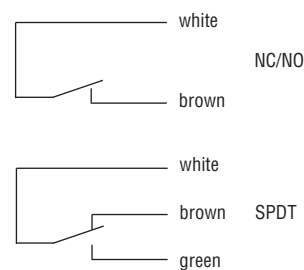
Dimensions (in mm)



Housing: Delrin®
Piston: Polysulfone*
Spring: Stainless Steel
O-Ring: Viton®

* Option Brass

Wiring Diagram



FLOW SWITCHES

FS-100E 2.0 - 15.0 l/min with pre-adjusted set points
 FS-100E-A 1.0 - 16.0 l/min with adjustable set points

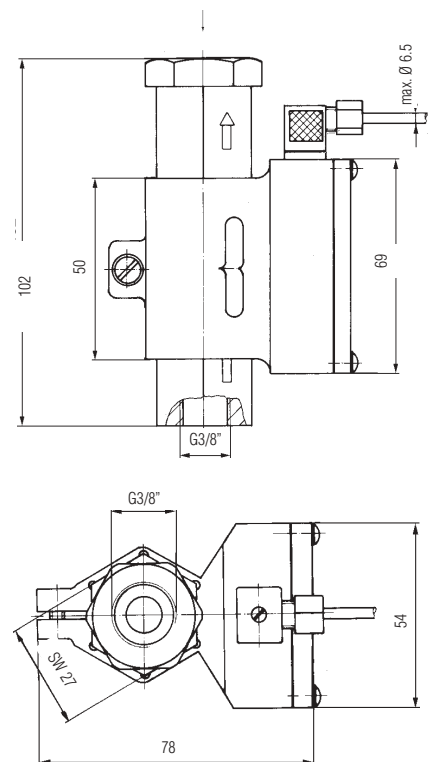
PISTON TYPE

The FS-100E version (with pre-adjusted set points 2.0 . . . 6.0 l/min) operates in vertical mounting position only. It is equipped with a calibrated piston which is displaced by liquid flow to magnetically actuate a hermetically sealed reed switch isolated within the unit body. When flow decreases the piston returns to its prior position by its own weight and deactuates the reed switch. The FS-100E version (with pre-adjusted set points 5.0 . . . 15.0 l/min) operates with the same principle but a positive spring-return deactuates the switch when flow decreases. Mounting is possible in any position.

The FS-100E-A (adjustment range 1.0 . . . 16.0 l/min) operates according to the same principle as the FS-100E with spring. The FS-100E-A is provided with an additional scale on the brass body on which set points as well as setting functions can be adjusted in one operation. Only the mark of the junction box has to be moved over the respective scale value. Pressure drop is not influenced at all when changing set points.

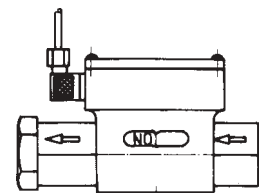


Dimensions (in mm)



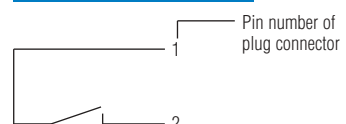
- Housing: Brass
- Piston: Brass
- O-Ring: Buna N
- Spring: Stainless Steel
- Magnet: Ferrite

Set point adjustment/
Contact configuration



Adjust the housing to setting required

Wiring diagram



Standard Products in **bold**

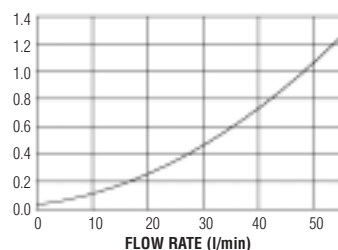
Specifications (all data related to water at +20°C)

	FS-100E	FS-100E-A
Max. flow	24 . . . 40 l/min.	55 l/min
Max. operating pressure	50 bar	50 bar
Max. pressure drop	0.3 bar	0.3 bar
Max. operating temperature	+90 °C	+90 °C
Set points	see order number	adjustable 1 ... 16 l/min
Switching function (related to increasing flow)	NO/NC; the required function may be adjusted by moving the junction box	
Mounting position	see order number	any position
Factory calibration position	vertical, inlet port down	vertical, inlet port down
Repeatability	± 1%	± 1%
Adjustment accuracy	±10%	±10%
Hysteresis	max. 5%	max. 20%
Mountings	G 3/8"	G 3/8"
Electrical connections	miniature plug connector with cable gland (max. cable ø: 6.5 mm)	
Enclosure	IP 65	IP65
Electrical data contact rating	40 VA, 2 A, 220 V~	40 VA, 2 A, 220 V~
Weight	appr. 0.5 kg	appr. 0.5 kg

How to Order

	set points (l/min)	Mounting position	order number
FS-100E	2.0	vertical	020-0402
	3.0	vertical	020-0403
	4.0	vertical	020-0404
	5.0	vertical	020-0405
	6.0	vertical	020-0406
	5.0	any position	020-0505
	6.0	any position	020-0506
	7.0	any position	020-0507
	8.0	any position	020-0508
	9.0	any position	020-0509
	10.0	any position	020-0510
	11.0	any position	020-0511
	12.0	any position	020-0512
	13.0	any position	020-0513
	14.0	any position	020-0514
15.0	any position	020-0515	
FS-100E-A		any position	020-0315

Pressure Drop Diagram



FS-380 1 - 7.6 (l/min) pre adjusted set points

PISTON TYPE

Compact Flow Switch for High Inline Pressures

These rugged inline flow switches use 150 micron filtration and are less susceptible to clogging than other high-pressure inline flow switches. The one-piece magnetic PPS composite piston makes the FS-380 ideal for high-pressure applications such as industrial cleaning equipment or high-pressure lubrication systems.

Specifications

(all data related to water at +20°C)

Operating pressure, max.	70 Bar
Operating temperature	-28.8°C to + 135°C
Set point accuracy	±20% Maximum
Set point differential	20% Maximum
Switch	SPST, 20VA N.O.at no flow
Inlet/outlet	3/8" NPT
Electrical termination	22 AWG, 0.6m Polymeric leads
Mounting orientation	Any position

How to Order

3/8" NPT

Flow settings l/min	Part numbers	
	Brass	Stainless Steel
1.0	168432	179992
1.9	168433	179993
3.8	168434	179994
5.7	168435	179995
7.6	178353	179996

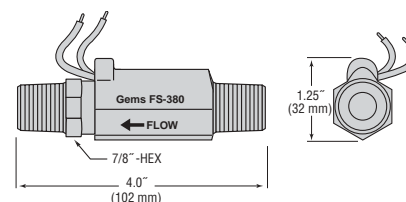
3/8" Tube Compression Fitting

Flow settings l/min	Part numbers	
	Brass	Stainless Steel
1.0		177592
1.9		177593
3.8		177594
5.7		177595
7.6		-

Models with compression fittings are available for OEM users.
Contact Sales Office for details.

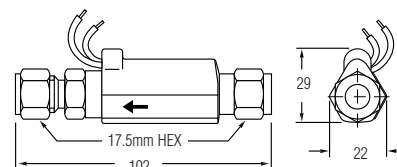


Dimensions (in mm)

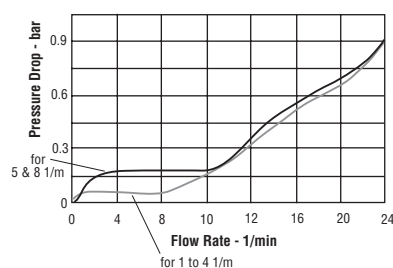


Housing: Brass or Stainless Steel
Piston: PPS Composite
Spring: 316 Stainless Steel
O-Ring: Fluorocarbon

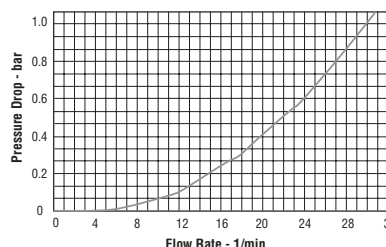
3/8" Tube End Compression Fitting



Pressure Drop - FS-380



Pressure Drop - FS-380P



FS-380P Series - Industrial Strength Inline Plastic Flow Switch

PISTON TYPE

Flow Rate Settings: 1.0 l/min to 7.6 l/min
 Port Size: 3/8" NPT Male and 1/4" Quick Disconnect (QDC) Male
 Primary Construction Material: Polypropylene
 Setting Type: Fixed

This rugged inline flow switch offers the same superior performance to non-clogging as its metal cousin (FS-380). The fixed set point and simple design make it a dependable switch. The FS-380P is an ideal choice for coolant applications requiring reliable flow detection in HVAC, semiconductor, welding, medical and other industries. 1/4" quick disconnect units have a host of snap-on mating adapters to fit most piping requirements.

Specifications

Wetted materials

Housing	Glass Reinforced Polypropylene
Piston	PPS Composite
Spring	316 Stainless Steel
O-Ring	Fluorocarbon
Operating pressure	8.6 bar @ 21°C (70°F), 50 PSI @ 100°C (212°F)
Operating temperature	-18°C to +100°C (0°F to 212°F)
Set Point accuracy	20% of Set Point
Set Point differential	20% Maximum
Switch*	SPST, 20VA, N.O. at no Flow
Electrical termination	0.6 (approx) Polymeric Leads, 22 AWG
Filtration	100 Micron
Approvals	UL and CSA Pending

How to Order

Specify Part Number based on flow settings. Adapters for the 1/4" Quick Disconnect (QDC) Male unit are listed in the table at right.

Flow Settings l/min	Part Numbers	
	3/8" NPT Male	1/4" QDC Male*
1.0	197081	197091
1.9	197082	197092
3.8	197083	197093
5.7	197084	197094
7.6	197085	197095

*See selection of adapters below. QDC = Quick Disconnect

Description	Part Numbers	
	Straight Through	with Shut-Off Valve
1/4" NPT Male Pipe Thread	195787	198063
1/4" BSPT Male Pipe Thread	198064	195788
3/8" NPT Male Pipe Thread	198065	198066
3/8" BSPT Male Pipe Thread	198067	198068
1/4" O.D., .27" I.D. (6mm O.D., 4.3mm I.D.) Polytube	198096	198097
3/8" O.D., 1/4" I.D. (9.5mm O.D., 6mm I.D.) Polytube	198099	198098
1/4" (6.4mm) I.D. Barb	198401	198402
5/16" (7.9mm) I.D. Barb	198403	198404
3/8" (9.5mm) I.D. Barb	198408	198405
1/4" O.D. (6.4mm) O.D. JG [®]	198470	198406
3/8" O.D. (9.5mm) O.D. JG [®]	198459	198407

JG[®] is a registered trademark of John Guest USA, Inc.

