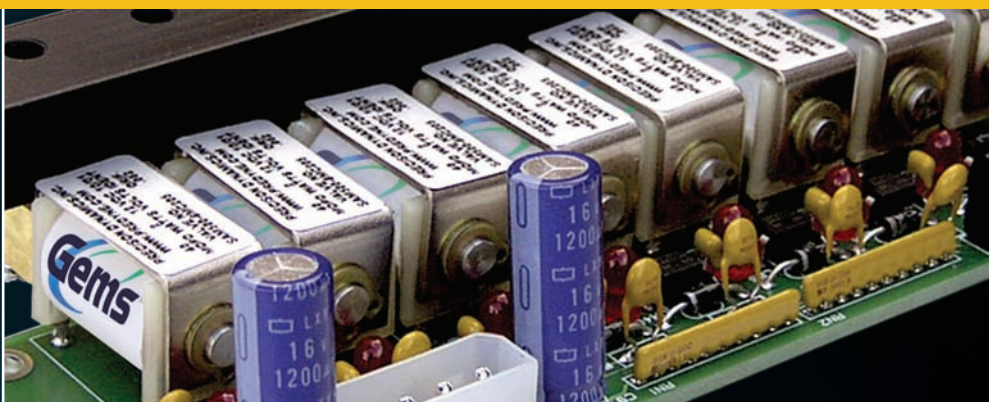


# sensors, controls and fluidic systems



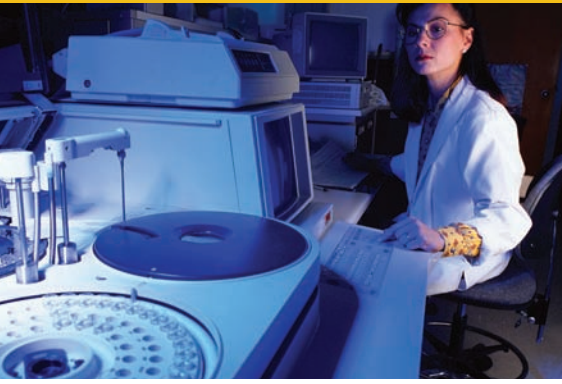
OUR EXPERIENCE

YOUR SOLUTION



product overview  
+ Master Product Catalog

# Our Experience | Your Solution



**Gems Sensors & Controls** is a leading manufacturer of a broad portfolio of liquid level, flow, and pressure sensors, miniature solenoid valves, solid-state electronics and fluidic systems. Decades of application engineering experience has given Gems the knowledge required to deliver tailored products that measure up to today's most sophisticated and critical applications. Working around the world with global resources, and to exact customer application and manufacturing requirements, products from Gems Sensors & Controls are used in almost every industry from medical to waste water treatment, semiconductor fabrication to off-highway vehicles and HVACR to food and beverage.

## Your Solution Partner

Supporting our customers with the best possible product while reducing time to market is our One Goal. To achieve it we apply a wealth of tools and global resources that include:

- A dedicated team of application engineers, with over 50 years of experience, who specialize in developing custom solutions to meet unique customer needs
- An extensive portfolio of thousands of proven designs that reduce the time required to successfully deliver your solution when it's needed
- A global direct sales force of experts in fluid level, flow and pressure sensors, controls, solenoid valves and associated fluidic systems
- The resources of Danaher Corporation, a Fortune 500 company; committed to quality, lean manufacturing, and ISO certification—with facilities in North America, Europe and Asia
- Dedicated tools and processes that eliminate product and process variation at every stage of manufacturing, including:
  - Design Failure Mode Effect Analysis (DFMEA)
  - Process Failure Mode Effect Analysis (PFMEA)
  - Process Capability Studies
  - Gauge Capability Studies
  - Design Verification and Validation
  - Corrective and Preventative Action (CAPA)
  - Lean Tools
  - 8D Problem Solving Methodology

Our Application Specialists are ready to discuss your system requirements. Contact us today at one of our global offices listed on the back cover. Full product details are available at [www.GemsSensors.com](http://www.GemsSensors.com)



## General Purpose

Providing 2- and 3-way functions and available in miniature and sub-miniature sizes, Gems general purpose solenoid valves deliver Flow Coefficients ( $C_v$ ) of .018 to .880. Select from NPT port, manifold or barbed connection types. Body materials include brass, stainless steel, acetal, aluminum, and polypropylene. Versions within this group will control operating pressure differentials up to 1000 psi (70 bar).

### Gems General Purpose Solenoid Valve Series:



All Gems valves are available with a wide range of options. Our modular designs can be easily configured to your specific application. For products with specifications not shown here please contact Gems.

## Cryogenic Valves to -320° F (-196° C)

These miniature 2-way valves can be configured for liquid nitrogen, liquid carbon dioxide and other extreme temperature media. Teflon® coated plungers, 316 stainless steel guide tubes and plunger springs, encapsulated coils, and Teflon® or Rulon™ seat seals produce a truly robust cryogenic valve for applications requiring high cycle life in extreme environments.



**Gems Cryogenic Solenoid Valve Series:**  
B-Cryo and D-Cryo.

## Isolation for High Purity or Aggressive Fluids

Available in miniature and sub-miniature sizes, these units feature a diaphragm design to isolate the media from the internal components. Diaphragm materials include Viton®, EPR, nitrile (NSF/FDA), perfluoroelastomer and EPDM. Numerous port configurations, voltage options, and coil constructions enable Gems Isolation valves to easily integrate into any complex or demanding system.

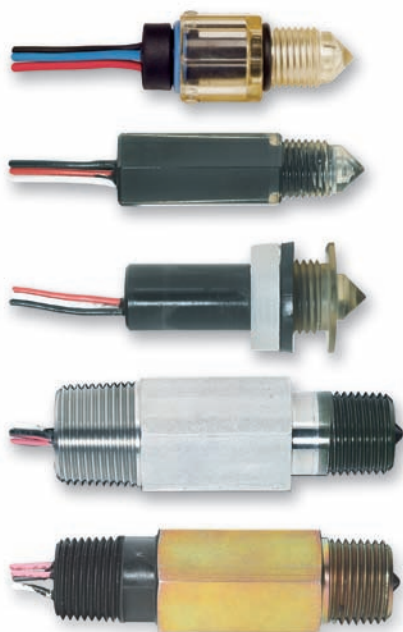
### Gems Isolation Solenoid Valve Series:



■ Switches

## Electro-Optic

Industry's largest selection of electro-optic liquid level sensors is right here at Gems. Compact design for a small footprint anywhere space is at a premium. Solid-state switching and no moving parts ensures dependability over long service life.



■ Switches

## Warrick® Conductivity

These single- or multi-point sensors have no moving parts. Stainless steel electrodes can be cut to desired length. Team with Gems conductivity controls to provide alarm, pump-up or pump-down control in electrically conductive liquids.



■ Switches

## Float

Available in a vast range of sizes, mountings and materials, Gems offers the broadest selection of float-type level switches anywhere. Using a proven reed switch design, float type switches deliver long, trouble-free service with precise repeatability. They are available in both single point and multi-point configurations. Multi-point switches monitor up to six levels with a single unit; lengths from a few inches (centimeters) to 10 feet (3 m).



top or bottom mounting  
single point

multi-point

side mounting

special purpose

includes bent stems, slosh shields, temperature sensing, siphon tubes and many others

■ Switches

## High Purity

Gems high purity sensors are designed for ultra-pure fluid applications. PTFE and PVDF resist build-up of foreign material and sticky media. These high-purity level sensors come in single, multi-point, float and electro-optic types.





■ Switches/Transmitters

## Ultrasonic

Gems ultrasonic switches and transmitters are ideal for applications requiring solid-state level measurement such as those with ultrapure, dirty, coating, scaling or corrosive-type liquids. Available in contact and non-contact single point, or multi-point versions. Up to four actuation levels or continuous measurement to 40 feet (12 m). Also available for small tanks less than 4 ft. (1.2 m). Made of polypropylene, PVDF, PFA.



■ Indicators

## DIPTAPE™ and DRUMTAPE™

Pop the cap, pull the tab—and up comes the tape to tell you exactly how much liquid remains in the tank or drum. Ideal for hazardous areas, DIPTAPE and DRUMTAPE indicators are non-electric, plus liquids and vapors remain sealed from the atmosphere. DIPTAPE indicators are designed for tanks; DRUMTAPE indicators fit 30 or 55 gallon storage drums. DIPTAPE and DRUMTAPE are available in alloy, all PVC and engineered plastic versions.



■ Switches

## Non-Intrusive

The ExOsense™ sensor is a break-through in liquid sensor technology. The unique, patented piezo-resonant transducer and microprocessor based electronic control module allow the sensor to accurately detect liquid levels non-intrusively from the outside of plastic bottles. ExOsense virtually eliminates all concerns over sensor compatibility, calibration and liquid media contamination.

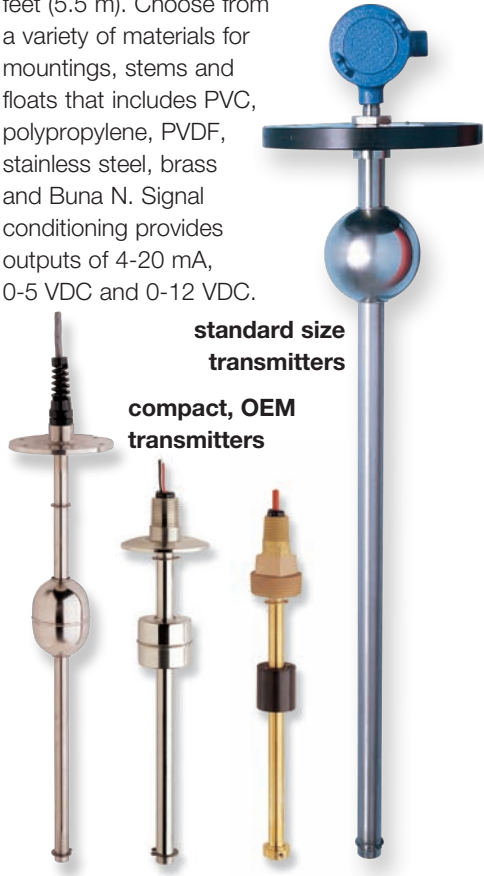
With simple “peel and stick” installation, liquid levels can be detected at any location on the container. The VHB® adhesive will permanently anchor the sensor in position for a lifetime of trouble free sensing.



■ Transmitters

## Float

Standard lengths offer measurement from a few inches (centimeters) to 18 feet (5.5 m). Choose from a variety of materials for mountings, stems and floats that includes PVC, polypropylene, PVDF, stainless steel, brass and Buna N. Signal conditioning provides outputs of 4-20 mA, 0-5 VDC and 0-12 VDC.



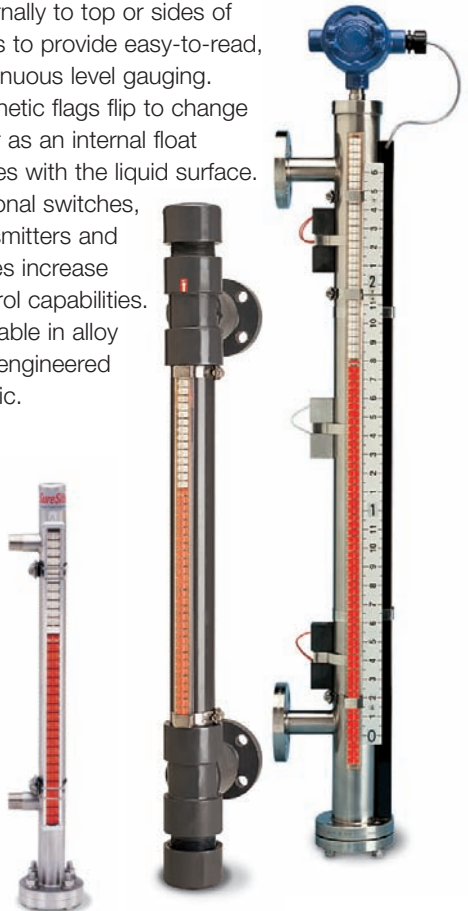
standard size transmitters

compact, OEM transmitters

■ Visual Level Indicators

## SureSite®

A more durable and safer alternative to breakable sight glasses. SureSite visual level indicators feature stainless steel, alloy or engineered plastic housings that mount externally to top or sides of tanks to provide easy-to-read, continuous level gauging. Magnetic flags flip to change color as an internal float moves with the liquid surface. Optional switches, transmitters and scales increase control capabilities. Available in alloy and engineered plastic.



■ Switches

## Piston/Diaphragm



Gems offers a choice of pressure switches, from compact cylindrical models for OEM use, to larger enclosed units for rugged process applications. A piston/diaphragm design, incorporating the high proof pressure of piston technology allows these switches to operate with the sensitivity and accuracy of a diaphragm design. Repeatability ranges from 0.2 to 2% of the highest set point. Enclosures include aluminum, stainless steel, baked-on enamel coating, reinforced plastic and zinc-plated steel. All are NEMA4 or NEMA4X certified.

■ Transducers

## Capacitive



Capacitive transducers are simple, durable and fundamentally stable. Variable capacitor technology, a rugged physical configuration, stainless steel wetted parts and a careful marriage of the mechanical assembly to the electronic circuitry combine to create highly repeatable transducers with low hysteresis and only .5% long-term-drift full scale per year, for low pressure applications. This large family of sensors includes models for positive pressures to 10,000 psi (700 bar), absolute vacuums, differential pressures, barometric pressure, low pressures (0-15 psi/ 0-1 bar), and clean-in-place 3A sanitary applications.

■ Switches

## Solid-State



Utilizing our proven pressure sensor and ASIC design, Gems solid state pressure switches offer greater accuracy and repeatability in high shock and vibration environments. They also provide an advantage over electromechanical switches when actuations exceed 50 cycles/minute and a broad frequency response is needed. Available with a large selection of pressure port and electrical connection options.

■ Transducers

## Submersible

9500 Series pressure transducers are designed specifically to meet the rigorous conditions for ground water monitoring while providing ultimate performance. They feature a true level reading through built in specific gravity compensation over a 23° F to 113° F (-5° C to 45° C) temperature range.

**2400 Series**



**9500 Series**



The 2400 Series features silicon-based Micro-Electro-Mechanical Systems (MEMS). Its complete 'system-on-chip' enables an ultra-slim design for bore hole applications.

Both series are impervious to the effects of water, even in the highest humidity and long-term submersion.



## ■ Transducers

### Sputtered Thin Film

Sputtered thin film technology provides years of worry-free measurements under demanding real-world conditions. Sputtered metallic strain gauge sensors have terrific thermal properties and superior stability specifications. Ideal for harsh applications demanding long-term service where precise laboratory-type measurements are required.



■ **4000 Series** — The King of Stability: just 0.06% drift per year (non-cumulative). A broad range of models include submersible, high temperature, and weather proof versions.



3100/3200 Series

■ **3100 Series** — Delivers an output signal for both temperature and pressure, providing full scale accuracy of 0.25% and long term drift to just 0.1% over the full scale per year. Unbeatable price to performance ratio in a compact package.

■ **3200 Series** — Features thicker diaphragm and pressure snubber to withstand pressure spikes and cavitation.

## ■ Transducers

### Chemical Vapor Deposition

Gems Chemical Vapor Deposition (CVD) pressure transducers and transmitters are based on a solid, proven technology. Our CVD instruments provide an effective method of overcoming the often severe limitations of other low-cost pressure measuring products. A state-of-the-art ASIC chip in each transducer provides greater linearity correction than traditional thermal compensation methods.



2600 Series



2200 Series

#### Thicker Diaphragm

Handles pulsating pressures—all stainless steel wetted parts.

#### CVD Sensor

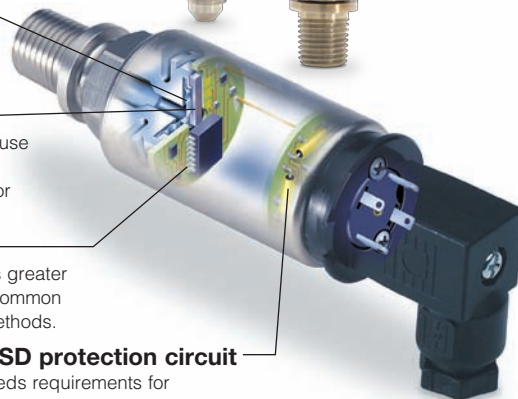
Stability and high sensitivity allow use of our thicker diaphragm. 17-4 PH SS sensor beam is laser welded for distortion-free construction.

#### ASIC Chip

Programmability provides greater linearity correction than common thermal compensation methods.

#### RFI/EMI & ESD protection circuit

Meets and exceeds requirements for CE marking. Protecting against noise, voltage spikes and static discharge.



■ **1200/1600 Series** — 4X full-scale proof pressure. Typical 0.5% full-scale accuracy.

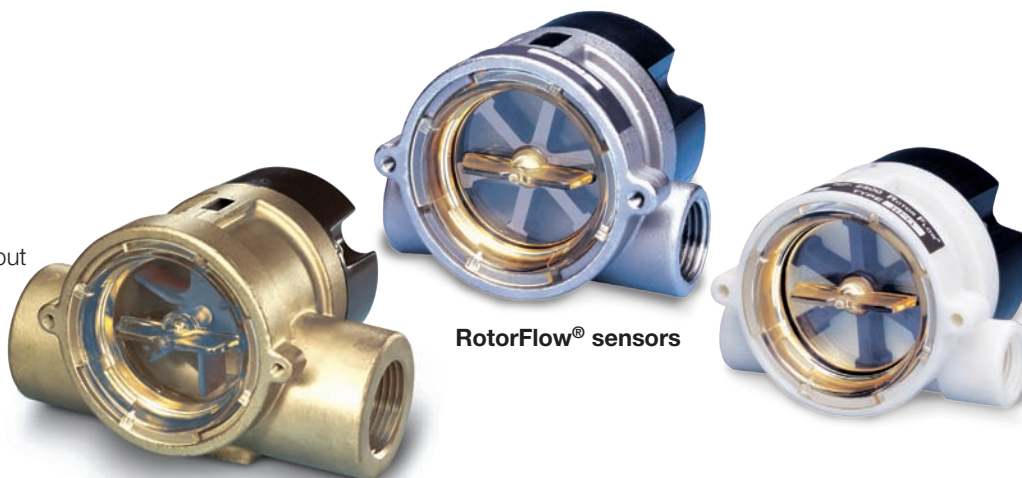
■ **2200/2600 Series** — 2X full-scale proof pressure. Typical 0.25% full-scale accuracy.

■ **6000 Series** — 5 to 1 turndown. Typical 0.15% full-scale accuracy.

■ Sensors/Indicators

## Electronic

**RotorFlow®:** These highly visible, paddle wheel designs offer accurate visual indication, flow rate sensing and switching. The visual indication is combined with a choice of either pulsed DC output 0-10V DC analog or adjustable 1 Amp switched output. Available with brass, stainless steel or hydrolytically-stable polypropylene housings. Line sizes: 1/4" to 1" (.64 to 2.5 cm). Adjustable settings: 0.1 to 60 GPM (.38 to 227 l/m).



RotorFlow® sensors

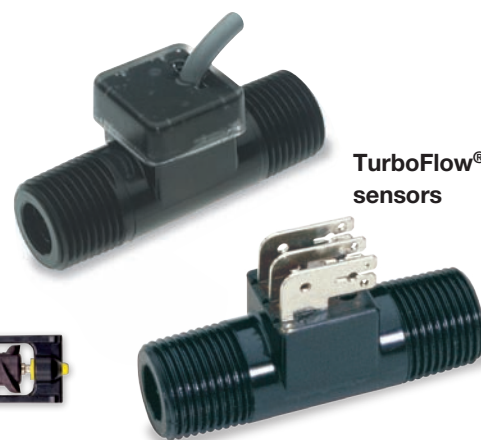
■ Switches

## Piston

Proven piston switch technology delivers high repeatability and precise calibration for liquids or gases. Fixed setpoints range from a low 50 cc/min to 1.5 GPM (5.7 l/m); adjustable version features setting of 0.5 to 20 GPM (2 to 76 l/m). Special capability versions offer viscosity compensation, and high pressure handling to 1,500 PSIG (103 bar). Brass, plastic or stainless steel bodies.



**TurboFlow®:** Ultra-compact TurboFlow® low flow rate sensors provide continual measurement ranging from 0.1 to 8 GPM (0.5 to 30 lpm). Their Hall-effect sensor delivers accuracy to  $\pm 3\%$  of reading and 0.5 % repeatability. Lightweight, they mount in any position. Incorporate flow sensing into custom assemblies with the tiny TurboFlow® Insert.



TurboFlow® sensors

Tiny TurboFlow® insert

■ Switches

## Paddle

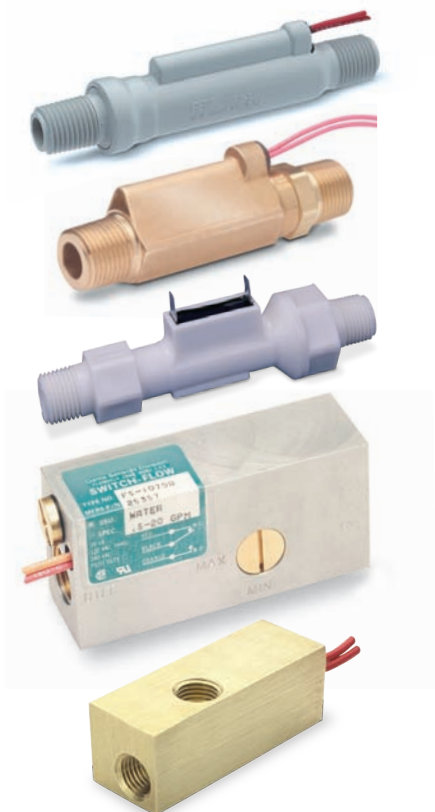
Flow/No-Flow detection for pipes with 1-1/4" (3 cm) diameter and up. Paddles are cut to length for desired actuation setting (from 1-1/4" to 5-1/2" (3 to 14 cm)). Unique, patented cam design assures low pressure drop and does not require bellows, seals or mechanical linkages.



■ Switches

## Shuttle

For monitoring water and oil—in line sizes 1/2" to 3" (2.5 to 7.6 cm). Accurate with 1% repeatability and low-pressure drop. Plastic, bronze, stainless steel and marine grade housings. Fixed settings from 0.5 to 100 GPM (1.9 to 378.5 l/m); adjustable settings from 0.75 to 15 GPM (2.8 to 56.8 l/m).





■ Solid-State

## Intrinsically Safe Relays and Controls

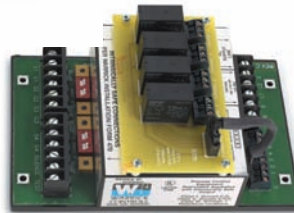
Render any non-voltage-producing sensor, switch or conductivity electrode intrinsically safe with these relays and barriers from Gems. They amplify sensor load-handling capabilities in a wide range of AC and DC control switching applications. They are designed for easy installation in standard circuit boxes in non-hazardous areas. The amount of energy they send to sensors and switches within hazardous areas is insufficient to cause ignition of a specific hazardous atmospheric mixture in its most ignitable concentration.

In addition to safety, they offer great economy by reducing your need for costly explosion-proof sensors, switches, controls and housings. Solid-state reliability assures consistent performance, and with a completely encapsulated construction they are impervious to dust, moisture or foreign material. Select from a broad choice of Safe-Pak® and Warrick models.



**Warrick®**  
Series 17/27  
conductivity  
level control

Series 47  
4-channel  
relay alarm  
panel control



■ Electrical

## Standard and Custom Warrick® Panels

Gems manufactures both custom and standard control panels, bearing the safety mark of UL or CSA, for use in hazardous (UL 913) and non-hazardous (UL 508A) locations. We offer a complete selection of controls including electromechanical and solid-state relays, timers, alternators, motor starters,

transformers, alarms, indicator lights and more.



single- and  
multi-function  
control panels



**RA-431**  
alarm panel



**Model 2800**  
moisture detector



**DMS-470/570 Series**

■ Solid-State

## Standard Relays and Conductivity Level Controls

These relays boost your sensor's load handling ability in non-hazardous locations with the reliability and advantages inherent in solid-state controls. Available with plug-in bases, open board or threaded terminals.

**Warrick®**  
Series 16M/26M



■ Electromechanical

## Warrick® Series 1 Controls

Offering two- or three-pole output contacts with 16 amp rating, these versatile controls can be configured for single-level service, differential control, low water cutoff (with manual reset or lock-out capability) control and many other functions.



■ Transmitters

## Receivers

Your sensors know what's going on, but you're still in the dark without one of Gems receivers. Each receiver features all the calibration adjustments needed to complete a continuous level indication system.



compact level cubes and  
panel mounted receivers



Fluidic systems are the key to your success and Gems makes it happen. By leveraging our expertise and technologies, Gems is able to deliver custom, engineered solutions, fluidic modules and integrated sub-assemblies better than any other company in the world.

Gems experience and passion for providing solutions to OEMs produces further benefits to our customers, including:

- Collaborative Engineering
- Reduced Development Costs
- Quicker Time to Market
- Reduced Supplier Base
- Managed Inventory

By freeing up their resources our customers can focus on their core competencies.

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, exactly when customers request delivery.

With more than 50 years 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 fast with the best possible solution.







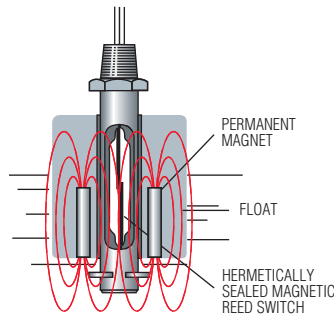
OUR EXPERIENCE ■ YOUR SOLUTION

Level | Pressure | Flow | Solenoid Valves

# Float Type Level Switches

## Single Point

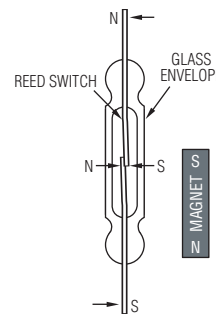
GEMS Level Switches operate on a direct, simple principle. In most models, a float encircling a stationary stem is equipped with powerful, permanent magnets. As the float rises or lowers with liquid level, the magnetic field generated from within the float actuates a hermetically sealed, magnetic reed switch mounted within the stem. The stem is made of non-magnetic metals or rugged, engineered plastics. When mounted vertically, this basic design provides a consistent accuracy of  $\pm 1/8$  inch. Multi-station versions use a separate reed switch for each level point being monitored.



Side-mounted units use different actuation methods because of their horizontal attitude. The basic principle, however, is the same: as a direct result of rising or falling liquid, a magnetic field is moved into the proximity of a reed switch, causing its actuation.

## Reed Switch Reliability

The durable construction of these reed switch designs ensures long, trouble-free service. Because the effects of shock, wear and vibration are minimized, these hermetically sealed switches provide precise repeatability with no more than 1% deviation. The switch actuation points remain constant over the life of the unit. See "Reed Switch Protection" in Appendix X for information on extending the life of GEMS Level Switches.



## Wide Variety

### Top/Bottom Mounting



### Side Mounting



### Specialty



Additional technical information can be found in Appendix X.

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Alloy.....	A-8
Large Size	
Engineered Plastic.....	A-12
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Specialty Switches.....	A-20
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LEVEL SWITCHES - SINGLE POINT



## Small Size – Engineered Plastics

### LS-3 Series – Offers High Reliability, Compact Size and Low Costs in NPT, Straight and Metric Threads

Ideal for shallow tanks or restricted spaces, or for any low-cost, high volume use. LS-3 Series are available in FDA compliant materials, consult GEMS for details.

LEVEL SWITCHES – SINGLE POINT

Polysulfone Float



For water based liquids, with limited use in oils and chemicals.

Polypropylene Float (Hollow)



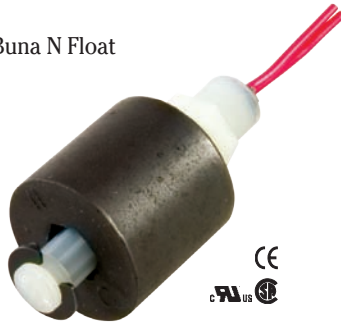
Features a low specific gravity float offering broad chemical compatibility.

Polypropylene Float (Solid)



With Polypropylene stem and float, switch offers broad chemical compatibility.

Buna N Float



Ideal for oils and fuels.

ALL-PVDF



Stem and float of corrosion-resistant PVDF for ultra-pure applications.

New 3/4" Polypropylene Float



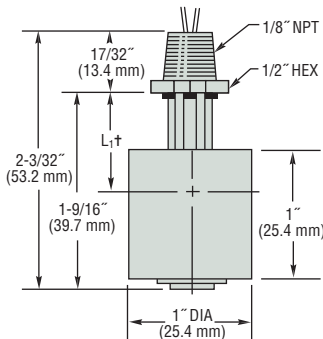
See next page for details.

### Common Specifications

**Approvals:** U.L. Recognized – File No. E45168; CSA Listed – File No. 30200. CE Declaration Available Upon Request. NSF materials are Standard 61 compliant. For NSF approved level switches contact Gems.

**Switch SPST:** 20 VA, 120-240 VAC. Units are shipped N.O. unless otherwise specified. Selectable, N.O. or N.C., by inverting float on unit stem.

### Dimensions – 1" Float Models only



† L<sub>1</sub> = Actuation Level (see chart below)

Electrical Termination	Alternate Mountings		
	3/8"-16 Straight Thread	G1/8" 1/8"-28 BSP	M12x 1.75 Straight Thread
Lead Wires			
Cable			

**How To Order – Select Part Number based on specifications required.**

Stem and Mounting Material	Float Material	Float Dia.	Actuation Level <sup>1</sup>	Min. Liquid Sp. Gravity	Pressure Max. @ 70°F (21°C)	Operating Temperature	Mounting Type	Electrical Termination	Part Number
Polysulfone	Polysulfone	1"	3/4" (19.0 mm)	.75	50 psi (3 bar)	-40°F to +225°F (-40°C to +107°C)	1/8" NPT	Lead Wires	<b>42295</b> ⚡
Polypropylene <sup>2</sup>	Polypropylene (Hollow)	1"	13/16" (20.6 mm)	.60	50 psi (3 bar)	-40°F to +225°F (-40°C to +107°C)	1/8" NPT	Lead Wires	<b>142505</b> ⚡
							3/8"-16	Lead Wires	<b>171517</b>
							G 1/8"-28	Cable	<b>171518</b>
							M12x1.75	Cable	<b>189739</b>
Polypropylene <sup>3</sup> NSF Std. C-2 (Kynar float retaining clip)	Polypropylene <sup>3</sup> (Hollow) NSF Std. C-2	1"	13/16" (20.6 mm)	.60	50 psi (3 bar)	-40°F to +225°F (-40°C to +107°C)	1/8" NPT	Lead Wires	<b>209475</b>
							3/8"-16	Lead Wires	<b>209455</b>
							G 1/8"-28	Lead Wires	<b>209460</b>
							M12x1.75	Lead Wires	<b>209465</b>
Polypropylene <sup>2</sup>	Polypropylene (Solid)	1"	9/16" (14.3 mm)	.90	150 psi (10 bar) @ 68°F (20°C)	-40°F to +150°F (-40°C to +66°C)	1/8" NPT	Lead Wires	<b>116826</b> ⚡
							3/8"-16	Lead Wires	<b>171514</b>
		3/4"	7/16" (11.1 mm)	.95	Atmospheric	-40°F to +176°F (-40°C to +80°C)	M12x1.75	Cable	<b>189787</b>
Nylon	Buna	1"	13/16" (20.6 mm)	.45	150 psi (10 bar)	-40°F to +250°F (oil) (-40°C to +121°C [oil])	1/8" NPT	Lead Wires	<b>162745</b> ⚡
							M12x1.75	Cable	<b>189786</b>
		3/4"	11/16" (17.5mm)	.85	150 psi (10.3 bar)	-40°F to +176°F (water) (-40°C to +80°C [water])	1/8" NPT	Lead Wire	<b>177818</b>
PVDF	PVDF	1"	1/2" (12.7 mm)	.86	50 psi (3 bar)	-40°F to +250°F (-40°C to +121°C)	1/8" NPT	Teflon Jacketed Lead Wires	<b>173250</b>

Notes:

1. Based on a liquid specific gravity of 1.0.
2. All Polypropylene units carry a Kynar retaining clip. Accessories Available in OEM Quantities: Jam Nut, Gaskets, and Slosh Shields.
3. NSF C-2 Approved unit, for water use only.

⚡ – Stock Items.

## 3/4" Diameter Floats for Tiny Tanks

### Our smallest LS-3 yet!

- ▶ Reliable alternative to more expensive electronic sensors.
- ▶ Fits smaller devices. Less material, lower cost.
- ▶ Proprietary float more buoyant than competitors.

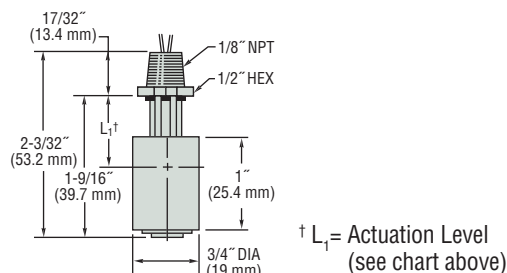
Small yes, but with BIG performance. No other 3/4" float switch on the market matches our LS-3 specs. These units are ideal for potable water, medical devices and other compact appliances, such as printers. Gems proprietary float enables use in lighter-than-water fluids. NSF/ FDA compliant models available at your request. Please consult factory.

### Specifications

Wetted Material	
<b>Stem and Mounting</b>	
P/N 201540	Polypropylene with Kynar retaining clip
P/N 177818	Nylon
<b>Float</b>	
P/N 201540	Polypropylene
P/N 177818	Buna-N
<b>Operating Temperature, Max.</b>	
P/N 201540	212°F (100°C)
P/N 177818	250°F (121°C) oil, -40°F to +176°F (-40°C to +80°C)
<b>Pressure, Max.</b>	
P/N 201540	Atmospheric
P/N 177818	150 psi (10.3 bar)



### Dimensions



### Order by Part Numbers:

- LS-3, 3/4" Polypropylene Float: 201540**
- LS-3, 3/4" Buna-N Float: 177818**



## Unique Features Make These LS-3 Models Special

These small switches feature unique configurations for special applications.

LEVEL SWITCHES – SINGLE POINT

Part No. 142545  
With Slosh Shield



Cut-away version shown

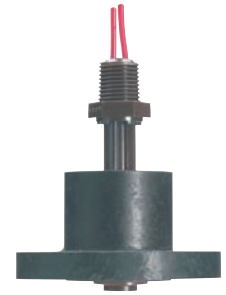
Compact, all-polypropylene switch with slosh shield is ideal for use with turbulent liquids in small tanks. FDA compliant materials.

Part No. 46999  
Bottle Level

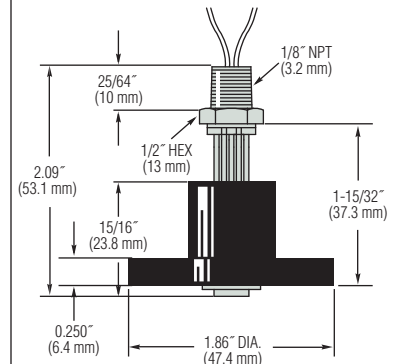
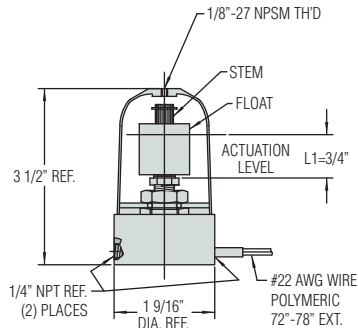
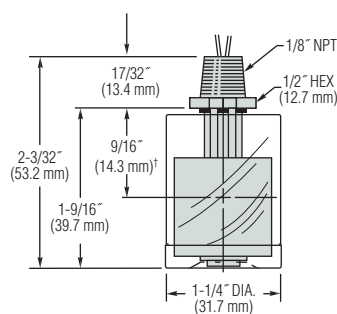


For external mounting on tanks too small to accommodate internally mounted switches. (See note below)

Part No. 76707  
For Low Level



For detecting levels as low as 5/8" from tank bottom. Use in water, some oils and chemicals.



Order By Part Number	142545 ⚡	46999 ⚡	76707 ⚡
<b>Materials</b>			
<b>Stem and Mounting</b>	All Polypropylene (Including Shield <sup>4</sup> )	Polysulfone	All Polysulfone (Including Collar)
<b>Float</b>	Polypropylene (Solid)	Polysulfone	Buna N
<b>Other Wetted</b>	—	Brass, Aluminum, Polycarbonate, Viton A	Epoxy
<b>Min. Liquid Sp. Gr.</b>	.90	.75	—
<b>Operating Temperature</b>	-40°F to +150°F (-40°C to +65.6°C)	-40°F to +120°F (-40°C to +48.9°C)	-40°F to +180°F (-40°C to +82.2°C)
<b>Pressure, PSI, Max.<sup>3</sup></b>	150	50	
<b>Switch<sup>1</sup>, SPST</b>	20 VA, N.C./N.O. Dry <sup>2</sup>	20 VA, N.C. Dry	
<b>Electrical Termination</b>	No. 22 AWG, 22" L., PVC Lead Wires	No. 22 AWG, 72" L., Polymeric Lead Wires	No. 22 AWG, 72" L., PVC Lead Wires

Notes:

- See "Electrical Data" on Page X-5 for more information.
- Switch operation is selectable, N.O. or N.C., by inverting the float on the unit stem.
- Maximum pressure at 70°F (21°C).
- Consult factory for other available materials.

† L<sub>1</sub> = Switch actuation level, nominal (based on a specific gravity of 1.0).

Note: LS-3 Series Bottle Level Switch is also available with any of the float materials shown on opposite page. Contact GEMS for correct part number.

⚡ – Stock Items.

## LS-7 with 5 Amp Relay

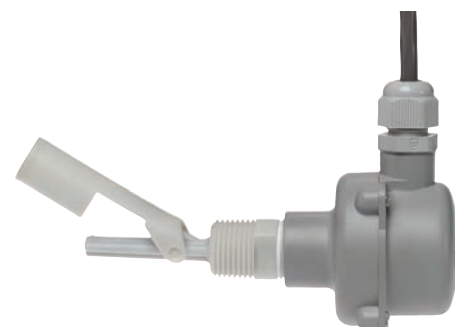
### ▶ O-Ring Sealed, Water Resistant J-Box

An SPDT relay enables this LS-7 to control two independent loads up to 5 amps each. Switching N.O. for one load and N.C. for the other. This unit is designed to operate with a load connected to each of the two outputs. These loads must be 10 watts, minimum, for correct SPDT switching. One load used alone must be connected to the N.O. terminal. With this load, which may be less than 10 watts, the unit will operate the same as an SPST unit.

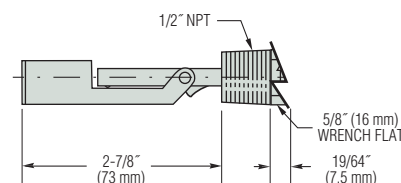
### Specifications

<b>Wetted Materials</b>	Polypropylene
<b>Min. Liquid Specific Gravity</b>	0.55
<b>Operating Temperature</b>	-40°F to +250°F (-40°C to +121°C)
<b>Operating Pressure</b>	100 psi @ 70°F, max.
<b>Float Arc Envelope</b>	1.50"
<b>J-Box with 5A Relay</b>	120 VAC 50/60 Hz Contacts: 5A – 240 VAC Res 1/3 HP – 120 VAC 5A – 28 VDC Res

Order by Part Number: 181291



### Dimensions



## LS-1 – Miniature Level Switch

- ▶ Extremely Compact
- ▶ Easy Installation
- ▶ Low Cost

This miniature level switch feature an all-polypropylene stem and float construction for broad chemical compatibility. Fluted stem resists solids build-up. Float is held in place with integral stem tangs, which simultaneously eliminates a separate retaining ring and makes inverting the float for reversing switch actuation very easy.

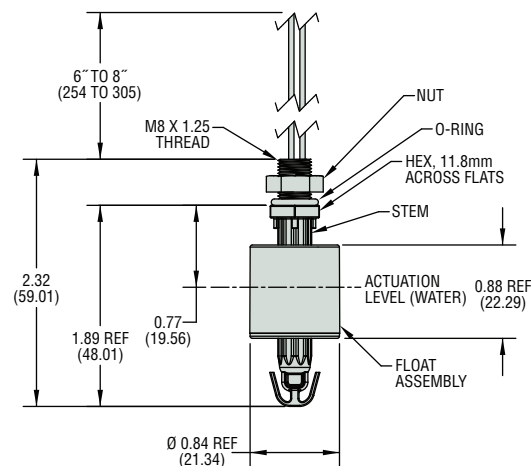
### Specifications

<b>Wetted Materials</b>	Polypropylene
<b>Stem and Float</b>	Polypropylene
<b>O-Ring</b>	EPDM
<b>Mounting Threads</b>	M8 x 1.25"
<b>Min. Liquid Specific Gravity</b>	0.70
<b>Operating Temperature</b>	0°F to 175°F (-17°C to +79°C)
<b>Operating Pressure</b>	0 to 5 psig (0 to 0.3 bar)
<b>Electrical Termination</b>	22 AWG, 6"-8" PVC Jacketed Lead Wires (Black)
<b>Switch Operation</b>	N.O. Dry (May be converted to N.C. Dry by inverting float on stem)
<b>Mounting Attitude</b>	Vertical with lead wires up.

Order by Part Number: 602881



### Dimensions





# Small Size – Engineered Plastics

## LS-7 Series–Compact Side Mounts are the Solution to Many Small Tanks

These low-cost units are ideal for high volume use in small tanks and vessels. Engineered plastics construction offers broad compatibility in water, oils and chemicals.

LEVEL SWITCHES – SINGLE POINT

Type 3 Internal Mounting	Type 5 External Mounting	Type 7 External Mounting
<p>UL US CE</p> <p>Polypropylene or Nylon.</p>	<p>UL US CE</p> <p>Polypropylene or Nylon.</p>	<p>UL US CE</p> <p>Polypropylene or Nylon; conduit connection.</p>
<p>ZIP CORD LEADWIRES, 24" EXTENDED</p> <p>3.84" (97.5 mm)</p> <p>GASKET (WHITE BUNA N INCLUDED)</p> <p>5/8"-11 THREAD</p> <p>LOCKING NUT (NYLON)</p> <p>2-3/4" (69.8 mm)</p>	<p>ZIP CORD STYLE 24" LEADWIRES</p> <p>4-1/4" (108 mm)</p> <p>5/8" (16 mm)</p> <p>2-7/8" (73 mm)</p> <p>5/8" HEX</p> <p>1/2" NPT</p>	<p>LEAD WIRES, 24" EXTENDED</p> <p>1/2" NPT</p> <p>4-1/2" (114 mm)</p> <p>5/8" (16 mm) WRENCH FLAT</p> <p>19/64" (7.5 mm)</p> <p>2-7/8" (73 mm)</p>

### Common Specifications

**Switch Rating\*:** SPST, 20VA

**Lead Wire Gauge:** No. 22 AWG

**Approvals:** All LS-7 Series switches on this page are U.L. Recognized – File No. E45168, and are CSA Listed-File No. 30200. For NSF approved level switches contact Gems.

**Mounting Attitude:** Horizontal.

\*See "Electrical Data" on Page X-5 for more information.

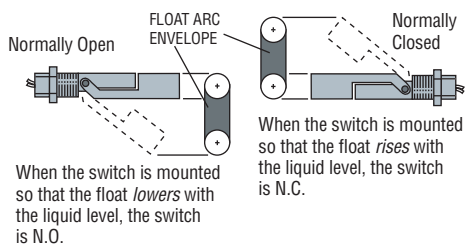
### Media Compatibility

Media	LS-7 Compatible Types
Oil, Fuel, Hydrocarbons	Nylon
Broad Range of Chemicals and Water	Polypropylene
Limited Chemicals and Water	Noryl®

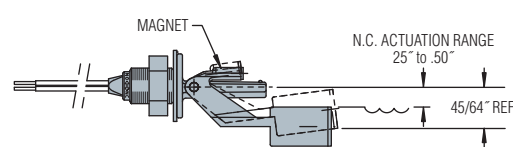
### Switch Operation

Depending on the mounting position, the float on these switches can rise or lower with the liquid level. By rotating the switch 180°, the switch operation can be Normally Open or Normally Closed (except Type 12).

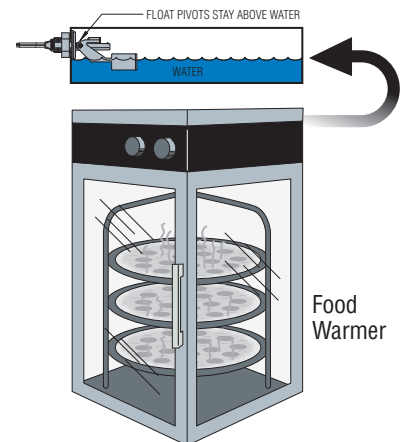
Types 3, 5, 7, 10 and 13






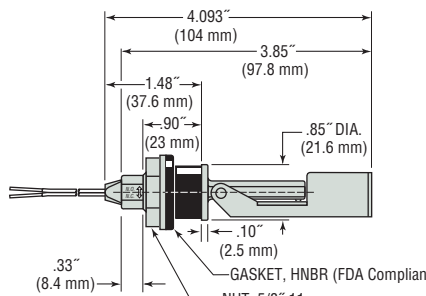
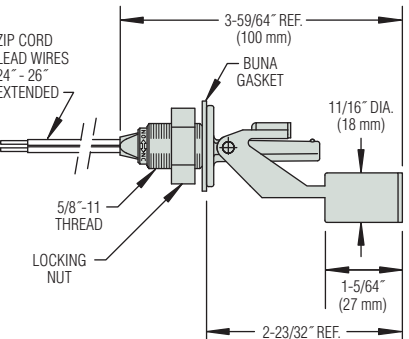
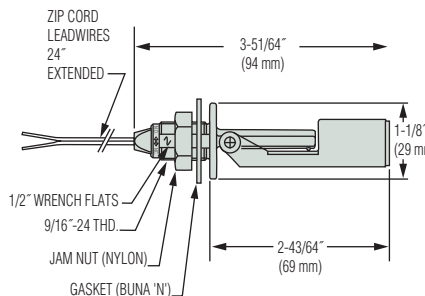
Type 12 – N.C. "Drop Float" Design



The LS-7 Type 12 is ideal for use on food warmers, hot water heaters, steam cookers, small boilers or wherever water evaporation occurs. The switch is used effectively for either high fluid level alarms or water make up systems. The units are made of Noryl®, which carries both NSF and WRC approval for use in potable water, and are supplied with FDA-approved Buna gaskets.



- ▶ Nylon is ideal for oils and fuels.
- ▶ NSF Standard 61 polypropylene is ideal for potable water and broad chemicals.

Type 10 External Mounting	Type 12 Internal Mounting	Type 13 Internal Mounting
 <p>Externally mounts through and seals non-threaded holes using a HNBR compression gasket.</p>	 <p>Side mount "Drop Down" design for calcifying hot water applications. NSF and WRC compliant Noryl®.</p>	 <p>Polypropylene or Nylon.</p>
 <p>Note: Recommended hole size = 7/8" dia. x 1/32" - 5/32" thick panel.</p>		

How To Order – Select Part Number based on specifications required.

Mounting Type	Materials*			Min. Liquid Sp. Gr.	Operating Temperature	Operating Pressure, Max.	Float Arc Envelope	Part Number
	Stem and Mounting	Float	Lead Wire Jacket					
3	Nylon	TPE†		.65	-40°F to +250°F (-40°C to +121.1°C)	100 psi @ 70°F	2.20	165570 ⚡
	Polypropylene			.55	-40°F to +225°F (-40°C to +107.2°C)			164520 ⚡
5	Polypropylene	TPE†		.55	-40°F to +225°F (-40°C to +107.2°C)	100 psi @ 70°F	1.25	131100 ⚡
	Nylon			.65	-40°F to +250°F (-40°C to +121.1°C)			140620 ⚡
7	Polypropylene	TPE†		.55	-40°F to +225°F (-40°C to +107.2°C)	100 psi @ 70°F	1.50	160450 ⚡
	Nylon			.65	-40°F to +250°F (-40°C to +121.1°C)			160460 ⚡
10	Polypropylene	TPE†		.55	-40°F to +225°F (-40°C to +107.2°C)	50 psi @ 70°F	2.08	165800 ⚡
	Nylon			.65	-40°F to +250°F (-40°C to +121.1°C)			165900 ⚡
12	Noryl®	TPE†		.80	-40°F to +225°F (-40°C to +107.2°C)	100 psi @ 70°F	.70	191080 ⚡
13	Polypropylene	TPE†		.55	-40°F to +225°F (-40°C to +107.2°C)	100 psi @ 70°F	2.20	197050 ⚡

\* Polysulfone and Ryton® R-4 are available upon request.  
 † Thermoplastic Elastomer Zip Cord, 22 AWG.  
 Note: NSF C2 Versions available. Contact factory.

⚡ – Stock Items.

See alloy versions on next page.

LEVEL SWITCHES – SINGLE POINT

## Small Size - Alloys

### LS-7 Series - Compact Alloy and Alloy/Plastics Side Mounts

Built for durability, our LS-7 Series switches utilize stainless steel, or zinc bodies. Ideal for any small tank or vessel destined for a rugged environment. All-stainless steel material of construction of Types 9 and 11 is generally recognized as safe with FDA for food contact regulations.

LEVEL SWITCHES - SINGLE POINT

Type 6 - External Mounting



Polysulfone float. Zinc alloy body with polypropylene or nylon float. SAE Mounting.

Type 8 - External Mounting



Zinc alloy body with nylon or polypropylene float.

Type 9 - External Mounting



316 Stainless Steel body with 316 SS, nylon or polypropylene float.

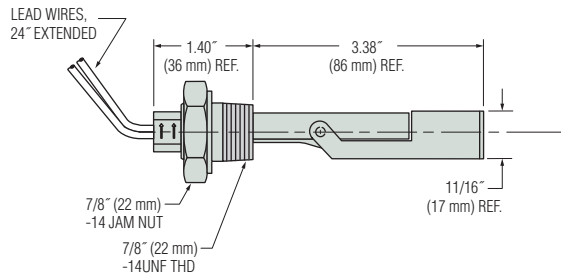
Type 11 - Internal Mounting



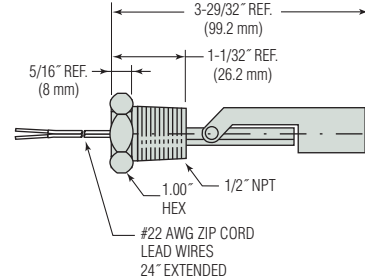
316 Stainless Steel body with 316 SS float.

### Dimensions

Type 6



Type 8



### Common Specifications

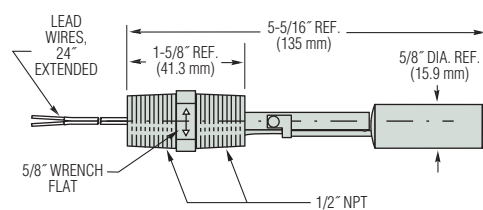
**Switch Rating\*:** SPST, 20VA

**Lead Wire Gauge:** No. 22 AWG

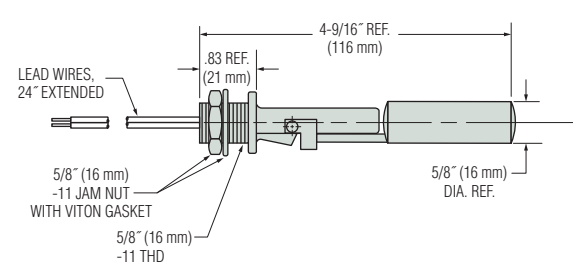
**Mounting Attitude:** Horizontal.

\*See "Electrical Data" on Page X-5 for more information.

Type 9



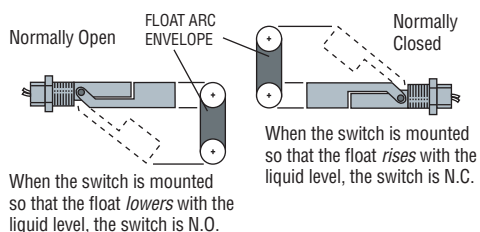
Type 11





### Switch Operation

Depending on the mounting position, the float on these switches can either rise or lower with the liquid level. By rotating the switch 180°, the switch operation can be Normally Open or Normally Closed.



### How To Order – Select Part Number based on specifications required.

Mounting Type	Materials			Min. Liquid Sp. Gr.	Operating Temperature	Operating Pressure, Max.	Float Arc Envelope	Part Number
	Stem and Mounting	Float	Lead Wire Jacket					
6	Zinc Alloy*	Nylon	TFE†	.65	-40°F to +250°F (-40°C to +121°C)	100 psi @ 70°F	1.36	<b>155660</b>
		Polypropylene		.75	-40°F to +225°F (-40°C to +107°C)	150 psi @ 70°F	1.36	<b>179870</b>
8	Zinc Alloy*	Nylon	TFE†	.65	-40°F to +250°F (-40°C to +121°C)	100 psi @ 70°F	1.40	<b>160950</b>
		Polypropylene		.55	-40°F to +225°F (-40°C to +107°C)	150 psi @ 70°F	1.40	<b>162795</b>
9	316 Stainless Steel	316 S.S.	TFE†	.80	-40°F to +300°F (-40°C to +149°C)	300 psi @ 70°F	1.43	<b>164870</b> ⚡
		Nylon		.65	-40°F to +250°F (-40°C to +121°C)	100 psi @ 70°F	1.40	<b>164850</b>
		Polypropylene		.55	-40°F to +225°F (-40°C to +107°C)	100 psi @ 70°F	1.40	<b>164860</b>
11	316 Stainless Steel		Teflon®	.80	-40°F to +300°F (-40°C to +149°C)	300 psi @ 70°F	1.65	<b>179445</b>

†Thermoplastic Elastomer Zip Cord.

⚡ – Stock Items.

**\*Zinc Alloy Material Note:**

When mounted in certain cathodic metals, including stainless steel, and used in water-based liquids, galvanic corrosion may occur. Consult factory for information.

## Small Size – Alloys

Rugged Durability, With Broad Heat and Pressure Capabilities, are Hallmarks of These Compact Switches

Ideal for shallow tanks or restricted spaces, or for low-cost, high volume use.

LS-1700 Series – Buna N Float



LS-1700 Series – Teflon® Float



LS-1750 Series – All Stainless Steel



LS-1755 Series – All Stainless Steel



Offer broad chemical compatibility for general purpose use. Also ideal for oils and water.

Rugged construction suitable for most corrosive liquids, and for high temperatures and pressures. Stainless steel is generally recognized as safe (GRAS) with FDA for food contact regulations.

### Dimensions

LS-1700 Series		LS-1750 Series		LS-1755 Series			
Buna N Float		Teflon® Float		Stainless Steel Float and Stem			
<p>Dimensions: 2-1/16" (52.4 mm) total height, 1-1/2" (38.1 mm) float height, 1" (25.4 mm) stem height, 1" DIA. (25.4 mm) float diameter, 1/2" HEX (12.7 mm) stem, 1/8" NPT top.</p> <p><math>L_1 = 9/16"</math> (14.2 mm) N.O.; <math>13/16"</math> (20.6 mm) N.C.</p>		<p>Dimensions: 2-1/16" (52.4 mm) total height, 1-1/2" (38.1 mm) float height, 3/4" (19.1 mm) stem height, 1" DIA. (25.4 mm) float diameter, 1/2" HEX (12.7 mm) stem, 1/8" NPT top, includes SPRING and FLAT WASHER.</p> <p><math>L_1 = 1/2"</math> (12.7 mm) N.O. and N.C.</p>		<p>Dimensions: 2-1/16" (52.4 mm) total height, 1-1/2" (38.1 mm) float height, 1" (25.4 mm) stem height, 1-1/2" DIA. (38.1 mm) float diameter, 1/2" HEX (12.7 mm) stem, 1/8" NPT top.</p> <p><math>L_1 = 5/8"</math> (15.7 mm) N.O.; <math>3/4"</math> (19.1 mm) N.C.</p>		<p>Dimensions: 2-21/64" (59.1 mm) total height, 1-45/64" (42.8 mm) float height, 1-7/32" (31.0 mm) stem height, 1-1/32" DIA. (26.2 mm) float diameter, 1/2" HEX (12.7 mm) stem, 1/8" NPT top.</p> <p><math>L_1 = 37/64"</math> (14.5 mm) N.O.; <math>53/64"</math> (20.8 mm) N.C.</p>	

† $L_1$  = Switch actuation level, nominal (based on a liquid specific gravity of 1.0).

### Common Specifications

**Electrical Termination:** No. 22 AWG, 24" L., Polymeric Lead Wires, (except Part No. 79990 which has Teflon® Lead Wires).

**Approvals:** Series Nos. LS-1700, LS-1750 and LS-1755 are U.L. Recognized – File No. E45168 and GSA Listed – File No. 30200.

**Switch Operation:** Units are shipped N.O. unless otherwise specified. Selectable, N.O. or N.C., by inverting float on unit stem (except for LS-1700 Series switches with Teflon® Floats; see selection in "How to Order" table).

### How To Order – Select Part Number based on specifications required.

Series Number	Material			Min. Liquid Sp. Gr.	Operating Temperature	Pressure, PSI, Max.**	Switch* SPST	Part Number
	Stem and Mounting	Float	Other Wetted					
LS-1700	Brass	Buna N	316 S.S., Epoxy	.45	Water: to 180°F (82.2°C) Oil: -40°F to +300°F (-40°C to +149°C)	300	20 VA	01701 ⚡
	316 S.S.						20 VA	01702 ⚡
	316 S.S.	Teflon®		.85	-40°F to +250°F (-40°C to +121.1°C)	1000	20 VA, N.O.	26791 ⚡
							20 VA, N.C.	27980 ⚡
LS-1750	316 S.S.	316 S.S.	316 S.S.	.70	-40°F to +300°F (-40°C to +148.9°C) -40°F to +480°F (-40°C to +204.4°C)	100	20 VA	01750 ⚡
							20 VA	79990 ⚡
LS-1755	316 S.S.	316 S.S.	316 S.S.	.90	-40°F to +300°F (-40°C to +148.9°C)	275	20 VA	01755 ⚡

\* See "Electrical Data" on Page X-5 for more information.

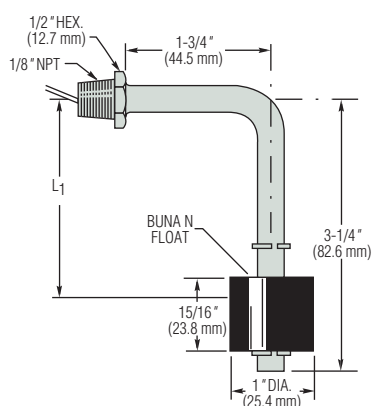
\*\* Higher pressures are temperature dependent.

## LS-77700 Series – Bent Stem Switches Provide Greatest Buoyancy Of Any Side Mount Version

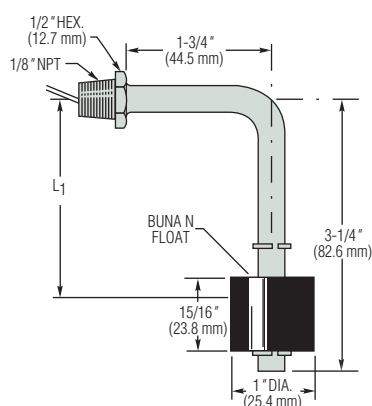
These units perform in liquids with specific gravities as low as .45; switches protrude into tank less than 3 inches.

### Dimensions

Type I – 1/8" NPT



Type II – 3/8-24" Thread



L<sub>1</sub> Dimension (based on liquid specific gravity of 1.0):

Buna N Float: 2-3/8" (60.3 mm) ± 3/16"

Stainless Steel Float: 2" (50.8 mm) ± 3/16"

### Common Specifications

**Electrical Termination:** No. 22 AWG, 24" L., Teflon® Lead Wires

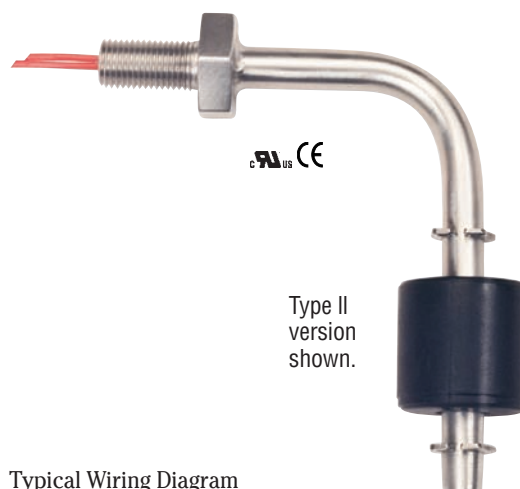
**Approvals:** U.L. Recognized – File No. E45168

**Switch\* SPST:** 20 VA, 120-240 VAC. Switch is N.O. (Dry), but available N.C. (Dry).

**Mounting Attitude:** Vertical ± 30°.

**Other Wetted Materials:** Float Stop is Beryllium Copper or PH-15-7-MO Stainless Steel.

**Grooved Stem Option:** Stem may be grooved to prevent accidental or vibrational movement of float stops (grip rings).



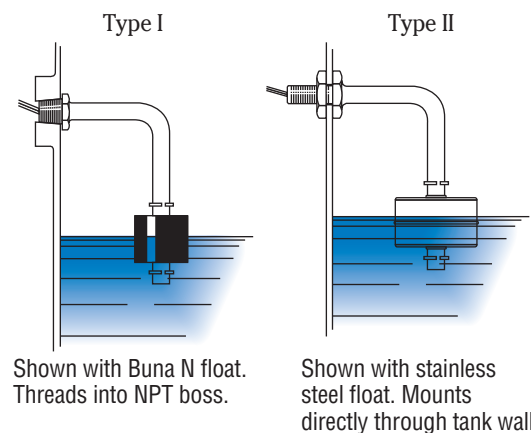
Type II version shown.

### Typical Wiring Diagram



When mounted "stem up," units are N.C. dry.

### Typical Installation



Shown with Buna N float. Threads into NPT boss.

Shown with stainless steel float. Mounts directly through tank wall.

### How To Order – Select Part Number based on specifications required.

Type	Materials		Min. Liquid Sp. Gr.	Operating Temperature	Pressure, PSI, Max.	Part Number
	Stem and Mounting	Float				
I	Brass	316 Stainless Steel	.70	-40°F to +300°F (-40°C to +149°C)	100	117711
	316 Stainless Steel					117712 ⚡
	Brass	Buna N	.45	Water: to 180°F (82°C) Oil: -40°F to +300°F (-40°C to +149°C)	300	118125 ⚡
	Stainless Steel					118126
II	Brass	316 Stainless Steel	.70	-40°F to +300°F (-40°C to +149°C)	100	117715
	316 Stainless Steel					117716 ⚡
	Brass	Buna N	.45	Water: to 180°F (82.2°C) Oil: -40°F to +300°F (-40°C to +149°C)	300	118127 ⚡
	Stainless Steel					118128

\*See "Electrical Data" on Page X-5 for more information.

⚡ – Stock Items.



# Large Size – Engineered Plastics

## Select from these Engineered Plastics for Aggressive or Ultra-Pure Liquids

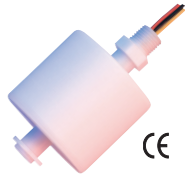
Each of these series offers unique features. Choose from this selection when all-plastic material is desirable and tank space is not restricted.

LS-74780 – All CPVC



Particularly well suited for rough service. Ideal for use in chemical and plating applications.

LS-1900TFE



Resists build-up of foreign material or sticky media. Float travel remains uninhibited in viscous or corrosive liquids. SPDT switch.

LS-1700TFE



A medium-size solution for ultra-pure liquid level sensing. Made of corrosion resistant PTFE for low particle generation.

LEVEL SWITCHES – SINGLE POINT

### Dimensions

LS-74780	LS-1900TFE	LS-1700TFE
<p>Dimensions for LS-74780: PVC JACKETED LEAD WIRES, 1/4" NPT, 5/8" HEX (15.9 mm), 21/32" (16.7 mm), 3-7/16" (87.3 mm), 3/4" (19.1 mm), 1-13/16" (46.0 mm), 2-25/32" (70.6 mm), 1-1/2" DIA. (38.1 mm).</p>	<p>Dimensions for LS-1900TFE: TEFLON® JACKETED LEAD WIRES, 1/4" NPT, 21/32" HEX (16.7 mm), 13/16" (20.6 mm), 92" (22.3 mm), 3-15/32" (88.1 mm), 2-21/32" (67.5 mm), 1-15/16" (49.2 mm), 2-1/8" DIA. (54 mm).</p>	<p>Dimensions for LS-1700TFE: WIRE 22 AWG. TEFLON JACKETED 24" TO 26" (610 mm to 660 mm) EXTENDED LENGTH, 1/8" NPT REF., 5/8" REF. (15.9 mm), 1/2" HEX. REF. (12.7 mm), 2-1/2" REF. (63.5 mm), ACTUATION LEVEL, #174105. FLOAT, 1-31/32" REF. (50.0 mm), #174106. RETAINING CLIP, 1-1/8" DIA. REF. (28.5 mm), 5/16" DIA. REF. (7.9 mm).</p>

†L<sub>s</sub> = Switch actuation level, nominal (based on a liquid specific gravity of 1.0 and N.O. dry circuit—dimension will vary for N.C. circuit).

### Common Specifications

**Electrical Termination:** No. 18 AWG, 24" L., Lead Wires (Jacket material is indicated on dimensional drawings, above).

### How To Order – Select Part Number based on specifications required.

Series Number	Materials		Min. Liquid Sp. Gr.	Operating Temperature	Pressure, PSI, Max.	Switch*	Part Number	
	Stem, Mounting and Other Wetted	Float					Mounting Size	
							1/4" NPT	1/8" NPT
LS-74780	CPVC		.85	-40°F to +180°F (-40°C to +82.2°C)	15	SPST, 20 VA	74780** ⚡	—
LS-1900TFE	Teflon®		.80	-40°F to +300°F (-40°C to +148.9°C)	30	SPDT, 20 VA	133299 ⚡	—
LS-1700TFE	PTFE		.86	+32°F to +212°F (0°C to +100°C)	25	SPST, 20 VA, N.O.	—	174100
						SPST, 20 VA, N.C.	—	174200

\* See "Electrical Data" on Page X-5 for more information.

\*\* Switch operation is selectable, N.O. or N.C., by inverting the float on the unit stem. Units are shipped N.O. unless otherwise specified.

†† 100 VA switches are not U.L. Recognized.

⚡ – Stock Items.

## Large Size – Alloys

### LS-1800 and LS-1900 Series are a Step Above Our Plastic Units for Pressure Capabilities

Excellent stability for general use in oils and water.

LS-1800 Series –  
Buna N Float



LS-1800 Series –  
Teflon® Float



LS-1900 Series –  
Buna N Float



Intermediate in size, LS-1800 switches provide long life and dependability to meet a broad range of requirements.

With large float displacement, switch withstands rough service; is suitable for high viscosity liquids.

### Dimensions

LS-1800 Series		LS-1900 Series
Buna N Float	Teflon® Float	Buna N Float
<p>17/32" (13.5 mm) 1/8" NPT 1/2" HEX (12.7 mm) 2-15/16" (74.6 mm) 7/8" (22.2 mm)† 2-13/32" (61.1 mm) 1-3/4" (44.5 mm) 1-1/4" DIA. (31.7 mm)</p>	<p>17/32" (13.5 mm) 1/8" NPT 1/2" HEX (12.7 mm) 2-15/16" (74.6 mm) 7/8" (22.2 mm)† 2-13/32" (61.1 mm) 1-3/4" (44.5 mm) 1-1/4" DIA. (31.75 mm) SPRING FLAT WASHER</p>	<p>21/32" (16.7 mm) 1/4" NPT 5/8" HEX (15.9 mm) 3-3/16" (80.9 mm) 1-3/16" (30.2 mm)† 2-17/32" (64.3 mm) 1-13/16" (46.1 mm) 1-7/8" DIA. (47.6 mm)</p>

†L<sub>1</sub> = Switch actuation level, nominal (based on a liquid specific gravity of 1.0).

### Common Specifications

**Electrical Termination:** No.18 AWG, 24" L., Polymeric Lead Wires.

**Approvals:** All Switches on this page are U.L. Recognized – File No. E45168, and are CSA Listed – File No. 30200.

**Switch Operation:** Selectable, N.O. or N.C., by inverting float on unit stem (except for LS-1800 Series switch with Teflon® float). Units are shipped N.O. unless otherwise specified.

**How To Order – Select Part Number based on specifications required.**

Series Number	Material			Min. Liquid Sp. Gr.	Operating Temperature	Pressure, PSI, Max.	Switch* SPST	Part Number
	Stem and Mounting	Float	Other Wetted					
LS-1800	Brass	Buna N	316 Stainless Steel, Hysol	.75	Water: to 180°F (82°C) Oil: -40°F to +230°F (-40°C to +110°C)	150	20 VA	01801 ⚡
		100 VA**		35651 ⚡				
	316 Stainless Steel	Buna N		.75	-40°F to +250°F (-40°C to +121°C)	300	20 VA	01807 ⚡
		Teflon®		.65			100 VA**	35657 ⚡
LS-1900	Brass	Buna N	316 Stainless Steel, Hysol	.55	Water: to 180°F (82°C) Oil: -40°F to +230°F (-40°C to +110°C)	150	20 VA	01901 ⚡
				100 VA***			35676 ⚡	
	316 Stainless Steel			.55	20 VA	01907 ⚡		
							100 VA	35682 ⚡

\*See "Electrical Data" on Page X-5 for more information.

\*\*\* LS-1900 100VA unit is UL Resistive Rated.

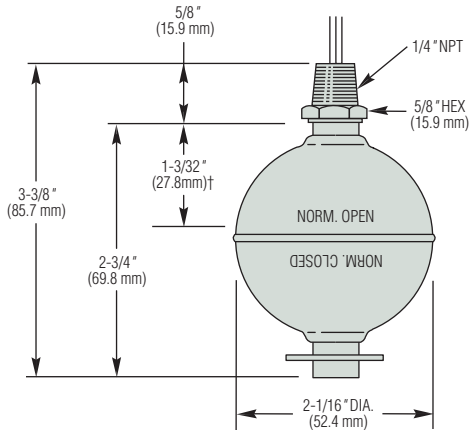
\*\*LS-1800 100 VA switches are not U.L. Recognized.

## Large Size – Alloys

### LS-1950 – All Stainless Steel For High Pressure and Temperature

For high performance applications, the LS-1950 provides high temperature and pressure capabilities. Materials of construction comply with FDA food contact regulations.

#### Dimensions



†L<sub>1</sub> = Switch actuation level, nominal (based on a liquid specific gravity of 1.0 and N.O. dry circuit – dimension will vary for N.C. circuit).

#### Common Specifications

**Electrical Termination:** No. 18 AWG, 24" L., Polymeric Lead Wires (except Part No. 79999 which has Teflon® lead wires).

**Approvals:** LS-1950 Series switches are U.L. Recognized – File No. E45168 and are CSA Listed - File No. 30200 (Part No. 79999 is U.L. Recognized only).

**Switch Operation:** Selectable, N.O. or N.C., by inverting float on unit stem. Units are shipped N.O. unless otherwise specified.

#### How to Order – Select Part Number based on specifications required.

Series Number	Materials		Min. Liquid Sp. Gr.	Operating Temperature	Pressure, PSI, Max.	Switch <sup>1</sup>	Part Number
	Stem and Mounting	Float					
LS-1950	316 Stainless Steel	0.75		-40°F to +300°F (-40°C to +149°C)	750	SPST, 20 VA	<b>01950</b> ⚡
				-40°F to +480°F (-40°C to +249°C)		SPST, 100 VA <sup>2</sup>	<b>26717</b> ⚡
						SPST, 20 VA	<b>79999</b> ⚡

Notes

- See "Electrical Data" on Page X-5 for more information.
- UL Resistive Rated

⚡ – Stock Items.



Exceptionally accurate and rugged for higher temperatures and in pressurized or corrosive liquids. For oils, water and chemicals.



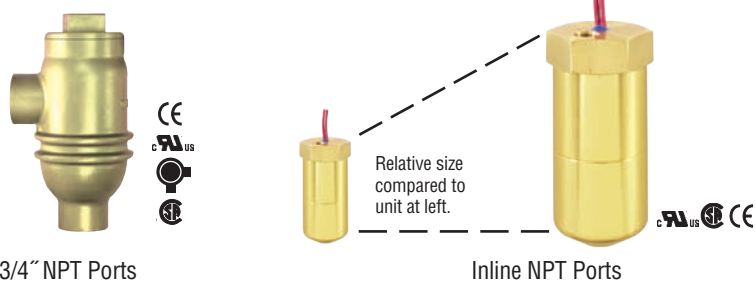
## Large Size – Alloys

### When a Switch Won't Fit In the Tank, Use a Non-Intrusive Bottle Type

Bottle type level switches are ideal for large or small tanks or where access to the inside is impractical or impossible. These units mount completely outside of the tank, at the level actuation point.

LS-800-5 Series – Single Level,  
Brass or Stainless Steel Housing

LS-159000 Series – Low Cost,  
Compact Aluminum Housing



For Remote Alarms –  
See Page E-29

- Adjustable Volume
- Indoor Outdoor
- Solid-State



### Dimensions

LS-800-5 – Brass and Stainless Steel	LS-159000

†L<sub>1</sub> = Switch actuation level, nominal (based on a liquid specific gravity of 1.0).

### Common Specifications

**Electrical Termination:** No. 18 AWG, 24" L., Polymeric Lead Wires (LS-800-5) / No. 22 AWG, 24" L., Polymeric Lead Wire (LS-159000).

**Approvals:** Series Nos. LS-800-5 and LS-159000 are U.L. Recognized – File No. E45168 and CSA listed – File No. LR-30200.

**Switch Operation:** Selectable, N.O. or N.C., by inverting float on unit stem.

**Mounting Attitude:** Vertical with lead wires up.

### How To Order - Select Part Number based on specifications required.

Series Number	Materials				Min. Liquid Sp. Gr.	Pressure, PSIG, Max.	Operating Temperature	L <sub>1</sub>	Switch*	Part Number	
	Housing	Stem and Mounting	Float	Other Wetted							
LS-800-5	Brass		316 Stainless Steel	Beryllium Copper	.75	500 @ 70°F	-40°F to +300°F (-40°C to +148.9°C)	3/4" (19 mm)	SPST, 20 VA	172625	
				Copper					SPST, 100 VA	172986	
	316 Stainless Steel			S.S. ARMCO H-15-7 MO	750			7/16" (11 mm)	DPDT	172988	
									SPST, 20 VA	172635	
LS-159000	Aluminum	Brass	316 S.S.	Beryllium Copper	.90	600 @ 70°F	-40°F to +300°F (-40°C to +148.9°C)	See Dimensions	SPST, 20 VA	144080	
			Buna N	Viton®	.50	250 @ 70°F				-40°F to +250°F (oil); +180°F (water) (-40°C to +121°C [oil]; +82°C [water])	160405

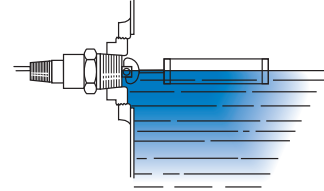
\*See "Electrical Data" on Page X-5 for more information. DPDT relay information is with Dimensions above.

## Large Size – Alloys

### Side Mounting Switches Solve the Problem of Inaccessible Tank Tops & Bottoms

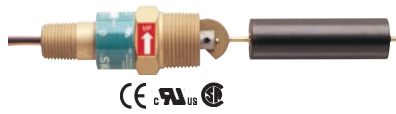
These units solve the problem of point level sensing in tanks with inaccessible tops or bottoms, or at intermediate locations in larger tanks. Operation is positive and dependable. The float pivots with changing liquid level, displacing a shuttle which magnetically actuates a hermetically sealed switch within the unit. Installation is through the tank side at the detection point.

Typical Installation

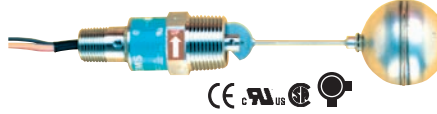


**UL Approved  
Explosion-Proof**

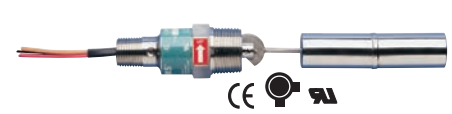
LS-2050 Series – Brass and Buna N



LS-2050 Series – All-Stainless Steel



LS-52100 Series – All Stainless Steel

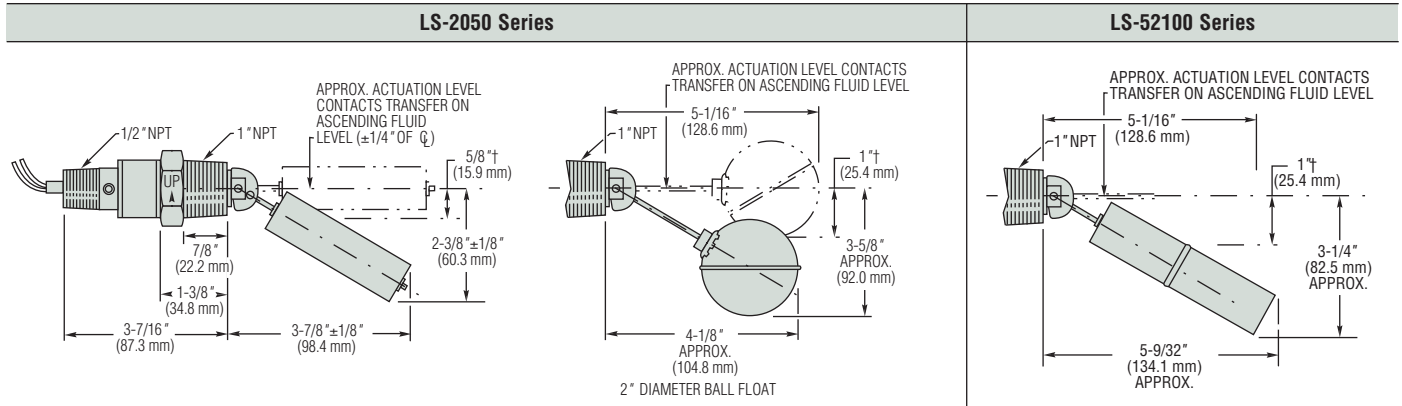


General purpose materials designed to provide reliable service in oils and water.

Ultimate strength: for pressures to 900 PSIG and temperatures to 300°F (148.9°C). Explosion-proof models available.

Rugged, all-stainless steel unit offers broad chemical compatibility at temperatures to 300°F (148.9°C). Explosion-proof models available.

### Dimensions



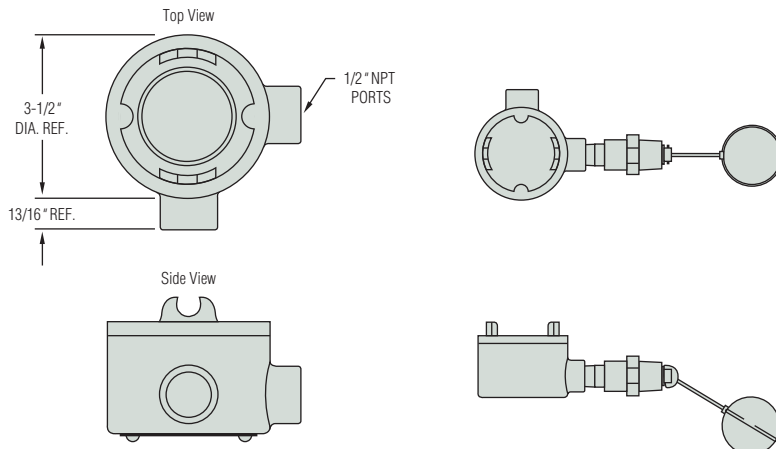
$\dagger$  Approximate de-actuation level, nominal (based on a liquid specific gravity of 1.0).

\* Switch Mounting dimensions are the same as shown on the LS-2050 Series drawing (far left).

### Explosion-Proof Versions

CSA or FM Approved versions are available in all-stainless steel configurations only.

Typical Example (P/N 55690 Shown):



### For Remote Alarms – See Page E-29

- Adjustable Volume
- Indoor Outdoor
- Solid-State



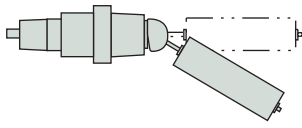
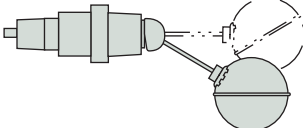
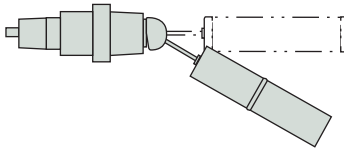
**Common Specifications**

**Electrical Termination:** No.18 AWG, 24" L., Polymeric Lead Wires.


**Approvals:** LS-2050 Series Switches are U.L. Recognized – File No. E45168 and are CSA Listed. Explosion-proof units are approved for Class I, Division 1, Group D hazardous areas.

**Mounting Attitude:** Horizontal, ±15°.

**Performance**

	LS-2050 Series		LS-52100 Series	
	Brass Mounting/Buna-N Float	All-Stainless Steel		
				
Operating Temperature	Water: to +180°F (82.2°C) Oil: -40°F to +250°F (-40°C to +121°C)		-40°F to +300°F (-40°C to +148.9°C)	
Pressure, PSIG Max. @ 70°F	150	900	500	
Min. Liquid Sp. Gr.	.8	.9	.85	
Switch Differential in Liquid	1/2" Minimum	Approximately 3/4"		

**How To Order – Select Part Number based on specifications required.**

Series Number	Materials			Switch <sup>1</sup>	Part Numbers		
	Stem and Mounting	Float	Other Wetted		Standard Versions	With Bellows (Details Below)	Explosion-Proof 
LS-2050	Brass	Buna N	316 Stainless Steel, Beryllium Copper, Teflon®, Ceramic	SPDT, 20 VA	<b>30288</b> ⚡	—	—
	316 Stainless Steel	316 Stainless Steel	Stainless Steel, Teflon®, Ceramic	SPDT, 20 VA	<b>30290</b> ⚡	<b>175650</b>	<b>55690</b>
				SPST, 100 VA, N.O. <sup>2,4</sup>	<b>48068</b>	—	—
				SPST, 100 VA, N.C. <sup>2,4</sup>	<b>48069</b>	—	—
LS-52100	316 Stainless Steel	304 Stainless Steel	430 Stainless Steel, Teflon®, Ceramic	SPDT, 20 VA	<b>52100</b> ⚡	—	<b>121753</b>
				SPST, 100 VA, N.O. <sup>3</sup>	<b>116971</b> ⚡	—	—
				SPST, 100 VA, N.C. <sup>3</sup>	<b>116972</b>	—	—

**Notes**

1. See "Electrical Data" on Page X-5 for more information.
2. Not CSA Approved.
3. Not U.L. Recognized or CSA Approved.
4. UL Resistive Rated

⚡ – Stock Items.

