Our experience

Your solution

Fluidic systems for critical applications

Designing custom systems
Take a Look
Look closely at medical equipment and you will find Gems Sensors components and assemblies inside.

- Anesthesia
- Chromatography
- Dental
- Gas Delivery
- In Vitro Diagnostics
- Lab Automation
- Mass Spectrometry
- Medical Imaging
- Medical Laser
- Pure Water Generators
- Renal
- Respiratory
- Sterilizers
- Surgical
...and many more

Experience. It’s more than “years in business”. It’s about what you’ve done and how you do it. It’s about your capacity to deliver the right solutions. It’s about making your customers look good and streamlining success. For more than 50 years Gems Sensors & Controls has been combining the elements of true experience and applying them to fluid sensors and controls development.

By leveraging our expertise and technologies, Gems is able to deliver custom, engineered fluidic systems and integrated sub-assemblies better than any other company in the world. We combine a unique array of intelligent sensors, world class lean manufacturing tools and ISO certified quality processes to significantly increase efficiency, productivity and quality.

As a Gems customer, you’ll experience firsthand our passion for generating solutions. A short list of services and advantages we bring to Medical OEMs includes:

- Collaborative Engineering Support or turnkey responsibility from concept to production
- Reduced Development Costs
- Quicker Time to Market
- Supply Chain management
- Lean Manufacturing Tools
- Certified Quality Processes

You receive added value when you work with Gems to develop and manufacture your complete fluidic system. Purchasing through one supplier eliminates the time and effort of multiple purchase orders and reduces receiving, inspection, and coordination of many different components down to a single assembly. Plus, buying from a single source, such as Gems Sensors & Controls provides you with one contact point for all of your needs.

Gems is dedicated to lean manufacturing and understands the critical need for a robust quality system that includes the right documentation, supplier qualification and ISO certification to meet the demanding requirements of the most specialized industries. With manufacturing facilities in the US, Europe and Asia, our global presence reduces lead-times and allows Gems to cost effectively ship ready-to-use systems throughout the world.

With more than a half-century of engineering and application experience, a broad portfolio of key products, lean manufacturing tools and quality systems, Gems has one goal: to enable our customers to get to market with the best possible solution.

Fluidic System Solutions
Gems custom design & manufacturing
Solutions Driven by Collaboration

Concept

Initial needs assessment and concept collaboration
- Collaboration
- Solid Modeling
- VOC
- Concept 3P

Feasibility

Collaborative engineering with development tools deliver clear objectives for design team
- Solid Modeling
- Design 3D
- Supplier Investigation
- Rapid prototyping
- Simplified QFD

Sustain

Productivity metrics drive continuous improvement in areas of Quality, Delivery, Cost
- Kaizen
- Standard Work
- Variation Reduction
- Visual Management

Production

Lean organization with the toolbox to produce what is needed
- Lean Mfg Tools
- Packaging
- Handling/Cleaning
- Testing
- Quality
- Custom Labeling
- Lean Supply Chain

Design

Experience to develop the right solution with design validation
- Rapid Prototyping
- FMEA
- Six Sigma Meth
- Process Capabilities Studies

Pre-Production

Smooth transitions from concept to production
- Documentation
- Process 3D
- P-FMEA
- Testing
- Supplier Certification
- Tooling/Fixturing

Production

Lean organization with the toolbox to produce what is needed
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Pre-Production

Smooth transitions from concept to production
- Documentation
- Process 3D
- P-FMEA
- Testing
- Supplier Certification
- Tooling/Fixturing

Our Experience • Your Solution

Gems surrounds a strong core of experience with key capabilities and organized processes. We are ready to be Your Partner!

- 50+ years fluid sensor & control design experience
- State-of-the-art design tools
- Methodical and predictable results
- Backed by the resource of a Fortune 500 company
- Worldwide engineering, sales and service presence
Solid Models
All of the geometry, specifications, dimensions, etc. are captured electronically and included as part of the solid model. The solid model is used throughout the design, tooling, manufacturing, sourcing, assembly and testing cycle. By using one model for the complete process, misinterpretations are prevented, cycle time is drastically reduced and quality is maximized.

Rapid Prototyping
Gems quickly creates prototype sensors or assemblies that match the fit, form and function of production units, providing the opportunity for you to confirm suitability of the solution in your system. Our goal is to get test-ready prototypes in your hands within 2 weeks of design approval.

Failure Mode and Effect Analysis
Gems routinely uses FMEA’s to evaluate new product designs and manufacturing processes to systematically determine how to prevent potential failures. We examine the following scenarios:
• How can a product or process fail?
• How severe could a potential failure be?
• How will Gems or the customer know if the product fails?
• Most importantly, what has to be done to prevent the product from failing at all?

Six Sigma Methodologies
Our Six Sigma practices identify design and process factors critical to the quality of your application. With the goal of reducing process variation, improving capabilities, increasing stability and designing systems to support these objectives, we continually train our engineers in the use of advanced statistics and modeling techniques. Benefits include optimized processes and material usage, highest delivered value with an overall increase in the reliability of your products and services.

Process Capability Studies
A subset of Six Sigma methodologies, this discipline uses statistical tools to predict the outcome of a manufacturing process. We ascertain, in advance of major production, the ability of the process to generate final product that conforms to requirements. Should the predicted outcomes fail to achieve targeted goals, actions are taken to find and eliminate root causes for variations, before we go into production.
Subminiature Pressure Switches

GEMS offers medical equipment designers a choice of economical pressure switches. Three subminiature, electromechanical versions are shown here. These switches are ideal for a wide variety of switch actuation chores and as redundant systems to existing monitors such as pressure transducers. Using a piston/diaphragm design, the switches highlighted here marry a rigid piston, to provide high proof pressure value, with a flexible diaphragm for optimum sensitivity and accuracy. Repeatability ranges from 2% to 5% of the highest set point.