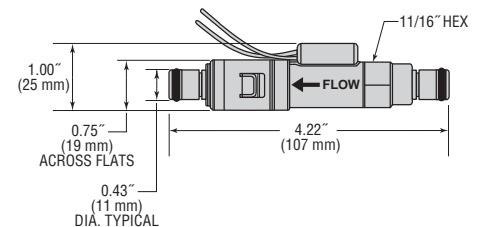
Standard Products in **bold**



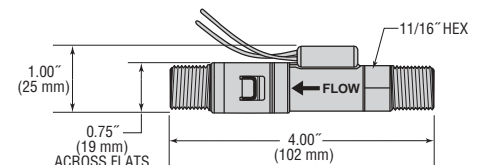
Dimensions (in mm)

1/4" Quick Disconnect Male Adapter

See table at bottom right for adapter Part Numbers.



3/8" NPT Port



Acetal Adapters for 1/4" Quick Disconnect Male Tube Fitting Units (82°C max.)

These adapters are available with or without an integral shut-off valve. The shut-off valve will stop line flow when the adapter is removed from the unit. Flow resumes when connected.



Typical shown: 1/4" NPT Male Pipe Thread with Shut-off Valve

FLOW SWITCHES

FS-105E 0.005 - 150 l/min with adjustable set-points

FS-107E 0.1 - 90 l/min Viscosity Compensated with adjustable set-points

FLOW SWITCHES

PISTON TYPE

The FS-105E model operates in any mounting position. It is equipped with a calibrated piston which is displaced by flow to magnetically actuate a sealed hermetic reed switch. When flow decreases a positive spring returns the piston to its prior position and de-actuates the reed switch. The reed switch assembly is movable to allow for customer setting of flow rate within the limits of the switch selected. The adjustment does not effect the flow path, therefore pressure drop is not influenced when changing set-points. Versions available are for Liquid flow only. Robust components allow a pressure of 250 bar, ideally suited for high pressure cleaning and lubrication systems.

The FS-107E model operates in any mounting position. It is equipped with a calibrated piston in a calibrated orifice for viscosity compensation over 1 to 600 cSt. The piston is displaced by flow to magnetically actuate a sealed hermetic reed switch. When flow decreases a positive spring returns the piston to its prior position and de-actuates the reed switch. The reed switch assembly is movable to allow for customer setting of flow rate within the limits of the switch selected. The adjustment does not effect the flow path, therefore pressure drop is not influenced when changing set-points. Robust components allow a pressure of 250 bar, ideally suited for high pressure lubrication systems.

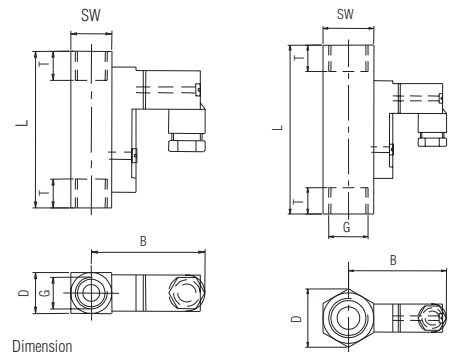
FS-105E



FS-107E



Dimensions (in mm)



Dimension

SW	D	B	G	T	L
17	17	47	1/4	10	65
27	31	52	1/2	14	90
41	47	72	1	17	130

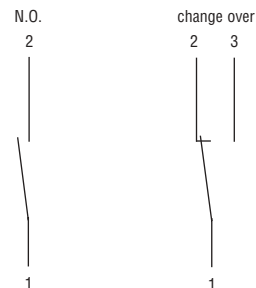
Dimension

SW	D	B	G	T	L
27	31	52	1/2	14	90
41	47	72	1	17	130

Meter 17mm wide

Housing Nickel plated Brass
Piston Brass
Spring Stainless Steel

Wiring Diagram



Specifications

	FS-105E	FS-107E
Max flow	100% above max. set-point range	100% above max. set-point range
Max operating pressure	250 bar	250 bar
Pressure drop	0.02 to 0.4 bar	0.02 to 0.4 bar
Operating temperature	-20° to 120°C	-20° to 120°C
Adjustable range	see order number	see order number
Switching function	NO with no flow, SPDT available	NO with no flow, SPDT available
Mounting orientation	Any position	Any position
Repeatability	1% of range	1% of range
Adjustment scale accuracy	+/- 10%	+/- 5%
Hysteresis	max 20%	max 20%
Mountings	G1/4, G1/2, G1	G1/2, G1
Electrical connection	Din 43650, Mini for G1/4, G1/2, Std for G1	Din 43650
Enclosure	IP 65	IP 65
Electrical contact rating	NO - 250V, 1A, 100VA - G1 port NO - 220V, 1A, 100VA - G1/2 port NO - 200V, 1A, 20VA - G1/4 port SPDT - 250V, 1.5A, 50VA - G1, G1/2 SPDT - 200V, 1A 20VA - G1/4 port	NO - 250V, 3A, 100VA - G1 port NO - 220V, 1A, 100VA - G1/2 port
Weight (approx)	G1/4 - 140g, G1/2 - 350g, G1 - 1000g	

How to Order

Order numbers for FS-105E

Adj Range L/min	Order 'NO'	Number "SPDT"	Port
5-60 ml	027-0100	027-0120	G1/4"
20-140ml	027-0101	027-0121	G1/4"
0.1-0.6	027-0102	027-0122	G1/4"
0.2-1.2	027-0103	027-0123	G1/4"
0.4-2.0	027-0104	027-0124	G1/4"
0.5-3.0	027-0105	027-0125	G1/4"
1.0-5.0	027-0106	027-0126	G1/4"
0.02-0.2	027-0107	027-0127	G1/2"
0.1-0.6	027-0108	027-0128	G1/2"
0.4-1.8	027-0109	027-0129	G1/2"
0.8-3.2	027-0110	027-0130	G1/2"
2-7	027-0111	027-0131	G1/2"
3-13	027-0112	027-0132	G1/2"
4-20	027-0113	027-0133	G1/2"
8-30	027-0114	027-0134	G1/2"
15-45	027-0115	027-0135	G1"
30-90	027-0116	027-0136	G1"
60-150	027-0117	027-0137	G1"

Order numbers for FS-107E

Adj Range L/min	Order 'NO'	Number "SPDT"	Port	Order No with visual indication 'NO'	Order No with visual indication "SPDT"
0.1-0.8	027-0300	027-0320	G1/2"		
0.4-1.6	027-0301	027-0321	G1/2"		
0.8-3	027-0302	027-0322	G1/2"		
2-7	027-0303	027-0323	G1/2"		
0.1-0.8	027-0304	027-0324	G1"	027-0340	027-0360
0.5-1.5	027-0305	027-0325	G1"	027-0341	027-0361
1-4	027-0306	027-0326	G1"	027-0342	027-0362
2-8	027-0307	027-0327	G1"	027-0343	027-0363
3-10	027-0308	027-0328	G1"	027-0344	027-0364
5-15	027-0309	027-0329	G1"	027-0345	027-0365
8-24	027-0310	027-0330	G1"	027-0346	027-0366
10-30	027-0311	027-0331	G1"	027-0347	027-0367
15-45	027-0312	027-0332	G1"	027-0348	027-0368
20-60	027-0313	027-0333	G1"	027-0349	027-0369
30-90	027-0314	027-0334	G1"	027-0350	027-0370

FLOW SWITCHES

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FS-200E 2.0 - 30 (l/min) with pre-adjusted set points
 FS-200E-A 3.0 - 57 (l/min) adjustable set points

SHUTTLE TYPE

The FS-200E flow switch offers accurate flow detection with 1% repeatability and European G1" port size. The durable construction delivers long life repeatability in either water or oil. The design of large flow paths keep pressure drop low, thus are ideal for detection of flow in high volume lubrication, cooling or process applications. The FS-200E Adjustable versions offer the same accuracy with the additional feature of external adjustment.

Specifications

(all data related to water at +20°C)

Max. flow	85 l/min
Max. operating pressure	27 bar
Proof pressure	45 bar
Temperature range	- 20 °C to +80 °C (cable, plug connector) - 20 °C to +150 °C (terminal box)
Set points	see order number
Switching function (related to increasing flow)	SPDT
Factory calibration position	horizontal, electrical connection up
Mounting orientation	any position
Repeatability	± 1%
Adjustment accuracy	±10%
Hysteresis	max. 15%
Mounting	G1"
Electrical connections	- cable: PVC, 3 x 0.34 mm2 (length: approx. 1 m) - plug connector per DIN 43650 - terminal box
Enclosure	- IP65
Electrical data contact rating	20 VA, 0.5 A, 250 V~
Weight	approx. 1.2 kg

How to Order

Order numbers for FS-200E

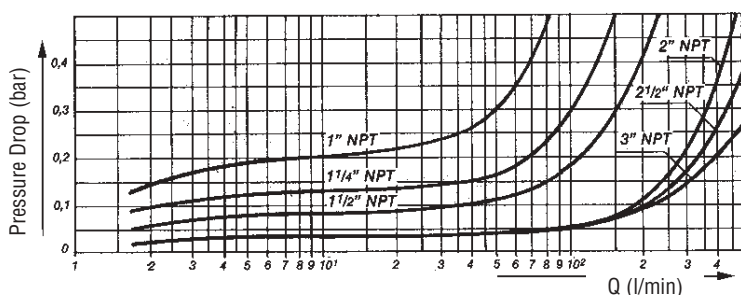
Set points (l/min)	Cable	Terminal box	Plug connector
2.0	020-2393	020-2401	020-3481
4.0	020-2394	020-2402	020-3482
7.5	020-2395	020-2403	020-3483
11.5	020-2396	020-2404	020-3484
15.0	020-2397	020-2405	020-3485
19.0	020-2398	020-2406	020-3486
22.5	020-2399	020-2407	020-3487
30.0	020-2400	020-2408	020-3488

Order numbers for FS-200E-A

Set points (l/min)	Cable	Terminal box	Plug connector
3.0 ... 22.5	020-2413	020-2416	020-3489
7.5 ... 30.0	020-2415	020-2418	020-3491
19.0 ... 57.0	020-2414	020-2417	020-3490