**LEVEL SWITCHES – SINGLE POINT**



# Large Size – Alloys

## FABRI-LEVEL™ Components and Kits Build Into Custom Switches in Minutes

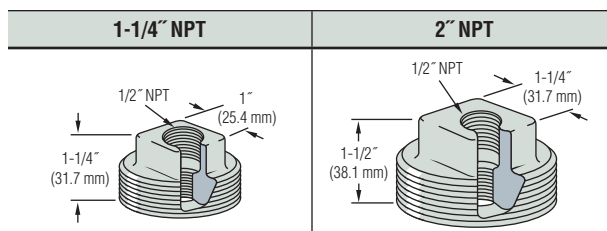
GEMS FABRI-LEVEL™ units can be custom-assembled in minutes from standard components, right in your plant. Simple instructions are furnished with kits.

### FABRI-LEVEL™ Components

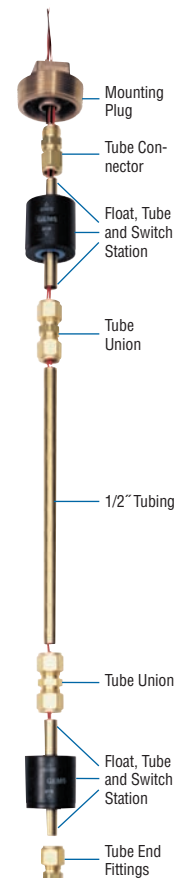
**How to Order:** Specify Part Number and quantity of each component required.

#### Mounting Types

Provides clearance for inserting unit in tank. 2" NPT Mounting must be used with stainless steel floats.



Material	Part Numbers	
Brass	26034 ⚡	24408 ⚡
316 Stainless Steel	26033	24407 ⚡



#### Level Station Assemblies

Each Station is comprised of a float, tube section and switch.

**Lead Wires: SPST:** #18 AWG, 60" L., Teflon®; **SPDT:** #22 AWG, 60" L., Teflon®

Float Material		Buna N				316 Stainless Steel			
Compatible Mounting Type		1-1/4" NPT		2" NPT					
<b>Float Dimensions</b>									
<b>Operating Temperature</b>		Water: to +180°F (+82°C); Oil: -40°F to +230°F (-40°C to +110°C)				-40°F to +275°F (-40°C to +135°C)			
<b>Pressure, PSI, Max.</b>		150				750			
<b>Min. Media Specific Gravity</b>		.75		.55		.75			
Mounting Size	Switch Type	Tubing Material	Part Number	A Dim.	Part Number	A Dim.	Part Number	A Dim.	
1-1/4" NPT	SPST 20 VA	Brass	26609 ⚡	4" (101.6 mm)	—	—	—	—	
		Stainless Steel	26608 ⚡						
	SPDT 20 VA	Brass	26737 ⚡	4-29/64" (113.0 mm)					
		Stainless Steel	26738						
2" NPT	SPST 20 VA	Brass	—	—	24410 ⚡	4" (101.6 mm)	—	4-1/4" (107.9 mm)	
		Stainless Steel			25328 ⚡				24411 ⚡
	SPDT 20 VA	Brass			24578	4-29/64" (113.0 mm)		—	4-29/64" (113.0 mm)
		Stainless Steel			25329				

\* See "Electrical Data" on Page X-5 for more information.

⚡ – Stock Items.

### Fittings and Tubing

Description (1/2" Fittings)	Tube Connector	Tube Union	Tube End Fitting	90° Elbow	1/2" O.D. Tubing	
					10" Length	36" Length
<b>Function</b>	Connects tube to mounting plug, mounts unit from inside of tank.	Connects level stations or extension tubes.	Seals end of unit.	For side entry into tank	For extending units or level station spacing.	
<b>Material</b>	<b>Part Numbers</b>					
<b>Brass (Nylon Ferrule)</b>	<b>24633</b> ⚡	<b>24412</b> ⚡	<b>24553</b> ⚡	<b>24631</b>	<b>25199</b> ⚡	<b>24637</b> ⚡
<b>All-316 Stainless Steel</b>	<b>24634</b> ⚡	<b>24413</b> ⚡	<b>24554</b> ⚡	<b>24632</b>	<b>25204</b>	<b>24638</b> ⚡

### FABRI-LEVEL™ Kits

FABRI-LEVEL Switch Kits contain all components for complete assembly of a 1- or 2- station level switch unit for pipe-plug mounting in your tank. Kits are available in several material and size combinations. N.O. or N.C. operation of the SPST switch is selectable by inverting the float(s) on the unit stem. Two 10" (254 mm) lengths of tube are furnished to space level stations as desired. Components available for custom-building other configurations are listed on the facing page and above.

### Specifications

Kits use the components listed individually on the facing page and above. Please review for performance and dimensional data.

### How To Order

Specify Kit Number and quantity.

Materials		Mounting NPT	Kit Number
Fittings	Floats		
Brass	Buna N	1-1/4"	<b>26128</b> ⚡
		2"	<b>24576</b> ⚡
316 Stainless Steel	Buna N	1-1/4"	<b>26130</b>
		2"	<b>26675</b>
316 Stainless Steel		2"	<b>24577</b> ⚡

Warning: Improper application, assembly or installation of FABRI-LEVEL™ Kits or components may result in injuries to personnel or damages.

⚡ – Stock Items.



#### Each Kit Contains:

- 1 Tube Connector
- 1 Mounting Plug
- 2 Level Stations (Switch, Tube, Float)
- 2 Extension Tubes
- 1 Tube End Fitting
- 3 Tube Unions

# Specialty Switches

## GEMS Excels in Switches for Special Requirements

The products below are examples of the custom engineering GEMS can provide to meet specific application needs. These units are ideal for use in oils and water.

**TH800**  
Series Temperature/  
Level Switch



Level monitoring and temperature switch in a single unit. Intermediate in size; single-setting temperature sensor is in bottom of stem.

**LS-38760 Series** –  
Cushioned Float



Cushioned float and switch for turbulent liquids or excessive vibration. Easily grounded. Ideal for tank trucks, construction equipment or mobile applications.

**LS-270 Series** –  
Bracket Mounting  
Slosh Shield



U.L. Recognized – File No. E45168

Small, lightweight, and extremely stable in nonstatic, highly contaminated liquids. Slosh shielding minimizes effects of turbulence and helps prevent interference by foreign material. Bracket-mounted to any convenient surface.

LEVEL SWITCHES – SINGLE POINT

### Dimensions

	TH800 Temperature/Level Switch	LS-38760 Series	LS-270 Series
	<p>Wire diagram on page B-21</p>		
<b>Electrical Termination</b>	18 AWG, 24" L., Polymeric Lead Wires	18 AWG, 36" L., Polymeric Lead Wires	18/2 Cable, 6 ft. L., Neoprene with waterproof connection

†L<sub>s</sub> = Switch actuation level, nominal (based on a liquid specific gravity of 1.0).

LS-270 Series Note: Installed vertically with cable upward. Caution: Elastomer seals in the sensor and cable are subject to deterioration and aging, and therefore need to be checked regularly. Life expectancy of seals varies with application.

### How To Order – Select Part Number based on specifications required.

Series	Material			Min. Liq. Sp. Gr.	Operating Temperature	Pressure PSI, Max.	Switch <sup>1</sup>		Part Number
	Stem and Mounting	Float	Other Wetted				Level SPST	Temperature <sup>3</sup>	
TH800 Temp./Level	Brass	Buna N	Beryllium Copper, Hysol	.75	Water: to 180°F (82°C) Oil: -40°F to +230°F (-40°C to +110°C)	150	20 VA, N.O.	N.C., open on +150°F ±10°F, incr.	57143 ⚡
								N.O., close on +150°F ±10°F, incr.	57144 ⚡
LS-38760	Aluminum	Buna N	S.S., Hysol	.55	-40°F to +180°F (-40°C to +82°C)	150	20 VA, N.C.	—	38760 ⚡
LS-270	316 S.S.	Buna N	Beryllium Copper, Copper Nickel, Polycarb. 304 S.S.	.55	-40°F to +140°F (-40°C to +60°C)	150	20 VA, N.O.	—	43765 ⚡
							20 VA, N.C.		43760 ⚡
							50 VA <sup>2</sup> , N.O.		43980 ⚡
							50 VA <sup>2</sup> , N.C.		43982 ⚡

Notes:

- See "Electrical Data" on Page X-5 for more information.
- Switches are not U.L. Recognized or CSA Listed.
- See Page B-21 for thermostat ratings and wiring diagram. Other temperature settings are available; consult factory.

Specialty Switches – Continued

Portable Level Switch — Integral Mounting Magnet



Precisely monitors liquid level and is ideal for controlling filling operations and preventing overflows. Permanent magnet attaches unit securely to steel tank wall at exact level required.

LS-750 Series — Weighted for Suspension Cable



With a compact-sized float, slosh shield and weighted collar, the LS-750 provides liquid level detection for a wide variety of applications. Suspend in stand pipes or sumps for leak detection duty, or drop into wells for ground-water monitoring. Supplied with 25 feet of waterproof cable.

U.L. Recognized—  
File No. E-45168.  
CSA Listed-File No. LR-30200.

LS-700F Series



Overfill Protection for Refrigerant Tanks. The LS-700F enables safe compliance with EPA directives to recover refrigerants. These units are designed to fit standard 30# and 50# D.O.T. approved refrigerant tanks. They provide 80% full shutoff capability when used as an integral part of a recovery system.

U.L. Recognized—  
File No. SA8857.  
CSA Listed-File No. LR-30200-31.

Dimensions

Portable Level Switch	LS-750	LS-700F
SJO, 18/2 10'L., Neoprene	22 AWG, 2-Wire Cable	3- or 4-Pin, Quick-Connect Receptacle

†L<sub>1</sub> = Switch actuation level. In liquid with specific gravity of 1.0, switch actuation is approximately half the distance from end of stem to mounting, or at the halfway point of float travel.

How To Order — Select Part Number based on specifications required.

Series	Material			Min. Liquid Sp. Gr.	Operating Temperature	Pressure PSI, Max.	Switch*	Electrical Termination Option	Part Number
	Stem and Mounting	Float	Other Wetted						
Portable	Brass	Buna N	Aluminum, 316 S.S.	.85	Oil: -40°F to +230°F (-40°C to +110°C) Water: to 180°F (82°C)	10	SPST, 20 VA N.O., Dry	—	15208 ⚡
LS-750	Brass	Buna N	Nylon, PVC, Beryllium Copper	.45		150	SPST, 20 VA N.C., Dry	PVC Cable Jacket	149350 ⚡
	316 S.S.**	316 S.S.	PVDF, Viton®	.65	-40°F to 212°F (-40°C to +100°C)	375	SPST, 10 VA N.C., Dry	Teflon® Cable Jacket	197433
LS-700F	Brass	304 S.S.	—	.98	-40°F to +221°F (-40°C to +105°C)	400	SPST, 20 VA N.C., Dry	3-Pin	128500 ⚡
								4-Pin	144900 ⚡

\*See "Electrical Data" on Page X-5 for more information.

⚡ – Stock Items.

\*\* Stainless steel is generally recognized as safe (GRAS) with FDA for food contact regulations.



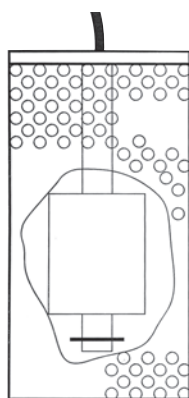
# Leak Detection Sensors

- ▶ Compact Size
- ▶ Low Cost
- ▶ Reliable
- ▶ Hydrocarbon Detection

Warrick® Leak Detection Sensors are designed for single wall piping, sump alarms and other small areas. Combine with Warrick Monitoring Panels for complete leak detection systems.

LEVEL SWITCHES – SINGLE POINT

DLP-1 & DLP-2



Designed to detect presence of liquid in sumps, attached access pipes, annular spaces, or locations requiring a small float-operated sensor. Two models to fit 1-1/2" and 2" standard piping.

DWP-25



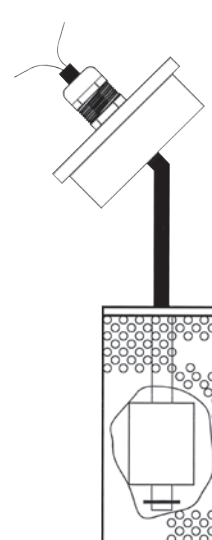
Designed for use in the annular space of double wall fiberglass tanks to detect the presence of conductive liquid. When combined with Warrick DMS or TA alarm panel, DWP-25 sensors can detect the presence of water or other conductive liquids in normally dry annular spaces.

DFP-25



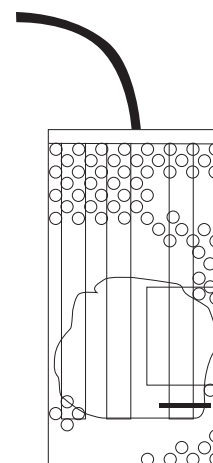
Designed for use in the annular space of double wall fiberglass tanks to detect hydrocarbon liquids. When hydrocarbons are present, a hydrocarbon wax pellet dissolves and closes a springloaded switch to signal a leak. This sensor is not reusable after exposure to hydrocarbons.

SVP-2



Designed to monitor hydrocarbon vapors in wells or sumps by absorbing the vapors and triggering a switch. Should not be used where vapors are continuously present. Fits in standard 2" pipe with cover.

DSP-2



Utilizes conductivity probes and a reed switch based float switch to detect the presence of liquid and differentiate between hydrocarbons and water. When combined with Warrick DMS or TA two-channel alarm panel, the DSP-2 can discriminate between water and hydrocarbon liquids causing fault condition.

## How to Order

Order by Part Number (same as Series Name for these products).

Series	Body Components	Number of Sensor Wires	Wire Length	O.D.	Part Number
DLP-1*	Buna-N float, Stainless Steel and plastic housing	2 (N.O. in resting position)	16 ft.	1.22"	DLP-1
DLP-2*				1.88"	DLP-2
DSP-2*					DSP-2
DWP-25	Stainless Steel probes in plastic housing	2	25 ft.	.625"	DWP-25
DFP-25	Spring-loaded switch, plastic housing, wax pellet	2	25 ft.	.625"	DFP-25
SVP-2	Chemical-resistant plastic and Stainless Steel housing	2	16 ft.	2"	SVP-2

\* EPA Approved when used with Warrick TA or DMS panel. See pages E-30 and E-31 respectively.

## Applications

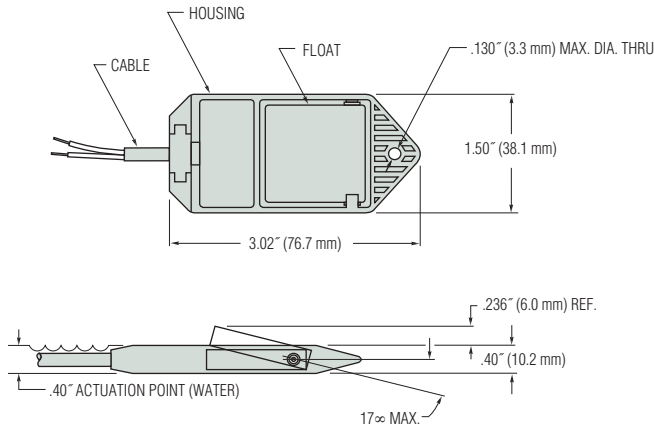
- Above Ground Storage Tanks
- Underground Storage Tanks
- Sumps
- Dry Annular Spaces

## LS-10 Series – Slim Profile for Interstitial Liquid Sensing

The GEMS LS-10 liquid sensor accurately detects the presence of liquid in fiberglass double-wall tanks, containment sumps and double-wall pipes. Dry contact switching ensures dependability throughout its long service life. This reusable sensor easily fits small, interstitial spaces and senses liquid hydrocarbons or water. The unit is unaffected by hydrocarbon vapor, thereby reducing the risk of false alarms.

The LS-10 sensor's rounded design makes it easy to remove, clean and reinstall after an alarm condition is triggered, or for maintenance.

### Dimensions



### Specifications

#### Wetted Materials:

**Housing:** Valox®

**Float:** Foamed Polyethylene with Solid Polyethylene Pin

**Tape:** UHB Double-Sided 3M Tape (p/n 160330 only)

**Cable:** PVC

**Pressure:** Atmospheric

**Operating Temperature:** -40°F to +176°F (-40°C to +80°C)

**Accuracy:** ±1/8 inch

**Switch Rating:** 10W, 50-100 VDC Resistive Only, N.C. (opens on rising)

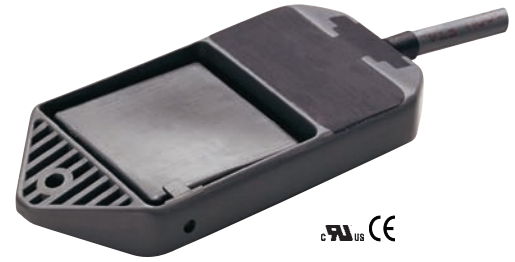
**Cable:** Two (2) Conductor PVC Jacketed 24-26" Extended

**Approvals:** UL Recognized

### How to Order – Select Part Number based on mounting option

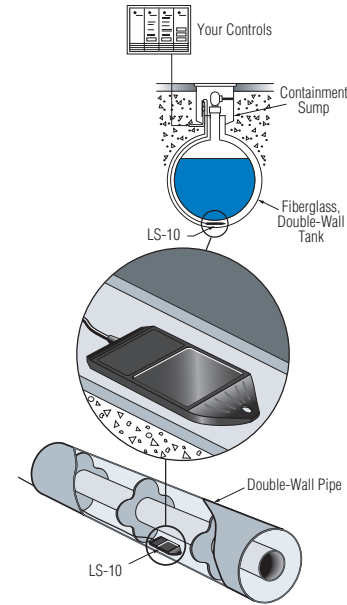
Series Number	Mounting Option	Part Number
LS-10	With Double-Sided Tape	<b>160330</b>
	No Tape	<b>160340</b>
	No Tape – 25' PVC Jacketed Cable	<b>156000</b> ⚡

Note: The LS-10 sensor is a non-voltage producing device and does not contain energy storing components. However, since primary use is in hazardous locations, an appropriate intrinsically safe interface device is required for its use.



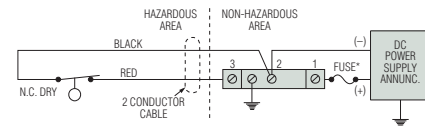
### Typical Applications

- ▶ Fiberglass Double-Wall Tanks
- ▶ Containment Sumps
- ▶ Double Wall Pipes
- ▶ Piping Sumps

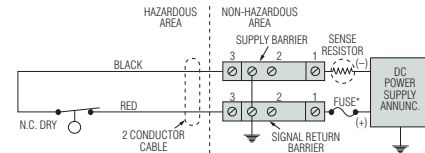


### Typical Wiring Diagrams

#### Non-Isolated System—Single Zener Barrier

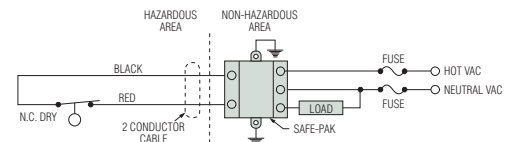


#### Isolated System - Dual Zener Barrier



If two signal lines must be maintained above ground potential, an individual zener barrier is required per single line.

#### Single Safe-Pak® Relay



Safe-Pak® is an intrinsically safe, solid state relay

LEVEL SWITCHES – SINGLE POINT

# Series M Mechanical Tilt Float Level Switch

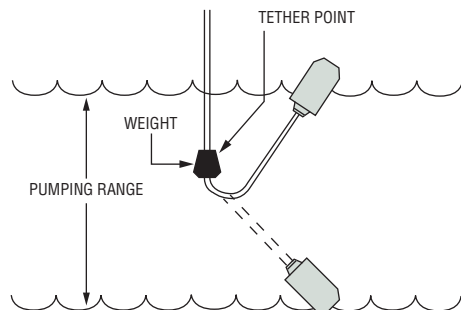
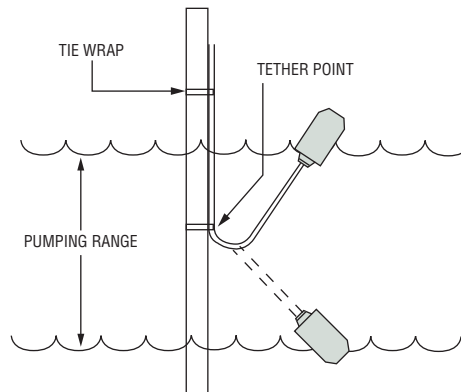
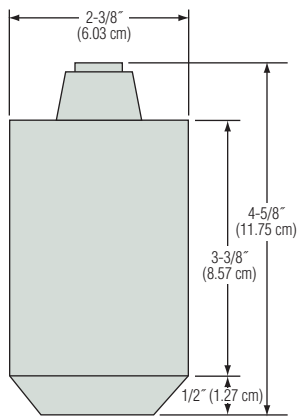
- ▶ Non-Mercury Switch
- ▶ Sealed Cable
- ▶ Impact & Corrosion Resistant ABS Shell
- ▶ N.O., N.C., SPDT Contacts
- ▶ Various Cable Lengths
- ▶ Color Coded Body

Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.

## Specifications

<b>Cord</b>	2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE
<b>Contact Rating</b>	13 amp @ 120/240 VAC 1/2 hp
<b>Contact Design</b>	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
<b>Temperature Rating</b>	
<b>Dry</b>	32°F to 194°F (0°C to 90°C)
<b>Water Resistant</b>	32°F to 140°F (0°C to 60°C)
<b>Overall Weight</b>	1.0 lbs. (not including weight)
<b>Tether Method</b>	Tie-wrap nylon, weight: 2.5 lbs.
<b>Approvals</b>	U.L. Recognized, CSA Cert.

## Dimensions

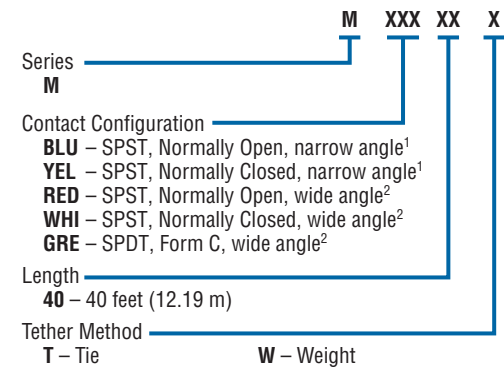


## Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

## How to Order

Use the **Bold** characters from the chart below to construct a product code.



Tether Method	Part Number
Tie Wrap	<b>7762360</b>
Weight	<b>7762381</b>

Notes:  
 1. Narrow angle pumping range approximately 2 in. to 8 in.  
 2. Wide angle pumping range approximately 5 in. to 18 in.

# Electro-Optic Level Switches

## Single Point

- ▶ Small size
- ▶ Economically priced
- ▶ Built-in, solid-state electronics
- ▶ No moving parts
- ▶ Simple, one-unit installation

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.

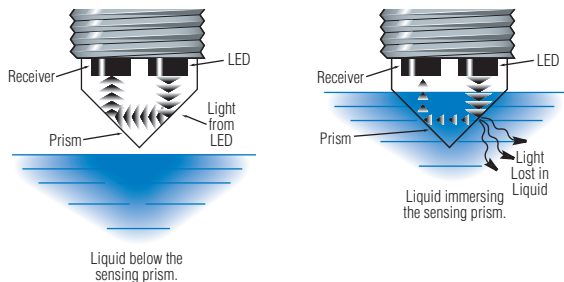
Level switches are suitable for high, low or intermediate level detection in practically any tank, large or small. Installation is simple and quick through the tank top, bottom or side. Solid state-switching ensures dependability over long service life.

The sensor offers  $\pm 1\text{mm}$  repeatability and broad liquid compatibility. They are not recommended for use in any liquid that crystallizes or leaves a solid residue.

### General Operating Principle

The electro-optic sensor contains an infrared LED and a light receiver. Light from the LED is directed into a prism which forms the tip of the sensor.

With no liquid present, light from the LED is reflected within the prism to the receiver. When rising liquid immerses the prism, the light is refracted out 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.

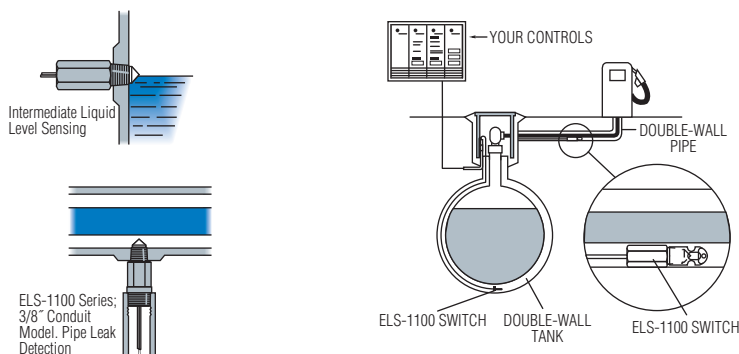


### Reflective Surface

Any optical sensor may be affected by reflective surfaces. Consult Gems if prism is to be less than 2 inches from any reflective surface.

### Typical Applications

- Medical laboratory
- Food and beverage systems
- Pharmaceuticals
- Petrochemicals
- Leak detection
- Hydraulic reservoirs
- Machine tools



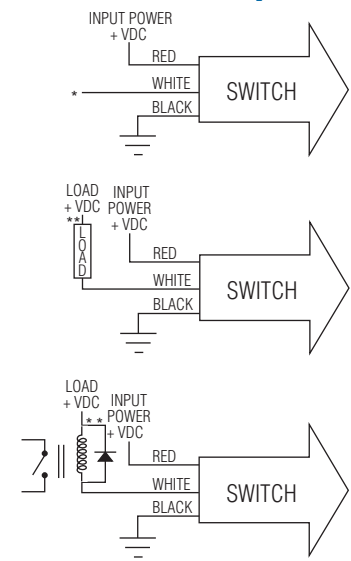
Contents	Page Start
Engineered Plastic .....	A-26
Alloy .....	A-30
Opto-Pak .....	A-31

## Industry's Largest Selection!



LEVEL SWITCHES - SINGLE POINT

### Typical Wiring Diagrams - For all electro-optic units not otherwise specified.



\* TTL/CMOS Output-For levels greater than 5 volts, a 10K pull-up resistor is required at the output.  
 \*\* Maximum load=40mA @ 30VCD.



# ELS-950 Series Rugged Electro-Optic Level Sensor

The ELS-950 Series represents Gems' smallest electro-optic level sensor developed to monitor a broad range of media including OHV type fluids.

Our UL approved design features a TPE over-molded electronics insert, TPE insulated wires, and fluorocarbon o-ring seals that create a watertight, environmentally resistant assembly, ideally suited for use in harsh environments.

The ELS-950 is excellent for industrial OEMs requiring a solid-state sensor for small space and high temperature environments.

## Typical Applications

- Coolant reservoir monitoring and warning
- Medical diagnostic, sterilizer, washers and dialysis equipment
- Low lubricant warning on machine tools, generator sets, on- or off-highway vehicles
- Low level warning in hydraulic reservoirs
- Plastic over flow bottles, plastic radiators
- Leak detection for drip pans

## Specifications

<b>Materials</b>	
<b>Housing</b>	Polysulfone (Contact Gems for alternative material types)
<b>O-Ring</b>	
1/2"- 20UNF Mounting	Fluorocarbon
M12x1-8 Mounting	Fluorocarbon
<b>Electronics</b>	Over-molded TPE
<b>Operating Pressure</b>	0 to 250 PSI (0 to 17 bar) maximum
<b>Operating Temperature</b>	-40°F to +230°F (-40°C to 110°C)
<b>Current Consumptions (No Load)</b>	
5 VDC	4 mA
12 VDC	10mA
<b>Output</b>	Sink 40 mA max., up to 30 VDC
<b>Repeatability</b>	±1 mm
<b>Approvals</b>	CE, UL file No. 108913 IP66/67 Rating Pending ROHS Compliant

## How To Order

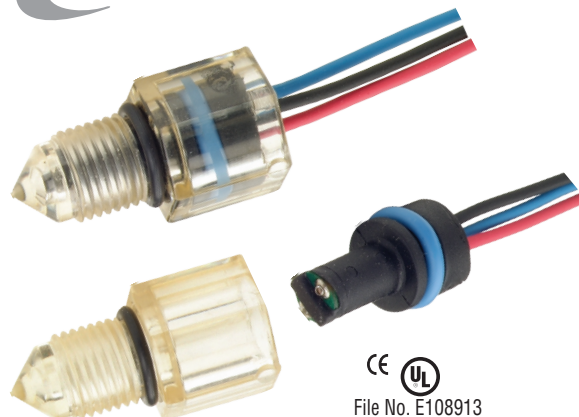
Specify Part Number based on Input and Output Condition required.

Input Power	Actuation Condition	Lead Wire Length	Mounting Type		
			1/4" MNPT	1/2"- 20UNF-2B	M12x1-8
5 VDC ±10%	Wet	6 inches	224504	224501	224508
		2 meters	226545	226541	226549
	Dry	6 inches	224505	224502	224509
		2 meters	226546	226542	226550
12 VDC ±10%	Wet	6 inches	224506	224503	224510
		2 meters	226547	226543	226551
	Dry	6 inches	224507	223625	224511
		2 meters	226548	226544	226552

Note: Cable length available in 6" or 2 meters

⚡ – Stock Items.

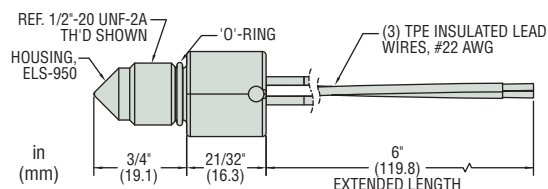
**New!**



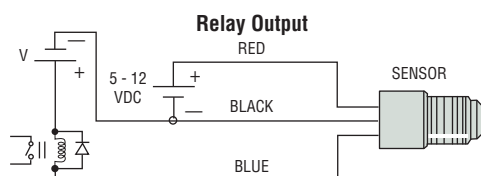
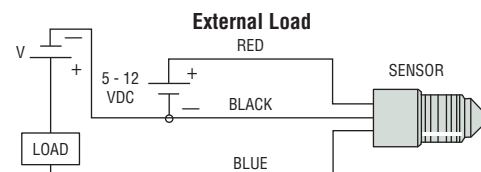
CE File No. E108913

ELS-950 shown with over-molded electronics and o-ring sealing exposed. Actual units are not designed for disassembly.

## Dimensions



## Wiring Diagrams



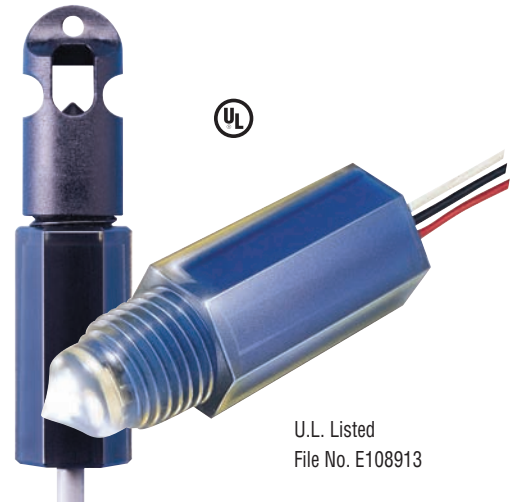
# General Purpose ELS –1100 Series Satisfies Most Applications

These polysulfone units are both compact and economical. They feature a variety of mountings, power requirements and electrical terminations to make it easy to find a perfect match for your application.

## Specifications

<b>Materials</b>	
<b>Housing and Prism</b>	Polysulfone or Nylon
<b>Operating Pressure</b>	0 to 150 PSI, Maximum
<b>Operating Temperature*</b>	0°F to 176°F (-17.8°C +80°C)
<b>Current Consumption</b>	18 mA, Approximately
<b>Output†</b>	TTL/CMOS Compatible. Open Collector Output May Sink 40 mA UP TO 30 VDC.
<b>Repeatability</b>	±1 mm
<b>EMI Susceptibility</b>	Meets (MIL-STD-461B Part 2 Modified) Specification of 10 V/M for Frequency Range 30 to 1000 MHz (Except 609 MHz = 9 V/M and 679 MHz = 7.5 V/M).

\* These switches are not for use in freezing liquid or steam/high condensation environments. Contact Gems for alternative solutions.



U.L. Listed  
File No. E108913

LEVEL SWITCHES – SINGLE POINT

## Dimensions

1/4" NPT Mounting	1/4" NPT Mounting with 3/8" Conduit	1/2" Straight Thread Mounting with O-Ring	M12x1-8g Straight Thread with O-Ring	"Fish" Pull Ring
<b>Electrical Termination</b>				
Lead Wires, 22 AWG, PVC Jacketed, 12" to 14" Extended				25' Cable, 22 AWG, PVC Jacketed

## How To Order

Specify Part Number based on Mounting Type, Input Power and Output Condition required.

Input Power	Probe Condition at Current Sink	Mounting Type					
		1/4" NPT	1/4" NPT & 3/8" Conduit		1/2" Straight Thread	M12x1-8g Straight Thread	"Fish" Pull Ring
		Polysulfone	Polysulfone	Nylon	Polysulfone	Polysulfone	Polysulfone
5 VDC	Wet	138167 ⚡	144225	175631	144235	166541	—
10-28 VDC	Wet	142700 ⚡	143585 ⚡	157750	143580	169555	143577
	Dry	143570 ⚡	143590	175632	143575	169556	148973

⚡ – Stock Items.

### Intrinsically-Safe Versions

GEMS ELS-1100 Switches may be rendered intrinsically-safe for Class I, Division 1, Group C & D when used with appropriate GEMS Zener Barriers. Call Gems Sensors for special ELS-1100-IS (intrinsically-safe) part numbers and Installation Bulletins 148745 and 148744, File No. E44570.

### Extended Power and Switching Capabilities of 12 VDC Models with Gems.

Converts TTL output signal to 5 Amp relay output. Available as open circuit board or mounted in a NEMA 4X enclosure (pictured). See Page A-31.



# ELS-1100HT

## Handles Temperatures to 212°F

Slightly larger than the ELS-1100, the "HT" or High Temperature version is made from high performance Isoplast® plastic. While maintaining broad chemical compatibility, these units also handle fluid temperatures to 212°F. They feature 3/8" NPT mountings and the shortest of any of our plastic electro-optic switch bodies – HTS versions are a mere 1/2" long!

### Typical Applications

- Coolant reservoir monitoring
- Medical diagnostic and sterilizer equipment
- Low lubricant warning on machine tools
- Low level warning in hydraulic reservoirs

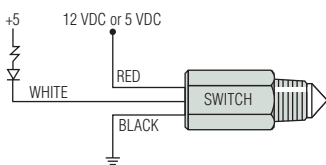
### Specifications

Materials	
Housing and Prism	Isoplast®
Operating Pressure	0 to 150 PSI, Maximum
Operating Temperature*	-40°F to +212°F (-40°C +100°C)
Current Consumption	45 mA, Approximately
Output	TTL/CMOS Compatible. Transistor Output with 10K Pull Up Resistor May Sink 18 mA. 12 VDC input power units switch a maximum 5 VDC on output
Repeatability	±1 mm

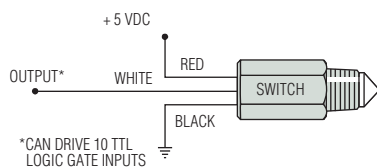
\* These switches are not for use in freezing liquids or steam/high condensation environments. Contact Gems for alternative solutions.

### Wiring Diagrams

#### Transistor Output



#### TTL Compatible Output



### How To Order

#### HT Series

Specify Part Number based on Input and Output Condition required.

Input Power	Probe Condition at Current Sink	
	Wet	Dry
5 VDC	153061 ⚡	153062
12 VDC*	153063 ⚡	153064

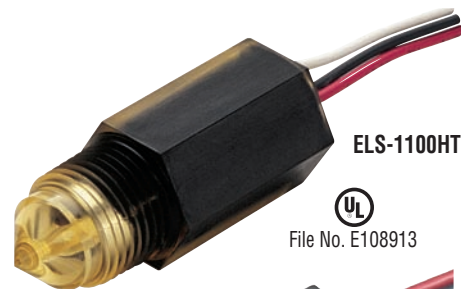
\*12 VDC input power units switch a maximum 5 VDC on output. Note: Extend the power and switching capabilities of 10-28 VDC models with Gems Opto-Pak Controllers.

⚡ – Stock Items.

#### HTS Series - 5 VDC Input Only

Specify Part Number based on Wet or Dry switch actuation and mounting type.

Mounting Type	Probe Condition at Current Sink	
	Wet	Dry
3/8" NPT	181674	181675
M16x2	191341	191342



ELS-1100HT



File No. E108913



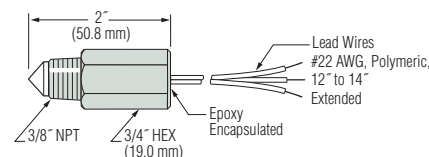
ELS-1100HTS



File No. E108913

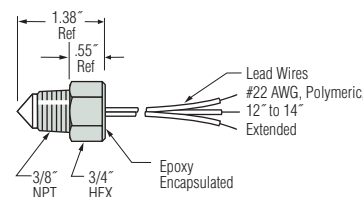
### Dimensions

#### HT Series

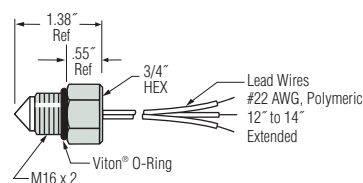


#### HTS Series

##### 3/8" NPT Mounting



##### M16 x 2 Straight Thread Mounting with O-Ring



### Extended Power and Switching Capabilities of 12 VDC Models with Gems.

Converts TTL output signal to 5 Amp relay output. Available as open circuit board or mounted in a NEMA 4X enclosure (pictured). See Page A-31.



## ELS-1100TFE Teflon® For Ultra-Pure or Aggressive Fluids

When high purity or resistance to chemical attack is vital, ELS-1100TFE sensors are the ultimate solution. They feature a pure Teflon® body and prism construction. Even the Hypalon® vapor barrier and Teflon® coated lead wires give evidence to the care we've taken to make this the perfect liquid level sensor for pharmaceuticals, semiconductor manufacturing, food and beverage, chemical processing, or anywhere purity or chemical resistance is the major criteria.

### Specifications

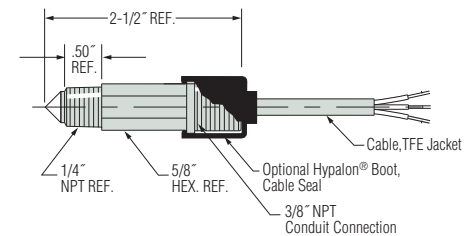
<b>Materials</b>	
<b>Housing and Prism</b>	Teflon®
<b>Operating Pressure</b>	0 to 150 PSI, Maximum
<b>Operating Temperature*</b>	0°F to 176°F (-17.8°C +80°C)
<b>Input Voltage</b>	10 - 28 VDC
<b>Current Consumption</b>	18 mA, Approximately
<b>Output†</b>	TTL/CMOS Compatible. Open Collector Output May Sink 40 mA Up to 30 VDC.
<b>Repeatability</b>	±1 mm
<b>EMI Susceptability</b>	Meets (MIL-STD-461B Part 2 Modified) Specification of 10 V/M for Frequency Range 30 to 1000 MHz (Except 609 MHz = 9 V/M and 679 MHz = 7.5 V/M).

\* These switches are not for use in freezing liquid or steam/high condensation environments.  
Contact Gems for alternative solutions.

† See Page A-25 for Wiring Diagrams



### Dimensions



### How To Order

Specify Part Number based on Output Condition and Boot Option.

Probe Condition at Current Sink	Part Number	
	With Cable Boot	No Cable Boot
Wet	<b>187595</b>	<b>173800</b> ⚡
Dry	<b>185600</b>	<b>173700</b>

## ELS-1100FLG Flange Mounting for Installations Without Threaded Holes

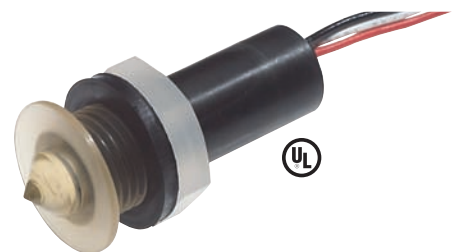
The easy solution for thin wall tanks ( $\leq 1/4$ " thick): ELS-1100FLG Series. No threads needed with these flanged units. Slip through a .75" hole and tighten the jam nut; Viton® gasket forms a tight seal. Ideal for sheet metal, molded plastic tanks and medical applications where elimination of exposed threads removes potential bacterial breeding grounds.

### Specifications

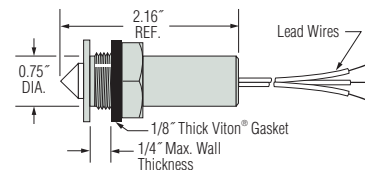
<b>Materials</b>	
<b>Housing and Prism</b>	Polysulfone
<b>Operating Pressure</b>	0 to 150 PSI, Maximum
<b>Operating Temperature*</b>	0°F to 176°F (-17.8°C +80°C)
<b>Input Voltage</b>	10 - 28 VDC
<b>Current Consumption</b>	18 mA, Approximately
<b>Output†</b>	TTL/CMOS Compatible. Open Collector Output May Sink 40 mA Up to 30 VDC.
<b>Repeatability</b>	±1 mm
<b>EMI Susceptability</b>	Meets (MIL-STD-461B Part 2 Modified) Specification of 10 V/M for Frequency Range 30 to 1000 MHz (Except 609 MHz = 9 V/M and 679 MHz = 7.5 V/M).

\* These switches are not for use in freezing liquid or steam/high condensation environments.  
Contact Gems for alternative solutions.

† See Page A-25 for Wiring Diagrams



### Dimensions



### How To Order

Specify Part Number based on Input Power and Output Condition Required.

Input Power	Probe Condition at Current Sink	
	Wet	Dry
5 VDC	<b>187575</b>	<b>187590</b>
10-28 VDC	<b>187585</b>	<b>187580</b>

### Extended Power and Switching Capabilities of 12 VDC Models with Gems.

Converts TTL output signal to 5 Amp relay output. Available as open circuit board or mounted in a NEMA 4X enclosure (pictured). See Page A-31.





# The Enhanced ELS-1150

## Compact Electro Optic Level Switch available in Nickel-Plated Carbon Steel or Stainless Steel

The enhanced ELS-1150 series is the highest performing electro optic level switch from Gems Sensors. At just 1.38" long, the ELS-1150 has been upgraded with a micro processor board design to provide a wide range of capabilities including sinking and sourcing and time delay outputs. The strong fused glass prism eliminates leak potential and is capable of handling extreme temperature and pressure applications up to 2500 psi. The ELS-1150 series is available in FM and EP versions with wide voltage ranges (ELS-1150XP). Built with solid state reliability, the sensor is available at an affordable price in Nickel-Plated Carbon Steel or Stainless Steel. The compact size of the sensor makes them ideal candidates for monitoring the small, pressurized vessels found in HVAC, refrigeration and hydraulic applications. The sensors are most commonly used for low, high and intermediate level detection.

The stainless steel version (ELS-1150SS) is excellent for application requiring corrosion resistance and is ideal for acids, solvents and dielectric water applications.

\* Higher temperature versions available up to 125°C.  
Contact our factory experts for additional ordering information.

### Applications

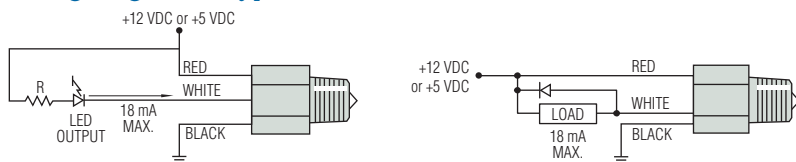
- Hydraulic and lubricating oil reservoirs
- Critical fluid level monitoring on machine tools, compressors, chillers and other industrial OEM equipment
- Ideal unit capable of handling corrosive liquids such as: acids, solvents, and dielectric water applications
- Medical Equipment; Anesthesia, Histology

### Specifications

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

\* These switches are not for use in freezing liquid or steam/high condensation environments. For higher temperature versions up to 257°F (125°C), and for other alternate requirements, contact Gems factory.  
\*\* Carbon Steel model only.

### Wiring Diagrams - Typical

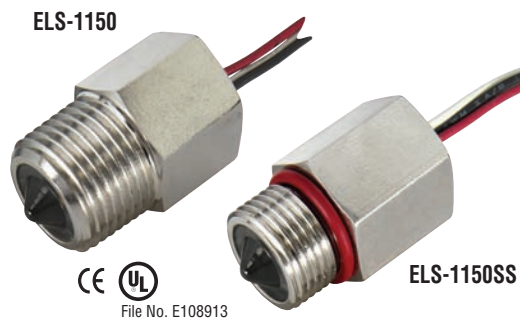


Note: Inductive loads must be diode suppressed.

### How To Order

Specify Part Number based on Input Power/ Output Condition and material required.

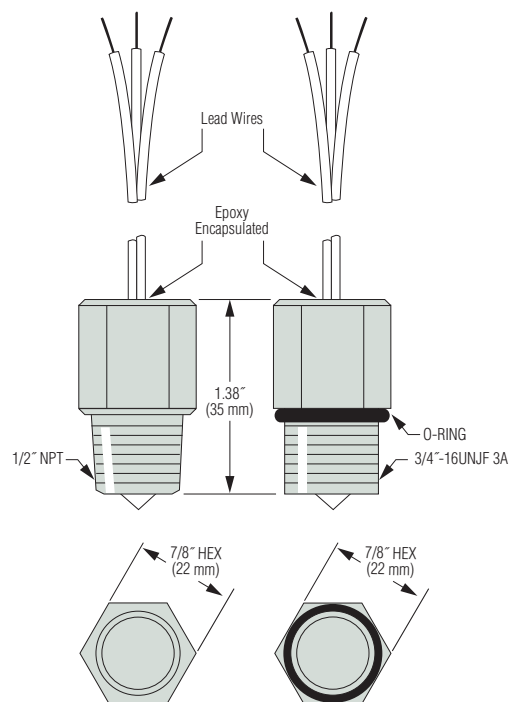
Input Power	Probe Condition at Current Sink	Nickel-Plated Steel Housing		Stainless Steel Housing
		1/2" NPT Mounting	3/4" - 16 Straight Thread	1/2" NPT Mounting
5 VDC	Wet	194469	195201	205486
	Dry	194470	195202	205487
12 VDC	Wet	194471	195203	205490
	Dry	194472	195204	205495



### Dimensions

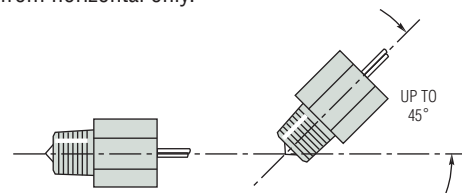
#### 1/2" NPT Mounting

#### 3/4" - 16 Straight Thread Mounting



### Mounting Attitude

These units must be mounted horizontally or up to 45° from horizontal only.



### Extended Power and Switching Capabilities of 12 VDC Models with Gems.

Converts TTL output signal to 5 Amp relay output. Available as open circuit board or mounted in a NEMA 4X enclosure (pictured). See Page A-31.



# Opto-Pak® Controllers for GEMS Electro-Optic Switches

## Extend power and switching capabilities of 12 VDC Electro-Optic switches

- ▶ Converts TTL output signal to an SPDT 5 Amp relay output.
- ▶ Operates with 12 VDC ELS-1100, ELS-1100HT\*, ELS-1150, ELS-1200\* and ELS-300 Series Electro-Optic Switches.
- ▶ Available as open board or mounted in NEMA 4X junction box.

GEMS Opto-Pak Controllers convert standard 110 VAC line current to the 12 input power required for ELS-1100 and ELS-300 operation, and provide an SPDT, 5 Amp relay output for direct control of moderate loads. Two models are available: an open circuit board Opto-Pak Controller for incorporation into custom enclosures, and the self-contained, NEMA 4X model pictured here.

\*12 VDC versions only.

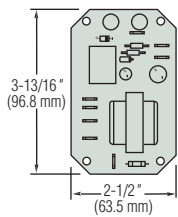
### Specifications

<b>Voltage Input</b>	115 VAC ±10%, 50/60 Hz
<b>Maximum Current Draw</b>	70 mA @ 120 VAC
<b>Relay Output</b>	SPDT; 5 Amps @ 115 VAC, 5 Amps @ 30 VDC
<b>Operating Temperatures</b>	-13°F to + 158°F (-25°C to + 70°C)
<b>Electrical Connections</b>	1/4" Male Spade Terminals*

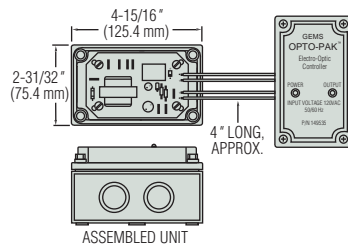
\*Ten (10) 1/4" female spade connectors (not shown) shipped loose with each unit.

### Dimensions

#### Open Circuit Board Type



#### NEMA 4X Type



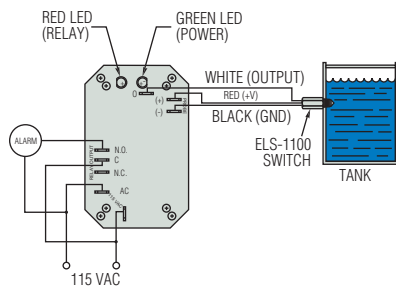
Green and Red LEDs indicate power and output status.

### Typical Applications

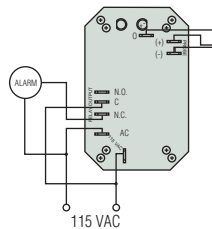
Works with 12V units:

- ELS-1100
- ELS-1100HT
- ELS-1200
- ELS-300
- ELS-1100FLG
- ELS-1150
- ELS-950

Typical Wiring Normally Open



Normally Closed



### How To Order

Specify Opto-Pak™ Controllers by Part Number.

Description	Part Number
Open Board	149536 ⚡
NEMA 4X Enclosure	149535

⚡ – Stock Items

# ExOsense™ Piezo-Resonant Sensors

- ▶ Non-Intrusive
- ▶ Repeatable
- ▶ Easy to Install – Easy to Use

ExOsense™ is the first affordable, non-intrusive liquid level sensor for plastic fluid containers. ExOsense™ sensors adhere to the outside of tanks, bottles and vessels, 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 containers to large tanks.

## Specifications

<b>Compatible Plastic Bottle Materials</b>	Polyethylene (PE), Polypropylene (PP) Polycarbonate (PC), ABS, Styrene, PVC, and others
<b>Bottle Materials Not Recommended</b>	Teflon® family, or Any Foamed Core Plastics
<b>Min. Bottle Diameter for Round Bottles</b>	3" (76.2 mm)
<b>Bottle Wall Thickness</b>	0.04" to 0.15" (1.0 mm to 3.8 mm)
<b>Termination of Sensor</b>	Mini USB Style Connector to Electronics
<b>Input Power Supply (volts)</b>	4.75 to 5.25 VDC (Optional Voltage Regulator available for 6 to 32 VDC.)
<b>Power Consumption (current)</b>	<40mA Typ. @ 5 VDC
<b>Calibration</b>	No User Calibration Required. Pre-configured for Container Materials, Wall Thickness, & Output Options. Works on Bottle Materials or Wall Thickness Without User Input.
<b>Output Configuration</b>	Open Collector; 40 mA, Max.
<b>Switch Condition</b>	Normally Open/Normally Closed
<b>Standard Response Time</b>	2 msec.
<b>Delay Range</b>	0 to 60 Seconds, Standard is No Delay, Optimal is 0 to 60 Seconds.
<b>RFI/EMI Susceptibility</b>	3v/m
<b>Agency Approvals</b>	UL 508 Listed (File E 305671), CE & IEC 61326 (RFI/EMI)
<b>Operating Temperature</b>	
<b>Sensor</b>	32°F to 158°F (0°C to 70°C)
<b>Electronics</b>	32°F to 149°F (0°C to 65°C)
<b>Repeatability</b>	±0.039" (±1 mm)
<b>Accuracy</b>	±0.063" (±1.6 mm)
<b>Sealing Capability</b>	IP65

## Operating Principle

Our sensor incorporates proprietary 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.

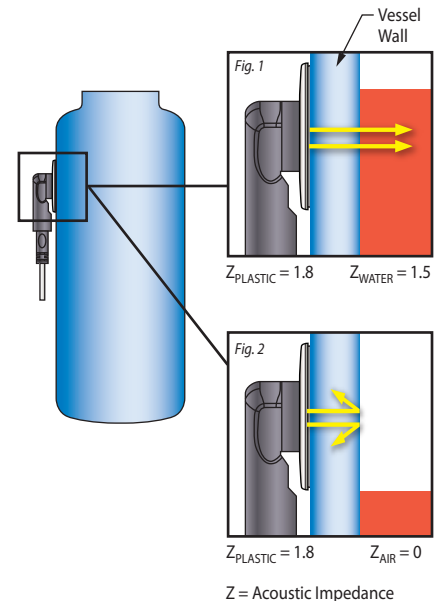
\* Acoustic Impedance: a material property defined as the product of sound velocity and material density. The relative transmission and reflection at an interface are governed in part by the acoustic impedances of the materials on each side of the interface. The letter Z is used for acoustic impedance and is expressed in [kg/s m<sup>2</sup>] = 1 Rayl: Water Z = 1.5 MRayls; Air Z = 0 MRayls



U.S. Patent 7,360,417 

## Typical Applications

- Fluid Monitoring:
- Ink handling systems
  - Water purification systems
  - Pesticide management and usage
  - Water treatment systems
  - Fluid storage tanks
  - Coolant
  - Saline
  - Nuclear liquid wastes
  - Containment systems
  - Oil water separation systems
  - Semiconductor fabrication
  - Waste
  - Chemicals
  - Detergent/wash





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.

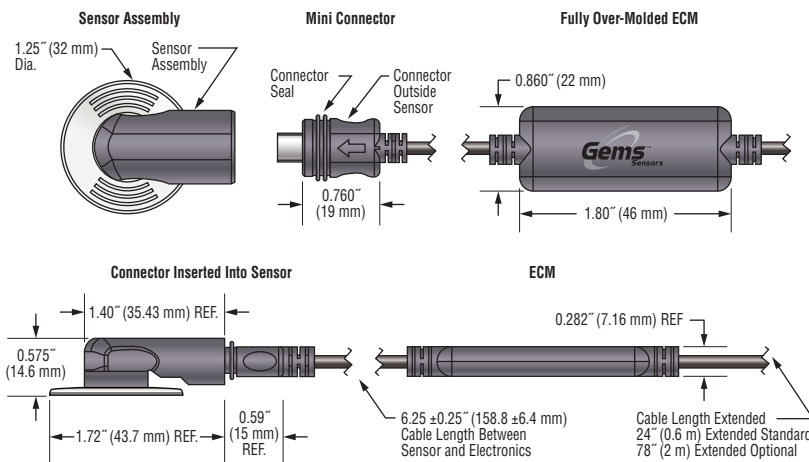
2. Connect

Connect the sensor to the ECM using the mini connector.

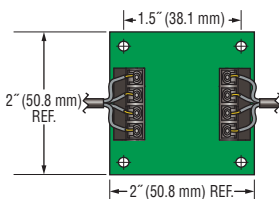
3. Sense

Apply power and sense the fluid level.

Dimensions



Optional Voltage Regulator 8-30V Input / 5V Output



Connection Type	Part Number
Header	219445
Solder	218699

Features

- Non-Intrusive, stays outside the container
- Simple installation
- No calibration needed
- No long-term drift
- ±1.6 mm Accuracy
- Very small footprint
- Robust design for rough handling
- Mini, moisture-resistant connector for ease of use
- Fully scaled, over molded ECM

Benefits

- Never contacts hazardous fluids
- Eliminates fluid contamination
- Repeatable liquid level sensing
- Easy to use
- Eliminates fluid compatibility issues
- Improves instrument uptime
- Maximizes tank volume
- Improves systems reliability
- No special mounting required
- Eliminates testing for media compatibility

How To Order

Use the matrix below to select a Part Number based on Container Material, Container Thickness and Sensor Condition @ Current Sink.

Container Material	Part Numbers							
	Container Thickness							
	.04" to .062" (1.02 to 1.57 mm)		.058" to .082" (1.47 to 2.08 mm)		.08" to .102" (2.03 to 2.59 mm)		.1" to .125" (2.54 to 3.18 mm)	
	N.O Wet Sink	N.C Dry Sink	N.O Wet Sink	N.C Dry Sink	N.O Wet Sink	N.C Dry Sink	N.O Wet Sink	N.C Dry Sink
HDPE	219005	219013	219005	219013	219005	219013	219005	219013
LDPE	219002	219010	219002	219010	219008	219016	219008	219016
Polypropylene	219001	219009	219004	219012	219004	219012	219004	219012
Polycarbonate	219006	219014	—	—	—	—	219004	219012
Polystyrene	219005	219013	219005	219013	219005	219013	219005	219013
Polysulfone	219007	219015	NR	NR	NR	NR	NR	NR
PVC	219003	219011	219003	219011	219003	219011	219003	219011
Polyester	—	—	219002	219010	—	—	219006	219014
ABS	219001	219009	219001	219009	219001	219009	219001	219009

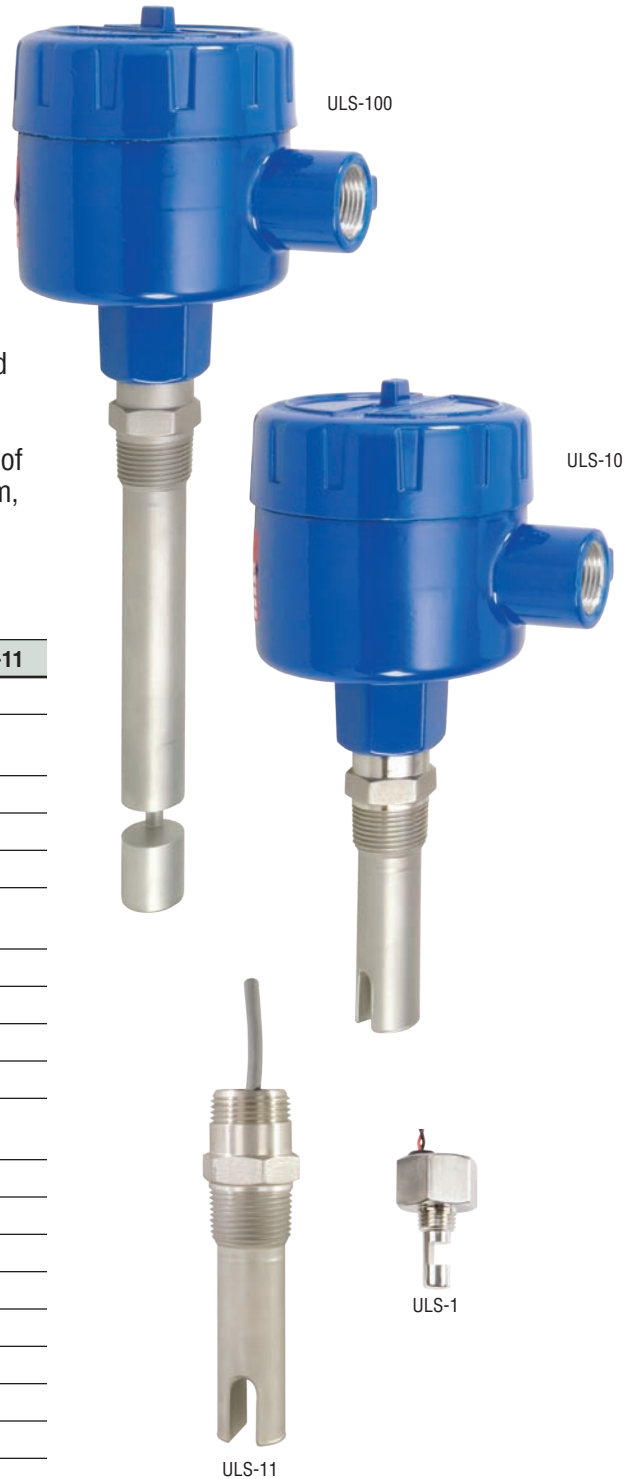
Note: All p/n above includes ExOsense sensor plus standard 5 VDC electronic control module, no delay 24" cable. Consult factory for combinations not listed above.



# Ultrasonic Switches Monitor the Toughest Applications

- ▶ Operates in a wide variety of liquids
- ▶ Handles pressures to 1000 psi
- ▶ Unaffected by foam, vapors, particulate or turbulence
- ▶ Lengths to 121 inches (307.3 cm)
- ▶ Can be side, top or bottom mounted
- ▶ Sized and priced for most applications
- ▶ Easy to install — simple to use

GEMS ULS Series of ultrasonic switches are designed for a broad spectrum of viscous to light liquids; including some of the most challenging liquids you may deal with: acids, freon, paints, lacquers, etc. Stainless steel units are built to withstand high temperatures and pressures with welded stainless steel sensor probes that have no seals to leak and no moving parts to wear out. ULS Series switches are unaffected by variation in temperature, pressure, density or type of liquid. ULS-10 and ULS-100 electronics are housed in cast aluminum, NEMA 4/NEMA 7 explosion proof and water tight enclosures.



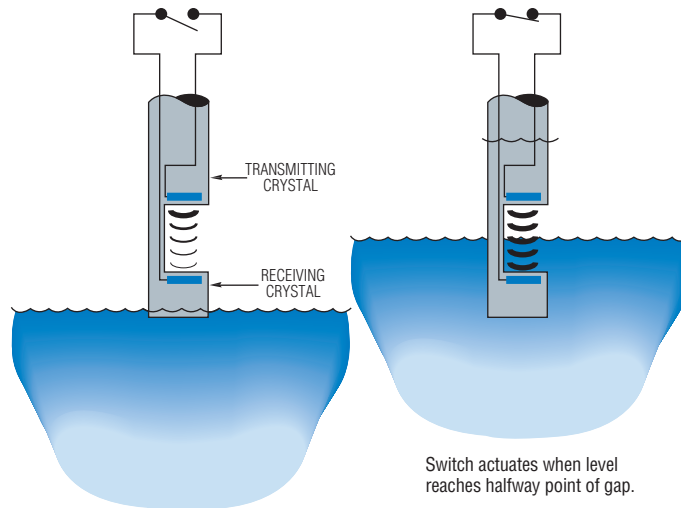
## Ultrasonic Switch

### Selection Guide

	ULS-1	ULS-10	ULS-100	ULS-11
Single Point Sensing	•	•	•	•
Input Power:				
115 VAC / 230 VAC		•	•	
12/24 VDC		•	•	
9-36 VDC				•
12-36 VDC	•			
Output:				
10 Amp DPDT		•	•	
1 Amp SPDT	•			•
5 mA (dry), 10 mA (wet)	•			
4 mA / 20 mA Single 2-Wire		•		
FM-Approved Explosion Proof Option			•	
Sensor Material Options:				
316 Stainless Steel (standard)		•	•	•
316L Stainless Steel			•	
Monel®			•	
Hastelloy B®			•	
Hastelloy C®			•	
Teflon®	•		•	
Kynar®			•	
CPVC			•	
Polypropylene	•			

## General Operating Principle

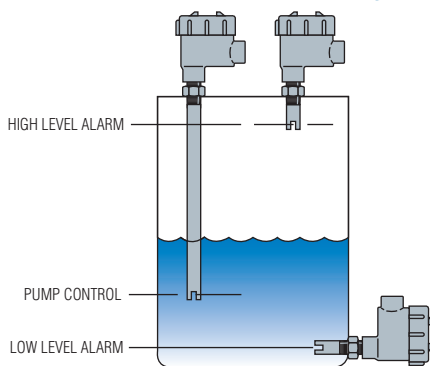
ULS Series switches operate using ultrasonic sound wave propagation. Ultrasonic sound waves are greatly attenuated when transmitted through air. Conversely, when liquid is present, transmission of the sound waves is greatly enhanced. The electronic control unit generates electrical signals that are converted to bursts of ultrasonic energy at the sensor. The ultrasonic bursts are transmitted across the liquid sensing gap. Upon receipt of a valid signal, the solid-state electronics generate a data enable condition, indicating liquid is present. This signal energizes a relay and provides an output condition.



## Typical Installation

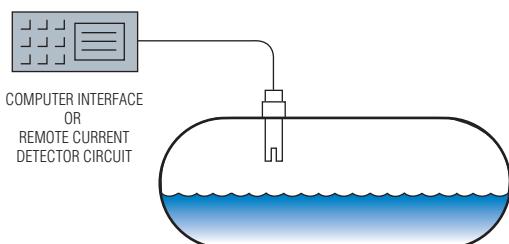
1. Drill a suitable hole in the vessel or pipe wall and tap for 3/4" NPT. In thin walled vessel or material not suitable for threading, weld or braze a bushing to accept the sensor.
2. Screw the sensor in the threaded section and make sure that there is a good seal. Use a pipe compound or sealing tape to avoid excessive tightening. Do not overtighten.
3. Run the power and control wiring cables to the electronics control unit.

## Vertical or Horizontal Mounting



### Advantages of GEMS ULS-10 2-Wire Output Switches

1. No A.C. Power
2. No Coaxial Cable Required
3. Up to 1000 ft. or Longer Distance
4. Reduces Installation Cost



## Secondary Containment Tanks and Piping Systems

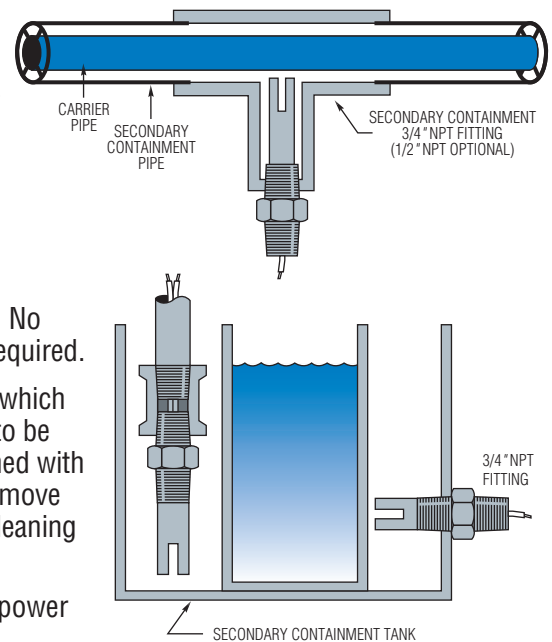
### Maintenance

Electronics are constructed with solid-state components and epoxy-potted. Periodically, check and clean the sensor when used with liquids which cause a coating build-up on the sensor. No other maintenance is required.

If the pipe or vessel to which the unit is mounted is to be steam-cleaned or cleaned with abrasive detergents, remove the entire unit before cleaning by:

- (1) Disconnecting the power at source.
- (2) Opening the housing cover.
- (3) Removing power and control wiring cables.
- (4) Unthreading the sensor.

To reinstall, follow installation procedures.



LEVEL SWITCHES – SINGLE POINT

Contents	Page Start
ULS-1 Low Power Steel.....	A-34
ULS-10 & ULS-100 10 Amp Switches .....	A-35
ULS-11 Low Power Steel.....	A-37

# ULS-1 Single Point Level Switches

- ▶ Compact 1/4" and 1/2" NPT versions
- ▶ All-Stainless Steel wetted materials
- ▶ IP68 construction for tanks or sumps

Gems ultrasonic switches are an excellent choice for a broad range of liquids including those with light coating or scaling type characteristics.

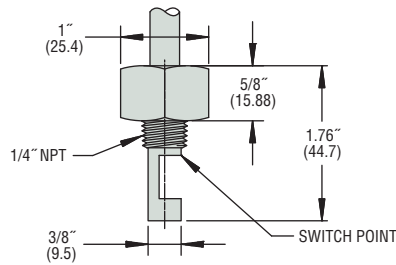
Relay output provides a reliable switch interface with remote devices such as a PLC, SCADA or alarm.

## Specifications

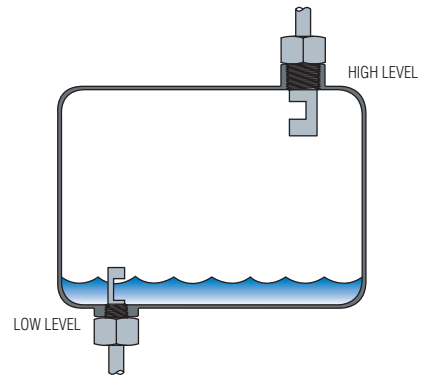
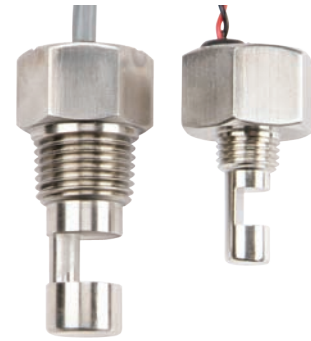
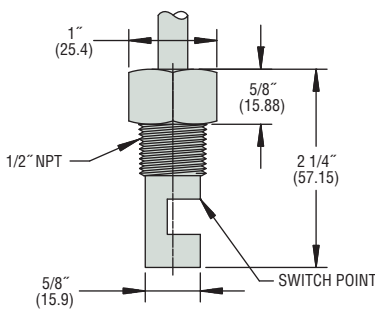
<b>Wetted Material</b>	316L Stainless Steel
<b>Repeatability</b>	2 mm (or better)
<b>Protection</b>	Transient Reverse Polarity
<b>Leakage Current</b>	<50µA
<b>Delay</b>	0.5 seconds
<b>Input Power</b>	5 VDC to 30 VDC
<b>Output</b>	See Ordering Table

## Dimensions

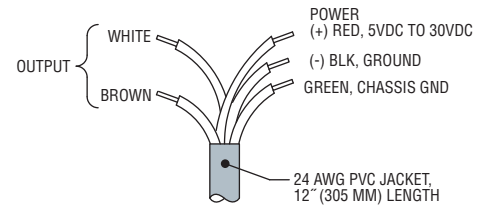
### 1/4" NPT Mounting



### 1/2" NPT Mounting



## Wiring



## How To Order

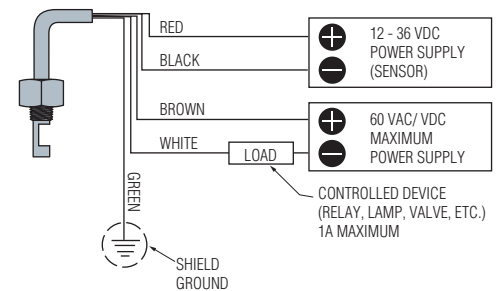
Select a Part Number based on Mounting Size and Output.

Mounting Size	Electronic Output	Part Number
1/4" NPT	Wet Sink	<b>220901</b>
	Wet Source	<b>220902</b>
	1A SPST Relay, Normally Closed	<b>220903</b>
1/2" NPT	Wet Sink	<b>221485</b>
	Wet Source	<b>221486</b>
	1A SPST Relay, Normally Closed	<b>221487</b>

Note: Other Electronic Output options are available. Please contact Gems.

## Wiring Direct to a Load

### N.C. Operation (Relay Signal Output)



# ULS-10 Series and ULS-100 Series

## High Performance Models with Explosion-Proof Enclosures

- ▶ 10 Amp Relay Output
- ▶ 115/230 VAC 12 VDC or 24 VDC Input
- ▶ High Gain
- ▶ No Calibration Necessary
- ▶ Temperatures to 300°F (149°C)
- ▶ Lengths to 99 inches (251.5 cm)

The ULS-100 Series features our high performance sensor probe for handling liquid temperature to 300°F (149°C) and pressure to 1000 psi. Explosion-proof and water-tight, cast aluminum enclosures are standard; FM Approved explosion-proof enclosures are also available.

The ULS-10 Series features a Tip Gap probe design for closer tank bottom access. The miniaturized, encapsulated electronic control unit may be supplied for remote mounting, or directly mounted on sensor in an explosion-proof, NEMA enclosure.

### Specifications

<b>Input Power</b>	115/230 VAC, 50/60 Hz; or 12/24 VDC
<b>Gain</b>	
<b>ULS-10 Series</b>	500:1
<b>ULS-100 Series</b>	1000:1
<b>Output</b>	
<b>ULS-10 Series</b>	10 Amp DPDT Relay, or 2-Wire, 4mA-Dry, 20mA-Wet (9-36 VDC)
<b>ULS-100 Series</b>	10 Amp DPDT Relay
<b>Delay (On)</b>	0.5 Seconds
<b>Repeatability</b>	2mm, Typical
<b>Housing</b>	NEMA 4/NEMA 7 Watertight, Explosion Proof Enclosure, Epoxy Coated Cast Aluminum Class I, Group C & D; Class II, Group E, F, & G; and Class III, Division 1 & 2.
<b>Operating Temperature</b>	
<b>Sensor</b>	
<b>ULS-10 Series</b>	-40°F to +300°F (-40°C to +149°C)
<b>ULS-100 Series</b>	-40°F to +300°F (-40°C to +149°C)
<b>Electronics</b>	-20°F to +170°F (-29°C to 77°C)
<b>Pressure, PSIG, Max.</b>	1000 @ 250°F

**ORDER IT!**  
 Ordering is Easy! See Page A-38.  
 Easy online ordering too!

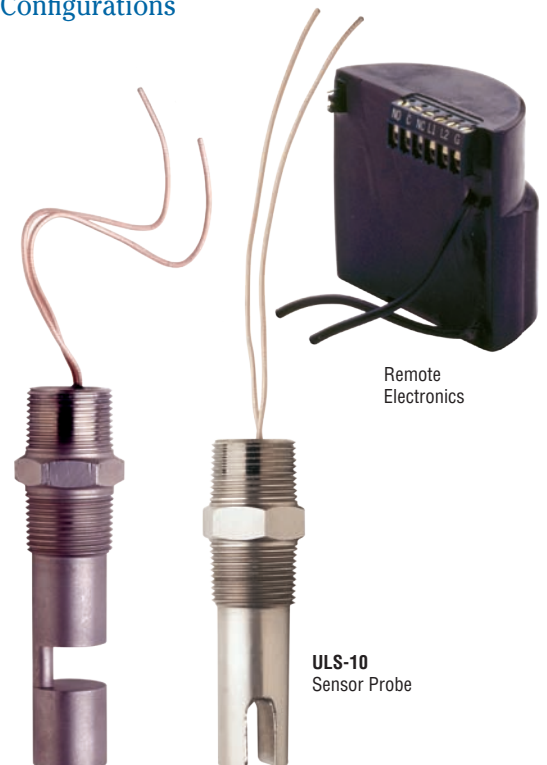


**ULS-100 Series**  
 FM-Approved Explosion-Proof Enclosure may be ordered by specifying ULS-100-EP.



**ULS-10 Series**  
 Will sense liquid to within 1/4" of tank bottom.

### Remote Electronics Configurations



**ULS-100**  
 Sensor Probe

**ULS-10**  
 Sensor Probe

LEVEL SWITCHES – SINGLE POINT

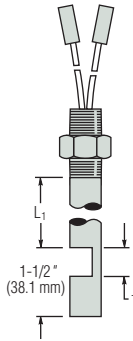


## 1. Mounting Type\*

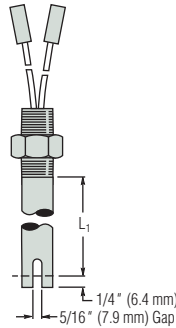
Integral Electronics 3/4" NPT		Remote Electronics 3/4" NPT	
Uls-100 Series	Uls-10 Series	Uls-100 Series	Uls-10 Series
<p>3-3/4" (95.2 mm) 4.0" (101.6 mm) 3/4" NPT THREADEC HUB 3/4" NPT 2-1/2" (63.5 mm) MIN. 1-1/2" (38.1 mm) 7/8" (22.2 mm)</p>	<p>3-3/4" (95.2 mm) 4.0" (101.6 mm) 3/4" NPT THREADEC HUB 3/4" NPT 2-1/2" (63.5 mm) MIN. 7/8" (22.2 mm)</p>	<p>3/4" NPT 2-1/2" (63.5 mm) MIN. 1-1/2" (38.1 mm) 7/8" (22.2 mm)</p>	<p>3/4" NPT 4-1/2" (114.3 mm) 2-1/2" (63.5 mm) MIN. 7/8" (22.2 mm)</p>
<b>Mounting and Sensor Materials</b>		316 Stainless Steel (Standard) Consult Factory For Other Materials.	

\*Flanges also available; consult factory for sizes and materials.

## 2. Actuation Level Dimensions



**Uls-100 Series**  
Switch actuation level ( $L_1$ ) is determined following the guidelines below.  
 $L_1 = 1'' (25.4 \text{ mm})$  Minimum  
99'' (251.5 cm) Maximum\*

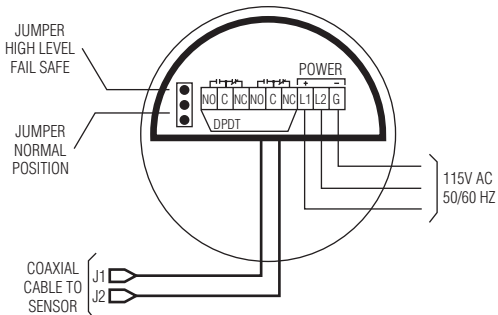


**Uls-10 Series**  
Switch actuation level ( $L_1$ ) is determined following the guidelines below.  
 $L_1 = 2-1/4'' (57.2 \text{ mm})$  Minimum  
99'' (251.5 cm) Maximum\*

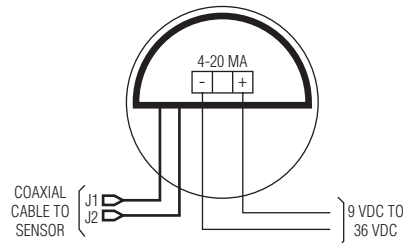
\*Consult factory for longer lengths.

## Wiring Diagrams

### DPDT – Uls-10 and Uls-100 Series



### 4-20mA – Uls-10 Series only



Note:  
For 24 VDC or 12 VDC Models  
Connect Positive (+) to L1-Terminal  
Connect GND (-) to G - Terminal

# ULS-11 Series – Single Point Self-Contained Relay Saves Space

- ▶ 1 Amp SPDT Relay Output
- ▶ 9 to 36 VDC Input
- ▶ Temperatures to 160°F (71.1°C)
- ▶ Lengths to 99 inches (251.5 cm)

By integrating a 1 amp relay into the stem, we've made the ULS-11 our most compact ultrasonic unit. Yet, as unobtrusive as it is, the ULS-11 still delivers ultra-reliable solid-state performance in lengths up to 99 inches. Tip gap probe configuration places sensing point at 1/4 inch from probe tip for closer tank bottom sensing. Electronics are completely epoxy sealed for years of maintenance free service.

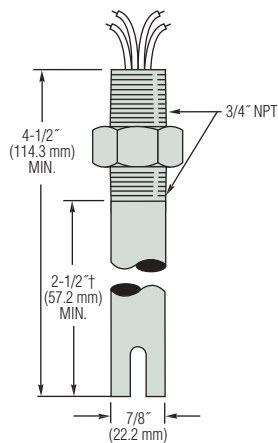
## Specifications

<b>Input Power*</b>	9 VDC to 36 VDC
<b>Leakage Current</b>	<50 µA
<b>Gain</b>	300:1
<b>Output</b>	1 Amp, SPST Relay output N.O. or N.C.
<b>Consumption</b>	Relay 40mA energized; 10mA relay off
<b>Repeatability</b>	2mm typical
<b>Delay (On)</b>	0.5 Seconds
<b>Operating Temperature</b>	-20°F to +160°F (-29°C to +71°C)
<b>Pressure, PSIG, Max.</b>	1000
<b>Protection</b>	Transient Reverse Polarity
<b>Lead length</b>	12" PVC**

\* Contact GEMS for optional AC input versions.  
\*\* Consult factory for longer lead lengths.

## 1. Mounting Type

**Type 1**  
3/4" NPT



<b>Mounting and Sensor Materials</b>	316 Stainless Steel
--------------------------------------	---------------------

† 2-1/4" units are standard stock units. All other lengths are custom and require 5-piece minimum order. Contact factory.

## How To Order

Specify ULS-11 Level Sensors by Part Number.

Description	Part Number
2.25" L <sub>1</sub> , SPST N.O.	175387

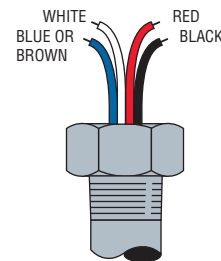
⚡ – Stock Items

**ORDER IT!**

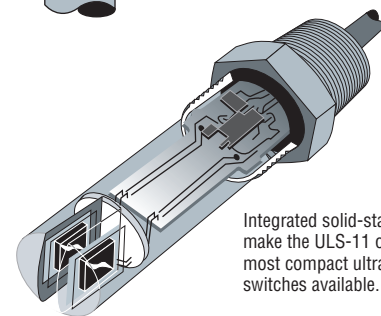
Ordering is Easy! See Page A-40.  
Easy online ordering too!



## Wiring Diagram

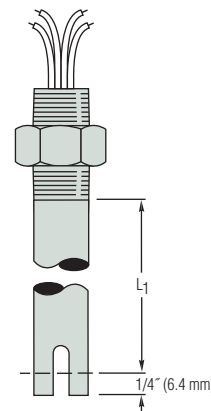


**Color Code**  
Power: Red (+)  
Black (-)  
Relay: Common - White  
N.O. - Blue  
N.C. - Brown




Integrated solid-state electronics make the ULS-11 one of the most compact ultrasonic level switches available.

## 2. Actuation Level Dimensions



Switch actuation level (L<sub>1</sub>) is determined following the guidelines below.

L<sub>1</sub> = 2-1/4" (57.2 mm) Minimum  
99" (251.5 cm) Maximum

 <p><b>Photocopy This Form</b> Use one form for each product type you are selecting. <small>This form may also be completed online at <a href="http://gemssensors.com">gemssensors.com</a> for RFQ.</small></p>	This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____ Quantity Needed _____ Date Required ____/____/____ Shipping Method: _____ Partials Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No	Name _____ Company _____ Street _____ City _____ State ____ Zip _____ Phone (____) _____ Fax (____) _____
--	---	--

## Ultrasonic Level Switches

### Application Environmental Conditions

This information is essential to the accurate and proper operation of your GEMS configurable sensors. Please complete fully and accurately.

- |   |  |
|---|--|
| <b>1. Liquid Media:</b> _____<br><b>2. Pressure:</b> Minimum _____ psig Maximum _____ psig<br><b>3. Temperature:</b> Minimum _____ °F Maximum _____ °F<br><b>4. Specific Gravity:</b> Minimum _____ Maximum _____ | <b>5. Viscosity:</b> _____ SSU<br><b>6. Tank Material:</b> _____<br><b>Tank Depth:</b> _____<br><b>7. Unit is Mounted In:</b> <input type="checkbox"/> Tank Top <input type="checkbox"/> Tank Bottom |
|---|--|

#### 1. Series (Page Number):

- ULS-11 (A-39)     ULS-10 (A-37)     ULS-100 (A-37)

#### 2. Input Power:

ULS-10, ULS-100:

- 115 VAC     230 VAC     12 VDC     24 VDC

ULS-11:

- 9 to 36 VDC

#### 3. Output (Check One Box Only):

ULS-11:     SPST     N.O.     N.C.