Operating Principle

Gems pressure switches employ a sensing element that consists of a flexible diaphragm and rigid piston working against a compression spring. The surface area of the diaphragm/piston combo and the degree of spring compression determine the amount of pressure necessary to actuate the switch. When pressure on the piston exceeds that exerted by the spring, the piston moves back and presses on a small electrical switch that closes or opens electrical contacts.
Comparison Chart

<table>
<thead>
<tr>
<th></th>
<th>PS31</th>
<th>PS32</th>
<th>PS41</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Range – PSI (Bar)</td>
<td>2 to 150 (0.14 to 10)</td>
<td>3 to 100 (0.2 to 7)</td>
<td></td>
</tr>
<tr>
<td>Proof Pressure – PSI (Bar)</td>
<td>500 (35)</td>
<td>350 (25)</td>
<td></td>
</tr>
<tr>
<td>Diaphragm Material</td>
<td>Teflon®-coated Kapton®</td>
<td>Nitrile Elastomer, EPDM or Viton®</td>
<td>Nitrile Elastomer, EPDM or Viton®</td>
</tr>
<tr>
<td>Switch</td>
<td>SPST</td>
<td>SPST, SPDT</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>±5%</td>
<td>±2%</td>
<td></td>
</tr>
<tr>
<td>Approvals</td>
<td>CE</td>
<td>CE and UL</td>
<td></td>
</tr>
<tr>
<td>Housing Material</td>
<td>Brass or 316 Stainless Steel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dimensions

**PS31 / PS32 – 1/4” Spades**

- 1.58” (40.16 mm)
- 0.36” (9.07 mm)
- 1.120” (29 mm)
- 1.51” (38.30 mm)

**PS31 / PS32 – Flying Leads with IP option**

- 15/16” Hex (24 mm)
- 0.54” (14 mm)
- Pressure Port
- Hex Head Adjustment Screw

**PS41 – Flying Leads**

- 1.58” (40 mm)
- 3/32” or 1/8” Allen Wrench Adjustment Screw
- Red, N.O.
- Green, N.C.
- Black, Common

**PS41 – Ingress Protection Option (IP66) with Flying Leads, Factory Set Only**

- 2.20” (56 mm)

**PS41 – DIN 43650A, Male Half Only**

- 1.16” (28 mm)
- DIN 43650A

**PS31**
- 5 to 150 psi (.345 to 10 bar)
- Ideal for pneumatic and low-pressure hydraulic applications
- Adjustable or factory set

These compact pressure switches are designed for OEM applications. Made economical with metal blade contacts in lieu of microswitches, the PS31 series features Kapton® diaphragms. Kapton® Polyimide maintains excellent physical properties over a wide temperature range. It also offers superb chemical resistance with no known organic solvents.

**PS32**
- 5 to 150 psi (.345 to 10 bar)
- Ideal for pneumatic and low-pressure hydraulic applications
- Adjustable or factory set

Like the PS31, these subminiature pressure switches incorporate metal blade contacts in lieu of microswitches for improved economy. This series differs from the PS31 with the use of long-lasting elastomer diaphragms made of Nitrile, EPDM or Viton®. Elastomer diaphragms offer increased sensitivity and life for applications without temperature extremes.

**PS41**
- 3 to 100 psi (0.2 to 7 bar)
- Field adjustable

These miniature pressure switches are designed for demanding applications where space and/or price are strong concerns. The PS41 series use robust microswitches, available in SPST or SPDT versions. Switches are field adjustable via a recessed-hex head screw that is hidden to protect against unauthorized tampering.

Our Medical Equipment Specialists are ready to discuss your sensor requirements, so don't hesitate to give us a call.

GemsMedicalSolutions.com
800.378.1600
Medical Equipment
Pressure Transducer

Gems 2200 Series range of pressure transducers feature proven Chemical Vapor Disposition (CVD) sensing technology to provide long-term stability and outstanding levels of accuracy over broad operating temperature ranges. The all stainless steel construction of media wetted parts ensures compatibility with medical gases and caustic fluids. A wide choice of pressure and electrical fittings allows direct fitting to existing systems.

Operating Principle
A four arm active Wheatstone Bridge manufactured using Chemical Vapor Deposition techniques to deposit silicon on stainless steel, is laser welded to a force summing diaphragm. ASIC technology provides accurate temperature compensation and a wide choice of electrical outputs.

Polysilicon strain gauges are attached to the sensor beam at the molecular level utilizing Chemical Vapor Disposition (CVD) manufacturing methods. P applied > P reference deflects the diaphragm and attached beam, the atomically fused strain gauges provide a proportional output for an applied pressure.
Specifications

2200 Series

Input
Pressure Range Vacuum to 400 bar G (6000 psi) 0 - 25 bar Absolute
Proof Pressure 2 x Full Scale (FS) (1.5 x FS for 400 bar, ≈ 5000 psi)
Burst Pressure >35 x FS ≤ 6 bar (100 psi)
           >20 x FS ≥ 60 bar (1000 psi)
           >5 x FS ≤ 400 bar (6000 psi)
Fatigue Life Designed for more than 100 million FS cycles

Performance
Long Term Drift 0.2% FS/year (non-cumulative)
Accuracy 0.25 % FS typical (optional 0.15% FS)
Thermal Error 1.5% FS typical (optional 1% FS)
Compressed Air Temp -20° to 80° C (-5° to 180° F)
Operating Temperature -40° to 125° C (-40° to 260° F) for elec. codes A, B
                   -20° to 80° C (-5° to 180° F) for elec. codes 2, D
                   -20° to 50° C (-5° to 125° F) for elec. code F
Zero Tolerance 1% of span
Span Tolerance 1% of span

Mechanical Configuration
Pressure Port See examples at right
Wetted Parts 17-4 PH Stainless Steel
Electrical Connection See examples below
Enclosure 316 SS, 17-4 PH SS
         IP65 for elec. codes A, B, D, F, 2
         IP67 for elec. code “F”
Vibration 35g peak sinusoidal, 5 to 2000 Hz
Acceleration 100g steady acceleration in any direction 0.032% FS/g for 1 bar
             (15 psi) range decreasing logarithmically to 0.0007% FS/g for
             400 bar (6000 psi) range.
Shock Withstands free fall to IEC 68-2-32 procedure 1
Approvals CE
Weight approx. 100 grams (additional cable; 75 g/m)

Components

The 2200 Series is highly configurable and provides a wide selection of both electrical connections (examples below) and pressure port connections (examples right). Your Gems Medical Specialist will help with the ideal configuration to suit your application requirements.

![Component Diagrams]

Contact us today to learn more about our medical equipment solutions.
Gems offers configurations needed to fulfill all the primary functions of fluid control.

Features
- Power as low as 0.5 Watt
- Lightweight compact sizes
- Fast response times—3 to 5 ms
- Manifold configurations and complete fluidic systems
- 100% performance tested
- Cleaned for oxygen use
- Broad range of wetted materials
- Numerous orifice sizes
- Bubble tight plunger construction

Benefits
- Suitable for battery powered applications
- Versatile and cost effective
- Durable and corrosion resistant
- Fully customizable to your application requirements
- Proven to be reliable and accurate for millions of cycles
- Manifolding reduces leak paths
- Small footprint when space is limited
- Easily integrated into any fluidic system

Applications
- Oxygen and respiratory therapy
- Mass spectrometry
- Ultra-pure water systems
- Chromatography
- Electrochemical analyzer
- Therapeutic beds
- Medical gas delivery
- Autoclaves
- Steam sterilizers
- Chemical sterilizers
- Anesthesia
- DNA sequencers

Miniature/Sub-Minature Solenoid Valves
General Purpose 2- and 3-Way Valves

Offering a compact size, consistent high-speed response time, and reliable operation, Gems solenoid valves are an excellent choice for medical equipment applications that demand uncompromised performance and precise flow control in a small lightweight package.