Pressure Drop Diagram

(at min. set point adjustment)

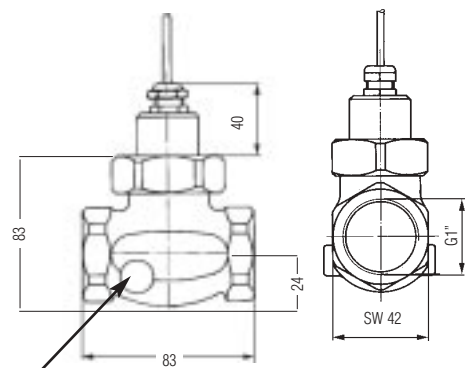


Standard Products in bold



Adjustment vane on FS-200E-A

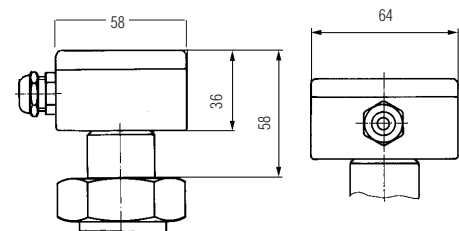
Dimensions (in mm)



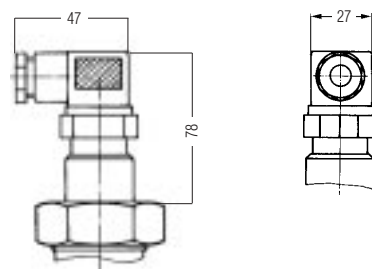
Adjustment vane on FS-200E-A

- Housing: Bronze
- Disc: Stainless Steel
- Spring: Stainless Steel
- O-Ring: Viton®
- Magnet: PTFE/Ceramic

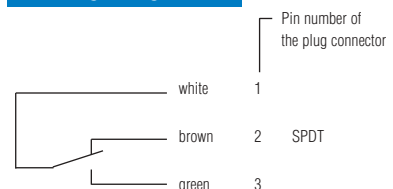
Terminal Box



Plug Connector



Wiring Diagram



FLOW SWITCHES

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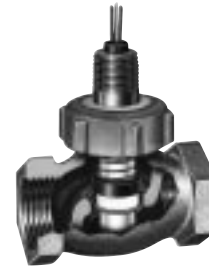
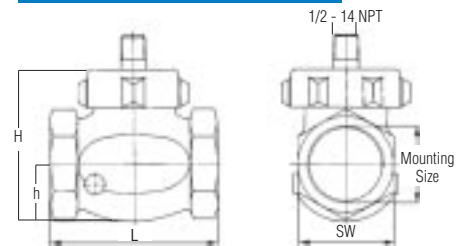
FS-200 2.0 - 190 (l/min) with pre-adjusted set points

The FS-200 range of flow switches offer accurate flow detection, with 1% repeatability, with a wide range of flow and port sizes. The durable construction delivers long life repeatability in either water or oil. The design of large flow paths keep pressure drop low, thus are ideal for detection of flow in high volume lubrication, cooling or process applications.

Specifications

(all data related to water at +20°C)

Max. flow	see order numbers
Max. operating pressure	27 bar at +20 °C
Proof pressure	45 bar
Temperature range	- 20 °C...+150 °C
Set points	see order numbers
Switching function (related to increasing flow)	SPDT
Factory calibration position	horizontal, electrical connection up
Mounting orientation	any position
Repeatability	±1%
Adjustment accuracy	±10%
Hysteresis	max. 15%
Mounting	1" NPT...2" NPT (see "dimensions" and "order number")
Electrical connections	- lead wire: Polymeric, 18 AWG (length: approx. 0.6m)
Enclosure	- IP 44 (with lead wire) - IP 54 (with conduit box IP65 [with K6])
Electrical data contact rating	20 VA; 0,5 A; 250 V~
Weight	see "dimensions"


Dimensions (in mm)


Housing: Bronze or Stainless Steel
 Disc: Stainless Steel
 Spring: Stainless Steel
 O-Ring: Viton®
 Magnet: PTFE/Ceramic

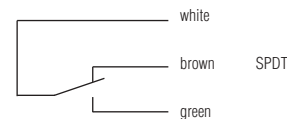
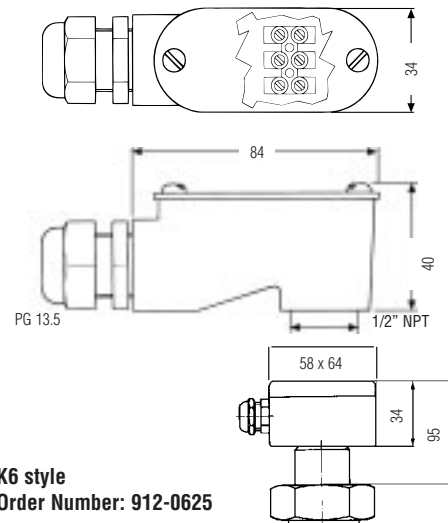
Mounting D	1" NPT	1 1/4" NPT	1 1/2" NPT	2" NPT
L	83	115	115	150
h	26	30	35	44
SW	42	53	62	72
H	71	83	98	118
Approx. weight	1.2 kg	1.8 kg	2.5 kg	4.0 kg

How to Order

Set point (l/min)	Mounting	Max. flow (l/min)	Order number Housing Bronze	Order number Housing Stainless Steel
2.0 4.0	1" NPT	80	27051	27059
7.5 11.5			27052	27060
15.0 19.0			27053	27061
22.5 30.0			27054	27062
			27055	27063
			27056	27064
27057	27065			
27058	27066			
4.0 7.5	1 1/4" NPT	140	27067	27076
15.0 22.5			27068	27077
30.0 37.5			27069	27078
			27070	27079
			27071	27080
			27072	27081
45.0 60.0 75.0	1 1/2" NPT	200	27073	27082
6.0 11.5			27074	27083
19.0 28.5			27075	27084
37.5 57.0			27085	27093
75.0 115.0			27086	27094
			27087	27095
	27088	27096		
	27089	27097		
	27090	27098		
	27091	27099		
	27092	27100		
7.0 15.0	2" NPT	350	27101	27109
19.0 37.5			27102	27110
57.0 95.0			27103	27111
			27104	27112
			27105	27113
			27106	27114
132.5 190.0			27107	27115
			27108	27116

Pressure Drop Diagram

see previous page

Wiring Diagram

Terminal boxes
Conduit style Order Number: 912-0615

K6 style Order Number: 912-0625

*Order numbers are valid for units with the electrical connection "lead wire". If you need a unit with the electrical connection "terminal box", please select the respective "lead wire" order number and add: "...with mounted terminal box 912-0615 or 912-0625. See drawing (previous page)

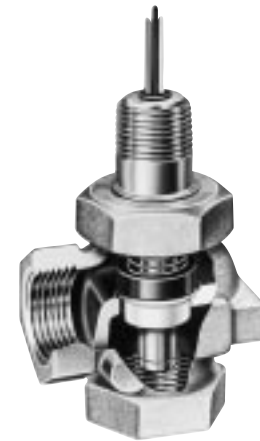
FS-400 3.0 - 37.5 (l/min) with pre-adjusted set points
 FS-400A 3.0 - 53.0 (l/min) variable adjustment of set points

SHUTTLE TYPE

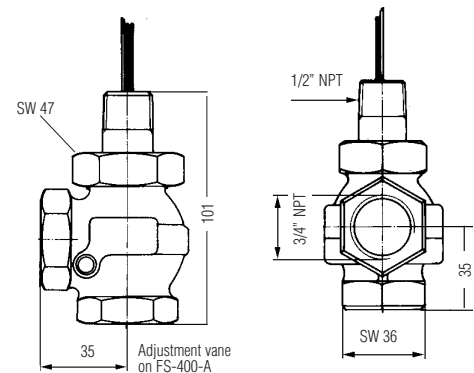
The FS-400 and FS-400-Adjustable switches provide 1% repeatability. The unit may be fitted instead of a pipe elbow where space is at a premium.

Specifications (all data related to water at +20°C)

Max. flow	55 l/min
Max. operating pressure	27 bar
Proof pressure	45 bar
Temperature range	- 20 °C...+150 °C
Set points	see order numbers
Switching function (related to increasing flow)	SPDT
Mounting orientation	any position
Factory calibration position	vertical, inlet port down, electrical connection up
Repeatability	± 1%
Adjustment accuracy	± 5%
Hysteresis	max. 15%
Mounting	3/4" NPT
Electrical connection	- lead wire: Polymeric, 18 AWG (length: approx. 0.6 m) - terminal box option see page FS-200
Enclosure	- IP 44 (with lead wire) - IP 54 (with terminal box) IP65 (with K6 box)
Electrical data contact rating	SPDT max. 20 VA, 0.5 A, 250 V~
Weight	0.8 kg

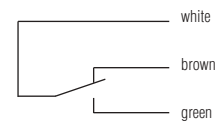


Dimensions (in mm)



- Housing: Bronze
- Disc: Stainless Steel
- O-Ring: Viton®
- Spring: Stainless Steel
- Magnet: PTFE/Ceramic

Wiring Diagram



How to Order

Order numbers for FS-400

Set points (l/min)	Order number
3.0	022-6440
6.0	022-6441
7.0	022-6442
9.5	022-6443
19.5	022-6444
28.5	022-6445
37.5	022-6446

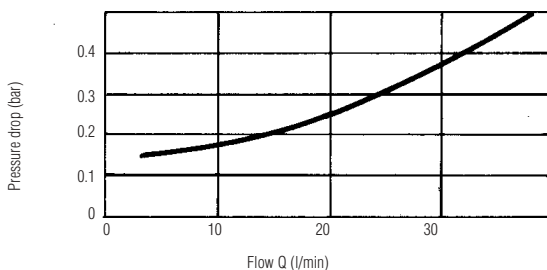
Order numbers for FS-400A

Set points (l/min)	Order number
3.0 ... 15.0	022-6600
7.5 ... 30.0	022-6601
26.5 ... 53.0	022-6602

*Order numbers are valid for units with the electrical connection "lead wire". If you need a unit with the electrical connection "terminal box", please select the respective "lead wire" order number and add: "...with mounted terminal box 912-0615 or 912-0625".