ULS-10:     DPDT     2-Wire, 4mA (Dry), 20mA (Wet)

ULS-100:     DPDT

#### 4. Mounting Type:

ULS-11:     Type 1

ULS-10, ULS-100:

- Integral Electronics:  
 NEMA 4 Enclosure:     NEMA 7 Enclosure:  
 Remote Electronics: Sensor Cable Length \_\_\_\_\_ inches

Please specify any non-standard material request here:

Standard sensor material is 316 Stainless Steel. See Table on Page A-34 for alternate materials available.

#### 5. Actuation Level Dimension:

Actuation Level	Distance to Actuation Level – Inches*	Range		
		Series	Min.	Max.
L1		ULS-11	2-1/4"	99"
		ULS-10	2-1/4"	120"
		ULS-100	1"	120"

\* Measure from bottom of mounting threads.

Please contact GEMS Sensors Inc. for any configuration or special requirements not covered on this form. **800-378-1600**

Quote \$ \_\_\_\_\_ Date Quoted \_\_\_\_/\_\_\_\_/\_\_\_\_



**Gems Sensors & Controls**  
 One Cowles Road  
 Plainville, CT  
 06062-1198

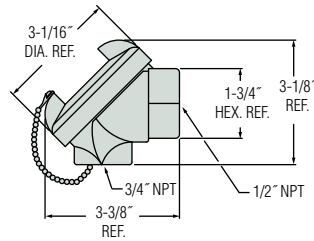
tel 860.747.3000  
 fax 860.747.4244  
[www.gemssensors.com](http://www.gemssensors.com)

# Junction Boxes

GEMS offers optional CSA Listed and FM Approved, explosion-proof junction boxes for many level switch models. Compatible level switches are indicated throughout this catalog by the small icon—

**NOTE:** Explosion-proof ratings are available only when J-boxes are part of factory assembled sensor unit. J-boxes below, when ordered separately, do not carry explosion-proof ratings.

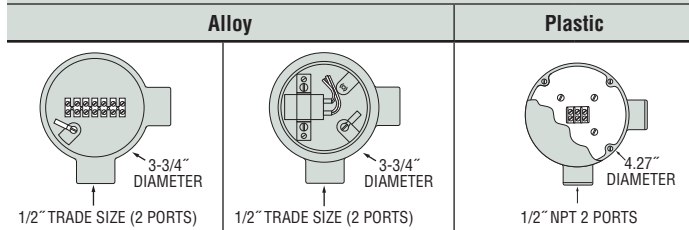
### Explosion-Proof J-Boxes



	Aluminum	Iron
<b>Materials</b>	Die Cast Aluminum	Cast Iron
	Stainless Steel Chain and Pin	
	EPDM Rubber Gasket (300°F/149°C Max. Service Temp.)	
<b>Finish</b>	Polished	Electroless Nickel Plate
<b>Weight (approx.)</b>	.62 lbs.	.62 lbs.
<b>NEMA Rating</b>	4, 13	4
<b>Part Number</b>	<b>192147</b>	<b>198848</b>

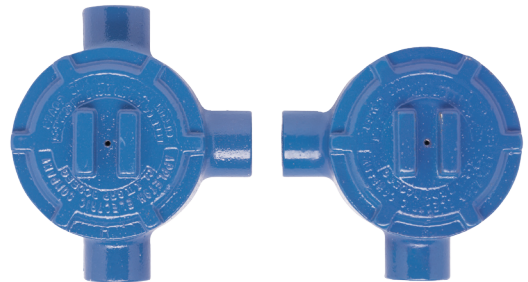


### Non-Explosion Proof J-Boxes



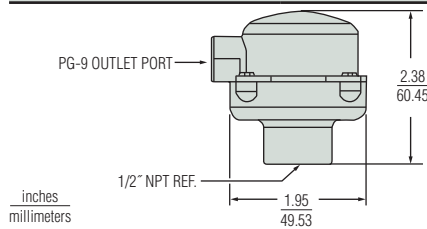
	Alloy		Plastic	
<b>Type</b>	3-pin	7-pin	3-pin	7-pin
<b>Part Number</b>	<b>113873</b> ⚡	<b>113877</b> ⚡	<b>113850</b>	<b>118828</b>

⚡ – Stock Items.



Junction boxes are CSA and FM approved for explosion proofing in Class I, Division 1, Groups B, C, D, E, F, G

### Conduit/Cable Gland Connections



	Standard	5-Amp Relay
<b>Specifications</b>	Empty enclosure for lead wire splice connections.	120 VAC 50/60 HZ Contacts: 5A – 240 VAC Res 1/3 HP – 120 VAC 5A – 28 VDC Res.
<b>Part Number</b>	<b>181410</b>	<b>180417</b>





# CAP-100 Series – Non-Contact, Capacitive Level Sensor

- ▶ For non-metallic containers
- ▶ Easy external mounting
- ▶ Compact – 30x45 mm (1.18" x 1.77")
- ▶ Potentiometer for sensitivity adjustment
- ▶ Power on and signal LED indicators

The CAP-100 series offers a unique level sensing solution for a wide variety of bottle types including plastic, glass and fiberglass. The non-contact sensor is ideally suited for medical applications such as waste, reagent or diluent liquids as well as dark, sticky or viscous fluids. The easy-to-calibrate sensor is available in both aqueous and non-aqueous versions and can be delivered with factory preset sensitivity for quick installation for OEM orders. The CAP-100 may also be used as a proximity sensor to detect the presence of solids such as paper or pulp.

## Specifications

<b>Performance</b>	
Nominal Sensing Distance, Sn	0.39" (10mm)
Sensing Range	0-0.39" (0-10mm)
Repeat Accuracy - (% of Sn)	<10%
Hysteresis - (% of Sn)	<20%
<b>Mechanical</b>	
Enclosure Ratings	IP67, NEMA 1,3,4,6,13
Operating Temperature Range	-13°F to +158°F (-25°C to +70°C)
LED Signal Indicator	Yellow
Power On LED Indicator	Green
Potentiometer	Yes
<b>Sensor Type</b>	
Unshielded	L-Type, Non-Embeddable
Shielded	D-Type, Embeddable
Sensor Material	Glass Filled Nylon
Cable	78.74" (2 meter), 3 Wire PVC
Shock	30g, 11ms
Vibration	55Hz, 1mm amplitude in all planes
<b>Electrical</b>	
Supply Voltage	10-48 VDC
Continuous Switching Current	300 mA
Voltage Drop	<2 VDC
Current Consumption	<10 mA
Switching Frequency	100 Hz
Transient Protection	2kV, 1ms, 1 kOhm
Overload Protection	Yes
Short Circuit	Yes
Reverse Polarity Protection	Yes
Approvals	CE

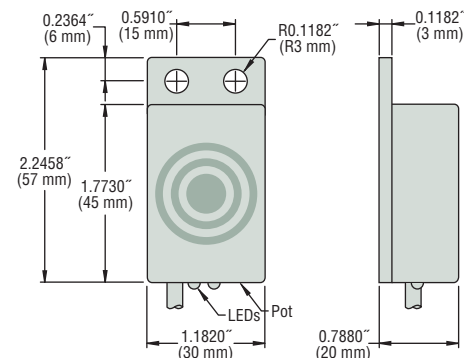


## Typical Applications

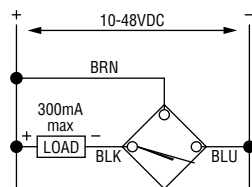
Fluid Monitoring:

- Waste
- Reagents
- Diluent
- Detergent/Wash
- Coolant
- Printing Ink

## Dimensions



## Wiring Diagram



## How To Order

Select a Part Number based on Fluid Properties and Sink State.

Fluid Properties	Max. Container Wall Thickness	Wet/Dry Sink	Part Number
Water Based, Conductive (unshielded sensor)	5/8"	Wet	<b>230079</b>
		Dry	<b>230081</b>
Non-Water Based, Not Conductive (shielded sensor)	3/8"	Wet	<b>228830</b>
		Dry	<b>229855</b>

## CAP-200 Series – Compact, 1/2" NPT Mount

- ▶ For metallic and non-metallic containers
- ▶ Food grade plastic housing
- ▶ No sensor well required
- ▶ Potentiometer for sensitivity adjustment

The CAP-200 Series is easily threaded directly into 1/2" NPT fittings for an easy level sensing solution within a wide variety of metal and non-metal tanks. The highly accurate sensor is built from durable Delrin® material, and is available in both aqueous and non-aqueous versions. The easy to calibrate sensor can be delivered with factory preset sensitivity for quick installation by OEM. The CAP-200 may also be used as a proximity sensor to detect the presence of solids such as paper or pulp.

### Specifications

Performance	
Nominal Sensing Distance, Sn	0.39" (10mm)
Sensing Range	0-0.39" (0-10mm)
Repeat Accuracy - (% of Sn)	<10%
Hysteresis - (% of Sn)	<20%
Mechanical	
Enclosure Ratings	IP67, NEMA 1,3,4,6,13
Operating Temperature Range	-13°F to +158°F (-25°C to +70°C)
LED Signal Indicator	Yellow
Power On LED Indicator	Green
Potentiometer	Yes
Sensor Type	
Unshielded	L-Type, Non-Embeddable
Shielded	D-Type, Embeddable
Barrel Material	Delrin®
Termination	78.74" (2 meter), 3 Wire PVC
Shock	30g, 11ms
Vibration	55Hz, 1mm amplitude in all planes
Electrical	
Supply Voltage	10-48 VDC
Continuous Switching Current	300 mA
Voltage Drop	<2 VDC
Current Consumption	<10 mA
Switching Frequency	100 Hz
Transient Protection	2kV, 1ms, 1 kOhm
Overload Protection	Yes
Short Circuit	Yes
Reverse Polarity Protection	Yes
Approvals	CE pending

### How To Order

Select a Part Number based on Fluid Properties and Sink State.

Fluid Properties	Min. Container Wall Thickness	Container Material	Wet/Dry Sink	Part Number
Water Based, Conductive (unshielded sensor)	5/8"	Non-Metallic	N.O. Wet	<b>230077</b>
			N.C. Dry	<b>230078</b>
Non-Water Based, Not Conductive (shielded sensor)	3/8"	Non-Metallic or Metallic	N.O. Wet	<b>230082</b>
			N.C. Dry	<b>230083</b>

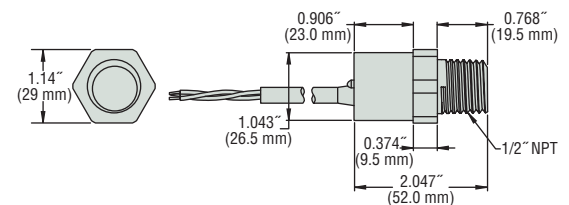


### Typical Applications

Fluid Monitoring:

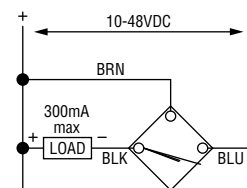
- Waste
- Reagents
- Diluent
- Detergent/Wash
- Coolant
- Printing Ink

### Dimensions

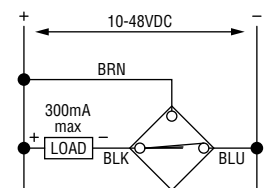


### Wiring Diagram

#### Normally Open



#### Normally Closed



# Float Type Multi-Point Custom Length – 1 to 7 Levels

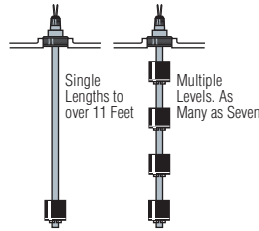
GEMS Custom Length level switches are extremely versatile. Within this section you'll find level switches that are configured to your custom specifications at the GEMS factory.

## Single Actuation Levels

When one of our Standard Single Level switches doesn't extend to the length you need, no problem, order a Custom Length single level switch from this section. Specify lengths to over 11 feet. These units also offer you the flexibility of mounting a low, or intermediate level switch from the tank top rather than a bottom or side mounting.

## 2 to 7 Levels

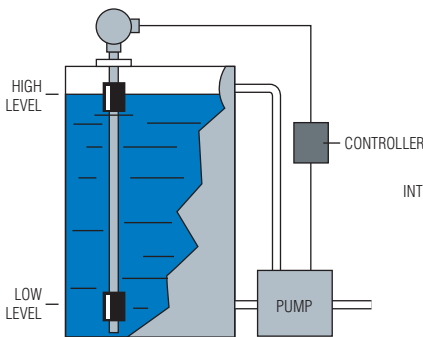
GEMS Custom Length models can be configured with "up to seven" independent switch actuation levels, depending on the series type. These "multi-station" units offer the most practical way to monitor multiple liquid level points within a single tank. Only a single entry point into the tank is required, and all electrical wiring emanates from a single source. In addition to tracking changing level points of a single liquid within a tank, "multi-station" level switches are ideal for monitoring liquid interfaces and emulsions in vessels simultaneously containing two or more liquids. Contact GEMS with your liquid specifications for further information on this type of application.



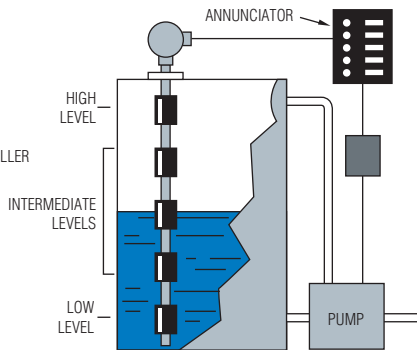
## Typical Application

GEMS Custom Length Switches are used to monitor water, diesel or lube oils, chemicals and petrochemicals.

Pump-Up/Pump-Down Operations



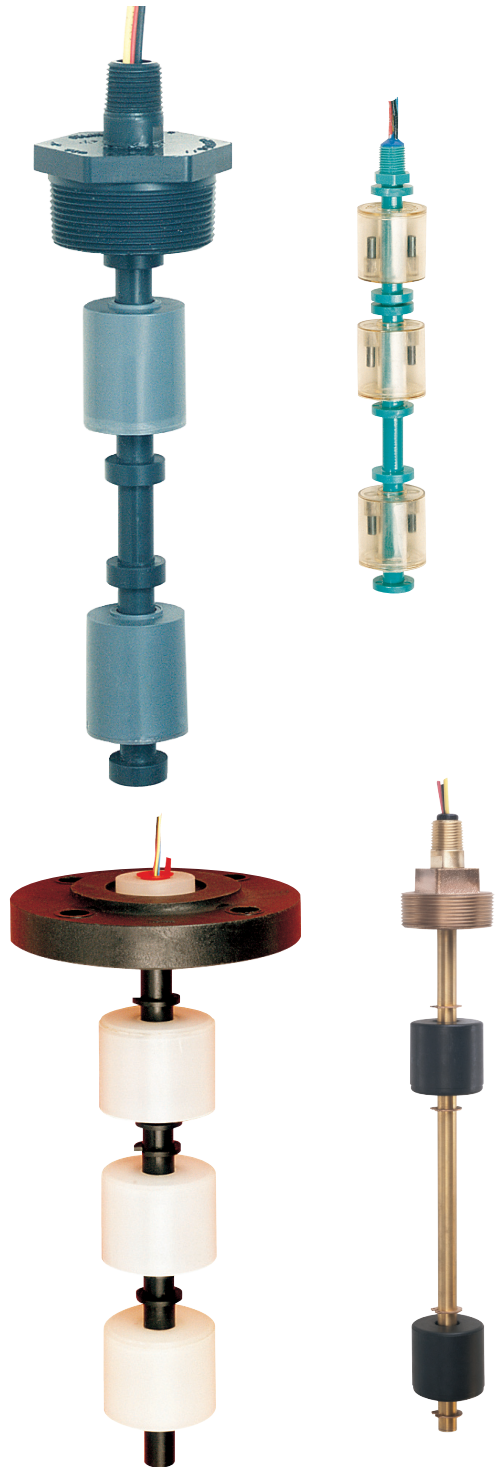
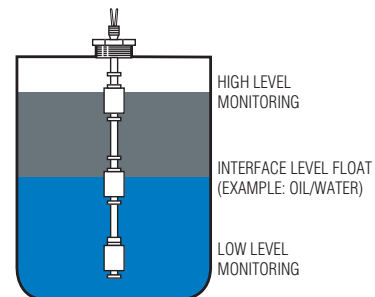
Pump-Up/Pump-Down with Intermediate Level Indication



Using GEMS Custom Length level switches, junction boxes, solid-state relays and annunciators, complete liquid level control systems are easily configured.

## Liquid Interface Monitoring

In addition to monitoring the surface level of liquids, many GEMS Level Switches can be used to sense the interface point between dissimilar liquids sharing the same tank. Monitoring water condensation in fuel storage tanks, and separating chemical emulsions in process systems are two typical application examples. Multi-station level switches can be configured to monitor this interface point in addition to high and low liquid levels. Contact Gems Sensors Inc. with your specific application.



## Ultrasonic — Non-Contact Multi-Point Sensors

- ▶ Accurate and reliable sensing method
- ▶ Ideal technology for difficult fluids

Gems delivers the answer for challenging fluid measurement with our new ultrasonic UCL-510 Transmitter/Multipoint Level Switching Combo. This accurate and reliable sensor is designed for the most difficult fluids to monitor — including ultrapure, dirty, coating, scalding or corrosive types.



### Typical Media

- Acids • Wastewater • Inks and Paints • Slurries • Food and Beverage
- Semiconductor Process Chemicals • Oils and Petroleum Distillates

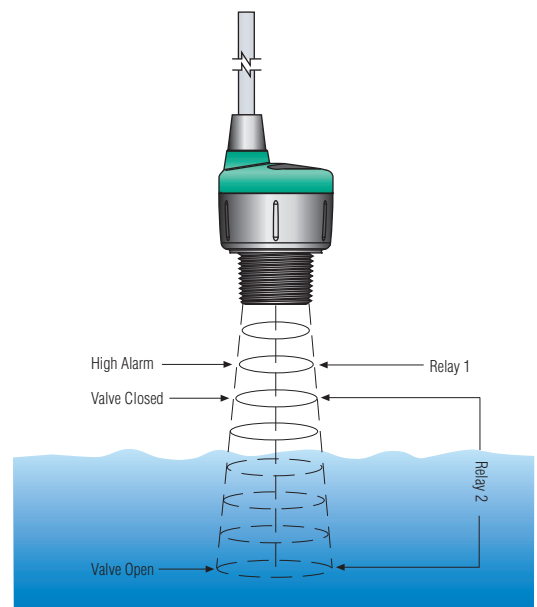
### How Ultrasonic Monitoring Works

Mounted at the top of a tank, the sensor continuously transmits pulses of high-frequency sound waves that travel away from the sensor, hit the surface of the liquid and return to the sensor. Solid-state electronics measure the time it takes from transmitted sound to return of the echo. With reference to the speed of sound in air, the exact distance of the liquid surface from the sensor can be calculated with high accuracy ( $\pm 0.125''$  (3mm) of maximum range). Level/Distance measurements are automatically temperature-compensated throughout the operating temperature range of the sensor.



See the UCL-510 and other Continuous Level Transmitters in Section C.

Contents	Page Start
<b>Small Size Engineered Plastic</b>	
LS-300 Series.....	B-3
LS-300TFE Series.....	B-7
LS-350 Series.....	B-10
<b>Small Size Alloy</b>	
LS-700 Series.....	B-14
<b>Large Size Plastic</b>	
LS-800PVC Series.....	B-18
LSP-800.....	B-20
<b>Large Size Alloy</b>	
LS-800 Series.....	B-22
<b>Integrated Temperature Sensors</b>	
for LS-700 & LS-800 Series.....	B-25
<b>OrderIt! Check List</b>	
All LS-800 Series Models.....	B-26
<b>UCL-510 Ultrasonic Transmitter/Multipoint Switch.....</b>	
	C-19



UCL-510 Series multi-point switches are designed for easy automatic tank “Hi/Lo” liquid level control. They combine non-contact continuous sensing with four SPST relays; actuation points are field adjustable in a range to 49 inches.

LEVEL SWITCHES – MULTI POINT



# Small Size – Engineered Plastics

## LS-300 Engineered Plastics Series

### Brings Multi-Point Switching to Shallow Tanks

Your most complete line of small, polysulfone liquid level switches...all from Gems Sensors.

- ▶ All-Plastic Wetted Parts
- ▶ 1 to 4 Actuation Levels
- ▶ Lengths to 20 inches (50cm)
- ▶ U.L. Recognized; CSA Listed Versions Available

Designed for the high quantity needs of the OEM, LS-300 Series Switches are the ideal level sensor for shallow tanks and reservoirs. Compact and versatile, these low-cost, plastic level switches offer a broad choice of mountings and float materials. The following pages illustrate the various design parameters available to configure custom LS-300 Series Switches.

### 1. Mounting Types

Each mounting type can be configured with stem lengths ( $L_0$ ) and float materials indicated in this bulletin.



**ORDER IT!**

Ordering is Easy! See Page B-6.  
Easy online ordering too!

LEVEL SWITCHES – MULTI POINT



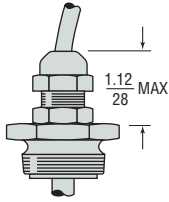
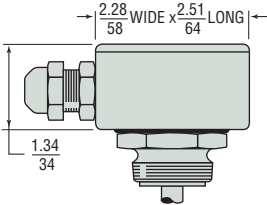
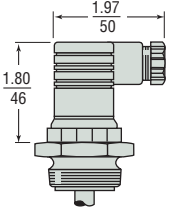
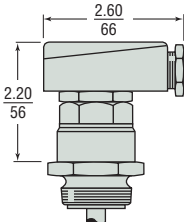
NPT Threads		Straight Threads		
<b>Type 21</b> 1/8" NPT 	<b>Type 22</b> 1" NPT 	<b>Type 31</b> 3/8" - 24 	<b>Type 32</b> 1-5/16" - 12 	<b>Type 33</b> 5/8" - 11 
Metric Threads		Compression Types		
<b>Type 41</b> G 1/4" (1/4" - 19 BSP) 	<b>Type 42</b> G 1" (1" - 11 BSP) 	<b>Type 51</b> M12 x 1.5 Straight Thread 	<b>Type 71'</b> 5/8" - 11 	<b>Type 11</b> No Mounting 
Flange Mountings <sup>2</sup>				
<b>Type 61</b> 2" O.D. Flange 		<b>Type 63</b> Pop Flange 		

<b>Stem, Mounting and Collar Material</b>	Polysulfone, Noryl®
<b>Max Length (<math>L_0</math>)</b>	20 inches (50 cm) Tolerance of $L_0 = \pm 1/16"$ (2 mm)
<b>Mounting Position</b>	Vertical $\pm 30^\circ$ Inclination

Notes:  
1. Type 71 mounting to be used with 3/4" diameter float only.  
2. Not recommended for pressure applications.

Dimensions expressed as:  $\frac{\text{inches}}{\text{millimeters}}$

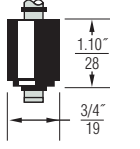
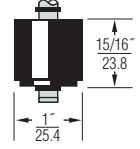
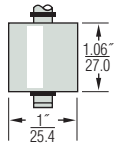
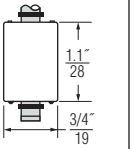
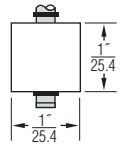
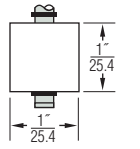
## 2. Electrical Connections

	Type 1 Leadwire	Type 2 Cable	Type 3 Liquid-Tight Cable	Type 4 Junction Box Assembly	Type 5 DIN43650 Plug	Type 6 DIN43651 Plug
						
Compatible Mounting Type(s)	All		42		42	42
Protection Rating	IP64		IP68	IP65		
Extended Leads	#22 AWG PVC Wire, 24" (610mm) Min.	#22 AWG PVC Jacketed Cable, 24" (610mm) Min.		Terminal Box (7 Terminals)	3 Poles	6 Poles
Max. Number of Levels						
Group I			4		2	4
Group II			2		1	2

\* Not CSA Approved  
 \*\* Not UL or CSA Listed

## 3. Float Types

A single float type is selected for use at all actuation points.

Float Material	Buna N		Polysulfone	Polypropylene		
	3/4"	1"		Solid Foamed		Hollow – 20% Glass Filled
Float Dimensions						
Part Number	187553	39049	39005	197732	119455	145730
Float Material Suitable for...	Oil, Fuels		Water-based Liquids	Broad Chemical Use		Low Specific Gravity Liquids
Operating Temperature <sup>1</sup>	Water: to 180°F (80°C) Oil: to 221°F (105°C)		-40°F to +221°F (-40°C to +105°C)	-40°F to +212°F (-40°C to +100°C)		-40°F to +221°F (-40°C to +105°C)
Pressure, psi (bar) Max. <sup>2</sup>	300 (21)	250 (17)	50 (3.5)	Atmospheric	150 (10)	50 (3.5)
Min. Media Specific Gravity	0.70	0.50	0.75	0.95	0.90	0.60

Notes:

- Operating temperature range based on float ratings.
- When used with mounting Type 21, 32 or 22 only; Mounting Type 61, and 63 are not recommended for pressure applications. Pressures are derated with increasing temperature above 70°F

Dimensions expressed as:  $\frac{\text{inches}}{\text{millimeters}}$

### 4. Electrical Specifications

Typically, one float is required for each point at which you need a switch action to occur. The number of actuation levels available depends on the Group Type Wiring selected; see below.

**Group I Wiring:** 1 to 4 Actuation Levels.

**Group II Wiring:** 1 or 2 Actuation Levels.

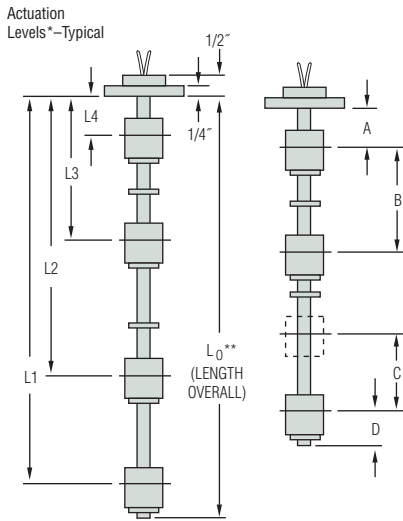
**Switch (SPST, N.O. or N.C.):** 10/20/50/100 VA.

**Approvals:** LS-300 Series switches are U.L. Recognized – File No. E45168; CSA Listed – 30200.

**Notes:**

- Units with 50 and 100 VA switches are not U.L. Recognized or CSA Listed.
- Other wiring options available. Consult factory.
- Consult Factory for load information.

### 6. Actuation Level Dimensions



\* Actuation level distances and L<sub>0</sub> (overall unit length) are measured from inner surfaces of mounting plug or flange. See mounting types on page 1 for L<sub>0</sub> reference point.  
 \*\* Length Overall (L<sub>0</sub>) = L<sub>1</sub> + Dimension D. See Mounting Types for Maximum Length values.

### 5. Wiring Group

Electrical Connection	Group 1	Group 2
<b>Lead Wire (*)</b>		
<b>Cable (*)</b>		

\*Pin correlation of plug connectors shown in parenthesis.

Switch actuation levels are determined following the guidelines below.

- A = Minimum distance to highest actuation level.
- B = Minimum distance between actuation levels.
- C = Minimum distance between two actuation levels with one float (Note: One float for two levels can be used only when low level is N.C. dry and high level is N.O. dry).
- D = Minimum distance from end of unit to lowest level.

Float Type	Dimensions			
	A	B	C	D
<b>Buna N – 1"</b> (P/N 39049)	1" (25 mm)	1-3/4" (45 mm)	1/8" (3 mm) Minimum	11/16" (18 mm)
<b>Buna N – 3/4"</b> (P/N 187553)	11/16" (17 mm)	1-7/16" (11.1 mm)		7/8" (22 mm)
<b>Polysulfone</b> (P/N 39005)	7/8" (22 mm)	1-3/4" (45 mm)		15/16" (24 mm)
<b>Solid P.P. – 1"</b> (P/N 119455)	5/8" (16 mm)			1-1/8" (29 mm)
<b>Solid P.P. – 3/4"</b> (P/N 197732)	1/2" (13 mm)	1-1/2" (38 mm)		1.19" (30 mm)
<b>Hollow P.P. – 1"</b> (P/N 145730)	7/8" (22 mm)	1-3/4" (45 mm)		7/8" (22 mm)

- Notes:**
- Actuation levels are calibrated on ascending fluid level with water, specific gravity 1.0, as the calibrating fluid, unless otherwise specified.
  - Tolerance on actuation levels is ±1/8" (3 mm).

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This is a  Request for a Quote  
 Order P.O.# \_\_\_\_\_

Quantity Needed \_\_\_\_\_

Date Required \_\_\_\_/\_\_\_\_/\_\_\_\_

Shipping Method: \_\_\_\_\_

Partials Accepted:  Yes  
 No

Name \_\_\_\_\_

Company \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_ Zip \_\_\_\_\_

Phone (\_\_\_\_) \_\_\_\_\_

Fax (\_\_\_\_) \_\_\_\_\_

## LS-300 Engineered Plastics Custom Length, Float Type Level Switch Check List

### Operational Parameters

This information is essential to the accurate and proper operation of your GEMS configurable sensor. Please complete fully and accurately before ordering.

- 1. Liquid Media:** \_\_\_\_\_
- 2. Pressure:** Minimum \_\_\_\_\_  psig  bar Maximum \_\_\_\_\_
- 3. Temperature:** Minimum \_\_\_\_\_  °F  °C Maximum \_\_\_\_\_  °F  °C
- 4. Specific Gravity:** Minimum \_\_\_\_\_ Maximum \_\_\_\_\_

- 5. Viscosity:** \_\_\_\_\_ SSU
- 6. Tank Material:** \_\_\_\_\_
- Tank Depth:** \_\_\_\_\_
- 7. Unit is Mounted In:**  T – Top Mounted  B – Bottom Mounted

### Product Parameters

#### 1. Mounting Type:

- 11 – No Mounting  21 – 1/8" NPT
- 22 – 1" NPT  31 – 3/8"-24 Straight Thread
- 32 – 1-5/16"-12  41 – G1/4" (1/4"-19BSP)
- 42 – G1" (1"-11BSP)  51 – M12 x 1.5 Straight Thread
- 61 – 2" O.D. Flange  33 – 5/8"-11
- 63 – Pop Flange  71 – 5/8"-11 with 3/4" floats only

#### 4. Electrical Rating:

- 010 – SPST, 10VA  020 – SPST, 20VA
- 050 – SPST, 50VA  100 – SPST, 100VA

#### 5. Wiring Group:

- Group 1 – Common Return
- Group 2 – Independent Return

#### 2. Electrical Connections:

<input checked="" type="checkbox"/>	Type	Description	Compatible Mountings
	1	Lead Wires, 24" to 26" (610mm, Min.)	All
	2	Cable, 24" to 26" (610mm, Min)	All
	3	Liquid-Tight Cable Fitting	42
	4	Junction Box Assembly	42
	5	DIN43650 Plug Connector, 3 Poles	42
	6	DIN43651 Plug Connector, 6 Poles	42

#### 3. Float Type:

- Buna-N – P/N 39049  Polysulfone – P/N 39005
- Solid Foamed Polypropylene – P/N 119455
- Buna N – P/N 187553  Solid Foamed Polypropylene – P/N 197732
- Hollow Polypropylene – P/N 145730

#### 6. Switch Actuation Level:

Actuation Level	Distance to Actuation Level* <input type="checkbox"/> Inches <input type="checkbox"/> Millimeters	SPST Switch Operation** (Check Type)	
		N.O.	N.C.
L4			
L3			
L2			
L1***			

\* Measured from inner surface of mounting plug or flange. See mounting types on page B-3.

\*\* Switch position is "normal" with unit dry (tank empty).

\*\*\* L1 is the distance to the lowest actuation level with mounting "up," and is the distance to the highest actuation level with mounting "down."

B. Length Overall \_\_\_\_\_  Inches  Millimeters

Please contact GEMS Sensors Inc. for any configuration or special requirements not covered on this form. **800-378-1600**

Quote \$ \_\_\_\_\_ Date Quoted \_\_\_\_/\_\_\_\_/\_\_\_\_



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06062-1198

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# Small Size – Engineered Plastics

## LS-300TFE Series – All-PTFE Wetted Parts for Ultra-Pure Fluids

- ▶ Low Particle Generation-One piece Molded Design
- ▶ Corrosion Resistant
- ▶ 1 to 4 Actuation Levels in a Single Unit
- ▶ Lengths to 24 Inches

### Typical Applications

- Semiconductor Process Equipment
- Pure Chemical Delivery System
- Wafer Cleaning and Etching Systems
- Cabinet Leak Sensing

### 1. Mounting Types

Each mounting type can be configured with stem lengths ( $L_0$ ) and float materials indicated in this bulletin.

Type 11, No Mounting	Type 22, 1" NPT	Type 24, 1/4" NPT	Type 25, 3/8" NPT

### 2. Electrical Connections

Type 1 Leadwire	Type 2 Cable	Type 3* Liquid-Tight Cable
<b>Extended Leads</b>	#22 AWG Teflon® Wire or #24 AWG PVC Jacketed Cable	

\* Available on Mounting Type 22 only.

### 3. Float Types

Float Material	PTFE	PVDF
<b>Float Dimensions</b>		
<b>Operating Temperature</b>	+32°F to +212°F (0°C to 100°C)	-40°F to +250°F (-40°C to 121°C)
<b>Pressure, PSIG (bar), Max. at Ambient Temperature</b>	25 (1.7)	50 (3.4)
<b>Min. Liquid Specific Gravity</b>	0.86	0.86

Note: A single float type is selected for use at all actuation points.

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### 4. Electrical Specifications

Typically, one float is required for each point at which you need a switch action to occur. The number of actuation levels available depends on the Group Type Wiring selected; see below.

**Group I Wiring:** 1 to 4 Actuation Levels.

**Group II Wiring:** 1 or 2 Actuation Levels.

**Switch (SPST, N.O. or N.C.):** 10/20/50/100VA.

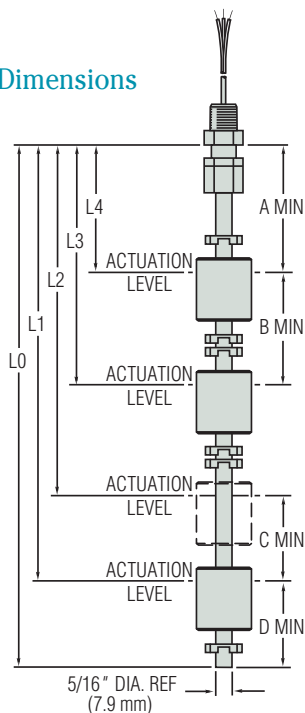
- Notes:  
 1. Other wiring options available. Consult factory.  
 2. Consult Factory for load information.

Electrical Connection	Group 1	Group 2
Lead Wire (*)		
Cable (*)		

\*Pin correlation of plug connectors shown in parenthesis.

### 5. Actuation Level Dimensions

- \* Actuation level distances and  $L_0$  (overall unit length) are measured from inner surface of mounting. See mounting types on opposite page for  $L_0$  reference point.
- \*\* Length Overall ( $L_0$ ) =  $L_1$  + Dimension D.  $L_{0max.} = 24"$ .



Switch actuation levels are determined following the guidelines below.

A = Minimum distance from highest actuation level to bottom of mounting.

B = Minimum distance between actuation levels.

C = Minimum distance between two actuation levels with one float (Note: One float for two levels can be used only when low level is N.C. dry and high level is N.O. dry).

D = Minimum distance from end of unit to lowest level.

Float Material	Dimensions			
	A	B	C	D
PTFE	$\frac{1-3/4}{44.5^*}$	$\frac{2}{50.8}$	$\frac{1/8}{3.2}$	$\frac{1-1/4}{31.8}$
PVDF	$\frac{1-3/4}{44.5^*}$	$\frac{2}{50.8}$	$\frac{1/8}{3.2}$	$\frac{1-1/8}{28.6}$

inch  
mm

\*Mounting Type 22 (1" NPT) requires a minimum "A" dim. of 1-3/4" (44.5mm)

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Quantity Needed \_\_\_\_\_

Date Required \_\_\_\_/\_\_\_\_/\_\_\_\_

Shipping Method: \_\_\_\_\_

Partial Accepted:  Yes  No

Name \_\_\_\_\_

Company \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_ Zip \_\_\_\_\_

Phone (\_\_\_\_) \_\_\_\_\_

Fax (\_\_\_\_) \_\_\_\_\_

## LS-300TFE Custom Length Level Switches

### Application Environmental Conditions

This information is essential to the accurate and proper operation of your GEMS configurable sensors. Please complete fully and accurately.

1. **Liquid Media:** \_\_\_\_\_

2. **Pressure:** Minimum \_\_\_\_\_ psig Maximum \_\_\_\_\_

3. **Temperature:** Minimum \_\_\_\_\_ °F Maximum \_\_\_\_\_

4. **Specific Gravity:** Minimum \_\_\_\_\_ Maximum \_\_\_\_\_

5. **Viscosity:** \_\_\_\_\_ SSU

6. **Tank Material:** \_\_\_\_\_

**Tank Depth:** \_\_\_\_\_

7. **Unit is Mounted In:**  Tank Top  Tank Bottom

### Product Parameters

#### 1. Mounting Type:

- Type 11 – No Mounting
- Type 22 – 1" NPT
- Type 24 – 1/4" NPT
- Type 25 – 3/8" NPT

#### 2. Electrical Connections:

- Type 1, Leadwire
- Type 2, Cable
- Type 3, Liquid-Tight Cable (Type 22 Mounting Only)

#### 3. Float Types:

- PTFE
- PVDF

#### 4. Electrical Specifications:

- A.  Group I Wiring  Group II Wiring
- B.  10 VA  20 VA
- 50 VA  100 VA

#### 5. Actuation Level Dimensions:

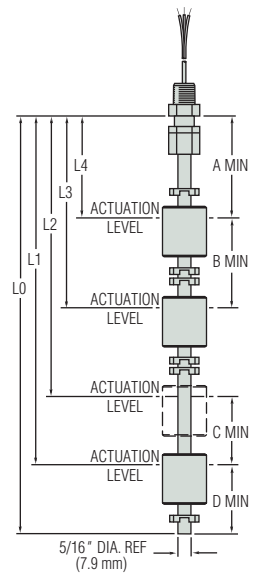
Actuation Level	Distance to Actuation Level – Inches*	SPST Switch Operation** (Check Type)	
		N.O.	N.C.
L4			
L3			
L2			
L1***			

\* Measured from inner surface of mounting.  
 \*\* Switch position is "normal" with unit dry (tank empty).  
 \*\*\* L1 is the distance to the lowest actuation level with mounting "up," and is the distance to the highest actuation level with mounting "down."

B. Length Overall \_\_\_\_\_ inches

Lead Wire Length:

- 24"  Other: \_\_\_\_\_ inches



Please contact GEMS Sensors Inc. for any configuration or special requirements not covered on this form. **800-378-1600**

Quote: \$ \_\_\_\_\_ Date Quoted: \_\_\_\_/\_\_\_\_/\_\_\_\_

Additional minimum charges may apply on special orders.



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# LS-350 Series

## Combination Siphon and Level Sensor

- ▶ Multi-Level Switch Options
- ▶ Up to 4 Actuation Points
- ▶ Integral Siphon or Fill Tube
- ▶ Customized Mountings
- ▶ Custom Configurable

Save valuable space and costly installation/maintenance time with these highly customizable sensors. LS-350 units combine a siphon tube and up to four 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.

### Typical Applications

- Immuno-Chemistry/Cytology
- Hematology
- Automated Urine Analysis
- Laboratory Automation

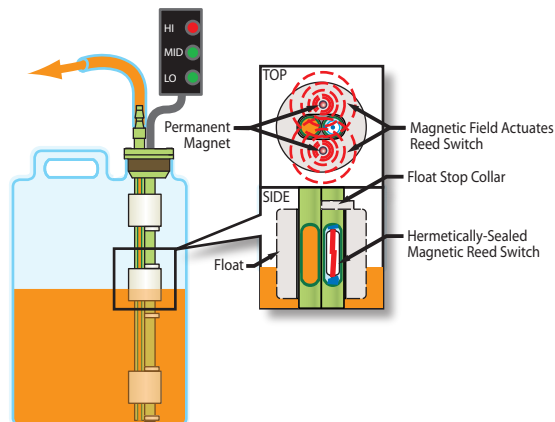
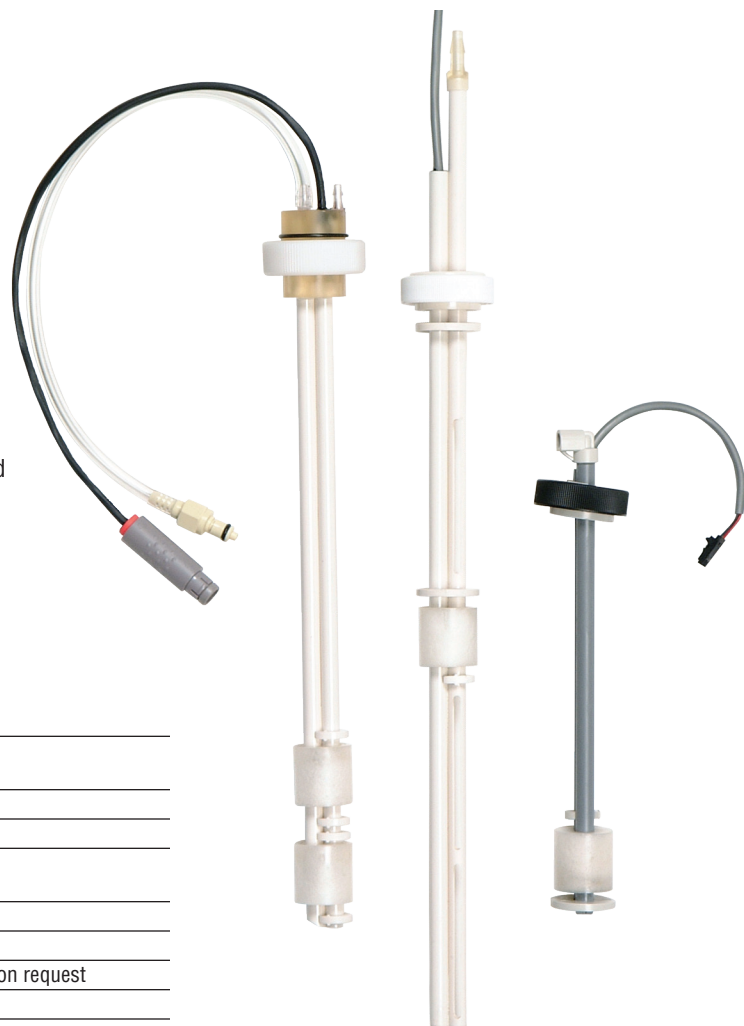
### Specifications

<b>Materials</b>	
<b>Stem and Mounting</b>	Polysulfone or Noryl®
<b>Floats</b>	Polypropylene or Buna N
<b>Gasket</b>	Buna N
<b>Operating Temperature</b>	
<b>Buna N Float</b>	221°F (105°C) Max.
<b>Polypropylene Float</b>	210°F (99°C) Max.
<b>Switch</b>	
<b>Length</b>	15" (380 mm) Max., Longer units available on request
<b>Mounting Attitude</b>	±30° from vertical
<b>Actuation Level Points</b>	6 Max.

### 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.

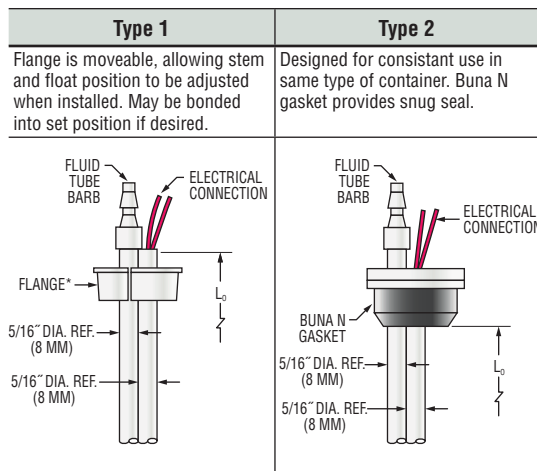
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LEVEL SWITCHES - MULTI POINT

## 1. Mounting Types

Each mounting type can be configured with stem lengths ( $L_0$ ) and as indicated below.



	Type 1	Type 2
<b>Mounting Hole Dia.</b>	1.20"/1.25" (30.5 mm/31.75 mm)	1.31"/1.32" (33.3 mm/33.5 mm)
<b>Stem, Mounting and Collar Material</b>	Polysulfone	Polysulfone with Buna N Gasket
<b>Pressure Rating (mounting)</b>	Atmosphere (Not recommended for pressurized applications)	
<b>Fluid Barb</b>	Compatible 3/16" I.D. Hose (Options available)	
<b>Max Length (<math>L_0</math>)</b>	15 inches (38 cm) $\pm$ 1/16" (2 mm)	
<b>Mounting Position</b>	Vertical $\pm$ 30° Inclination	
<b>Mounting Compatibility</b>	Cubitainer® Style Opening	Tank Wall Thickness 1/32"~1/8"

\* Orientation of slot in flange is not critical.

## 2. Float Types

A single float type is used for all actuation points.

	Buna N	Polypropylene
<b>Part Number</b>	<b>128642</b>	<b>130893</b>
<b>Liquid Suitability</b>	Oil-Based	Water-Based
<b>Min. Media Specific Gravity</b>	0.75	0.98
<b>Operating Temperature</b>	Oil: -40°F to +221°F (-40°C to +105°C) Water: to 180°F (82°C)	-40°F to +210°F (-40°C to +99°C)

## 3. Electrical Specifications

Typically, one float is required for each point at which you need a switch action to occur. The number of actuation levels available depends on the Group Type Wiring selected; see below.

**Group I Wiring:** 1 to 4 Actuation Levels.

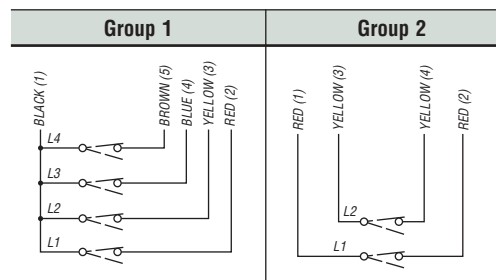
**Group II Wiring:** 1 or 2 Actuation Levels.

**Switch (SPST, N.O. or N.C.):** 10/20/50/100 VA.

Notes:

1. Other wiring options available. Consult factory.
2. Consult Factory for load information.

## 4. Wiring Group



## 5. Electrical Connections

**Type 1:** Lead Wires, 24" to 26" (610 mm, Min.)

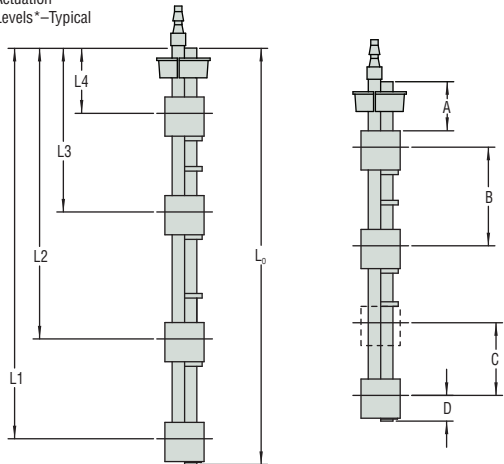
**Type 2:** Cable, 24" to 26" (610 mm, Min.)



## 6. Actuation Level Dimensions

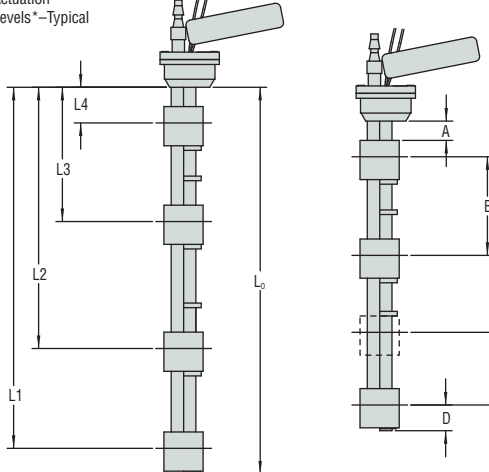
### Type 1

Actuation Levels\*--Typical



### Type 2

Actuation Levels\*--Typical



\* Actuation level distances and  $L_0$  (overall unit length) are measured from inner surfaces of mounting plug or flange. See mounting types on page 1 for  $L_0$  reference point.

\*\* Length Overall ( $L_0$ ) =  $L_1$  + Dimension D. See Mounting Types for Maximum Length values.

Switch actuation levels are determined following the guidelines below.

A = Minimum distance to highest actuation level.

B = Minimum distance between actuation levels.


C = Minimum distance between two actuation levels with one float (Note: One float for two levels can be used only when low level is N.C. dry and high level is N.O. dry).

D = Minimum distance from end of unit to lowest level.

Float Type	Dimensions				
	A		B	C	D
	Type 1 Mount	Type 2 Mount			
<b>Buna N</b>	3/4" (19 mm), Min.	3/4" (19 mm)	1-3/4" (45 mm)	1/8" (3 mm)	15/16" (24 mm)
<b>Polysulfone</b>	1/2" (13 mm), Min.	1/2" (13 mm)	1-3/4" (45 mm)	Minimum	1-3/16" (30 mm)

Notes:

1. Actuation levels are calibrated on ascending fluid level with water, specific gravity 1.0, as the calibrating fluid, unless otherwise specified.
2. Tolerance on actuation levels is  $\pm 1/8"$  (3 mm).

 <p><b>Photocopy This Form</b> Use one form for each product type you are selecting. <small>This form may also be completed online at gemssensors.com for RFQ.</small></p>	This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____ Quantity Needed _____ Date Required ____/____/____ Shipping Method: _____ Partial Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No	Name _____ Company _____ Street _____ City _____ State ____ Zip _____ Phone (____) _____ Fax (____) _____
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## LS-350 Engineered Plastics Custom Length with Siphon Tube Float Type Level Switch Check List

### Application Environmental Conditions

This information is essential to the accurate and proper operation of your GEMS configurable sensor. Please complete fully and accurately before ordering.

- |  |  |
|--|--|
| <p><b>1. Liquid Media:</b> _____</p> <p><b>2. Pressure:</b> Minimum _____ <input type="checkbox"/> psig <input type="checkbox"/> bar      Maximum _____</p> <p><b>3. Temperature:</b> Minimum _____ <input type="checkbox"/> °F <input type="checkbox"/> °C      Maximum _____ <input type="checkbox"/> °F <input type="checkbox"/> °C</p> <p><b>4. Specific Gravity:</b> Minimum _____      Maximum _____</p> | <p><b>5. Viscosity:</b> _____ SSU</p> <p><b>6. Tank Material:</b> _____</p> <p><b>Tank Depth:</b> _____</p> <p><b>7. Unit is Mounted In:</b> <input type="checkbox"/> T – Top Mounted    <input type="checkbox"/> B – Bottom Mounted</p> |
|--|--|

#### 1. Mounting Type:

- Type 1 (Standard)  
 Type 2

#### 2. Float Type:

- Buna-N – P/N 128462  
 Solid Foamed Polypropylene – P/N 130893 (Standard)

#### 3. Electrical Rating:

- 010 – SPST, 10VA     020 – SPST, 20VA  
 050 – SPST, 50VA     100 – SPST, 100VA

#### 4. Wiring Group:

- Group 1 – Common Return  
 Group 2 – Independent Return

#### 5. Electrical Connections:

<input checked="" type="checkbox"/>	Type	Description
1		Lead Wires, 24" to 26" (610mm, Min.)
2		Cable, 24" to 26" (610mm, Min)

#### 6. Switch Actuation Level:

Actuation Level	Distance to Actuation Level* <input type="checkbox"/> Inches <input type="checkbox"/> Millimeters	SPST Switch Operation** (Check Type)	
		N.O.	N.C.
L4			
L3			
L2			
L1***			

\* Measured from inner surface of mounting plug or flange. See mounting types on page B-11.  
 \*\* Switch position is "normal" with unit dry (tank empty).  
 \*\*\* L1 is the distance to the lowest actuation level with mounting "up," and is the distance to the highest actuation level with mounting "down."

B. Length Overall \_\_\_\_\_  Inches     Millimeters

#### 7. Barb Fitting:

- 3/16" (Standard)  
 Other \_\_\_\_\_

Please contact GEMS Sensors Inc. for any configuration or special requirements not covered on this form. **800-378-1600**

Quote \$ \_\_\_\_\_      Date Quoted \_\_\_\_/\_\_\_\_/\_\_\_\_



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## Small Size – Alloys

### LS-700 Series Combines Durability of Metal With a Compact Design for Restricted Spaces

- ▶ Stainless Steel or Brass Mountings and Stems
- ▶ 1 to 5 Actuation Levels
- ▶ Lengths to 48 inches

These compact units feature the rugged durability of stainless steel or brass construction in a lightweight package. Ideal for tanks less than 4 feet.

LS-700 Series switches are exceptionally versatile because of the many useful options available. Described briefly below, these options can extend the functionality of your GEMS LS-700 Series custom switch.

#### Temperature Sensing

To save space and simplify wiring, GEMS can incorporate a temperature sensor in the end of the float stem on any model type LS-700.

Two sensor types are available: Transducers for continuous output, and Thermostats for switch actuation. See Page B-25 for details.



#### Solid-State Relays

Control motors, pumps, valves and other “load” devices with GEMS Solid-State Relays. Intrinsically-safe relays and barriers allow safe operation of level switches in hazardous areas. See Section I for details.

#### Factory Mutual Approved Explosion Proof

LS-700-EP Series offers 1 to 5 actuation levels with lengths to 48” for use in hazardous locations. Call Gems factory for details.



### 1. Mounting Types

Each mounting type can be configured with stem lengths (L<sub>0</sub>) and float material indicated in this table.

Note: Sanitary flange mountings are also available, but not shown. Please contact factory.



Type 1 1/8" NPT	Type 2 3/4" NPT <sup>1</sup>	Type 3 1" NPT <sup>1</sup>	Type 4 3-5/8" Dia. Flange

<b>Stem and Mounting Material</b>	Brass or 316 Stainless Steel	
<b>Max Length</b>	48 inches (121.9 cm) – 21" Max On Bent Stem Versions (Consult Factory)	
<b>Mounting Position</b>	Vertical ± 30° Inclination	
<b>Float Stops<sup>3</sup></b>	Brass Units: Beryllium Copper Grip Rings; Stainless Steel Units: S.S. ARMCO PH-15-7MO Grip Rings	
<b>Pressure Rating, PSI, Max.<sup>4</sup></b>	See Float Value on Following Page	50

Notes: 1. Mounting Types 2, 3 & 7 are available with a 1/2" MNPT conduit adaptor. This option can be selected on the checklist.

2. Mounting Type 7 is not U.L. Approved.

3. In some instances, concentrations of chlorine and other corrosive compounds in the media require the use of collar type float stops. Consult factory for details.

4. Mounting only. Maximum pressure rating for complete unit will be the lower of this pressure or the selected float pressure (see Float Types, on next page).

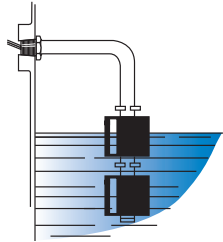
Mounting Options and Float Selection on following pages.

### Optional Mountings

Please contact Gems Sensors about these mountings or other requirements not seen here.

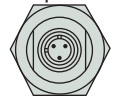
#### Bent Stem (LS-77700)

Used when tank top or bottom is inaccessible.



#### Integral Receptacle

2-5 Pin miniature receptacle for mounting



Type 2 or Type 3; eliminates splicing and eases connections.



#### Conduit Adapter

A 1/2" MNPT conduit is available for Mounting Type 2 & 3. Select from list of options on the Check List.

## 2. Float Types

A single float type is selected for use at all actuation points.

Float Materials	Buna N		PTFE – Spring Biased	Polypropylene
<b>Compatible Mounting Types</b>	1, 2, 3, 4, 5, 6, 7	1, 3, 4, 5, 6, 7	1, 2, 3, 4, 5, 6, 7	1, 3, 4, 5, 6, 7
<b>Float Dimensions</b>				
<b>Part Number</b>	<b>187553</b>	<b>39049</b>	<b>133764</b>	<b>145730</b>
<b>Operating Temperature</b>	Water: to 180°F (82.2°C) Oil: -40°F to +300°F (-40°C to 149°C)		-40°F to +300°F (-40°C to +149°C)	-40°F to +225°F (-40°C to +107°C)
<b>Pressure, PSI, Max.</b>	300*		1000*	50 PSI @ 70°F*
<b>Min. Liquid Specific Gravity</b>	0.70	0.50	0.65	0.60

\*De-rated with increasing temperature above 70°F (21°C).

## 3. Number of Actuation Levels and Electrical Specifications

Typically, one float is required for each point at which you need a switch action to occur. The number of actuation levels available depends on the Group Type Wiring selected; see below.

**Group I Wiring:** 1 to 5 Actuation Levels.

**Group II Wiring:** 1 to 3 Actuation Levels.

**Switch (SPST, N.O. or N.C.):** 20/100 VA.

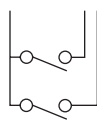
**Lead Wires:** #22 AWG, 24" L., PTFE.

**Approvals:** LS-700 Series switches are U.L. Recognized – File No. E45168; CSA Listed – 30200.

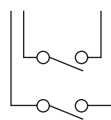
#### Typical Wiring Diagrams

For clarity, only two actuation levels are shown in each group diagram.

**GROUP I SPST**



**GROUP II SPST**



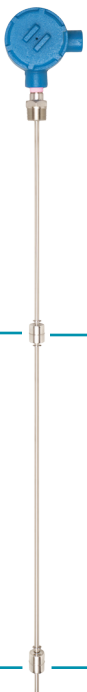
#### Wiring Color Code

Tinted area designates U.L. Recognized wiring configurations.

SPST Switches			
Wiring	Group I	Group II	
<b>Common Wire</b>	Black	None	
	NO/NC	SW Com.	NO/NC
<b>L1</b>	Red	Red	Red
<b>L2</b>	Yellow	Yellow	Yellow
<b>L3</b>	Blue	Blue	Blue
<b>L4</b>	Brown		
<b>L5</b>	Orange		

#### Notes:

- Units with 100 VA switches are not U.L. Recognized or CSA Listed.
- See "Electrical Data" on Page X-5.



## Factory Mutual Approved Explosion-Proof

For Hazardous areas give Gems a call and ask about the LS-700-EP Series. These custom-length sensors provide up to 5 actuation levels, with lengths up to 48". Multiple mounting, float and material options. **800-378-1600**

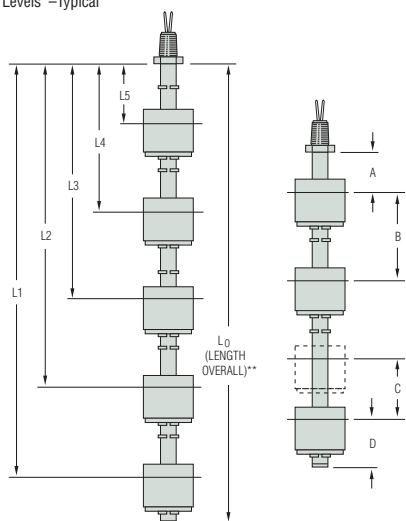


316 Stainless Steel**				
1, 4, 6	1, 3, 4, 5, 6, 7	1, 4, 5, 6, 7	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5, 6, 7
<b>60241</b>	<b>141750</b>	<b>156900</b>	<b>136550</b>	<b>158369</b>
-40°F to +300°F (-40°C to +149°C)**				
100	275	600	400	150
0.70	0.90	0.90	1.10	.90

\*\* 316 Stainless Steel floats are available with ceramic potting that allows temperatures to 400°F (204°C); contact factory for these high-temperature applications.

### 4. Actuation Level Dimensions

Actuation Levels\*—Typical



\* Actuation level distances and L<sub>0</sub> (overall unit length) are measured from inner surfaces of mounting plug or flange.

\*\* Length Overall (L<sub>0</sub>) = L<sub>1</sub> + Dimension D. See Mounting Types for Maximum Length values.

Switch actuation levels are determined following the guidelines below.

A = Minimum distance to highest actuation level.

B = Minimum distance between actuation levels.

C = Minimum distance between two actuation levels with one float (Note: One float for two levels can be used only when low level is N.C. dry and high level is N.O. dry).


D = Minimum distance from end of unit to lowest level.

Float Part Number	Dimensions			
	A	B	C	D
<b>39049</b>	7/8" (22.2 mm)	1-3/4" (44.4 mm)	1/8" (3.2 mm) Min.	3/4" (19.1 mm)
<b>60241</b>	3/4" (19.1 mm)	1-13/16" (46.0 mm)		15/16" (23.8 mm)
<b>133764</b>	15/16" (23.8 mm)	1-7/8" (47.6 mm)		7/8" (22.2 mm), N.O. 1-3/16" (30.2 mm), N.C.
<b>136550</b>	9/16" (14.3 mm)	2-7/16" (61.9 mm)		1-3/4" (44.4 mm)
<b>141750</b>	13/16" (20.6 mm)	2" (50.8 mm)		1-1/8" (28.6 mm)
<b>145730</b>	7/8" (22.2 mm)	1-7/16" (36.5 mm)		7/8" (22.2 mm)
<b>156900</b>	3/4" (19.1 mm)	1-7/8" (47.6 mm)		1-1/16" (27.0 mm)
<b>158369</b>	13/16" (20.6 mm)	2-7/16" (61.9 mm)		1-7/16" (36.5 mm).
<b>187553</b>	11/16" (17.5 mm)	1-7/16" (36.5 mm)		7/8" (22 mm)

Notes:

1. A, B and D dimensions based on a liquid specific gravity of 1.0.
2. Tolerance on actuation levels is ±1/8" (3.2 mm).
3. For bent stem versions, please request drawing LS-77700.



 <p><b>Photocopy This Form</b> Use one form for each product type you are selecting. This form may also be completed online at <a href="http://gemssensors.com">gemssensors.com</a> for RFQ.</p>	This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____	Name _____ Company _____ Street _____ City _____ State ____ Zip _____ Phone (____) _____ Fax (____) _____
	Quantity Needed _____ Date Required ____/____/____ Shipping Method: _____ Partial Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No	

## LS-700 Types Custom Length Float Type Level Switches

### Application Environmental Conditions

This information is essential to the accurate and proper operation of your GEMS configurable sensors. Please complete fully and accurately.

- 1. **Liquid Media:** \_\_\_\_\_
- 2. **Pressure:** Minimum \_\_\_\_\_ psig Maximum \_\_\_\_\_
- 3. **Temperature:** Minimum \_\_\_\_\_ °F Maximum \_\_\_\_\_
- 4. **Specific Gravity:** Minimum \_\_\_\_\_ Maximum \_\_\_\_\_
- 5. **Viscosity:** \_\_\_\_\_ SSU
- 6. **Tank Material:** \_\_\_\_\_  
**Tank Depth:** \_\_\_\_\_
- 7. **Unit is Mounted In:**  Tank Top  Tank Bottom

### 1. Series Type:

- LS-700  TH-700 (Thermostat Equipped)
- TM-700 (Thermistor Equipped)

### 2. Mounting Type and Materials:

- A. Mounting Type:**
- Type 1  Type 2  Type 3  Type 4
  - Type 5  Type 6  Type 7
- B. Mount and Stem Material:**
- Brass
  - 316 Stainless Steel

### 3. Float Part Number: \_\_\_\_\_

Matching floats will be used at each actuation level specified.

### 4. Switch Type and Rating:

- A.**  Group I  Group II
- B.**  SPST
- C.**  20 VA  100 VA
- Please indicate if using microprocessor/PLC load:  Yes  No

### 5. Switch Actuation Level

Actuation Level	Distance to Actuation Level – Inches*	SPST Switch Operation** (Check Type)	
		N.O.	N.C.
L5			
L4			
L3			
L2			
L1***			

\* Measured from inner surface of mounting plug or flange.  
 \*\* Switch position is "normal" with unit dry (tank empty).  
 \*\*\* L1 is the distance to the lowest actuation level with mounting "up," and is the distance to the highest actuation level with mounting "down."

**B.** Length Overall (L<sub>0</sub>) \_\_\_\_\_ inches.

### 6. Lead Wire Length:

- 12"  24"  Other: \_\_\_\_\_ inches.

### 7. Options:

- Temperature Switch Settings (°F):  100  125  150  175  200
- On rising temperature, switch...  Opens  Closes
- Slosh Shield  Collars
- 1/2" NPT Conduit Connection (available for Types 2, 3 & 7)
- J-box Electrical Connection
- Explosion Proof Type (FM/CSA)  NEMA 4 Type

Please contact GEMS Sensors Inc. for any configuration or special requirements not covered on this form. **800-378-1600**

Quote: \$ \_\_\_\_\_ Date Quoted: \_\_\_\_/\_\_\_\_/\_\_\_\_

Additional minimum charges may apply on special orders.



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# Large Size – Engineered Plastics


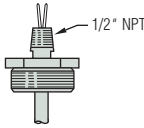
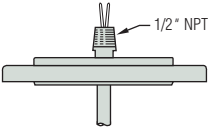
## LS-800PVC Series – Our Most Economical Large Size Unit

- ▶ NSF Approved All-PVC Wetted Parts Available
- ▶ 1 to 7 Actuation Levels
- ▶ Lengths to 60 inches

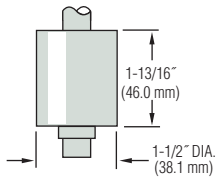
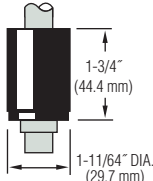
Inexpensive, all-PVC LS-800PVC Series switches bring reliable level sensing to corrosive liquids. These durable, yet economical, switches use the same high-quality, dependable reed switches found in GEMS' most expensive models. NSF-approved wetted parts make the LS-800PVC suitable for potable water applications.



### 1. Mounting Types

	Type 1 1/2" NPT	Type 3 2" NPT	Type 4 3", 150# Flange
			
<b>Mounting and All Wetted Parts</b>	PVC		
<b>Operating Temperatures</b>	0°F to 125°F (-17.8°C to 51.7°C)		
<b>Pressure, PSI, Max.</b>	15 @ 70°F (21°C)		
<b>Max. Length (Lo)</b>	60 inches (152.4cm)		
<b>Mounting Position</b>	Vertical ±30° Inclination		

### 2. Float Type

Float Material	PVC*	Buna N
<b>Float Dimensions</b>		
<b>Float Part Number</b>	<b>16306</b>	<b>142251</b>
<b>Min. Liquid Specific Gravity</b>	0.85	0.80

\*Select for potable water applications.

## LS-800PVC Series – Continued

### 3. Number of Actuation Levels and Electrical Specifications

Typically, one float is required for each point at which you need a switch action to occur. The number of actuation levels available depends on type of wiring selected. See below.

**Group I Wiring:** 1 to 7 Actuation Levels

**Group II Wiring:** 1 to 4 Actuation Levels

**Group III Wiring:** 1 to 3 Actuation Levels

**Group IV Wiring:** 1 to 2 Actuation Levels

**Switch (N.O. or N.C.):**

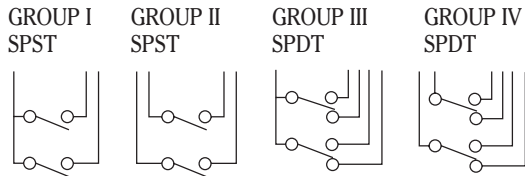
**SPST:** 20 VA or 100 VA

**SPDT:** 20 VA

**Lead Wires:** #22 AWG, 24" L., PVC

Typical Wiring Diagrams

For clarity, only two actuation levels are shown in each group diagram.

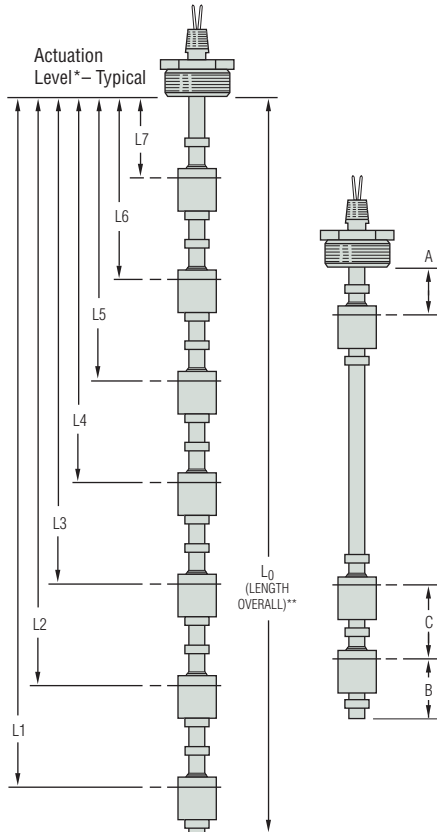


Wiring Color Code

Wiring	SPST Switches			SPDT Switches 20 VA				
	Group I	Group II		Group III		Group IV		
<b>Com. Wire</b>	Black	None		Black		None		
	NO/NC	SW. Com.	NO/NC	NO	NC	SW. Com.	NO	NC
<b>L1</b>	Red	Red	Red	Red	Wh/Red	Red	Wh/Red	Wh/Blk/Red
<b>L2</b>	Yellow	Yellow	Yellow	Yellow	Wh/Yel	Yellow	Wh/Yel	Wh/Blk/Yel
<b>L3</b>	Blue	Blue	Blue	Blue	Wh/Blue			
<b>L4</b>	Brown	Brown	Brown					
<b>L5</b>	Orange							
<b>L6</b>	Gray							
<b>L7</b>	White							

Notes: See "Electrical Data" on Page X-5 for more information.

### 4. Actuation Level Dimensions



Switch actuation levels are determined following the guidelines below.

A = 1-1/2" (38.1 mm) Minimum distance to highest actuation level.

B = 2" (50.8 mm) Minimum distance from end of unit to lowest actuation level.

C = 3" (76.2 mm) Minimum distance between actuation levels.

Notes:

1. Actuation levels are calibrated on descending fluid level, with water as the calibrating fluid, unless otherwise specified.
2. A and B dimensions based on a top mounted unit.
3. Float stops are permanently cemented in place.
4. Tolerance on actuation levels is  $\pm 1/8"$  (3.2 mm).
5. Dimensions based on a liquid specific gravity 1.0.

\* Actuation level distances and  $L_0$  (overall unit length) are measured from inner surfaces of mounting plug or flange.

\*\* Length Overall ( $L_0$ ) =  $L_1$  + Dimension B. See Mounting Types for Maximum Length values.

# Large Size – Engineered Plastics

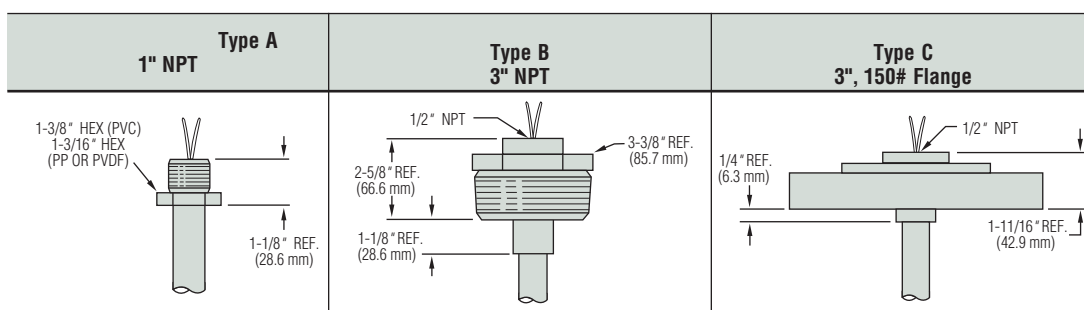
## LSP-800 Series – Features Inert Materials for Corrosive Liquids

- ▶ All-Plastic Wetted Parts - PVC, Polypropylene or PVDF
- ▶ 1 to 6 Actuation Levels
- ▶ Lengths to 70 inches

Specifically designed for corrosive liquids and vapors. Three standard model types in a choice of materials offer broad chemical compatibility.

### 1. Mounting Types

Each mounting type can be configured with stem lengths ( $L_0$ ) and materials indicated in the table below. Floats and float stop collars are of same material specified for mounting.



Stem, Mounting, Float and Collar Material	PVC, Polypropylene or PVDF
Max. Length ( $L_0$ )	70 inches (177.8 cm)
Mounting Position	Vertical $\pm 30^\circ$ Inclination

### 2. Float Types

Float Material	PVC	Polypropylene	PVDF
Float Dimensions	<p>2.28" (58 mm)</p> <p>2.84" Dia. (72 mm)</p>	<p>2.28" (58 mm)</p> <p>2.84" Dia. (72 mm)</p>	<p>2.28" (58 mm)</p> <p>2.84" Dia. (72 mm)</p>
Operating Temperature and Pressure	See Ratings Chart at top of following page		
Min. Liquid Specific Gravity	0.60	0.40	0.75

Note: Floats are always supplied in same material as specified for mounting.

## LSP-800 Series – Continued

### Temperature and Pressure Ratings Chart

Maximum Pressure vs. Temperature

LSP-800 Material	Operating Temperature							
	0°F (-17.7°C)	70°F (21.1°C)	100°F (37.7°C)	125°F (51.7°C)	140°F (60.0°C)	170°F (76.6°C)	200°F (93.3°C)	210°F (98.8°C)
PVC	50 PSI (3.4 bar)	50 PSI (3.4 bar)	35 PSI (2.4 bar)	20 PSI (1.4 bar)	10 PSI (0.68 bar)	X	X	X
Polypropylene	50 PSI (3.4 bar)	50 PSI (3.4 bar)	40 PSI (2.7 bar)	35 PSI (2.4 bar)	30 PSI (2.0 bar)	25 PSI (1.7 bar)	X	X
PVDF	50 PSI (3.4 bar)	50 PSI (3.4 bar)	45 PSI (3.1 bar)	40 PSI (2.7 bar)	35 PSI (2.4 bar)	30 PSI (2.0 bar)	25 PSI (1.7 bar)	25 PSI (1.7 bar)

### 3. Electrical Specifications

Switch (N.O. or N.C.):

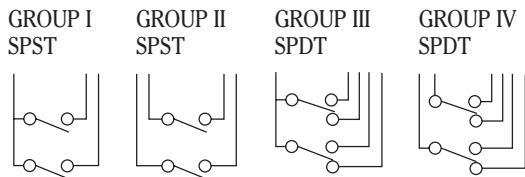
SPST: 20 VA or 100 VA

SPDT: 20 VA

Lead Wires: #22 AWG, 24" L., Polymeric

Typical Wiring Diagrams

For clarity, only two actuation levels are shown in each group diagram.

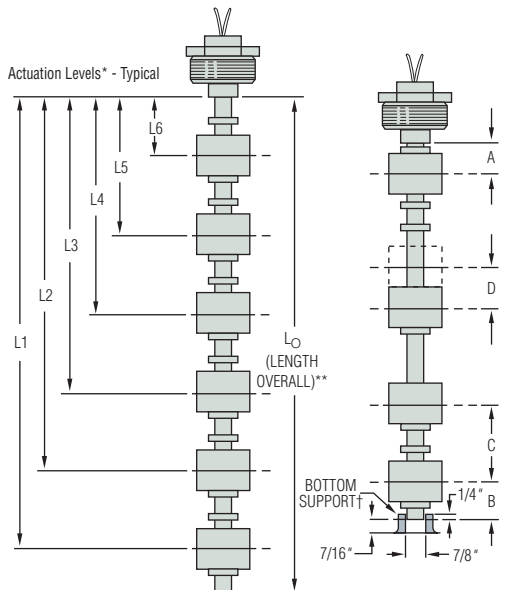


### Wiring Color Code

Wiring	SPST Switches			SPDT Switches 20 VA				
	Group I	Group II		Group III		Group IV		
Com. Wire	Black	None		Black		None		
	NO/NC	SW. Com.	NO/NC	NO	NC	SW. Com.	NO	NC
L1	Red	Red	Red	Red	Wh/Red	Red	Wh/Red	Wh/Blk/Red
L2	Yellow	Yellow	Yellow	Yellow	Wh/Yel	Yellow	Wh/Yel	Wh/Blk/Yel
L3	Blue	Blue	Blue	Blue	Wh/Blue	Blue	Wh/Blu	Wh/Blk/Blu
L4	Brown	Brown	Brown	Brown	Wh/Brn	Brown	Wh/Brn	Wh/Blk/Brn
L5	Orange	Orange	Orange	Orange	Wh/Orn	Orange	Wh/Orn	Wh/Blk/Orn
L6	Gray	Gray	Gray	Gray	Wh/Gra	Gray	Wh/Gra	Wh/Blk/Gra

Notes: See "Electrical Data" on Page X-5 for more information.

### 4. Actuation Level Dimensions



Switch actuation levels are determined following the guidelines below.

- A = 2-1/16" (52.4 mm) ±1/16" minimum distance to centerline of float (ref. mounting).
- B = 2-11/16" (68.3 mm) ±1/16" minimum distance to centerline of float (ref. stem end).
- C = 3-1/2" (88.9 mm) minimum distance between actuation levels.
- D = Distance between actuation levels using one float.  
Minimum = 1/4" (6.3 mm)  
Maximum = 3-1/2" (88.9 mm)

Notes:

1. The centerline of the float is used as a standard reference for actuating the switches.
2. All levels are set on descending float travel with overtravel = 1/4" (6.3mm) ±1/8" (3.2mm).  
Overtravel on Ascending = 1/8" (3.2mm) min.
3. Tolerance on all actuation levels is ±1/8" (3.2 mm) Ref.

\* Actuation level distances and L<sub>0</sub> (overall unit length) are measured from inner surfaces of mounting plug or flange.

\*\* Length Overall L<sub>0</sub> = L<sub>1</sub> + Dimension B. See Mounting Types for Maximum Length values.

† Bottom support recommended for units longer than 36 inches, or in applications having turbulent conditions.



# Large Size – Alloys

## LS-800 Series – The General Purpose Workhorse for Water and Oils

- ▶ Stainless Steel or Brass Mountings
- ▶ 1 to 6 Actuation Levels
- ▶ Lengths to over 11 feet (3.4 m)
- ▶ CSA Listed

Rugged construction and multiple options provide the LS-800 Series with exceptional versatility. Longer and more substantial than other metallic models, the LS-800 is capable of supporting larger, more buoyant floats, and is physically stronger for better reliability in contaminated or turbulent media. This series offers SPST or SPDT switches, and a choice of mountings, floats and materials that can be configured for a wide range of applications in water, oils, chemicals and corrosive liquids.

### Temperature Sensing

To save space and simplify wiring, GEMS can incorporate a temperature sensor in the end of the float stem on any model type LS-800. Two sensor types are available: Transducers for continuous output, and Thermostats for switch actuation. See Page B-25 for details.



### Adjustable Mounting

Allows stem to travel up and down for fine tuning your actuation points. See next page.



### LS-800 switches are U.L. Approved for Class I, Division 2, Groups B, C, D hazardous locations

They are also available with FM-approved, explosion-proof junction box for Class I, Division 1, Group D hazardous locations (Type 1 mounting excluded). Units must be specified with stainless steel floats and be assembled completely at GEMS.



## 1. Mounting Types

Each mounting type can be configured with stem lengths ( $L_0$ ) and float material indicated in the table below. Mountings are also continued on following page.

Note: Sanitary flange mountings are also available, but not shown. Please contact factory.  
Type 1 mounting not FM approved.

	Type 1 1/2" NPT†	Type 2 1-1/4" NPT	Type 3 2" NPT	Type 4 3", 150# Dia. Flange
<b>Stem and Mounting Material</b>	Brass or 316 Stainless Steel			Flange: Carbon Steel or 316 S.S. Stem: 316 S.S.
<b>Max Length (Lo)</b>	36" (91.4 cm)	60" (152.4 cm)	140" (355.6 cm)	
<b>Mounting Position</b>	Vertical ± 30° Inclination			
<b>Float Stops*</b>	Brass Units: Beryllium Copper Grip Rings; Stainless Steel Units: S.S. ARMCO PH-15-7MO Grip Rings			

\* Units greater than 72" overall length are supplied with collars with setscrews (made of same material as stem and mounting) in place of float-stop rings. Collars are optional on units less than 72" overall length. Units requiring 316 SS float stops must be special ordered with 316 SS collars instead of grip rings. In some instances, concentration of chlorine and other corrosive compounds in the media require the use of collar type float stops. Consult factory for details.

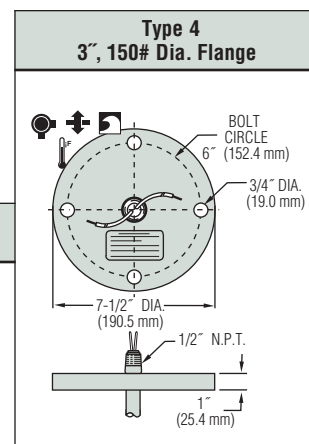
† Type 1 mounting not FM approved.



**ORDER IT!**

Ordering is Easy! See Page B-26.  
Easy online ordering too!

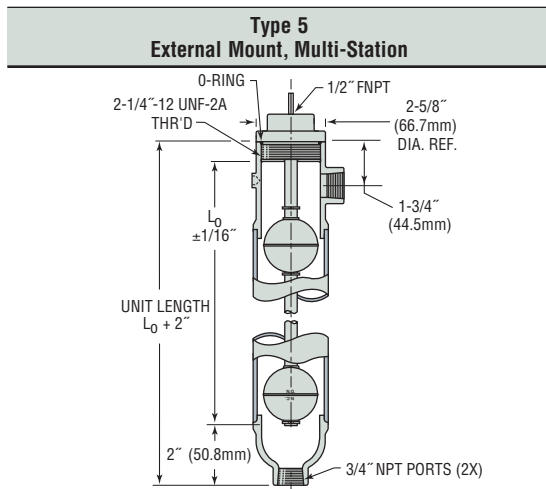
UL Approved  
Explosion-Proof



## LS-800 Series - Continued

### 1. Mounting Types - continued

Type 5 External Mounting units are ideal for tanks with limited access to tops or bottoms.



<b>Housing Material</b>	Brass	316 Stainless Steel
<b>Stem and Mounting</b>	Brass	316 Stainless Steel
<b>Port Sizes</b>	3/4" NPT	
<b>Max. Length (Lo)</b>	120" (305 cm)	
<b>Float Stops*</b>	Beryllium Copper	S.S. ARMCO PH-15-7 MO

\* Units greater than 72" overall length are supplied with collars with setscrews (made of same material as stem and mounting) in place of float-stop rings. Collars are optional on units less than 72" overall length. Units requiring 316 SS float stops must be special ordered with 316 SS collars instead of grip rings. In some instances, concentration of chlorine and other corrosive compounds in the media require the use of collar type float stops. Consult factory for details.