Gems 2- and 3-way solenoid valves are available in a broad range of orifice and port sizes, with a wide variety of wetted materials, wattages, and coil constructions for the utmost adaptability to your application requirements.

Proven to perform for over 200 million cycles without failure, Gems general purpose valves and manifold configurations are easily designed into sub-assemblies and complete fluidic systems.

Valve Functions
Gems offers configurations needed to fulfill all the primary functions of fluid control.

Schematics at the right illustrate the flow paths and functions in a de-energized state.

All schematics shown in de-energized state.
Valve Series Overview

A Series — .019 - .300 CV
Body: SS, B, PP & Other Materials
Power: 4.5 - 6 watts
Plunger Seal: E, N, NS, PF, V, GV, T, R
O-Ring: EO, NO, NSO, PFO, TO, VO

B Series — .018 - .430 CV
Body: SS, B & Other Materials
Power: 7 watts
Plunger Seal: E, GV, N, NS, PF, R, T, V
O-Ring: EO, NO, NSO, PFO, TO, VO

D Series — .045 - .880 CV
Body: SS, B, & Other Materials
Power: 10 watts
Plunger Seal: NB, E, GV, N, NS, PF, R, T, V
O-Ring: NO, EO, NO, NSO, PFO, TO, VO

G Series — .018 - .063 CV
Body: SS, Acetal
Power: .65 - 2 watts
Plunger Seal: V, NB, E, N
O-Ring: VO, NSO, EO, NO

O-Ring Material
- EO: EPR
- MQO: Silicone
- NO: Neoprene
- NSO: Nitrile (2-way valves only)
- PFO: Perfluoroelastomer
- TO: Teflon®
- VO: Viton®

Fluid Compatibility
- Gas / Liquid
- Gas

Material Code Key
Body: A- Aluminum, B-Brass, PP- Polypropylene, SS-Stainless Steel
Plunger Seal Material
- E: EPR
- EPDM: Ethylene Propylene Diene Monomer
- GV: Gasoline Viton (2-way valves only)
- MQ: Silicone
- N: Neoprene
- NB: Nitrile (G Series)
- NS: Nitrile (2-way valves only)
- PF: Perfluoroelastomer
- R: Rulon®
- T: Teflon®
- V: Viton®

Gems Medical Solutions has over 30 years experience working with OEMs to design and manufacture integrated valve and manifold assemblies. We deliver fluidic systems that shorten development time, reduce assembly time, and increase product quality.

Our Medical Equipment Specialists are ready to discuss your sensor requirements, so don’t hesitate to give us a call.

Gems Medical Solutions
GemsMedicalSolutions.com
888.840.1230
### Features
- Custom voltages and wattages
- Various flow orifices and pressure ranges
- Several diaphragm material options
- Multiple mounting and port configurations
- Minimal power consumption
- 100% performance tested
- Electrical connection via quick connect spade

### Benefits
- Adaptable modular design
- Compact size
- Protects high purity media
- Broad fluid compatibility
- Hassle free installation reduces assembly time
- Low internal volume
- Minimal diaphragm displacement reduces pulsing
- Flexibility for single or multiple valve mounting

### Equipment Used On
- Clinical chemistry
- Analytical
- Hematology
- Histology
- Immuno-chemistry
- Lab automation

### Fluid Monitoring Applications
- Reagents
- High purity fluids
- Saline solution
- Perisitic acids
- Deionized water
- Solvent based fluids

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**The Chem-S™ utilizes diaphragm technology in a liquid compatible, miniature inert isolation valve.** With a compact size, flexible diaphragm design, low power consumption, and low cost, the Chem-S provides a unique and valuable option for the medical and scientific instrumentation industries. The Chem-S specifically targets the performance and price void between the limited pinch valve and the very expensive rocker style solenoid.

The Chem-S provides a new opportunity for the analytical and clinical chemistry industry. Its modular design coupled with Gems flexible engineering and manufacturing techniques, results in a truly adaptable valve that is easily integrated into any fluidic system.

### Operating Principle

The Chem-S is a direct-acting inert solenoid valve with an internal diaphragm separating the plunger and guide assembly from the fluid passing through the valve; therefore, the fluid contacts only the inert valve body and the diaphragm material.

This inert 2-way valve has one inlet port and one outlet port. In the de-energized condition, the core spring holds the diaphragm seal on the valve seat to shut off the flow. When energized, the plunger is pulled into the solenoid coil and the diaphragm seal is lifted off the orifice seat, opening the valve. The electro-magnetic force is greater than the combined spring force and the static and dynamic pressure forces of the medium.
Specifications
All Gems valves are built-to-order. Custom options are available. Below are benchmark Chem-S valve specs.

- **Function**: 2-way normally closed
- **Media**: Gas and liquid
- **CV**: 0.016 at 70 psig and an orifice size of .031; 0.040 at 25 psig and an orifice size of .052
- **Port Configurations**: 1/8” barb; Face Mount; #10-32 thread flat bottom
- **Orifice Diameter**: 0.032” or 0.052”
- **Power Consumption**: 2 watts nominal
- **Maximum Operating Pressure**: 70 psi
- **Coil Construction**: Quick connect .110 spade
- **Body Material**: Polyurethane (Isoplast™)
- **Diaphragm Seal Materials**: Viton®, EPDM
- **Voltage**: 5 VDC; 12 VDC; 24 VDC
- **Pressure Rated**: Vacuum to 70 psig
- **Additional Options**: Vacuum application (0 to 27” Hg)

Dimensions

**1/8” I.D. Tube Barb Ports**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.26” (6.6 mm) Typ.</td>
<td>For #3 Mtg. Screw</td>
</tr>
<tr>
<td>.455” (11.6 mm) Typ.</td>
<td>.390” (9.9 mm)</td>
</tr>
<tr>
<td>.35” (8.9 mm)</td>
<td>.86” (21.8 mm)</td>
</tr>
<tr>
<td>2.21” (56.1 mm)</td>
<td></td>
</tr>
</tbody>
</table>

**#10-32 UNF-2B Ports**

<table>
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<tr>
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<tr>
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<td></td>
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</tbody>
</table>

**Manifold Mount Ports**

<table>
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<tr>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.35” (8.9 mm)</td>
<td></td>
</tr>
<tr>
<td>.86” (21.8 mm)</td>
<td></td>
</tr>
</tbody>
</table>

Fluid Port Options

1/8” I.D. Tube Barb Ports

- "Out" (Overseat) .312” (7.9 mm)
- "In" (Underseat) .35” (8.9 mm)

#10-32 UNF-2B Ports

- "Out" (Overseat) .312” (7.9 mm)
- "In" (Underseat) .35” (8.9 mm)

Manifold Mount Ports

- .06” (1.5 mm) (2 pcs.)
- .896” (22.8 mm)
- .43” (10.9 mm)
- .86” (21.8 mm)

Manifold Assemblies

Gems PreDyne® valve engineers have over 30 years experience working with OEMs to design and manufacture integrated valve and manifold assemblies. We deliver fluidic systems that shorten development time, reduce assembly time, and increase product quality.