See drawing (page 60, FS-200)

Pressure Drop Diagram (at min. set point adjustment)



FLOW SWITCHES

FS-500 1 - 18.5 (l/min) with pre-adjusted set points

SHUTTLE TYPE

The FS-500 offers economical flow monitoring, with a variety of switch actuation points and low pressure drop. The FS-500 is designed for ease of maintenance, as the bonnet and shuttle can be removed, leaving the housing and pipework connections intact. All wetted parts are manufactured from polypropylene or stainless steel, making the FS-500 ideal for a wide range of chemical and temperature applications.



Housing: Polypropylene
 O-Ring: Viton®
 Spring: Stainless Steel

Specifications

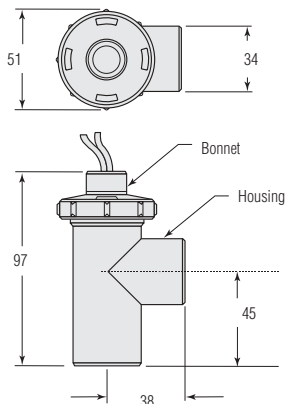
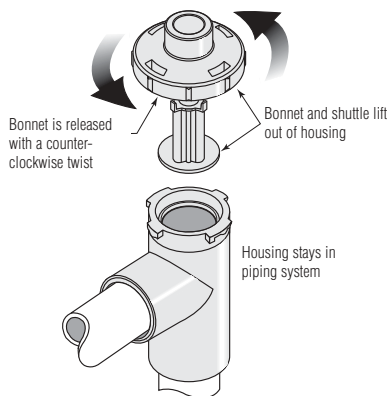
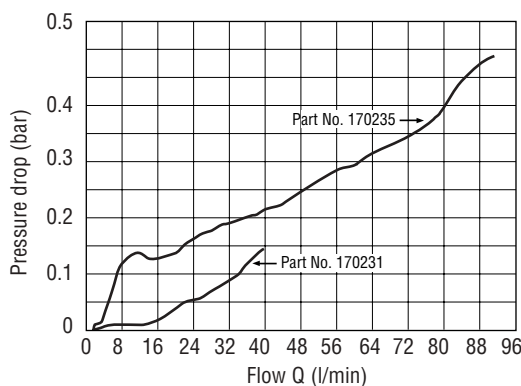
Operating pressure	7 bar at 20°C, 3.5 bar at 80°C
Temperature	+100°C
Set point differential	± 20% maximum
Set point accuracy	± 20%
Switch	SPST 20VA, N.O., 120-240VAC or VDC
Inlet/outlet ports	3/4" NPT, R3/4"
Electrical termination	0.6m lead wire
Mounting orientation	any position

How to Order

Order numbers for FS-500

Flow rate	R3/4" parallel	3/4"NPT
1 l/min	175171	170231
2 l/min	175172	170232
3.5 l/min	175173	170233
10 l/min	175174	170234
18.5 l/min	175175	170235

Pressure Drop Diagram



FS-925E 0.4 - 6.0 (l/min) with pre-adjusted set points
 FS-926E 0.05 - 0.3 (l/min) with pre-adjusted set points

PISTON TYPE

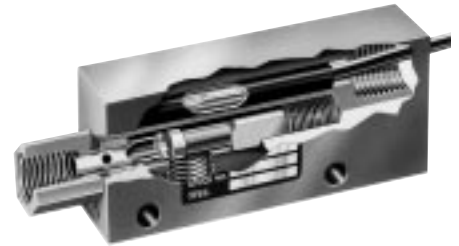
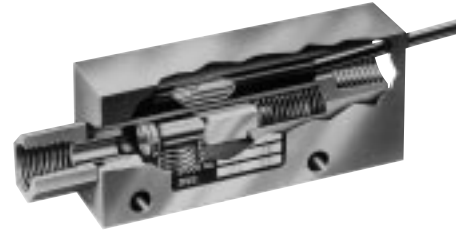
These two series of precision-calibrated switches provides reliable and consistent performance; repeatability is within 1%. FS-925E and FS-926E units are factory preset for actuation at specified flow rates.

These switches provide accurate detection of excessive or insufficient flow rates in such applications as: protecting against loss of fluid flow in hydraulic systems, assuring proper coolant flow in semiconductor processing equipment, monitoring high pressure lubrication systems, and ensuring proper air flow in water/waste systems.

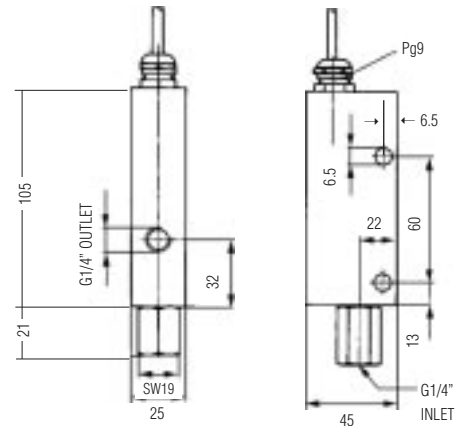
Specifications

(all data related to water at +20°C)

	FS-925E	FS-926E
Max. flow	12 l/min	3 l/min
Max. operating pressure	68 bar	68 bar
Proof pressure	100 bar	100 bar
Temperature range	- with Polysulfone piston (standard), with cable, with plug connector: -20 °C...+80 °C - with metal piston and terminal box: -20 °C...+150 °C	
Set points (l/min)	0.4; 1.0; 2.0; 3.0; 4.0; 6.0	0.05, 0.1, 0.15; 0.1; 0.25; 0.3
Switching function (related to increasing flow)	NC, NO, SPDT	NC, NO, SPDT
Mounting orientation	any position	any position
Factory calibration position with set point adjustment	vertical, inlet port down, electrical connection up	
Repeatability	± 1%	± 1%
Adjustment accuracy	±10%	±10%
Hysteresis	max. 15%	max. 20%
Mounting	G 1/4"	G 1/4"
Electrical connections	- cable: PVC, 2 or 3 x 0.34 mm ² (length: approx. 1 m) - plug connector per DIN 43650 - terminal box	
Enclosure	- IP 65	IP 65
Electrical data contact rating	- SPST (NC/NO): max. 100 VA, 3 A, 220 V~ - SPDT: max. 20 VA, 0.5 A, 250 V~	
Weight	0.5 kg	0.5 kg

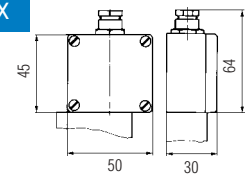


Dimensions (in mm)

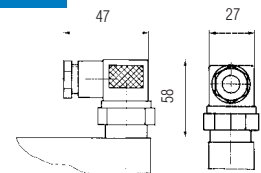


Housing: Brass or Stainless Steel
 Piston: Polysulfone* or Stainless Steel (* option Brass)
 Spring: Stainless Steel
 O-Ring: Vitton®

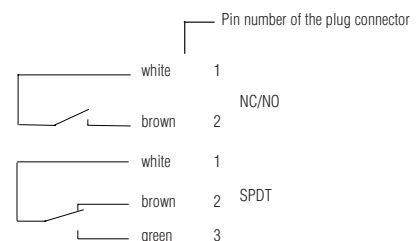
Terminal Box



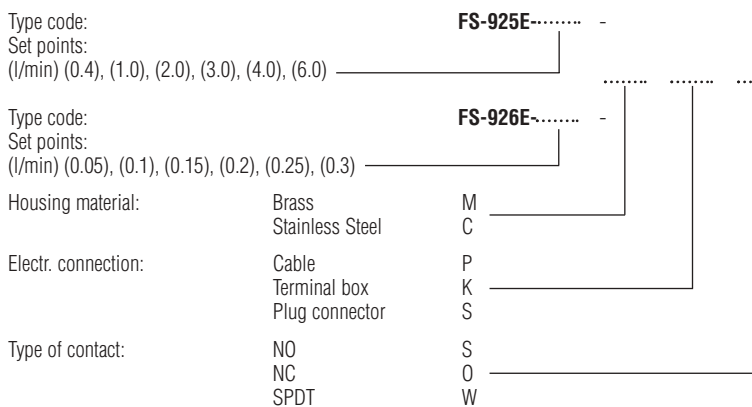
Plug Connector



Wiring Diagram



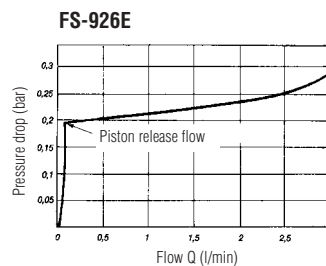
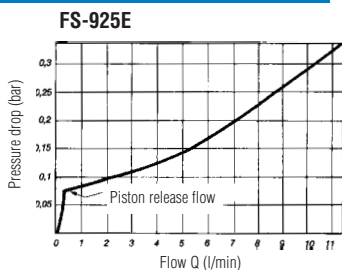
How to Order for FS-925E / FS-926E



Note: For mineral oil applications please order brass piston instead of polysulfone piston, -GE169 to the number e.g. FS-925E-0.4-M-P-W-GE169

Pressure Drop Diagram

(at min. set point adjustment)



FS-10798E 2.0 - 75 (l/min) variable adjustment of set points

PISTON TYPE

These externally adjustable switches are ideal for protecting machine tools from coolant flow failure, for protecting bearings from loss of lubricant or to assure proper air flow. They offer an infinite number of flow settings at pressures up to 68 bar, with low pressure drop and precise repeatability.

The adjusting vane is easily field adjustable using an ordinary flat-bladed screwdriver. The adjustment is set-screw-locked for tamper-free operation after field calibration.