### 2. Float Types

A single float type is selected for use at all actuation points. Be sure, by reviewing the table below, that the desired float is compatible with the Mounting Type selected in Step 1.

Float Material	Buna N			316 Stainless Steel		
<b>Compatible Mounting Types</b>	2	1, 3, 4, 5	3, 4, 5 (Units >72")	1, 3, 4, 5 (Units ≤72")	3, 4, 5 (Units >72")	1, 3, 4
<b>Float Dimensions</b>						
<b>Part Number</b>	<b>26032</b>	<b>10558</b>	<b>24864</b>	<b>14569</b>	<b>15666</b>	<b>138935</b>
<b>Operating Temperature</b>	Water: to 180°F (82°C) Oil: -40°F to +230°F (-40°C to +110°C)			-40°F to +300°F (-40°C to +149°C)		
<b>Min. Media Specific Gravity</b>	0.75	0.55	0.55	0.75	0.75	0.80

Pressure Ratings Chart (PSI, Max.)

Mounting Type		Float Part Number					
		26032	10558	24864	14569	15666	138935
1, 2, 3	4		150		750	300	180
	5	Brass	100 @ 70°F (21°C)				
		316 S.S.	150		750	300	120

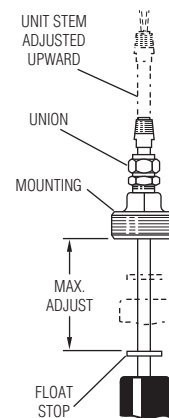
Review the Compatible Mounting Type row in the "Float Types" table above this matrix for produceable mounting/float combinations. Not all combinations implied by this Pressure Rating Chart are possible or recommended.

### LS-800-A Series Adjustable Mounting

Available for LS-800 Series Mounting Types 2, 3 and 4.

Special cinch-nut on mounting allows stem to travel up or down for fine tuning the actuation points. The extent of adjustment depends on unit length and distance from mounting to highest float stop. When ordering, specify "LS-800-A" as Series Type.

Note: Maximum overall length is limited to 72" with this option.



### Intrinsically-Safe Relays

Using Gems SAFE-PAK® relays and barriers, these switches provide automatic refills/pumpdown and are intrinsically-safe without explosion-proof housing and piping.



See Section L

### 3. Electrical Specifications

**Switch (N.O. or N.C.):**

**SPST:** 20 VA or 100 VA

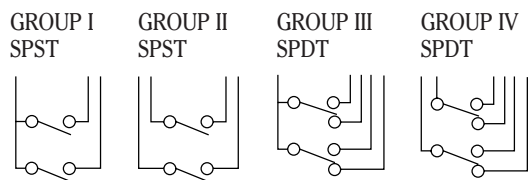
**SPDT:** 20 VA

**Lead Wires:** #18 AWG, 24" L., Polymeric (except as noted in Wiring Color Code chart at right).

**Approvals:** LS-800 Series switches are U.L. Recognized – File No. E45168; CSA Listed – File No. 30200

Typical Wiring Diagrams

For clarity, only two actuation levels are shown in each group diagram.



### Wiring Color Code

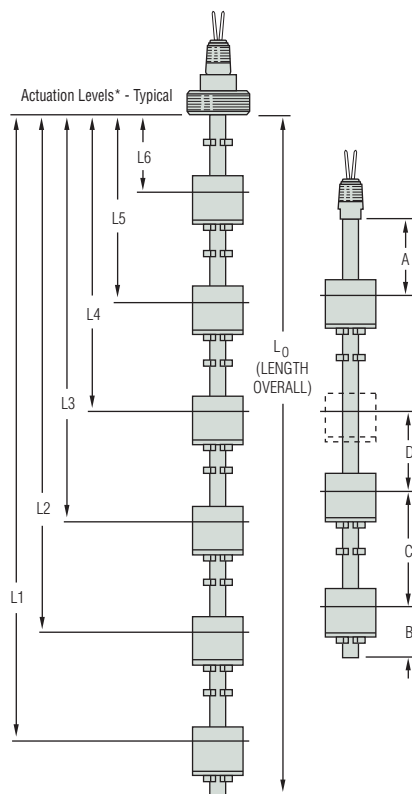
Tinted area designates U.L. Recognized wiring configurations.

Wiring	SPST Switches			SPDT Switches 20 VA				
	Group I	Group II		Group III		Group IV		
<b>Com. Wire</b>	Black	None		Black		None		
	NO/NC	SW. Com.	NO/NC	NO	NC	SW. Com.	NO	NC
<b>L1</b>	Red	Red	Red	Red	Wh/Red	Red	Wh/Red	Wh/Blk/Red
<b>L2</b>	Yellow	Yellow	Yellow	Yellow	Wh/Yel	Yellow	Wh/Yel	Wh/Blk/Yel
<b>L3</b>	Blue	Blue	Blue	Blue	Wh/Blue	Blue	Wh/Blu	Wh/Blk/Blu
<b>L4</b>	Brown	Brown	Brown	Brown	Wh/Brn	Brown	Wh/Brn	Wh/Blk/Brn
<b>L5</b>	Orange	Orange	Orange	Orange	Wh/Orn	Orange	Wh/Orn	Wh/Blk/Orn
<b>L6</b>	Gray	Gray	Gray	Gray	Wh/Gra	Gray	Wh/Gra	Wh/Blk/Gra

Notes:

1. Non-U.L. Recognized units (white areas) use #22 AWG, 24" L., PTFE Lead wires.
2. Units with 100 VA switches are not U.L. Recognized or CSA Listed.
3. See "Electrical Data" on Page X-5 for more information.

### 4. Actuation Level Dimensions



Switch actuation levels are determined following the guidelines below.

All units 72" or less  $L_0$  with Stainless Steel or Buna N floats. Also any unit over 72"  $L_0$  with Buna N floats:

A = 1-1/2" (38.1 mm) minimum distance to highest level (2", Type 5 only).

B = 2" (50.8 mm) minimum distance from end of unit to lowest level.

C = 3" (76.2 mm) minimum distance between levels.

D = 1/4" (6.3 mm) minimum distance between actuation levels (Note: One float for two levels can be used only when low level is N.C. dry and high level is N.O. dry).

Types 1, 3, 4, and 5 units with stainless steel float, Part Number 15666:

A = 1-5/8" (41.3 mm) minimum distance to highest level (2", Type 5 only).

B = 2-1/2" (63.5 mm) minimum distance from end of unit to lowest level.

C = 4" (101.6 mm) minimum distance between level.

D = 1/4" (6.3 mm) minimum distance between actuation levels (Note: One float for two levels can be used only when low level is N.C. dry and high level is N.O. dry).

Notes:

1. A, B and C dimensions based on a liquid specific gravity of 1.0.
2. One float for two levels can be used only when 20VA switch is used.
3. Actuation levels are calibrated on descending fluid level, with water as the calibrating fluid, unless otherwise specified.
4. Tolerance on actuation levels is  $\pm 1/8"$  (3.2 mm).
5. TH (Temperature option) makes "B" dimension a minimum of 2.75" (69.8 mm).

\* Actuation level distances and  $L_0$  (overall unit length) are measured from inner surfaces of mounting plug or flange.

\*\* Length Overall  $L_0 = L_1 +$  Dimension B.


See Mounting Types for Maximum Length values.

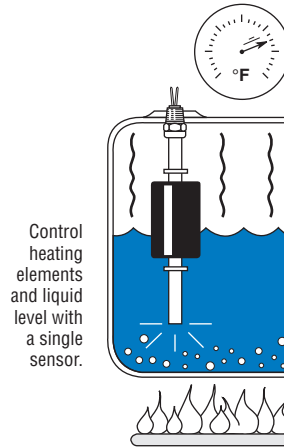
## Optional Integrated Temperature Sensors

- ▶ Compatible with LS-700 and LS-800 Series Units
- ▶ Thermostat Switches or Thermistor Versions

Advantages of integrated temperature sensors:

- Space Saving.
- Fewer intrusions into the tank.
- Electrical wiring emanates from a single source – eliminate multiple conduits.
- Economical – typically less expensive than separate sensors.

Look for units in this catalog with the temperature sensor icon: 



### Thermistor for Continuous Indication – TM-800 and TM-700

- Excellent repeatability.

**Value:** 10,000 ohms @ 77°F (25°C)

**Tolerance:** ±0.2°C from 32°F to 158°F (0°C to 70°C)

**Operating Temperature:** 302°F (150°C), Max.

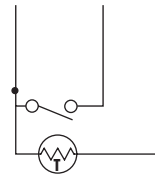
**Alpha @ 25°C:** -4.39%/°C

**Dissipation Constant:** 1mW/°C in Still Air;  
8mW/°C in Oil Bath.

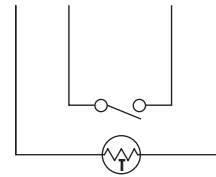
#### How to Order

Temperature thermistors are available on LS-700 Series units with up to three actuation levels, and on LS-800 Series units with up to five actuation levels. To have thermistor added, order model TM-800 or TM-700.

Note: This option is not CE Approved.



GROUP I



GROUP II

### Thermostat for Switch Actuation

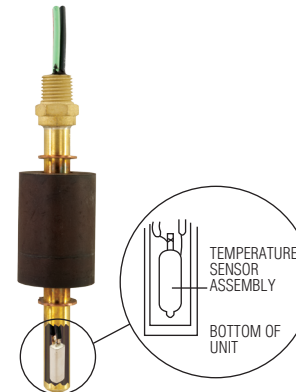
- Standard Settings from 100°F to 200°F.
- Open or close switch on increasing temperature.

Use these switches to set off High/Low temperature alarms. Or, combine with GEMS relays to control tank heating and cooling, motor-operated valves, etc.

To designate the thermostat switch option, order model TH-700 or TH-800. Also specify the choice from selections A, B and C below.

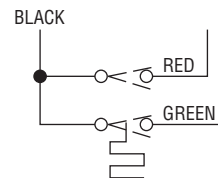
- Switch Rating:**  
For LS-800 Series: 6A/120V, 4A/240V, 100VA (non-inductive).  
For LS-700 Series: 2.6A/120V (inductive).
- Contact Operation on Increasing Temperature:**  
“Opens” when Set Point reached or “Closes” when Set Point reached.
- Standard Temperature Set Point (±7.2°F; ±4°C):**  
100°F (37.7°C), 125°F (51.6°C), 150°F (65.6°C), 175°F (79.4°C), 200°F (93.3°C)

- Note:
- Other temperature settings and tolerances available; 25 piece minimum order quantity applies. Please call GEMS Sensors Inc. for more information.
  - This option is not CE Approved.

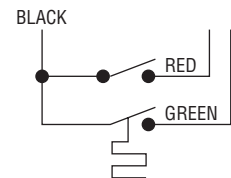


Note: End of unit stem must be submerged a minimum of 2-3/4" for level switch actuation.


#### Typical Wiring Diagram



GROUP I



GROUP II

 <b>Photocopy This Form</b> Use one form for each product type you are selecting. This form may also be completed online at <a href="http://gemssensors.com">gemssensors.com</a> for RFQ.	This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____	Name _____ Company _____ Street _____ City _____ State _____ Zip _____ Phone (____) _____ Fax (____) _____
	Quantity Needed _____ Date Required ____/____/____ Shipping Method: _____ Partial Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No	

## LS-800 Types Custom Length Float Type Level Switches

### Application Environmental Conditions

This information is essential to the accurate and proper operation of your GEMS configurable sensors. Please complete fully and accurately.

1. **Liquid Media:** \_\_\_\_\_
2. **Pressure:** Minimum \_\_\_\_\_ psig Maximum \_\_\_\_\_ psig
3. **Temperature:** Minimum \_\_\_\_\_ °F Maximum \_\_\_\_\_ °F
4. **Specific Gravity:** Minimum \_\_\_\_\_ Maximum \_\_\_\_\_
5. **Viscosity:** \_\_\_\_\_ SSU
6. **Tank Material:** \_\_\_\_\_
- Tank Depth:** \_\_\_\_\_
7. **Unit is Mounted In:**  Tank Top  Tank Bottom

#### 1. Series (Page No.):

- LS-800PVC (B-18)  LSP-800 (B-20)  LS-800 (B-22)  
 LS-800-Adjustable (B-23)  
 TM-800 (B-25. Thermistor Equipped)  
 TH-800 (B-25. Thermostat Equipped)

See product page number for available mounting type and materials.

#### 2. Mounting Type:

- Type A  Type B  Type C  
 Type 1  Type 2  Type 3  
 Type 4  Type 5

#### 3. Mounting and Stem Material (if choice available):

- Brass  Polypropylene  
 PVC  PVDF  
 316 Stainless Steel  Carbon Steel (Flanges Only, in association with stainless steel stems.)

#### 4. Mounting Position:

- Tank Top  Tank Bottom

#### 5. Float Part Number: \_\_\_\_\_

Matching floats will be used at each actuation level specified.

#### 6. Switch Type and Rating:

- A.  Group I  Group II  
 Group III\*  Group IV\*
- B.  SPST  SPDT\*
- C.  20 VA  100 VA (SPST only)  
 Please indicate if using microprocessor/PLC load:  Yes  No

\* Not Available on the TM-800 Series.

#### 7. Switch Actuation Level

Actuation Level	Distance to Actuation Level (Inches) <sup>1</sup>	SPST Switch Operation <sup>2</sup> (Check Type)	
		N.O.	N.C.
L6			
L5			
L4			
L3			
L2			
L1 <sup>3</sup>			

Notes:

- Measured from inner surface of mounting plug or flange.
- Switch position is "normal" with unit dry (tank empty).
- L1 is the distance to the lowest actuation level with mounting "up," and is the distance to the highest actuation level with mounting "down."
- Float stops are standard; see B-24 for specifications.

- B. Length Overall (L<sub>0</sub>) \_\_\_\_\_ inches (customer supplied support bracket assembly recommended for lengths over 72".)

#### 8. Lead Wire Length:

- 12"  24"  Other: \_\_\_\_\_ inches.

#### Options:

- Temperature Switch Settings (°F):  100  125  150  
 175  200

On rising temperature, switch...  Opens  Closes

- Slosh Shield  316 SS (316 SS units only)  
 Brass (Brass units only)

J-Box Electrical Connection:

- Explosion Proof Type (FM/CSA)\*  
 NEMA 4 Type  Plastic ABS Type

\* Requires stainless steel floats

Please contact GEMS Sensors Inc. for any configuration or special requirements not covered on this form. **800-378-1600**

Quote: \$ \_\_\_\_\_ Date Quoted: \_\_\_\_/\_\_\_\_/\_\_\_\_

Additional minimum charges may apply on special orders.

Visit [www.GemsSensors.com](http://www.GemsSensors.com) for most current information.



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 fax 860.747.4244  
[www.gemssensors.com](http://www.gemssensors.com)



## GEMS Continuous Electrical Output Transmitters Provide Direct Liquid Measurement

- ▶ Lengths to 18 feet (5.5 m)
- ▶ Alloys or Engineered Plastic Wetted Parts
- ▶ Analog Output

Completely electronic, Gems Liquid Level Transmitters provide reliable and durable remote tank gauging. A wide variety of material combinations provide compatibility for most liquid media. Gems XM- & XT-800 Series provide solutions for most small to mid-size tanks in both process and OEM applications; for deeper tanks (to 18 feet) look to Gems 36000 and 66000 Series.

Gems experienced engineering and sales staff can provide customized solutions for applications not satisfied by the standard transmitters shown in this catalog. Do not hesitate to contact Gems if you require a configuration not shown here.

### Single Probe or Complete Systems

As a component, Gems transmitters provide the output options compatible with most programmable controllers and other digital receivers. Combined with Gems Digital Receivers you can create a complete tank gauging system.

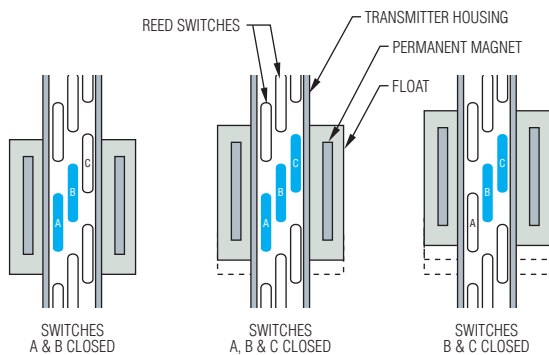
### Typical Applications

Consider GEMS' versatile transmitters for all your continuous liquid level monitoring needs — water, diesel, lube oils and fuels, as well as various chemical and petrochemical liquids. Here are just a few areas where GEMS' transmitters are used:

- Utilities • Beverage Industry • Medical • Pharmaceuticals • OHV
- Food Processing • Wineries • Printing • HVAC • Semiconductor

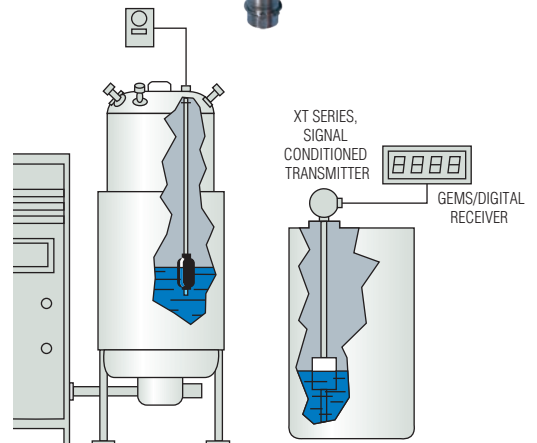
### Operating Principle

Gems voltage divider design uses a staggered series of reed switches. As the float moves with the liquid level, the magnets in the float close these reed switches in a “2-3-2 at-a-time” sequence. With every movement of the float, either one additional switch closes or one drops off.

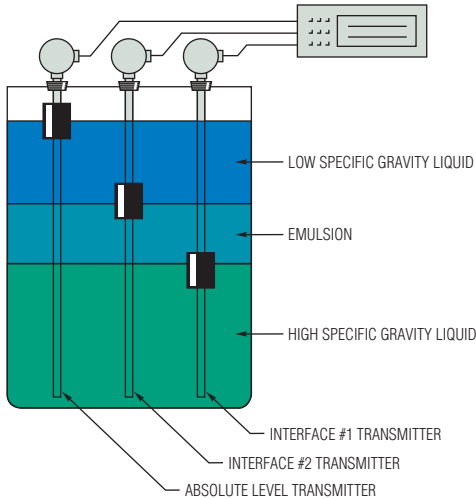


### What does this mean to you?

Ensures better accuracy — if one switch was to fail, the signal would be affected only at that point.



GEMS Transmitters monitor water, diesel or lube oils, chemicals and petrochemicals in industries such as pharmaceuticals, municipalities, breweries, textiles, automotive, pulp and paper and others.



## Got Mud?

Here's a tip. Gems Float Sensors are the best, most reliable method to monitor mud pits. See our Large Size Alloy models on Page C-13, and use with the 8" float for best results.

Use multiple Gems Transmitters to accurately monitor proportions of dissimilar liquids and emulsions within a single tank.

Contents	Page Start
XM/XT-800 Series .....	C-3
XM/XT-860 Series .....	C-7
XMP/XTP-800.....	C-10
XM/XT-36490.....	C-13
XM/XT-66400.....	C-13
Signal Conditioning Modules.....	C-16
Receivers .....	D-24

## Only a Float Can Show True Interface!

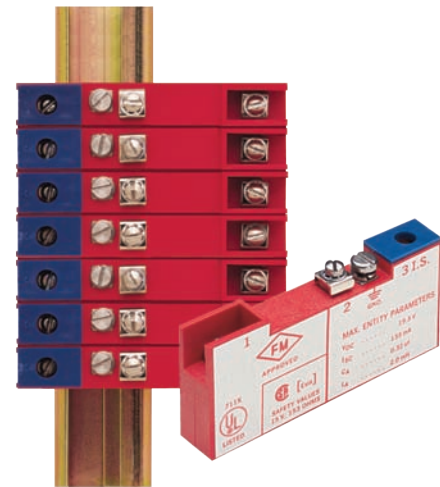
- By design or otherwise, dissimilar liquids often reside in the tank — one floating atop another. Most tank gauging methods are limited in these cases, and can only indicate the level of the uppermost surface. With GEMS Transmitters, you can easily monitor the interface between liquids...including the emulsions and slurries that sometimes form between them.
- By adjusting the density of the magnetic float, GEMS can adapt the transmitter to monitor the interface of a broad range of media. This principle applies to oil and water, slurries, acids, bilge and other dissimilar liquids.
- In conjunction with low level alarms, or automatic controllers, GEMS Transmitters will help assure that only the “correct” liquid is taken from a tank, or introduced into a process system.

## Selection Guide

Tank Depth	Maximum Pressure	Primary Material	Resolution	Output	Transmitter Series
Less Than 12 Feet (3.7 m)	150 psi (10 bar)	Alloy	1/4 inch (6.4 mm)	10-30 VDC Proportional	<b>XM-800/860</b>
				Signal Conditioned	<b>XT-800/860</b>
	50 psi (3.4 bar)	Engineered Plastic	1/4 inch (6.4 mm)	10-30 VDC Proportional	<b>XMP-800</b>
				Signal Conditioned	<b>XTP-800</b>
	300 psi (2 bar)	Alloy	1/2 inch (12.7 mm)	0-12 VDC Proportional	<b>XM-860</b>
				Signal Conditioned	<b>XT-860</b>
12 to 18 Feet (3.7 m to 5.5 m)	500 psi (35 bar)	Alloy	1/2 inch (12.7 mm)	10-30 VDC Proportional	<b>XM-66400</b> <b>XM-36490</b>
				Signal Conditioned	<b>XT-66400</b> <b>XT-36490</b>
12 to 18 Feet (3.7 m to 5.5 m)	2000 psi (138 bar)	Alloy	1/2 inch (12.7 mm)	10-30 VDC Proportional	<b>XM-66400</b>
				Signal Conditioned	<b>XT-66400</b>

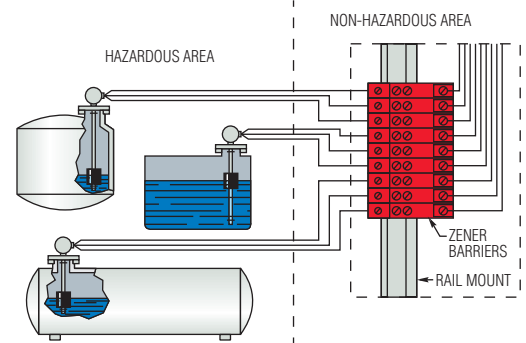
### Notes:

1. Proportional Voltage = DC voltage proportional to liquid level and source voltage. Ex. 5 VDC input, 0-5 VDC output.
2. Signal Conditioned = Regulated 0-5 VDC, 0-10 VDC, 0-12 VDC and 4-20 mA outputs.



## Intrinsic Safety

GEMS transmitters are intrinsically safe for hazardous area operation when properly connected to a GEMS Zener Barrier, a solid-state, energy limiting device. Any need for explosion-proof housings or special wiring of any kind is eliminated. GEMS Zener Barriers are variously UL, FM, CSA and MSHA approved. See Section I.



Any non-voltage-producing sensor or switch is rendered intrinsically safe for hazardous locations when properly connected to the output of GEMS Zener Barriers. These are described in Section I.

**ORDER IT!**

Ordering is Easy! See Page C-5.  
Easy online ordering too!

## Small Size – Alloys

### XM/XT-800 Series – Compact Analog Sensors

- ▶ Stainless or Brass Construction
- ▶ 1/4" Resolution
- ▶ Lengths to 144 inches (366 cm)
- ▶ OEM Configurations Available

These compact transmitters feature the rugged durability of stainless steel or brass construction. The XM-800 series provides analog output, and can be combined with GEMS Digital Meter Receiver Stations and compact Level Cubes described in this catalog. Our versatile XT-800 Series adds a choice of signal conditioning for use with GEMS digital bargraph receivers or other digital display and control equipment.

#### Approvals

XM-800 and XT-800 Series transmitters may carry the following commercial approvals:

- FM Approved, Explosion-Proof (J-Box and Stainless Steel Float required).
- UL-Recognized.

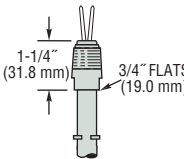
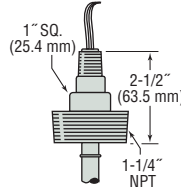
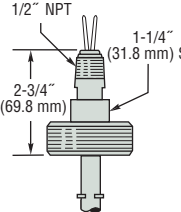
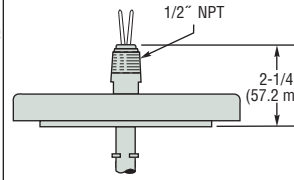
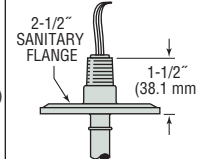
XM-800 Series transmitters only:

- CSA Certified

XT-800 Series transmitters only:

- FM Approved, Intrinsic Safety (J-Box and Stainless Steel Float required).

#### 1. Mounting Types

Type 1 1/2" NPT	Type 2 1-1/4" NPT	Type 3 2" NPT	Type 4 3" 150# Flange	Type 6 2-1/2" Sanitary Flange
				

<b>Stem Material</b>	Brass or 316 Stainless Steel	316 Stainless Steel	
<b>Mounting Material</b>	Brass or 316 Stainless Steel	Carbon Steel or 316 Stainless Steel	316 Stainless Steel
<b>Float Stop Material</b>	Brass Units: Beryllium Copper Grip Rings; Stainless Steel Units: S.S. ARMCO PH-15-7MO Grip Rings		
<b>Operating Temperature*</b> With J. Box Mounted or XM Signal Conditioners	Oil: -40°F to +230°F (-40°C to 110°C), Water to +180°F (82.2°C)—Buna N Float -40°F to +230°F (-40°C to 110°C)—Stainless Steel Float		
<b>With Stem Mounted Signal Conditioners</b>	+5°F to +160°F (-15°C to +70°C)		
<b>Operating Pressure</b>	Dependent on Float Type; See Next Page		
<b>Overall Length, Max.</b>	72" (183 cm) Tubing; 144" (366 cm) Pipe (Types 3 & 4 only)		

\* Consult factory for higher temperature ranges.



**Lengths to 12 ft!**



**3-Day**  
Qwik Configured  
Available for up to 5 units  
**Built & Shipped in 3 Days!**

## 2. Float Types

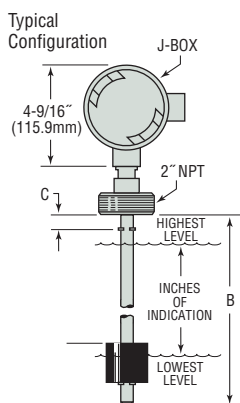
Based on the overall length required by your tank, select from two main subsets of floats below; further refine selection based on material and performance parameters.

Float Material	For Overall Lengths To 72"				For Lengths Greater Than 72" (144" Max.)	
	Buna N		Stainless Steel		Buna N	Stainless Steel
<b>Float Dimensions</b>						
<b>Compatible Mountings</b>	1, 2, 3, 4, 6	1, 3, 4	1, 3, 4, 6	1, 3, 4	3, 4	3, 4
<b>Part Number</b>	<b>164255<sup>2</sup></b>	<b>43359</b>	<b>156490</b>	<b>43590</b>	<b>69654</b>	<b>52084</b>
<b>Min. Liquid Spec. Gravity</b>	.55	.55	.70	.75	.55	.75
<b>Operating Pressure, Max.<sup>1</sup></b>	150 psi (10 bar)	150 psi (10 bar)	80 psi (6 bar)	300 psi (21 bar)	150 psi (10 bar)	300 psi (21 bar)
<b>Operating Temp., Max.</b>	Water: 180°F (82°C) Oil: 230°F (110°C)		230°F (110°C) <sup>3</sup>		Water: 180°F (82°C) Oil: 230°F (110°C)	230°F (110°C)*

Notes:

- @ Ambient Temperature
- Recommended for Type 2 mounting only.
- Consult factory for higher temperature range.

## 3. To Determine Dimensions



- B: Overall Length = Inches of Indication + C + X (See Table at Right)  
 C: Distance From Bottom of Mounting to Float Stop (Customer Specified):
- 1/4" (6.4mm) Minimum
  - 1-1/4" (31.8mm) Minimum on Type 1, XT Series only.

### Calculating Length

- To find Overall Length when Inches or Indication is known:
- Inches of Indication + C\* + X = Overall Length
- To find Maximum Inches of Indication when Overall Length is known:
- Overall Length - C\* - X = Maximum Inches of Indication

\*C dimension is determined by customer.

### Float Factor – X

Float Part Number	X
<b>164255</b>	2.0" (50.8)
<b>43359</b>	2.5" (63.5)
<b>156490</b>	2.062" (52.4)
<b>43590</b>	3.437" (87.3)
<b>69654</b>	2.687" (68.3)
<b>52084</b>	3.625" (92.1)


Inch (mm)

## 4. Input/Output

For XM-800 Series, no special output designation is necessary.  
 For XT-800 Series, specify the desired signal conditioning by Part Number.  
 Additional information about GEMS signal conditioning modules is found on Page C-16.

Series	Input Voltage	Output Signal	Part Number	Electrical Termination	Compatible Mountings		
					Type 1	Type 3	Type 4
XM-800	10 to 30 VDC	Proportional Voltage	—	Lead Wires (3), #22 AWG, 24" (60.9 cm), PTFE Jacket	•	•	•
	8 to 24 VDC*	0-5 VDC	<b>51965</b>	Lead Wires, #22 AWG, 24" (60.9 cm), PTFE Jacket	•	•	•
XT-800	14 to 30 VDC*	0-12 VDC	<b>51970</b>		•	•	•
	8 to 24 VDC*	0-5 VDC	<b>52536</b>	Junction Box		•	•
	15 to 30 VDC*	0-12 VDC	<b>52537</b>			•	•
	10 to 40 VDC	4-20 mA	<b>52555</b>	Panel Mount with Plug-in Base		•	•
	4-20 mA	<b>112300</b>	•		•	•	

\* Stem mounted.

 <p><b>Photocopy This Form</b> Use one form for each product type you are selecting. <small>This form may also be completed online at <a href="http://gemssensors.com">gemssensors.com</a> for RFQ.</small></p>	This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____ Name _____ Company _____ Quantity Needed _____ Street _____ Date Required ____/____/____ City _____ State ____ Zip _____ Shipping Method: _____ Phone (____) _____ Partial Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No Fax (____) _____
--	--

## Float Type Level Transmitters – XM/XT-800 Series

### Application Environmental Conditions

This information is essential to the accurate and proper operation of your GEMS configurable sensors. Please complete fully and accurately.

- 1. Liquid Media:** \_\_\_\_\_
- 2. Pressure:** Minimum \_\_\_\_\_ psig Maximum \_\_\_\_\_ psig
- 3. Temperature:** Minimum \_\_\_\_\_ °F Maximum \_\_\_\_\_ °F
- 4. Specific Gravity:** Minimum \_\_\_\_\_ Maximum \_\_\_\_\_

- 5. Viscosity:** \_\_\_\_\_ SSU
- 6. Tank Material:** \_\_\_\_\_  
**Tank Depth:** \_\_\_\_\_
- 7. Unit is Mounted In:**  Tank Top  Tank Bottom
- 8. Moisture Protection Required?**  Yes  No

#### 1. Series:

- XM/XT-800 (1/4" Resolution)

#### 2. Mounting Type:

- Type 1 (1/2" NPT)  Type 2 (1-1/4" NPT)  Type 3 (2" NPT)  
 Type 4 (3" 150# flange)  Type 6 (2-1/2" sanitary flange)

#### 3. Materials:

- a. Stem:  
 Brass<sup>1</sup>  316 Stainless Steel
- b. Mounting:  
 Brass<sup>1</sup>  316 Stainless Steel  
 Carbon Steel (Type 4 flange only)
- c. Collar Float Stops<sup>2</sup>:  
 Brass  316 Stainless Steel

#### 4. Float Type<sup>1</sup>:

Match to Overall Length of Transmitter Stem

To 72 Inches	Over 72 Inches
<input type="checkbox"/> 164255 – Buna N <sup>2</sup>	<input type="checkbox"/> 69654 – Buna N
<input type="checkbox"/> 43359 – Buna N	<input type="checkbox"/> 52084 – Stainless Steel
<input type="checkbox"/> 156490 – Stainless Steel	
<input type="checkbox"/> 43590 – Stainless Steel	

**Notes:**

1. Type 1, Type 2 and Type 3 only
2. Standard Float Stops supplied in PH 15-7 MO on S.S. units and Beryllium Copper on Brass units. Brass and S.S. Float Stops with Brass and S.S. units only, respectively.

**Notes:**

1. Stainless Steel float required for FM Approved Explosion Proof units.
2. Recommended for Type 2 mounting.

#### 5. Dimensions:

Overall Length (complete one line only):

Float Selected	Indicating Length (Half Inches)	+	"C" Dimension ±1/16" (1.8 mm)	+	Float Factor X Inch (mm)	=	Overall Length
43359		+		+	2.5 (63.5)	=	
43590		+		+	3.44 (87.3)	=	
52084		+		+	3.63 (92.1)	=	
69654		+		+	2.69 (68.3)	=	
156490		+		+	2.06 (52.3)	=	
164255		+		+	2 (50.8)	=	

**Notes:**

1. Indicating Length: 1/2" increments
2. Minimum C Dimension = 1/4"; or 1/2" on units greater than 72" in length.

#### 7. Options:

- Explosion Proof J-Box\*  NEMA 4 J-Box  
 \* Required for FM Approved Explosion Proof units

Please contact Gems for any configuration or special requirements not covered on this form. **800-378-1600**

Quote: \$ \_\_\_\_\_ Date Quoted: \_\_\_\_/\_\_\_\_/\_\_\_\_

#### 6. Input/Output:

- a. Optional 24 VDC Power Supply:  
 115 VAC input  230 VAC input
- b. Signal Conditioners (XT-800 Series Only)  
 Output Shown in Parenthesis:  
 51965 (0-5 VDC – stem)  
 51970 (0-12 VDC – stem)  
 52536 (0-5 VDC – J-box)  
 52537 (0-12 VDC – J-box)  
 52555 (4-20 mA – J-box)  
 120650 (0-5 VDC – panel mount)  
 149600 (0-10 VDC – panel mount)  
 112300 (4-20 mA – panel mount)



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## Small Size – Alloys

### XM/XT-860 Series – Compact, Resistive Output Level Sensors

- ▶ High Volume/Low Cost OEM Design
- ▶ Brass or Stainless Steel Construction
- ▶ 1/2" or 1" Resolution
- ▶ Lengths to 24 inches (610 mm)

OEMs with fluid gauging requirements now have an affordable, yet robust continuous output sensor they can use to great value. Gems XM-860 liquid level sensors are a durable, low-cost solution for applications that don't require high-resolution output. Made of brass or stainless steel, this series offers rugged construction, utilizing a new, coated reed switch core that stands up to high levels of shock and vibration. They are equally at home in applications ranging from tranquil storage day tanks to the challenge of off-highway vehicle fluids tank gauging. Minimum order for this series is 250 units.

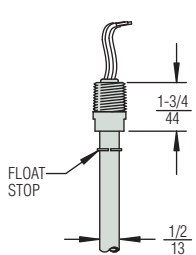
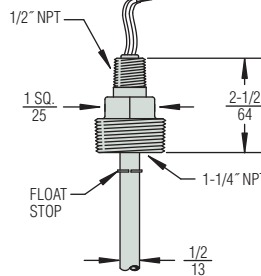
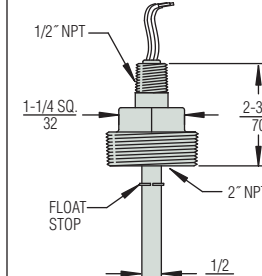
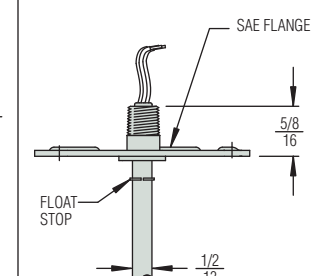
#### Gems XM-860 Advantages

- Floats provide true reading of liquid's surface position
- Floats can be used to sense dissimilar liquid interfaces (e.g. water/oil interface), including resulting emulsions.
- Unaffected by dielectric property of fluid
- Intrinsically-safe and Explosion-proof models available
- Unaffected by turbulence and motion

#### Typical Applications

- Generator Sets Fuel Tanks
- Auto Transmissions Fluid Reservoirs
- Reclamation Systems
- OHV Fuel Tanks
- Coolant Reservoirs
- Storage Day Tanks

### 1. Mounting Types

	Type 1 1/2" NPT Internal Mount	Type 2 1-1/4" NPT External Mount	Type 3 2" NPT External Mount	Type 4 SAE Flange External Mount
				
<b>Stem Material</b>	Brass or 316 Stainless Steel			Brass
<b>Mounting Material</b>	Brass or 316 Stainless Steel			Brass
<b>Float Stop Material</b>	Brass Units: Beryllium Copper Grip Rings; Stainless Steel Units: S.S. ARMCO PH-15-7MO Grip Rings			
<b>Stem Length</b>	24 inches (610 mm), Max.			
<b>Output Wiring</b>	Lead Wires Only	Lead Wires or Junction Box*		

\* Explosion-Proof (EP) units are supplied with junction box. Junction boxes for IS- or non-rated units may be ordered separately—P/N 113873.



**ORDER IT!**

Ordering is Easy! See Page C-9.  
Easy online ordering too!

## 2. Output Types

Make ordering selections from *either* the 2-wire or 3-wire output types detailed below.

### 2a. 2-Wire Versions, 1-inch Resolution

Designed for simplicity and economy, 2-wire resistive-output versions connect directly to many common automotive-type panel meters. Accuracy is 1 inch. Select the output resistance code from the table below for your Order Check List.

Output Resistance				
Resistance Code	Top Hard Stop	Individual Step R	Full Transition	Unit
R1	33	240-33 A (In.)	240	Ohms
R2	33	255-33 A (In.)	255	Ohms
R3	240	240-33 A (In.)	33	Ohms
R4	255	255-33 A (In.)	33	Ohms

High Resistance =  $\pm 2.75$   
Low Resistance =  $33 \pm 0.50$

#### Electrical Rating – Red to Black Wire

Resistance	33-240 or 33-255
Minimum Resistance	1000 Ohms
Maximum Voltage	30.0 VDC
Maximum Current	0.030 Amps
Maximum Power Dissipation	0.10 Watts/Inch of Indication

### 2b. 3-Wire Versions, 1/2-inch Resolution

These versions connect to Gems signal-conditioners (optionally selected in step 6b) for a variety of VDC and mA outputs. Accuracy is 1/2 inch. The standard resistance code is shown below. Consult factory for other resistance values.

Resistance Code	Resistance Value			
	R <sub>Lead</sub>	R	R <sub>Lag</sub>	Unit
P1	0	100	0	Ohms

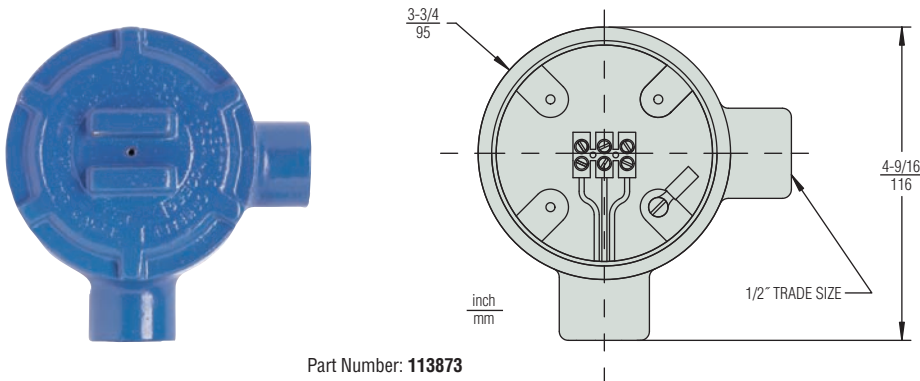
Total Indicating R =  $R_{Lead} + (A \text{ (In.)} * R) + R_{Lag}$

#### Electrical Rating – Red to Black Wire

Minimum Resistance	1000 Ohms
Maximum Voltage	30.0 VDC
Maximum Current	0.030 Amps
Maximum Power Dissipation	0.10 Watts/Inch of Indication

## 3. Output Options

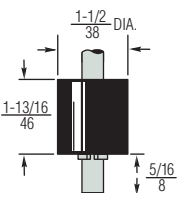
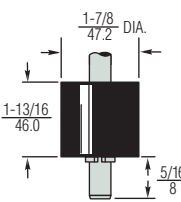
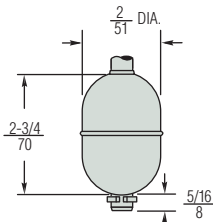
- A. Non-Rated Units.** Supplied with lead wire output; junction box optional. (See below.)
- B. Explosion-Proof Rated Units.** Supplied from factory with explosion-proof junction box.
- C. Intrinsically-Safe Rated Units.** Supplied with lead wire output; junction box optional. (See below.)
- D. Optional Junction Boxes – P/N 113873.** Simplify and protect wire connections for any non-Explosion-Proof Rated Unit. Optional Junction Boxes are supplied separately and must be assembled and wired by customer.



### 4. Float Types

Make selection based on Mounting Type being used and performance requirements.

**IMPORTANT:** If you are specifying either an Explosion-Proof or Intrinsically-Safe output, you must select a stainless steel float here.

Float Material	Buna N	Buna N	316 Stainless Steel
Compatible Mountings	Type 1, 2, 3, 4	Type 1 & 3	Type 1 & 3
Float Dimensions  inch mm			
Part Number	197428	43359	43590
Min. Liquid Specific Gravity	.63	.55	.75
Operating Pressure, Max*	150 PSI (10.3 bar)		300 PSI (20.7 bar)
Operating Temperature, Max.	Water: 180°F (82°C) Oil: 230°F (110°C)		300°F (149°C)

\*@ Ambient Temperature

### 5. To Determine Dimensions

**X:** Dimensional factor based on selected float (see table below)

**B:** Overall Length = Inches of Indication + C\*\* + X

**C:** Distance from bottom of mounting to float stop (customer specified):

- 1/4" (6.4mm) minimum
- 1-1/4" (31.8mm) minimum on Type 1, XT Series only

**M:** Distance from stem bottom to lowest level of indication

**N:** Distance from upper float stop to highest level of indication

#### Calculating Length

Note: 2-wire output units must specify Inches of Indication in even increments of 1 inch;  
3-wire output units must be specified in even increments of 1/2 inch.

To find Overall Length when Inches or Indication is known:

- Inches of Indication + C\*\* + X = Overall Length

To find Maximum Inches of Indication when Overall Length is known:

- Overall Length - C\*\* - X = Maximum Inches of Indication

\*\* C dimension is determined by customer.

If not specified, the float stop will be located at the minimum value (1/4").

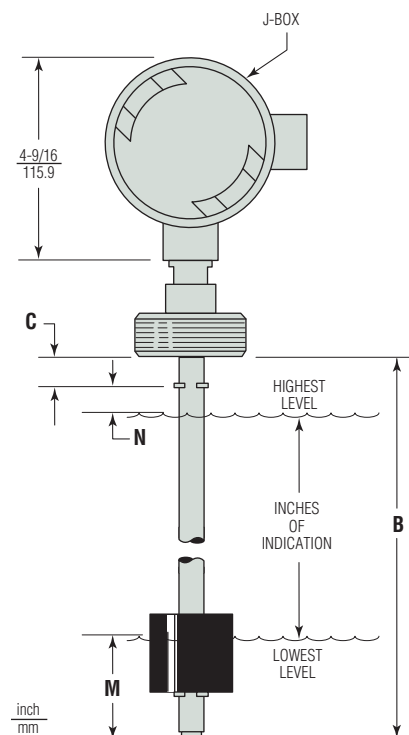
### Float Factors


Float Part Number	X Factor	M Dimension	N Dimension
197428	2.5 (63.5)	1.312 (33.3)	1.187 (30.1)
43359	2.5 (63.5)	1.312 (33.3)	1.187 (30.1)
43590	3.437 (87.3)	2.187 (55.5)	1.25 (31.7)

inch (mm)

M and N Dimensions are based on water (specific gravity 1.0).

Typical Configuration



 <p><b>Photocopy This Form</b> Use one form for each product type you are selecting. <small>This form may also be completed online at <a href="http://gemssensors.com">gemssensors.com</a> for RFQ.</small></p>	This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____ Quantity Needed _____ Date Required ____/____/____ Shipping Method: _____ Partial Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No	Name _____ Company _____ Street _____ City _____ State ____ Zip _____ Phone (____) _____ Fax (____) _____
--	--	--

## Float Type Level Transmitters – XM/XT-860 Series

### Application Environmental Conditions

This information is essential to the accurate and proper operation of your GEMS configurable sensors. Please complete fully and accurately.

- |  |  |
|--|--|
| <p><b>1. Liquid Media:</b> _____</p> <p><b>2. Pressure:</b> Minimum _____ psig Maximum _____ psig</p> <p><b>3. Temperature:</b> Minimum _____ °F Maximum _____ °F</p> <p><b>4. Specific Gravity:</b> Minimum _____ Maximum _____</p> | <p><b>5. Viscosity:</b> _____ SSU</p> <p><b>6. Tank Material:</b> _____<br/><b>Tank Depth:</b> _____</p> <p><b>7. Unit is Mounted In:</b> <input type="checkbox"/> Tank Top <input type="checkbox"/> Tank Bottom</p> <p><b>8. Moisture Protection Required?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No</p> |
|--|--|

#### 1. Series

- XM/XT-860 (1/2" Resolution) – 3 wire output  
 XM/XT-860 (1" Resolution) – 2 wire output

#### 2. Mounting Type

- Type 1 (1/2" NPT)       Type 2 (1-1/4" NPT)  
 Type 3 (2" NPT)       Type 4 (SAE Flange)

#### 3. Materials

- a. Stem:  
 Brass       316 Stainless Steel
- b. Mounting:  
 Brass       316 Stainless Steel\*
- \*Type 1, 2, & 3 only

#### 4. Float Type

- 197428** – Buna N (Use with any Mounting Type)  
 **43359** – Buna N (Use **only** with Mounting Type 1 or 3)  
 **43590** – Stainless Steel (Use **only** with Mounting Type 1 or 3)

#### 5. Dimensions

Overall Length (complete one line only):

Float Selected	Indicating Length <sup>1</sup> (Whole Inches)	+	C Dimension ±1/16" (1.6mm)	+	Float Factor X Inch (mm)	=	Overall Length 24" (610 mm) Max.
197428		+		+	2.5 (63.5)	=	
43359		+		+	2.5 (63.5)	=	
43590		+		+	3.44 (87.3)	=	

- Notes:  
 1. Indicating Length: 1" increments  
 2. Minimum C Dimension = 1/4"

#### 6. Input/Output

- a. Optional 24 VDC Power Supply:  
 115 VAC input     230 VAC input
- b. Signal Conditioners  
 Output Shown in Parenthesis:  
 51965 (0-5 VDC – stem)  
 51970 (0-12 VDC – stem)  
 52536 (0-5 VDC – J-box)  
 52537 (0-12 VDC – J-box)  
 52555 (4-20 mA – J-box)  
 112300 (4-20 mA – panel mount)

Please contact Gems for any configuration or special requirements not covered on this form. **800-378-1600**

Quote: \$ \_\_\_\_\_ Date Quoted: \_\_\_\_/\_\_\_\_/\_\_\_\_



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tel 860.747.3000  
 fax 860.747.4244  
[www.gemssensors.com](http://www.gemssensors.com)

## Small Size – Engineered Plastics

### XMP/XTP-800 Series Delivers Excellent Chemical Compatibility

- ▶ PVC, Polypropylene or PVDF Materials
- ▶ 1/4" Resolution
- ▶ Lengths to 70 inches (177.8 cm)

Specifically designed to monitor chemical tanks and vats, the XMP-800 Series provides superb resistance to corrosive liquids and vapors. Use XMP-800 transmitters with GEMS Digital Bargraph Display Receiver or Level Cube Receivers described in this catalog. The XTP-800 Series adds a choice of signal conditioning for use with GEMS digital bargraph display receivers or other digital instrumentation and control equipment.

**ORDER IT!**  
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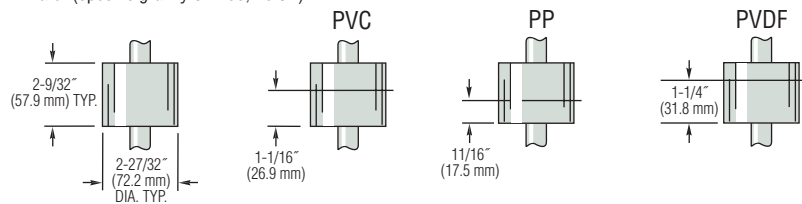


	Type A	Type B	Type C
	1" NPT	3" NPT	3" 150# Flange
<b>XMP-800 Dimensions</b>			
<b>XTP-800 Dimensions</b>			
<b>Stem, Mounting and Float Stop Material</b>	PVC, Polypropylene or KYNAR® (PVDF)		
<b>Operating Temperature</b>	See Chart, Next Page		
<b>Operating Voltage</b>	10-30 VDC		
<b>Overall Length, Max.</b>	70" (177.8 cm); please consult factory for longer lengths		



## 2. Float Types

Float submersion depths:  
In water (specific gravity of 1.00; ±0.3")

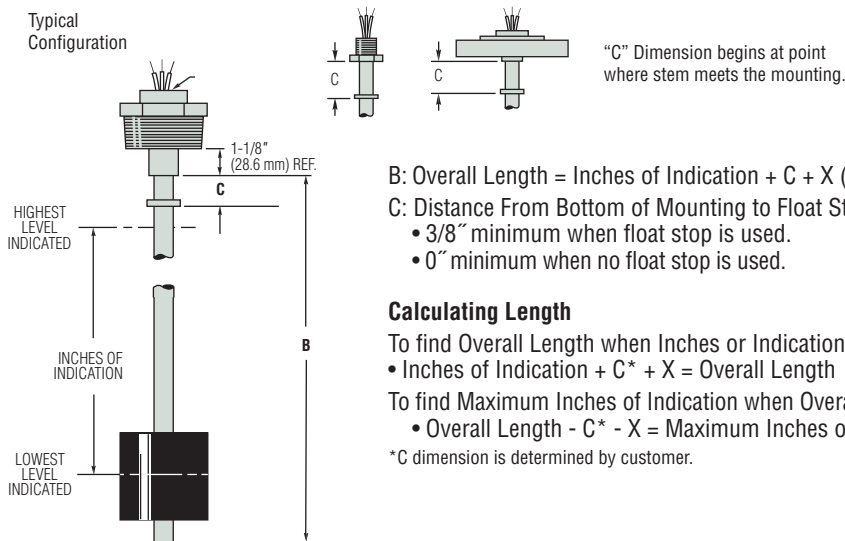


Material	Min. Liq. Specific Gravity	Part Number	Maximum Pressure vs. Temperature							
			0°F (17.8°C)	70°F (21.1°C)	100°F (37.8°C)	125°F (51.7°C)	140°F (60.0°C)	170°F (76.7°C)	200°F (93.3°C)	210°F (98.9°C)
PVC	.60	<b>61326</b>	50 PSI	50 PSI	35 PSI	20 PSI	10 PSI			
Polypropylene	.40	<b>61327</b>	50 PSI	50 PSI	40 PSI	35 PSI	30 PSI			
PVDF	.75	<b>61328</b>	50 PSI	50 PSI	45 PSI	40 PSI	35 PSI	30 PSI	25 PSI	25 PSI

■ = Not recommended at these temperatures

## 3. Dimensions

Typical Configuration



B: Overall Length = Inches of Indication + C + X (See Table at Right)

C: Distance From Bottom of Mounting to Float Stop (Customer Specified):

- 3/8" minimum when float stop is used.
- 0" minimum when no float stop is used.

### Calculating Length

To find Overall Length when Inches or Indication is known:

- Inches of Indication + C\* + X = Overall Length

To find Maximum Inches of Indication when Overall Length is known:

- Overall Length - C\* - X = Maximum Inches of Indication

\*C dimension is determined by customer.

### Float Factor – X

Float Part Number	X
<b>61326</b>	3.5" (88.9)
<b>61327</b>	3.5" (88.9)
<b>61328</b>	3.5" (88.9)

Inch (mm)

## 4. Input/Output


For XM Series, no special output designation is necessary.

For XT Series, specify the desired signal conditioning by Part Number.

Additional information about GEMS signal conditioning modules is found on Page C-16.

Series	Input Voltage	Output Signal	Part Number	Electrical Termination	Compatible Mountings		
					Type A	Type B	Type C
XMP-800	10 to 30 VDC	Proportional Voltage	—	Lead Wires (3), #22 AWG, 24" (60.9 cm), Polymeric Jacket	•	•	•
XTP-800	8 to 24 VDC	0-5 VDC*	<b>51965</b>	Lead Wires, #22 AWG, 24" (60.9 cm), PTFE Jacket	•	•	•
	14 to 30 VDC	0-12 VDC*	<b>51970</b>		•	•	•
	8 to 24 VDC	0-5 VDC	<b>154687</b>	ABS Junction Box		•	•
	15 to 30 VDC	0-12 VDC	<b>154685</b>			•	•
	10 to 40 VDC	4-20 mA	<b>116970</b>			•	•
		4-20 mA	<b>112300</b>	Panel Mount with Plug-in Base	•	•	•

\* Stem mounted.

 <b>Photocopy This Form</b> Use one form for each product type you are selecting. <small>This form may also be completed online at gemssensors.com for RFQ.</small>	This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____	Name _____ Company _____ Street _____ City _____ State ____ Zip _____ Phone (____) _____ Fax (____) _____
	Quantity Needed _____ Date Required ____/____/____ Shipping Method: _____ Partial Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No	

## Float Type Level Transmitters – XMP/XMT-800 Series

### Small Size, Engineered Plastics

#### Application Environmental Conditions

This information is essential to the accurate and proper operation of your GEMS configurable sensors. Please complete fully and accurately.

- |   |  |
|---|--|
| <b>1. Liquid Media:</b> _____                             | <b>5. Viscosity:</b> _____ SSU   |
| <b>2. Pressure:</b> Minimum _____ psig Maximum _____ psig | <b>6. Tank Material:</b> _____   |
| <b>3. Temperature:</b> Minimum _____ °F Maximum _____ °F  | <b>Tank Depth:</b> _____   |
| <b>4. Specific Gravity:</b> Minimum _____ Maximum _____   | <b>7. Unit is Mounted In:</b> <input type="checkbox"/> Tank Top <input type="checkbox"/> Tank Bottom |

#### 1. Series:

- XMP-800  XTP-800

#### 2. Mounting Type:

- Type A  Type B  Type C

#### 5. Dimensions:

a. Overall Length:

Indicating Length C Dimension X  
 \_\_\_\_\_ + \_\_\_\_\_ " + 3.5" =   " 70" (177.8 cm) maximum.

Notes:

1. Consult factory for longer lengths.
2. Indicating Length: 1/2" Increments.
3. C Dimension: 3/8" minimum when float stop is used; 0" minimum when no float stop is used.

#### 6. Input/Output:

a. Optional 24 VDC Power Supply:

- 115 VAC input  230 VAC input

b. Signal Conditioners (XTP-800 Series Only):

- 51965 (0-5 VDC – stem)
- 51970 (0-12 VDC – stem)
- 154687 (0-5 VDC – J-box)
- 154685 (0-12 VDC – J-box)
- 116970 (4-20 mA – J-box)
- 112300 (4-20 mA – panel mount)

#### 3. Mounting and Stem Material:

- PVC  Polypropylene  PVDF

#### 4. Float Type:

- 61326 – PVC  61327 – Polypropylene  61328 – PVDF

Please contact Gems for any configuration or special requirements not covered on this form. **800-378-1600**

Quote: \$ \_\_\_\_\_ Date Quoted: \_\_\_\_/\_\_\_\_/\_\_\_\_



**Gems Sensors & Controls**  
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 06062-1198

tel 860.747.3000  
 fax 860.747.4244  
 www.gemssensors.com

**ORDER IT!**

Ordering is Easy! See Page C-15.  
Easy online ordering too!

## Large Size – Alloys

### Sized for Deep Tanks and Rugged Duty



- ▶ Stainless Steel Construction
- ▶ Standard Lengths to 18 feet (549 cm)

These rugged transmitters are designed for tanks up to 18 feet (549 cm) in depth. Heavy duty stems resist turbulence, and float options accommodate liquids with minimum specific gravity as low as 0.53. Standard resolution is 1/2 inch; higher resolutions are available on request.

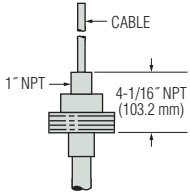
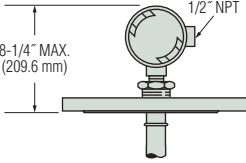
\* Contact GEMS about solutions for deeper tanks.

### Approvals

XM-36490 and XT-36490 Series transmitters may carry the following commercial approvals:

-  FM Approved, Explosion-Proof for lengths up to 10 feet (305 cm)
-  UL-Approved, Explosion-Proof

### 1. Mounting Types

Series	XM/XT-66400	XM/XT-36490
Mounting	4" NPT	5" ANSI Flanges; 150#, 300#, or 600#
		
Stem Material	316L Stainless Steel	316L Stainless Steel
Mounting Material	316L Stainless Steel; or Carbon Steel	316L Stainless Steel; or Carbon Steel Flange
Float Stop Material	316L Stainless Steel	316L Stainless Steel
Overall Length, Max.	216" (549 cm)	

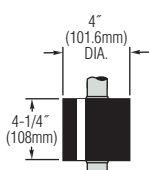
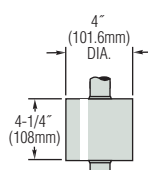
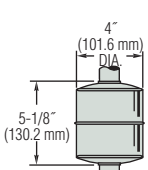
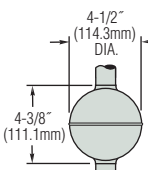
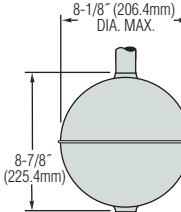
Note: XM/XT-36490 will be manufactured with matching Stem and Float Stop material. Consult factory for longer lengths.

### Got Mud?

These Gems Alloy Float Level Sensors are the best, most reliable method to monitor mud pits. The large diameter, stainless steel stems are rugged and strong to handle heavily viscous mud and slurries. Use with the exceptionally-buoyant 8" float for best results.



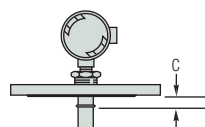
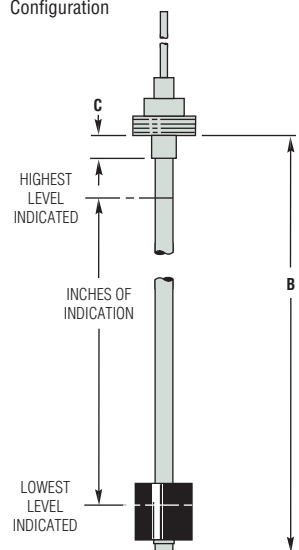
## 2. Float Types

Material	Buna N	4" Dia. Syntactic Foam	4" Dia. Stainless Steel	4-1/2" Dia. Stainless Steel	8" Dia. Stainless Steel**
Float Dimensions					
Part Number	32230	31830	125520	35560	38609
Minimum Liquid Specific Gravity	0.59	0.87	0.57	0.78	0.53
Operating Temperature	-40°F to +180°F (-40°C to +82°C)	-40°F to +225°F (-40°C to +107°C)	-40°F to +230°F (-40°C to +110°C)		
Operating Pressure, Max*	150 PSI (10 bar)	2000 PSI (138 bar)	15 PSI (1 bar)	500 PSI (35 bar)	150 PSI (10 bar)

\* Unit pressure rating is determined by the flange and float selected. Consult factory for higher pressure ratings.  
 \*\* Float P/N 38609 must be installed on the transmitter stem from within the tank; or consult factory for larger flanges.

## 3. Dimensions

Typical Configuration



B: Overall Length = Inches of Indication + C + X (See Table at Right)  
 C: Distance From Bottom of Mounting to Float Stop (Customer Specified):  
 • 1/2" (12.7mm) Minimum

### Calculating Length

To find Overall Length when Inches or Indication is known:  
 • Inches of Indication + C\* + X = Overall Length  
 To find Maximum Inches of Indication when Overall Length is known:  
 • Overall Length - C\* - X = Maximum Inches of Indication

\*C dimension is determined by customer.

### Float Factor – X

Float Part Number	X
32230	6.75" (171.5)
31830	6.75" (171.5)
125520	7.75" (196.5)
35560	6.75" (171.5)
38609	11.375" (288.9)


Inch (mm)

## 4. Input/Output

For XM- Series, no special output designation is necessary.  
 For XT- Series, specify the desired signal conditioning by Part Number.  
 Additional information about GEMS signal conditioning modules is found on Page C-16.

Series	Input Voltage	Output Signal	Part Number	Electrical Termination
XM-36490	10 to 30 VDC	Proportional Voltage	—	Junction Box
XM-66400				Cable, (4) Conductor, 30 ft. long, Nitrile Jacket
XT-Series	8 to 24 VDC	0-5 VDC	52532	Junction Box
	15 to 30 VDC	0-12 VDC	52533	
	10 to 40 VDC	4-20 mA	52550	Panel Mount with Plug-In Base
	4-20 mA	112300 ⚡		

⚡ = Stock item

 <p><b>Photocopy This Form</b> Use one form for each product type you are selecting. <small>This form may also be completed online at <a href="http://gemssensors.com">gemssensors.com</a> for RFQ.</small></p>	This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____ Name _____ Company _____ Quantity Needed _____ Street _____ Date Required ____/____/____ City _____ State ____ Zip _____ Shipping Method: _____ Phone (____) _____ Partial Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No Fax (____) _____
--	--

## Float Type Level Transmitters – Large Size

### Application Environmental Conditions

This information is essential to the accurate and proper operation of your GEMS configurable sensors. Please complete fully and accurately.

- |   |  |
|---|--|
| <b>1. Liquid Media:</b> _____<br><b>2. Pressure:</b> Minimum _____ psig Maximum _____ psig<br><b>3. Temperature:</b> Minimum _____ °F Maximum _____ °F<br><b>4. Specific Gravity:</b> Minimum _____ Maximum _____ | <b>5. Viscosity:</b> _____ SSU<br><b>6. Tank Material:</b> _____<br><b>Tank Depth:</b> _____<br><b>7. Unit is Mounted In:</b> <input type="checkbox"/> Tank Top <input type="checkbox"/> Tank Bottom |
|---|--|

#### 1. Series:

- XM/XT-66400       XM/XT-36490

#### 2. Mounting Type:

- 4" NPT (66400)  
 Flange Size:  4"       5"       6"  
 Flange:  150#       300#       600# (36490 Series Only)

#### 3. Material:

- a. Stem:  316L Stainless Steel  
 b. Mounting:  
 36990:  316L Stainless Steel     Carbon Steel  
 66400:  316L Stainless Steel

#### 4. Float Type P/N – Description:

- 32230 – Buna N  
 125520 – 4" Stainless Steel  
 35560 – 4-1/2" Stainless Steel  
 38609 – 8" Stainless  
 31830 – 4" Syntactic Foam

#### 5. Dimensions:

Float Selected	Indicating Length (Whole Inches)	+	C Dimension (1/2" min.)	+	Float Factor X	=	Overall Length (180" (457.2 cm), Max.)
31830							
32230		+		+	6.75" (171.5 mm)	=	
35560							
38609		+		+	11.375" (288.9 mm)	=	
125520		+		+	7.75" (196.8 mm)	=	

Note: Indicating Length = Whole Inch Increments

#### 6. Input/Output:

- a. Optional 24 VDC Power Supply:  
 115 VAC input  
 230 VAC input
- b. Signal Conditioners:  
 52550 (4-20 mA)  
 52532 (0-5 VDC)  
 52533 (0-12 VDC)

Please contact Gems for any configuration or special requirements not covered on this form. **800-378-1600**

Quote: \$ \_\_\_\_\_ Date Quoted: \_\_\_\_/\_\_\_\_/\_\_\_\_



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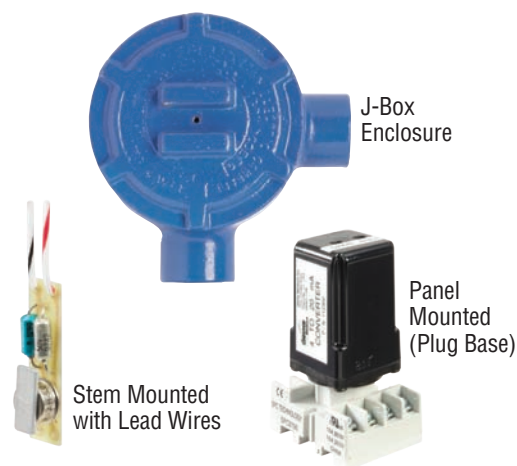


# Signal Conditioning Modules, 0-5 VDC, 0-12 VDC and 4-20 mA Outputs

Provide signal conditioning as an integral part of the XT-Series Transmitters

- ▶ Stem Mounted
- ▶ Panel Mounted
- ▶ J-Box Enclosed
- ▶ Units with Preset High and Low Alarm

GEMS' signal conditioners provide outputs for direct connection to a wide range of instrumentation. They are ideal for large, multi-tank complexes. Units with 4-20 mA outputs are particularly well suited for instrumentation control loops. No intermediate receiver is required.

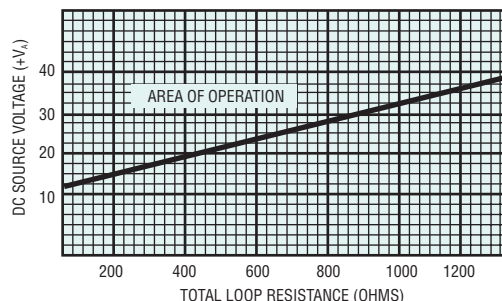


## Specifications (Not included in table below)

<b>System Accuracy</b>	With XT-36000 Series Transmitters: ±0.4% of full scale or ±1", whichever is greater. With XT-800 Series Transmitters: ±0.4% of full scale or ±1/2", whichever is greater.
<b>Operating Temperature</b>	+5°F to +160°F (-15°C to +71°C)
<b>Storage Temperature</b>	-40°F to +212°F (-40°C to +100°C)
<b>Output Temperature Coefficient (% of full scale, max.)</b>	±0.00388%/°F (±0.007%/°C)
<b>20 mA Types</b>	To within ±1% of 16 mA

## Excitation Required for Transmitters using 4-20 mA Signal Conditioners

The minimum excitation required for operation of transmitters with 4-20 mA, DC signal converters (See chart at right) can be determined for a given total loop resistance from the graph shown. (Total loop resistance = the sum of the DC termination resistance plus loop resistance.) For optimum operation, which is a function of source voltage (+V<sub>A</sub>) and total loop resistance, the source voltage value used should be above the minimum load line for the related loop resistance.



## Power Supply Module

Input Power	Part Number
115 VAC, 60 Hz	<b>52560</b>
230 VAC, 60 Hz	<b>52570</b>

Operates on 115 VAC or 230 VAC inputs to supply a regulated 24 VDC to the signal conditioned transmitter where external VDC power is not available. Maximum Load: 70 mA.

## How To Order

Select Part Number based on Output Signal desired and XT-Series sensor being used.

Electrical Termination Method	Output Signal	Input Voltage	Module Part Numbers For:			
			XT-800, XT-860 Series	XTP-800	XT-36488	XT-36490 XT-66400
Stem Mount, Lead Wires #22 AWG, Teflon® Jacket, 24" Length	0-5 VDC	8-24 VDC	<b>51965</b>	<b>51965</b>	—	—
	0-12 VDC	14-30 VDC	<b>51970</b>	<b>51970</b>	—	—
Junction Box	0-5 VDC	8-24 VDC	<b>52536</b>	<b>154687</b>	<b>154687</b>	<b>52532</b>
	0-12 VDC	15-30 VDC	<b>52537</b>	<b>154685</b>	<b>154685</b>	<b>52533</b>
	4-20 mA	10-40 VDC	<b>52555</b>	<b>116970</b>	<b>116970</b>	<b>52550</b>
Panel Mount with Plug-In Base	4-20 mA	10-40 VDC	<b>112300 ⚡</b>	<b>112300 ⚡</b>	<b>112300 ⚡</b>	<b>112300 ⚡</b>

⚡ = Stock item

## NOTES

A large grid of graph paper for taking notes, consisting of 20 columns and 30 rows of small squares.

## Ultrasonic Continuous Liquid Level Sensors

- ▶ Accurate and reliable sensing method
- ▶ Ideal technology for difficult fluids
- ▶ Sized and priced for most applications
- ▶ Easy to install—simple to use

Gems delivers the answer for challenging fluid measurement and monitoring with our new ultrasonic UCL Series Continuous Non-Contact Level Transmitters. These accurate and reliable sensors are designed for the most difficult fluids to monitor — including ultrapure, dirty, coating, scaling or corrosive types.

### Typical Media

- Acids
- Wastewater
- Inks and Paints
- Slurries
- Food and Beverage
- Semiconductor Process Chemicals
- Oils and Petroleum Distillates

### How Ultrasonic Monitoring Works

**UCL Series Continuous Non-Contact Transmitters:** Mounted at the top of a tank, the sensor continuously transmits pulses of high-frequency sound waves that travel away from the sensor, hit the surface of the liquid and return to the sensor. Solid-state electronics measure the time it takes from transmitted sound to return of the echo. With reference to the speed of sound in air, the exact distance of the liquid surface from the sensor can be calculated with high accuracy ( $\pm 0.2\%$  of maximum range). Level/Distance measurements are automatically temperature-compensated throughout the operating temperature range of the sensor.

Contents	Page Start
UCL-510.....	C-19
UCL-520.....	C-21



## UCL-510 — Transmitter/Multipoint Switching Combo

- ▶ 49-inch (1.25m) range. Compact sensor with 2" dead band and beam width are optimized for small tank applications
- ▶ 1" NPT mounting
- ▶ Reliable, non-contact alternative to float and conductivity level sensors for corrosive, sticky or dirty media
- ▶ Outputs continuous level and provides full pump or valve control
- ▶ PVDF transducer for corrosive liquid media

The UCL-510 is a general purpose ultrasonic sensor providing non-contact level detection up to 49.2" (1.25m), with 4 relays for switch or control functions and continuous level measurement. This compact unit offers a non-contact alternative to our float or conductance sensors in small tank chemical feed or handling applications when corrosive, sticky or dirty media is involved.

The configuration software, supplied with the sensor, provides flexible system integration or retrofit of existing level devices with configuration control. Integral level automation functions can further reduce system costs through the reduction of external control hardware. The analog output enables local tank level indication, remote PLC monitoring or automation functions. Gems UCL-510 is the non-contact solution for small tank level switch, control and measurement.

### Specifications

<b>Range</b>	49.2" (1.25 m)
<b>Accuracy</b>	0.125" (3 mm)
<b>Resolution</b>	0.019" (0.5 mm)
<b>Beam Width</b>	2" (5 cm)
<b>Dead Band</b>	2" (5 cm)
<b>Supply Voltage</b>	24VDC (loop)
<b>Loop Resistance</b>	400Ω max.
<b>Consumption</b>	0.5W
<b>Signal Output</b>	4-20 mA, two-wire (when loop powered)
<b>Contact Type</b>	(4) SPST relays 1A
<b>Loop Fail-Safety</b>	4 mA, 20 mA, 21 mA, 22 mA or hold last
<b>Relay Fail-Safety</b>	Power loss: Hold last; Power on: Open, close or hold last
<b>Hysteresis</b>	Selectable
<b>Configuration Software</b>	PC Windows® USB 2.0
<b>Temp. Comp.</b>	Automatic over range
<b>Process Temp.</b>	20°F to 140°F (-7°C to +60°C)
<b>Ambient Temp.</b>	-31°F to +140°F (-35°C to +60°C)
<b>Pressure</b>	MWP = 30 PSI
<b>Enclosure</b>	Type 6P encapsulated, corrosion resistant & submersible
<b>Encl. Material</b>	PC/ABS FR
<b>Strain Relief Mat.</b>	Santoprene®
<b>Trans. Material</b>	PVDF
<b>Cable Length</b>	48" (1.2 m)
<b>Cable Jacket Mat.</b>	Polyurethane
<b>Process Mount</b>	1" NPT (1" G)
<b>Mount. Gasket</b>	Viton®
<b>Classification</b>	General Purpose
<b>Approvals</b>	CE, cFMus



### Typical Applications

- Water and Waste Water
- Control Automation
- Chemical Feed
- Food and Beverage
- Acids, Inks, Paints
- Slurries

### Control and Switch Functions

- 2 pumps with 2 alarms
- 1 pump with 3 alarms
- 2 pumps (lead-lag) with 2 alarms
- 2 pumps (duplexing) with 2 alarms
- 4 level switch points

## Versatile Application

### Controller

- Auto fill/empty
- Can control 2 pumps/valves
- Lead/lag
- Duplex
- Unused relays may be used as additional alarms

The UCL-510 feature programmable level intelligence and can be reconfigured for different sensing duties (such as switch actuation points) after installation. This is an advantage over our float or conductivity type sensors. The user-friendly configuration software provides un-matched accuracy and programming for control applications. Multi-function relay control, coupled with 4-20 mA output generates amazing control capabilities. Advanced signal processing techniques provides the UCL-510 with next generation digital processing for control. The UCL-510 is level control made simple.

### Switching

- High level alarm (1-4)
- Low level alarm (1-4)
- Any combination of high and/or low alarms

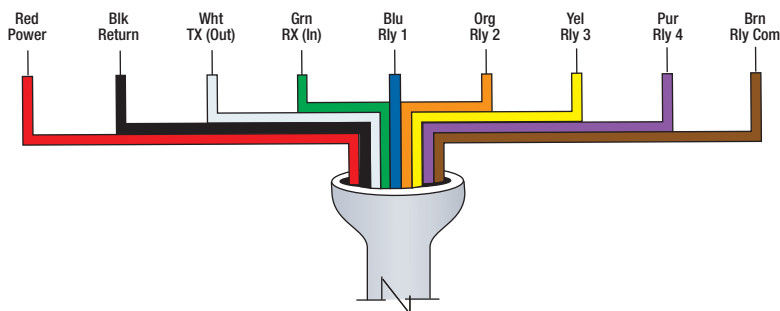
The UCL-510 provides a non-contact alternative to our float and conductivity probes multipoint level switches. It combines 4 built in SPST relays, with a selectable hysteresis that eliminates relay chatter from turbulent media. Additionally, non-contact sensors are immune to the performance issues influenced by changes in a media's specific gravity.

### Continuous Transmitter

- Adjustable 4-20 mA output
- Reversible output
- Interface directly to local display and/or to PLC, SCADA, DCS systems
- Remote displays/controllers can increase relay functionality

The UCL-510 is a good non-contact alternative to our XT float type transmitters for challenging media that can damage moving parts. The UCL-510 is for sticky, scaling or corrosive media. It provides exceptional measurement accuracy (0.125"), resolution (0.019") and repeatability ensuring overall system performance reliability.

## Wiring



## How To Order

Select by Part Number.

Description	Part Number
UCL-510 Transmitter/Multipoint Switch with Configuration Software and Fob	225100
Replacement/Additional Configuration Fob	227100

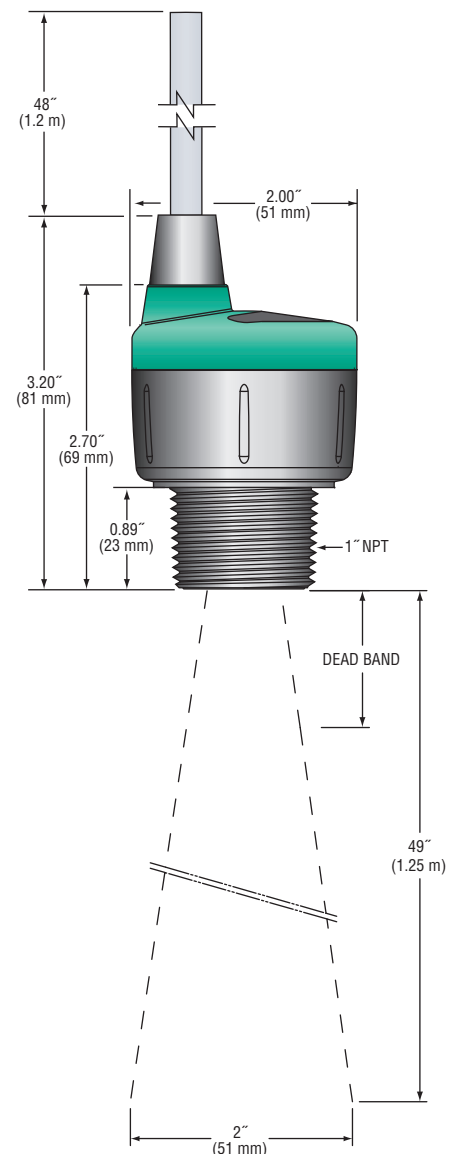
## Configuration Software

- Free download @ [GemsSensors.com/software](http://GemsSensors.com/software)
- Windows XP or 2000 compatible; USB 2.0 connection
- Provides configuration, file management (saving, printing, backup), and troubleshooting

The user interface allows you to take complete visual control of your set-up and configuration. Using simple menus and visual representations, the confusion of target calibration are gone. Once you have completed your configuration design, simply click "Write to Unit" and the UCL-510 is configured. It also enables multiple UCL-510's to be configured with just a click of the button. It even generates viewable and printable PDF wiring diagrams of your configurations to simplify and ensure proper field installation.

Gems supplies the USB Fob required to use the configuration software with each UCL-510 sensor. Replacements or additional Fobs may be ordered separately.

## Dimensions



LEVEL SENSORS – CONTINUOUS



## UCL-520 — 2-Wire Transmitter for Midsize Tanks

- ▶ To 26-feet (8m) range with 2" transducer
- ▶ 2" NPT mounting
- ▶ Setup is fast and easy. Incorporates push button calibration and LCD display
- ▶ 6-segment LCD display indicates level in inch or centimeter values
- ▶ 7.6 cm minimum beam width for applications with restricted space
- ▶ Fail-safe intelligence with diagnostic feedback for easy troubleshooting

The UCL-520 is a general purpose two-wire ultrasonic transmitter providing non-contact level measurement up to 26.2' or 8m. It is ideally suited for challenging ultrapure, corrosive or waste liquids.

Push button calibrated, the UCL-520 is broadly selected for atmospheric bulk storage, day tank and waste sump applications. Media examples include wastewater and sodium hydroxide. The PC/ABS enclosure is rated NEMA 4X, and the transducer is housed in rugged PVDF.

### Specifications

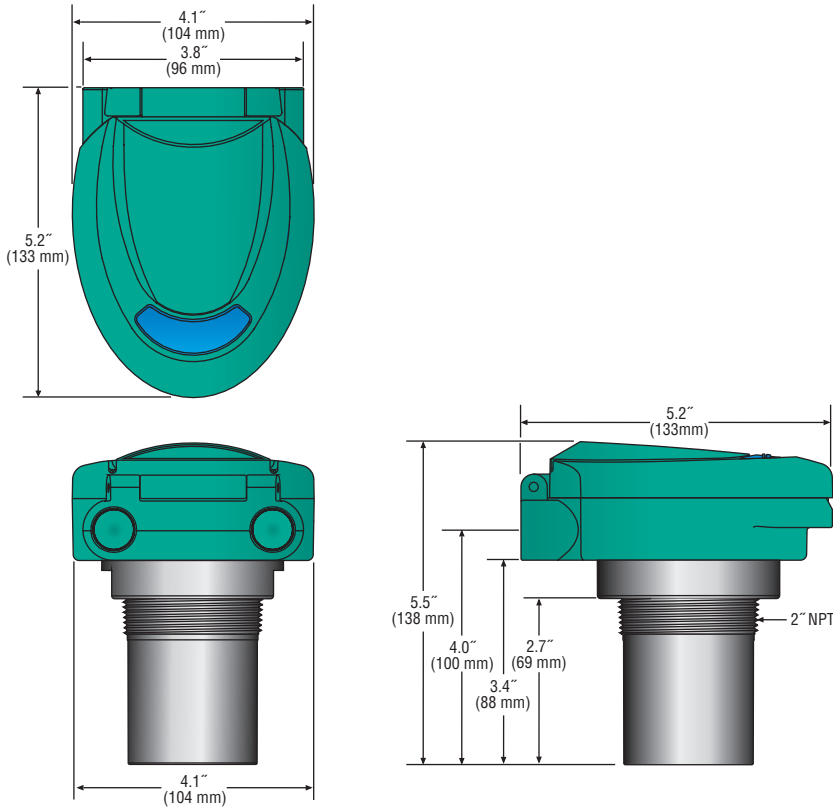
<b>Range</b>	6' to 26.2' (1.8 m to 8 m)
<b>Accuracy</b>	± 0.2% of span in air
<b>Resolution</b>	0.039" (1 mm)
<b>Beam Width</b>	3" (7.6 cm) dia.
<b>Dead Band</b>	8" (20 cm)
<b>Display Type</b>	LCD, 6-digit
<b>Display Units</b>	Inch, cm or percent
<b>Display Mode</b>	Air gap or liquid height
<b>Memory</b>	Non-volatile
<b>Supply Voltage</b>	12-28 VDC
<b>Loop Resistance</b>	500 Ohms @ 24 VDC
<b>Signal Output</b>	4-20 mA, two-wire
<b>Signal Invert</b>	4-20 mA or 20-4 mA
<b>Calibration</b>	Push button
<b>Fail-Safety</b>	Selectable 4 mA, 20 mA, 21 mA, 22 mA or hold
<b>Process Temp.</b>	-7°F to +140°F (-20°C to +71°C)
<b>Temp. Comp.</b>	Automatic
<b>Electronics Temp.</b>	-40°F to +160°F (-40°C to +71°C)
<b>Pressure</b>	30 PSI (2 bar) @ 25°C, derated @ 1.667 PSI (0.113 bar) per °C above 25°C
<b>Enclosure Rating</b>	NEMA 4X (IP65)
<b>Enclosure Vent</b>	Water tight membrane
<b>Enclosure Material</b>	PC/ABS FR
<b>Trans. Material</b>	PVDF
<b>Process Mount</b>	2" NPT (2" G)
<b>Mount. Gasket</b>	Viton®
<b>Conduit Entrance</b>	Dual, 1/2" NPT
<b>Classification</b>	General Purpose
<b>CE Compliance</b>	EN 61326 EMC



### Typical Applications

- Water and Waste Water
- Petrochemical
- Health Care
- Mining
- Cleaning
- HVAC
- Chemical
- Semiconductor
- Agriculture
- Electric Power
- Water Parks/Swimming Pools

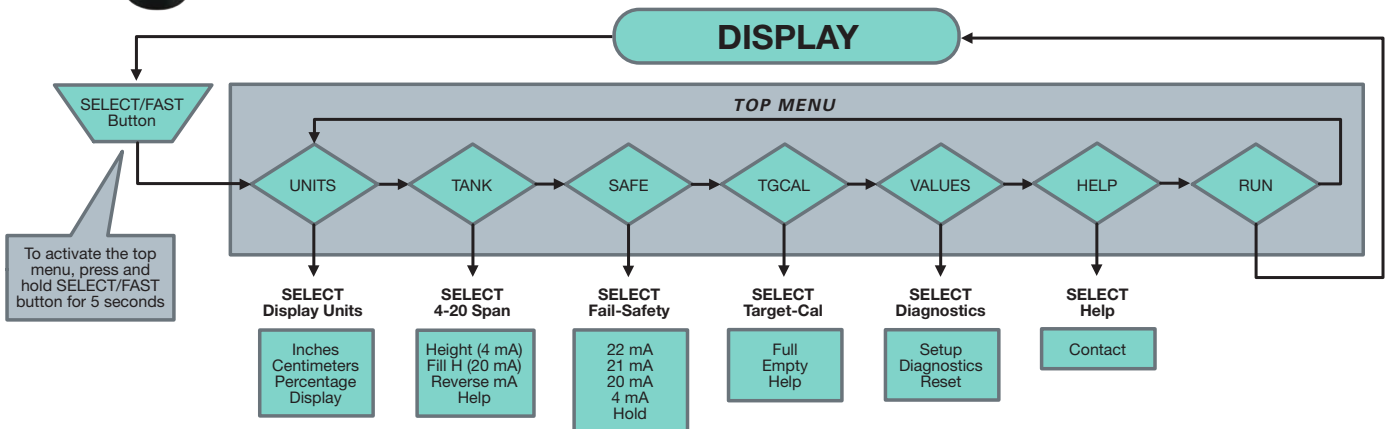
Dimensions



Easy Calibration



Calibration is fast and simple with our scrolling single layer menu, three button interface and 6-segment LCD display. Troubleshooting is easy with our unique Setup and Diagnostic feedback modes. Setup displays the transmitter's calibration set points. Diagnostics provides users with a snapshot of sensor performance and application variables. Gems UCL-520 is full feature level sensing made simple.