Our Medical Equipment Specialists are ready to discuss your sensor requirements, so don’t hesitate to give us a call.

Gems Medical Solutions
888.840.1230
Inert material, low internal volume and small footprint make Gems K Series Isolation Valves an excellent choice for Medical or Life Science OEMs. Proven to perform for over 20 million cycles, Gems flexible valve configurations are easily designed into sub-assemblies or complete fluidic systems. A variety of porting options provide application versatility; these include choices of side ports, bottom ports, or manifold mounting.

Whether you need a chemically inert or particle-tolerant valve, look for Gems K Series solenoid valves. For high purity applications and aggressive media handling, the fluid path can be made entirely of extremely inert materials: PTFE, EPDM, FKM or FFKM diaphragms, and PTFE, ETFE, PPS, PEEK or PSU body. Special elastomer diaphragm valves are forgiving of particulate matter that would typically damage a plastic (PTFE) valve seat.

**Operating Principle**

Fluid connections are made via body ports. When energized a magnetic field is generated attracting the armature towards it, moving the diaphragm. When de-energized the field disappears and the spring then returns the diaphragm to the seat.
Dimensions – Side Port Body

**KS Series 2-Way Normally, Closed (N.C.)**

Function 2- & 3-way
Media Liquids only
Cv Range 0.008 – 0.015
Port Configuration 1/4-28 UNF (side or bottom) Manifold mount*
Orifice Diameter 0.011" – 0.030"
Internal Volume 13 - 42 µl
Power (watt) @ 70°F 1.8 (12VDC)
Max operating pressure 15 - 20 PSI
Body Materials PPS, PEEK
diaphragm Materials PTFE, EPDM, FFKM

**KM Series 2-Way, Normally Closed (N.C.)**

Function 2- & 3-way
Media Liquids only
Cv Range 0.008 – 0.030
Port Configuration 1/4-28 UNF (side or bottom) Manifold mount*
Orifice Diameter 0.011" – 0.030"
Internal Volume 19 - 54 µl
Power (watt) @ 70°F 2.8 (12VDC)
Max operating pressure 15 - 20 PSI
Body Materials PTFE, ETFE, PPS, PEEK, PSU
diaphragm Materials PTFE, EPDM, FKM, FFKM

**KL Series 2-Way, Normally Closed (N.C.)**

Function 2- & 3-way
Media Liquids only
Cv Range 0.010 – 0.105
Port Configuration 1/4-28 UNF (side or bottom) Manifold mount*
Orifice Diameter 0.010" – 0.105"
Internal Volume 47 – 133 µl
Power (watt) @ 70°F 4.0 (12 & 24 VDC)
Max operating pressure 10 - 30 PSI
Body Materials PTFE, ETFE, PPS, PEEK, PSU
diaphragm Materials PTFE, EPDM, FKM, FFKM

* Alternate port configurations are available.

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Our Medical Equipment Specialists are ready to discuss your requirements, so don't hesitate to give us a call.

Gems Medical Solutions
800.770.0505
**ExOsense™ Piezo-Resonant Liquid Level Sensors**

*Developed specifically for the In Vitro Diagnostic market.*

**Features**
- Non-Intrusive, stays outside-the-bottle
- Small footprint
- Simple installation
- Robust design
- No user calibration needed
- Highly repeatable
- Eliminates fluid compatibility issues
- Mini moisture-resistant connector
- Works on most plastic bottles
- Programmable digital filter & output delay option

**Benefits**
- Never contacts the fluid
- Eliminates contamination
- Improves instrument uptime
- Maximizes container volume
- Gets closest to high and low levels
- No special mounting required
- Eliminates testing for compatibility
- Easy installation
- Works with sloshing fluid

**Equipment Used On**
- Clinical chemistry
- Hematology
- Immuno-chemistry
- Histology
- Medical Laser Systems
- Hemodialysis
- Cytology

**Fluid Monitoring Applications**
- Reagents
- Waste
- Diluent
- Detergent/wash
- Dialysate
- Coolant
- Saline
- Pure water

**New ExOsense™** is the first affordable, non-intrusive liquid level sensor for plastic fluid containers. ExOsense™ sensors adhere to the outside of plastic bottles and are unaffected by the color or transparency of the plastic. Liquids inside the bottle are untouched, so with ExOsense™ there is no issue of material compatibility or contamination. Best of all, ExOsense™ sensors fit any size and shape vessel, from small bottles to large tanks.

The ExOsense™ sensor head features a peel-and-stick adhesive face that can be affixed anywhere on the outside of the tank to provide high, low or any intermediate point level fluid sensing. A detachable electrical cable feeds the fully sealed solid-state electronic control module (ECM).

**Operating Principle**
Our sensor incorporates patented transducer technology, employing piezoelectric material. When piezoelectric material is excited, it creates an acoustic signal as a function of the natural resonance of the material. ExOsense™ sensors generate this acoustic signal, direct it through the bottle wall and sense the reflected pulse.

The amount of energy that is reflected is determined by the "acoustic impedance* mismatch" of the materials in use. For example, if sound passes through two materials with similar acoustic impedances (figure 1), very little energy will be reflected. If sound passes through two materials with dissimilar impedance values (figure 2), the majority of the acoustic energy will be reflected. This acoustic impedance mismatch provides the basis for the detection of liquid level.

![Diagram of acoustic impedance mismatch](image)

*Acoustic Impedance: a material property defined as the product of sound velocity and material density. The relative transmission and reflection at an interface are governed in part by the acoustic impedances of the materials on each side of the interface. The letter Z is used for acoustic impedance and is expressed in [kg/s m²] = 1 Rayl:

- Water Z = 1.5 MRayls
- Air Z = 0 MRayls

**ZPLASTIC** = 1.8

**ZWATER** = 1.5
Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatible Plastic Bottle Materials</td>
<td>Polyethylene (PE), Polypropylene (PP), Polycarbonate (PC), ABS, Styrene, PVC, and others</td>
</tr>
<tr>
<td>Bottle Materials Not Recommended</td>
<td>Teflon® family, or Any Foamed Core Plastics</td>
</tr>
<tr>
<td>Min. Bottle Diameter for Round Bottles</td>
<td>3” (76.2 mm)</td>
</tr>
<tr>
<td>Bottle Wall Thickness</td>
<td>0.4” to 0.15” (1.0 mm to 3.8 mm)</td>
</tr>
<tr>
<td>Termination of Sensor</td>
<td>Mini Connector to Electronics Control Module (ECM)</td>
</tr>
<tr>
<td>Input Power Supply (volts)</td>
<td>4.75 to 5.25 VDC (Optional Voltage Regulator available for 6 to 32 VDC.)</td>
</tr>
<tr>
<td>Power Consumption (current)</td>
<td>&lt;40mA Typ. @ 5 VDC</td>
</tr>
<tr>
<td>Calibration</td>
<td>No User Calibration Required. Pre-configured for Container Materials, Wall Thickness, &amp; Output Options. Factory Calibrated</td>
</tr>
<tr>
<td>Output Configuration</td>
<td>Open Collector; 40 mA, Max.</td>
</tr>
<tr>
<td>Switch Condition</td>
<td>Normally Open/Normally Closed</td>
</tr>
<tr>
<td>Standard Response Time</td>
<td>2 msec.</td>
</tr>
<tr>
<td>Delay Range</td>
<td>0 to 60 Seconds, Standard is No Delay, Optimal is 0 to 60 Seconds.</td>
</tr>
<tr>
<td>RFI/EMI Susceptibility</td>
<td>3V/m</td>
</tr>
<tr>
<td>Agency Approvals</td>
<td>UL 508 Listed (File E 305671), CE &amp; IEC 61326 (RFI/EMI)</td>
</tr>
<tr>
<td>Operating Temperature Sensor</td>
<td>32°F to 158°F (0°C to 70°C)</td>
</tr>
<tr>
<td>Electronics</td>
<td>32°F to 149°F (0°C to 65°C)</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.039” (±1 mm)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.063” (±1.6 mm)</td>
</tr>
<tr>
<td>Sealing Capability</td>
<td>IP65</td>
</tr>
</tbody>
</table>

Dimensions

- **Sensor Assembly**: 1.25” (32 mm) Dia. 0.575” (14.6 mm) REF.
- **Mini Connector**: 0.760” (19 mm) 1.40” (35.43 mm) REF.
- **Fully Over-Molded ECM**: 0.860” (22 mm) 1.80” (46 mm) REF.
- **Connector Inserted Into Sensor**: 1.40” (35.43 mm) REF. 1.72” (43.7 mm) REF. 0.59” (15 mm) REF.
- **ECM**: 0.282” (7.16 mm) REF. 0.25” ±0.25” (158.8 ±6.4 mm) Cable Length Between Sensor and Electronics 1.5” (38.1 mm) REF.
- **Optional Voltage Regulator**: 2” (50.8 mm) REF.

Super Simple Installation:

1. **Peel & Stick**
   - Peel the adhesive cover off the sensor and stick it on the bottle where you want to indicate the level.
2. **Connect**
   - Connect the sensor to the electronic module using the mini USB connector.
3. **Sense**
   - Apply power and sense the fluid level.

ExOsense™ features an inline fully over-molded electronic control module and an optional voltage regulator.

Our Medical Equipment Specialists are ready to discuss your sensor requirements, so don’t hesitate to give us a call.
LS-350 Series: Combination Siphon and Level Sensors

Features
- Multi-level switch points
- Integral siphon or fill tube
- Customized mountings
- NSF approval materials
- Custom configurable

Benefits
- Liquid level up to 6 actuation points
- Combination level & siphon tube saves space and installation time
- Molded bottle cap designs
- Broad compatibility
- Easily customized to application

Equipment Used On
- Immuno-chemistry
- Hematology
- Immuno-cytometry
- Automated urine analysis
- Laboratory automation
- Freeze drying

Fluid Monitoring Applications
- Waste
- Buffer
- Wash
- Chiller
- Reagents
- Coolant

Save valuable space and costly installation/maintenance time with these highly customizable sensors. LS-350 units combine a siphon tube and up to six liquid level sensors as a single component. The complete unit installs through a single opening in the fluid container.

Simple and clean — a single component that enables remote monitoring of a tank’s fluid content while allowing access for container filling and draining. These units are custom configured to fit the container of your choice, with a wide range of mountings, fluid and electrical connectors, materials and lengths.

Operating Principle
The LS-350 Series provides two functions: liquid level monitoring and fluid fill or extraction access. The latter function is accomplished with an integrated siphon tube that runs parallel to the float sensor stem and through the top mounting; it is commonly topped with a barb (or customer specified) fitting for the connection of flexible tubing. Fluid level sensing is accomplished with magnetic reed switch technology. One or more floats encircling a stationary stem are equipped with powerful, permanent magnets. As a float rises or lowers with liquid level, the magnetic field generated from within the float actuates a hermetically sealed magnetic reed switch mounted inside the stem. The switch actuation may be used for alarm, solenoid, pump or other fluid control operations.
Specifications

LS-350

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Type 1</th>
<th>Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>Polysulfone or Noryl®</td>
<td>Polypropylene or Buna N</td>
</tr>
<tr>
<td>Stem and Mounting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floats</td>
<td>Polypropylene or Buna N</td>
<td></td>
</tr>
<tr>
<td>Gasket</td>
<td>Buna N</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>250°F (121°C) maximum</td>
<td></td>
</tr>
<tr>
<td>Switch</td>
<td>SPST or SPDT</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>15” (381 mm) maximum. Longer units available on request.</td>
<td></td>
</tr>
<tr>
<td>Mounting Attitude</td>
<td>±30° from vertical</td>
<td></td>
</tr>
<tr>
<td>Actuation Level Points</td>
<td>6 maximum</td>
<td></td>
</tr>
</tbody>
</table>

Dimensions

The types shown below are typical and represent basic dimensions only. Gems manufactures the LS-350 to customer specifications. Please contact us for a complete description of the various mounting and connectors available for your application.

Multiple Actuation Points

Using a single LS-350 unit, up to six liquid level points may be used to cause a switch action. In this way they are utilized to monitor customer-specified high, low and intermediate liquid level points through a single opening in a tank, or disposable container.

Fluid tube may be used for either filling or siphoning fluid from container.

Our Medical Equipment Specialists are ready to discuss your sensor requirements, so don’t hesitate to give us a call.

Gems Sensors
800.378.1600
**LEVEL SENSORS**

- **ELS-900 Series** – Engineered Plastic
- **ELS-1150 Series** – Stainless Steel

**Features**
- Small, compact size
- Solid-state technology
- High temperature capabilities
- Variety of materials
- Economically priced
- Configurable

**Benefits**
- Fits easily into small bottles/vessels
- No moving parts to bind or wear
- Reliability at higher temperature
- Compatible with variety of fluids
- Affordable for OEMs
- Easily customized to application needs

**Equipment Used On**
- Immuno-chemistry
- Hematology
- Hemodialysis
- Aesthetic lasers
- Chemical sterilizers for reprocessing

**Fluid Monitoring Applications**
- Reagents
- Waste
- Dialysate
- Diluent
- Detergent/wash
- Coolant

**Custom Modifications**
Gems can accommodate many special requirements. Here are a few examples of what we’ve already done:
- O-ring/custom housing integration into customer’s housing
- Thin hex for tight installation areas
- Heated design to prevent coating of prism
- Shortened design for tight installation areas
- Special thread & flange mountings to meet equipment specifications

**Electro-Optic Single Point Level Sensors**

**ELS Series Level Switches** are low cost, compact, optical level sensors with built-in switching electronics. With no moving parts, these small units are ideal for a variety of point level sensing applications — especially where dependability and economy are a must.