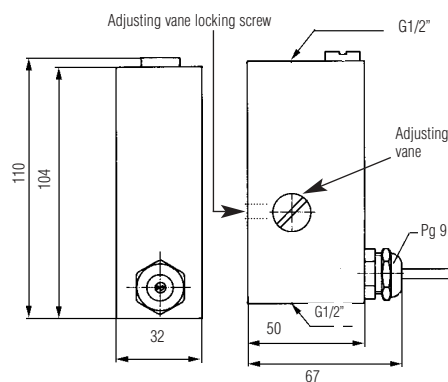
Specifications

(all data related to water at +20°C)

Max. flow	85 l/min
Max. operating pressure	68 bar
Proof pressure	100 bar
Temperature range	- with Polysulfone piston (standard), with cable, with plug connector: -20 °C...+80 °C - with metal piston and terminal box: -20 °C...+150 °C
Adjustment range	2...75 (l/min)
Switching function (related to increasing flow)	-NC, NO, SPDT
Mounting orientation	any position
Factory calibration position	horizontal, electrical connection up
Repeatability	± 1%
Adjustment accuracy	±10%
Hysteresis	max. 15%
Mounting	G 1/2"
Electrical connections	- cable: PVC, 2 or 3 x 0.34 mm ² (length: approx. 1 m) - plug connector per DIN 43650 - terminal box
Enclosure	- IP 65
Electrical data contact rating	- SPST (NC/NO): 100 VA, 3 A, 220 V~ - SPDT 20 VA, 0.5 A, 250 V~
Weight	1.2 kg



Dimensions (in mm)



Housing: Brass or Stainless Steel
Piston: Polysulfone* or Stainless Steel
Spring: Stainless Steel
O-Ring: Viton®

* option Brass

How to Order

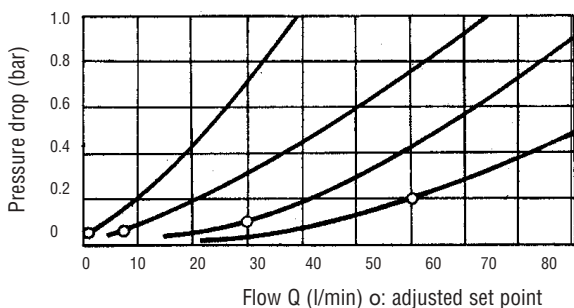
Type code: **FS-10798E-.....**

Housing material:	Brass	M	_____
	Stainless Steel	C	_____
Electr. connection:	Cable	P	_____
	Terminal box	K	_____
	Plug connector	S	_____
Type of contact:	NO	S	_____
	NC	O	_____
	SPDT	W	_____

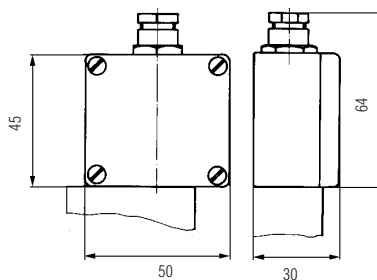
Note: For mineral oil applications please order brass piston instead of polysulfone piston, add -GE169 to type number e.g. FS-10798E-M-P-W-GE169

Pressure Drop Diagram

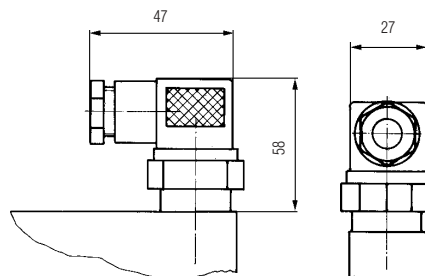
(at min. set point adjustment)



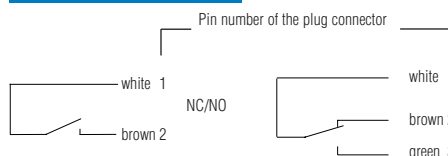
Terminal Box



Plug Connector



Wiring Diagram



Standard Products in **bold**

FLOW SWITCHES

FS-550E 15.0 - 125.0 (l/min) with pre-adjusted set points

PISTON TYPE

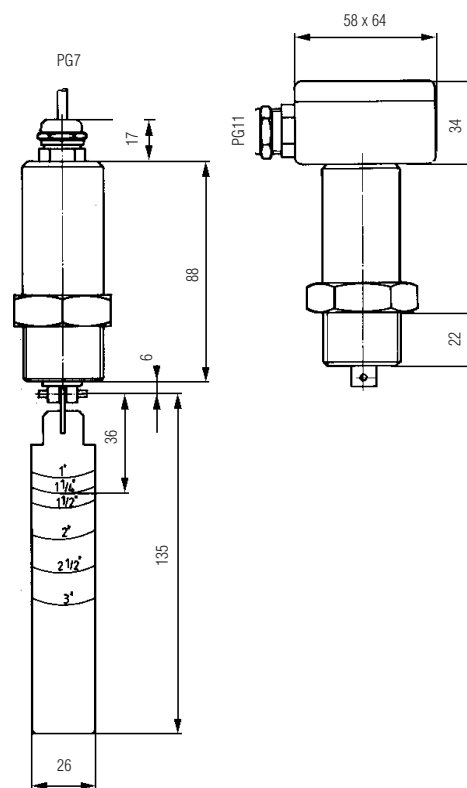
Standard FS-550E switches sense liquid flow in either direction to monitor flow/no-flow conditions. The paddle is trimmed during installation to permit switch actuation at the desired flow rate. As flow increases in a pipe, the paddle of the switch pivots to move out of the liquid path, producing less than 200mb of pressure drop regardless of pipe size.

Specifications (all data related to water at +20°C)

Max. flow	determined by the pipe's inside diameter
Max. operating pressure	55 bar
Proof pressure	82 bar
Max. pressure drop	0.2 bar
Temperature range	cable: -20 °C...+80 °C terminal box: -20 °C...+150 °C
Set points	see set point adjustment guideline
Switching function (related to increasing flow)	-SPDT
Mounting orientation	vertical, electrical connection up
Repeatability	±5%
Adjustment accuracy	±25%
Hysteresis	max. 50%
Mounting	R1"
Electrical connections	- cable: PVC, 3 x 0.34 mm ² (length: approx. 1 m) - terminal box
Enclosure	- IP 65
Electrical data contact rating	- SPDT max. 20 VA, 0.5 A, 250 V~
Weight	0.6 kg



Dimensions (in mm)



Housing: Brass or Stainless Steel
Paddle: Stainless
Spring: Stainless
Magnet: PTFE

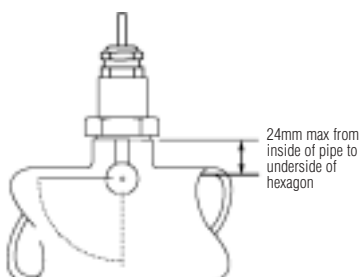
How to Order

Electrical Connection	Brass	Stainless Steel
Cable	020-3493	020-3495
Terminal box	020-3497	020-3499

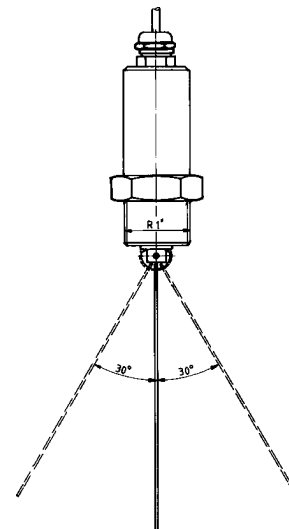
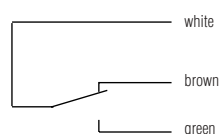
Set Point Adjustment (approximate)

Cut-off size	Pipeline sizes							
	1 1/2"		2"		2 1/2"		3"	
	Set points (l/min) with increasing and decreasing flow							
	incr.	decr.	incr.	decr.	incr.	decr.	incr.	decr.
1 1/2"	57	42	106	80	144	114		
2"			84	57	103	76	182	144
2 1/2"					80	53	152	99
3"							118	76

Mounting Method



Wiring Diagram



Standard Products in **bold**

FLOW SWITCHES

www.gems-sensors.co.uk

RotorFlow® Visual Indicators with Switch or Continuous Output Options

FLOW SWITCHES

ROTOR & TURBINE

The Gems Sensors generation of rotorflow indicators offer high performance and durability, all at an affordable cost. Three distinct options are available, all boasting broad chemical, pressure and temperature capabilities.

RFI RotorFlow Indicators

Simple visual confirmation of flow, the RFI indicator provides the low cost answer.

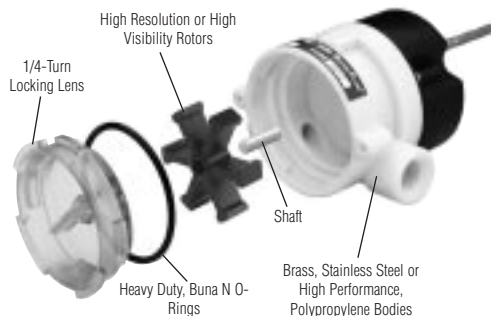
RFS RotorFlow Indicator and Switch

Visual indication plus switch, adjustable over the required flow rate. High reliable system guarding against jamming or false actuation.

RFO RotorFlow Indicator and Output

Visual indicator plus continuous output. Pulse or analogue DC voltage output proportional to the flow rate. Easy integration into all digital logic families.

Construction



- ▶ Flow range from 0.4 to 225 l/min
- ▶ Bright, visual indication
- ▶ Choice of pulsed analogue DC output or adjustable 1 amp switched output
- ▶ Available in high performance plastic, brass or Stainless Steel housing



Operating Principle

VISUAL ONLY

As liquid passes through the RotorFlow body, the rotor spins at a rate proportional to the flow.

OUTPUT VERSIONS

1. As liquid passes through the RotorFlow body the magnetic rotor spins at a rate proportional to flow. This causes a series of magnetic fields (the rotor vanes) to excite the Hall Effect sensor, producing a series of voltage pulses.
2. The output pulses are at the same voltage level as the input (4.5 – 24 Vd.c.) with a frequency proportional to the flow rate. The output signal can be utilised by digital rate meters, totalisers or other electronic controllers.

SWITCH

1. RFS Type switches incorporate state-of-the-art circuitry to compare the frequency of incoming pulses to an adjustable, preset frequency. When the pulse rate meets or exceeds the preset value, the SPDT relay closes. When the pulse rate falls below the preset value, the output relay opens. This unique design eliminates the possibility of a RotorFlow switch from remaining in a 'switch actuated' mode, if the rotor jams accidentally.
2. RotorFlow Indicators may be mounted with flow entering either port. Performance is optimised by positioning ports at the top of the unit, in a horizontal plane.