How To Order

Select by Part Number.

Description	Part Number
UCL-520 2-Wire Transmitter	225200

## NOTES

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# XT-1000 Series

## Magnetostrictive Level Sensor

- ▶ Measuring accuracy up to  $\pm 0.008''$  (0.2 mm)
- ▶ Resolution better than  $0.004''$  (0.1 mm)
- ▶ Temperature-compensated
- ▶ 2-wire terminal (4-20mA)
- ▶ Measuring range along the complete probe length
- ▶ Lengths of 8" to 157" (200 to 4,000 mm)

The high-precision and robust level sensor is designed to provide continuous gauging of liquid media levels in tanks. The measuring principle used by the sensor exploits the physical effect of magnetostriction and is largely unaffected by temperature. Magnetostriction is particularly ideal where level measurements are required to be extremely accurate, e.g. in the chemical industry. The level sensor outputs measuring signals in the range 4 to 20 mA. Available in lengths of 8" to 157" (200 to 6,000 mm), it is compatible with a variety of tank dimensions. It also comes in the following versions:

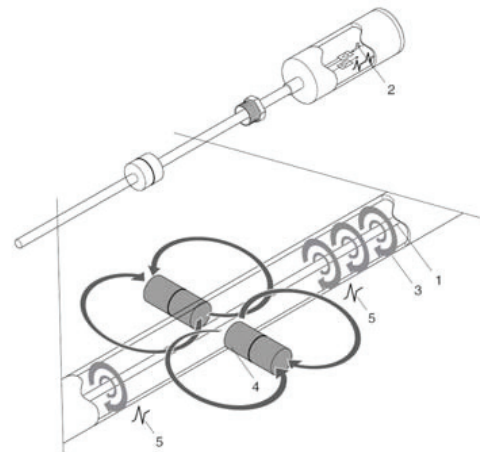
The explosion-proof version of the level sensor can be installed in potentially explosive atmospheres in which electrical equipment of category 1 (zone 0) or category 1/2 (zone 0/1) are required. Operating on the digital HART protocol, the HART level sensor is able to output the position of the first, second or both floats.

### Specifications

<b>Housing</b>	
Protection Type	IP 68
Material	Stainless Steel
Cable Diameter	0.19" to 0.394" (5 to 10 mm)
<b>Probe Tube</b>	
Diameter	0.472" (12 mm)
Material	Stainless Steel 316 Ti; Hastelloy C
Length	8" to 157" (200 to 4,000 mm)
<b>Electrical</b>	
Connection	2-wire
Supply	10 to 30 VDC
Current Signal	4 to 20 mA
Error Message	Adjustable to 3.6 or 21.5 mA
<b>Measuring Accuracy</b>	
Filling Level	Up to 0.020" (0.5 mm)
Resolution	Up to 0.004" (0.1 mm)
Analog Part	$\pm 0.1\%$ / K, resolution better 0.5 $\mu$ A

### Operating Principle

Inside the probe tube there is a rigid wire (1) made of magnetostrictive material. The sensor circuitry emits pulses of current (2) through the wire, generating a circular magnetic field (3). The level transmitter is a magnet (4), which is integrated into the float. Its magnetic field magnetizes the wire axially. Since the two magnetic fields are superimposed, around the float magnet a torsion wave (5) is generated which runs in both directions along the wire. One wave runs directly to the probe head while the other is reflected at the bottom of the probe tube. The time is measured between emission of the current pulse and arrival of the wave at the probe head. The position of the float is determined on the basis of the transit times.



**Mounting Types**

Size	Material	Mounting Type	Code
R 1-1/2*	Brass	Threaded	<b>1</b>
2" NPT	316 Stainless Steel	Threaded	<b>2</b>
3" - 150#		Flange	<b>3</b>

\* Includes adjustable mounting option

**Float Types**

Min. Specific Gravity	Max. Operating Pressure	Float Type	Material	Diameter	Code
≥0.50	290 psi (20 bar)	Ball	Titanium	1.99" (50 mm)	<b>11</b>
≥0.60			316 Ti	2.05" (52 mm)	<b>02</b>
≥0.70	145 psi (10 bar)	Cylinder	C276	1.81" (46 mm)	<b>12</b>
	232 psi (16 bar)				<b>07</b>
≥0.85	290 psi (20 bar)	Ball	316 Ti	1.69" (43 mm)	<b>09</b>
≥0.95	725 psi (50 bar)				<b>03</b>

**Temperature Ranges**

<b>Ambient</b>	-40°F to +185°F (-40°C to +85°C)
----------------	----------------------------------

**Process Medium**

Temperature	Range	Code
Standard	-40°F to +257°F (-40°C to +125°C)	<b>1</b>
Low	-85°F to +257°F (-65°C to +125°C)	<b>4</b>
High	-40°F to +482°F (-40°C to +250°C)	<b>3</b>
Highest	-40°F to +842°F (-40°C to +450°C)	<b>5</b>

**How to Order**

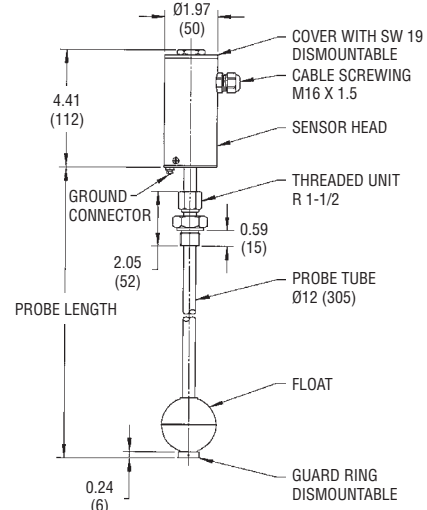
Use the **bold** characters from the chart below to construct a product code

**XT-1000 - X - XXX - XX - X - X - X - X**

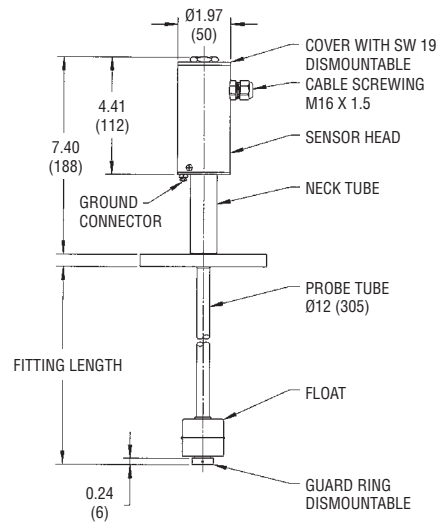
<p>Probe Tube Material</p> <p><b>B</b> - 4-20 mA</p> <p><b>N</b> - 0.5-4.5 V</p> <p>Probe Lengths</p> <p>For flanged version state the fitting length</p> <p>Length in inches</p> <p>Float Type</p> <p><b>00</b> - None</p> <p><b>02</b> - Ball dia. 2.05" (52 mm), 316 Ti, 290 psi (20 bar), ≥ 0.60 SG</p> <p><b>03</b> - Ball dia. 1.69" (43 mm), 316 Ti, 725 psi (50 bar), ≥ 0.95 SG</p> <p><b>07</b> - Cylinder dia. 1.69" (43 mm), 316 Ti, 232 psi (16 bar), ≥ 0.70 SG</p> <p><b>09</b> - Ball dia. 1.69" (43 mm), 316 Ti, 290 psi (20 bar), ≥ 0.85 SG</p> <p><b>10</b> - Ball dia. 2.05" (52 mm), 316 Ti, 40 bar, ≥ 0.70 SG</p> <p><b>11</b> - Ball dia. 1.99" (50 mm), Titanium, 20 bar, ≥ 0.50 SG</p> <p><b>12</b> - Cylinder dia. 1.81" (46 mm), C276, 10 bar, ≥ 0.70 SG</p>	<p>HART</p> <p><b>0</b> - None</p> <p><b>1</b> - Hart Protocol</p> <p>Certificate</p> <p><b>0</b> - None</p> <p><b>1</b> - Ex (ATEX)</p> <p>Medium Temperature Range</p> <p><b>1</b> - Standard Temperature</p> <p><b>3</b> - High Temperature</p> <p><b>4</b> - Low Temperature</p> <p><b>5</b> - Highest Temperature</p> <p>Mounting Type</p> <p><b>0</b> - None</p> <p><b>1</b> - Threaded, Brass, R 1-1/2</p> <p><b>2</b> - 2" NPT, Stainless Steel 316</p> <p><b>3</b> - 3" 150# Flange, Stainless Steel</p>
---	---

**Dimensions – in. (mm)**

**Threaded**



**Flange**





# SureSite® Visual Liquid Level Indicators

...the safe alternative to cloudy, breakable sight glasses.

**High Visibility**—Brilliantly colored flags are easy to read, even at great distances. The indicator is isolated from the measured media; therefore, SureSite Indicators can be used where sight glasses are not even a consideration.

**Durability**—Stainless steel, PVC, CPVC, PVDF, Hastelloy or other exotic housings, whatever the media requirements, provide years of maintenance-free service.

**Environmentally Safe**—Monitored liquid is contained inside a pressure-tight housing.

**Efficient**—Continuous level indication without external power.

**Electronic Control**—Attach optional point level switches and/or continuous level transmitters to extend capabilities beyond those of a simple sight glass.

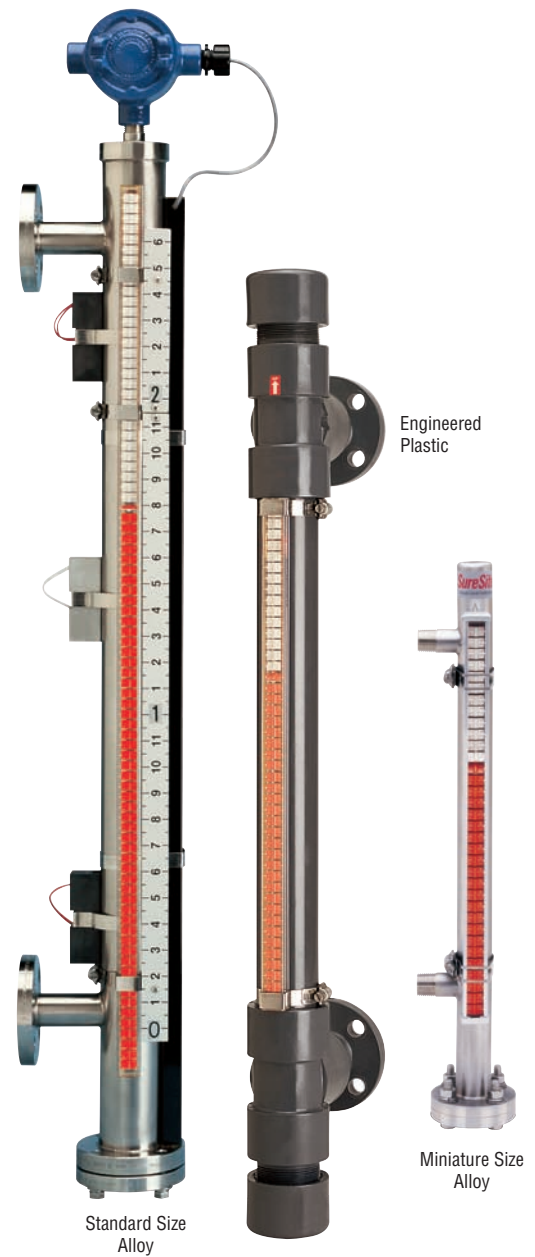
- Low Maintenance—No glass to break, durable housings
- OSHA Friendly—Accident incidence reduction
- Reduced Workload—Quick and easy viewing shortens monitoring chores
- EPA Friendly—Fewer seals and no glass protect against spillage
- Multi-Purpose—Not single purpose as with sightglasses; can replace simple tank gauging systems as a complete level gauge package

When Gems Sensors & Controls introduced SureSite® Liquid Level Indicators almost 30 years ago, no one had seen anything like them... sightglasses were the standard in liquid level indication. Well, we are happy to say that since that time SureSite Indicators have retired more sightglasses than we can count! Our success has spawned many imitators, but there is still only one SureSite Indicator with its many exclusive features, and more importantly there is no manufacturer so uniquely capable as Gems to be your sensor supplier.

Fifty years of experience has taught us which technologies and product characteristics will provide the most effective solutions to your requirements. And our engineering resources have long been helping customers solve their most challenging application problems. So, there is a good chance we've already dealt with the design criteria you are working on. If you don't see materials or configurations in the following pages to suit your needs, please give Gems a call for custom application assistance.

## Gems Serves the OEM and End User

Gems welcomes any size order...whether a single unit or 100 units or more. Gems commitment is to meet your most stringent requirements of price, delivery and quality.



**LEVEL INDICATORS - VISUAL**

Contents	Page Start
Specifying and Ordering.....	D-3
Alloy Versions	
Miniature Size .....	D-4
Standard Size.....	D-7
High Performance SureSite.....	D-10
Engineered Plastic Version .....	D-13
Optional Transmitters.....	D-16
Optional Switch Modules.....	D-18
Optional Indicating Scale.....	D-18

# SureSite® Visual Liquid Level Indicators

Simply the Most Versatile Liquid Level Monitoring System Available ...  
and Tough Enough For All Kinds of Applications!

LEVEL INDICATORS – VISUAL

**Visual Indication**

- Handles full vacuum to high pressure
- Highly visible from over 100 ft. (30m)
- Eliminates downtime
- Virtually maintenance free
- Custom configured units

INDICATING SCALE  
HIGH VISIBILITY INDICATOR FLAGS

**Comprehensive Indication**

- Pressures to 4200 PSI
- Externally mounted electronics
- Hi/Low alarms, Switch Points
- ANSI Flange/ASME Type
- Cenelec, FM, UL, CSA Approved

EXPLOSION PROOF LEVEL SWITCHES  
EXPLOSION PROOF CONTINUOUS OUTPUT TRANSMITTER

**Cold Service Applications**

- -200°F (-129°C)
- Frost proof lens
- Insulation (Cold Service)
- Magnified visibility

FROST PROOF LENS  
INSULATION BLANKET (Cut Away)

**Hot Service Applications**

- Process temps to 750°F (399°C)
- External electronics to 750°F (399°C)
- High temp insulation available

INSULATION BLANKET (Cut Away)  
HEAT TRACE

**Oil/Water Applications**

- Interface application
- Materials: Stainless Steel, engineered plastics
- Multiple process ports required
- Electronics for pump control
- Valves available
- Consult factory for details

HI AND LO LEVEL SWITCHES FOR VALVE CONTROL

**Acid Applications**

- Fluid compatible materials - Hastelloy C 276, PVDF, Alloy 20, Titanium
- Eliminate dangerous/costly leaks

HIGH LEVEL SWITCH FOR ALARM  
CONTINUOUS OUTPUT TRANSMITTER  
PVDF HOUSING AND FITTINGS

Top mount units available. Contact factory for details.

## Versatile Design

The SureSite Indicators described on the following pages represent only "basic designs." An infinite variety of configurations can be derived, custom built to your exact dimensions and application specifications on existing or new tank designs.

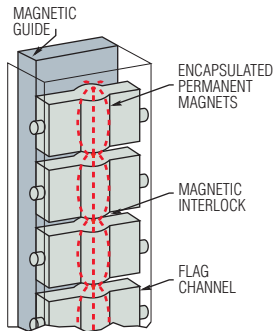


## SureSite Indicators Are Superior To Other Magnetic Type Indicators. Here's Why:

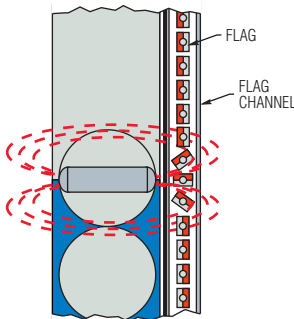
It begins with a patented Flag Assembly and integrated Magnetic Guide

Many magnetic flag type indicators look the same, but look closer and you'll see they are not made the same. SureSite® Indicators are unique. They incorporate a patented design and special features that provide the ultimate in performance and reliable operation.

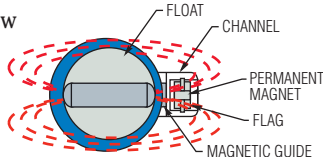
Flag Channel Assembly (partial close-up)



Profile View



Top View



- A permanent magnet, encapsulated into each flag, forms a secure magnetic interlock with adjacent flags. Proper alignment is assured, and is unaffected by shock, vibration, surges or rapid level changes.
- A Magnetic Guide (a SureSite exclusive) enables the use of a more powerful bar magnet in the float assembly. The guide is integrated into the flag channel, so regardless of positioning, the bar magnet within the float is always aligned for optimum performance and exactness.
- A powerful, permanent bar magnet lies in a horizontal position within the float. This preferred attitude directs the flux density of the magnetic field toward the flags. Flag rotation is positive and reliable.
- Float capability to handle liquid specific gravity range as low as 0.40.

## SureSite® Indicators in the Process...

Many applications require high temperature/pressure capabilities, or strict adherence to industry standards such as

- ASME
- CENELEC
- CSA
- FM
- UL

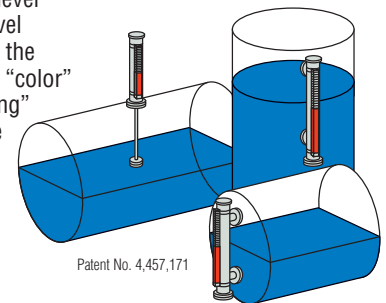
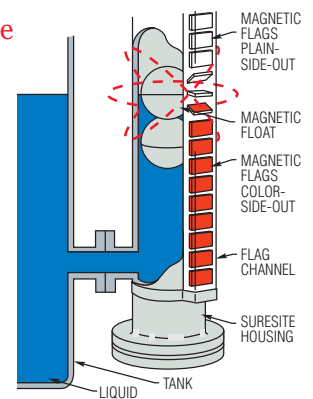
Gems High Performance SureSite Indicators are manufactured to fill these requirements.

See pages D-10 and D-11.



## Operating Principle

As liquid level rises, a magnet-equipped float within the unit inverts the magnetic flags in the external indicator to "color-side-out." The flags remain magnetically interlocked in a column until again inverted to "contrasting-side-out" by the float as liquid level falls. Liquid level is indicated by the junction of the "color" and "contrasting" portions of the column.



Patent No. 4,457,171

## Ordering SureSite® Indicators

Order online or use our quick and easy OrderIt! Forms.

1. To specify this product, start by photocopying the appropriate OrderIt! PRODUCT CHECK LIST located on pages D-6, D-9, D-12, and D-15.
2. Next, using the product information supplied in this section, check off the boxes and fill in the blanks of the OrderIt! Check List to specify your desired product configuration. Accurate answers to each question will assure correct fit and function of your custom built product. Note: Use a separate Check List for each unique configuration.
3. To obtain a priced quotation, fax your completed OrderIt! Check List to Gems at **860-747-4244** or fax it to the Sales Partner nearest you. You can now configure and request quotes directly online at [www.gemssensors.com](http://www.gemssensors.com). All of our Sales Partner locations, along with their fax numbers, are conveniently located on the Web at [www.gemssensors.com](http://www.gemssensors.com).
4. To order your CUSTOM product, either place your order over the phone with one of our representatives, or use the OrderIt! method. Just photocopy the appropriate OrderIt! PRODUCT CHECK LIST (D-6, D-9, D-12, and/or D-15). Accurately complete all of the purchasing information that we'll need to process your order and fax it. These forms will provide us with the shipping and billing information we need, along with any prices or delivery dates quoted.

## Alloy Versions—Miniature Size

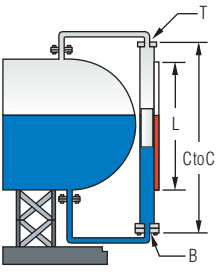
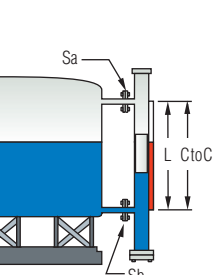
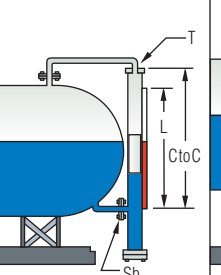
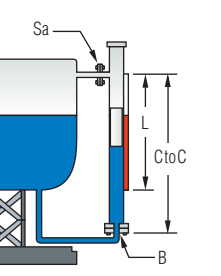
- ▶ Lengths to over 20 feet (6.1 meters)
- ▶ 316 Stainless Steel construction
- ▶ Pressures to 400 PSI (27 bar) – Temperature to 400°F (204°C)

Use these Mini SureSite Indicators where space is tight—they feature a diameter of only 1-1/4"! They can replace existing, antiquated sightglasses for excellent external, visual liquid level indication. Mini SureSite Indicators are ideal for use with clean, low viscosity liquids.

### Typical Applications

- Pharmaceuticals • Medical Equipment • Food and Beverages
- Semiconductor Manufacturing • Boilers

### 1. Mounting Configuration Types

	Type AM	Type BM	Type CM	Type DM
	Top and Bottom Process Connections	Side and Side Process Connections	Top and Side Process Connections	Side and Bottom Process Connections
				
L = Length of Visual Indication				
<b>Typical Lengths*</b>	C to C = L + 7.72" (196 mm)	C to C = L	C to C = L + 3" (76 mm)	C to C = L + 5" (127 mm)
<b>Flag Material</b>	Plastic (300°F/148.9°C) or Aluminum (400°F/204°C)			
<b>Length of Indication (Uninterrupted)</b>	240" (610 cm)			

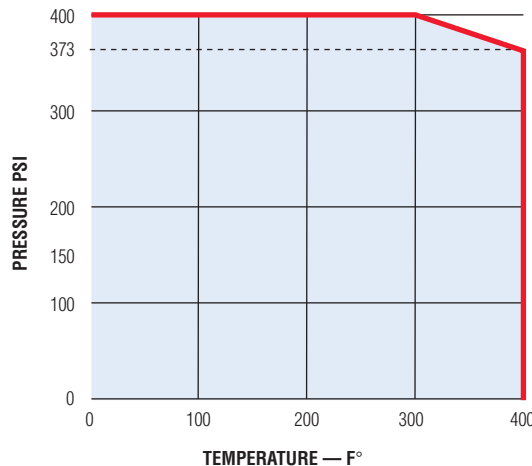


\*Dimensions vary due to connections, material and specific gravity.

Note: Additional materials, floats, connections and manufacturing techniques are available to extend lengths and operational capabilities. Please contact Gems if the parameters above do not meet your requirements.














### Miniature SureSite Performance

Gems configures Miniature SureSite Indicators, using various materials and fittings, to perform within the Pressure/Temperature parameters specified in the chart at right. Consult the factory with pressure/temperature requirements that fall outside the parameters shown here.











Note: SureSite Indicators are available for temperatures as low as -200°F (-129°C)














**2. Connection Codes**  
(See complete descriptions below)

	Blind		NPT				Flange		Weld	
	Fixed	Removable	Fixed		Removable		Fixed	Removable	Socket Butt	Removable Butt
			Female	Male	Female	Male				
<b>TOP</b>  <b>T</b>	<b>T1</b> 	<b>T10</b> 	<b>T2</b> 	<b>T3</b> 	<b>T11</b> 	<b>T12</b> 	<b>T19</b> 	<b>T20</b> 	<b>T18</b> 	<b>T13</b> 
<b>Sanitary Connections</b>							<b>T7</b> 	<b>T8</b> 		

	Blind		NPT		Flange	Sanitary Flange	Buttweld Nipple
	Male	Female					
<b>SIDE</b>  <b>Sa</b>	<b>S1</b> 	<b>S2</b> 	<b>S3</b> 	<b>S4</b> 	<b>S5</b> 	<b>S6</b> 	
<b>SIDE</b>  <b>Sb</b>							

	Blind		NPT				Flange		Weld	
	Fixed	Removable	Fixed		Removable		Fixed	Removable	Socket Butt	Removable Butt
			Female	Male	Female	Male				
<b>BOTTOM</b>  <b>B</b>	<b>B1</b> 	<b>B10</b> 	<b>B2</b> 	<b>B3</b> 	<b>B11</b> 	<b>B12</b> 	<b>B19</b> 	<b>B20</b> 	<b>B18</b> 	<b>B13</b> 
<b>Sanitary Connections</b>							<b>B7</b> 	<b>B8</b> 		

— Connection Codes and Materials background-shaded in this color are stocked by Gems. Select these connections where possible to obtain the most economical SureSite Indicators with a prompt 3-day delivery.

Note: Gems recommends a removable top and/or bottom connection for float access.

**Connection Code Descriptions**

Please provide all connections when completing the Order! Product Check List (located on the following page).

**Note:** Before selecting your connections, consider incorporating your vent and drain requirements.

**T & B (Top and Bottom)**

- T/B 1. Welded cap
- T/B 2. Welded cap with FNPT
- T/B 3. Welded cap with MNPT
- T/B 7. Sanitary flange
- T/B 8. Sanitary flange with mating blind flange
- T/B 10. Standard fixed flange/mating blind flange
- T/B 11. Standard fixed flange/mating FNPT reducing flange
- T/B 12. Standard fixed flange/mating flange with MNPT nipple
- T/B 13. Standard fixed flange/mating flange with butt weld nipple
- T/B 18. Welded cap with butt weld nipple
- T/B 19. Welded cap with ANSI flange
- T/B 20. Standard fixed flange/mating reducing flange spool with ANSI flange

**Sa & Sb (Sides)**

- S1. No connection
- S2. MNPT nipple
- S3. FNPT coupling
- S4. ANSI flange
- S5. Sanitary flange
- S6. Buttweld nipple



Need it quick? Choose materials and components with the color shading for 3-Day manufacturing and shipping. See the Product Configurator section at [www.gemssensors.com](http://www.gemssensors.com) for further details.

**Accessories – Pages D-16 to D-18**

Make more of your SureSite® Indicator with the productivity-enhancing accessories found at the end of this section.

- **Indicating Scales**  
Add graduations to your flag indication.
- **Switch Modules**  
Control pumps, valves, alarms, etc. Mount externally on housing for infinite positioning.
- **Continuous Output Transmitters**  
Signal conditioned for compatibility with most electronic instruments to 300°F (149°C).

**Performance Notes:**

1. As an option **either** the Switch Modules or Transmitter can be used on a Miniature SureSite Indicator - **Not Both**.
2. Minimum specific gravity is 0.7.
3. Standard O-ring seal material is Viton®. Others available upon request.
4. Electropolished Outer Diameter (OD) and/or Inner Diameter (ID) housings available upon request.



<p><b>FAX IT!</b> <b>860-747-4244</b></p> <p><b>Photocopy This Form</b> Use one form for each product type you are selecting.</p> <p><small>This form may also be completed online at <a href="http://gemssensors.com">gemssensors.com</a> for RFQ.</small></p>	<p>This is a <input type="checkbox"/> Request for a Quote      Name _____</p> <p style="padding-left: 40px;"><input type="checkbox"/> Order P.O.# _____      Company _____</p> <p>Quantity Needed _____      Street _____</p> <p>Date Required ____/____/____      City _____ State ____ Zip _____</p> <p>Shipping Method: _____      Phone (____) _____</p> <p>Partials Accepted: <input type="checkbox"/> Yes      Fax (____) _____</p> <p style="padding-left: 40px;"><input type="checkbox"/> No</p>
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## SureSite Indicators, Alloy Versions – Miniature Size

### Process Conditions

This information is essential to the accurate and proper operation of your SureSite® Visual Level Indicators. Please complete fully and accurately.

- |   |   |
|---|---|
| <p><b>1. Pressure:</b> Operating _____ psig    Maximum _____ psig</p> <p><b>2. Temperature:</b> Operating _____ °F    Maximum _____ °F</p> <p><b>3. Liquid Media:</b> _____</p> | <p><b>4. Specific Gravity @ Operating Condition:</b> _____</p> <p><b>5. Viscosity:</b> _____ SSU</p> <p><b>6. Application Location:</b> <input type="checkbox"/> Indoors    <input type="checkbox"/> Outdoors</p> |
|---|---|

### Physical Configuration

#### 1. Mounting Configuration Types:

- Type AM     Type BM     Type CM     Type DM

#### 2. Connection Codes – Complete all 4 connection code lines. Check off NPT or Flange size where appropriate.

▼ Connection Code Number Goes Here. **Connection Code Numbers and their descriptions are on Page D-5.**

Top <b>T</b>	NPT or Weld	Flange	
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 3/4" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 3/4" <input type="checkbox"/> 1" <input type="checkbox"/> Other _____	<input type="checkbox"/> 150# RF <input type="checkbox"/> 300# RF <input type="checkbox"/> Other _____
Side <b>Sa</b>	NPT or Weld	Flange	
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 3/4" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 3/4" <input type="checkbox"/> 1" <input type="checkbox"/> Other _____	<input type="checkbox"/> 150# RF <input type="checkbox"/> 300# RF <input type="checkbox"/> Other _____
Side <b>Sb</b>	NPT or Weld	Flange	
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 3/4" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 3/4" <input type="checkbox"/> 1" <input type="checkbox"/> Other _____	<input type="checkbox"/> 150# RF <input type="checkbox"/> 300# RF <input type="checkbox"/> Other _____
Bottom <b>B</b>	NPT or Weld	Flange	
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 3/4" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 3/4" <input type="checkbox"/> 1" <input type="checkbox"/> Other _____	<input type="checkbox"/> 150# RF <input type="checkbox"/> 300# RF <input type="checkbox"/> Other _____

- 3. Length of Visual Indication – L:** \_\_\_\_\_ inches (240", Max.).  
Connection to Connection Dimension – C to C: \_\_\_\_\_ inches.

#### 4. Flag Type

- Plastic flags available to 300°F (149°C).  
Aluminum flags only for temperatures to 750°F (399°C).
- Plastic (Orange and White)     Aluminum (Black and Silver)
- Non-Standard; Specify: \_\_\_\_\_, consult factory.

#### 5. O-Ring Material:

- Viton® (Standard)     Ethylene Propylene  
 Other \_\_\_\_\_

#### Special Instructions (Materials, Connections, etc.)

\_\_\_\_\_

\_\_\_\_\_

### Accessories (Pages D-16 to D-18)

- 1. Switch Modules (Single Point):** \_\_\_\_\_ Quantity
- a.  SPST     SPDT     DPDT 120 VAC     DPDT 24 VDC
- b.  Standard – 300°F     High Temperature  
 Explosion Proof
- 2. Indicating Scales:**
- Feet and Inches     Inches     Metric     Blank
- Custom Graduations; specify: \_\_\_\_\_
- 3. Continuous Transmitter:**
- Output:  0-5 VDC     0-12 VDC     4-20 mA
- J-Box:  Standard     Explosion Proof

Please contact GEMS Sensors Inc. for any configuration or special requirements not covered on this form. **800-378-1600**

Quote \$ \_\_\_\_\_      Date Quoted \_\_\_\_/\_\_\_\_/\_\_\_\_



**Gems Sensors & Controls**  
One Cowles Road  
Plainville, CT  
06062-1198

tel 860.747.3000  
fax 860.747.4244  
[www.gemssensors.com](http://www.gemssensors.com)

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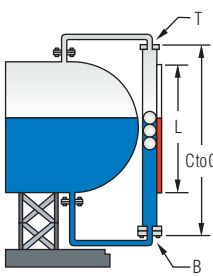
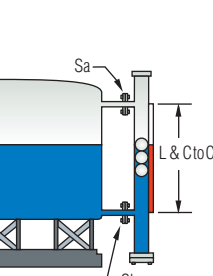
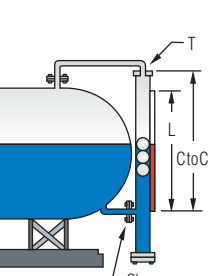
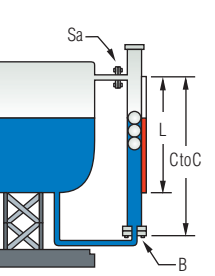
## Standard Alloy Versions – Standard Size

- ▶ Temperatures to 750°F (399°C)
- ▶ Pressures to 700 PSI (48 bar)

Rugged, welded construction makes these 2-1/2" (63.5 mm) diameter design, alloy SureSite Indicators dependable over a long service life indoors and out.

### 1. Mounting Configuration Types

To choose the best configuration for your application, focus on the process connections (connections where the liquid typically enters/leaves the SureSite).

	Type AA	Type BA	Type CA	Type DA
	Top and Bottom Process Connections	Side and Side Process Connections	Top and Side Process Connections	Side and Bottom Process Connections
				
L = Length of Visual Indication				
<b>Typical Lengths*</b>	C to C = L + 10-1/4" (260.4 mm)	C to C = L	C to C = L + 3-3/4" (95.2 mm)	C to C = L + 6-1/2" (165.1 mm)
<b>Flag Material</b>	Plastic (300°F/148.9°C) or Aluminum (750°F/399°C)			
<b>Length of Indication (Uninterrupted)</b>	240" (610 cm)			
<b>Minimum Specific Gravity</b>	0.39			

\* Dimensions vary due to connections, material and specific gravity.

Note: Additional materials, floats, connections and manufacturing techniques are available to extend lengths and operational capabilities. Please contact GEMS Sensors if the parameters above do not meet your requirements.

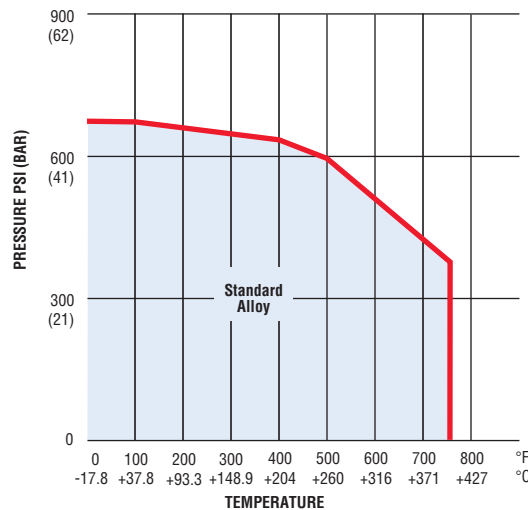
### 2. Material

Housing and Float: 316 Stainless Steel  
Pressure/Temperature performance parameters for alloy SureSite versions are specified in the chart at right. Please consult the factory with temperature/pressure requirements that fall outside the parameters shown here.

 = Stock Material (Best economy and delivery).

Materials		Code
Housing	Float	
316L Stainless Steel	316L Stainless Steel	2
Carpenter 20	Hastelloy C276	3*
Hastelloy C276	Hastelloy C276	4*

\* Consult factory for pressure/temperature capabilities.



Note: SureSite Indicators are available for temperatures as low as -200°F (-129°C).



Type BA Shown

### 3. Connection Codes

(See complete descriptions below)

TOP	T	Blind		NPT				Flange	
		Fixed	Removable	Fixed		Removable		Fixed	Removable
				Female	Male	Female	Male		
		T1	T2	T3	T5	T6	T8	T9	T10

SIDE	Sa	SIDE	Sb	B	BOTTOM	B						

SIDE	Sa	SIDE	Sb	B	BOTTOM	B				

— Connection Codes and Materials background-shaded in this color are stocked by Gems. Select these connections where possible to obtain the most economical SureSite Indicators with a prompt 3-day delivery.

#### Connection Code Descriptions

Please provide all connections when completing the Order! Product Check List (located on the following page).

**Note:** Before selecting your connections, consider incorporating your vent and drain requirements.

#### T & B (Top and Bottom)

- T/B 1. Welded pipe cap
- T/B 2. Standard fixed flange/blind mating flange
- T/B 3. Welded pipe cap w/FNPT
- T/B 5. Welded pipe cap w/MNPT nipple
- T/B 6. Standard fixed flange/mating FNPT reducing flange
- T/B 8. Standard fixed flange/mating flange with MNPT nipple
- T/B 9. Welded pipe cap with ANSI flange
- T/B 10. Standard fixed flange/mating reducing flange spool

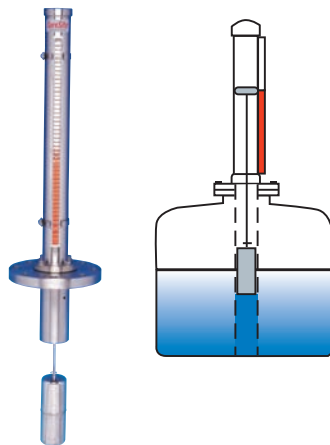
#### Sa & Sb Sides

- S1. No connection
- S2. MNPT nipple
- S3. FNPT coupling
- S4. ANSI flange



### Top Mount Units

When it's not practical to access the side of a tank for liquid monitoring, look to SureSite Top Mount Indicators for the solution. Please consult with the factory for these specially configured indicators **1-800-378-1600**.




Need it quick? Choose materials and components with the color shading for 3-Day manufacturing and shipping. See the Product Configurator section at [www.gemssensors.com](http://www.gemssensors.com) for further details.

### Accessories – Pages D-16 to D-18

Make more of your SureSite® Indicator with the productivity-enhancing accessories found at the end of this section.

- **Indicating Scales**  
Add graduations to your flag indication.
- **Switch Modules**  
Control pumps, valves, alarms, etc. Mount externally on housing for infinite positioning.
- **Continuous Output Transmitters**  
Signal conditioned for compatibility with most electronic instruments to 300°F (149°C).

 <p><b>Photocopy This Form</b> Use one form for each product type you are selecting. <small>This form may also be completed online at gemssensors.com for RFQ.</small></p>	This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____ Name _____ Company _____ Quantity Needed _____ Street _____ Date Required ____/____/____ City _____ State ____ Zip _____ Shipping Method: _____ Phone (____) _____ Partial Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No Fax (____) _____
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## SureSite Indicators, Alloy Versions – Standard Size

### Process Conditions

This information is essential to the accurate and proper operation of your SureSite® Visual Level Indicators. Please complete fully and accurately.

- |   |  |
|---|--|
| <p><b>1. Pressure:</b> Operating _____ psig Maximum _____ psig</p> <p><b>2. Temperature:</b> Operating _____ °F Maximum _____ °F</p> <p><b>3. Liquid Media:</b> _____</p> | <p><b>4. Specific Gravity @ Operating Condition:</b> _____</p> <p><b>5. Viscosity:</b> _____ SSU</p> <p><b>6. Application Location:</b> <input type="checkbox"/> Indoors <input type="checkbox"/> Outdoors</p> |
|---|--|

### Physical Configuration

#### 1. Mounting Configuration Types:

- Type AA     Type BA     Type CA     Type DA

#### 2. Housing and Float Material

- Code 2     Code 3     Code 4

#### 3. Connection Codes – Complete all 4 connection code lines. Check off NPT or Flange size where appropriate.

▼ Connection Code Number Goes Here. **Connection Code Numbers and their descriptions are on Page D-8.**

Top <b>T</b>	NPT	Flange
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> Other _____
Side <b>Sa</b>	NPT	Flange
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> Other _____
Side <b>Sb</b>	NPT	Flange
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> Other _____
Bottom <b>B</b>	NPT	Flange
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> Other _____

- 4. Length of Visual Indication – L:** \_\_\_\_\_ inches (240", Max.).  
 Connection to Connection Dimension – C to C: \_\_\_\_\_ inches.

#### 5. Flag Type

- Plastic flags available to 300°F (149°C).  
 Aluminum flags only for temperatures to 750°F (399°C).  
 Plastic (Orange and White)     Aluminum (Black and Silver)  
 Non-Standard; Specify: \_\_\_\_\_ consult factory.

#### Special Instructions (Materials, Connections, etc.)

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### Accessories (Pages D-16 to D-18)

- 1. Transmitters (Continuous Electrical Indication):**  
 Low Temperature – 300°F (149°C)     Explosion-Proof  
 High Temperature – 750°F (399°C)
- 2. J-Box/Signal Conditioners Accessories:**  
 Terminal Strip     4-20 mA Output  
 0-12 VDC Output     0-5 VDC Output
- 3. Power Supply:**     115 VAC (Input) /24 VDC (Output) (Optional)  
                                    230 VAC (Input) /24 VDC (Output)

- 4. Switch Modules (Single Point):** \_\_\_\_\_ Quantity (only if required)  
 a.  SPST    SPDT    DPDT 120 VAC    DPDT 24 VDC  
 b.  Standard – 300°F (149°C)     Explosion Proof  
                                    High Temperature – 750°F (399°C)

#### 5. Indicating Scales:

- Feet and Inches     Inches     Metric     Blank  
 Custom Graduations; specify: \_\_\_\_\_

Please contact GEMS Sensors Inc. for any configuration or special requirements not covered on this form. **800-378-1600**

Quote: \$ \_\_\_\_\_ Date Quoted: \_\_\_\_/\_\_\_\_/\_\_\_\_



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# High Performance Versions – Standard Size

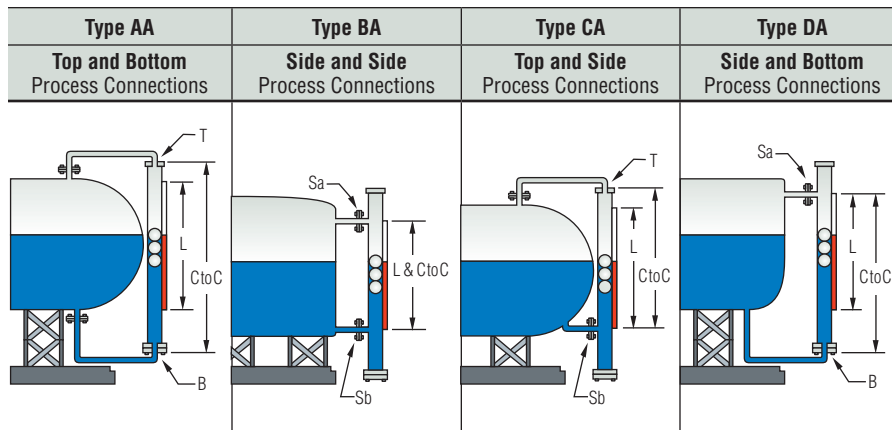
- ▶ Designed to meet the requirements of ASME B31.1/B31.3\*
- ▶ Temperatures to 750°F (399°C)
- ▶ Pressures to 4200 PSI (290 bar)

For your most demanding applications, these SureSite® Indicators feature ANSI flanges and fittings and construction to rigorous ASME standards. You can't specify a better visual level indicator.



## 1. Mounting Configuration Types

To choose the best configuration for your application, focus on the process connections (connections where the liquid typically enters/leaves the SureSite).



L = Length of Visual Indication

	Type AA Top and Bottom Process Connections	Type BA Side and Side Process Connections	Type CA Top and Side Process Connections	Type DA Side and Bottom Process Connections
<b>Typical Lengths†</b>	C to C = L + 10-1/4" (260.4 mm)	C to C = L	C to C = L + 3-3/4" (95.2 mm)	C to C = L + 6-1/2" (165.1 mm)
<b>Flag Material</b>	Plastic (300°F/148.9°C) or Aluminum (750°F/399°C)			
<b>Length of Indication (Uninterrupted)</b>	240" (610 cm)			
<b>Minimum Specific Gravity</b>	0.39			

† Dimensions vary due to connections, material and specific gravity.

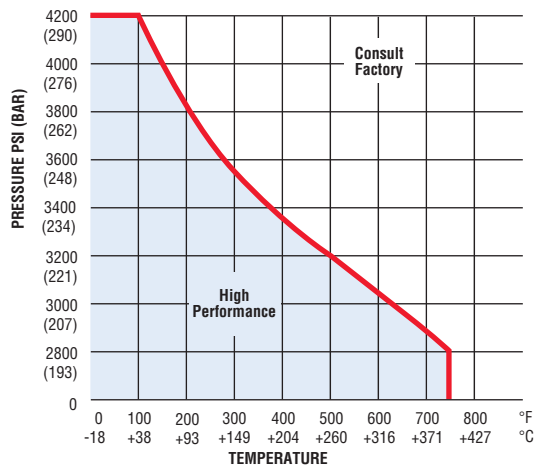
## 2. Material

Select desired material from those tabulated below. Mark the Code Number on your Order! Check List. The pressure/temperature performance parameters are specified in the chart at right. Consult the factory with pressure/temperature requirements that fall outside the parameters shown here. These units are manufactured in Schedule 40, 80 or 160 pipe accordingly.

= Stock Material (Best economy and delivery).

Materials		Code
Housing	Float	
316L Stainless Steel	316L Stainless Steel 600 psi –	2
316L Stainless Steel	Titanium (Ti-6Al-4V) 600 psi+	9

Note: Additional materials, floats, connections and manufacturing techniques are available to extend lengths and operational capabilities. Please contact Gems if the parameters above do not meet your requirements.




\*Units requiring ASME certification must be specified at time of request.





3. Connection Codes


All connections comprised of ANSI fittings (See complete descriptions below)

	Blind		NPT				Flange		Weld			
	Fixed	Removable	Fixed		Removable		Fixed	Removable	Fixed		Removable	
			Female	Male	Female	Male			Socket	Butt	Socket	Butt
<b>TOP</b>  T	T15	T16	T17	T19	T20	T22	T23	T24	T25	T26	T27	T28
		T29			T30	T32		T33			T34	T35

	Blind		NPT		Flange		Weld	
	Male	Female	Male	Female	Socket	Butt	Socket	Butt
<b>SIDE</b>  Sa								
<b>SIDE</b>  Sb								

	Blind		NPT				Flange		Weld			
	Fixed	Removable	Fixed		Removable		Fixed	Removable	Fixed		Removable	
			Female	Male	Female	Male			Socket	Butt	Socket	Butt
<b>BOTTOM</b>  B	B15	B16	B17	B19	B20	B22	B23	B24	B25	B26	B27	B28
		B29			B30	B32		B33			B34	B35

— Connection Codes and Materials background-shaded in this color are readily available from Gems. Select these connections where possible to obtain the most economical SureSite Indicators.

Note: Gems recommends a removable top and/or bottom connection for float access.

Connection Code Descriptions

Please provide all connections when completing the Order! Product Check List.

**Note:** Before selecting your connections, consider incorporating your vent and drain requirements.

T & B (Top and Bottom)

- T/B 15. ANSI welded pipe cap
- T/B 16. ANSI fixed slip-on flange/blind mating flange
- T/B 17. ANSI welded pipe cap with FNPT
- T/B 19. ANSI welded pipe cap with MNPT nipple
- T/B 20. ANSI fixed slip-on flange/mating FNPT reducing flange
- T/B 22. ANSI fixed slip-on flange/mating flange w/MNPT nipple
- T/B 23. ANSI welded pipe cap with ANSI flange
- T/B 24. ANSI fixed slip-on flange/mating reducing ANSI flange spool
- T/B 25. ANSI welded pipe cap with socketweld coupling
- T/B 26. ANSI welded pipe cap with butt weld nipple
- T/B 27. ANSI fixed slip-on flange/mating flange with socketweld coupling
- T/B 28. ANSI fixed slip-on flange/mating flange with butt weld nipple
- T/B 29. ANSI fixed weldneck flange/blind mating flange
- T/B 30. ANSI fixed weldneck flange/mating FNPT reducing flange
- T/B 32. ANSI fixed weldneck flange/mating flange w/MNPT nipple
- T/B 33. ANSI fixed weldneck flange/mating reducing flange spool
- T/B 34. ANSI fixed weldneck flange/mating flange with socketweld coupling
- T/B 35. ANSI fixed weldneck flange/mating flange with butt weld nipple

Sa & Sb (Sides)

- S1. No connection
- S2. MNPT nipple
- S3. FNPT coupling
- S4. ANSI flange
- S5. Weldneck flange
- S6. Socketweld coupling
- S7. Butt weld nipple

Accessories – Pages D-16 to D-18

Make more of your SureSite® Indicator with the productivity-enhancing accessories found at the end of this section.

- **Indicating Scales**  
Add graduations to your flag indication.
- **Switch Modules**  
Control pumps, valves, alarms, etc. Mount externally on housing for infinite positioning.
- **Continuous Output Transmitters**  
Signal conditioned for compatibility with most electronic instruments to 300°F (149°C).

<p><b>FAX IT!</b> <b>860-747-4244</b></p> <p><b>Photocopy This Form</b> Use one form for each product type you are selecting.</p>	<p>This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____</p> <p>Quantity Needed _____</p> <p>Date Required ____/____/____</p> <p>Shipping Method: _____</p> <p>Partials Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No</p>	<p>Name _____</p> <p>Company _____</p> <p>Street _____</p> <p>City _____ State ____ Zip _____</p> <p>Phone (____) _____</p> <p>Fax (____) _____</p>
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## SureSite Indicators, High Performance Versions

### Process Conditions

This information is essential to the accurate and proper operation of your SureSite® Visual Level Indicators. Please complete fully and accurately.

**Use this page for high performance units only.**

- |   |  |
|---|--|
| <p><b>1. Pressure:</b> Operating _____ psig Maximum _____ psig</p> <p><b>2. Temperature:</b> Operating _____ °F Maximum _____ °F</p> <p><b>3. Liquid Media:</b> _____</p> | <p><b>4. Specific Gravity @ Operating Condition:</b> _____</p> <p><b>5. Viscosity:</b> _____ SSU</p> <p><b>6. Application Location:</b> <input type="checkbox"/> Indoors <input type="checkbox"/> Outdoors</p> |
|---|--|

### Physical Configuration

- |   |   |
|---|---|
| <p><b>1. Mounting Configuration Types:</b><br/> <input type="checkbox"/> Type AA    <input type="checkbox"/> Type BA    <input type="checkbox"/> Type CA    <input type="checkbox"/> Type DA</p> <p><b>3. Connection Codes – Complete all 4 connection code lines.</b> Check off NPT or Flange size where appropriate.<br/>                 ▼ Connection Code Number Goes Here. <b>Connection Code Numbers and their descriptions are on Page D-11.</b></p> | <p><b>2. Housing and Float Material – Housing:</b> 316L/SS<br/> <input type="checkbox"/> Code 2 – 316L SS Float    <input type="checkbox"/> Code 9 – Titanium Float</p> |
|---|---|

Top T	NPT or Weld	Flange		
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 1.5" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> 900# (RF) <input type="checkbox"/> Other _____	
Side Sa	NPT or Weld	Flange		
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 1.5" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> 900# (RF) <input type="checkbox"/> Other _____	
Side Sb	NPT or Weld	Flange		
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 1.5" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> 900# (RF) <input type="checkbox"/> Other _____	
Bottom B	NPT or Weld	Flange		
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 1.5" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> 900# (RF) <input type="checkbox"/> Other _____	

- |   |  |
|---|--|
| <p><b>4. Length of Visual Indication – L:</b> _____ inches (240", Max.).<br/>                 Connection to Connection Dimension – C to C: _____ inches.</p> <p><b>5. Flag Type</b><br/>                 Plastic flags available to 300°F (149°C). Specify aluminum flags for temperatures of 301°F to 750°F (149°C to 399°C).<br/> <input type="checkbox"/> Plastic (Orange and White)    <input type="checkbox"/> Aluminum (Black and Silver)<br/> <input type="checkbox"/> Non-Standard; Specify: _____ consult factory.</p> | <p><b>6. <input type="checkbox"/> ASME Stamp Required</b></p> <p><b>Special Instructions</b> (Materials, Connections, etc.)</p> <p>_____</p> <p>_____</p> <p>_____</p> |
|---|--|

### Accessories (Pages D-16 to D-18)

- |   |   |
|---|---|
| <p><b>1. Transmitters</b> (Continuous Electrical Indication):<br/> <input type="checkbox"/> Low Temperature – 300°F (149°C)    <input type="checkbox"/> Explosion-Proof<br/> <input type="checkbox"/> High Temperature – 750°F (399°C)</p> <p><b>2. J-Box/Signal Conditioners Accessories:</b><br/> <input type="checkbox"/> Terminal Strip    <input type="checkbox"/> 4-20 mA Output<br/> <input type="checkbox"/> 0-12 VDC Output    <input type="checkbox"/> 0-5 VDC Output</p> <p><b>3. Power Supply:</b>    <input type="checkbox"/> 115 VAC (Input) /24 VDC (Output) (Optional)<br/> <input type="checkbox"/> 230 VAC (Input) /24 VDC (Output)</p> | <p><b>4. Switch Modules</b> (Single Point): _____ Quantity (only if required)<br/>                 a. <input type="checkbox"/> SPST   <input type="checkbox"/> SPDT   <input type="checkbox"/> DPDT 120 VAC   <input type="checkbox"/> DPDT 24 VDC<br/>                 b. <input type="checkbox"/> Standard – 300°F (149°C)    <input type="checkbox"/> Explosion Proof<br/> <input type="checkbox"/> High Temperature – 750°F (399°C)</p> <p><b>5. Indicating Scales:</b><br/> <input type="checkbox"/> Feet and Inches   <input type="checkbox"/> Inches   <input type="checkbox"/> Metric   <input type="checkbox"/> Blank<br/> <input type="checkbox"/> Custom Graduations; specify: _____</p> |
|---|---|

Please contact Gems for any configuration or special requirements not covered on this form. **800-378-1600**

Quote: \$ \_\_\_\_\_ Date Quoted: \_\_\_\_/\_\_\_\_/\_\_\_\_



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Type BP Shown

LEVEL INDICATORS – VISUAL

## Engineered Plastics Versions – Standard Size

- ▶ Temperatures to 280°F (139°C)
- ▶ Pressures to 150 PSI (10.3 Bar)
- ▶ Up to 19 feet (5.8 meters) of continuous visual indication

The 2" Schedule 80 pipe design is ideal for use on chemical storage tanks, or with almost any liquid where temperature and pressure requirements are moderate. All SureSite Indicators feature the same patented flag and guide assemblies used on our alloy versions, so you can be assured of excellent visibility and long-life reliability.

### 1. Mounting Configuration Types

To choose the best configuration for your application, focus on the process connections (connections where the liquid typically enters/leaves the SureSite).

	Type AP Top and Bottom Process Connections	Type BP Side and Side Process Connections	Type CP Top and Side Process Connections	Type DP Side and Bottom Process Connections
<b>Typical Lengths*</b>	C to C = L + 11" (279 mm) Overall Length = C to C	C to C = L + 8" (203 mm) Overall Length = C to C + 11" (279 mm)	C to C = L + 9.5" (241 mm) Overall Length = C to C + 5-1/2" (140 mm)	C to C = L + 9.5" (241 mm) Overall Length = C to C + 5-1/2" (140 mm)
<b>Flag Indicator Material</b>	Plastic			
<b>Length of Indication, Max.</b>	228" (579 cm)			

\*Dimensional data varies due to connections, material and specific gravity.  
Note: Additional materials, floats, connections and manufacturing techniques are available to extend lengths and operational capabilities.  
Please contact GEMS Sensors if the parameters above do not meet your requirements.

### 2. Material

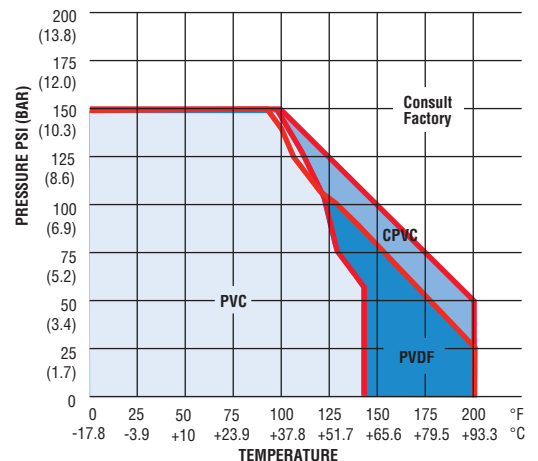
Select desired material from those tabulated below. Mark the Code Number on your OrderIt! Check List. The pressure/temperature performance parameters are specified in the charts at right. Consult the factory with pressure/temperature requirements that fall outside the parameters shown here.

Materials	Code
<b>Housing &amp; Float</b>	
PVC	<b>1</b>
Clear PVC Housing/ PVC Float	<b>1A*</b>
CPVC	<b>2</b>
PVDF	<b>4</b>

\* 2" Schedule 40 pipe

= Stock Material  
(Best economy and delivery).

### Pressure/Temperature Performance



### 3. Connection Codes (See complete descriptions below)

TOP T	Blind			NPT				Flange	
	Fixed	Removable		Fixed		Removable		Fixed	Removable
		Female	Male	Male	Female				
T1	T2	T3	T4	T5	T6	T7	T9	T10	T11

SIDE Sa	Blind	NPT		Flange
		Male	Female	
		S1	S2	

SIDE Sb	Blind			NPT				Flange	
	Fixed	Removable		Fixed		Removable		Fixed	Removable
		Female	Male	Male	Female				
B1	B2	B3	B4	B5	B6	B7	B9	B10	B11

— Connection Codes and Materials background-shaded in this color are stocked by Gems. Select these connections where possible to obtain the most economical SureSite Indicators.

BOTTOM B	Blind			NPT				Flange	
	Fixed	Removable		Fixed		Removable		Fixed	Removable
		Female	Male	Male	Female				
B1	B2	B3	B4	B5	B6	B7	B9	B10	B11

#### Connection Code Descriptions

Please provide all connections when completing the Order! Product Check List.

**Note:** Before selecting your connections, consider incorporating your vent and drain requirements.

#### T & B (Top and Bottom)

- T/B 1. Welded cap
- T/B 2. Threaded cap (PVC/CPVC only)
- T/B 3. Fixed flange/blind mating flange
- T/B 4. Welded coupling/FNPT
- T/B 5. Welded coupling/MNPT
- T/B 6. Threaded union/MNPT
- T/B 7. Fixed flange/mating flange MNPT
- T/B 9. Fixed flange/mating flange/FNPT
- T/B 10. Welded coupling flange
- T/B 11. Threaded union flange

#### Sa & Sb (Sides)

- S1 – Blind–No Connection
- S2 – MNPT nipple
- S3 – FNPT coupling
- S4 – ANSI flange

## Accessories – Pages D-16 to D-18

Make more of your SureSite® Indicator with the productivity-enhancing accessories found at the end of this section.

- **Indicating Scales**  
Add graduations to your flag indication.
- **Switch Modules**  
Control pumps, valves, alarms, etc. Mount externally on housing for infinite positioning.
- **Continuous Output Transmitters**  
Signal conditioned for compatibility with most electronic instruments.

<p style="font-size: 1.2em; font-weight: bold; color: red; margin: 5px 0;">Photocopy This Form</p> <p style="font-size: 0.8em;">Use one form for each product type you are selecting.</p>	This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____ Name _____ Company _____ Street _____ City _____ State _____ Zip _____ Phone (____) _____ Fax (____) _____ Quantity Needed _____ Date Required ____/____/____ Shipping Method: _____ Partial Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No
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## SureSite Indicators, Engineered Plastic Versions – Standard Size

### Process Conditions

This information is essential to the accurate and proper operation of your SureSite® Visual Level Indicators. Please complete fully and accurately.

- |  |   |
|--|---|
| <b>1. Pressure:</b> Operating _____ psig Maximum _____ psig<br><b>2. Temperature:</b> Operating _____ °F Maximum _____ °F<br><b>3. Liquid Media:</b> _____ | <b>4. Specific Gravity @ Operating Condition:</b> _____<br><b>5. Viscosity:</b> _____ SSU<br><b>6. Application Location:</b> <input type="checkbox"/> Indoors <input type="checkbox"/> Outdoors |
|--|---|

### Physical Configuration

#### 1. Mounting Configuration Types:

- Type AP     Type BP     Type CP     Type DP

#### 2. Housing and Float Material:

- Code 1     Code 1A     Code 2     Code 3     Code 4

#### 3. Connection Codes – Complete all 4 connection code lines.

Check off NPT or Flange size where appropriate.

▼ Connection Code Number Goes Here. **Connection Code Numbers and their descriptions are on Page D-14.**

Top <b>T</b>	NPT	Flange
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> 150# (FF) <input type="checkbox"/> Other _____
Side <b>Sa</b>	NPT	Flange
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> 150# (FF) <input type="checkbox"/> Other _____
Side <b>Sb</b>	NPT	Flange
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> 150# (FF) <input type="checkbox"/> Other _____
Bottom <b>B</b>	NPT	Flange
	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> Other _____	<input type="checkbox"/> 1/2" <input type="checkbox"/> 1" <input type="checkbox"/> 2" <input type="checkbox"/> 150# (FF) <input type="checkbox"/> Other _____

#### 4. Length of Visual Indication – L: \_\_\_\_\_ inches (228", Max.).

Connection to Connection Dimension – C to C: \_\_\_\_\_ inches.

#### 5. Flag Type: Plastic (Orange and White)

#### Special Instructions (Materials, Connections, etc.)

---



---

### Accessories (Pages D-16 to D-18)

#### 1. Transmitters (Continuous Electrical Indication):

- Standard – 300°F (149°C)     Explosion-Proof

#### 2. J-Box/Signal Conditioners Accessories:

- Terminal Strip     4-20 mA Output     0-5 VDC Output  
 0-12 VDC Output

#### 3. Power Supply:

- 115 VAC (Input) /24 VDC (Output)  
 (Optional)     230 VAC (Input) /24 VDC (Output)

#### 4. Switch Modules (Single Point): \_\_\_\_\_ Quantity (only if required)

- a.  SPST    SPDT    DPDT 120 VAC    DPDT 24 VDC  
 b.  Standard – 300°F (149°C)    High Temperature  
 Explosion Proof

#### 5. Indicating Scales:

- Feet and Inches    Inches    Metric    Blank  
 Custom Graduations; specify: \_\_\_\_\_

Please contact Gems for any configuration or special requirements not covered on this form. **800-378-1600**

Quote: \$ \_\_\_\_\_ Date Quoted: \_\_\_\_/\_\_\_\_/\_\_\_\_



**Gems Sensors & Controls**  
 One Cowles Road  
 Plainville, CT  
 06062-1198

tel 860.747.3000  
 fax 860.747.4244  
 www.gemssensors.com

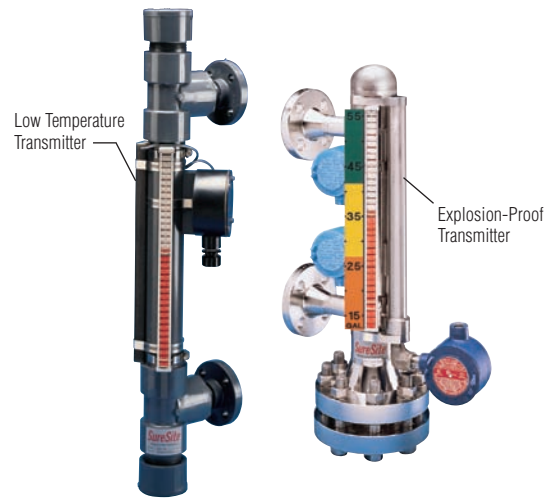




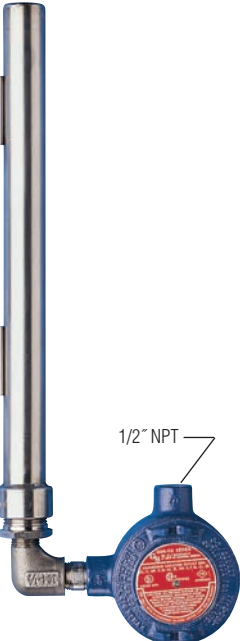
## Continuous Electrical Output Transmitters for *all* SureSite Indicators

Broaden the SureSite Indicator's capabilities; add one of these transmitters. You can have visual indication and a continuous electrical output too without additional tank penetrations. Use them to know what's in your tank remotely, send the signal to your controller, schedule your next inventory.

These transmitters are compatible with the readout displays at the end of this Section (D-24 to D-26) or can interface directly to your equipment by specifying the appropriate output.

Select your transmitter preference on the SureSite Product Check List (pages D-6, D-9, D-12 and D-15).



	Low Temperature Transmitter	Explosion-Proof Transmitter	Explosion-Proof / High Temperature Transmitter
			
<b>Compatible SureSite Types</b>	Plastic and Standard Alloy Units	Mini Alloys	Standard Alloy and High Performance Alloy Units
<b>Operating Temperature, Max.</b>	+300°F (149°C)	+300°F (149°C)	+750°F (399°C)
<b>Housing Materials</b>	Polysulfone	316 Stainless Steel	
<b>Output Termination</b>	Cable	Junction Box (Ferralloy Iron)	
<b>Transmitter Resolution</b>		3/8" (9.5 mm)	
<b>Accuracy</b>		3/8" (9.5 mm)	

### Signal Conditioned Modules

Gems offers a variety of electrical Junction Boxes with built-in Signal Conditioners to increase the versatility of SureSite Indicators. Voltage outputs available:

- 0-5VDC
- 0-10VDC
- 0-12 VDC

Current output available:

- 4-20mA (loop powered)

Electrical specifications and ordering information for these units are found on Page D-17. Junction boxes with terminal blocks are also on Page D-17.

### Intrinsic Safety



Operation is intrinsically safe when transmitters are properly connected with a Gems, or other appropriate, zener barrier in Section L.

## Signal Conditioning Modules, 0-5 VDC, 0-12 VDC and 4-20 mA Outputs

Provide signal conditioning as an integral part of the SureSite® Level Indicators

- ▶ Stem Mounted
- ▶ J-Box Enclosed
- ▶ Panel Mounted

Gems signal conditioners provide outputs for direct connection to a wide range of instrumentation. They are ideal for large, multi-tank complexes. Units with 4-20 mA outputs are particularly well suited for instrumentation control loops. No intermediate receiver is required.

### Specifications (Not included in table below)



<b>Operating Temperature</b>	+5°F to +160°F (-15°C to +71°C)
<b>Storage Temperature</b>	-40°F to +212°F (-40°C to +100°C)
<b>Output Temperature Coefficient (% of full scale, max.)</b>	±0.00388%/°F (±0.007%/°C)
<b>4-20 mA Types</b>	To within ±1% of 16 mA

### Excitation Required for Transmitters using 4-20 mA Signal Conditioners

The minimum excitation required for operation of transmitters with 4-20 mA, DC signal converters (See chart at right) can be determined for a given total loop resistance from the graph shown. (Total loop resistance = the sum of the DC termination resistance plus loop resistance.) For optimum operation, which is a function of source voltage (+V<sub>A</sub>) and total loop resistance, the source voltage value used should be above the minimum load line for the related loop resistance.

### How To Order

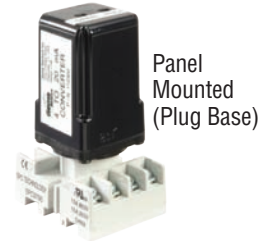
Select Part Number based on Output Signal desired and SureSite Indicator being used.

Electrical Termination Method	Output Signal	Input Voltage	Module Part Numbers For:	
			SureSite Low Temperature	SureSite High Temperature
 Junction Box	0-5 VDC	8-24 VDC	<b>86156</b>	<b>52536</b>
	0-12 VDC	15-30 VDC	<b>85997</b>	<b>52537</b>
	4-20 mA	10-40 VDC	<b>86158</b>	<b>152800</b>
 Panel Mount with Plug-In Base	4-20 mA	10-40 VDC	<b>112300 ⚡</b>	<b>112300 ⚡</b>

⚡ = Stock item



J-Box Enclosure

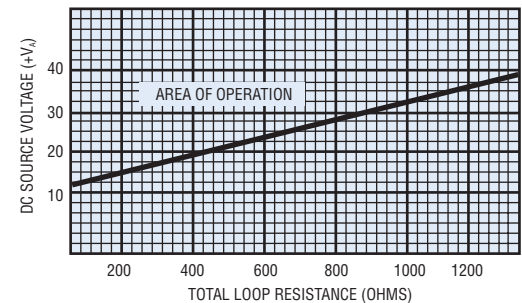


Panel Mounted (Plug Base)

### Power Supply Module

Input Power	Part Number
115 VAC, 60 Hz	<b>52560</b>
230 VAC, 60 Hz	<b>52570</b>

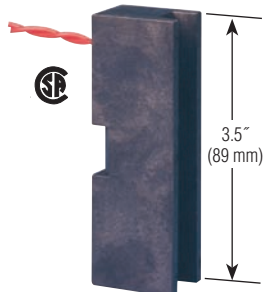
Operates on 115 VAC or 230 VAC inputs to supply a regulated 24 VDC to the signal conditioned transmitter where external VDC power is not available. Maximum Load: 70 mA.



**LEVEL INDICATORS – VISUAL**

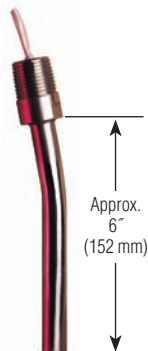
# Switch Modules Provide High-, Low- or Intermediate-Level Alarms or Control Logic

## Standard Switch Modules



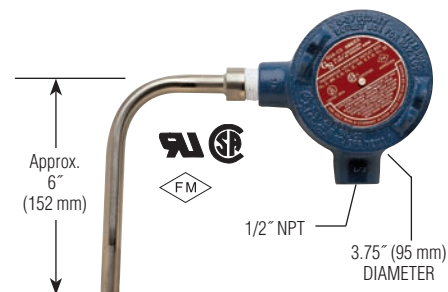
- CSA Approved
- Includes Stainless Steel Mounting Clamp
- Polysulfone Housing
- Withstands Temperatures to 300°F (148.9°C)
- Connection: 1/4" FNPT

## High Temperature Switch Module



- Withstands Temperatures of 750°F (399°C)
- 316 Stainless Steel Construction
- 1/2" MNPT Conn.
- Includes Stainless Steel Mounting Clamp

## Explosion-Proof Switch Module



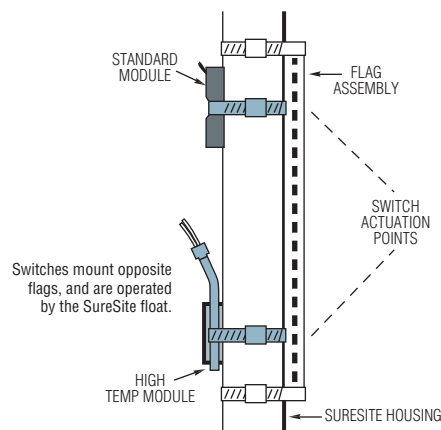
- UL, CSA, FM Approved
- Withstands Temperatures of 750°F (399°C)
- J-Box Terminated
- Stainless Steel Construction
- Includes Stainless Steel Mounting Clamp

## Switch Logic (All Models)

	<b>Lead Wires Up</b>	Switch closes on rising level and remains closed until opened by falling level.	<b>For Intrinsic Safety...</b> These switch modules can be rendered intrinsically safe with the use of GEMS SAFE-PAKS® and Zener Barriers. See Section L.
	<b>Lead Wires Down</b>	Switch opens on rising level and remains open until closed by falling level.	

## Mounting

Switches mount opposite flags (180°) and may be positioned next to each other for multiple actuation requirements.



## How To Order

Switch modules can be added to any SureSite Indicator at any time. Specify the Part Number and quantity of switches desired on Product Check List.

Switch Type		Rating*	Part Numbers – Based on SureSite Version		
			Alloy & ASME SureSite	Mini SureSite	Plastic SureSite
Standard	SPST	20VA	86435 ⚡	86567 ⚡	80469
Hi-Temp	SPST	20VA	83150	83150-M	83150-P
	SPDT	20VA	84320	84320-M	84320-P
Explosion-Proof	SPST	20VA	83130	83130-M	83130-P
	SPDT	20VA	84330	84330-M	84330-P
	DPDT, 120 VAC	10A	83100	83100-M	83100-P
	DTDT, 24 VDC	10A	83110	83110-M	83110-P

\* See "Electrical Data" on Page X-5 for more information.

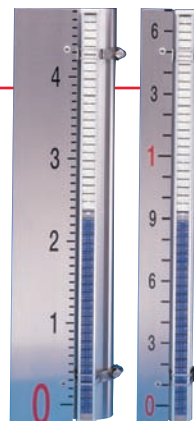
⚡ = Stock item

## Indicating Scales

These optional stainless steel indicating scales provide a numerical readout of the liquid level in addition to the flag indication. They mount alongside the flag assembly for easy viewing.

- Available in 1.5" and 3" wide versions.
- Markings: Feet and Inches  
Inches  
Metric (Decameter, centimeter, millimeter)

Custom marked graduations such as gallons, liters or percentage available.



## DIPTAPE Visual Level Indicators – Manually Operated

These manually-operated indicators are compact and completely self-contained. They need no electricity to provide continuous indication of liquid level in storage tanks and vessels. DIPTAPE Indicators are ideal for quick, periodic readouts that are accurate to 1/16 inch or 1 mm; especially in remote areas where power is unavailable, or undesirable. Only the float and stem contact the liquid, so the readout tape is always clean and readable.

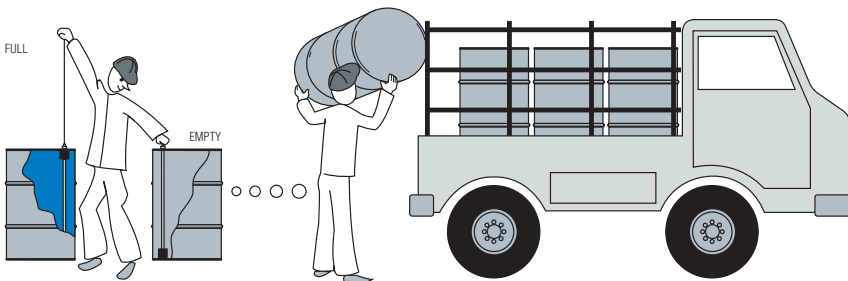
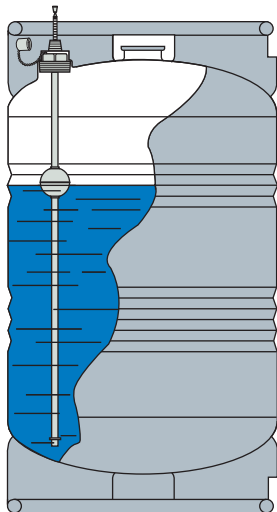
Custom-configurable DIPTAPE Indicators described on the following pages are available in a broad range of materials and mounting types in lengths to six feet (1.8 m). For lengths six to ten feet, consult factory.

### General Operating Principle

A magnet-equipped float moves with liquid level along the unit stem, inside the storage vessel. Level readout is obtained by simply removing the protective cap atop the unit and lifting the calibrated indicator (within the unit) until magnetic interlock with the float is felt. The indicator is held at this point and level is read where the calibration aligns with the top of the mounting. The indicator is then lowered back inside the unit for storage and is protected by the screw type cap when not in use.

### Typical Application

Refillable, portable chemical tanks are monitored and exchanged when empty. DIPTAPE Indicators maintain a “closed” system on tanks or drums containing environmentally hazardous liquids and vapors. Plus, their rugged construction stands up to the rigors of transportation.



LEVEL INDICATORS – VISUAL

Contents	Page Start
All-PVC Versions .....	D-20
Engineered Plastic Versions .....	D-21
Alloy Versions .....	D-22

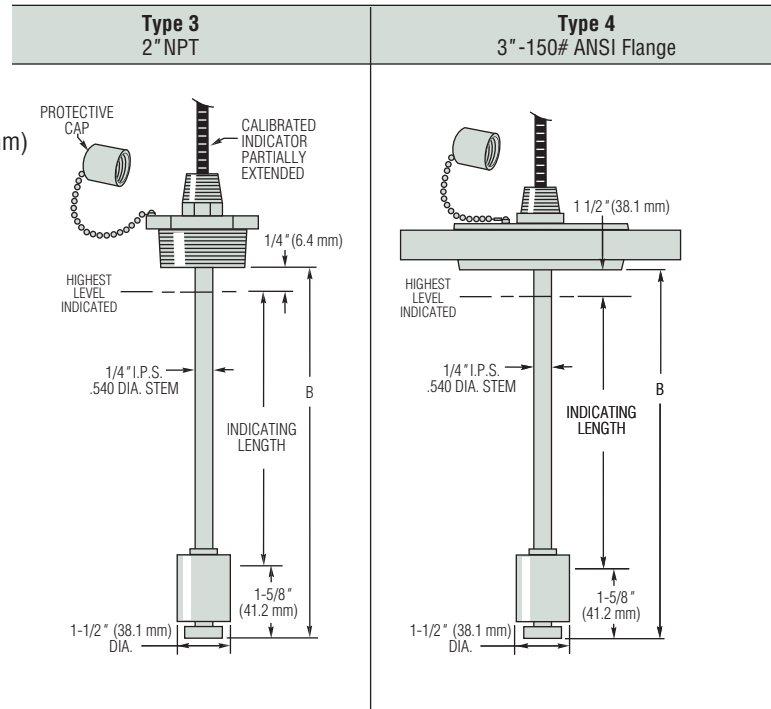
## All-PVC Versions Are Economical for Light Duty

- ▶ Temperatures to 140°F (60°C)
- ▶ Pressures to 15 PSI (1 bar) Max.

Ideal for chemical storage tanks, our all-PVC DIPTAPE Indicators provide one of your best values for liquid level monitoring. These light duty versions are recommended for use in calm liquids and ambient temperature and pressure levels. See Engineered Plastic versions on the next page for enhanced performance characteristics.

### 1. Mounting Types

"B" Dimension (Length Overall):  
Indicating Length + 1-7/8" (47.6 mm)



<b>Stem, Float and Mounting Material</b>	PVC
<b>Min. Liquid Specific Gravity</b>	0.65
<b>Operating Temperatures</b>	0°F to +140°F (-17.7°C to 60°C)
<b>Operating Pressure, Max.</b>	15 psi (1 bar)
<b>Indicating Length*</b>	6" to 72" (15.2 cm to 182.9 cm)
<b>Std. Indication Markings</b>	1/16" or 1 mm increments

\*For longer lengths, please consult factory.

### Ordering Is Easy

1. To specify DIPTAPE Level Indicators, start by photocopying the OrderIt! Product Check List located on Page D-23.
2. Use the product information in this section to make your selections on the Check List. Please use a separate Check List for each unique configuration.
3. Fax your completed OrderIt! Check List to Gems for a price quotation.  
Fax: 860-747-4244

# Engineered Plastic Versions Offer Best Chemical Resistance

**ORDER IT!**

Ordering is Easy! See Page D-23.  
Easy online ordering too!

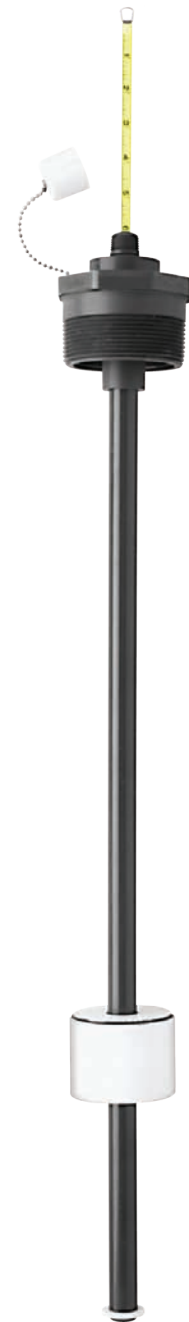
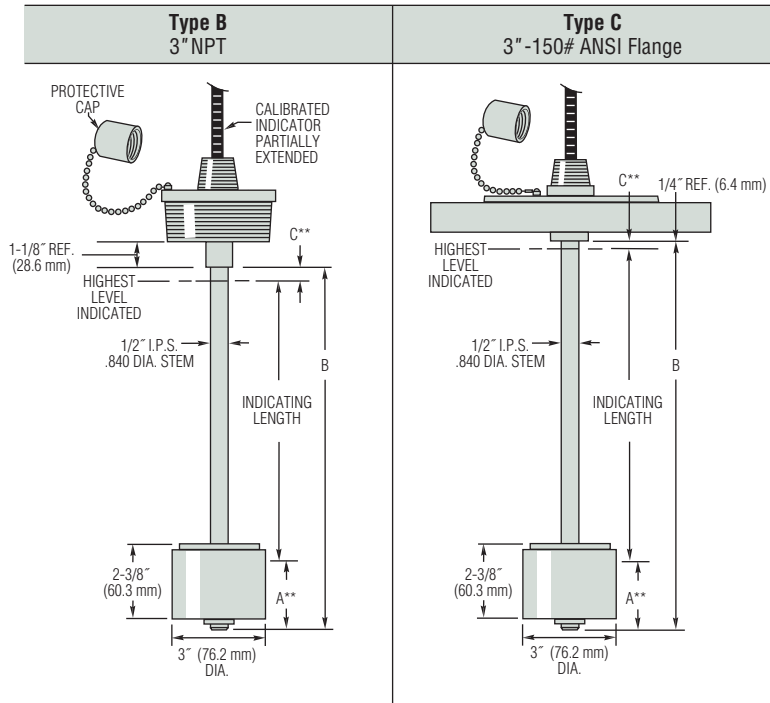
- ▶ Temperatures to 140°F (60°C)
- ▶ Pressures to 50 PSI (3.4 bar)

With a choice of three highly resistive, engineered plastic materials, large floats and 1/2 inch IPS stems, these DIPTAPE Indicators provide rugged durability in almost any chemical tank. For higher temperature and pressure capability, review the alloy versions on next page.

## 1. Mounting Types

“B” Dimension (Length Overall):  
Indicating Length + A + C

Note: Dimensions “A” and “C” are dependent on float selected. See Float Types below.