Installation is simple and quick through the tank top, bottom or side for high, low or intermediate level detection in practically any tank, large or small. Solid-state switching ensures dependability over long service life. They are, however, not recommended for use in any liquid that crystallizes or leaves a solid residue.

**Operating Principle**

These sensors contain both infrared LED and light receiver. Light from the LED is directed into a prism that forms the tip of the sensor. When no liquid is present, light from the LED is reflected within the prism to the receiver. When liquid immerses the prism, the light refracts out of the prism, into the liquid, leaving little or no light to reach the receiver. Sensing this change, the receiver actuates electronic switching within the unit to operate an external alarm or control circuit.

*Note:* Any optical sensor may be affected by reflective surfaces. Consult Gems if prism is to be less than 2 inches (51 mm) from any reflective surface.
### Specifications

#### ELS-900

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mounting</strong></td>
<td>1/4” NPT, 1/2”-20 SAE #5, M12X1-8</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>Polyethersulfone</td>
</tr>
<tr>
<td><strong>O-Ring</strong></td>
<td>Viton® (1/2” SAE #5 and M12x1-8)</td>
</tr>
<tr>
<td><strong>Operating Pressure</strong></td>
<td>0 to 250 PSI (17 bar), maximum</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong>*</td>
<td>-40°F to +257°F (-40°C to +125°C)</td>
</tr>
<tr>
<td><strong>Current Consumption</strong></td>
<td>4 mA, for 5 VDC (No Load), 10 mA for 12 VDC (No Load)</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>Open Collector Output, 40 mA Sink, Max. up to 30 VDC</td>
</tr>
<tr>
<td><strong>Repeatability</strong></td>
<td>± 1 mm (0.039”)</td>
</tr>
<tr>
<td><strong>EMI</strong></td>
<td>CE approved per EN 61000</td>
</tr>
<tr>
<td><strong>Shock Tested</strong></td>
<td>Per MIL-Std-202 Method 204</td>
</tr>
<tr>
<td><strong>Vibration Tested</strong></td>
<td>Per MIL-Std-202 Method 2138</td>
</tr>
</tbody>
</table>

*These switches are not for use in freezing liquids

#### ELS-1150

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mounting</strong></td>
<td>1/2” NPT, 3/4”-16 Straight Thread</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>Nickel-Plated Carbon Steel or 316 Stainless Steel</td>
</tr>
<tr>
<td><strong>Prism</strong></td>
<td>Fused Glass</td>
</tr>
<tr>
<td><strong>Operating Pressure</strong></td>
<td>0 to 2500 PSI (0 to 172 bar), Maximum</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong>*</td>
<td>-40°F to +212°F (-40°C to +100°C)</td>
</tr>
<tr>
<td><strong>Current Consumption</strong></td>
<td>~45 mA</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>Open Collector Output, 18 mA Sink, Max.</td>
</tr>
<tr>
<td><strong>Electrical Termination</strong></td>
<td>22 AWG, Polymeric, 12” to 14” Extended Lead Wires</td>
</tr>
<tr>
<td><strong>Repeatability</strong></td>
<td>± 1 mm (0.039”)</td>
</tr>
<tr>
<td><strong>Approvals</strong></td>
<td>CE, UL File No. E108913, CUL</td>
</tr>
</tbody>
</table>

*These switches are not for use in freezing liquid
**Carbon Steel model only.

### Dimensions

**ELS-900**

- 1/4” NPT, 5/8” Hex
- 1.27” (32 mm)
- Lead Wires, Polyester
- 6 to 6-1/2” (150 to 165 mm) Extended

**ELS-1150**

- 1/2” NPT
- 1.38” (35 mm)
- Epoxy Encapsulated
- Lead Wires
- 3/4”-16UNJF 3A
- 7/8” HEX (22 mm)

---

**ELS-900 Series**

The smallest electro optic sensor in our arsenal, the ELS-900 also carries the highest temperature capability of any of our optic sensors. Its Polyethersulfone housing extends this sensor’s compatibility and is very affordable in high volumes. Excellent for medical OEMs preferring optics with high temperature and small space requirements.

**ELS-1150 Series**

At just 1.38” (35 mm) long, ELS-1150 represents the smallest electro-optic level sensor in its performance class, and by far the most economical. ELS-1150 switches utilize a strong, glass prism fused to a nickel-plated, carbon steel or stainless steel housing to easily monitor vessels pressurized up to 2500 PSI (172 bar). Their compact package size makes them the ideal candidate for monitoring the small, pressurized vessels found in medical applications. Industry’s only glass-fused stainless steel electro-optic sensor, the ELS-1150SS, offers greater corrosion resistance and fluid compatibility than carbon steel versions. It is ideal for acids, solvents, and dielectric deionized water applications.

*Our Medical Equipment Specialists are ready to discuss your sensor requirements, so don’t hesitate to give us a call.*

GemsSensors.com
800.378.1600
**Compact Liquid Level Switches**

- **LS-3 Series – Engineered Plastic**
- **LS-1700 Series – Alloy Stems**
- **LS-1755 Series – All Stainless Steel**

### Features
- Durable, rugged
- Broad temperature & pressure capabilities
- Variety of materials
- Compact size
- Economical

### Benefits
- Reliable
- Versatile in demanding applications
- Broad chemical compatibility
- Ideal for tight spaces
- Affordable in any application

### Equipment Used On
- Chemical sterilizers
- Hypothermia systems
- Laboratory automation
- Dental sterilizers
- MRI

### Fluid Monitoring Applications
- Water chillers
- Waste
- Reagents
- Detergent/wash
- Coolant

Designed for small fluid tanks, these compact liquid-level switches offer specific materials and features to handle a wide range of fluid, temperature and pressure compatibility. They operate by using the simple float / reed switch technology. Direct indication of the liquid level is accomplished by fluid changes moving the float unlike indirect level indication from more complex methods.

The durable construction of these reed switch designs ensures long, trouble-free service. Using hermetically sealed reed switches, our switches provide repeatability with less than 1% deviation. Shock, wear and vibration resistant, the switch point remains constant over a very long life cycle.