How to Order

Description	Part No.
DM21 Rate Meter/Totaliser	DM2150000
DM21 Rate Meter/Totaliser + 2nd Relay	DM2151000
DM21 Rate Meter/Totaliser + 2nd Relay + Analog Output	DM2153000



DM21 Series - 1/8 DIN Rate Meter/Totalizer

- ▶ Large 18mm high digits (LED)
- ▶ Programmable colour change display based on an event (red/green)
- ▶ Display configurable for update time, minimum number of pulses, and forced zero time
- ▶ Optional linear analog output relative to rate
- ▶ Standard outputs: two NPN transistors and one relay (2nd relay optional)
- ▶ CE Approved
- ▶ Standard 1.8 DIN size (92mmx45mm cutout)
- ▶ Easy programming
- ▶ Include output 1 and 2 status annunciators

Specifications

Supply voltage	90-264 VAC, 50/60 Hz, 4 watts
Sensor Power Supply	9-15 Vdc, Unregulated
Output	NPN Open Collector, 30 VDC Max, 100 mA Max
Relay	SPDT, 5A Resistive @ 110 VAC
Analog Output	0-20 mA, 4-20 mA, 0-10 V, 2-10 V, 0-5V, 1-5V

FLOW SWITCHES

www.gems-sensors.co.uk

RotorFlow - RFI-Types, Visual Indicators

ROTOR & TURBINE

Applications - Visual only - RFI

There are varied applications, but some of the more common are:

- ▶ Plastic injection moulding equipment
- ▶ Visual flow on heat exchangers

Applications - Switch/Analogue Output - RFO & RFA

- ▶ Lasers
- ▶ Medical Equipment
- ▶ X-Ray Tubes
- ▶ Computers
- ▶ Robotic Welding Equipment
- ▶ Water Purification/Dispensing Systems
- ▶ Chemical Metering Equipment
- ▶ Water Sampling
- ▶ Ice Making Machinery
- ▶ Water Injection Systems
- ▶ Proof of Delivery Systems

OEMS

Specialist designs are available based on your requirements. Please contact Sales Office for further details on options such as potable water, enhanced chemical capabilities or 4-20mA loop powered units.

This is RotorFlow in its most basic form – a bright orange rotor turning with fluid flow. Simple, direct and reliable.

Flow rate is estimated, or simply confirmed, by viewing the speed of the turning rotor. Either port may be used for incoming flow, and new bayonet mounting lens is easily removed for quick cleanout. RFI Type RotorFlow sensors are easy to see, easy to install and easy to afford.

Specifications

Wetted Materials

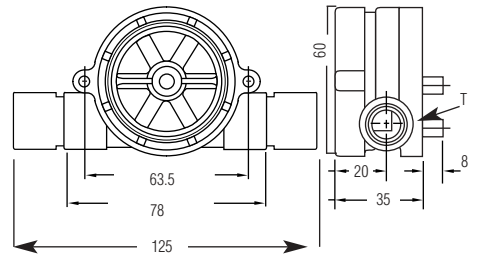
Body	Polypropylene (Hydrolytically Stable, Glass Reinforced), SS or Brass
Rotor pin	Ceramic
Rotor	Moulded Nylon, Colour: High Visibility Orange
Lens	Polysulfone
O-Ring	Buna N (Metal body = Viton)
Adaptor	Acetal (Polypropylene body only)

Max. operating pressure	Polypropylene Body: 7 bar	Metal Body: 14 bar
--------------------------------	---------------------------	--------------------

Max. operating temperature	Polypropylene Body: 80°C	Metal Body: 100°C
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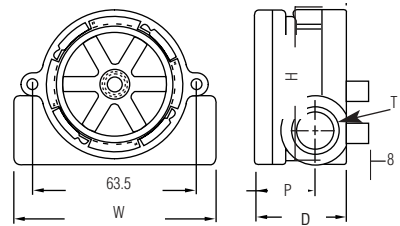
Typical pressure drop	See Graph (Page 70 RFS)
------------------------------	-------------------------

Polypropylene Bodies



Adaptors, See Note 1

Metal Bodies



T	W	H	D	P
1/4	77	60	35	20
1/2	77	60	35	22
3/4	100	66	51	27
1	100	66	51	27

Notes:

1. Adaptors are supplied fitted to plastic units, sealed using Teflon (PTFE) tape.
2. If NPT thread is required for plastic units discard adaptor.
3. For pressure drop curves see RFS page.

FLOW SWITCHES

www.gems-sensors.co.uk

How to Order

Body Material	Port Size	Flow Ranges (l/min)		Order Number	
		Low Range*	Standard Range	BSP	NPT
Polypropylene	1/4"	0.4 to 4.0	2.0 to 20.0	155420BSPP	155420
	1/2"	6.0 to 45.0	15.0 to 75.0	155480BSPP	155480
Brass	1/4"	0.4 to 4.0	2.0 to 20.0	142541BSPP	142541
	1/2"	6.0 to 45.0	15.0 to 75.0	142542BSPP	142542
	3/4"	---	20 to 112.5	180392BSPP	180392
	1"	---	30 to 225	181681BSPP	181681
Stainless Steel	9/16 x 18 UNF	0.4 to 4.0	2.0 to 20.0	N/A	174596
	1/2"	6 to 45	15.0 to 75.0	173138BSPP	173138
	3/4"	---	20 to 112.5	181682BSPP	181682
	1"	---	30 to 225	181683BSPP	181683

* With use of low flow adaptor supplied, see page 70

RotorFlow - RFO and RFA Types

4.5 - 24 VDC Pulsed Output - RFO 0 - 10 V, RFA

Gems Sensors popularised the Rotor-Flow's paddlewheel design by combining high visibility rotors with solid-state electronics that are packaged into compact, panel mounting housings. They provide accurate flow rate output with integral visual confirmation ... all with an unprecedented price/performance ratio.



Hall-Effect-Sensor sends a voltage pulse with each pass of magnetic field

High Resolution Black Rotor

Ryton composite. Each of the six rotor arms are magnetized.



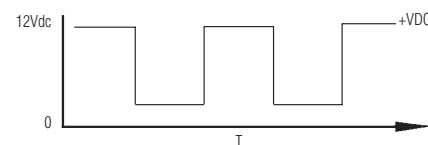
Signal Output

Output signal for RFO Types is an on/off pulse of the DC voltage supplied to the unit, it is compatible with all digital logic families. Input voltage range is 4.5 to 24 Vd.c.

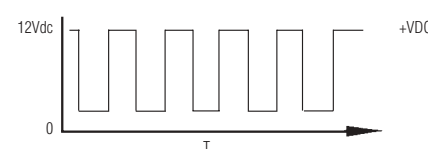
Frequency of the output pulse is proportional to the flow rate and ranges from approximately 25 Hz at low flow to 225 Hz at high flow. See order number for more information.

Following examples are at 12Vdc supply

Low Flow



HighFlow



* With use of Low-Flow-Adapter supplied.

See page 70 for more information.

For dimensions see page RFS

Please consult factory for detailed flow rate / frequency curves.

Specifications

Wetted materials	Polypropylene (Hydrolytically Stable, Glass Reinforced), Stainless Steel or Brass	
Body		
Rotor pin	Ceramic	
Rotor	Ryton Composite, Colour: Black	
Lens	Polysulfone	
O-Ring	Buna N (Metal body = Viton)	
Max. operating pressure	Polypropylene Body:	7 bar
	Metal Body:	14 bar
Max. operating temperature	Polypropylene Body:	80 °C
	Metal:	100 °C
Electronics (both bodies)	65 °C Ambient	
Max. viscosity	45 cSt	
Input power	4.5 to 24 Vdc, (24Vdc Regulated Supply for RFA models)	
Output signal	4.5 to 24 Vdc Pulse, Pulse Rate dependent on Flow Rate, Port Size and Range 0 to 10 V, available (RFA model), consult Sales Office	
Max. current source output	70 mA	
Frequency output range	25 Hz (Low Flow) to 225 Hz (High Flow)	
Electrical termination	AWG 22 PVC-Jacketed Cable, Length 60 cm Colour Code: Red = + Vdc, Black = Ground, White = Signal output	
Typical pressure drop	See Graphs	

How to Order

Body Material	Port Size	Flow Ranges (l/min)		Output (Hz) Approximate	RFO		RFA
		Low Range*	Standard Range		BSP	NPT	
Polypropylene	1/4"	0.4 to 4.0 (±7%)	2.0 to 20.0 (±7%)	15-180	155421BSPP	155421	Consult Factory
	1/2"	6.0 to 45.0 (±7%)	15.0 to 75.0 (±15%)	20-190	155481BSPP	155481	
Brass	1/4"	0.4 to 4.0 (±7%)	2.0 to 20.0 (±7%)	15-180	156261BSPP	156261	Consult Factory
	1/2"	6.0 to 45.0 (±7%)	15.0 to 75.0 (±15%)	20-190	156262BSPP	156262	
	3/4"	---	20 to 112.5 (±15%)	25-210	194761BSPP	194761	
	1"	---	30 to 225 (±15%)	15-180	194762BSPP	194762	
Stainless Steel	9/16 - 18 UNF	0.4 to 4 (±7%)	2 to 20.0 (±7%)	15-180	N/A	165071	Consult Factory
	1/2"	6 to 45 (±7%)	15.0 to 75.0 (±15%)	20-190	165075BSPP	165075	
	3/4"	---	20 to 112.5 (±15%)	25-210	194763BSPP	194763	
	1"	---	30 to 225 (±15%)	15-180	194764BSPP	194764	

* With use of Low-Flow-Adaptor supplied

RotorFlow - RFS Types Flow Setpoint Switching

ROTOR & TURBINE

RotorFlow Switches build an extra level of reliability and protection into your equipment. By principle of operation, the rotor cannot be deceived into indicating a positive flow situation when no flow actually exists. Once set to a desired actuation point, RotorFlow will switch to a 'no-flow' condition should the rotor stop for any reason.

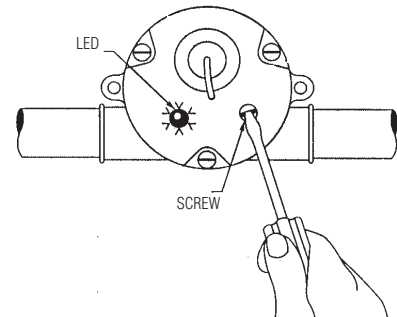
Specifications

Wetted Materials	Polypropylene, Brass, S Steel (Hydrolytically Stable, Glass Reinforced)	
Body	Ceramic	
Rotor Pin	Ryton Composite, Colour: Black	
Rotor	Polysulfone	
Lens	Buna N (Metal Body = Viton)	
O-Ring		
Max. Operating Pressure	Polypropylene Body:	7 bar
	Metal Body:	14 bar
Max. Operating Temperature	Polypropylene Body:	80 °C
	Metal Body:	100 °C
Electronics	65°C Ambient	
Max. Viscosity	45 cst	
Input Power	24 Vd.c. or 110 Va.c.	
Relay Contact Ratings (SPDT)	1A, 24 Vd.c. Resistive 0,5 A, 110 Va.c. (230 V a.c. on request)	
Repeatability	2% max. Deviation	
Set Point Accuracy (Factory Set)	± 5%	
Hysteresis	max. 15%	
Electrical Termination	22 AWG PVC-Jacketed Cable, Length 60 cm, Colour Code: Red = +Va.c./Vd.c., Black = Ground, White = N.O., Brown = N.C., Green = Common	
Typical Pressure Drop:	See Graphs	

Switch Set Point Calibration With LED Signal (RFS Type)

With the unit installed in the line and power supplied, complete the following steps to calibrate switch actuation point with proper flow rate. A small flat-blade screwdriver is the only tool required.