LEVEL INDICATORS – VISUAL

Stem and Mounting Material	PVC, PVDF or Polypropylene
Indicating Length*	6" to 72" (15.2 cm to 182.9 cm)
Std. Indication Markings	1/16" or 1 mm increments

\*For longer lengths, please consult factory.  
\*\*Dimensions listed below, under "Float Types."

## 2. Float Types

Float Material	PVC	Polypropylene	PVDF
Part Number	71741	73742	73740
Min. Liquid Specific Gravity	0.65	0.46	0.83
Operating Temperatures	+40°F to +140°F (+4.4°C to +60°C)		
Operating Pressure, Max.	50 psi (3.4 bar)		
“A” Dimension (From Mounting Types)	1-3/4" (44.4 mm)	1-3/8" (34.9 mm)	2-3/16" (55.6 mm)
“C” Dimension (From Mounting Types)	15/16" (23.8 mm)	1-5/16" (33.3 mm)	1/2" (12.7 mm)



**ORDER IT!**

Ordering is Easy! See Page D-23.  
Easy online ordering too!

# DIPTAPE™ Indicators – Alloy Versions

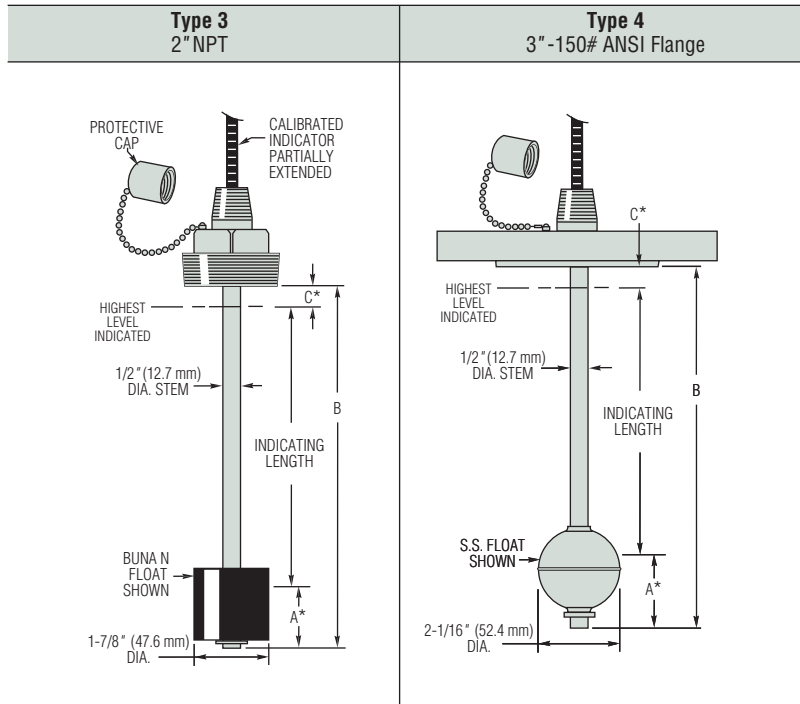
- ▶ Temperatures to 300°F (148°C)
- ▶ Pressures to 750 PSI (52 bar)

Rugged brass or stainless steel units are ideal for use in water and oils. Select these units for best temperature and pressure capabilities.

## 1. Mounting Types

“B” Dimension  
(Length Overall):  
Indicating Length + A + C

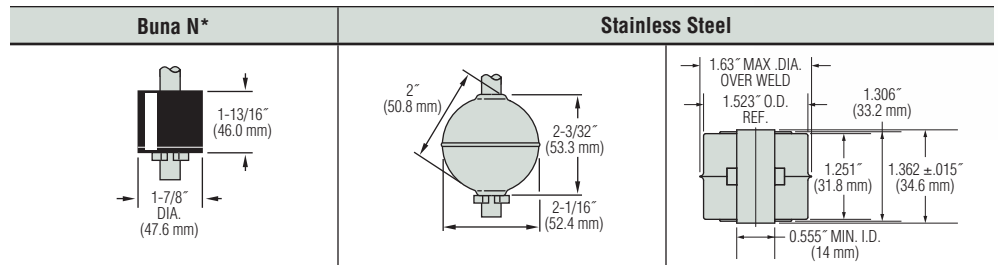
Note: Dimensions “C” and “A”  
are dependent on float selected.  
See Float Types below.



<b>Stem and Mounting Material</b>	Brass or 316 Stainless Steel	316 Stainless Steel Stem with Carbon Steel or 316 Stainless Steel Flange
<b>Indicating Length**</b>	6" to 72" (15.2 cm to 182.9 cm)	
<b>Std. Indication Markings</b>	1/16" or 1 mm increments	

\* Dimensions listed below, under “Float Types.”  
\*\* For longer lengths, please contact factory.


## 2. Float Types



	Buna N*	Stainless Steel	
<b>Float Part Number</b>	<b>73710</b>	<b>73709</b>	<b>138935</b>
<b>Min. Liquid Specific Gravity</b>	0.45	0.67	0.67
<b>Operating Temperatures</b>	Oil: -40°F to +230°F (-40°C to +110°C) Water: to 180°F (+82.2°C)	-40°F to +300°F (-40°C to +148.8°C)	-40°F to +220°F (-40°C to +104°C)
<b>Operating Pressure, Max.</b>	300 psi (21 bar) max. @ 77°F (25°C)	750 psi (52 bar) Mounting Type 3 150 psi (10 bar) Mounting Type 4	150 psi (10 bar)
<b>“A” Dimension (From Mounting Types)</b>	1-1/4" (31.7 mm)	1-3/8" (34.9 mm)	1" (25.4 mm)
<b>“C” Dimension (From Mounting Types)</b>	11/16" (17.5 mm)	3/4" (19.05 mm)	9/16" (14.3 mm)

\*Other Wetted Material: Hysol.

LEVEL INDICATORS – VISUAL

 <p><b>Photocopy This Form</b> Use one form for each product type you are selecting. <small>This form may also be completed online at <a href="http://gemssensors.com">gemssensors.com</a> for RFQ.</small></p>	This is a <input type="checkbox"/> Request for a Quote <input type="checkbox"/> Order P.O.# _____ Quantity Needed _____ Date Required ___/___/___ Shipping Method: _____ Partials Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No	Name _____ Company _____ Street _____ City _____ State ___ Zip _____ Phone (____) _____ Fax (____) _____
--	--	---

## DIPTAPE Level Indicators

### Application Environment Conditions

This information is essential to the accurate and proper operation of your DipTape Level Indicators. Please complete fully and accurately.

- |   |  |
|---|--|
| <p><b>1. Liquid Media:</b> _____</p> <p><b>2. Pressure:</b> Minimum _____ psig    Maximum _____ psig</p> <p><b>3. Temperature:</b> Minimum _____ °F    Maximum _____ °F</p> <p><b>4. Specific Gravity:</b> Minimum _____    Maximum _____</p> | <p><b>5. Viscosity:</b> _____ SSU</p> <p><b>6. Tank Material:</b> _____</p> <p><b>7. Tank Depth:</b> _____</p> |
|---|--|

#### 1. Mounting Type:

- Type B       Type C  
 Type 3       Type 4

#### 2. Material:

- PVC       PVDF       Polypropylene  
 Brass       316 Stainless Steel  
 Flange – Alloy Version:  
 316 Stainless Steel       Carbon Steel

#### 3. Float Types:

- PVC       PVDF       Polypropylene  
 Buna N       316 Stainless Steel

#### 4. Stem Length (Length Overall) “B”

Dimension B = \_\_\_\_\_  inches  
 centimeters  
 Max. indicating length 72".  
 Other lengths, consult factory.

Please contact Gems for any configuration or special requirements not covered on this form. **800-378-1600**

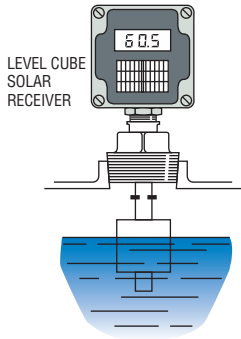
Quote: \$ \_\_\_\_\_    Date Quoted: \_\_\_/\_\_\_/\_\_\_



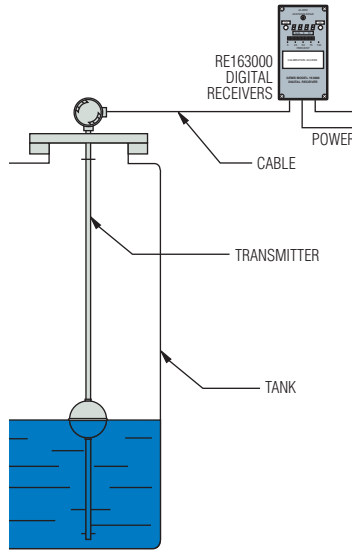
**Gems Sensors & Controls**  
 One Cowles Road  
 Plainville, CT  
 06062-1198  
 tel 860.747.3000  
 fax 860.747.4244  
[www.gemssensors.com](http://www.gemssensors.com)

# GEMS Receivers Tell You What Your Sensors Already Know

GEMS Receivers house a numerical digital readout, and all of the calibration adjustments for a complete Continuous Level Indication system. Those receivers designed for the XM-Series transmitters also include a power supply for the transmitter.



Level Cube with 1/2" NPT shown mounted directly on GEMS XM-Series Transmitter. Or, they may be mounted remotely, up to 100 feet from the transmitter.



## 3-Digit Level Cube Receivers



## Digital Bargraph Receivers



These units feature a large 4-digit display and bright LED bargraph to visually clarify relative tank content level.

LEVEL INDICATORS – VISUAL

## Selector Guide

The Selector Guide below lists standard GEMS Receivers and the transmitter series with which they are normally configured. GEMS doesn't stop, however, with the standard designs shown in this catalog. Our experienced engineering staff will custom design receivers to suit your application. Don't hesitate to contact us about your special requirements.

Receivers	Mounting*	Alarm	Operating Voltage	Compatible GEMS Products
<b>3-Digit Level Cube Receivers</b>	Wall or Transmitter	None	9V Battery, 9 VDC / 117 VAC, Solar	XM-Series (1/4" or 1/2" Resolution), and SureSite Transmitters
<b>RE163000</b>	Panel or Wall	2 Alarm	90-120 VAC, 20-50 VDC	All Continuous Transmitters, SureSite Transmitters, Pressure Transmitters

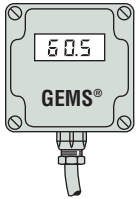
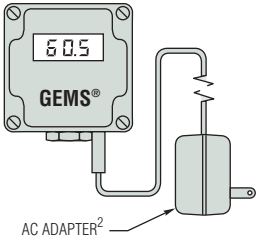
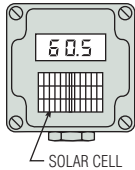
\*Mounting Definitions:  
 Wall: Mounted **onto** a surface; i.e., wall, bulkhead, deck, etc.  
 Panel: Mounted **into**, and approximately flush with, a surface through a cutout.  
 Transmitter: Mounted directly to the top of the transmitter.

# 3-Digit Level Cube Receivers

For use with GEMS Transmitters and SureSite® Transmitters.

These compact, low-cost Level Cubes provide accurate, continuous 3-digit readout of liquid level. The indicating range and decimal point location on the display are quickly and easily selectable with the readout plainly visible.

## 3 Power Choices with NPT or Cable Mounted

9-V Battery Powered	9 VDC/117 VAC Powered	Solar-Powered
		
<b>Part Numbers:</b> <b>118600—Cable Output</b> <b>119250—1/2" NPT</b>	<b>Part Numbers:</b> <b>118620—Cable Output</b> <b>119270—1/2" NPT</b>	<b>Part Numbers:</b> <b>118610—Cable Output</b> <b>119260—1/2" NPT</b>
FM Approved, Intrinsically Safe, Class I, Division 1, Groups C & D		—

**Notes:**

- 9-V Alkaline Battery Powered Units:** Two batteries (supplied) are snapped into terminals in Cube. On/Off switch available
- 9 VDC/117 VAC Powered Units:** Power is supplied from AC adapter. A plug, Part Number 119218, is available for use where 7-VDC power is supplied by customer. These units are not watertight.
- Solar-Powered Units:** Sunlight or a flashlight beam directed on a solar cell in the front cover is all that's needed to operate.

## Specifications

<b>Housing Material</b>	Polycarbonate, NEMA-4X, watertight*
<b>Cable Distance from Transmitter</b>	100 feet, Max.
<b>Operating Temperature</b>	+23°F to 131°F (-5°C to +55°C)
<b>Accuracy</b>	± 2%

\*Except for 9 VDC/117 VAC Powered Units which are not watertight.

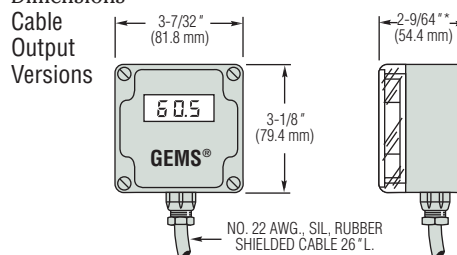
## How To Order – Standard Models

Style	Mounting	Part Number
9-V Battery	Cable Output	<b>118600</b>
	1/2" NPT	<b>119250</b>
9 VDC / 117 VAC	Cable Output	<b>118620</b>
	1/2" NPT	<b>119270</b>
Solar	Cable Output	<b>118610</b>
	1/2" NPT	<b>119260</b>

## NPT or Cable Mounted

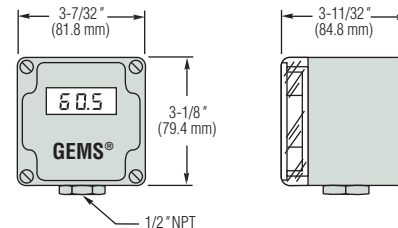


**Dimensions**

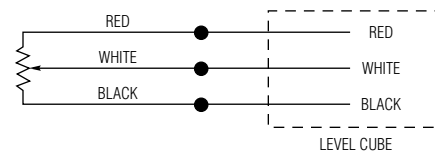


\* P/N 118600 9-V Battery = 3-11/32" (84.8 mm) only.

**1/2" NPT Versions**



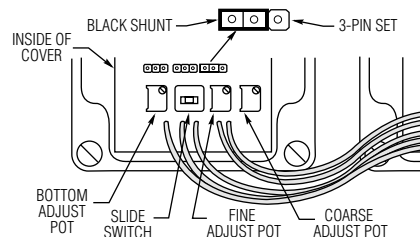
## Typical Wiring Diagram



Note: For ullage indication, transpose red and black connections.

## Easy to Adjust and Calibrate

Adjustments must be performed with cover removed (see illustration) and power applied. Results are observed on the front display.



**To position decimal point:** Place black shunt over left two pins of proper 3-pin set for desired decimal in display. For no decimal, place shunt over right two pins of any set.

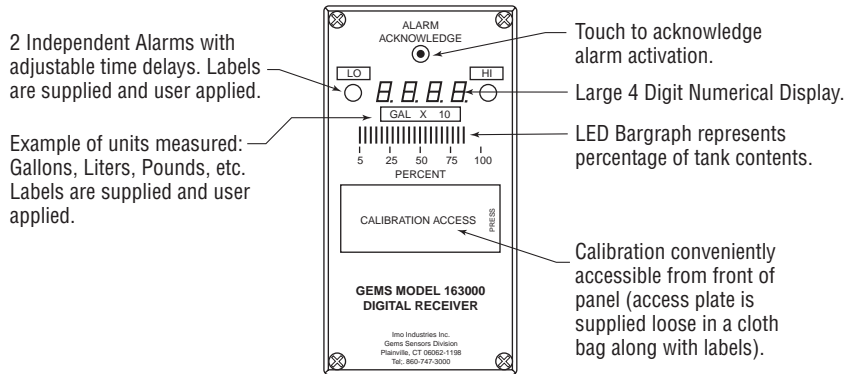
# Digital Bargraph Display Receivers - 163000 Series

Gems Digital Bargraph Receivers improve the way you are able to visualize the data being received from your liquid level transmitters. These new receivers display liquid level information in digital numerals in conjunction with a 0-100% LED bargraph readout. The numeric portion is a 1/2" 4-digit display that provides detailed quantification of tank contents, while the bright LED bargraph represents the tank contents as a bar length relative to the percentage of fluid volume within the tank.

If you have a non-linear tank, such as a sphere or a cylinder laying on its side, these receivers are a blessing. They can be calibrated easily so that the digital and bargraph displays will indicate accurate content information for "odd" shape tanks. See "Linearization" below.

In addition to the dual visual displays, the Gems Bargraph Receiver features two independent alarms with adjustable time delays, 10 amp auxiliary dry contacts and easy user set-up. The receiver is available in component form for mounting into custom enclosures or panels, or housed within a NEMA 4X enclosure.

## Panel Mounted Versions



## Enclosed Versions



LEVEL INDICATORS - VISUAL

## Linearization

Certain tanks, like a sphere or a cylinder laying on its side, are considered "Non-Linear" in terms of volume versus tank height. In these cases this receiver may be linearized according to your tank parameters so that the correct volume is displayed. Any units may be displayed by the receiver. Gallons, inches, tons, cubic inches, liters and etc.

The receiver uses a scheme where 9 points or 8 straight lines are used to calculate the numbers to be displayed. These 8 lines approximate the curve of the non-linear tank.

## Examples of Non-Linear Display Values.

1. Gallons in a spherical tank.
2. Gallons in a cylindrical tank laying down.
3. Pounds of liquid in a spherical tank.
4. Cubic meters in a conical shaped tank.
5. Gallons in a non-linear shaped tank.

**IMPORTANT: Customer must supply a sounding table, capacity curve and/or tank drawing for linearization of the digital bar graph display receiver.**

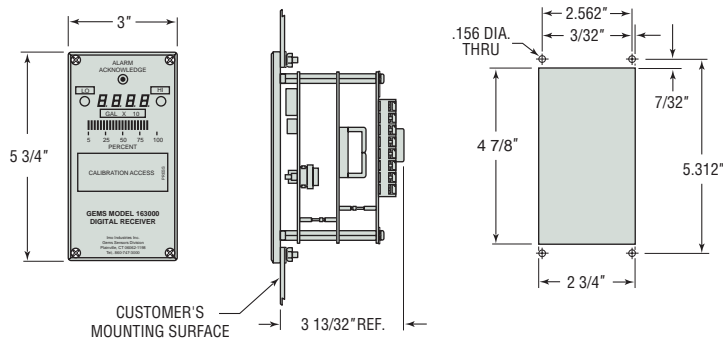
## Specification

Input Signal	4-20mA, Proportional Voltage*, Serial
Accuracy Over Given Range	± 1.0%
Operating Voltage	24VDC or 115VAC
Operating Temperature	-4°F to +140°F (-20°C to +60°C)
Alarm Contacts, Load	10Amp, Dry Contact
Digital Readout	0000 to 9999

\* Proportional voltage as produced by the non-signal conditioned Gems Liquid Level Transmitters (Section H and SureSite Transmitters (Section G).  
Note: Customer alarms (High & Low) set upon request.

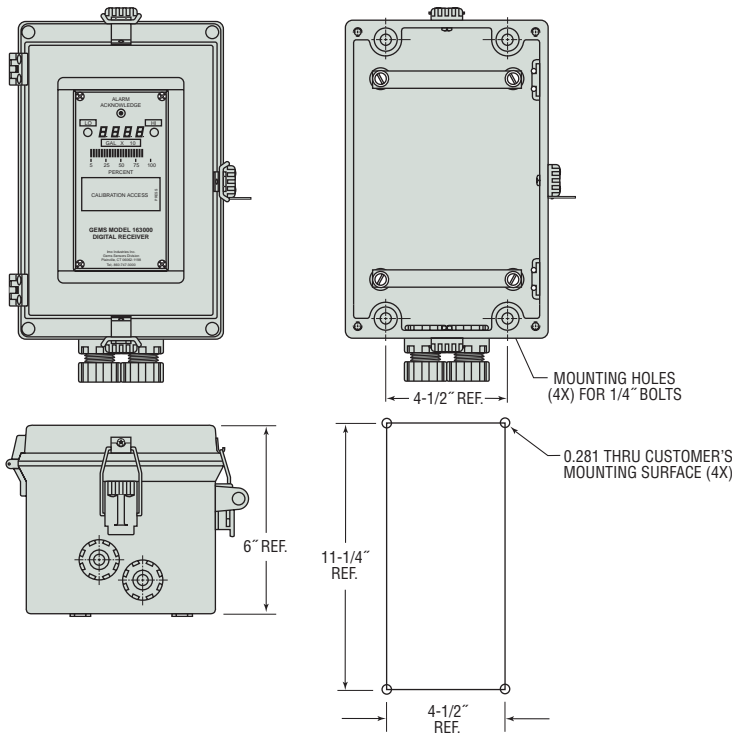
Dimensions

Panel Mounting Receivers

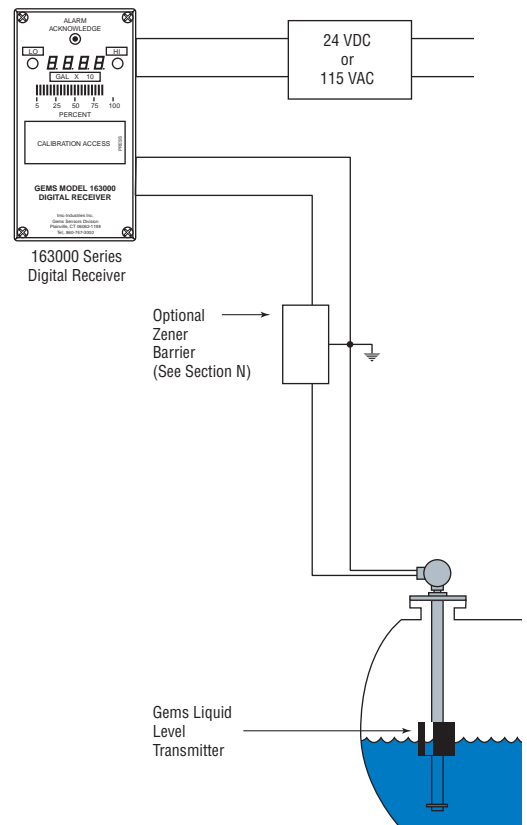


Static Sensitive.  
Handling Precautions Required.

NEMA 4X Enclosed Receivers



Typical Installation



How To Order - Standard

Select receiver type by Part Number based on Input Power and Input/Output Signals required.

Input Power	Input/Output Signals		Part Number	
	Input	Output	Panel Mount	NEMA 4X Fiberglass Enclosed
24 VDC	Transmitter*	None	170680-0100	170690-0100
	Serial	None	170681-0100	170691-0100
	Transmitter*	4-20mA	170682-0100	170692-0100
	4-20mA	4-20mA	170683-0100	170693-0100
		None	170684-0100	170694-0100
115 VAC	Transmitter*	None	170685-0100	170695-0100
	Serial	None	170686-0100	170696-0100
	Transmitter*	4-20mA	170687-0100	170697-0100
	4-20mA	4-20mA	170688-0100	170698-0100
		None	170689-0100	170699-0100

\* Proportional voltage as produced by the non-signal conditioned Gems Liquid Level Transmitters (Sections C) and SureSite Transmitters (Section D). When used in conjunction with RE-163000, no additional signal conditioning required.



**NOTES**

A large grid of red dashed lines for taking notes, consisting of 20 columns and 30 rows.

# Warrick® Conductivity-Based Liquid Level Control

The concept is simple: Take advantage of a liquid's conductive properties to complete a circuit and cause a control relay to actuate. Use of permanently-mounted stationary electrodes gives the user precise accuracy, repeatability and no-moving-parts reliability.

## Application Versatility

**Pumps.** For feeding of elevated tanks; drainage of wastewater from industrial sumps; batch processing; irrigation and flood control; sewage disposal; seal leakage detection.

**Boilers.** Supervise feedwater flow; critical low water cutoff protection; alarm functions.

**Steam.** Steam cookers; steam generators; evaporators; sterilizers. Automatic shut off of heat source in the event of a low water level; proper water level maintenance through the energizing of a solenoid valve.

**Drink Dispensers.** Control the carbonator tanks' water level.

**High and/or Low Level Alarms.** In boilers, process and storage tanks and similar equipment.

**Solenoid Control.** As simple on/off devices, for process control.

**Fuel.** Fuel storage tank level detection and leakage indication.

**Sewage.** Sewage and waste water level detection.

**Specialty Control Panels.**



## System Components

The illustration, to the right, graphically defines the typical Warrick® liquid level control system, which includes three basic elements:

**1. Controls.** The control is an electrical device with contacts that open and close in response to liquid levels sensed by the probes. Because it is wired directly to the power source and to the sensing source, it can send signals that activate or de-activate solenoids, pumps, or alarms.

Warrick® controls are available in many different designs and sensitivity ratings for a wide range of application requirements.

**2. Fittings.** The fitting is a housing that holds the probes (or floats), insulates them from the vessel, and provides a means of connection to the control.

Warrick® fittings are available for single-probe or multi-probe applications, for mounting to vessels in a variety of ways, and in open or pressure tight styles.

**3. Probes.** The probe is a sensor that extends downward from the fitting, with the tip positioned precisely at the level where the control should be activated.

Warrick® probes are available in a variety of materials to suit different liquids and a variety of lengths to fit different depth requirements.

Contents	Page Start
General Purpose Plug-In Modules .....	E-4
General Purpose Open Board Controls .....	E-6
Low Water Cutoff Controls .....	E-7
Relay Output .....	E-9
Kits and Options .....	E-11
Relay Output .....	E-12
Intrinsically Safe Controls .....	E-15
Multi-Function Controls .....	E-17
Electromechanical Controls .....	E-18
Pump Protection .....	E-19
Fittings and Probes .....	E-20
Panel Controls and Alarms .....	E-29



## Example of Warrick System Application

The liquid level control system shown here is designed for "pump up" application. The pump will start refilling the vessel when the liquid reaches the lower probe tip, then stop refilling the vessel when the liquid reaches the higher probe tip.

## Principle of Operation



**Electromechanical Controls** employ a simple series circuit which includes the transformer, relay coil, electrode probes and the liquid media being monitored. When liquid contacts both the reference and set point electrode probes, current flows through the liquid media which in turn energizes the relay coil and mechanically changes the output contacts state.

When liquid is below the electrode probes, the probe circuit is open, the relay coil is not energized, and the output contacts return to their 'normal' state.

Sensitivity (the maximum liquid resistance allowable) is adjusted by changing the secondary voltage passed through the electrodes and liquid media (500 VAC max).

**Solid State Controls** employ two separate circuits, one for sensing and comparing current flow and one for energizing the output relay. This 'switch within a switch' allows solid state controls to operate at much lower secondary voltages (12VAC typical), and much higher sensitivities. Advantages of this technology include reduced shock hazard, one moving part the output relay, wide sensitivity range and latching capability for auto refill or empty applications.



**Intrinsically Safe Controls** are solid state controls which limit current and voltage to a level incapable of igniting flammable gasses, vapors or dust. They can be used as conductivity liquid level controls or with dry contact devices such as Gems Flow and Level Switches or other non voltage storing or producing devices.



## Sensitivity Data

Sensitivity vs. Maximum Probe Wire Distances – in feet\*

Ohms	Controls								
	Series 1	Series 16, 16D, 16M, 16DM, 16VM	Series 17	Series 27, 37	Series 47	Series 67	Series 26, 26M	Series 19MR	Series DF
50	75000	—	—	—	—	—	—	—	—
450	7500	—	—	—	—	—	—	—	—
1,500	1750	—	—	—	—	—	—	—	—
3,000	—	—	—	4000	—	—	—	—	—
3,300	—	—	5000	—	—	—	—	—	—
4,700	—	10000	3500	—	—	4000	900	—	900
7,000	500	—	—	—	—	—	—	—	—
10,000	—	5700	1750	900	—	2400	600	—	600
11,000	—	—	—	—	—	—	—	5500	—
19,000	—	—	—	—	—	—	—	3000	—
20,000	150	—	—	—	—	—	—	—	—
22,000	—	—	1000	—	—	—	—	—	—
26,000	—	2200	—	—	1500	1200	250	—	250
47,000	—	—	500	—	—	—	—	—	—
50,000	—	1075	—	—	900	600	—	—	—
100,000	—	570	250	75	—	—	—	—	—
470,000	—	270	—	—	—	—	—	—	—
1,000,000	—	38	—	—	400	300	—	—	—
3,000,000	Contact factory for more information								
5,500,000									

\* Based on type MTW or THHN #14 or #16 AWG wire. Other wire size and sensing medium may reduce overall maximum distance.

Notes:

1. DC on probe circuit-maximum distance between control and probe is limited to the total resistance of the wire and liquid.
2. Total resistance must not exceed the sensitivity of the control.
3. On controls directly connected to floats rather than probes, maximum distance is limited only to the total resistance of the wire.
4. AC on probe circuit has greater restrictions on maximum distance.

## Sensitivity &amp; Material Selection

Liquid or Material	Sensitivity-Conductivity		Probe Material	
	Ohms/cm	Micro-Mhos/cm	Good <sup>1</sup>	Better <sup>2</sup>
Acids <sup>3</sup>	Consult Factory		Consult Factory	
Aluminum Hydroxide	2.2K	450	316 Stainless Steel	Titanium
Aluminum Sulfate	2.2K	250	316 Stainless Steel	Hastelloy C
Ammonia	5K	200	316 Stainless Steel	N.A.
Ammonium Chloride	1K	1K	316 Stainless Steel	Titanium
Ammonium Hydroxide	10K	100	316 Stainless Steel	Titanium
Ammonium Nitrate	18K	50	316 Stainless Steel	316 Stainless Steel
Ammonium Sulfate	10K	100	316 Stainless Steel	Titanium
Baby Foods	1K	1K	316 Stainless Steel	316 Stainless Steel
Barium Chloride	1K	1K	Carpenter 20	N.A.
Barium Nitrate	1K	1K	316 Stainless Steel	N.A.
Beer	2.2K	450	316 Stainless Steel	316 Stainless Steel
Black Liquor	1K	1K	Consult Factory	
Borax – Aqueous	10K	100	Brass	316 Stainless Steel
Bourbon	200K	5	N.A.	316 Stainless Steel
Brine	1K	1K	N.A.	Hastelloy C
Buttermilk	1K	1K	N.A.	316 Stainless Steel
Cadmium Chloride	1K	1K	316 Stainless Steel	N.A.
Cadmium Nitrate	1K	1K	316 Stainless Steel	N.A.
Cake Batter	5K	200	316 Stainless Steel	316 Stainless Steel
Calcium Chloride	1K	1K	Carpenter 20	Hastelloy C
Calcium Hydroxide	10K	100	316 Stainless Steel	Titanium
Catsup	2.2K	450	316 Stainless Steel	316 Stainless Steel
Caustic Soda	1K	1K	316 Stainless Steel	Hastelloy B
Cement Slurry	5K	200	316 Stainless Steel	316 Stainless Steel
Coffee	2.2K	450	316 Stainless Steel	316 Stainless Steel
Corn Syrup	45K	21	316 Stainless Steel	316 Stainless Steel
Corn – Cream Style	2.2K	450	316 Stainless Steel	316 Stainless Steel
Ferric Chloride	10K	100	N.A.	Titanium
Ferrous Sulfate	10K	100	Carpenter 20	Titanium
Ink (Water Base)	2.2K	450	N.A.	316 Stainless Steel
Jams/Jellies	45K	21	316 Stainless Steel	316 Stainless Steel
Juices – Fruit/Vegetable	1K	1K	316 Stainless Steel	316 Stainless Steel
Lithium Chloride	1K	1K	N.A.	Carpenter 20
Magnesium Chloride	1K	1K	316 Stainless Steel	Carpenter 20
Magnesium Hydroxide	2.2K	450	316 Stainless Steel	N.A.
Mayonnaise	5K	200	316 Stainless Steel	316 Stainless Steel
Mercuric Chloride	90K	11	N.A.	Titanium
Milk	1K	1K	316 Stainless Steel	316 Stainless Steel
Molasses	10K	100	316 Stainless Steel	316 Stainless Steel
Mustard	1K	1K	316 Stainless Steel	316 Stainless Steel
Oil – Soluble	10K	100	N.A.	316 Stainless Steel
Paper Stock	5K	200	Titanium	N.A.
Photographic Solutions	1K	1K	316 Stainless Steel	Hastelloy C
Plating Solutions	2.2K	450	N.A.	316 Stainless Steel
Potassium Chloride	1K	1K	316 Stainless Steel	Titanium
Salts – Chemical	2.2K	450	Monel	N.A.
Sewage	5K	200	316 Stainless Steel	316 Stainless Steel
Silver Nitrate	1K	1K	316 Stainless Steel	Carpenter 20
Soap Foam	18K	50	316 Stainless Steel	316 Stainless Steel
Sodium Carbonate	2.2K	450	316 Stainless Steel	Monel
Sodium Hydroxide	1K	1K	316 Stainless Steel	Hastelloy B
Soups	1K	1K	316 Stainless Steel	316 Stainless Steel
Starch Solutions	5K	200	316 Stainless Steel	316 Stainless Steel
Vinegar – Aqueous	2.2K	450	316 Stainless Steel	Carpenter 20
Water – Carbonated	3K	330	316 Stainless Steel	316 Stainless Steel
Water – Condensate	18K	50	Brass	316 Stainless Steel
Water – Chlorinated	5K	200	316 Stainless Steel	Monel
Water – Distilled	450K	2	Brass	316 Stainless Steel
Water – Deionized	2.0M	0.5	Brass	316 Stainless Steel
Water – Hard/Natural	5K	200	Brass	316 Stainless Steel
Water – Salt	2.2K	450	Monel	N.A.
Water – R.O.	18M	0.056	N.A.	N.A.
Wine	2.2K	450	316 Stainless Steel	316 Stainless Steel
Zinc Chloride	1K	1K	Carpenter 20	Titanium
Zinc Sulfate	2.2K	450	316 Stainless Steel	Titanium

Notes:

1. Less than .020" erosion per year.
  2. Less than .002" erosion per year.
  3. Liquid concentration and temperature will affect conductivity and material erosion rate. Contact factory for detailed information.
- N.A. – No material available with this erosion rate.

# Series 16 Modules Controls – Solid State Plug-In Modules

- ▶ Compact Size
- ▶ Modular Plug-in Design
- ▶ Various Time Delays
- ▶ Low Voltage Sensor
- ▶ Solid State Reliability
- ▶ LED Monitoring
- ▶ U.L. “Motor Control”

## Series 16M – General Purpose Control

- New Microprocessor Design

Designed for either differential or single-level service. U.L. “Motor Controller” listing, 8 pin socket with screw-type connections make the unit easy to install and service. Sensitivity of up to 1 million ohm/cm.

## Series 16HM – High Sensitivity Control

Series 16HM is similar to Series 16M but provides higher sensitivity up to 5.5 million ohm/cm. Probe voltage is 12 VDC for applications with low conductive media.

## Series 16DM – DPDT Load Contact

Similar to Series 16M but with DPDT load contacts. Eliminates the need for slave relays. 11 pin octal plugs. Requires little panel space. General purpose single-level or differential applications. U.L. listed.

## Series 16VM – Field Selectable Sensitivity

Similar to Series 16M but with the added flexibility of field adjustable sensitivity, made possible through external setpoint resistors. Uses 11 pin octal socket. U.L. listed.

## Specifications

<b>Contact Design</b>	
Series 16M & 16HM	1 N.O. & 1 N.C. (1 form C)
Series 16DM	2 N.O. & 2 N.C. (2 form C)
Series 16VM	1 N.O. & 1 N.C. (1 form C)
<b>Contact Rating (120. 240 VAC)</b>	
Series 16M & 16HM	10 amp Resistive 1/3 hp
Series 16DM	5 amp Resistive 1/10 hp
Series 16VM	10 amp Resistive 1/3 hp
<b>Mode of Operation</b>	Direct/Inverse, factory set
<b>Sensitivity</b>	
Series 16M	0-1M ohm, factory set
Series 16HM	0-5.5M ohm, factory set
Series 16DM	0-1M ohm, factory set
Series 16VM	0-1M ohm, field adjustable
<b>Primary Voltage</b>	24 VAC, 120 VAC, 240 VAC (+10%/-15%) 208/240: 187 V min. to 255 V max. VAC 50/60 Hz
<b>Secondary Voltage</b>	
Series 16M	12 VAC, 1.5 mA
Series 16HM	12 VDC
Series 16DM & 16VM	12 VAC, 1.5 mA
<b>Temperature</b>	-40°F to +150°F (-40°C to +65°C)
<b>Approvals</b>	U.L. 508 File #E44426
<b>Terminal Style</b>	Screw connector
<b>Options</b>	Time Delays



Series 16M/16HM

Series 16DM/16VM

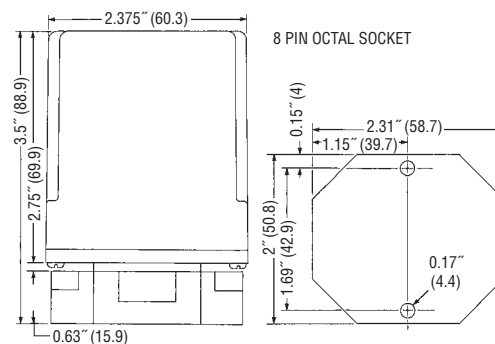


## Applications

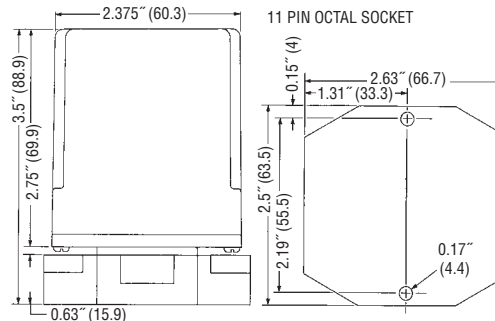
- Single-Level Service
- Point Level
- Valve Control
- Differential Service
- Alarms
- Pump Control

## Dimensions

### Series 16M & 16HM



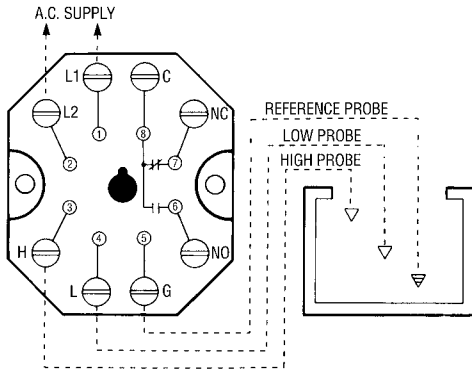
### Series 16DM & 16VM



Note: Controls also available with DIN mount socket.

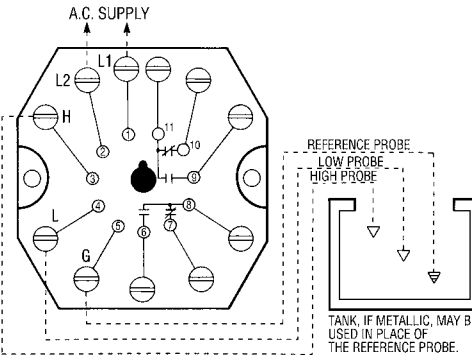
## Wiring

### Series 16M & 16HM

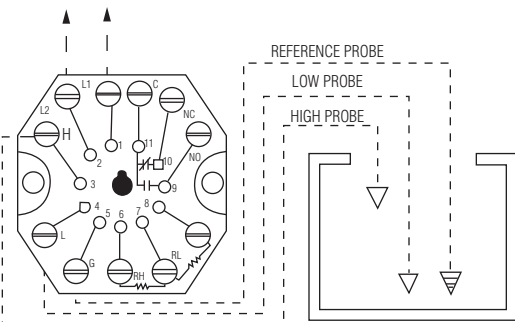


Note: For single level service, use "H" and "G" connections.

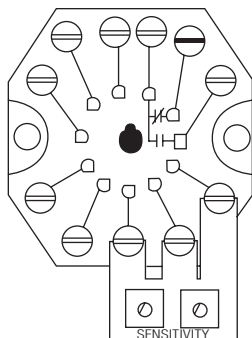
### Series 16DM



### Series 16VM



### Variable Sensitivity Option



Part number 16Z1VG Potentiometer Board available for 16VM only. Consult factory.

## How to Order

Use the **Bold** characters from the chart below to construct a product code.

### 16M Series – Microprocessor Version

1. Series	<b>16M</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>XX</b>	<b>XX</b>
2. Mode of Operation	<b>Direct</b>	<b>Inverse</b>						
	<b>A</b> – 4.7K <b>B</b> – 10K <b>C</b> – 26K <b>D</b> – 50K	<b>E</b> – 100K <b>F</b> – 470K <b>G</b> – 1M	<b>K</b> – 4.7K <b>L</b> – 10K <b>M</b> – 26K <b>N</b> – 50K	<b>P</b> – 100K <b>R</b> – 470K <b>S</b> – 1M				
3. Supply Voltage	<b>1</b> 120 VAC; <b>2</b> 240 VAC; <b>3</b> 24 VAC; <b>8</b> 208/240 VAC							
4. Socket Style*	<b>A</b> 8 Pin Octal <b>B</b> 8 Pin DIN							
5. Enclosure	<b>0</b> None; <b>1</b> NEMA 1; <b>4</b> NEMA 4							
6. Time Delay (increasing level) Option	<b>00-90</b> seconds <b>Blank</b> 0 seconds							
7. Time Delay (decreasing level) Option	<b>00-90</b> seconds <b>Blank</b> 0 seconds							
8. Time Out Option	See page E-11, Chart A							

\*See page E-11 for descriptions.

### 16 HM, 16DM or 16VM Series

1. Series	<b>16HM</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>XX</b>	<b>XX</b>
2. Mode of Operation <sup>2</sup>	<b>Direct</b>	<b>Inverse</b>					
	<b>A</b> – 4.7K <sup>4</sup> <b>B</b> – 10K <sup>4</sup> <b>C</b> – 26K <sup>4</sup> <b>D</b> – 50K <sup>4</sup> <b>E</b> – 100K <sup>4</sup>	<b>F</b> – 470K <sup>4</sup> <b>G</b> – 1M <sup>4</sup> <b>H</b> – 3M <sup>3</sup> <b>J</b> – 5.5M <sup>3</sup> <b>Y</b> – 0-700K <sup>5,7</sup>	<b>K</b> – 4.7K <sup>4</sup> <b>L</b> – 10K <sup>4</sup> <b>M</b> – 26K <sup>4</sup> <b>N</b> – 50K <sup>4</sup> <b>P</b> – 100K <sup>4</sup>	<b>R</b> – 470K <sup>4</sup> <b>S</b> – 1M <sup>4</sup> <b>T</b> – 3M <sup>3</sup> <b>W</b> – 5.5M <sup>3</sup> <b>Z</b> – 0-700K <sup>5,7</sup>			
3. Supply Voltage	<b>1</b> 120 VAC; <b>2</b> 240 VAC; <b>3</b> 24 VAC; <b>8</b> 208/240 VAC						
4. Socket Style	<b>A</b> 8 Pin Octal (16M & 16HM), 11 Pin Octal (16DM & 16VM); <b>B</b> DIN Mount; <b>M</b> None, Module Only <sup>6</sup>						
5. Enclosure	<b>0</b> None; <b>1</b> NEMA 1; <b>4</b> NEMA 4						
6. Time Delay (increasing level) Option	<b>01-20</b> seconds; <b>0V</b> variable (16VM only)						
7. Time Delay (decreasing level) Option	<b>01-20</b> seconds; <b>0V</b> variable (16VM only)						

#### Notes:

- 16VM select modes **A**, **K**, **Y** or **Z** only.
- 16HM & 16DM only. Series 16VM includes full set of the resistors listed above. Specify a sensitivity to determine mode of operation.
- 16VM only.
- All Series except 16HM.
- 16VM only.
- Socket style M requires enclosure **0** – None.
- Mounting style A (11 pin octal only)

Socket Details and Option Availability are located on web site.



## Series 16 – Open Circuit Board Controls

- ▶ Solid State Reliability
- ▶ Spade Terminals
- ▶ Time Delays Available
- ▶ U.L. “Motor Control”
- ▶ Optional Dirty Electrode Detection\*
- ▶ AC Current Minimizes Electrolysis
- ▶ Compact Size
- ▶ Low-Voltage Sensor
- ▶ LED Monitoring

### Series 16 – General Purpose Control

- New Microprocessor Design

Engineered for general purpose single-level or differential applications, these economy priced controls have spade terminals for easy wiring and provide sensitivities up to 1 million ohm/cm.

### Series 16D – DPDT Load Contacts

Same features and specifications as Series 16, but these controls also have DPDT load contacts to eliminate the need for slave relays.



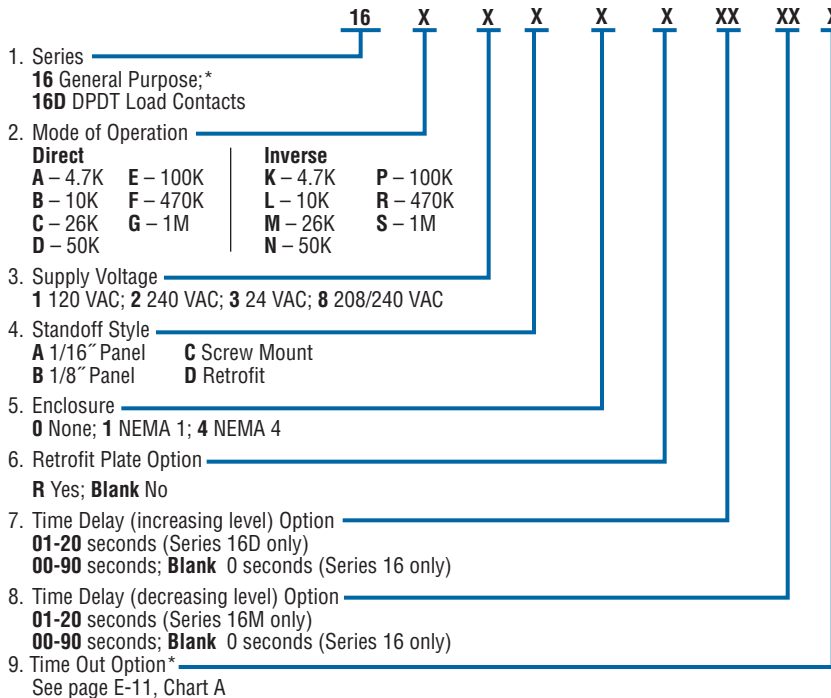
Series 16

### Specifications

<b>Contact Design</b>	
<b>Series 16</b>	1 N.O. & 1 N.C. (1 form C)*
<b>Series 16D</b>	2 N.O. & 2 N.C. (2 form C)
<b>Contact Rating (120, 240 VAC)</b>	
<b>Series 16</b>	10 amp Resistive 1/3 hp*
<b>Series 16D</b>	5 amp Resistive 1/10 hp
<b>Mode of Operation</b>	
Direct/Inverse, factory set	
<b>Sensitivity</b>	
0-1M ohm, factory set	
<b>Primary Voltage</b>	
120 VAC, 240 VAC, 24 VAC, 208 VAC (+10%/-15%) 50/60 Hz	
208/240: 187 V min. to 255 V max. VAC 50/60 Hz	
<b>Secondary Voltage</b>	
12 VAC, 1.5 mA	
<b>Temperature</b>	
-40°F to +150°F (-40°C to +65°C)	
<b>Approvals</b>	
U.L. 508 File # E44426	
<b>Terminal Style</b>	
Spade connection	
<b>Options</b>	
Time Delays, Retrofit Plate, Time Out.	
See page E-11 for descriptions.	

### How to Order

Use the **Bold** characters from the chart below to construct a product code.

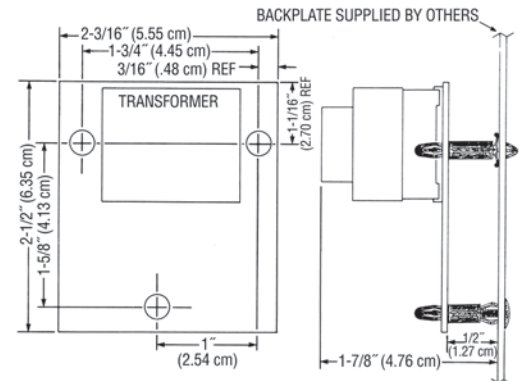


\* New Series 16 Microprocessor Design only.

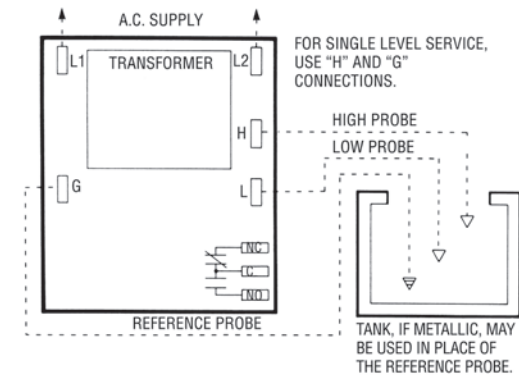
### Applications

- Single-Level Service
- Point Level
- Valve Control
- Low-Water Cutoff
- Differential Service
- Alarms
- Pump Control

### Dimensions



### Wiring



Note: Series 16D similar to Series 16, but with DPDT load contacts.

# Series 26 Modules Low-Water Cutoff – Plug-In Modules

- ▶ Powered Contacts
- ▶ Modular Plug-In Design
- ▶ Low Voltage Sensor
- ▶ 11-Pin Socket
- ▶ U.L. “Limit Control”
- ▶ Optional Dirty Electrode Detection
- ▶ Optional Manual Reset Button Feature.
- ▶ Optional Power Outage Feature Ignores Nuisance Outages and Resets When Power is Restored
- ▶ Solid State Reliability
- ▶ LED Monitoring
- ▶ Time Delays Available
- ▶ Meets CSD1 Requirements
- ▶ Optional Test Feature

## Series 26M – General Purpose Control

Series 26M is designed for low-water cutoff protection. This control meets CSD1 requirements for boiler low water cutoff. Series 26M features powered contacts. If non-powered contacts are required, request information on Series 26NM.

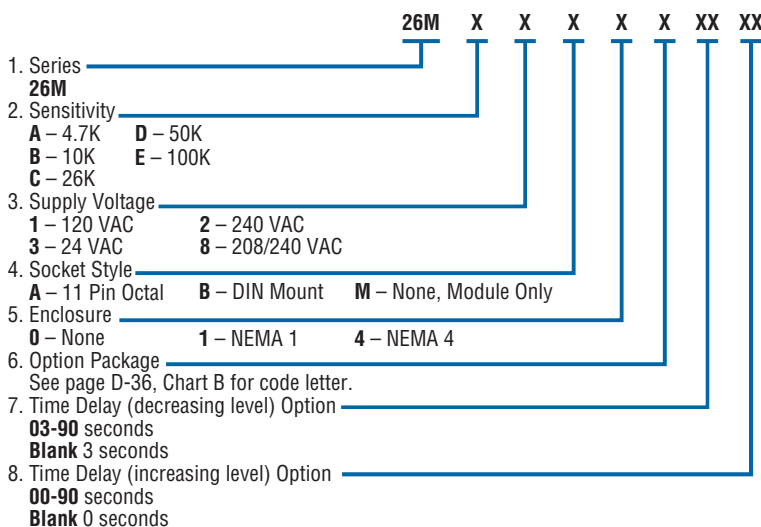
## Specifications

<b>Contact Design</b>	1 N.O. & 1 N.C. (powered)
<b>Contact Rating (24/120/240VAC)</b>	10 amp Resistive 1/3 hp
<b>Mode of Operation</b>	Direct
<b>Sensitivity</b>	0 - 26K ohm, factory set
<b>Primary Voltage</b>	24 VAC, 120 VAC, 240 VAC <sup>1</sup>
<b>Secondary Voltage</b>	12 VAC
<b>Temperature</b>	-40°F to +150°F (-40°C to +65°C)
<b>Approvals<sup>1</sup></b>	U.L. 353 File # MP1430
<b>Terminal Style</b>	Screw connector
<b>Options</b>	Time Delays, Power Outage, Manual Reset, Test Feature, Dirty electrode detection; See page E-11 for descriptions

Notes:  
1. 240 VAC and 208/240 VAC units do not carry U.L. Limit Control recognition.

## How to Order

Use the **Bold** characters from the chart below to construct a product code.

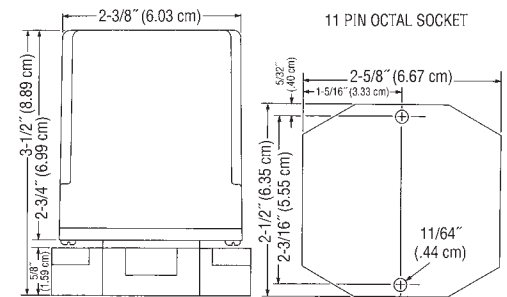


Series 26M

## Applications

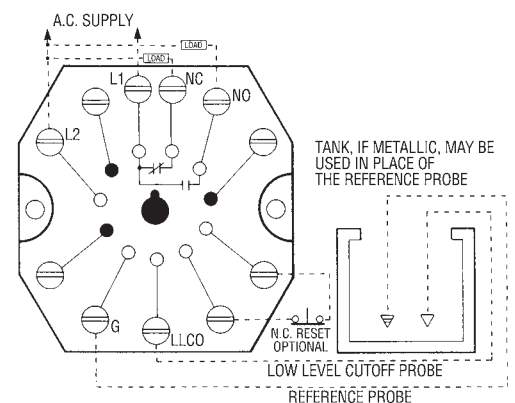
- Low-Water Cutoff
- Point Level
- Alarms

## Dimensions



Note: Controls also available with DIN mount socket.

## Wiring



Caution: Contacts are powered. If non-powered contacts are required, request information on Series 26NM.

Socket Details and Option Availability are located on web site.

## Series 26 Low Water Cutoff – Standoff Mount

- ▶ Meets CSD1 Requirements
- ▶ Non Powered Contacts
- ▶ Time Delays Available
- ▶ LED Monitoring
- ▶ Test Feature
- ▶ AC Current Minimizes Electrolysis
- ▶ Optional Dirty Electrode Detection
- ▶ Snap-Thru Standoff Mounting
- ▶ Compact Size
- ▶ Power Outage Feature
- ▶ U.L. “Limit Control”

### Series 26 – General Purpose Control

Designed for boiler low-water cutoff protection. A snap-through standoff mounting device is available for Series 26 units. Optional Power Outage feature resets after nuisance outages. Optional reset button is used when device has been deactivated because of low water condition. Reset is functional only if water has returned to normal level. Built-in 3 second time delay is standard. Up to 90 seconds available for increasing and decreasing levels.

### Specifications

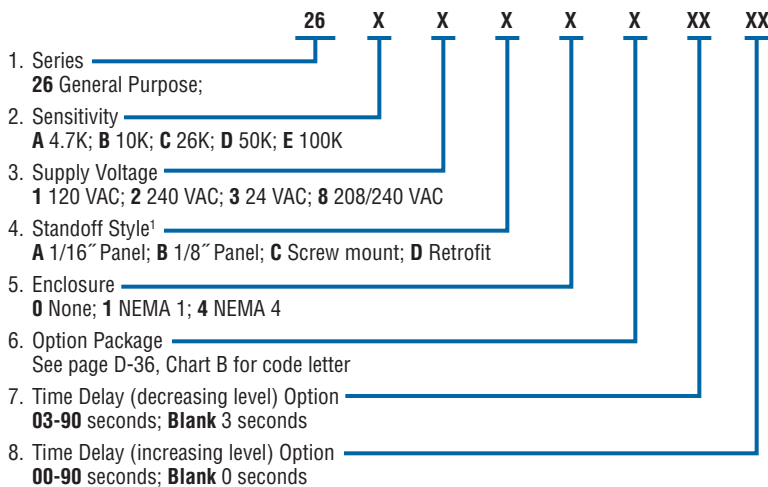
<b>Contact Design</b>	1 N.O. & 1 N.C. (1 form C)
<b>Contact Rating</b>	10 amp Resistive 1/3 hp at 120, 240 VAC
<b>Mode of Operation</b>	Direct
<b>Sensitivity</b>	0-100K ohm, factory set
<b>Primary Voltage</b>	120 VAC, 240 VAC <sup>1</sup> , 24 VAC, 208/240 VAC (+10%/-15%) 50/60 Hz
<b>Secondary Voltage</b>	12 VAC, 1.5 mA
<b>Temperature</b>	-40°F to +150°F (-40°C to +65°C)
<b>Approvals<sup>1</sup></b>	U.L. 353, U.L. 508 File # MP1430
<b>Terminal Style</b>	Spade connection
<b>Options</b>	Time Delays, Power Outage, Retrofit Plate, Test Feature, Dirty Electrode Detection; See page E-11 for descriptions

Notes:

1. 240 VAC and 208/240 VAC are not U.L. recognized

### How to Order

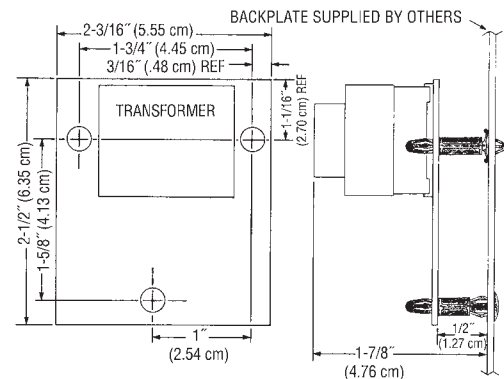
Use the **Bold** characters from the chart below to construct a product code.



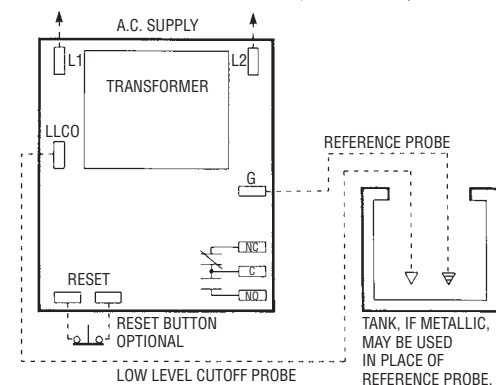
### Applications

- Low-Water Cutoff
- Point Level
- Valve Control
- Single-Level Service
- Alarms
- Pump Control

### Dimensions



### Wiring



Socket Details and Option Availability are located on web site.

# Series DF Dual Function Controls

- ▶ Solid State Reliability
- ▶ Compact Size
- ▶ Meets CSD1 Requirements
- ▶ U.L. “Motor Control”
- ▶ AC Current Minimizes Electrolysis
- ▶ Optional Test Feature
- ▶ Optional Dirty Electrode Detection
- ▶ Spade Terminals for Easy Wiring
- ▶ Manual Reset (optional)
- ▶ Power Outage Feature (optional)
- ▶ U.L. “Limit Control”
- ▶ Time Out Option

Dual function Series DF models are designed to control two independent level functions, one single-level control operation and one differential-level operation.

Optional Power Outage feature resets after nuisance outages. Optional Reset Button is used when device has been deactivated due to low water condition. Reset is activated only after water has returned to normal level. This control is ideal in applications on boilers, food service equipment, and chemical delivery systems.

## Specifications

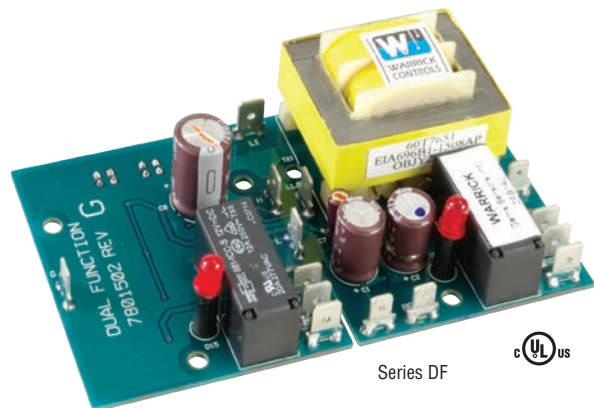
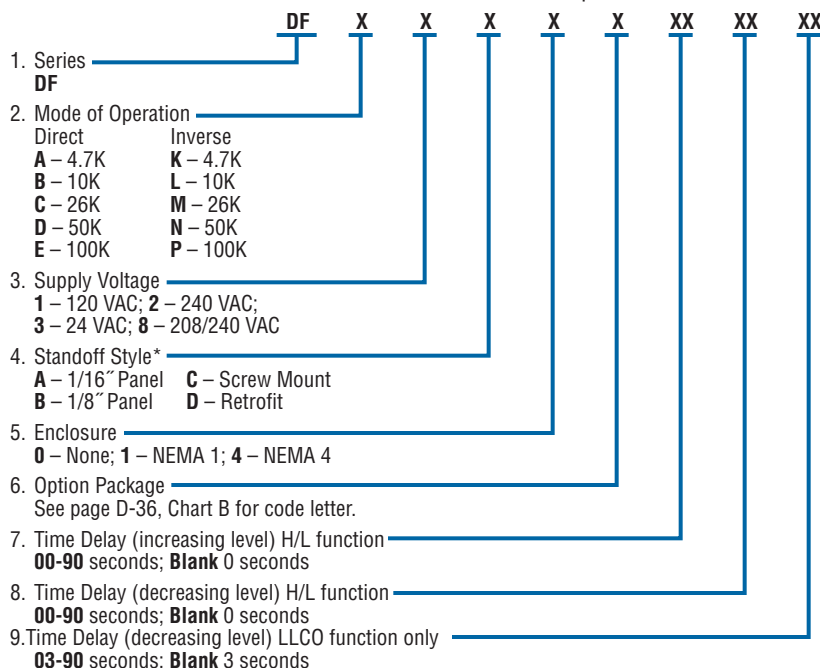
<b>Contact Design</b>	1 N.O. & 1 N.C. (1 form C) extra function
<b>Contact Rating (120, 240 VAC)</b>	10 amp Resistive 1/3 hp
<b>Mode of Operation</b>	H/L Direct/Inverse, LLCO – factory set
<b>Sensitivity</b>	0-26K ohm, factory set
<b>Primary Voltage</b>	120 VAC, 240 VAC <sup>1</sup> , 24 VAC (+10%/-15%) 208/240: 187 V min. to 255 V max. VAC 50/60 Hz
<b>Secondary Voltage</b>	12 VAC
<b>Temperature</b>	-40°F to +150°F (-40°C to +65°C)
<b>Approvals</b>	U.L. 508 File # E44426, U.L. 353 File # MP1430
<b>Terminal Style</b>	Spade connection
<b>Options</b>	Time Delays, Manual Reset, Power Outage, Retrofit Plate, Test Feature, Dirty Electrode Detection; See page E-11 for descriptions

**Notes:**

- 240 VAC and 208/240 VAC units do not carry U.L. Limit Control recognition.

## How to Order

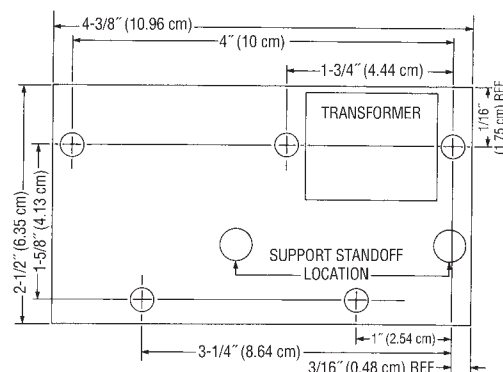
Use the **Bold** characters from the chart below to construct a product code.



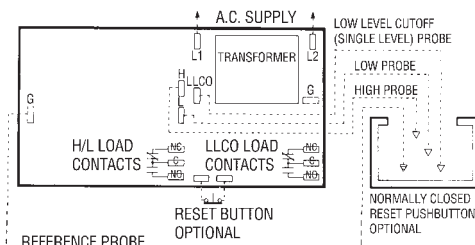
## Applications

- Dual Function
- Single-Level Service
- Differential Service
- Feedwater Control / Low-Water Cutoff
- High Level / Low Level
- Pump Down / High Level

## Dimensions



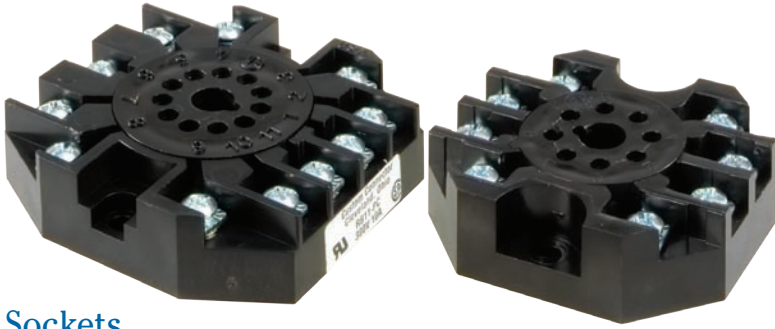
## Wiring



Note: For single level service, use “H” and “G” connections.

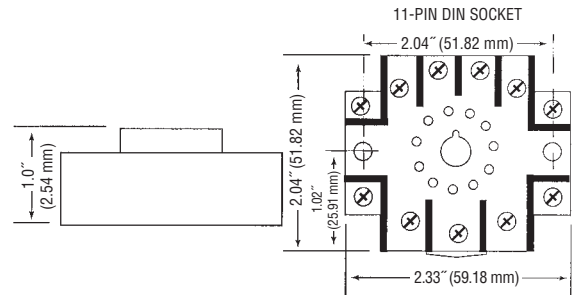
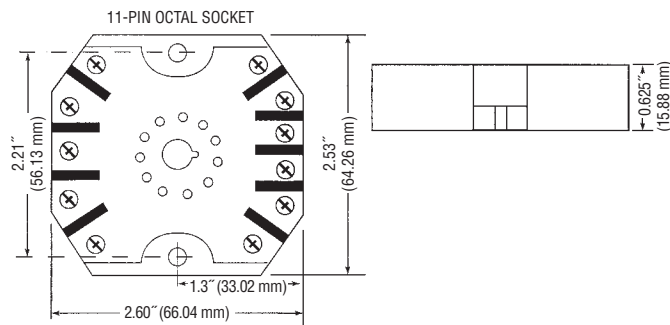
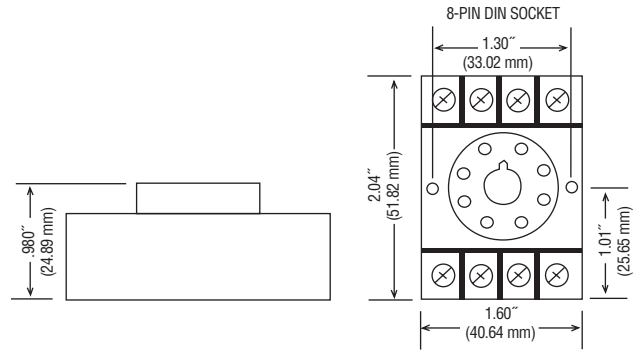
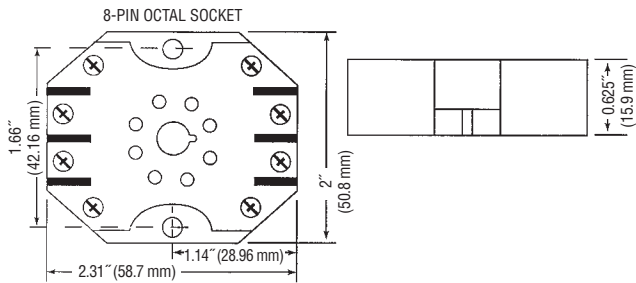
Socket Details and Option Availability are located on web site.

# Sockets and Standoffs – 16, 26 and DF Series Only



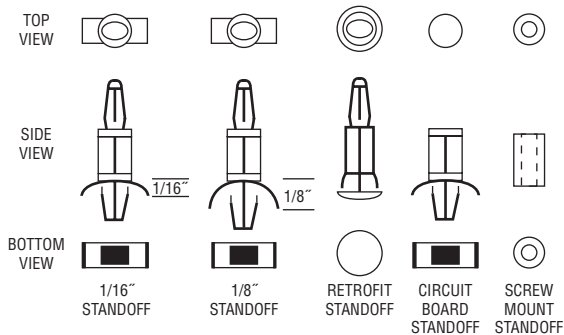
## Sockets

Warrick provides four different types of sockets for use with plug-in control modules.



## Standoffs

Warrick provides four different types of standoffs designed to connect circuit boards to panels.





# Optional Character Reference – 16, 26 and DF Series Only

## Manual Reset

**Available on Series 26, 26M and DF controls**

(Normally closed pushbutton across reset terminals. Pushbutton ordered separately): Manual reset only applies to the function associated with terminal LLCO. When the liquid rises to the electrode on terminal LLCO, the control will remain de-energized (load contacts in original state) until the pushbutton is depressed. The control will then energize, (LED will be lit) changing the state of the contacts. The control remains energized until the liquid level recedes below electrode on terminal LLCO. The control then de-energizes, (LED will go off) returning load contacts to their original state. Unless otherwise specified, there is a three second time delay on decreasing level. Liquid must be below probe on terminal LLCO for full three seconds before control de-energizes.

## Manual Reset with Power Outage Feature

**Available on Series 26, 26M, and DF controls**

Reset (Normally closed pushbutton across reset terminals. Pushbutton ordered separately) Control will ignore power loss to control. With liquid in contact with electrode on terminal LLCO, a power outage will cause the control to de-energize, but will automatically energize upon return of power. However, loss of liquid will cause control to de-energize and remain so until liquid again rises to electrode and pushbutton is depressed.

## Time Delays Associated with Terminals H and L

**Available on Series 16, 16M, and DF controls**

With time delay on increasing level, the liquid must be in contact with the high electrode for the full duration of the time delay before control will operate. With delay on decreasing level, the liquid must be below the low electrode for the full duration of the time delay before control will operate. In single level service, terminals 3 and 4 must be jumpered together to achieve time delays on both increasing and decreasing levels or just decreasing level.

## Time Delays Associated with Terminal LLCO

**Available on Series 26, 26M, and DF controls**

3 Second time delay on decreasing level is standard. Delay up to 90 seconds, can be specified and would act in the same manner as listed above.

## Time Out Option

**Available on Series 16, 16M, and DF controls**

The latching circuit for the high and low electrode has an optional timer. In some applications the High or Low electrode may become short circuited or disconnected. Such an occurrence may potentially over fill in fill applications, or cause the pump to run dry in pump down applications. The time option is custom programmed up to 3 minutes. When a fault condition occurs, the FILL LED will have a blink sequence of .5 seconds on 2 seconds off. See Chart A for time delay options.

## Test Feature

**Available on Series 26, 26M, and DF controls**

Allows LLCO circuit to be tested. Holding down the reset button for 3 seconds will allow the LLCO circuit to trip which simulates the loss of water, without the need of draining the water level in the boiler. The control will return to normal operation once the reset button is pressed a second time. (Test feature option only available with the manual reset function.)

Chart A – Time Out Option

Optional Character	Time Out (in seconds)					
	30	60	90	120	150	180
A						
B	•					
C		•				
D			•			
E				•		
F					•	
G						•
K	•					
L		•				
M			•			
N				•		
P					•	
Q						•

Chart B – Optional Character Information

Reset Function	Option Components				Control Series	Optional Character
	Normally Closed Pushbutton*	Power Outage	Retrofit Plate	Test Feature		
•					DF "LLCO"	D
	•				26, 26M, 26NM	C
		•			26, 26M, 26NM	E
			•		16, 16D, 26, DF	R
•	•				DF "LLCO"	S
•		•			DF "LLCO"	K
•			•		DF	W
•				•	26, 26M, 26NM, DF"LLCO"	B
	•	•			26, 26M, 26NM	F
		•	•		26	N
•	•	•			DF "LLCO"	G
•	•		•		DF	T
•	•			•	26, 26M, 26NM, DF"LLCO"	Y
•		•	•		DF	L
•		•		•	26, 26M, 26NM, DF"LLCO"	Z
	•	•	•		26	P
•	•	•	•		DF	J
•	•	•		•	26, 26M, 26NM, DF"LLCO"	A
					No options	X

\* N.C. pushbutton when purchased in conjunction with open control must be remotely mounted by customer



# Series 19MR

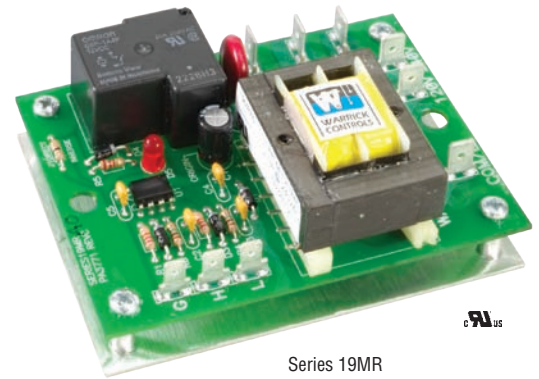
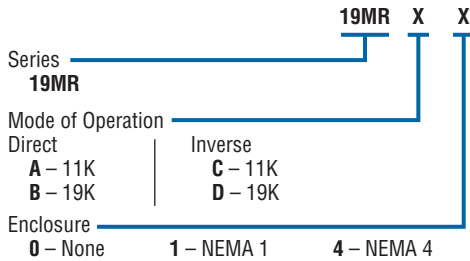
## Direct Motor Load of 30 Amps @ 240 VAC

Series 19MR controls are the ideal choice where pump up or pump down service is necessary. This control eliminates the need for contactors because it can directly handle motors up to 1 HP at 120 VAC, or motors up to 2 HP at 240 VAC.

Enclosures	Optional
Output Contact Rating	30 amp @ 240 VAC
Powered Output Contact	SPST 30 A at supply voltage (120 or 240 VAC)
Horsepower Range	1 hp for 120 VAC; 2 hp for 240 VAC
Terminals	3/16" spade lug on probe connections 1/4" spade lug on power connections
Primary Voltage	120 VAC or 240 VAC (+10%/-15%), 50/60 Hz
Secondary Voltage	11.0 VAC, 1.5 mA
Temperature	-40°F to +150°F (-40°C to +65°C)
Approvals	U.L. 508 File # E44426, Vol. 1 Sec. 6

### How to Order

Use the **Bold** characters from the chart below to construct a product code.

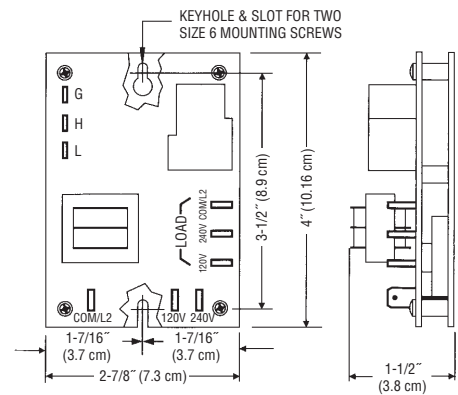


Series 19MR

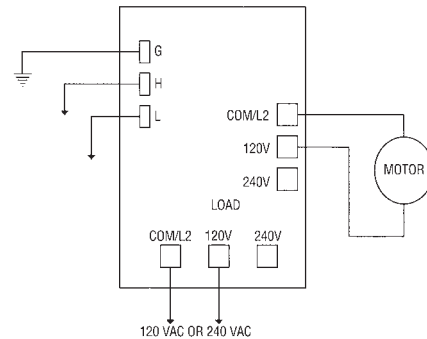
### Applications

- Carbonators
- Appliances
- Sumps
- Low-Water Cutoff
- Direct Motor Load

### Dimensions



### Wiring



**Caution:** 19MR contacts are powered contacts. When power is applied to the 19MR controller, power may be present on relay output connections. Output voltage will be same as input voltage.

## Series DC For Remote Applications

Series DC controls are designed for applications where only direct current power is available. DC units can be used as differential level controls or single point alarm contactors. Because of solid state reliability, plug-in convenience, and choice of 12 or 24 VDC supply voltage, Warrick DC controls can be used with confidence in many applications.

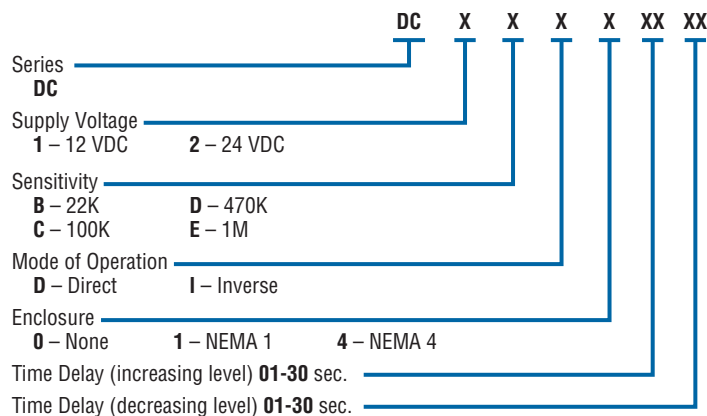
<b>Contact Design</b>	SPDT 1 N.O. & 1 N.C. (1 form C), non-powered contacts
<b>Contact Rating</b>	5 amp @ 30 VDC or 120 VAC Resistive 1/8 hp
<b>Mode of Operation</b>	Direct/Inverse, factory set
<b>Sensitivity</b>	0 - 1M ohm maximum, factory set
<b>Primary Voltage</b>	12 VDC, 24 VDC, negative ground ( $\pm 20\%$ )
<b>Supply Current</b>	40 mA when relay energized, 10 mA w/relay de-energized
<b>Secondary Voltage</b>	12 VDC
<b>Terminal Style</b>	Screw connector
<b>Temperature</b>	-50°F to +150°F (-46°C to +65°C)
<b>Options</b>	Time Delay



Series DC

### How to Order

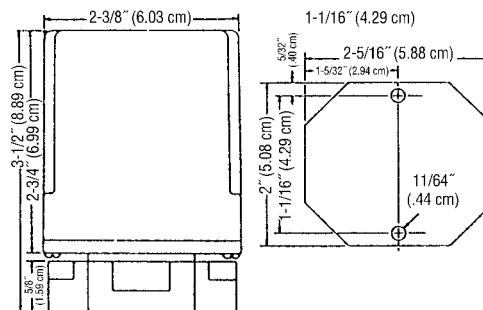
Use the **Bold** characters from the chart below to construct a product code.



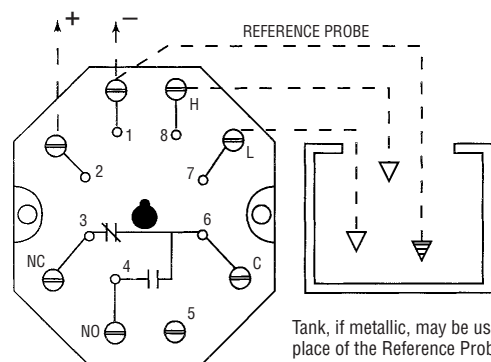
### Applications

- Single and Differential Service
- Solar and Wind Powered Pumps
- Portable Cleaning Equipment
- Battery-Powered Level Control
- Well Pumps
- Remote Reservoirs
- Remote Irrigation
- Onboard Ship Level Control

### Dimensions



### Wiring



Tank, if metallic, may be used in place of the Reference Probe.

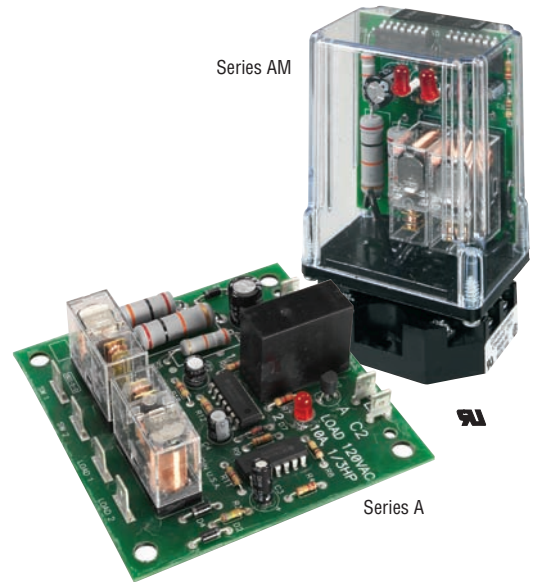
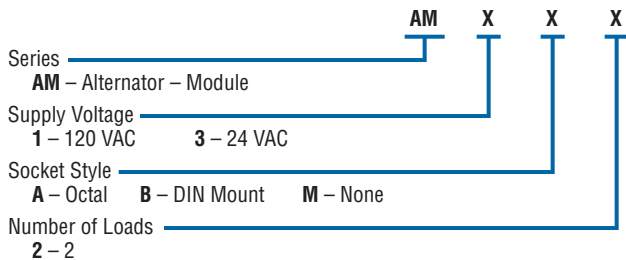
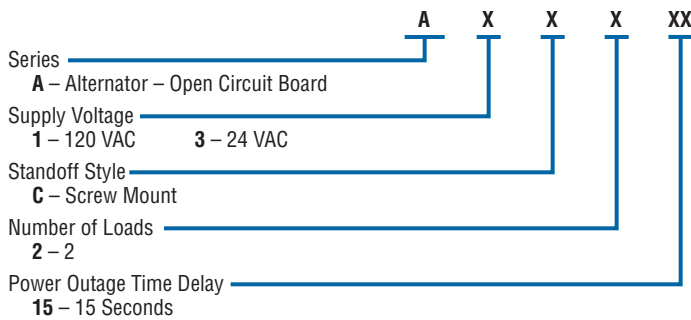
# Series A & AM Solid State Alternators

Series A has an open circuit board design. Series AM provides convenient plug-in design, either octal socket or DIN mount. The housing carries no NEMA rating.

<b>Contact Rating</b>	10 amp @ 120 VAC or 24 VAC Resistive
<b>Primary Voltage</b>	120 VAC, 24 VAC (+10%/-15%) 50/60 Hz
<b>Secondary Voltage</b>	20 mA @ 120 VAC, 80 mA @ 24 VAC
<b>Temperature</b>	-40°F to +150°F (-40°C to +65°C)
<b>Terminal Style</b>	
<b>Series A</b>	1/4" spade
<b>Series AM</b>	Screw connector
<b>Approvals</b>	U.L. 508 Recognized Motor Control

## How to Order

Use the **Bold** characters from the chart below to construct a product code.

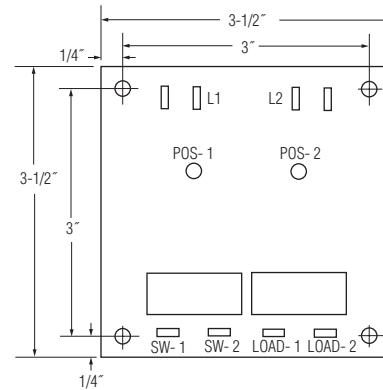


## Applications

- Duplex Pumping
- Single or Dual Switch Operation
- Power Outage Time Delay Available on Open Version (Series A)

## Dimensions

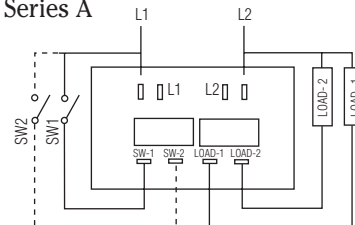
Series A



Series AM dimensions are the same as Series DC above.

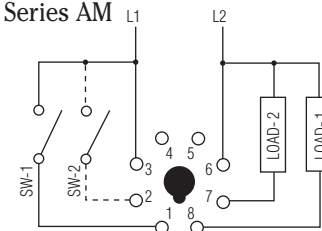
## Wiring

Series A



Note: For ease of wiring, L1 and L2 each have two tabs.