### Operating Principle
The cylindrical float encircling a stationary stem is equipped with powerful, permanent magnets. As the float rises or lowers with liquid level, the magnetic field generated from within the float actuates a hermetically sealed magnetic reed switch mounted with the stem. The stem is made of non-magnetic alloys or engineered plastics. When mounted vertically, this design provides a consistent accuracy of ±1/8” inch.
Comparison Chart

Series | Stem Material | Float Material | Min. Specific Gravity | Operating Temperatures | Pressure, Max. |
--- | --- | --- | --- | --- | --- |
LS-3 | Polysulfone | Polysulfone | .75 | -40°F to +225°F (-40°C to +107°C) | 50 psi (3 bar) |
 | Polypropylene | Hollow Polypropylene | .60 | | |
 | Polypropylene (1” float) | Solid Polypropylene (1” float) | .90 | -40°F to +150°F (-40°C to +66°C) | 150 psi (10 bar) |
 | Solid Polypropylene (3/4” float) | Solid Polypropylene (3/4” float) | .95 | -40°F to +212°F (-40°C to +100°C) | Atmospheric |
 | PVDF | PVDF | .86 | -40°F to +250°F (-40°C to +121°C) | 50 psi (3 bar) |
LS-1700 | Brass | Buna N | .45 | Water to +180°F (82°C) | 50 psi (3 bar) |
 | Buna N | Buna N | | | |
 | 316 Stainless Steel | Teflon* | .85 | -40°F to +250°F (-40°C to +121°C) | 1000 psi (69 bar) |
LS-1755 | 316 Stainless Steel | 316 Stainless Steel | .90 | -40°F to +300°F (-40°C to +149°C) | 275 psi (19 bar) |

Dimensions

LS-3 – 1” (25.4 mm) floats

- 1/8” NPT and Straight Thread, M12x1.75, and 3/8”-16 mountings
- Float diameter as small as 3/4” (19.0 mm)
- Ideal for shallow tanks and restricted spaces, or for any low-cost, high volume use. LS-3 Series sensors are available in FDA or NSF Standard 61 compliant materials, including an all-PVDF version. Operate in specific gravities as low as .60.

LS-1700 Series – Alloy Stems

- Brass or stainless stems and mountings
- 1/8” NPT mounting
- Buna N or Teflon® float
- These are very durable sensors, with pressure capability up to 1000 PSI (69 bar) and temperatures to 250°F (121°C). Buna N float versions operate in specific gravities as low as 0.45, and are operation selectable (N.O. or N.C) by simply inverting the float on the stem.

LS-1755 Series – All Stainless Steel

- 1/8” NPT mounting
- 275 PSI (19 bar) pressure capability
- 316 stainless steel stem and float
- Their rugged construction is suitable for most corrosive or high-purity liquids, and for high temperatures and pressures. The LS-1755 float has a diameter of just 1-1/32” (26.2 mm).

Our Medical Equipment Specialists are ready to discuss your sensor requirements, so don’t hesitate to give us a call.

Gems Sensors
GemsSensors.com
800.378.1600
TurboFlow®
Flow Rate Sensors

Features
- Small, compact size
- Low liquid flow rates
- Fast response time
- High accuracy ±3%

Benefits
- Fits in tight spaces
- Reliable function at low flow rates
- Reacts quickly to starts & stops

Equipment Used On
- Dental sterilizers
- Tissue processing
- Heat exchanger for medical lasers
- Slide staining
- Hyper/Hypothermia systems

Flow Monitoring Applications
- Cooling loops
- Thermoregulation
- Wash/detergents

Gems TurboFlow® turbine flow rate sensors are ideal for medical equipment applications involving low flow liquid monitoring. The small turbine reacts quickly to on/off flow characteristics. This attribute, combined with a low cost and 0.5% repeatability, makes TurboFlow® sensors ideal candidates for replacing dispensing timer systems. Unlike existing timing systems, our proven turbine technology is not influenced by changes in system pressure caused by aging filters. Each sensor is 100% tested, ensuring years of service life. The sensor’s standard power and output specifications make it easy to retrofit to existing controllers.

Operating Principle
Fluid flow causes a bladed rotor inside the TurboFlow® body to turn at an angular velocity directly proportional to the velocity of the fluid measured. As the blades pass beneath a magnetic pickup coil, a frequency signal is generated. Each pulse is equivalent to a discrete volume of fluid. The frequency pulse is directly proportional to the rotor angular velocity and the flow rate. The waves are readily transmitted to local or remote electrical instrumentation.
## Specifications

### FT-110

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Range</td>
<td>0.1 to 8 GPM (0.38 to 30.3 LPM)</td>
</tr>
<tr>
<td>Wetted Materials</td>
<td></td>
</tr>
<tr>
<td>Body</td>
<td>Nylon 12</td>
</tr>
<tr>
<td>Turbine</td>
<td>Nylon 12 Composite</td>
</tr>
<tr>
<td>Bearings</td>
<td>PTFE/15% Graphite</td>
</tr>
<tr>
<td>Operating Pressure</td>
<td>200 PSI (14 bar)</td>
</tr>
<tr>
<td>Burst Pressure</td>
<td>2500 PSI (172 bar)</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-4°F to 212°F (-20°C to 100°C)</td>
</tr>
<tr>
<td>Viscosity</td>
<td>32 to 81 SSU (.8 to 16 Centistokes)</td>
</tr>
<tr>
<td>Filter</td>
<td>&lt;50 Microns</td>
</tr>
<tr>
<td>Input Power</td>
<td>5 to 24 VDC @ 8mA</td>
</tr>
<tr>
<td>Output (Hz)</td>
<td>NPN Sinking Open Collector @ 50mA Maximum</td>
</tr>
<tr>
<td></td>
<td>(1 to 2.2K Ohm Pull-Up Resistor Required)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3% of Reading</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.5% of Full Scale</td>
</tr>
<tr>
<td>Electrical Connection</td>
<td>Spade Terminals .110˝/248˝ x .031˝</td>
</tr>
<tr>
<td></td>
<td>(2.8/6.3 x .8 mm) or 3 ft. cable</td>
</tr>
<tr>
<td>Inlet/Outlet Ports</td>
<td>3/8˝ NPT Male (3/8˝ G Male also available)</td>
</tr>
</tbody>
</table>