1. Adjust liquid flow in the line to the rate at which switch actuation is desired.
2. Insert screwdriver into opening on backside of housing and fit blade into the potentiometer adjustment screw inside.
3. If LED is not illuminated, slowly turn screwdriver counterclockwise and stop as soon as LED illuminates.
4. If LED is illuminated, turn screwdriver clockwise until LED light goes out. Then, slowly turn screwdriver counterclockwise and stop as soon as LED illuminates.



How to Order

Body Material	Port Size	Flow Ranges (l/min)		Input Power	Order Number	
		Low Range*	Standard Range		BSP	NPT
Polypropylene	1/4"	0.4 to 4.0	2.0 to 20.0	24 VDC 110 VAC	155425BSPP 155876BSPP	155425 155876
	1/2"	6.0 to 45.0	15.0 to 75.0	24 VDC 110 VAC	155485BSPP 155886BSPP	155485 155886
Brass	1/4"	0.4 to 4.0	2.0 to 20.0	24 VDC 110 VAC	156265BSPP 156266BSPP	156265 156266
	1/2"	6.0 to 45.0	15.0 to 75.0	24 VDC 110 VAC	156268BSPP 156269BSPP	156268 156269
	3/4"	---	20 to 112.5	24 VDC 110 VAC	180395BSPP 180396BSPP	180395 180396
	1"	---	30 to 225	24 VDC 110 VAC	181688BSPP 181689BSPP	181688 181689
	9/16" - 18UNF	0.4 to 4	2.0 to 20.0	24 VDC 110 VAC	N/A N/A	165073 165074
Stainless Steel	1/2"	6 to 45	15.0 to 75.0	24 VDC 110VAC	165077BSPP 165078BSPP	165077 165078
	3/4"	---	20 to 112.5	24 VDC 110 VAC	181691BSPP 181692BSPP	181691 181692
	1"	---	30 to 225	24 VDC 110 VAC	181693BSPP 181694BSPP	181693 181694

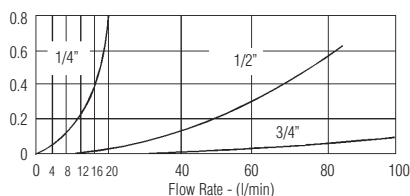
* With use of Low-Flow-Adapter supplied,

FLOW SWITCHES

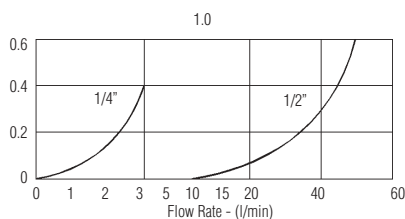
Pressure Drop Typical

throughout all options

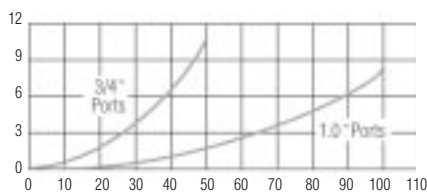
Standard Flow Range Units



Low Flow Range Units

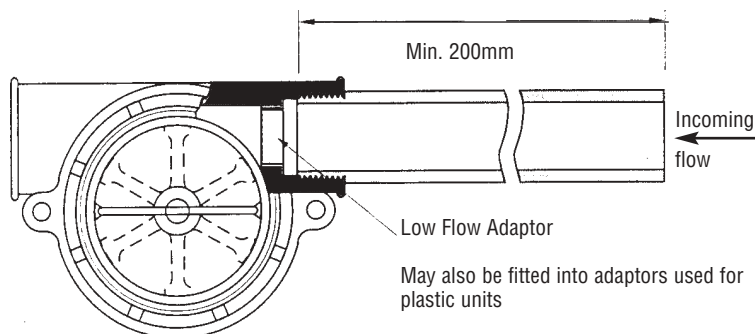


High Flow Units



Installation and Maintenance

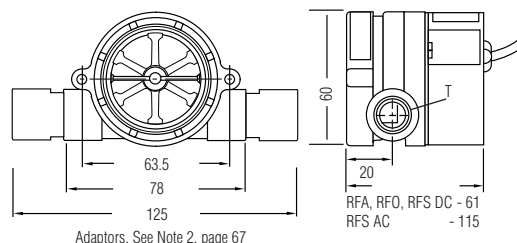
A proper installation will enhance RotorFlow sensor performance. Install using standard pipe fitting tools; horizontal fluid lines are recommended. For further installation and maintenance recommendations, refer to one of the following instruction bulletins: RFO Types - Part Number 157258; RFI Types - Part Number 157259; RFS Types - Part Number 157261. Since their function is to monitor dynamic fluid flow, naturally the rotor will react to turbulence, pulsation, entrained air, and other flow anomalies induced in the flow stream by other process hardware. For optimum performance, install RotorFlow units where nominal flow conditions exist with ports located at the top. Incoming flow may be placed to either port; a minimum of 20 cm of straight pipe on the inlet side is required. When operating in the low flow range, the supplied Low Flow Adapter must be installed in the incoming port.



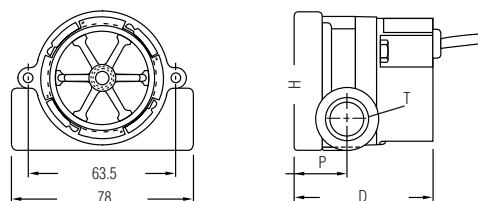
RotorFlow sensors connect to piping via NPT mating thread forms. The use of an appropriate thread sealant is necessary to assure a leak-tight connection. Permatex "No More Leaks" or 2 wraps of Teflon tape are the only sealants recommended for GEMS flow sensors. 150 micron filtration is recommended. However, should foreign particles enter RotorFlow sensor, accumulation is easily cleared by removing the lens from the body. The lens is removed by turning its centre rib 45° counter-clockwise, and then pulling it out. To reinstall the lens, simply reverse the process.

Dimensions (in mm)

RFA, RFO, RFS Polypropylene Bodies



Metal Bodies



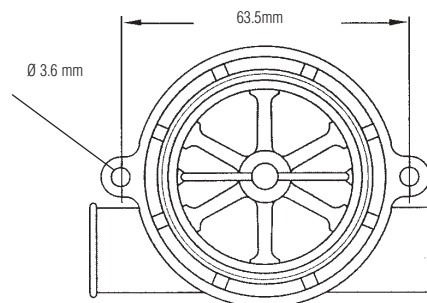
T	W	H	D DC models	D AC models	P
1/4	77	60	61	114	20
1/2	77	60	61	114	22
3/4	100	66	75	121	27
1	100	66	75	121	27

Panel Mounting

Any RotorFlow sensors may be panel mounted using holes integrated into the bodies.

Two (2) mounting ears are provided at the body centre line to receive 3.5mm \varnothing self tapping screws (e.g. DIN 7971-B 3, 5 x 19) to accommodate panel mounting of the plastic RotorFlow units.

Note: ANSI T type 23 self-tapping screw are recommended. They may be replaced with standard machine screws if reinstallation should be required.



Important: In either case, pressure must be relieved from the system prior to sensor clean-out.

Low Flow Applications

A low flow adaptor is supplied with all Rotorflow units. It is used to produce accurate response at low flow rates. Install the adapter, as shown above, in the port selected for incoming flow.

FT-110 Series - TurboFlow™

TURBINE TYPE

Economical Flow-Rate Sensors

- ▶ Low Cost Plus High Accuracy $\pm 3\%$ of Reading
- ▶ Measures Low Liquid Flow Rates of 0.4 to 30 l/min
- ▶ FDA Approved Materials
- ▶ Lightweight Plastic design enables mounting in any position

GEMS hall effect turbine flow rate sensor is ideal for OEM applications involving low flow liquid monitoring. The low cost coupled with 0.5% repeatability makes it an ideal candidate for replacing dispensing timer systems. Unlike existing timing systems, turbine technology is not influenced by changes in system pressure caused by ageing filters. The sensor's standard power and output specifications make it easy to retrofit to existing controllers.

Specifications

Wetted materials

Body	Nylon 12
Turbine	Nylon 12 Composite
Bearings	PTFE/15% Graphite

Operating pressure	14bar max
Burst pressure	170bar
Operating temperature	-20°C to 100°C (Ambient +80°C for cable)
Viscosity	32 to 81 SSU (.8 to 16 Centistokes)
Filter	<50 Microns
Input power	5 to 24 VDC @ 8mA
Output	NPN Sinking Open Collector @ 50mA Maximum (1 to 2.2K Ohm Pull-Up Resistor Required) (Hz Output)
Accuracy	$\pm 3\%$ of Reading
Repeatability	0.5% of Full Scale
Electrical connection	Spade Terminals 2.8/6.3 x .8mm : 1m cable
Inlet/outlet ports	3/8" NPT Male : G 3/8" Male

How to Order

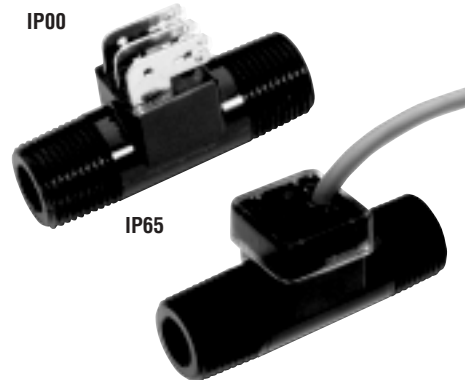
Specify Part Number based on desired flow range and thread type

Flow Range	Pulses per Litre	Frequency Output	Part Number				Pressure Drop Code
			Terminals		Cable		
Litres/m			3/8" NPT	G 3/8"	3/8" NPT	G 3/8"	
.5-5	6900	58-575 Hz	173931	173936	173931-C	173936-C	A
1-10	3300	55-550 Hz	173932	173937	173932-C	173937-C	
1-15	4600	76-1150 Hz	173933	173938	173933-C	173938-C	
1-15	2200	37-550 Hz	173934	173939	173934-C	173939-C	B
2-30	1000	33-500 Hz	173935	173940	173935-C	173940-C	

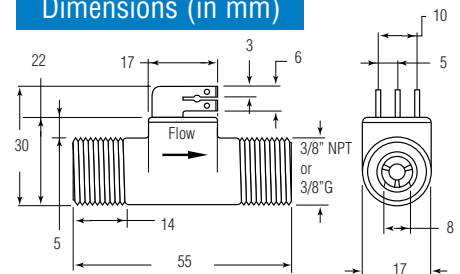
- Consult Sales Office if there is a possibility of particles in the flow stream.