Series AM



# Series 17 and 27 Intrinsically Safe Controls

- ▶ Cannot Ignite Flammable Materials
- ▶ Solid State Reliability
- ▶ Up to 470K Ohm/cm Sensitivity (Series 17)
- ▶ Internal Surge Suppression
- ▶ SPST Contacts (Series 17)
- ▶ SPDT Contacts (Series 27)
- ▶ Can Be Used for Single Level or Differential Service

## Series 17 – FM Approved

Series 17 is FM Approved for use in Class I or II, Division 1, Groups A-G hazardous atmospheres. SPST isolated contacts. Field adjustable sensitivity by use of external resistors.

## Series 27 – UL Approved

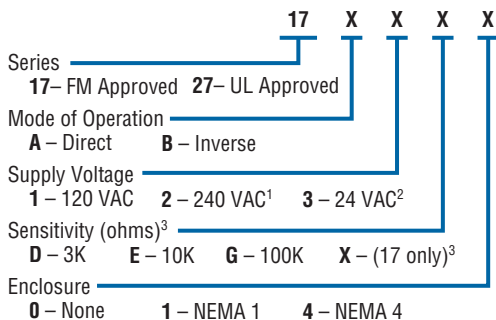
Series 27 is UL approved for use in Class I, Groups A, B, C, D; Class II, Groups E, F, G; and Class III hazardous locations. SPDT output contacts. UL Pilot Duty rated.

## Specifications

<b>Contact Design</b>	
Series 17	1 N.O. & 1 N.C. Isolated Contacts
Series 27	1 N.O. & 1 N.C. (1 form C)
<b>Contact Rating (24/120/240VAC)</b> 8 amp Resistive	
<b>Mode of Operation</b> Direct/Inverse, factory set	
<b>Sensitivity</b>	
Series 17	0-470K ohm, field adjustable
Series 27	0-100K ohm, factory set
<b>Primary Voltage</b>	
Series 17	24 VAC, 120 VAC, 240 VAC (+10%/-15%) 50/60 Hz
Series 27	120 VAC, 240 VAC (+10%/-15%) 50/60Hz
<b>Secondary Voltage</b>	
Series 17	13 VAC, 4 mA
Series 27	11 VAC, 2.3 mA
<b>Temperature</b> -40°F to +150°F (-40°C to +65°C)	
<b>Approvals</b>	
Series 17	FM File # 1G9A1.AX
Series 27	U.L. 913 File # E44570
<b>Connections</b> All screw type connections	

## How to Order

Use the **Bold** characters from the chart below to construct a product code.



- Notes:
- 240V standard in Series 17. Non-standard, but available in Series 27.
  - 24V available only in Series 17.
  - Series 27 only. Series 17 includes a full set of resistors (3.3K, 4.7K, 10K, 47K, 100K, 220K, 470K ohms) to allow modification of sensitivity in the field. Product code symbol in this position for Series 17 is "X."



Series 17



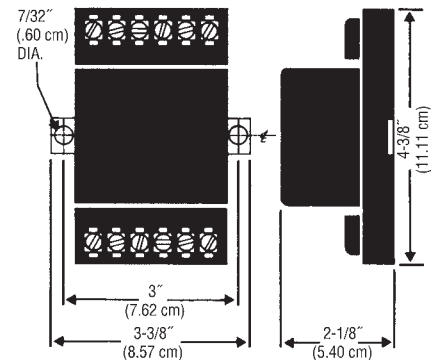
Series 27



## Applications

- Hazardous Atmospheres
- Pumps
- Waste Treatment
- Alarms
- Sewage
- CP Industry

## Dimensions



# Series 47 4-Channel Relay, Alarm Panel Control

- ▶ Solid State Reliability
- ▶ 0-50K Ohm/cm Sensitivity
- ▶ Alarm Contacts for Audible and Visual Alarms
- ▶ 4 Channel Relay
- ▶ Removable Terminal Strips
- ▶ Inverse or Direct Acting Field Selectable
- ▶ U.L. Recognized

Series 47 controls offer complete alarm panel control in a single package. Powered output contacts allow quick connection of lights and audible alarms. Test and silence functions are built in. Unit also carries one SPDT master alarm contact for remote alarm activation.

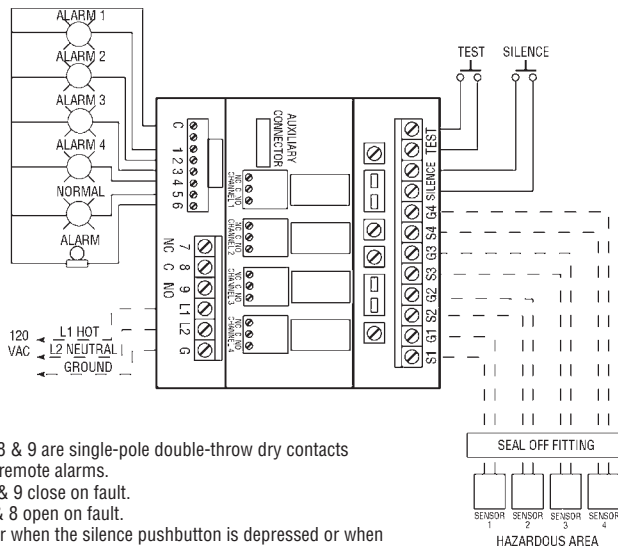
Approved for Class I, II, III, Division 1, Groups C, D, E, F, G hazardous atmospheres, Series 47 controls supply four channels which can be used with conductivity liquid level sensors or dry contact sensors.

This device functions as an alarm or single point control. Field adjustable for direct or inverse operation, it can operate separate visual alarms with a common audible alarm channel. Silence and test terminals are standard. For additional lights, alarms or outputs, auxiliary contacts must be ordered.

## Alarm Specifications

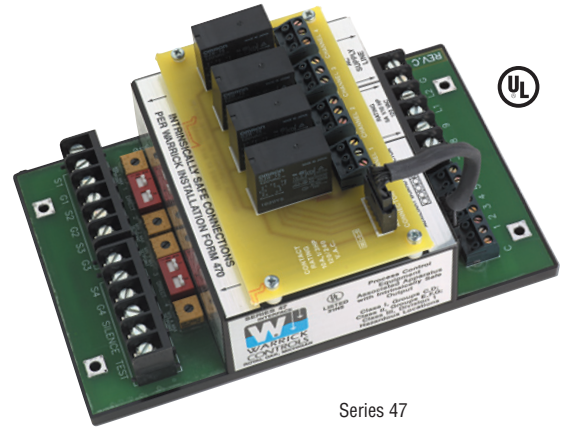
<b>Contact Design</b>	SPDT 1 N.O. & 1 N.C.
<b>Master Alarm Contact Rating (30VDC, 120/240VAC)</b>	5 amp Resistive, 1/10 hp
<b>Indicator Contacts</b>	Powered 120 VAC 25mA
<b>Indicator Contacts for Audible Alarm</b>	Powered 120 VAC 5A
<b>Auxiliary Contacts (optional)</b>	SPDT 120 VAC 10A (not powered)
<b>Sensitivity</b>	0-50K ohm maximum specific resistance
<b>Primary Voltage</b>	120 VAC (+10%/-15%) 50/60 Hz
<b>Secondary Voltage</b>	12 VAC @ 6mA RMS
<b>Temperature</b>	-40°F to +150°F (-40°C to +65°C)
<b>Approvals</b>	U.L. 913 File # E44570

## Wiring



**Notes:**

1. Terminals 7, 8 & 9 are single-pole double-throw dry contacts designed for remote alarms.
2. Terminals 8 & 9 close on fault.
3. Terminals 7 & 8 open on fault.
4. Contacts clear when the silence pushbutton is depressed or when the fault condition is cleared.

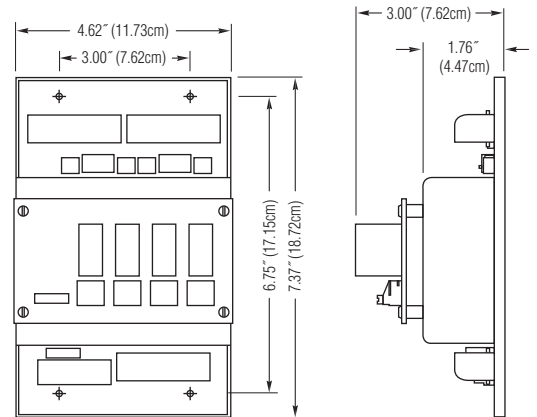


Series 47

## Applications

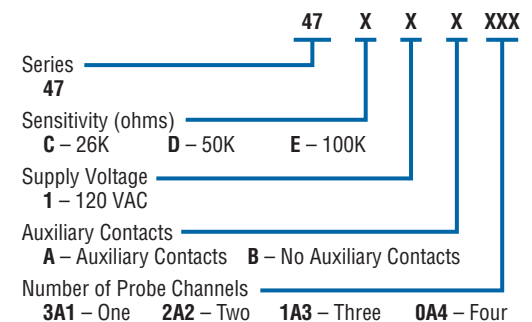
- Hazardous Atmospheres
- Monitoring and Control
- Storage Tank Alarm Panels
- Input for Computer
- Input for Phone Dialer

## Dimensions

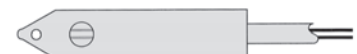


## How to Order

Use the **Bold** characters from the chart below to construct a product code.



See Our Interstitial Tank Monitoring Products on page A-22.





# Series 67 Multi-Function Control Duplex Pump System Control

- ▶ Inverse or Direct Acting, Field Selectable
- ▶ Solid State Reliability
- ▶ Compact Size
- ▶ Four Independent Channels – 2 Single, 2 Differential
- ▶ Field Adjustable, Sensitivity and Mode Selection
- ▶ LED Channel Indicators
- ▶ Built-in Silence/Acknowledge Circuit
- ▶ U.L. “Intrinsically Safe”

Warrick's Series 67 four channel level control is an ideal solution to liquid level problems in hazardous applications for the sewage, waste water, chemical and groundwater remediation industries.

Connected to floats or conductance probes this versatile control provides simplex or duplex pump/solenoid valve control; automatic or manual alternation; high and/or low level alarms with silence/acknowledge capabilities.

The Series 67 can be used in hazardous applications as an intrinsically safe interface to non-powered contacts and sensors such as push button operators, limit, temperature, pressure and vacuum switches.

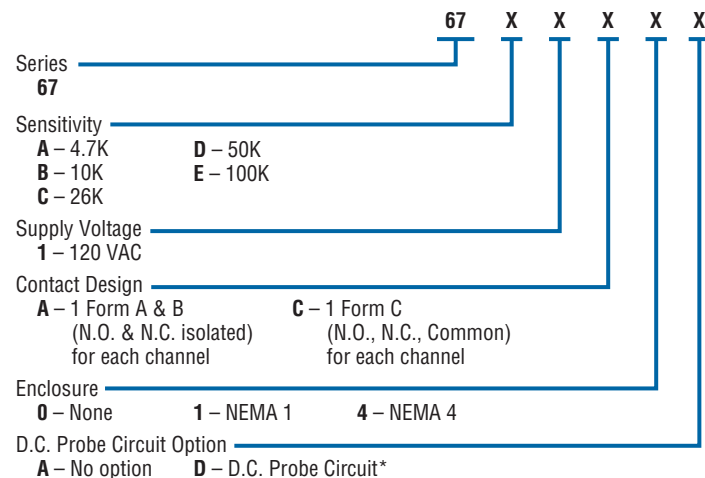
Designed for hazardous applications, its low cost, integrated features and compact size also make it ideal for non-hazardous applications.

## Specifications

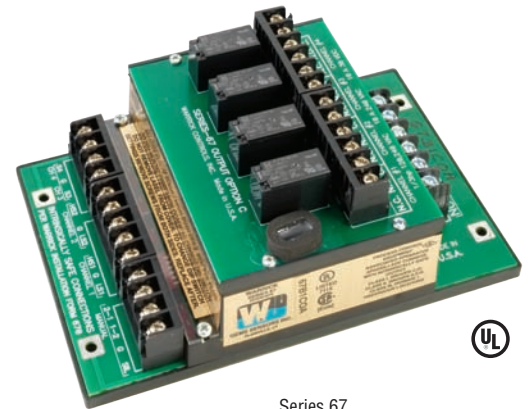
<b>Contact Design</b>	Standard N.O., N.C. (form C); Optional N.O., N.C.
<b>Contact Rating (30VDC, 120/240VAC)</b>	10 amp (style C); 5 amp (style A)
<b>Primary Voltage</b>	120 VAC, 50/60 Hz
<b>Secondary Voltage</b>	12 VAC @ 6mA RMS
<b>Sensitivity</b>	4.7K - 100K ohms maximum specific resistance, factory set
<b>Temperature</b>	-40°F to +150°F (-40°C to +65°C)
<b>Approvals</b>	U.L. 913 File # E44570

## How to Order

Use the **Bold** characters from the chart below to construct a product code.



\*Eliminates short cycles

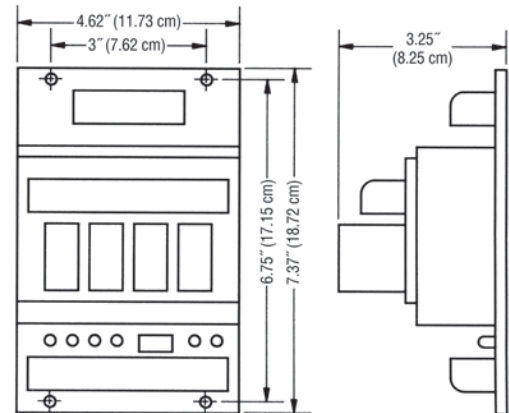


Series 67

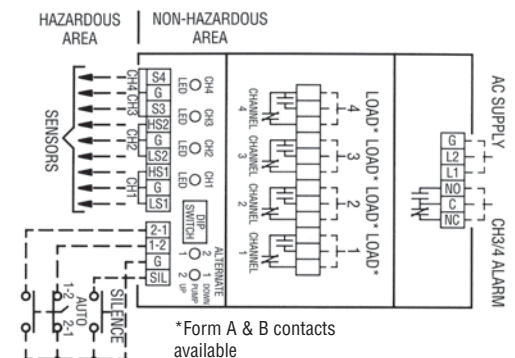
## Applications

- Hazardous Atmospheres
- Multiple Functions
- Simplex or Duplex
- High/Low Level Alarms
- Auto or Manual Alternation
- Pump/Solenoid Valves
- Sewage Lift Stations
- Wastewater Treatment
- Chemical Plants
- Groundwater Remediation

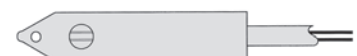
## Dimensions



## Wiring



See Our Interstitial Tank Monitoring Products on page A-22.





# Models 2800 and 2810 Moisture Detectors

- ▶ Neon Warning Lamps
- ▶ Choice of Voltages
- ▶ Pushbutton Test Circuit
- ▶ Easy Screw-in Connections
- ▶ NEMA Enclosures

These Warrick devices are designed to detect seal leaks in submersible, oil-filled pump motors. Using conductivity technology, the Model 2800 moisture detection system signals the presence of water in an oil-filled cavity. When combined with a Warrick 3H fitting installed by pump manufacturer, it will indicate the presence of water in the oil when the pump is operating.

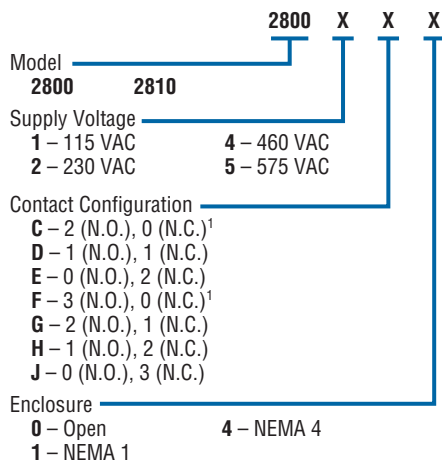
The Model 2810 is similar to the 2800, except it also provides an indicator lamp for outer seal leakage.

## Specifications

<b>Supply Voltage</b>	115 VAC, 230 VAC, 460 VAC, 575 VAC
<b>Secondary Voltage</b>	500 VAC
<b>Connections</b>	All screw type connections
<b>Contact Rating</b>	16 amp Resistive 1 hp

## How to Order

Use the **Bold** characters from the chart below to construct a product code.



Notes:  
 1. 2800 only. On 2810, one (1) N.C. contact is dedicated to outer seal leakage indicator.

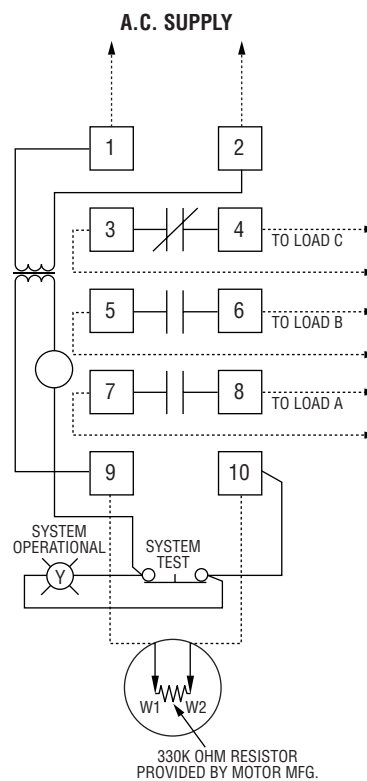


Model 2800

## Applications

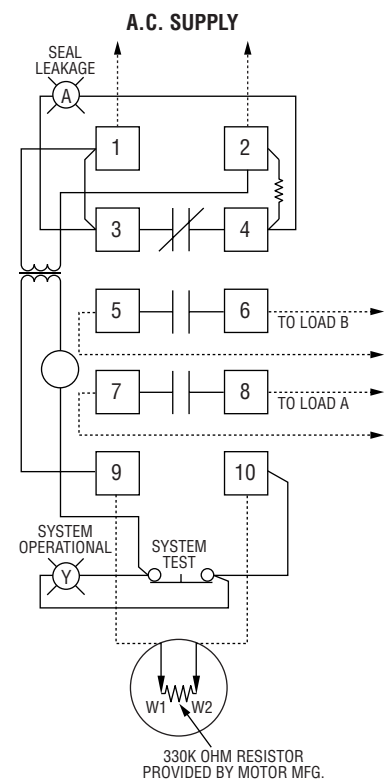
- Submersible Pumps
- Seal Leak Warning
- Preventive Maintenance

## Wiring - 2800



(G contact configuration shown)

## Wiring - 2810



(G contact configuration shown)

# Warrick® Sensor Fittings and Probes

Warrick Liquid Level Sensors are available in single- and multi-probe models and with a variety of fittings. The versatility of the Warrick design makes these sensors ideal for a diverse range of applications.

Examples include:

- Food and Beverage
- Caustics and Acids
- Sumps
- Reservoirs
- Pharmaceuticals
- Boilers and Steam Generators
- Ponds
- Sewage and Wastewater

## Probe Styles

- Metal Rods
- Wire Suspended
- Corrosion Resistant
- Sanitary



## Fitting Styles

- 3/8" to 3" Threaded Mount
- Bracket Mount
- Flange Mount
- External Mount
- Sanitary Mount
- Condulet Mount



## Sensor Selection Chart




SERIES		3E	3N	3F	3G	3C	3K	3J	3L	3M	3MT	3S	3R	3T	3B	3H	3W	3Y
Page Number		E-23	E-23	E-22	E-22	E-26	E-26	E-21	E-21	E-28	E-28	E-27	E-24	E-24	E-23	E-21	E-25	E-25
<b>Body Options</b>	Flange			•	•													
	Pipe Thread	•			•			•										
	Flat Mount		•		•													
	Side Chamber					•	•											
	Non-Contact Electrodes											•						
	Food Grade Connection									•	•							
	Bracket Mount											•						
<b>Fitting Body Material Options</b>	Brass	•	•	•		•		•										
	PVC		•	•	•													
	1018 Carbon Steel			•														
	Stainless Steel	•		•														
	Forged Steel			•														
	Nylon									•	•							
	Cast Iron	•				•	•	•				•						
<b>Housing Material</b>	Coated Aluminum	•	•	•		•	•	•			•							
	Polycarbonate				•													
<b>Number of Probes</b>	1 to 3		•					•										
	1 to 4					•	•			•	•							
	1 to 7	•		•	•							•						
<b>Electrodes</b>	Electrode Only								•				•	•	•	•	•	•

WARRICK CONDUCTIVITY SENSORS

## Designed for OEM

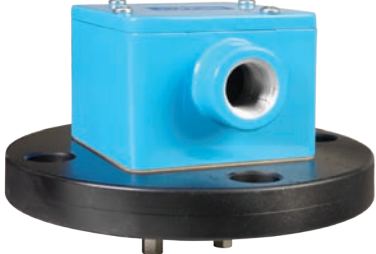

- ▶ Compact
- ▶ One-Piece Probe/Body Construction
- ▶ Quick Install & Connect
- ▶ Order Sized to Your Spec

These Warrick fitting are designed for OEM use. They are shipped ready for quick installation. Integrated probes eliminate pre-assembly tasks, and avoid potential vibration-induced loosening when installed with power tools. Choose from single- or multi-electrode probe series. Gems supplies these series with probes pre-cut to lengths you specify.

Series	3J	3H	3L
			
<b>Probe Quantity</b>	1, 2 or 3	1	1
<b>Mounting Size</b>	1" NPT	3/8" NPT or 5/8" NF/NFE	1/8" NPT
<b>Materials</b>			
<b>Body</b>	Case iron or red brass	316 stainless steel	316 stainless steel
<b>Terminal Housing</b>	Diecast aluminum, epoxy coated (optional)	—	—
<b>Probe</b>	316 stainless steel	316 stainless steel	316 stainless steel
<b>Insulation</b>	Teflon®	Teflon®	Teflon®
<b>Probe Diameter</b>	3/16"	1/4"	3/16"
<b>Pressure/Temperature</b>	0 psig @ 500°F	250 psig @ 406°F	150 psig @ 365°F
<b>Approvals</b>	—	U.L. File #MP2489, Vol. 1 Sec. 1; CSA; FM	U.L. File #MP2489
Use the <b>Bold</b> characters from the chart below to construct a product code.	<p>Series <b>3J</b></p> <p>Number of Probes: <b>1</b> - One    <b>2</b> - Two    <b>3</b> - Three</p> <p>Body Material<sup>1</sup>: <b>B</b> - Cast Iron    <b>C</b> - Red Brass</p> <p>Housing: <b>0</b> - None    <b>1</b> - Optional Housing</p> <p>Length of Probes<sup>2</sup>: <b>A</b> - All probes 10-1/4"    <b>C</b> - For lengths less than 10-1/4" indicate length as inches in decimal form</p>	<p>Series <b>3H</b></p> <p>Thread: <b>1</b> - 3/8" - 18 NPT    <b>2</b> - 5/8" - 18 UNF    <b>3</b> - 5/8" - 24 UNEF</p> <p>Sleeve<sup>1</sup>: <b>B</b> - Teflon® 3/4" Long</p> <p>Length (Feet)<sup>2</sup>: <b>1</b> - One    <b>2</b> - Two    <b>3</b> - Three</p>	<p>Series <b>3L</b></p> <p>Connection Size: <b>1</b> - 1/8" NPT    <b>2</b> - 2-1/4" NPT</p> <p>Insulator Length: <b>D</b> - Teflon® 1-1/4"</p> <p>Length in Inches<sup>1, 2</sup>: <b>02</b> - Two    <b>06</b> - Six    <b>10</b> - Ten  <b>03</b> - Three    <b>07</b> - Seven    <b>11</b> - Eleven  <b>04</b> - Four    <b>08</b> - Eight    <b>12</b> - Twelve  <b>05</b> - Five    <b>09</b> - Nine</p>
<b>Notes</b>	<ol style="list-style-type: none"> <li>Probes are stainless steel.</li> <li>10-1/4" maximum</li> </ol>	<ol style="list-style-type: none"> <li>Longer Teflon® sleeves are available. Contact factory or your representative</li> <li>Custom probe and insulation lengths are available. Contact your representative.</li> </ol>	<ol style="list-style-type: none"> <li>12" maximum</li> <li>Indicate fractional inches in decimal form (01.75 = 1-3/4")</li> </ol>

WARRICK CONDUCTIVITY SENSORS




# Top Mounting Fixtures – General Purpose

Series	3F	3G																									
																											
<b>Mounting Connection</b>	Flange — 4.5" to 7.5" Dia.	NPT, Flange, Bracket (Plate)																									
<b>Probe Quantity</b>	1 thru 7	1 thru 7																									
<b>Description</b>	Designed for general purpose service, Series 3F flanged, pressure-tight fittings can handle up to 7 probes. They mate with standard pipe flanges coupled to the top of the vessel. Available in a variety of materials.	Series 3G fittings are designed for general purpose use, and are made of PVC to withstand corrosive conditions. The flanged assemblies are sized to accommodate up to 7 probes and to mate with standard flanges on the tops of vessels.																									
<b>Materials</b>																											
<b>Terminal Housing</b>	Die-cast aluminum, epoxy coated	Polycarbonate																									
<b>Body</b>	Forged steel, red brass, 316 S.S., 1018 C.S, PVC	PVC																									
<b>Probe Insulation</b>	Teflon®	Teflon®																									
<b>Pressure/Temperature</b>	125 psig @ 323°F (cast iron) 225 psig @ 150°F (brass) 230 psig @ 100°F (316 S.S.) 275 psig @ 100°F (1018 C.S.) PVC – not rated	0 psig @ 150°F (PVC)																									
<b>Approvals</b>	CSA	—																									
<b>Dimensions</b>	<table border="1"> <thead> <tr> <th>No. of Probes</th> <th>Nominal Pipe Flange Size</th> <th>Diameter of Flange</th> <th>Conduit Boss Thread Size</th> <th>Terminal Housing Size (W" x D" x H")</th> </tr> </thead> <tbody> <tr> <td align="center">1</td> <td align="center">1</td> <td align="center">4-1/2"</td> <td align="center">1/2" NPT</td> <td align="center">2-1/4 x 2-1/4 x 2-1/4</td> </tr> <tr> <td align="center">2-3</td> <td align="center">2</td> <td align="center">6"</td> <td align="center">1/2" NPT</td> <td align="center">3-1/4 x 3-1/4 x 2-3/8</td> </tr> <tr> <td align="center">4</td> <td align="center">2-1/2</td> <td align="center">7"</td> <td align="center">1/2" NPT</td> <td align="center">3-1/4 x 3-1/4 x 2-3/8</td> </tr> <tr> <td align="center">5-7</td> <td align="center">3</td> <td align="center">7-1/2"</td> <td align="center">3/4" NPT</td> <td align="center">4 x 4 x 2-1/2</td> </tr> </tbody> </table>	No. of Probes	Nominal Pipe Flange Size	Diameter of Flange	Conduit Boss Thread Size	Terminal Housing Size (W" x D" x H")	1	1	4-1/2"	1/2" NPT	2-1/4 x 2-1/4 x 2-1/4	2-3	2	6"	1/2" NPT	3-1/4 x 3-1/4 x 2-3/8	4	2-1/2	7"	1/2" NPT	3-1/4 x 3-1/4 x 2-3/8	5-7	3	7-1/2"	3/4" NPT	4 x 4 x 2-1/2	
No. of Probes	Nominal Pipe Flange Size	Diameter of Flange	Conduit Boss Thread Size	Terminal Housing Size (W" x D" x H")																							
1	1	4-1/2"	1/2" NPT	2-1/4 x 2-1/4 x 2-1/4																							
2-3	2	6"	1/2" NPT	3-1/4 x 3-1/4 x 2-3/8																							
4	2-1/2	7"	1/2" NPT	3-1/4 x 3-1/4 x 2-3/8																							
5-7	3	7-1/2"	3/4" NPT	4 x 4 x 2-1/2																							
<b>How to Order</b>	<p>Use the <b>Bold</b> characters from the chart at right to construct a product code.</p> <p>Electrode Probes are ordered separately.</p> <p>Series <b>3F</b> X X</p> <p>Number of Probes 1 thru 7</p> <p>Body Material A – Forged Steel (Raised Face)            B – Red Brass (Flat Face)            C – 316 S.S. (Raised Face)            D – 1018 C.S. (Raised Face)            E – PVC (Flat Face)</p>	<p>Series <b>3G</b> X X X</p> <p>Number of Probes 1 thru 7</p> <p>Base Size and Style A – 2" Flange (6" O.D.)<sup>3</sup> E – 2" NPT<sup>3</sup>            B – 3" Flange (7-1/2" O.D.) H – 3" NPT            C – 3-1/4" x 6" x 3/4" PVC Plate</p> <p>Probe Type 1 – 316 S.S. Inserts for Use with 1/4" Rod Extensions<sup>4</sup>            2 – Tapered Probe Assembly<sup>5</sup>            3 – Wire-Suspended Probes<sup>6</sup></p>																									
<b>Compatible Electrode Probes (order separately)</b>	3R, 3W <sup>1</sup> , 3Y <sup>2</sup>	3R, 3T, 3W <sup>1</sup> , 3Y <sup>2</sup>																									

**Notes:**

- Requires 3Z1B Adapter and 3Z1A Wire.
- Requires 3Z1B Adapter.
- Maximum 4 probes.
- Order 3R rods separately. See page E-24.
- Order 3T rods separately. See page E-24.
- Order 3W/3Y probes separately. See page E-25.

Custom options available. Consult factory.

3E		3N		3B	
					
1" to 3" NPT		#10 Machine Screws from Underside		3/8" - 18NPT, 5/8" - 18UNF, 5/8" - 24UNEF	
1 thru 7		1 thru 3		1	
Series 3E fittings are cast metal, pressure-tight assemblies capable of handling 1-7 probes. Attachment to vessels is accomplished with external pipe threading. 3E Fittings require the use of 3R rigid or 3W wire suspended electrodes.		Series 3N fittings accommodate 1-3 probes operating at atmospheric pressure. The assembly mounts on a flat surface atop open tanks or closed vessels. 3N Fittings require the use of 3R rigid or 3W wire suspended electrodes.		Series 3B fittings are compact pressure tight assemblies that hold a single electrode probe for use in water and chemicals. These fittings incorporate a 1/4-20 female thread that must be combined with a Series 3R (rigid rod electrode) or Series 3W/3Y (wire suspended electrode) to make a complete assembly.	
Die-cast aluminum, epoxy coated		Die-cast aluminum, epoxy coated		—	
Cast iron, red brass, 316 stainless steel		PVC, red brass, 316 stainless steel		316 stainless steel	
Teflon®		Teflon®		Teflon®	
125 psig @ 353°F (cast iron) 250 psig @ 406°F (brass, 316 S.S.)		0 psig @ 150°F (PVC) 0 psig @ 500°F (brass, 316 S.S.)		400 psig @ 406°F (saturated steam)	
U.L. File #MP2489, Vol. 1 Sec. 1; CSA; FM		CSA File #LR11644		U.L. File #MP2489, Vol. 1 Sec. 1; CSA; FM	
No. of Probes	Attachment to Vessel	Conduit Boss Thread Size	Terminal Housing Size (W" x D" x H")		
3E	1	1" NPT	1/2" NPT	2-1/4 x 2-1/4 x 2-1/4	
	2-3	2" NPT	1/2" NPT	3-1/4 x 3-1/4 x 2-3/8	
	4	2-1/2" NPT	1/2" NPT	3-1/4 x 3-1/4 x 2-3/8	
	5-7	3" NPT	3/4" NPT	4 x 4 x 2-1/2	
3N	1-3	2-1/4" square flat pad, 1-1/2" dia. hole in top of vessel secured with #10 machine screws at the corners of a 1-1/2" square	1/2" NPT	2-1/4 x 2-1/4 x 2-1/4	
<p>Series <b>3E</b></p> <p>Number of Probes <b>1 thru 7</b></p> <p>Body Material</p> <p><b>A</b> – Cast Iron</p> <p><b>B</b> – Red Brass</p> <p><b>C</b> – 316 Stainless Steel</p>		<p>Series <b>3N</b></p> <p>Number of Probes <b>1 thru 3</b></p> <p>Body Material</p> <p><b>A</b> – PVC</p> <p><b>B</b> – Red Brass</p> <p><b>C</b> – 316 Stainless Steel</p>		<p>Series <b>3B</b></p> <p>Thread</p> <p><b>1</b> – 3/8" - 18 NPT</p> <p><b>2</b> – 5/8" - 18 UNF</p> <p><b>3</b> – 5/8" - 24 UNEF</p> <p>Metal Parts</p> <p><b>B</b> – 316 Stainless Steel</p>	
3R, 3W <sup>1</sup>		3R, 3W <sup>1</sup>		3R solid rod (up to 4') 3W <sup>1</sup> or 3Y <sup>2</sup> (greater than 4')	

Custom options available. Consult factory.

# Series 3R/3T General Purpose Probes

- ▶ Metallic Rods
- ▶ Available in Many Materials for Various Requirements
- ▶ Adaptable for Various Fittings

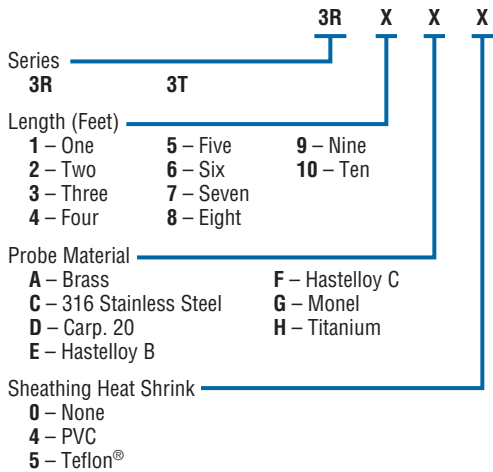
For general purpose use, Series 3R probes are metallic rods with threaded ends that screw into a fitting that extends vertically down into the liquid. Available in a variety of materials for different applications. 3T tapered rods are also available.

## Specifications

<b>Style</b>	
<b>Series 3R</b>	1/4" (.64 cm) threaded rod
<b>Series 3T</b>	1/4" (.64 cm) tapered rod
<b>Material</b>	Brass, Hastelloy C, Monel, 316 stainless steel, titanium, Carp. 20
<b>Sheathing (optional)</b>	PVC heat shrink 200°F (93°C), Teflon® heat shrink 350°F (177°C)

## How to Order

Use the **Bold** characters from the chart below to construct a product code.



Contact your representative for custom lengths.

Note: Long lengths can be coupled to facilitate shipping and installation. Consult factory.

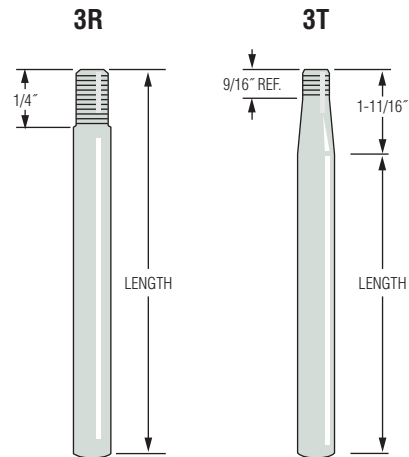


## Applications

3R: For use with Series 3E, 3F, 3G, 3B fittings

3T: For use with Series 3G and other custom configurations

## Dimensions





## Series 3W – Wire Suspended Probes

- ▶ Metallic Bars
- ▶ Plastic Shield Protected
- ▶ Adaptable to Many Fittings
- ▶ Field Assembled

Series 3W probes, consisting of metallic bars within a protective plastic shield, are designed to be suspended in liquid with PVC-insulated wires. They are ideal for applications where rigid electrode rods are impractical or cumbersome, such as:

- Deep Wells
- Pump Control
- Waste Water
- Deep Tanks

7/8" (2.22 cm) diameter x 3-3/4" (9.52 cm) length. 3Z1A wire and 3Z1B adaptor kit required for use with 3E, 3F and 3N fittings.

### How to Order

Select a 3W electrode, a 3Z1B adaptor and a length of 3Z1A suspension wire to form a complete suspended probe.

#### 1. 3W Electrodes

Probe Material	Part Number
Brass	3W1
316 Stainless Steel	3W2

#### 2. 3Z1B Adaptor Kit

For use with 3E, 3F and 3N fittings.  
Part Number: 3Z1B

#### 3. 3Z1A Suspension Wire

Order in standard or custom length.

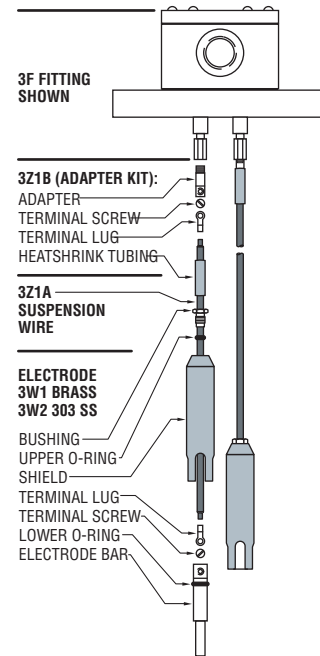
Length (Feet)	Part Number
500	100325-500
1000	100325-1000
5000	100325-5000
Custom	3Z1A-XX

Specify in one foot increments up to 5000 ft.



Series 3W

### Components Detail



## Series 3Y – Corrosion Resistant Probes

- ▶ Metallic Bars
- ▶ Corrosion Resistant
- ▶ Available in Many Materials for Various Requirements
- ▶ Adaptable for Various Fittings

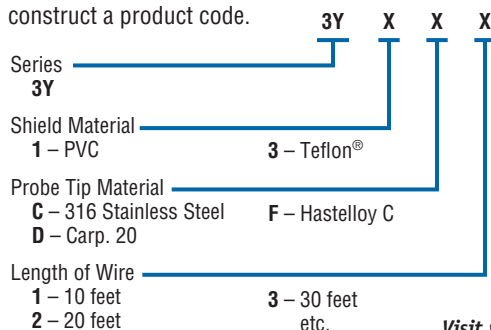
Series 3Y wire suspended probes consist of metallic bars within a protective plastic shield, designed to be suspended in liquid. Series 3Y suspension wires are PVC or Teflon® insulated for use in corrosive liquid applications. 7/8" (2.22 cm) diameter x 3-1/2" (8.90 cm) length.

### Specifications

<b>Style</b>	Wire suspended
<b>Tip Material</b>	Carp. 20, Hastelloy C, 316 stainless steel
<b>Shield Material</b>	PVC 150°F (66°C), Teflon®

### How to Order

Use the **Bold** characters from the chart below to construct a product code.



Note: 3Z1B Connector is used to connect suspension wire with 3B, 3E, 3F, 3G or 3N fitting.



Series 3Y

### Applications

- General Purpose
- Wire Suspended Probes
- Corrosive Liquids, Chemicals

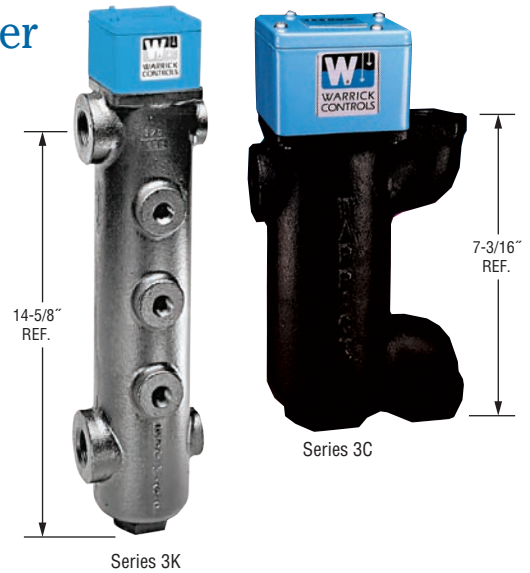
# Series 3C – Short External Mount Side Chamber

# Series 3K – Long External Mount Side Chamber

- ▶ Side Mounting
- ▶ Gauge Tappings
- ▶ Pressure Tight
- ▶ CSA Approved
- ▶ FM Approved
- ▶ Tricock Tappings
- ▶ 1-4 Probes
- ▶ Cast Iron and Brass
- ▶ U.L. Recognized

Series 3C side chamber fittings are cast iron or brass, pressure-tight chambers containing up to 4 probes from 1-1/2" to 6" in length. Pipe tappings provide connection to the side of boilers and pressure vessels to equalize the level in the chamber with the level in the vessel.

Series 3K fittings contain up to 4 probes and accommodate probes from 1-3/4" to 13" in length. Additional tappings are available for tricocks and gauges.



## Specifications

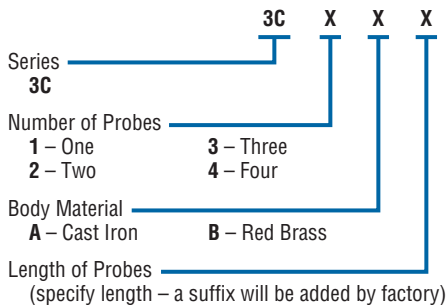
<b>Probes</b>	1 thru 4, with 316 Stainless Steel/Teflon® wetted parts
<b>Body Material</b>	
<b>Series 3C</b>	Cast iron, red brass
<b>Series 3K</b>	Cast iron
<b>Pressure/Temperature</b>	250 psig (17.2 bar) @ 406°F (200°C) (saturated steam)
<b>Probe Length</b>	
<b>Series 3C</b>	1-1/2" to 6" (3.81 cm to 15.24 cm)
<b>Series 3K</b>	1-3/4" to 13" (4.45 cm to 33.02 cm)
<b>Approvals</b>	U.L. File # MP2489, Vol. 1, Sec. 2; CSA; FM

## Applications

- Boilers
- Hydropneumatic Tanks
- Steam Generators
- Pressure Vessels
- Pump Operation
- Low Water / High Water Alarm

## How to Order Series 3C

Use the **Bold** characters from the chart below to construct a product code.

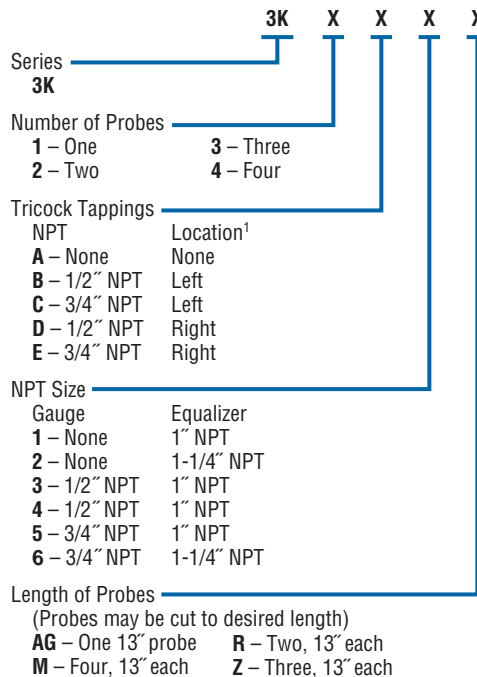


**Notes:**

1. Contact your representative for more details on this fitting.
2. The 3C attaches to a vessel by two 1" NPT tappings, one 1" NPT blowdown port and one 3/4" NPT side port.

## How to Order Series 3K

Use the **Bold** characters from the chart below to construct a product code.



**Note:**

1. Viewer facing gauge glass

# Series 3S Multi-Wire Suspended Fittings

- ▶ Probe Isolation
- ▶ Long Length

The 3S series electrode fitting is designed to provide isolation of electrodes from liquids containing solids, grease, soaps, sludge, rags, paper and other debris commonly found in wastewater and sewage pumping applications.

Isolation is accomplished by enclosing wire suspended electrodes within a 1-1/2" galvanized pipe assembly with a neoprene flexible bulb installed on the lower end of the pipe. The bulb and pipe assemblies contain 3-1/2 quarts clean water with one ounce of sodium bicarbonate (baking soda).

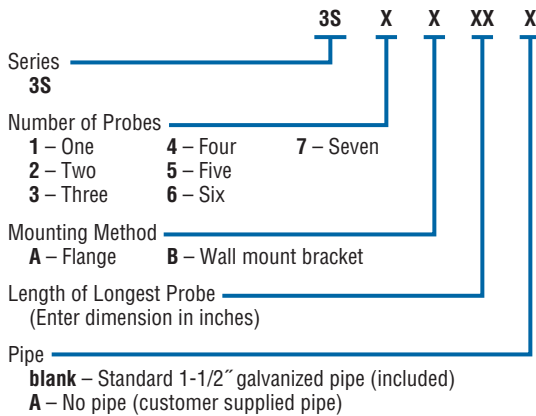
When mounted in a sump, the pipe and bulb assembly is acted on by the hydrostatic pressure exerted by the liquid outside the bulb. Assuming the density of the liquid outside is equal to water, the height of the water inside the bulb will equal the height outside.

## Specifications

<b>Probes</b>	1 thru 7
<b>Materials of Construction</b>	Cast iron, galvanized pipe, stainless steel, neoprene
<b>Type of Connection</b>	3" flange (7-1/2" O.D.), or bracket
<b>Terminal Housing</b>	Die-cast aluminum, epoxy coated
<b>Pressure</b>	Atmosphere
<b>Temperature</b>	-40°F to +212°F (-40°C to +100°F)

## How to Order

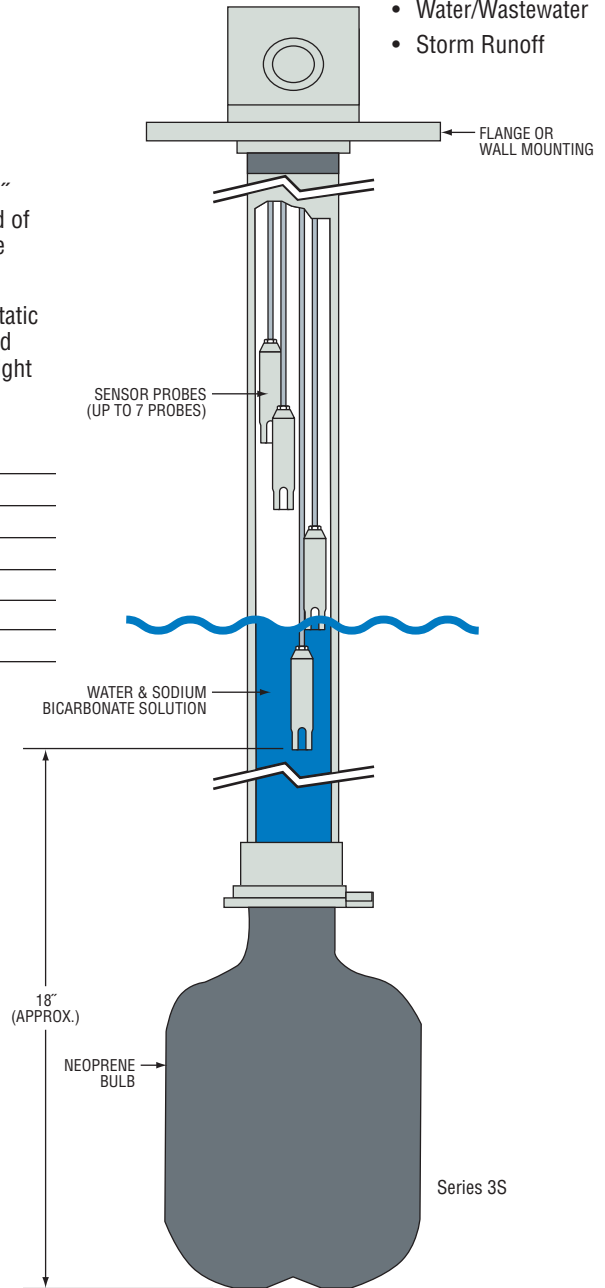
Use the **Bold** characters from the chart below to construct a product code.



Note:  
Overall length is approximately 18" more than distance to longest electrode.  
Probe is adjusted by customer in the field.

## Applications

- Sewage
- Water/Wastewater
- Storm Runoff



# Series 3M – Food Grade Fitting

## Series 3MT – Food Grade Fitting

- ▶ Easy Removal for Cleaning
- ▶ CSA Approved
- ▶ FDA Approved Materials

Designed for use in food, beverage and pharmaceutical applications where cleanliness is vital. Two-piece Series 3M assemblies can handle up to 4 probes. FDA-approved materials. Engineered for fast removal of fitting to facilitate cleaning and sterilization.

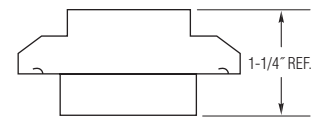
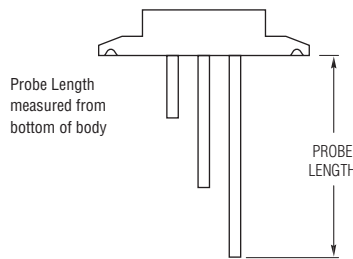
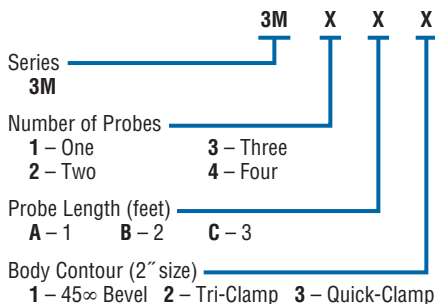
Series 3MT fittings are similar to 3M fittings, except they also feature Teflon®-covered probes with polished tips to meet the most demanding application requirements.

### Specifications

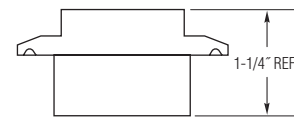
<b>Probes</b>	1 thru 4
<b>Body Contour</b>	45° bevel, Tri-Clamp, Quick Clamp
<b>Body Material</b>	Type 66 Nylon
<b>Probe Material</b>	
<b>Series 3M</b>	316 stainless steel, cut to length by user
<b>Series 3MT</b>	Teflon®-covered 316 stainless steel probes. Tip polished to RA <25 microns max. spec. (factory set lengths)
<b>Pressure/Temperature</b>	150 psig (10.3 bar) @ 150°F (65°C)
<b>Approvals</b>	FDA-approved materials; CSA

### How to Order Series 3M

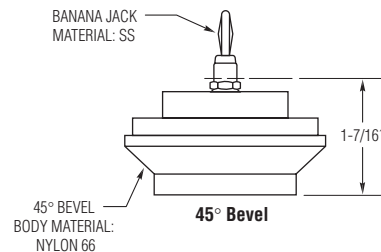
Use the **Bold** characters from the chart below to construct a product code.



**Quick-Clamp**



**Tri-Clamp**



### How to Order Series 3MT

**3MT components must be ordered separately.**

#### Step 1. Upper Assembly\*:

Select one part number.

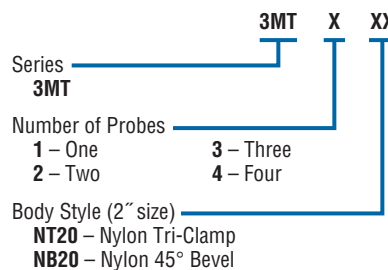
- 7790575** – 1 Probe
- 7790577** – 2 Probes
- 7790581** – 3 Probes
- 7790584** – 4 Probes

\*10' lead length standard.



#### Step 2. Lower Assembly:

Complete part number based on Upper Assembly selected and Body Style.



#### Step 3. Probe Lengths\*:

Select a length for each probe to be used; maximum four.

- Probe 1 3MTPRL \_\_\_ (inches)
- Probe 2 3MTPRL \_\_\_ (inches)
- Probe 3 3MTPRL \_\_\_ (inches)
- Probe 4 3MTPRL \_\_\_ (inches)

\*Probe length must be specified in whole inches, 06" to 36". Length is not field adjustable.



# CP Series Control Panels Standard Level Control System Electrical Panels

- ▶ NEMA-1 Enclosure – General Purpose
- ▶ NEMA-4 Enclosure – Water Resistant
- ▶ NEMA-4X Enclosure – Corrosion and Water Resistant
- ▶ Optional Equipment – Visual Alarms, High & Low Audible/Silent Alarms, Hand-off Auto Switches

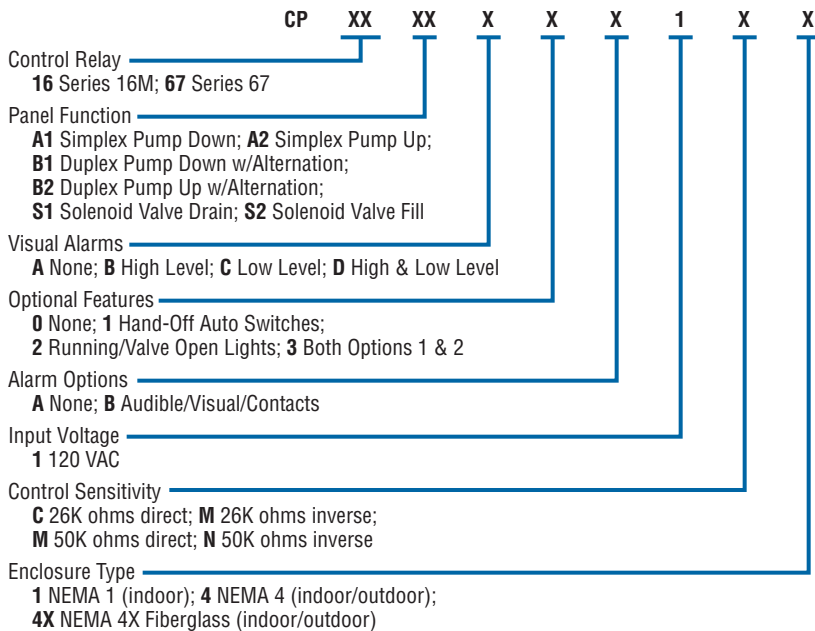
When it comes to control panels, Gems Sensors can satisfy most requirements with our new family of CP Series Panels. These standard models were specifically designed around our most popular panel types. These industrial control panels interface with level and flow switches, Warrick conductance probes and a variety of sensors and are factory set for pump up/pump down. Gems can provide the panel and sensors you need for intrinsically safe and non-intrinsically safe environments. With each control panel, Gems provides electrical and mechanical drawings along with installation and operations manuals.

## Specifications

<b>Contact Design</b>	SPST
<b>Contact Rating (120 VAC)</b>	10 amp Resistive
<b>Primary Voltage</b>	120 VAC (+10%/-15%) 50/60 Hz
<b>Temperature</b>	-40°F to +150°F (-40°C to +65°C) Ambient
<b>Enclosure Type</b>	NEMA 1, NEMA 4, NEMA 4X Fiberglass
<b>Approvals</b>	U.L. 508A File # E100709; U.L. 698A File # E120178 (Series 67 control only)

## How to Order

Use the **Bold** characters from the chart below to construct a product code.



Single-function standard panel

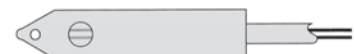


## Applications

- Simplex Pump Up/Down
- Duplex Pump Up/Down
- Pump Alternation
- Valve Fill & Drain

WARRICK CONDUCTIVITY SENSORS

See Our Interstitial Tank Monitoring Products on page A-22.



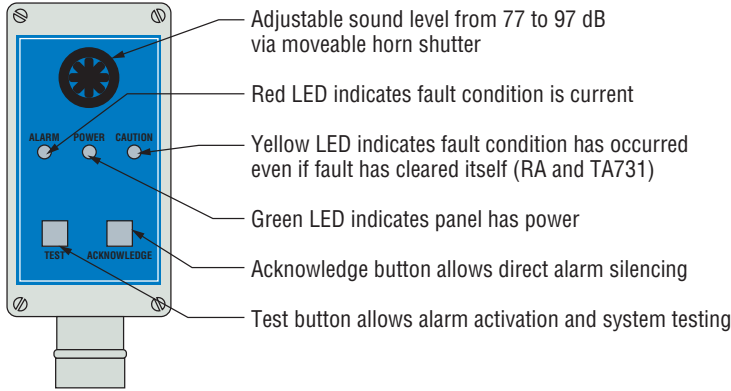
# RA431 and TA73x Alarm Panels Scream Warning @ 97 dB

## RA Features

- Can be used with conductivity probes
- Small footprint design
- Size 6 pan head screw connections

## TA Features

- Intrinsically safe approved
- Auxiliary contact for remote annunciation or cutoff
- One or two channels
- Two conduit connection hubs

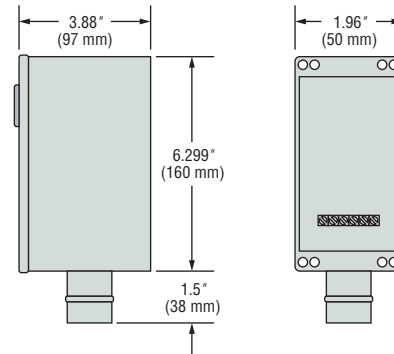


RA-431 shown. TA Series includes an additional 1/2" NPT conduit connection for power.

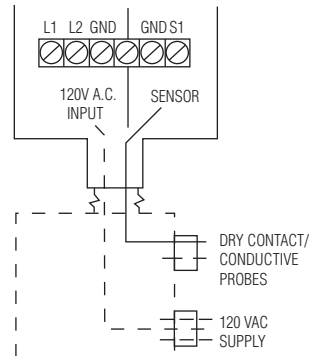
## Specifications

<b>Supply Voltage</b>	120 VAC +10%/-15%, 4.8 VA Max.
<b>Indicators</b>	Red, Green and Yellow Solid-State LED's
<b>Audible Alarm</b>	Field Adjustable From 77 to 97 dB @ 2 Feet
<b>Enclosure</b>	NEMA 4X – Weather tight polycarbonate
<b>Sensor Voltage</b>	12 VAC or 12 VDC
<b>Terminals</b>	Size 6 Pan Head Screws with Captive Wire Clamping Plate
<b>Temperature</b>	-22°F to +150°F (-5.5°C to +65.5°C)
<b>Sensitivity</b>	0-26K Ohm Maximum Specific Resistance
<b>Maximum Wire Run</b>	1000 Feet (14 or 16 Gauge MTW or THHN Wire)
<b>Conduit Connection</b>	3/4" FNPT, PVC Material
<b>Listings</b>	
<b>TA Series</b>	U.L. 913 Intrinsically Safe, File # E44570
<b>RA Series</b>	U.L. 508 Motor Control, File # E138209

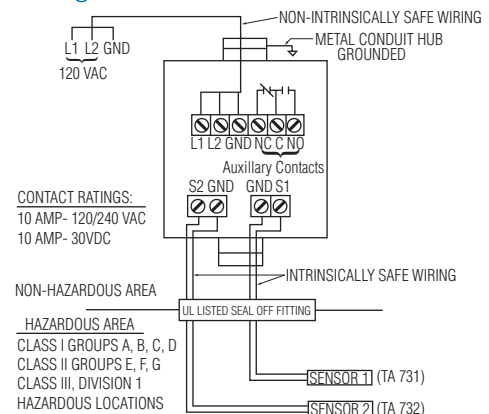
## Dimensions



## Wiring – RA Series



## Wiring – TA Series



## How To Order

Select Part Number based on switch logic and number of channels.

### RA Series

Used for non-hazardous liquid monitoring applications.

Interface Contacts	Part Number
N.O. Dry (Sensor Normally Dry)	<b>RA-431A-0</b>
N.C. Dry (Sensor Normally Wet)	<b>RA-431B-0</b>

### TA Series

Intrinsically-safe for hazardous locations.

Interface Contacts	Number of Channels	Part Number
N.O. Dry (Sensor Normally Dry)	1	<b>TA-731A-0</b>
	2	<b>TA-732A-0</b>
N.C. Dry (Sensor Normally Wet)	1	<b>TA-731B-0</b>
	2	<b>TA-732B-0</b>



# DMS 470/570 Series Leak Detection Systems for UST and AST Storage Tanks

- ▶ Low Cost
- ▶ U.L. Approved Intrinsically Safe
- ▶ Easily Maintained
- ▶ Audio/Visual Alarm

The DMS 470/570 monitoring systems are ideal for a number of UST and AST monitoring applications. The DMS 470 includes an audible bell while the DMS 570 uses a piezoelectric horn. Applications include vapor monitoring of monitoring wells surrounding single wall tanks, high/low product level alarms, vapor sensors for single wall piping and piping sump sensors for double wall piping.

### Auxiliary Contacts

Auxiliary alarm contacts are also available for interfacing to remote alarms, computers, tank gauging systems, phone dialers, etc.

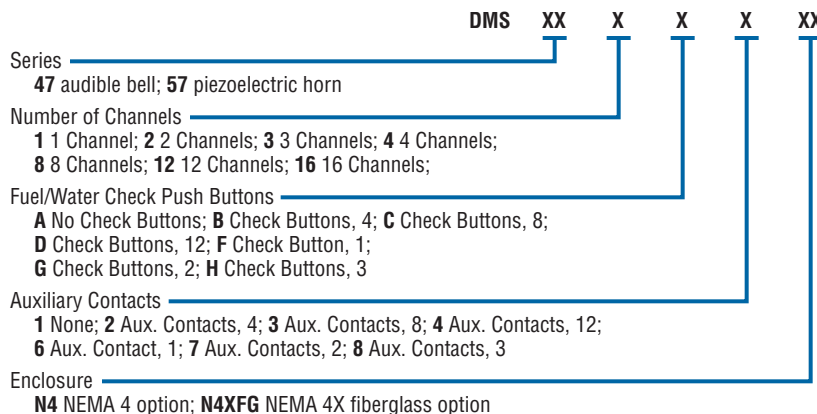
### Specifications

<b>Contact Design</b>	SPDT (1 form C), one normally open, one normally closed
<b>Contact Rating</b>	120 VAC or 30 VAC, 10A, 1/3 h.p.
<b>Sensitivity Range</b>	0-50,000 ohms max. specific resistance
<b>Remote Alarm Contact</b>	Terminals; 7 N.C., 8 com, 9 N.O.
<b>Primary Voltage</b>	120 VAC (+10%/-15%) 60 Hz
<b>Probe Voltage</b>	Nominal 12 VAC @ 6ma RMS
<b>Optional Auxiliary Contacts</b>	One relay contact per channel
<b>Optional "Check" Push Button Board*</b>	Terminals: Size four (4) pan head screw with a clamping plate; will accept up to 14 AWG.
<b>Enclosure Type</b>	NEMA 3R; optional NEMA 4, Weather-proof; optional NEMA 4X, Fiberglass
<b>Temperature</b>	-40°F to +150°F (-40°C to +65.5°C)
<b>Approval</b>	U.L. Listed (U.L. 913) E120178

\*For media discrimination in-storage tank

### How to Order

Use the **Bold** characters from the chart below to construct a product code. One set of auxiliary contacts is standard with every four (4) channels supplied. A common test button is standard for every four (4) channels supplied. The fuel/water check buttons listed below are used to distinguish water or hydrocarbon when three wire sensors are used. Each sensor or detection point requires its own channel.



### Applications

Above Ground Fuel Storage Tanks (AST)

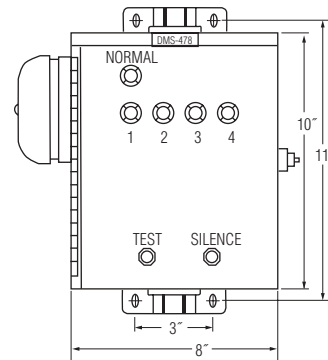
- Leak Detection
- Overfill
- Refill

Underground Fuel Storage Tanks (UST)

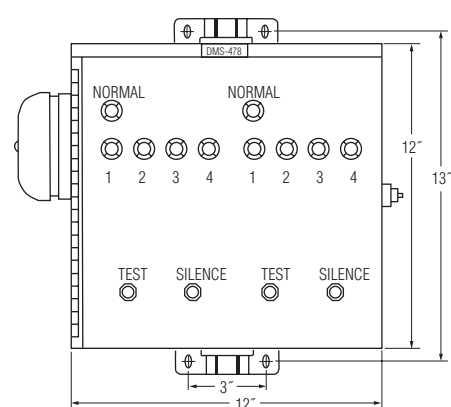
- High Level Alarm
- Leak Detection
- Piping Sumps
- Monitoring Well

### Dimensions

4 Channel



8 Channel



See Our Interstitial Tank Monitoring Products on page A-22.



WARRICK CONDUCTIVITY SENSORS

# Solutions in a Box: Application-Specific Kits Bring Simplicity to Systems Engineering

- ▶ Time Savers
- ▶ No Component Selection Hassles
- ▶ Compatible Components
- ▶ Little or No Assembly

If you need to automatically refill or drain tanks, wells or pressurized vessels, these convenient pre-packaged kits contain everything you need. These Warrick® level control kits combine all the know-how and components you'll need to add automatic control to pump-up/pump-down operations. Each kit is supplied with controllers, probes, electrical enclosures and full instructions.



TK-1 shown

## TK Kits – Refill or Drain Open Tanks

TK-1 Kits are designed to automatically control the refill pump in open tanks and ponds that drain regularly, turning the pump ON when the liquid level in the tank drops to a point and turning it OFF when the level rises back to a second point. No assembly is required, just connect wire to control.

TK-2 Kits are designed for the opposite application—controlling the drain pump in open tanks and ponds that fill regularly. It turns the pump ON when the liquid level rises to a point and turns it OFF when the level drops back to a point.



WK-1 shown

## WK Kits – Refill or Drain Wells

WK Kits are designed for use in wells. WK-1 Kits control refill in wells that drain regularly; WK-2 Kits control the pump-down in wells that fill regularly. Minimal assembly is required. WK Kits can also be used for low-water cutoff applications.

Length of suspension wire is 50 feet. Additional suspension wire (3Z1A) is available from your local Warrick Controls Stocking Representative or Distributor.

## HP Kits – Refill or Drain Pressure Vessels

HP-1 Kits are designed to automatically control the refill pump in up to 125 psi pressure vessels that drain regularly, turning the pump ON when the liquid level in the vessel drops to a low point and turning it OFF when the level rises back to a high point. Minimal assembly is required. Also for low-pressure sealed vessels.

HP-2 Kits are designed for the opposite application—controlling the drain pump in pressure vessels that fill regularly. It turns the pump ON when the liquid level rises to a high point and turns it OFF when the level drops back to a certain point.



HP-2 shown

## How To Order

Select Part Number based on application. Each kit contains everything needed for specified application: control, fitting, probes, electrical enclosure, and instructions.

Part No.	Application	Primary Voltage	Secondary Voltage	Sensitivity	Contact Rating	Mode of Operation
TK-1	Tank refill	115 VAC	12 VAC	26K	10 amp Resistive 1/3 hp	Inverse
TK-2	Tank drain					Direct
WK-1	Well or sump refill	115 VAC or 230 VAC		19K	30 amp Resistive 1 hp @ 115VAC or 2 hp @ 240 VAC	Inverse
WK-2	Well or sump drain					Direct
HP-1	Tank refill	115 VAC		26K	10 amp Resistive 1/3 hp	Inverse
HP-2	Tank drain					Direct

# RotorFlow® Sensors Provide Visual Indication, Continuous Sensing and Accurate Switching

- ▶ Bright, visual indication with choice of pulsed DC output, or adjustable 1 amp switched output
- ▶ Flow ranges from .1 GPM to 60.0 GPM
- ▶ Compact inline housings
- ▶ Available in high performance plastic, brass, or stainless steel housings

Determined to provide you with the most versatile line of flow sensors available, we've continued a non-stop refinement process for the entire RotorFlow® Series. GEMS new generation of RotorFlow® sensors, the RF-2500 Series, have been totally re-engineered with a one piece composite rotor, stronger unibody construction, ceramic shaft and better sealing. The results are greater durability with broader chemical, temperature and pressure capabilities.

Today's RotorFlow Series is state-of-the-art and offers more options, better performance and durability than ever before...all at an affordable price geared for high volume, OEM applications.

Select the RotorFlow sensor that is right for your application by choosing one of our three distinct configurations. You'll find details on each of these configurations inside.

## RotorFlow Switch Types

For specific flow setpoint switching, RotorFlow RFS type switches are one of the most reliable flow switches available. Setpoints are fully adjustable over the specified flow range. The dynamic operation of the rotor guards against jamming and false actuation.

## RotorFlow Output Types

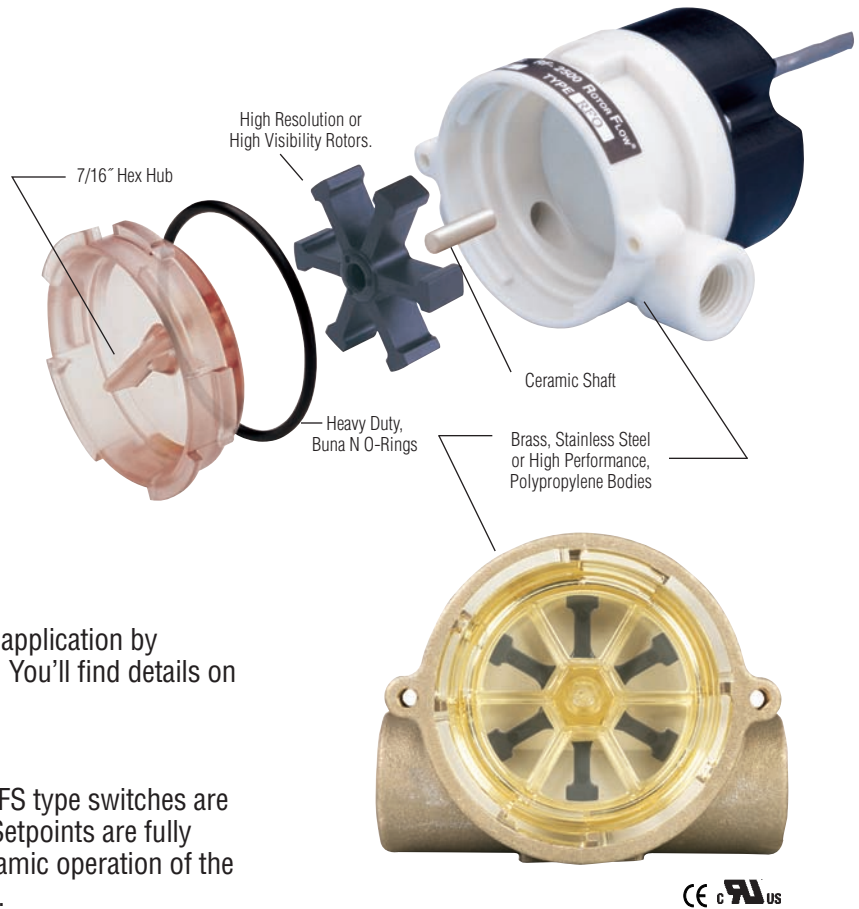
For flow rate monitoring or metering applications. RotorFlow RFO Type sensors provide a pulsed DC voltage output that is proportional to the rate of flow. The operating range of 4.5 to 24 VDC pulsed output is easily integrated into most digital logic units. RFA Type RotorFlow sensors provide a continuous 0-10 VDC analog output.

## RotorFlow Indicator Types

For those who want simple visual confirmation of flow, RotorFlow RFI indicators provide the durable, low-cost answer. A bright, orange spinning rotor provides visual flow confirmation at a glance.



RotorFlow Series Sensors are U.L. Recognized — File No. E45168.



**Now for line sizes up to 1"**



New wide-body senses flow up to 60 GPM. 3/4" and 1" line models.



FLOW SENSORS - ELECTRONIC

# Flow Set Point Switching – RFS Types

- ▶ Combines visual confirmation of flow with dynamic, electronic switch operation
- ▶ Easy, adjustable switch point calibration: a local LED signals when set point is reached

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.

## Typical Applications

Protect expensive electronic equipment from coolant flow failure on...

- Semiconductor Processing Equipment
- Lasers • Medical Equipment
- X-Ray and Other High Power Tubes
- Robotic Welding Equipment



File No. E45168



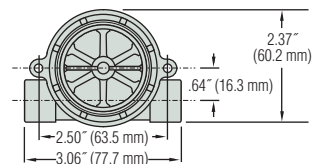
## Specifications

<b>Wetted Materials</b>	Brass, 316 Stainless Steel or Polypropylene (Hydrolytically Stable, Glass Reinforced)	
<b>Body</b>		
<b>Rotor Pin</b>	Ceramic	
<b>Rotor</b>	PPS Composite, Black	
<b>Lens</b>	Polysulfone	
<b>O-Ring</b>	Viton® (Alloy Bodies); Buna N (Polypropylene Body)	
<b>Low Flow Adaptor</b>	Glass Reinforced Polypropylene	
<b>Operating Pressure, Maximum</b>	200 PSIG (13.8 bar) @ 70°F (21°C), 100 PSIG (6.9 bar) Max. @ 212°F (100°C) <sup>1</sup>	
<b>Brass or Stainless Steel Body</b>		
<b>Polypropylene Body</b>	100 PSIG (6.9 bar) @ 70°F (21°C), 40 PSI (2.8 bar) Max. @ 180°F (82°C)	
<b>Operating Temperature,</b>	-20°F to 212°F (-29°C to 100°C)	
<b>Brass or Stainless Steel Body</b>		
<b>Polypropylene Body</b>	-20°F to 180°F (-29°C to 82°C)	
<b>Electronics</b>	150°F (65°C) Ambient	
<b>Viscosity, Maximum</b>	200 SSU	
<b>Input Power</b>	24 VDC or 115 VAC	
<b>Relay Contact Ratings (SPDT)</b>	1 Amp, 24 VDC Resistive; 0.3 Amp, 110 VAC	
<b>Current Consumption</b>	<b>No Load</b>	<b>Load (Relay Energized)</b>
<b>24 VDC</b>	20mA	35mA
<b>115 VAC</b>	45mA	95mA
<b>Repeatability</b>	2% Maximum Deviation	
<b>Set Point Accuracy (Factory Set)</b>	± 5%	
<b>Set Point Differential</b>	15% Maximum	
<b>Electrical Termination</b>	20 AWG PVC-Jacketed, 24" Cable. Color Codes: Red = +VAC/VDC, Black = Ground, White = N.O. Contact, Brown = N.C. Contact, Green = Common	

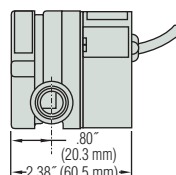
Note:  
1. Optional pulsed output available with RFS. Consult factory.

## Dimensions

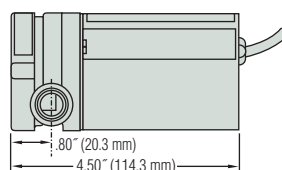
### Polypropylene Bodies



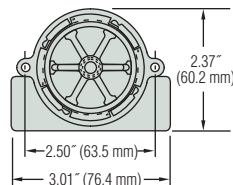
### VDC



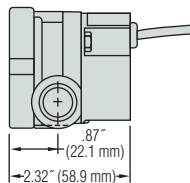
### VAC



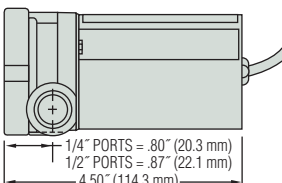
### Brass and Stainless Steel Bodies - .25" and .50" Port



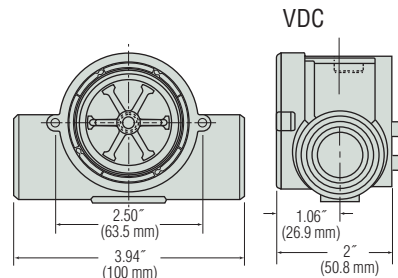
### VDC



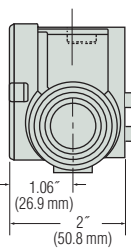
### VAC



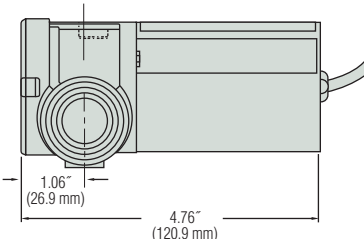
### Brass and Stainless Steel Bodies - .75" and 1.00" Port



### VDC



### VAC

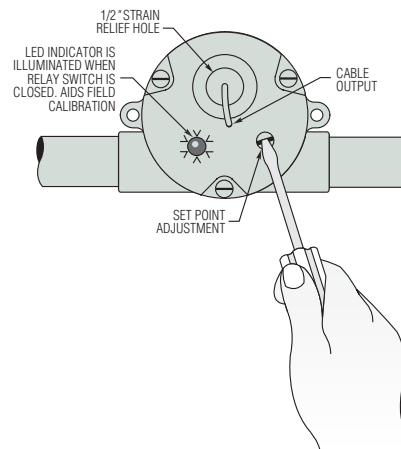




### Switch Set Point Calibration With LED Signal (RFS Type)

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

Specify Part Number based on desired body material, port size and input power rating.

Body Material	Port Size NPT	Flow Ranges – GPM		Input Power	Part Number
		Low Range*	Standard Range		
Polypropylene	.25"	0.1 to 1.0	0.5 to 5.0	24 VDC	<b>155425</b> ⚡
				115 VAC	<b>155876</b> ⚡
	.50"	1.5 to 12.0	4.0 to 20.0	24 VDC	<b>155485</b> ⚡
				115 VAC	<b>155886</b> ⚡
Brass	.25"	0.1 to 1.0	0.5 to 5.0	24 VDC	<b>156265</b> ⚡
				115 VAC	<b>156266</b> ⚡
	.50"	1.5 to 12.0	4.0 to 20.0	24 VDC	<b>156268</b> ⚡
				115 VAC	<b>156269</b> ⚡
	.75"	–	5.0 to 30.0	24 VDC	<b>180395</b> ⚡
				115 VAC	<b>180396</b> ⚡
	1.00"	–	8.0 to 60.0	24 VDC	<b>181688</b> ⚡
				115 VAC	<b>181689</b> ⚡
Stainless Steel	9/16-18**	0.1 to 1.0	0.5 to 5.0	24 VDC	<b>165073</b> ⚡
				115 VAC	<b>165074</b> ⚡
	.50"	1.5 to 12.0	4.0 to 20.0	24 VDC	<b>165077</b> ⚡
				115 VAC	<b>165078</b> ⚡
	.75"	–	5.0 to 30.0	24 VDC	<b>181691</b> ⚡
				115 VAC	<b>181692</b> ⚡
	1.00"	–	8.0 to 60.0	24 VDC	<b>181693</b> ⚡
				115 VAC	<b>181694</b> ⚡

\* With use of Low Flow Adapter supplied. See Page F-8 for more information.  
 \*\* Straight thread with O-ring seal.

⚡ – Stock Items.

### Special Requirements:

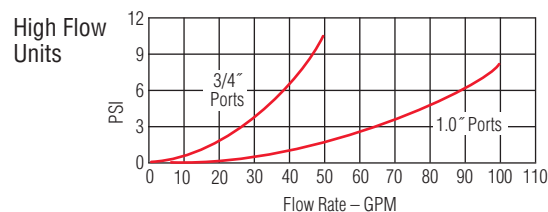
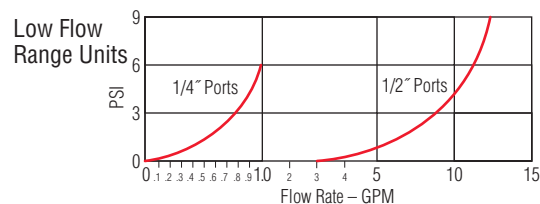
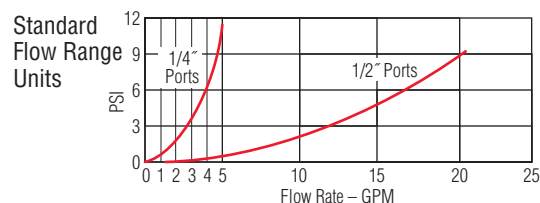
GEMS caters to OEM needs with special configurations for potable water and enhanced chemical capabilities. Consult factory for further details.

For higher pressure/temperature ratings, stainless face plates are available. Consult factory.

**High Resolution Black Rotor**  
 PPS composite. Each of the six rotor arms is magnetized. A PTFE loaded bushing ensures long life.



### Pressure Drop-Typical



# Flow Rate Monitoring – RFO Type

## ► 4.5 to 24 VDC Pulsed Output

GEMS Sensors popularized the RotorFlow'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. RFO Types feature a VDC pulsed output.

## Typical Applications

- Water Purification/Dispensing Systems • Chemical Metering Equipment
- Lasers and Welders • Water Injection Systems
- Semiconductor Processing Equipment • Chillers and Heat Exchangers

## Specifications

<b>Wetted Materials</b>	
<b>Body</b>	Brass, 316 Stainless Steel or Polypropylene (Hydrolytically Stable, Glass Reinforced)
<b>Rotor Pin</b>	Ceramic
<b>Rotor</b>	PPS Composite, Black
<b>Lens</b>	Polysulfone <sup>1</sup>
<b>O-Ring</b>	Viton® (Alloy Bodies); Buna N (Polypropylene Body)
<b>Low Flow Adaptor</b>	Glass Reinforced Polypropylene
<b>Operating Pressure, Maximum</b>	
<b>Brass or Stainless Steel Body</b>	Optional SS Face Plate 500 PSIG 200 PSIG (13.8 bar) @ 70°F (21°C), 100 PSI (6.9 bar) Max. @ 212°F (100°C) <sup>1</sup>
<b>Polypropylene Body</b>	100 PSIG (6.9 bar) @ 70°F (21°C), 40 PSI (2.8 bar) Max. @ 180°F (82°C)
<b>Operating Temperature</b>	
<b>Brass or Stainless Steel Body</b>	-20°F to 212°F (-29°C to 100°C)
<b>Polypropylene Body</b>	-20°F to 180°F (-29°C to 82°C)
<b>Electronics</b>	150°F (65°C) Ambient
<b>Viscosity, Maximum</b>	200 SSU
<b>Input Power</b>	4.5 VDC to 24 VDC
<b>Output Signal</b>	4.5 VDC to 24 VDC Pulse. (Sourcing) Pulse Rate Dependent on Flow Rate, Port Size and Range.
<b>Current Consumption</b>	8 mA, No Load
<b>Current Source Output, Max.</b>	70 mA
<b>Frequency Output Range</b>	15 Hz (Low Flow) to 225 Hz (High Flow)
<b>Accuracy</b>	See Table Below
<b>Electrical Termination</b>	22 AWG PVC-Jacketed, 24" Cable. Color Coded: Red = +VDC; Black = Ground; White = Signal Output

### Notes:

1. For higher pressure/temperature ratings, stainless face plates are available. Consult factory.

## How To Order

For standard configurations, specify Part Number based on desired body material and port size.