### FT-210

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Range</td>
<td>0.03 to 0.66 GPM (0.1 to 2.5 LPM)</td>
</tr>
<tr>
<td>Wetted Materials</td>
<td></td>
</tr>
<tr>
<td>Body</td>
<td>Nylon 12 (Grilamid TR55)</td>
</tr>
<tr>
<td>Turbine</td>
<td>Nylon 12 Composite</td>
</tr>
<tr>
<td>Bearings</td>
<td>PTFE/15% Graphite</td>
</tr>
<tr>
<td>Operating Pressure</td>
<td>350 PSI (24 bar)</td>
</tr>
<tr>
<td>Burst Pressure</td>
<td>1400 PSI (97 bar)</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-4°F to 212°F (-20°C to 100°C)</td>
</tr>
<tr>
<td>Viscosity</td>
<td>32 to 70 SSU (.8 to 16 Centistokes)</td>
</tr>
<tr>
<td>Filter</td>
<td>&lt;50 Microns</td>
</tr>
<tr>
<td>Input Power</td>
<td>5 to 24 VDC</td>
</tr>
<tr>
<td>Output (Hz)</td>
<td>NPN Sinking Open Collector @ 20mA Maximum</td>
</tr>
<tr>
<td></td>
<td>Leakage Current 10μA (2K-10K Pull up resistor required)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3% of Reading</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.5% of Full Scale</td>
</tr>
<tr>
<td>Electrical Connection</td>
<td>9.4mm Spacing 3-pole DIN Connector (1˝ high)</td>
</tr>
<tr>
<td>Inlet/Outlet Ports</td>
<td>1/4˝ NPT (1/4˝ G Male also available)</td>
</tr>
</tbody>
</table>

## Dimensions

### FT-110

- **.866˝ (22.0 mm)**
- **1.18˝ (30.0 mm)**
- **.197˝ (5.0 mm)**
- **.569˝ (17 mm)**
- **.110˝ (2.8 mm)**
- **.248˝ (6.3 mm)**
- **3/8˝ MNPT or 3/8˝ G**
- **.315˝ (8.0 mm)**
- **.393˝ (10.0 mm)**
- **.197˝ (5.0 mm)**

### FT-210

- **.11˝ (2.8 mm)**
- **.83˝ (21.2 mm)**
- **1.11˝ (28.2 mm)**
- **.67˝ (17.0 mm)**
- **.43˝ (11.0 mm)**
- **1/4˝ NPT or 1/4˝ G**
- **1.77˝ (45.0 mm)**
- **.315˝ (8.0 mm)**
- **.70˝ (17 mm)**

---

Our Medical Equipment Specialists are ready to discuss your sensor requirements, so don't hesitate to give us a call.

Gems Sensors
GemsSensors.com
800.378.1600
Engineered Plastic Flow Switches

- FS-150 Series – 0.5 to 5 GPM (1.89 to 18.9 LPM)
- FS-380P Series – 0.25 to 2 GPM (0.95 to 7.57 LPM)
- FS-4 Series – 0.1 to 1.5 GPM (0.38 to 5.68 LPM)

Features
- Broad range of flow settings
- Small, compact housings
- Right angle and in-line designs
- Variety of configurations
- Primarily plastic construction

Benefits
- Monitor low and higher flow rates
- Space saving designs
- Adaptable to equipment configurations
- Non-clogging
- Easily customized to application or equipment
- Eliminates corrosion concerns

Equipment Used On
- Surgical lasers
- Dental lasers
- Cardiovascular surgical equipment
- Aesthetic laser systems
- Hyper/Hypothermia systems
- X-ray equipment

Flow Monitoring Applications
- Cooling loops
- Thermoregulation

Gems piston type flow switches sense true flow rather than interpret flow rates from temperature or pressure changes. Indirect sensing methods can generate erroneous results in a less-than-perfect system. The three Gems sensors shown here place a piston directly in the flow path for direct reaction to the fluid media. The engineered plastics offered deliver broad media compatibility with excellent temperature and pressure capability. Gems offers both straight-thru or 90° flow path models. Set points on these series range from 0.1 to 5 GPM (see comparisons on back).

Operating Principle
A piston, encapsulating a permanent magnet, is positioned in the flow path within the unit housing. When displaced by the pressure differential from fluid flow, this piston magnetically actuates a hermetically sealed SPST or SPDT reed switch within the unit. The piston metering land diameter precisely sets the actuation point by regulating bypass clearance. A stainless steel spring provides positive piston return as flow decreases. The reed switch, when actuated, can be used to operate remote alarms or indicators. Or, it may be integrated into automatic system controls.
Comparison Chart

<table>
<thead>
<tr>
<th></th>
<th>FS-150</th>
<th>FS-380P</th>
<th>FS-4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed Set Pts. GPM (LPM)</strong></td>
<td>0.5, 1.0, 2.0, 3.0, 4.0, 5.0 (1.9, 3.8, 7.6, 11.4, 15.1, 18.9)</td>
<td>0.25, 0.50, 1.00, 1.50, 2.00 (0.95, 1.89, 3.79, 5.69, 7.57)</td>
<td>0.1, 0.25, 0.5, 0.75, 1.0, 1.5 (0.38, 0.95, 1.89, 2.84, 3.79, 5.69)</td>
</tr>
<tr>
<td><strong>Primary Construction Material</strong></td>
<td>Polypropylene</td>
<td>Polypropylene</td>
<td>Ryton®</td>
</tr>
<tr>
<td><strong>Port Size</strong></td>
<td>1/2” MNPT</td>
<td>3/8” MNPT and 1/4” Quick Disconnect QDC Adapters: 1/4” MNPT, 1/4” BSPT, 3/8” MNPT, 3/8” BSPT, 1/4” and 3/8” O.D. Polytube, 1/4” Barb, 5/16” Barb, 3/8” Barb, 1/4” and 3/8” O.D. JG® with and without check valve</td>
<td>9/16”-18 UNF-2B Adapters: 1/8” FNPT, 1/4” FNPT, 1/2” Barb</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>0°F to 212°F (-18°C to +100°C)</td>
<td>0°F to 225°F (-18°C to 107°C)</td>
<td></td>
</tr>
<tr>
<td><strong>Max. Pressure @ 70°F (21°C)</strong></td>
<td>200 PSIG (14 bar)</td>
<td>125 PSI (9 bar)</td>
<td>250 PSIG (17 bar)</td>
</tr>
<tr>
<td><strong>Switch Rating Set Pt. Accy.</strong></td>
<td>SPST 20 VA ±15%</td>
<td>SPST 10 VA ±20%</td>
<td>SPST 20 VA ±15% max.</td>
</tr>
</tbody>
</table>

**Dimensions**

FS-150

This slim, inline switch reduces pressure drop to a minimum. It incorporates a unique, dual-diameter, internal bore and piston configuration to minimize flow constriction. Liquids are able to smoothly pass around the piston and flow through the switch body with little pressure loss to the line downstream. 150 micron filtration is recommended.

FS-380P Series

This is rugged flow switch whose inline design is less susceptible to clogging than most other flow sensors — just 100 micron filtration is recommended. Fixed set points and a simplified, straight-thru design make it a very dependable switch. Our 1/4” quick disconnect version features a host of snap-on mating fittings sold separately to fit most piping requirements.

FS-4 Series

This series makes flow protection economical for a broad range of applications, including medical sterilizers and dispensing equipment. A 90° flow path aids fluid system routing in many compact applications. Ryton® plastic housing provides superior temperature and pressure capability. 50 micron filtration is recommended.

Our Medical Equipment Specialists are ready to discuss your sensor requirements, so don't hesitate to give us a call.