FT-110 Accessories

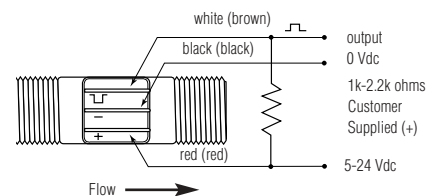
Description	Part Number
Mating connector w/1m, 3 conductor, PVC pigtail leads	173941
Mating connector w/3m, 3 conductor, PVC pigtail leads	173942



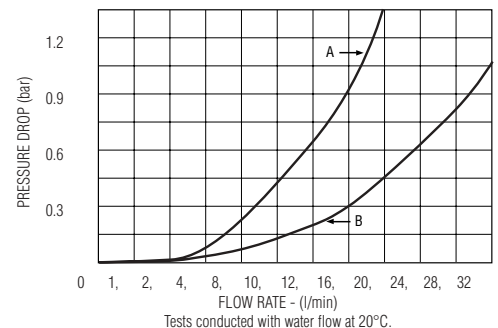
Dimensions (in mm)



Wiring (Integral Cable in brackets)



Pressure Drop - Typical



Conversions

Temperature Conversion

°F to °C	=	$(°F - 32) \times 0.556$
°C to °F	=	$(1.8 \times °C) + 32$
KELVIN	=	$°C + 273.15$
RANKLINE	=	$°F + 459.67$

Bars - (bar)

x 100	=	Kilopascals (kPa)
x 14.504	=	Pounds-force per square inch (psi)
x 33.52	=	Feet of water (ftH ₂ O) at 20°C (68°F)
x 29.53	=	Inches of mercury (in Hg) at 0°C
x 1.0197	=	Kilograms-force per square centimeter (kg/cm ²)
x 0.98692	=	Atmospheres (atm) sea-level standard
x 1.0443	=	Tons-force per square foot (tonf/ft ²)
x 750.06	=	Torr (torr) (=mmHg at 0°C)

Litres - (l)

x 1000	=	Cubic centimetres (cm ³)
x 0.035315	=	Cubic feet (ft ³)
x 61.204	=	Cubic inches (in ³)
x 1.308 x 10³	=	Cubic yards (yd ³)
x 0.2642	=	U.S. gallons (U.S. gal)
x 0.220	=	Imperial gallons (imp gal)

Inches of water - in H₂ at 20°C (68°F)

x 0.2487	=	Kilopascals (kPa)
x 2.487 x 10⁻³	=	Bars (bar)
x 0.07342	=	Inches of mercury (in Hg) at 0°C
x 2.535 x 10⁻³	=	Kilograms-force per square centimeter (kg/cm ²)
x 0.5770	=	Ounces-force per square foot (ozf/ft ²)
x 5.193	=	Pounds - force per square foot (1bf/ft ²)
x 0.03606	=	Pounds - force per square inch (psi)
x 2.454 x 10⁻³	=	Standard atmospheres

Cubic feet (ft³)

x 0.02832	=	Cubic metres (m ³)
x 2.832 x 10⁻²	=	Cubic centimetres (cm ³)
x 1728	=	Cubic inches (in ³)
x 0.03704	=	Cubic yards (yd ³)
x 7.481	=	U.S. gallons (U.S. gal)
x 6.229	=	Imperial gallons (imp gal)
x 28.32	=	Litres (l)

International

1 inch	=	25.4mm
Standard gravity	=	9.80665 m/sec ²
1 atmosphere	=	1013.25 mbar
1 pound mass	=	453.59237 gm

Dielectric Constants

Common Name	State	Degrees C / F	Dielectric Constant
Acetic Acid	Liquid	20 / 68	6.15
Acetone	Liquid	27 / 80	20.7
Ammonia	Liquid	-1 / 30	22.4
Aniline	Liquid	20 / 68	7.3
Aviation Spirit (100 Octane)	Liquid	25 / 77	3
Benzene	Liquid	20 / 68	2.284
Bitumen	Liquid		3.5
Bromine	Liquid	20 / 68	3.09
Butanol-1	Liquid	25 / 77	17.1
Butyl Acetate	Liquid	20 / 68	5.01
Carbon Tetrachloride	Liquid	25 / 77	2.23
Castor Oil, Hydrogenated	Liquid	27 / 80	10.3
Chlorine	Liquid	0 / 32	2
Chlorobenzene	Liquid	25 / 77	5.621
Chloroform	Liquid	0 / 32	5.5
Cyclohexane	Liquid	25 / 77	2.02
Dichloromethane	Liquid	20 / 68	9.08
Diethyl Ketone	Liquid	14 / 58	17.3
Dimethyl Sulphate	Liquid	20 / 68	55
Ethanol	Liquid	25 / 77	24.3
Ethyl Acetate	Liquid	20 / 68	6.4
Ethyl Benzene	Liquid	20 / 68	2.412
Ethyl Bromide	Liquid	18 / 64	4.9
Ethyl Ether	Liquid	20 / 68	4.34
Ethylene Chloride	Liquid	20 / 68	10.5
Ethylene Glycol	Liquid	25 / 77	37.7
Formic Acid	Liquid	21 / 69.8	57
Gasoline	Liquid		2 - 2.2
Glycerine	Liquid		47.0 - 68.0
Glycerol	Liquid	77	42.5
Glycol	Liquid	68	42.2
Hexane	Liquid	68	1.89
Hexanol	Liquid	76	13.3
Hydrazine	Liquid	68	52.9
Hydrogen Bromide	Liquid	76	3.8
Hydrogen Sulphide	Liquid	48	5.8
Isobutyl Alcohol	Liquid	68	18.7

Common Name	State	Degrees C / F	Dielectric Constant
Isobutyl Chloride	Liquid	68	7.1
Isopropyl Alcohol	Liquid	68	15.7
Jet Fuel (Military-JP4)	Liquid	70	1.7
Lactic Acid	Liquid	66	19.4
Maleic Anhydride	Liquid	140	51
Methanol	Liquid	77	32.63
Methyl Acetate	Liquid	68	7.3
Methyl Alcohol	Liquid	68	33.1
Methyl Butyl Ketone	Liquid	62	12.4
Methyl Ether	Liquid	77	5.02
Methyl Salicylate	Liquid	68	9
Methyl Thiocyanate	Liquid	68	35.9
Mineral Oil	Liquid	80	2.1
Nitrobenzene	Liquid	77	34.82
Octane	Liquid	76	2.061
Oil, Linseed	Liquid	55	3.4
Oil, Vegetable	Liquid		2.5 - 3.5
Pentanol	Liquid	77	13.9
Petroleum	Liquid		1.8 - 2.2
Phenol	Liquid	118	9.9
Phosgene	Liquid	71.6	4.3
Phosphorus	Liquid	93.2	4.1
Phosphorus Trichloride	Liquid	77	3.4
Propanol-1	Liquid	77	20.1
Propanol-2	Liquid	77	18.3
Pyridine	Liquid	68	12.5
Sulphur	Liquid	448	3.48
Sulphur Dioxide	Liquid	32	15.6
Sulphur Trioxide	Liquid	70	3.6
Sulphuric Acid	Liquid	68	84
Tetrachloroethylene	Liquid	77	2.3
Tetrahydrofuran	Liquid	86	7.25
Toluene	Liquid	68	2.4
Trichloroacetic Acid	Liquid	140	4.6
Trichloroethylene	Liquid	61	3.4
Water	Liquid	68	80.4
Xylene	Liquid	68	2.4

- Contact Sales Office for additional dielectric constants

Also available from Gems

Pressure Transducers

Gems Sensors is the leading European manufacturer of high performance sputtered thin film and cost effective CVD pressure transducers and transmitters. With sales of over a million pressure sensors, Gems' products are renowned throughout the world for their exceptional levels of quality, reliability and long term stability, in applications in the water, power machinery and aircraft industries. Gems' pressure sensors are manufactured in our purpose built class 100 clean room using CAD/CAM technology, laser welding, mass spectrometry and special brazing equipment.

CVD

- ▶ Cost effective
- ▶ Large volumes available
- ▶ Accuracy +/-0.15%
- ▶ Large choice of electrical and pressure connections
- ▶ Short lead time



Thin Film

Thin film transducers and transmitters offer the ultimate combination of accuracy, stability and repeatability. The 4000 series are accurate to 0.08% and are rated for 25 years MTBF.

- ▶ High performance
- ▶ Class leading accuracy +/-0.08%
- ▶ High stability
- ▶ Large number of options
- ▶ Choice of material



Level Measurement - Pressure Based

Continuous level measurement for waste and water treatment and tank levels.

- ▶ Five year anti-water ingress warranty
- ▶ Lightning protection
- ▶ Zero maintenance
- ▶ No calibration needed



Pressure Switches

Various selections for OEM variants to process applications.

- ▶ Wide variety
- ▶ OEM design service

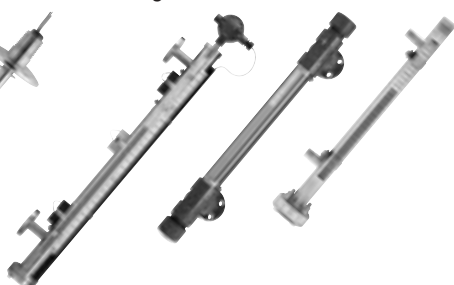


Specialist Products

Tank Level Transmitters



Magnetic Level Indicators



Dip Tape Visual Level Indicators