Body Material	Port Size NPT	Flow Range – GPM		Part Number
		Low Range* (Accuracy)	Standard Range (Accuracy)	
Polypropylene	.25"	0.1 to 1.0 (±7.0%)	0.5 to 5.0 (±7.0%)	<b>155421</b> ⚡
	.50"	1.5 to 12.0 (±7.0%)	4.0 to 20.0 (±15.0%)	<b>155481</b> ⚡
Brass	.25"	0.1 to 1.0 (±7.0%)	0.5 to 5.0 (±7.0%)	<b>156261</b> ⚡
	.50"	1.5 to 12.0 (±7.0%)	4.0 to 20.0 (±15.0%)	<b>156262</b> ⚡
	.75"	—	5.0 to 30.0 (±15.0%)	<b>194761</b> ⚡
	1.00"	—	8.0 to 60.0 (±15.0%)	<b>194762</b> ⚡
Stainless Steel	9/16"~18**	0.1 to 1.0 (±7.0%)	0.5 to 5.0 (±7.0%)	<b>165071</b> ⚡
	.50"	1.5 to 12.0 (±7.0%)	4.0 to 20.0 (±15.0%)	<b>165075</b> ⚡
	.75"	—	5.0 to 30.0 (±15.0%)	<b>194763</b>
	1.00"	—	8.0 to 60.0 (±15.0%)	<b>194764</b>

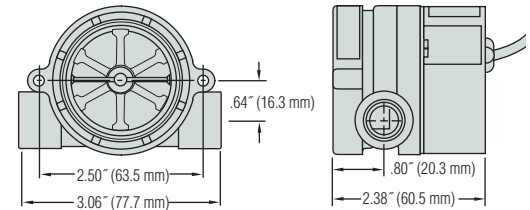
⚡ – Stock Items.



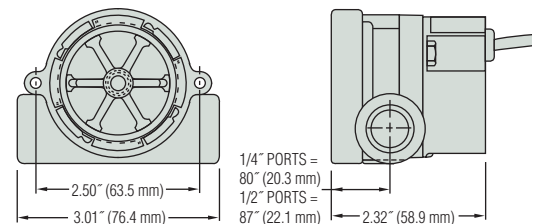
File No. E45168

## Dimensions

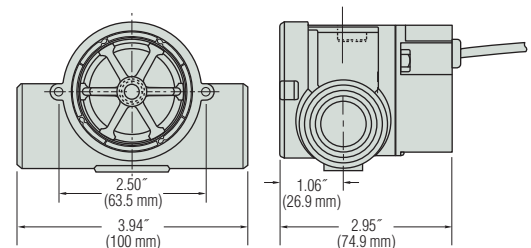
Polypropylene Bodies



Brass and Stainless Steel Bodies - .25" and .50" Ports



Brass Bodies – .75" and 1.00" NPT Ports



## High Resolution

**Black Rotor**  
PPS composite. Each of the six rotor arms is magnetized. A PTFE loaded bushing ensures long life.



Note: Improved accuracy can be achieved by calibrating the individual RFO unit.

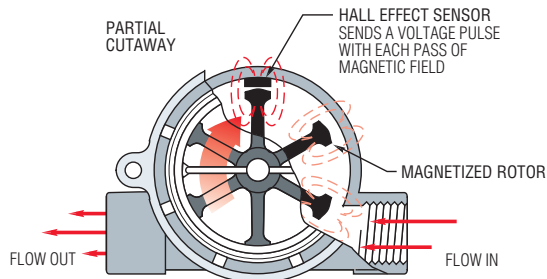
\*With use of Low Flow Adapter supplied.

See Page F-8 for more information.

\*\*Straight thread with O-ring seal.



### Operating Principle



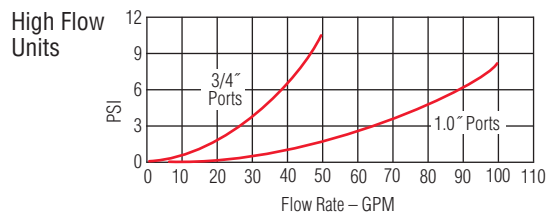
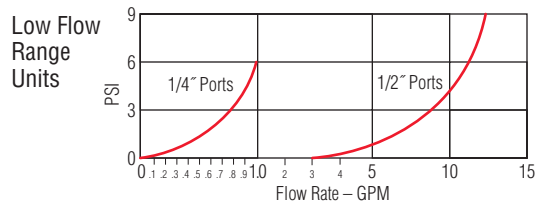
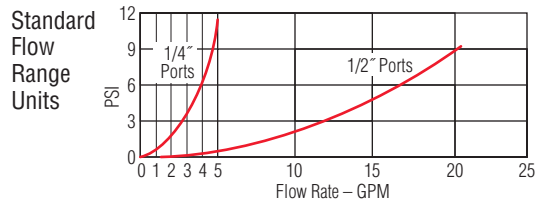
1. As liquid passes through the RotorFlow body, the magnetic rotor spins at a rate proportional to flow. This causes a series of magnetic fields (the rotor vanes) to excite the Hall Effect sensor, producing a series of voltage pulses.
2. The output pulses (RFO) are at the same voltage level as the input (4.5 - 24 VDC) with a frequency proportional to the flow rate. The output signal can be utilized by digital rate meters totalizers or other electronic controllers. RFA Type analog sensors condition the output signal to 0-10 VDC.
3. RotorFlow Indicators may be mounted with flow entering either port. Performance is optimized by positioning ports at the top of the unit, in a horizontal plane.

### Frequency vs. Flow Rate-Typical

Flow Rate (GPM)	Output Frequency – Hz					
	RFO Model – Based on Port Size					
	.25"	.25" with Adapter*	.50"	.50" with Adapter*	.75"	1"
0.10		13				
0.25		41				
0.50	15	90				
0.75		137				
1.0	34	186				
1.5	54			17		
2.0	73			25.9		
2.5	90			34		
3.0	110			43		
3.5	128					
4.0	148		34	60		
4.5	168					
5.0	185		44.8	76.7	24	
6.0			55	94		
7.0			65.9	111		
8.0			76	129		22
9.0			87.5	147		
10			99	165	61	30
11			110	185		
12			122	204		
13			135			
14			147			
15			158		93	43
16			170			
17			183			
18			195			
19			207			
20			220		128	60
25					163	74
30					196	91
35						107
40						123
45						137
50						153
55						170
60						185

\*Low Flow Adapter

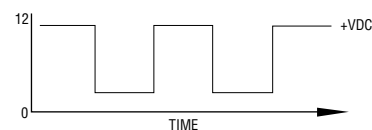
### Pressure Drop-Typical



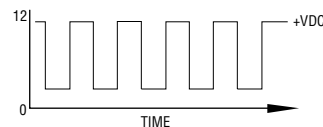
### Signal Output

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 VDC. Frequency of the output pulse is proportional to the flow rate and ranges from approximately 15 Hz at low flow to 225 Hz at high flow.

Example:  
**Low Flow**



**High Flow**



Note: Consult factory for flow rate/frequency curves.

# Flow Rate Monitoring – RFA Types

## ► 0 to 10 VDC Analog Output

GEMS Sensors popularized the RotorFlow'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. RFA Types feature a 0 to 10 VDC analog output which is proportional to flow rate.

### Specifications

<b>Wetted Materials</b>	
<b>Body</b>	Brass, 316 Stainless Steel or Polypropylene (Hydrolytically Stable, Glass Reinforced)
<b>Rotor Pin</b>	Ceramic
<b>Rotor</b>	PPS Composite, Black <sup>1</sup>
<b>Lens</b>	Polysulfone
<b>O-Ring</b>	Viton® (Alloy Bodies); Buna N (Polypropylene Body)
<b>Low Flow Adaptor</b>	Glass Reinforced Polypropylene
<b>Operating Pressure, Maximum</b>	
<b>Brass or Stainless Steel Body</b>	200 PSIG (13.8 bar) @ 70°F (21°C), 100 PSIG (6.9 bar) @ 212°F (100°C) <sup>2</sup>
<b>Polypropylene Body</b>	100 PSIG (6.9 bar) @ 70°F (21°C), 40 PSI (2.8 bar) Max. @ 180°F (82°C)
<b>Operating Temperature</b>	
<b>Brass or Stainless Steel Body</b>	-20°F to 212°F (-29°C to 100°C)
<b>Polypropylene Body</b>	-20°F to 180°F (-29°C to 82°C)
<b>Electronics</b>	150°F (65°C) Ambient
<b>Viscosity, Maximum</b>	200 SSU
<b>Input Power</b>	24 VDC, ±10%
<b>Output Signal</b>	0-10 VDC Analog Signal @ 1mA, Max.
<b>Current Consumption</b>	25 mA, Max.
<b>Accuracy</b>	
	See Table Below
<b>Electrical Termination</b>	
	22 AWG PVC-Jacketed, 24" Cable. Color Coded: Red = +VDC; Black = Ground; White = Signal Output

- Notes:  
 1. Standard on Stainless Steel bodies.  
 2. For higher pressure/temperature ratings stainless steel face plates are available. Consult factory.

### How To Order

For standard configurations, specify Part Number based on desired body material and port size.

Body Material	Port Size NPT	Flow Ranges – GPM			
		Low Range (Accuracy)	Part Number	Standard Range (Accuracy)	Part Number
Polypropylene	.25"	0.1 to 1.0 (±7.0%)	<b>230206</b> ⚡	0.5 to 5.0 (±7.0%)	<b>230205</b> ⚡
	.50"	1.5 to 12.0 (±7.0%)	<b>230207</b> ⚡	4.0 to 20.0 (±15.0%)	<b>230201</b> ⚡
Brass	.25"	0.1 to 1.0 (±7.0%)	<b>230209</b> ⚡	0.5 to 5.0 (±7.0%)	<b>230202</b>
	.50"	1.5 to 12.0 (±7.0%)	<b>230210</b>	4.0 to 20.0 (±15.0%)	<b>230203</b>
	.75"	—	—	5.0 to 30.0 (±10.0%)	<b>230212</b>
	1.00"	—	—	8.0 to 60.0 (±15.0%)	<b>230214</b>
Stainless Steel	9/16"-18	0.1 to 1.0 (±7.0%)	<b>230211</b>	0.5 to 5.0 (±7.0%)	<b>230204</b>
	.50"	1.5 to 12.0 (±7.0%)	<b>230216</b>	4.0 to 20.0 (±15.0%)	<b>230208</b>
	.75"	—	—	5.0 to 30.0 (±10.0%)	<b>230213</b>
	1.00"	—	—	8.0 to 60.0 (±15.0%)	<b>230215</b>

⚡ – Stock Items.

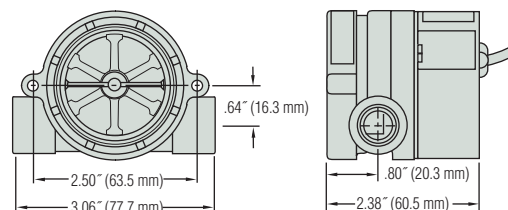


### Typical Applications

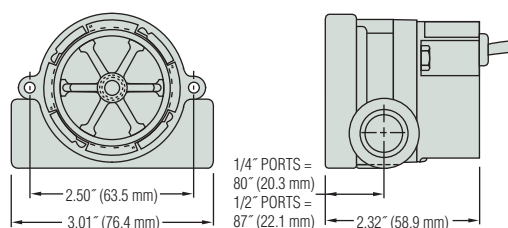
- Water Purification/Dispensing Systems
- Chemical Metering Equipment
- Lasers and Welders
- Water Injection Systems
- Semiconductor Processing Equipment
- Chillers and Heat Exchangers

### Dimensions

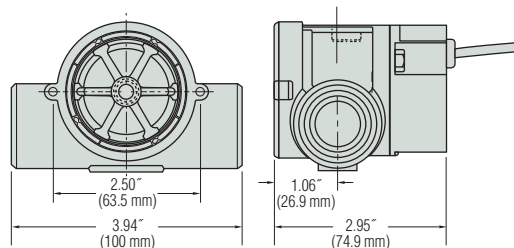
Polypropylene Bodies



Brass and Stainless Steel Bodies - .25" and .50" Ports



Brass Bodies – .75" and 1.00" NPT Ports



**High Resolution Black Rotor**  
 PPS composite. Each of the six rotor arms is magnetized. A PTFE loaded bushing ensures long life.



# Visual Indicators – RFI Types

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 bayonet mounting lens is easily removed for quick cleanout. RFI Type RotorFlow sensors are easy to see, easy to install and easy to afford.

## Typical Applications

- Visual flow confirmation on heat exchangers
- Plastic injection molding equipment

## Specifications

<b>Wetted Materials</b>	
<b>Body</b>	Brass, 316 Stainless Steel or Polypropylene (Hydrolytically Stable, Glass Reinforced)
<b>Rotor Pin</b>	Ceramic
<b>Rotor</b>	High Visibility Orange, Molded Nylon
<b>Lens</b>	Polysulfone
<b>O-Ring</b>	Viton® (Brass Body); Buna N (Polypropylene Body)
<b>Low Flow Adaptor</b>	Glass Reinforced Polypropylene
<b>Operating Pressure, Brass or Stainless Steel Body</b>	
	100 PSIG (7 bar) @212°F (100°C) 200 PSIG (13.8 bar) Max. @ 70°F (21°C)
<b>Polypropylene Body</b>	
	100 PSIG (6.9 bar) at 70°F (21°C), 40 PSI (2.8 bar) Max. @ 180°F (82°C)
<b>Operating Temperature, Brass or Stainless Steel Body</b>	
	-20°F to 212°F (-29°C to 100°C)
<b>Polypropylene Body</b>	
	-20°F to 180°F (-29°C to 82°C)

## Operating Principle

1. As liquid passes through the RotorFlow body, the rotor spins at a rate proportional to flow.
2. RotorFlow Indicators may be mounted with flow entering either port. At low flow rates, performance is optimized by positioning ports at the top of the unit, in a horizontal plane.

## How To Order

Specify Part Number based on desired body material and port size.

Body Material	Port Size NPT	Flow Ranges – GPM		Part Number
		Low* Range	Standard Range	
Polypropylene	.25"	0.1 to 1.0	0.5 to 5.0	<b>155420</b> ⚡
	.50"	1.5 to 12.0	4.0 to 20.0	<b>155480</b> ⚡
Brass	.25"	0.1 to 1.0	0.5 to 5.0	<b>142541</b> ⚡
	.50"	1.5 to 12.0	4.0 to 20.0	<b>142542</b> ⚡
	.75"	—	5.0 to 30.0	<b>180392</b> ⚡
	1.00"	—	8.0 to 60.0	<b>181681</b> ⚡
Stainless Steel	9/16" - 18**	0.1 to 1.0	0.5 to 5.0	<b>174596</b>
	.50"	1.5 to 12.0	4.0 to 20.0	<b>173138</b> ⚡
	.75"	—	5.0 to 30.0	<b>181682</b>
	1.00"	—	8.0 to 60.0	<b>181683</b>

\* With use of Low Flow Adapter supplied. See Page F-8 for more information.

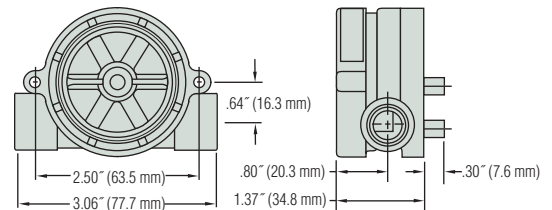
\*\* Straight thread with O-ring seal.

⚡ – Stock Items.

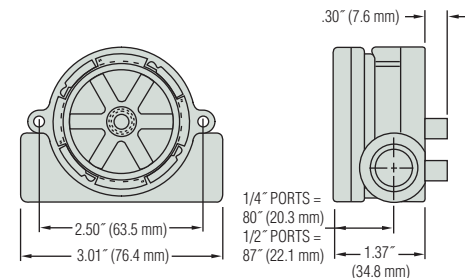


## Dimensions

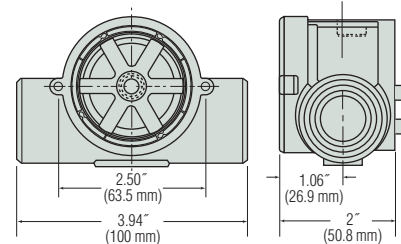
### Polypropylene Bodies



### Brass and Stainless Steel Bodies - .25" and .50" Ports



### Brass Body – .75" and 1.00" Ports



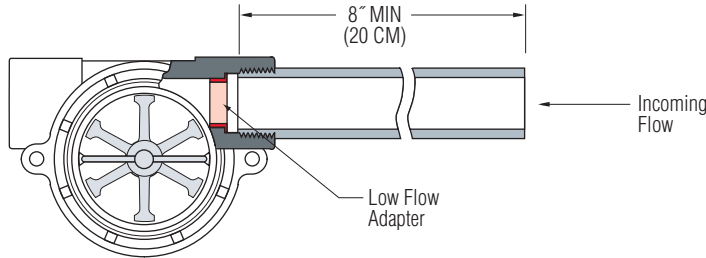
**High Visibility Orange Rotor**  
Constructed of Molded Nylon for good general purpose compatibility with a wide range of fluids. Offers high visibility.



## Easy 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 8 inches (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.



Except for straight-thread versions, 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. Straight-thread versions require an O-ring for sealing.

150 micron filtration is recommended. However, should foreign particles enter the RotorFlow sensor, accumulation is easily cleared by removing the lens from the body. The lens is removed by turning its 7/16" hex center hub 45° counter-clockwise with a standard socket wrench. To reinstall the lens, simply reverse the process. Pressure must be relieved from the system prior to sensor clean-out. O-rings should be lubricated prior to re-assembly.

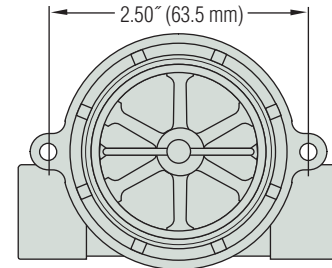
## Low Flow Applications

A low flow adapter 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.

## Panel Mounting

**Plastic Bodies.** Two (2) mounting ears are provided at the body center line to receive #8 self-tapping screws to accommodate panel mounting of the plastic RotorFlow units. Note: ANSI T type 23 self-tapping screws are recommended. They may be replaced with standard machine screws if re-installation should be required.

**Brass and Stainless Steel Bodies.** Two (2) mounting holes are provided on the body centerline, as shown below. #8-32UNC-2B screws are required for mounting.



## RotorFlow® Maintenance Kits

Rebuild your RotorFlow® Sensors and Switches in less than 5 minutes with one of these kits.

Includes:

- Ceramic Rotor Pin
- 6-Pole Magnetic Rotor with PPS/PTFE Bushing
- Buna N or Viton® O-Ring
- Polysulfone Lens

Rotorflow® Type		O-Ring Material in Kit	Part Numbers	
Line Size	Body Material		RFA/RFO/RFS	RFI
1/4" & 1/2"	Plastic	Buna-N	155870 ⚡	155872
	Brass/SS	Viton®	167364 ⚡	166267
3/4" & 1"	Brass/SS	Viton®	182695	157187

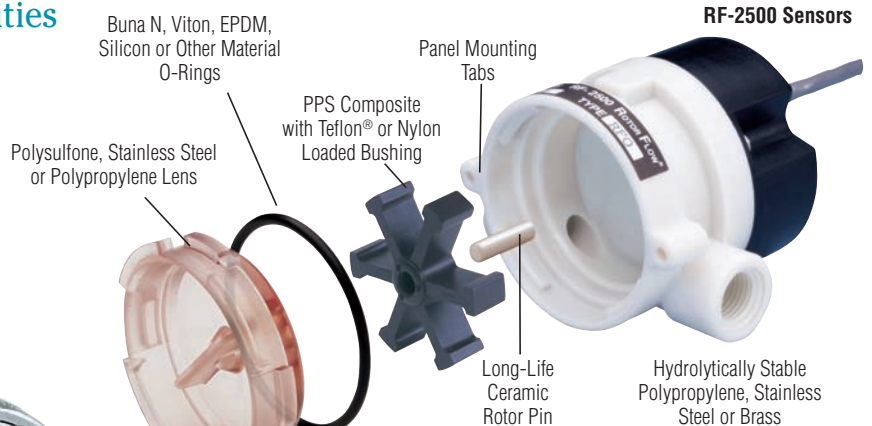
⚡ – Stock Items.

## RotorFlow® Sensor Special Capabilities are Yours for the Asking.

Gems caters to OEM needs with special configurations that go beyond the standards in this catalog. We can provide RotorFlow sensors with enhanced chemical compatibility, higher temperature and pressure capabilities, and alternate electrical terminations.

Other Capabilities Available to OEMs:

- Electrical outputs: Combined switch and frequency; transistor switching; 0-10 VDC analog.
- Custom face plate (cast stainless steel face plate pictured)



We are committed to providing our customers with the product that best meets the requirements of their applications. Please call us and tell us what you need, and ask us about Swagelok® tube fittings, faceplate options, and 9/16" and 3/4" straight-thread versions.

**Call 800-378-1600**



# FT-110 Series – TurboFlow® Economical Flow-Rate Sensors

- ▶ Low Cost Plus High Accuracy ±3% of Reading
- ▶ Measures Low Liquid Flow Rates of .1 to 8 GPM
- ▶ 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 1/2% 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 aging filters. The sensor's standard power and output specifications make it easy to retrofit to existing controllers.

## Specifications

<b>Wetted Materials</b>	
<b>Body</b>	Nylon 12
<b>Turbine</b>	Nylon 12 Composite
<b>Bearings</b>	PTFE/15% Graphite
<b>Operating Pressure</b>	200 PSIG
<b>Burst Pressure</b>	2500 PSIG
<b>Operating Temperature</b>	-4°F to 212°F (-20°C to 100°C)
<b>Viscosity</b>	32 to 81 SSU (.8 to 16 Centistokes)
<b>Filter</b>	<50 Microns
<b>Input Power</b>	5 to 24 VDC @ 8mA
<b>Output (Hz)</b>	NPN Sinking Open Collector @ 20mA Maximum Leakage Current 10µA (Pull-Up Resistor Required)
<b>Accuracy</b>	±3% of Reading
<b>Repeatability</b>	0.5% of Full Scale
<b>Electrical Connection</b>	Spade Terminals .110" x .248" x .031" (2.8/6.3 x .8 mm) or 3 ft. cable
<b>Inlet/Outlet Ports</b>	3/8" NPT Male (3/8" G Male also available)

## How To Order – Standard Models

Specify Part Number based on flow range.

For 1-meter (3-ft.) cable units, add "-C" to part number

Flow Range		Pulses per		Frequency Output	Part Number
GPM	Liters/m	Gallon	Liter		
.13-1.3	0.5-5	12500	3300	27-275 Hz	173932 ⚡
		26100	6900	58-575 Hz	173931 ⚡
.13-2.0	.5-7.5	17400	4600	38-575 Hz	173933 ⚡
.26-4.0	1-15	8300	2200	37-550 Hz	173934 ⚡
.53-7.9	2-30	3800	1000	33-500 Hz	173935 ⚡

⚡ – Stock Items.

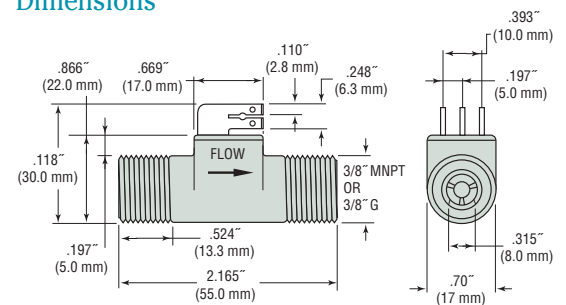
## FT-110 Accessories

Consult factory for special customized OEM versions.

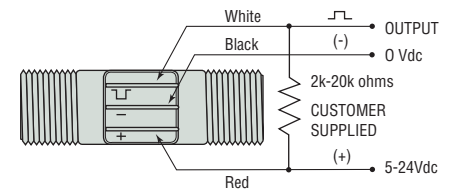
Description	Part Number
Mating connector w/3 feet, 3 conductor, PVC pigtail cable	173941 ⚡
Mating connector w/10 feet, 3 conductor, PVC pigtail cable	173942 ⚡



## Dimensions

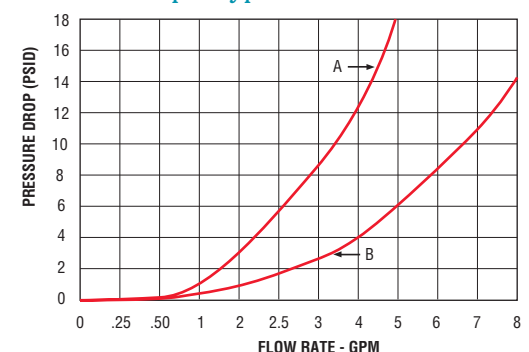


## Wiring



Cable Wire Code: Red = 5 to 24 VDC  
Black = Ground  
Brown = Signal Output

## Pressure Drop—Typical



A) Part #173931  
173932  
173933

B) Part #173934  
173935

# FT-210 Series – TurboFlow® Low Flow Turbine Sensor

- ▶ Low Flow Rates .1 to 2.5 LPM and High Accuracy  $\pm 3\%$  of Reading
- ▶ Lightweight Turbine Ensures Fast Startup
- ▶ Mounts In Any Orientation

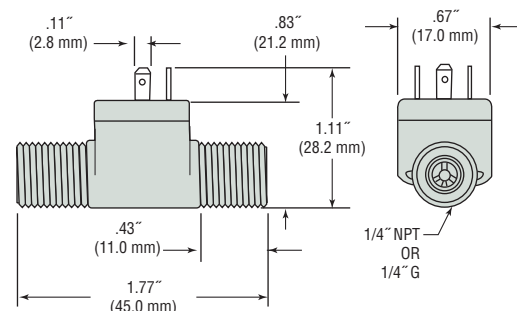
Gems FT-210 features proven turbine technology in a small package for low flow applications. The turbine technology provides a highly repeatable sensor ideally suited for measurement of either volume dispensing and/or flow rate applications. The small turbine reacts quickly to on/off dispensing applications. Each sensor is 100% tested, ensuring years of service life.

## Specifications

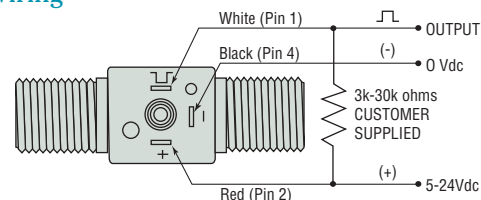
<b>Wetted Materials</b>	
<b>Body</b>	Nylon 12 (Grilamid TR55) or Grivory
<b>Turbine</b>	Nylon 12 Composite
<b>Bearings</b>	PTFE/15% Graphite
<b>Operating Pressure</b>	350 PSI (24 bar)
<b>Burst Pressure</b>	1400 PSI (97 bar)
<b>Flow Range</b>	.026- 65 gallons/minute 0.1-2.5 liters/minute 3.4-84.5 ounces/minute
<b>Pulses</b>	83,200 per gallon 22,000 per liter 650 per ounce
<b>Frequency Output</b>	36.6-917 Hz
<b>Operating Temperature</b>	-4°F to 212°F (-20°C to 100°C)
<b>Viscosity</b>	32 to 70 SSU (.8 to 16 Centistokes)
<b>Filter</b>	<50 Microns
<b>Input Power</b>	5 to 24 VDC
<b>Output (Hz)</b>	NPN Sinking Open Collector @ 20mA Maximum Leakage Current 10 $\mu$ A (3K-30K Pull up resistor required)
<b>Accuracy</b>	$\pm 3\%$ of Reading
<b>Repeatability</b>	0.5% of Full Scale
<b>Electrical Connection</b>	9.4mm Spacing 3-pole DIN Connector (1" high)
<b>Inlet/Outlet Ports</b>	1/4" NPT (1/4" G Male also available)



## Dimensions

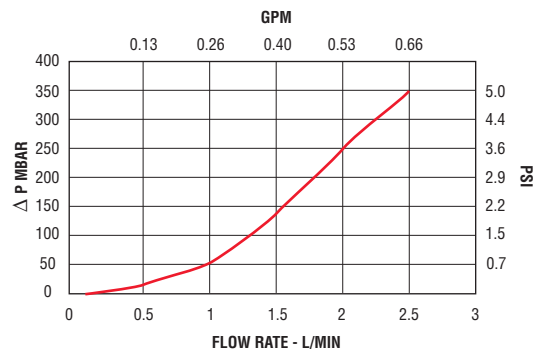


## Wiring



Pin Code: 1 = Output  
2 = Supply  
4 = Common

## Pressure Drop—Typical



## How To Order

Specify a Part Number for the Port Connection AND a Part Number for the DIN Electrical Connection. Two Part Numbers are required for a complete part assembly.

## FT-210 Sensor

Body Material	Port Size	Part Number
Nylon 12	1/4" NPT	212465
	1/4" G	212460
Grivory®	1/4" NPT	223910
	1/4" G	223190

## Electrical Connection

Description	Part Number
1 meter DIN PVC Cable Assembly with 10K pull-up resistor	218572
Mating DIN Connector	212404



# FT-330 Series – NSF Approved Materials

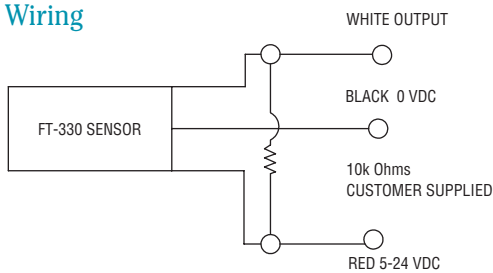
- ▶ High Accuracy:  $\pm 2\%$  of reading
- ▶ High repeatability:  $\pm 0.5\%$  of reading
- ▶ Overmolded electronics with integral cable strain reinforcement
- ▶ Measures flow rates from .2 to 4 GPM
- ▶ Lightweight plastic design for multiple mounting positions

The FT-330 is a highly accurate and repeatable, Hall Effect turbine flow sensor designed for low flow OEM applications. This low cost, NSF Std. 61 listed flow sensor is ideal for water or beverage dispensing applications or any application with water based liquids. The 316SS shaft coupled with Delrin® bearings allows for accurate measurements during quick dispensing cycles. The sensor's standard power and output specifications make it easy to retrofit existing controllers.

## Specifications

<b>Materials</b>	
<b>Body</b>	Glass Reinforced PPO (Noryl)
<b>Turbine</b>	PA Composite (Nylon)
<b>Axle</b>	316 Stainless Steel
<b>Bearings</b>	Delrin® (Polyoxymethylene, POM)
<b>Inlet/Outlet Ports</b>	3/8" NPT Male
<b>Pressure</b>	
<b>Operating</b>	200 PSIG
<b>Burst</b>	1000 PSIG
<b>Operating Temperature</b>	-4°F to 176°F (-20°C to 80°C)
<b>Viscosity</b>	32 to 81 SSU (1.8 to 16 Centistokes)
<b>Recommended Filtration</b>	< 50 Microns
<b>Input Power</b>	5 to 24 VDC @ 8mA
<b>Output (Hz)</b>	NPN Sinking Open Collector @ 25mA Maximum leakage current 10µA (5k to 30k Pull-Up Resistor Required)
<b>Accuracy</b>	$\pm 2\%$ of reading
<b>Repeatability</b>	$\pm 0.5\%$ of reading
<b>Electrical Connection</b>	3 ft PVC cable #22 AWG
<b>Approvals</b>	NSF Std. 61 listed

## Wiring



## How To Order

Specify Part Number based on flow rate measuring capability.

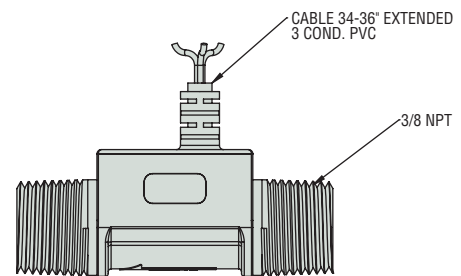
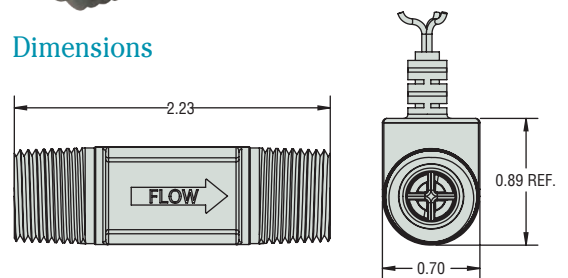
Flow Range		Frequency Out	Pulses Per Gallon	Pulses Per Liter	Part Number
GPM	LPM				
0.2 to 2	0.8 to 7.6	34 to 343 Hz	10,313	2724	226000 ⚡
0.4 to 4	1.5 to 15	29 to 343 Hz	4,994	1319	226100 ⚡

⚡ – Stock Items.

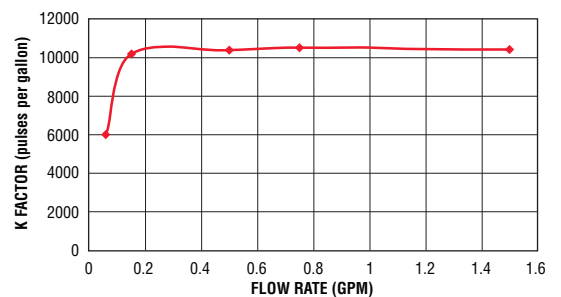


NSF approved

## Dimensions

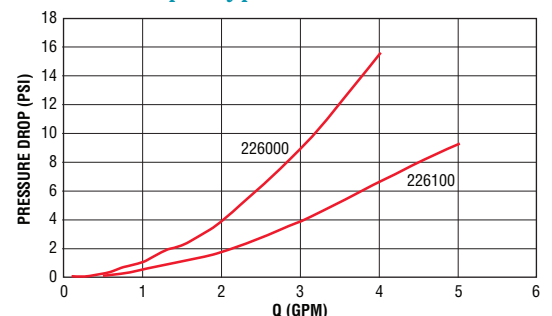


## K-factor Chart\* - Part Number 226000



\* Consult factory for P/N 226100 K-factor chart

## Pressure Drop—Typical



# FS-600 Series – No Moving Part, Thermal Dispersion Flow Switch

**Flow Rate Settings:** 0.1 GPM to 11 GPM (0.5 LPM to 41 LPM)

**Port Size:** 1/2" to 1-1/2" (NPT or G thread)

**Setting Type:** Fixed

The FS-600 series uses proven thermal dispersion technology to provide a robust no moving part flow switch even without filtration. The solid state sensor is compatible with both conductive and non-conductive fluids. Suitable for fluids with particulates or slurries, and is immune to changes in media viscosity. The straight through switch is designed for a long life and can be mounted in any orientation and can handle a wide range of flow rates. No moving parts means years of reliable service.

## Specifications

<b>Wetted Materials</b>	
<b>Probe</b>	303 Stainless Steel
<b>Flow Body</b>	316 Stainless Steel
<b>Operating Pressure (Max.)</b>	363 PSIG (25 bar)
<b>Operating Temperature</b>	-14° F to 140°F (-10°C to 60°C)
<b>Power on Delay Time</b>	15 Seconds Max (Output On)
<b>Response Time</b>	10 Seconds Max.
<b>Inlet/Outlet Ports</b>	1/2", 3/4", 1", 1-1/2" NPT 1/2", 3/4", 1", 1-1/2" G Internal
<b>Operating Voltage</b>	24 Vdc or 24Vac +/- 15%
<b>Current Consumption</b>	Less than 50mA
<b>Switch Contact Rating</b>	30Vac@45mA, 42Vdc @65mA
<b>Switch Logic</b>	Normally Open
<b>Ingress Protection</b>	IP65
<b>Set point Accuracy</b>	15%
<b>Set point Differential</b>	20% (Max.)
<b>Electrical Termination</b>	M12 x 1 (4-Pin) (1 meter cable included)
<b>Approvals</b>	CE

## Calorimetric Principle/Thermal Dispersion

The operating principle of the FS-600 flow switch is based on the calorimetric principle. The FS-600 uses the cooling effect of a flowing fluid or gas to monitor the flow rate. The amount of thermal energy that is removed from the tip determines the local flow rate. This temperature-based operating principle can reliably sense the flow of virtually any liquid or gas.

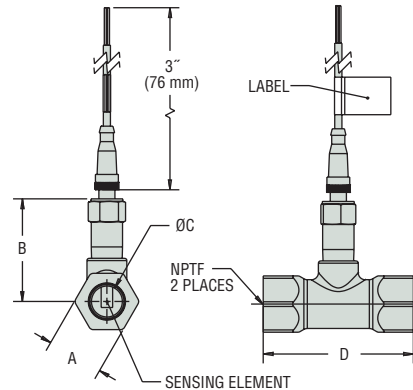
The sensor tip of the FS-600 flow sensor houses two transistors and a heater element. One transistor is located in the sensor tip, closest to the flowing fluid. This transistor is used to detect changes in the flow velocity of the liquid. The second transistor is bonded to the cylindrical wall and is a reference for ambient fluid conditions.

In order to make the sensor sense flow, it is necessary to heat one of the transistors in the probe. When power is applied, the tip of the probe is heated. As the fluid starts to flow, heat will be carried away from the sensor tip. Cooling of the first transistor is a function of how fast heat is conducted away by the flowing liquid. The difference in temperature between the two transistors provides a measurement of fluid velocity past the sensor probe. When fluid velocity is high, the temperature differential is small. As fluid velocity decreases, there is an increase in temperature differential.

CE



## Dimensions

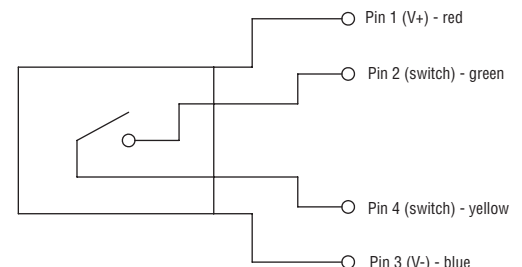


Port Size NPTF	A	B	C	D
1/2"	1.13 (28.7)	2.65 (67.3)	0.62 (15.8)	3.06 (77.8)
3/4"	1.50 (38.1)	2.75 (69.9)	0.824 (20.9)	4.00 (101.6)
1"	1.50 (38.1)	2.75 (69.9)	1.05 (26.7)	4.00 (101.6)
1-1/2"	2.25 (57.1)	3.00 (76.2)	1.61 (40.9)	4.25 (107.9)

Notes:

- Standard calibration is in water with units in a horizontal position.
- Consult Gems for special applications.

## Wiring Diagram



**How To Order – Standard Models**

Specify Part Number based on flow rates for the FS-600 Series per the following chart.

Port Size NPT	Flow Setting		Part Numbers	Port Size NPT	Flow Setting		Part Numbers
	GPM	LPM			GPM	LPM	
1/2"	0.13	0.48	<b>230500-1-5</b>	1"	0.64	2.20	<b>230500-3-5</b>
	0.24	0.90	<b>230500-1-10</b>		0.97	3.20	<b>230500-3-10</b>
	0.35	1.31	<b>230500-1-15</b>		1.31	4.25	<b>230500-3-15</b>
	0.46	1.73	<b>230500-1-20</b>		1.65	5.30	<b>230500-3-20</b>
	0.57	2.14	<b>230500-1-25</b>		1.99	6.5	<b>230500-3-25</b>
	0.68	2.56	<b>230500-1-30</b>		2.32	7.5	<b>230500-3-30</b>
	0.79	2.98	<b>230500-1-35</b>		2.66	8.5	<b>230500-3-35</b>
	0.90	3.39	<b>230500-1-40</b>		3.00	9.5	<b>230500-3-40</b>
	1.01	3.81	<b>230500-1-45</b>		3.33	10.0	<b>230500-3-45</b>
	1.12	4.23	<b>230500-1-50</b>		3.67	12.0	<b>230500-3-50</b>
	1.23	4.64	<b>230500-1-55</b>		4.01	13.0	<b>230500-3-55</b>
	1.34	5.06	<b>230500-1-60</b>		4.34	14.0	<b>230500-3-60</b>
	3/4"	0.35	1.31		<b>230500-2-5</b>	1-1/2"	1.48
0.57		2.15	<b>230500-2-10</b>	2.28	8.5		<b>230500-4-10</b>
0.79		2.99	<b>230500-2-15</b>	3.07	11.6		<b>230500-4-15</b>
1.01		3.83	<b>230500-2-20</b>	3.86	14.6		<b>230500-4-20</b>
1.23		4.67	<b>230500-2-25</b>	4.66	17.6		<b>230500-4-25</b>
1.46		5.51	<b>230500-2-30</b>	5.45	20.6		<b>230500-4-30</b>
1.68		6.00	<b>230500-2-35</b>	6.0	22.7		<b>230500-4-35</b>
1.90		7.00	<b>230500-2-40</b>	7.0	26.5		<b>230500-4-40</b>
2.12		8.00	<b>230500-2-45</b>	8.0	30.3		<b>230500-4-45</b>
2.34		9.00	<b>230500-2-50</b>	9.0	34.1		<b>230500-4-50</b>
2.57		10.00	<b>230500-2-55</b>	10.0	37.9		<b>230500-4-55</b>
2.79		11.00	<b>230500-2-60</b>	11.0	41.6		<b>230500-4-60</b>

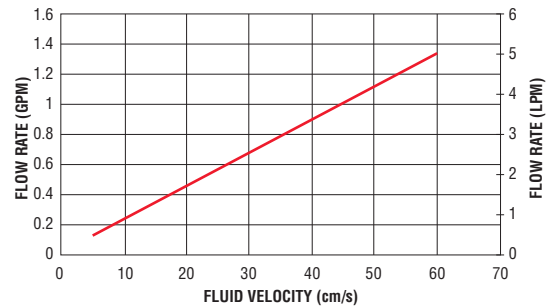
Notes:  
 1. G threads are available upon request. Minimum order quantities apply. Contact factory.  
 2. -5 through -60 = fluid velocity (cm/s)

**Accessories**

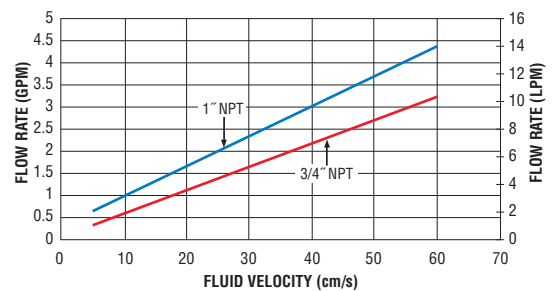
Description	Part#
M12 cord Set-1 meter (Red 1, Green 2, Blue 3, Yellow 4) 22 AWG	<b>557703-01M0</b>
M12 cord Set-3 meter (Red 1, Green 2, Blue 3, Yellow 4) 22 AWG	<b>557703-03M0</b>
M12 cord Set-4 meter (Red 1, Green 2, Blue 3, Yellow 4) 22 AWG	<b>557703-04M0</b>
M12 cord Set-5 meter (Red 1, Green 2, Blue 3, Yellow 4) 22 AWG	<b>557703-05M0</b>

**Fluid Velocity vs. Flow Rate in GPM/LPM**

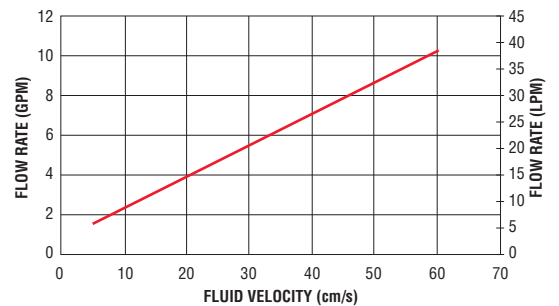
1/2" NPT Ports (1/2" G Port)



3/4" NPT and 1" NPT Ports (3/4" and 1" G Ports)



1-1/2" NPT Ports (1-1/2" G Ports)



## Flow Switches

- ▶ Piston
- ▶ Shuttle
- ▶ Paddle

### 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 rates, ranging from 50 cc/min. to 100 GPM, GEMS switches will initiate alarm actuation or 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.

### Variety of Operating Principles

The versatile GEMS Flow Switch line utilizes four basic operating principles. This catalog is organized 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.

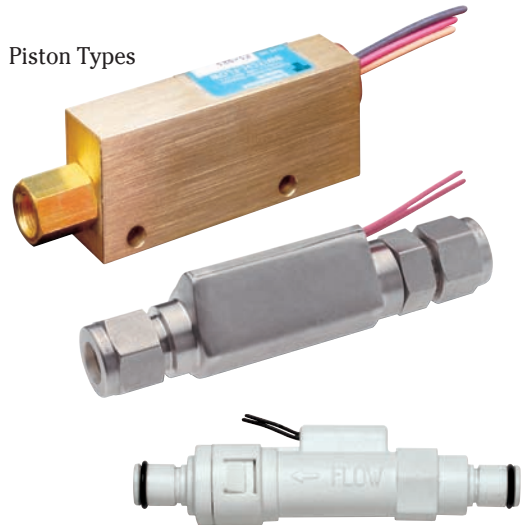
### Flow Rate Selection Guide

Set Point		Switch Series	Body Materials
Water	Air		
50 cc to 300 cc/min.	2 to 50 SCFH	FS-926	Alloys
0.1 to 1.0 GPM (oil)	—	FS-930	
0.1 to 1.5 GPM	—	FS-4	Engineered Plastics
0.1 to 1.5 GPM	0.5 to 25.0 SCFM	FS-925	Alloys
0.1 to 1.5 GPM	—	FS-927	
0.15 to 2.0 GPM	—	FS-380	
0.25 to 2.0 GPM	—	FS-380P	
0.1 to 60 GPM	—	RFS-2500 Rotorflow <sup>1</sup>	Eng. Plastics & Alloys
0.5 to 3.0 GPM	—	FS-480	Alloys
0.5 to 5.0 GPM	—	FS-150	Engineered Plastics
0.5 or 2 GPM	—	FS-400P	
0.25 to 5.0 GPM	—	FS-500	
0.5 to 20.0 GPM	1.0 to 160.0 SCFM	FS-10798	Alloys
0.5 to 100 GPM	—	FS-200	
0.75 to 10.0 GPM	—	FS-400	
0.75 to 14.0 GPM	—	FS-400 Adjustable	
1.0 to 15.0 GPM	—	FS-200 Adjustable	
Dependent on Pipe Size and Paddle Length	—	FS-550 Series	

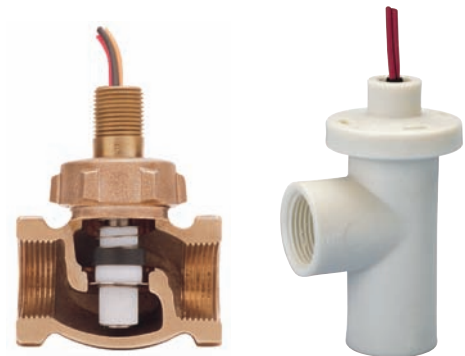
Note:  
1. See Section E.

Contents	Page Start
Piston Type.....	G-2
Shuttle Type.....	G-16
Paddle Type .....	G-23

Piston Types



Shuttle Types



Paddle Types



## Piston Type Switches – For Low Flow Rates in Liquids and Gases

- ▶ Models for liquid flow rates as low as 50 cc/min. and gas flow rates as low as 2 SCFH
- ▶ Small, compact housings with port sizes from 1/4" NPT
- ▶ Precision built for superior accuracy

### Typical Applications

Protect your expensive electronic equipment from coolant flow failure on...

- Laser Heads • Welders • Power Supplies • High Speed Spindles • X-Ray Tubes
- Semiconductor Equipment

Assure proper lubrication flow to critical bearings or gears to prevent system downtime on...

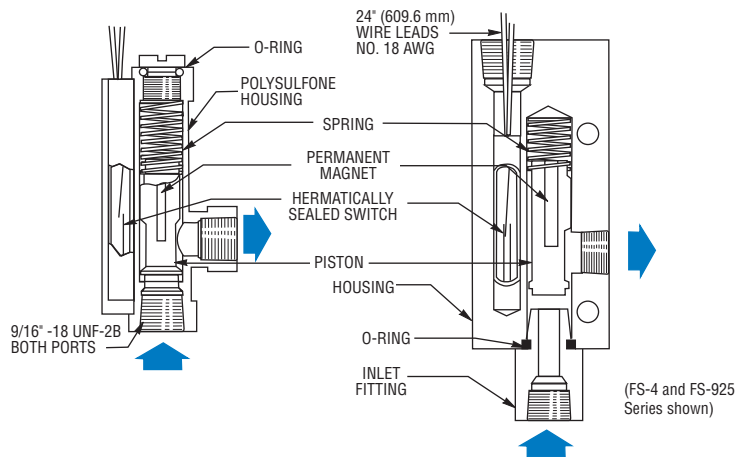
- Presses • Rotating Equipment • Conveyors • Machine Tools • Robotics

Ensure system integrity in processing and dispensing equipment on...

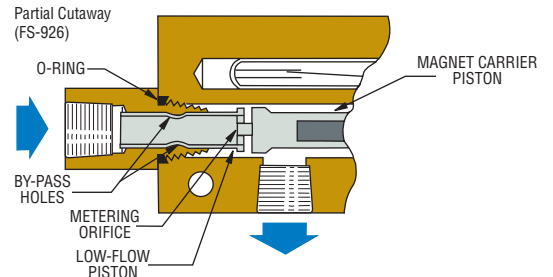
- Water Purifications and Filtering • X-Ray film Processing
- Beverage dispensing • Chemical additives • Gas sampling • Distilling

### Design Data

#### General Operating Principles

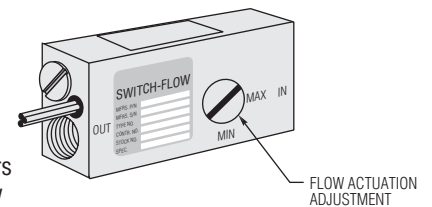


#### Low-Flow Switches



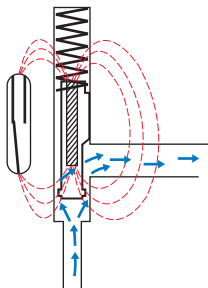
An additional, lap-fitting piston is used in GEMS FS-926 Series to accurately detect low-flow rates. Calibration is determined by one or more metering holes in the top of the low-flow piston, which regulates bypass flow, and therefore the actuation setting. When metered bypass flow is exceeded, the resultant pressure differential displaces the low-flow piston, moving the magnet carrier piston to actuate the reed switch. Two large bypass holes in the piston skirt are exposed after actuation to maintain low pressure drop.

#### Externally Adjustable Switches



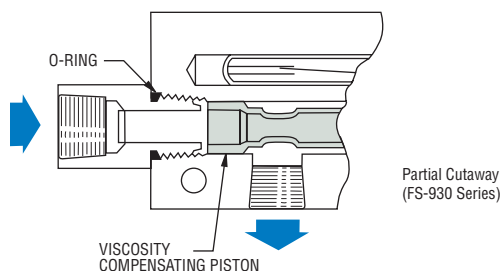
The FS-10798 Series offers infinite flow settings from 0.5 to 20 GPM. Versions suitable for gas flow monitoring are also available.

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 reed switch (SPST or SPDT, depending on the series) 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.



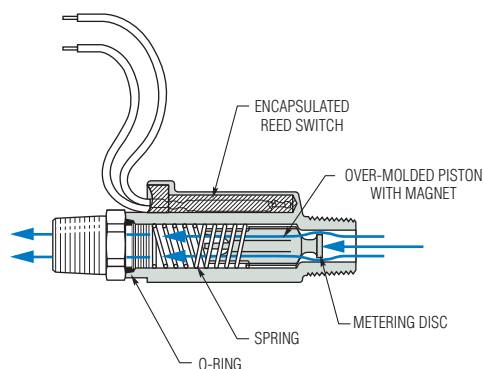


### Viscosity Compensating Switches



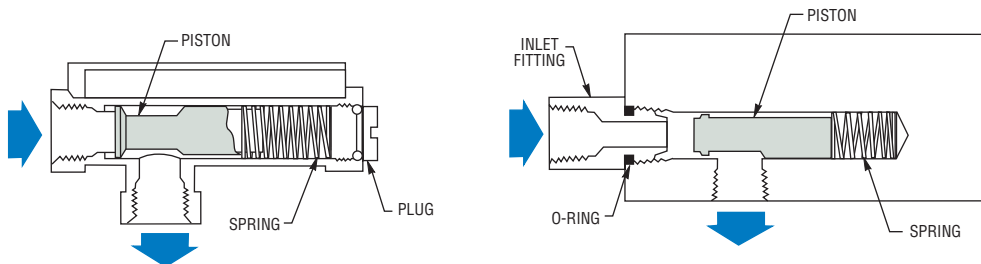
When temperatures of viscous fluids change, so do their flow properties. With viscosity lowered by increasing temperature, a greater flow is generally required to create actuation pressure differential. A unique patented piston within GEMS FS-930 Series switches accommodates these changes in fluid viscosity while maintaining accurate switch actuation. Units can detect flow rates with 20% accuracy for liquid viscosities between 40 to 1000 SSU.

### Low Pressure Drop Switches



The key to the excellent flow qualities of the FS-150 and FS-380 Series switches is the dual diameter internal bore. At flow rates below the actuation point, the fluid passes around the piston and metering disc within the “metering bore.” As fluid flow increases past the actuation point, the metering disc enters the “flow bypass bore” where the increased diameter provides generous flow paths. The result is a low pressure drop for high flow rates and less susceptibility to fouling.

### Typical Piston and Spring Removal



Accumulation of foreign debris should periodically be removed from these switches. GEMS' designs provide for easy piston and spring removal for this occasional cleaning. Recommended cleaning procedures are provided in the Instruction Bulletin shipped with each unit. 150 micron filtration is recommended for the FS-150 Series; 100 micron for FS-380, 50 micron filtration is recommended for all other piston type switches.

NOTE: All air/gas Flow Switches are factory calibrated using a special piston. Water calibrated units are not recommended for air/gas applications.

Contents	Page Start
FS-4 Series	
Molded Plastic Construction.....	G-4
FS-150 Series	
Straight-Through Flow Path, Ryton Material.....	G-5
FS-380 Series	
High Pressure Inline .....	G-6
FS-380P Series	
Inline – Plastic Flow .....	G-7
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General Purpose.....	G-10
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Externally Adjustable .....	G-12
FS-930 Series	
Viscosity Compensating.....	G-14

# FS-4 Series – Low Cost, Molded Plastic Construction

**Flow Rate Settings:** 0.1 GPM to 1.5 GPM

**Port Size:** 9/16"-18 UNF

**Primary Construction Material:** Ryton®

**Setting Type:** Fixed

The FS-4 Series makes flow protection economical for a broad range of industrial applications such as welders, lubrication systems, medical sterilizers and laundry chemicals dispensing.

## Specifications

<b>Wetted Materials</b>	
Housing and Piston	Ryton® R4
Spring	316 Stainless Steel
O-Ring	Viton®
<b>Other Wetted Parts</b>	
	Epoxy
<b>Operating Pressure, Maximum</b>	250 PSIG (17.2 bar) @ 70°F (21°C)
<b>Operating Temperature</b>	0°F to 225°F (-17°C to +107°C)
<b>Set Point Accuracy</b>	±15% Maximum
<b>Set Point Differential</b>	20% Maximum
<b>Switch*</b>	SPST or SPDT, 20 VA (SPDT: 240 VAC Max.)
<b>Inlet/Outlet Ports</b>	9/16"-18 UNF-2B Thread
<b>Recommended Filtration</b>	50 Microns or Better
<b>Electrical Termination</b>	
SPST	18 AWG, Zipcord, 24" Long
SPDT	18 AWG, PVC 24" Long Leads

\* See "Electrical Data" on Page X-5 for more information.

## How To Order – Standard Models

Housing and Piston Material	Flow Setting GPM	Part Numbers		
		SPST Switch		With SPDT Switch
		N.O., No Flow	N.C., No Flow	
Ryton®	0.1	122340	122346	122352
	0.25	122341	122347	122353
	0.5	122342	122348	122354
	0.75	122343	122349	122355
	1.0	122344	122350	122356
	1.5	122345	122351	122357

Note:  
Flow settings are calibrated using water @ +70°F on increasing flow, with units in a vertical position (lead wires up).

## Port Adapters for FS-4

Converts 9/16" threaded ports to NPT or barbed connection. Made of Ryton®-R4 or polypropylene with O-Rings in place.

**CAUTION:** Do not exceed 15 in./lbs. maximum torque when installing adapter fittings.

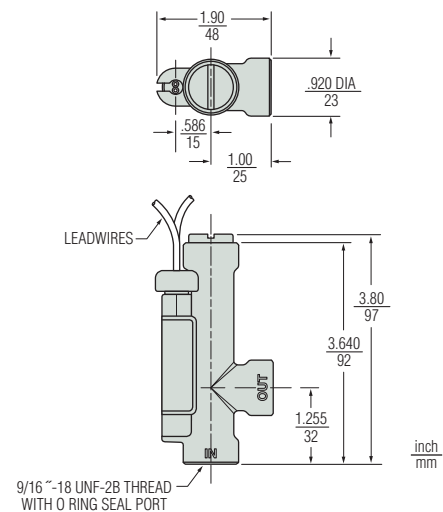
Material	Adapter Size	Part Numbers
Ryton®	1/8" NPT*	123028
	1/4" NPT*	123029
Polypropylene	1/4" NPT*	158602
	1/2" Barb**	158603

\*Wrench flats provide for proper assembly.  
\*\* Accepts 1/2" I.D. flexible hose  
– Stock Items.

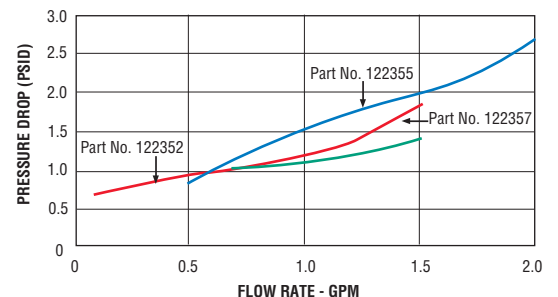


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CSA Listed —  
File No. LR30200

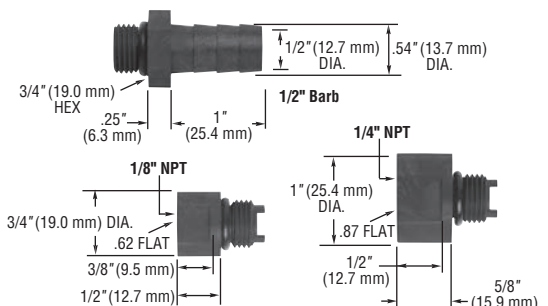
## Dimensions



## Pressure Drop – Typical



Tests conducted with units in vertical position (lead wires up) with water at +70 F (21 C).



# FS-150 Series – Straight Flow Path with Low Pressure Drop

**Flow Rate Settings:** Liquids: 0.5 GPM to 5 GPM  
**Port Size:** 1/2" NPT  
**Primary Construction Material:** Polypropylene  
**Setting Type:** Fixed

These slim, inline switches reduce pressure drop to a minimum. They incorporate 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 with little pressure loss to the down stream line.

## Specifications

<b>Wetted Materials</b>	
<b>Housing</b>	Polypropylene, Hydrolytically Stable, Glass Reinforced
<b>Piston</b>	Ryton® -R4, 316 Stainless Steel
<b>O-Ring</b>	Viton®
<b>Spring</b>	316 Stainless Steel
<b>Operating Pressure, Maximum</b>	200 PSIG (13.8 bar) @+70°F to +150°F (+21.1°C to 65.5°C) 150 PSIG (10.3 bar) @+150°F to +212°F (+65.5°C to +100°C)
<b>Operating Temperature</b>	0°F to 212°F (-17.8°C to +100°C)
<b>Set Point Accuracy</b>	±15%
<b>Set Point Differential</b>	20% Maximum
<b>Switch*</b>	SPST, 20 VA
<b>Inlet/Outlet Ports</b>	1/2" NPT Male
<b>Electrical Termination</b>	1/4" Male Quick Connect Terminals (2)

\*See "Electrical Data" on Page X-5 for more information.

## How To Order – Standard Models

Specify Part Number based on flow setting and switch operation.

Flow Settings GPM	Part Numbers	
	Normally Open @ No Flow	Normally Closed @ No Flow
0.5	129660 ⚡	129666
1.0	129661 ⚡	129667
2.0	129662 ⚡	129668
3.0	129663 ⚡	129669
4.0	129664	129670
5.0	129665	129671

Notes:

- Flow settings are calibrated using water @ +70°F on increasing flow, with units in a horizontal position (terminals up).
- Care should be taken by specifiers to ensure fluid compatibility with the above listed wetted materials.
- Use of 150 micron filtration is recommended.

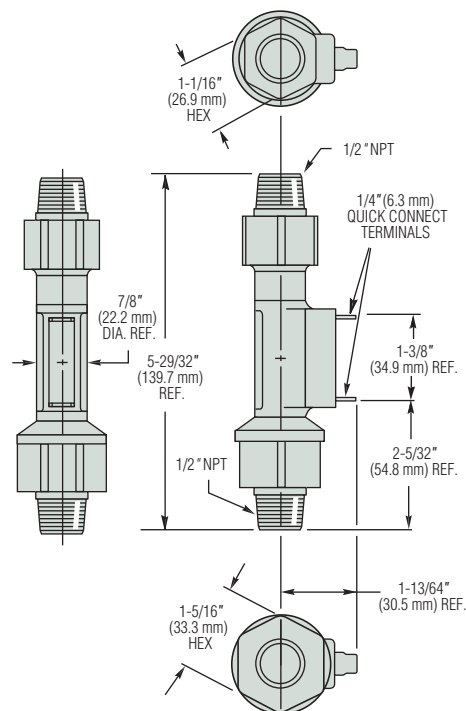
⚡ – Stock Items.



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 CSA Listed —  
 File No. LR30200

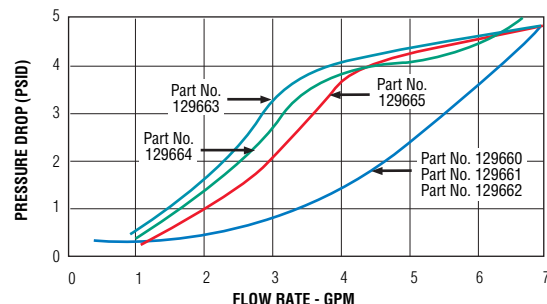
Patent #  
 4.996.396

## Dimensions



Note: Cable output available. Please consult factory.

## Pressure Drop - Typical



Tests conducted with units in a horizontal position with water at +70°F (21°C). Data will vary slightly for vertically mounted units.

# FS-380 Series – Compact Flow Switch for High Inline Pressures

**Flow Rate Settings:** 0.15 GPM to 2.00 GPM  
**Port Size:** 3/8" NPT Male  
**Primary Construction Material:** Brass or Stainless Steel  
**Setting Type:** Fixed

These rugged inline flow switches use 100 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. The FS-380 is also an excellent choice for semicon cooling applications where simple design and reliable operation are required.

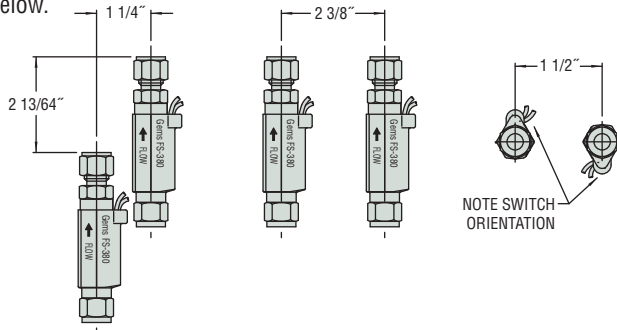
## Specifications

<b>Wetted Materials</b>	
<b>Housing</b>	Brass or 316 Stainless Steel
<b>Piston</b>	PPS Composite, Epoxy
<b>Spring</b>	316 Stainless Steel
<b>O-Ring</b>	Fluorocarbon
<b>Operating Pressure, Maximum</b>	1500 PSI (107 bar)
<b>Operating Temperature</b>	-20°F to +275°F (-28.8°C to +135°C)
<b>Set Point Accuracy</b>	±20% Maximum
<b>Set Point Differential</b>	20% Maximum
<b>Switch*</b>	SPST, 20VA, N.O. at no Flow
<b>Electrical Termination</b>	No. 22 AWG, 24" to 26" Polymeric leads

\* See "Electrical Data" on Page X-5 for more information.

## Spacing

To prevent sensor to sensor magnetic field interference, follow the spacing guidelines below.



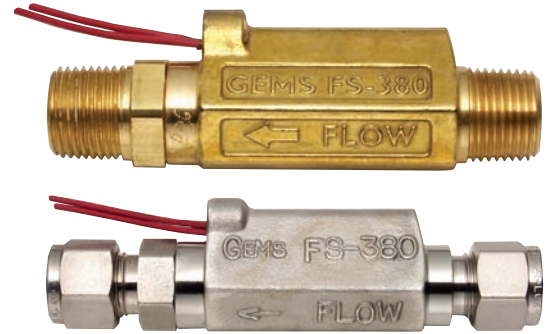
## How To Order – Standard Models

Specify Part Number based on flow settings.

Flow Settings GPM <sup>1</sup>	3/8" NPT Male		3/8" Tube Compression Fitting	1/2" NPT Male
	Brass	Stainless Steel	Stainless Steel	Brass
0.15	181130	193482	212136	—
0.25	168432 ⚡	179992 ⚡	177592 ⚡	192562
0.50	168433 ⚡	179993 ⚡	177593	192563
1.00	168434 ⚡	179994 ⚡	177594 ⚡	192564
1.50	168435	179995	177595	192566
2.00	178353	179996	225525	192567

⚡ – Stock Items.

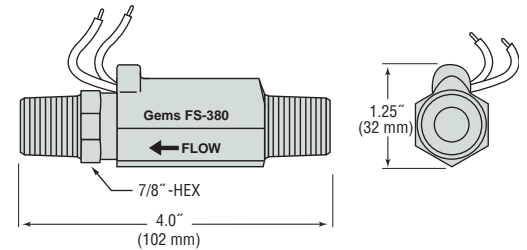
Note:  
 1. Flow settings are calibrated using water @ 70°F on increasing flow with units in horizontal position. Consult factory for other fluid compatibility.



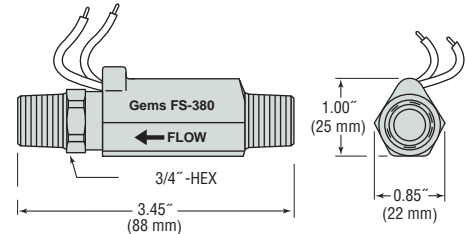
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## Dimensions

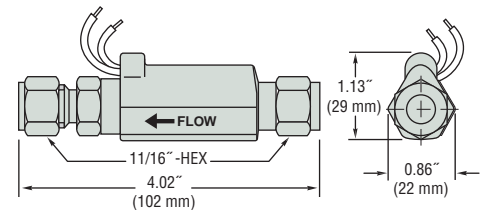
### 1/2" NPT Ports



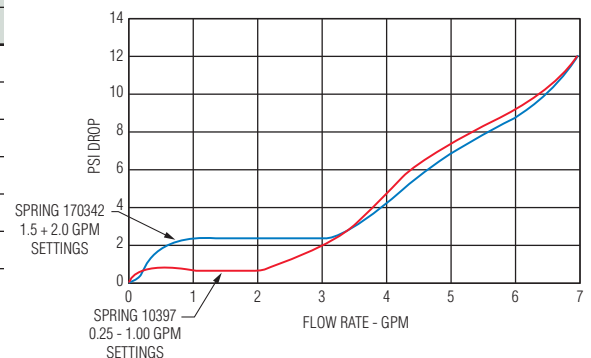
### 3/8" NPT Ports



### 3/8" Tube End Compression Fitting



## Pressure Drop – Typical



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

**Flow Rate Settings:** 0.25 GPM to 2.00 GPM  
**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

<b>Wetted Materials</b>	
<b>Housing</b>	Glass Reinforced Polypropylene
<b>Piston</b>	PPS Composite
<b>Spring</b>	316 Stainless Steel
<b>O-Ring</b>	Fluorocarbon
<b>Operating Pressure</b>	125 PSI (8.6 bar) @ 70°F (21°C), 50 PSI (3.4 bar) @ 212°F (100°C)
<b>Operating Temperature</b>	0°F to 212°F (-18°C to +100°C)
<b>Set Point Accuracy</b>	20% of Set Point
<b>Set Point Differential</b>	20% Maximum
<b>Switch*</b>	SPST, 10VA, N.O. at no Flow
<b>Electrical Termination</b>	24" to 26" Polymeric Leads, 22 AWG
<b>Filtration</b>	100 Micron
<b>Approvals</b>	CUL

\*See "Electrical Data" on Page X-5 for more information.

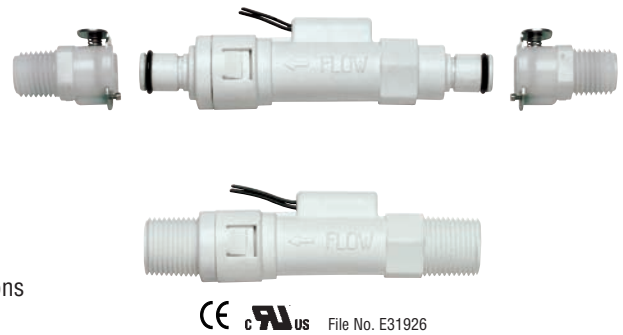
## How To Order

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 GPM	Part Numbers	
	3/8" NPT Male	1/4" QDC Male*
0.07	216445**	216446**
0.15	209876	203206
0.25	197081 ⚡	197091 ⚡
0.50	197082 ⚡	197092 ⚡
1.00	197083 ⚡	197093 ⚡
1.50	197084 ⚡	197094 ⚡
2.00	197085 ⚡	197095 ⚡

\* See selection of adapters at right.  
 QDC = Quick Disconnect  
 \*\* Set point accuracy 0.06 to 0.1 GPM

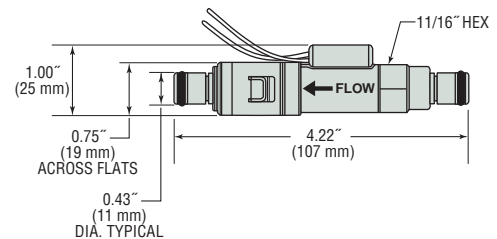
⚡ – Stock Items.



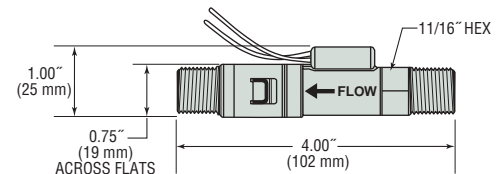
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## Dimensions

**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 (180°F 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

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. (6 mm O.D., 4.3 mm I.D.) Polytube	198096 ⚡	198097
3/8" O.D., 1/4" I.D. (9.5 mm O.D., 6 mm I.D.) Polytube	198099 ⚡	198098
1/4" (6.4 mm) I.D. Barb	198401 ⚡	198402
5/16" (7.9 mm) I.D. Barb	198403 ⚡	198404
3/8" (9.5 mm) I.D. Barb	198408 ⚡	198405
1/4" O.D. (6.4 mm) O.D. JG®	198470 ⚡	198406
3/8" O.D. (9.5 mm) O.D. JG®	198459 ⚡	198407

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



# FS-480 Series – Stainless Steel Flow Switch for Large Flow, Low Pressure Drop

**Flow Rate Settings:** 0.50 GPM to 3.00 GPM  
**Port Size:** 1/2" NPT, 3/4" NPT, 1/2" Tube Compression Fitting  
**Primary Construction Material:** 316 Stainless Steel  
**Setting Type:** Fixed

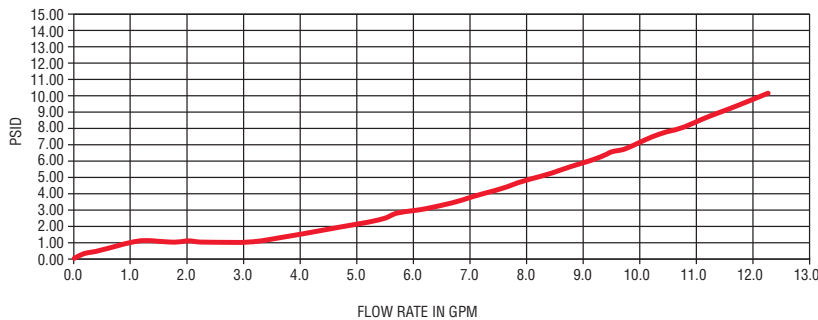
The FS-480 large-body inline flow switch delivers ample flow rates with minimal pressure drop. 25% larger than its FS-380 sibling, the FS-480 is ideal for processes that push more fluid through their systems and demand low pressure drops. Designed to accommodate the Semiconductor Industry's move to larger 300 mm wafer and cross-over equipment, this switch is also perfect for critical medical equipment applications. A glass-reinforced PPS piston and forged 316 stainless steel body make this sensor rugged enough for high pressure lubrication and cooling systems as well. This simple, yet meticulously perfected design provides the reliability required in critical applications while allowing for much lower pressure drop rates than other available switches.

## Specifications

<b>Wetted Materials</b>	
Housing/End Fitting	316 Stainless Steel
Piston	PPS, Epoxy
Spring	316 Stainless Steel
O-Ring	Fluorocarbon
<b>Operating Pressure, Maximum</b>	1000 PSI (69 bar)
<b>Operating Temperature</b>	-20°F to +250°F (-28.8°C to +121°C)
<b>Set Point Accuracy</b>	±20% Maximum
<b>Set Point Differential</b>	20% Maximum
<b>Recommended Filtration</b>	100 Micron or better
<b>Switch*</b>	SPST, 20VA, 120/240 VAC, N.O. at no Flow
<b>Electrical Termination</b>	No. 22 AWG, 24" PVC Cable

\*See "Electrical Data" on Page X-5 for more information.

## Pressure Drop – Typical 1.0 GPM Set Point

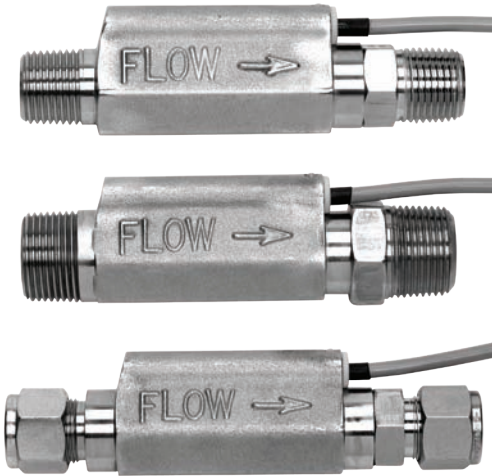


## How To Order – Standard Models

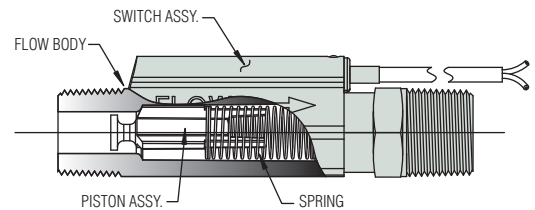
Specify Part Number based on flow settings.

Flow Settings* GPM	1/2" NPT Port	3/4" NPT Port	1/2" Tube Compression Fitting
0.50	206915	204715	204710
1.00	206916	204716	204711
1.50	206917	204717	204712
2.00	206918	204718	204713
3.00	206919	204719	204714

\*Calibrated with unit in horizontal position.



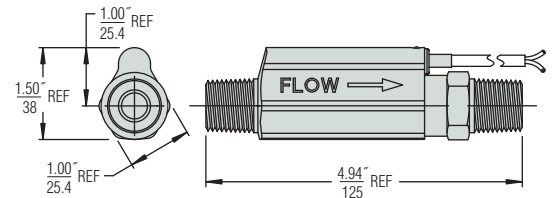
**RU** us File No. E31926



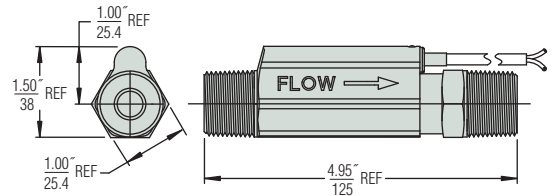
Straight design and large bore body minimizes pressure drop.

## Dimensions

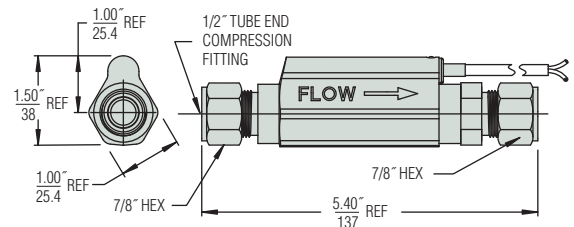
### 1/2" NPT Ports



### 3/4" NPT Ports



### 1/2" Tube End Compression Fitting



# FS-927 Series – Small Design for Tight Instrumentation Packages

**Flow Rate Settings:** 0.10 GPM to 1.50 GPM  
**Port Size:** 1/4" NPT  
**Primary Construction Material:** Brass, Stainless Steel  
**Setting Type:** Fixed

Measuring only 1" x 2-3/4", these compact switches are ideal for use where space is at a premium. Designed for use with water and oil, these switches are suitable for high volume OEM applications. They are ideal for coolant or lubricant flow monitoring in portable equipment and many other applications with space constraints.

## Specifications

<b>Wetted Materials</b>	
Housing and Piston	Brass, Stainless Steel
Spring	316 Stainless Steel
<b>Other Wetted Parts</b>	
	Stainless Steel
<b>Operating Pressure, Maximum</b>	1000 PSIG (69 bar)
<b>Operating Temperature</b>	-20°F to +200°F (-29°C to +93.3°C)
<b>Set Point Accuracy</b>	±15%
<b>Set Point Differential</b>	20% Maximum
<b>Switch*</b>	SPST, 20 VA
<b>Inlet/Outlet Ports</b>	1/4" NPT
<b>Electrical Termination</b>	No. 18 AWG, 24" L., PVC Lead Wires

\*See "Electrical Data" on Page X-5 for more information.

## How To Order – Standard Models

Specify Part Number based on flow setting and switch operation.

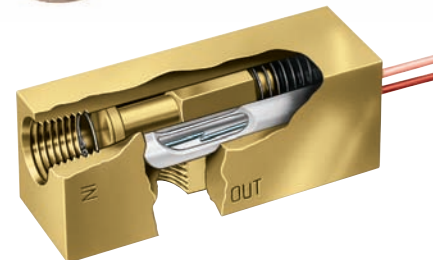
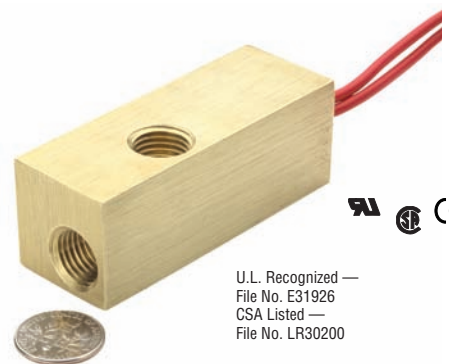
**Liquids other than water:** Special calibration is available from Gems for media other than water. Please consult factory with your requirements, including flow media, operating pressure, flow set point and liquid viscosity (SSU).

Flow Settings GPM	Part Numbers		
	Brass		Stainless Steel
	Normally Open @ No Flow	Normally Closed @ No Flow	Normally Open
0.10	70820 ⚡	70826	26969
0.25	70821 ⚡	70827	26970
0.50	70822 ⚡	70828	26971
0.75	70823 ⚡	70829	26972
1.00	70824 ⚡	70830	26973
1.50	70825	70831	26974

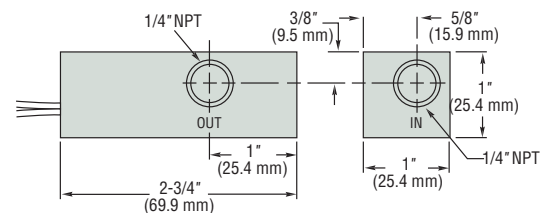
Notes:

- Flow settings are calibrated using water @ +70°F on increasing flow, with units in a vertical position (lead wires up).
- Care should be taken by specifiers to ensure fluid compatibility with the above listed wetted materials.
- Use of 50 micron filtration is recommended.

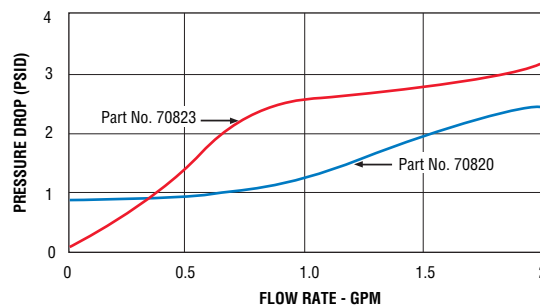
⚡ – Stock Items.



## Dimensions



## Pressure Drop – Typical



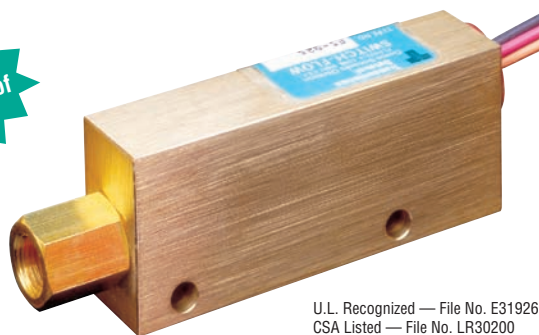
FLOW SWITCHES

## FS-925 Series – General Purpose

**Flow Rate Settings:** Liquids: 0.1 GPM to 1.5 GPM  
Air/Gases: See Flow Settings at right

## FS-926 Series – Low Flow

**Port Size:** 1/4" NPT  
**Primary Construction Material:** Brass or Stainless Steel  
**Setting Type:** Fixed  
**Flow Rate Settings:** Liquids: 50-300 cc/min.  
Air/Gases: See Flow Settings at right



FS-925/926 Series



U.L. Recognized — File No. E31926  
CSA Listed — File No. LR30200  
FM Approved — File No. 1H3A2.AX  
and 0A8A3AE

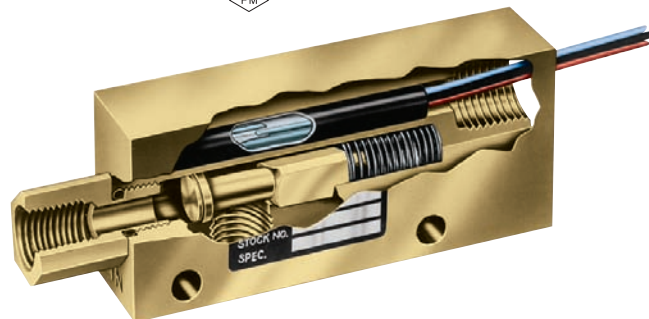
These two series of precision-calibrated switches provides reliable and consistent performance; repeatability is within 1%. FS-925 and FS-926 units are factory preset for actuation at specified flow rates.

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

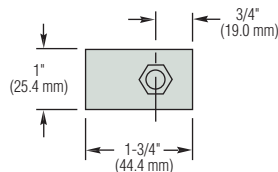
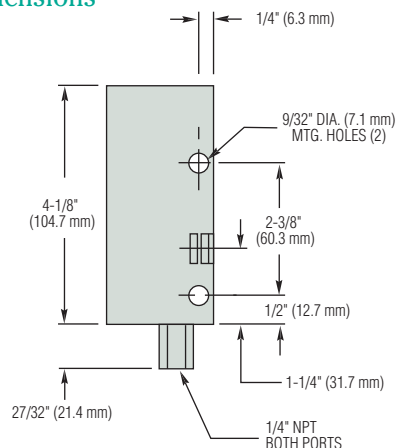
<b>Wetted Materials</b>	
<b>Housing</b>	Brass or 316 Stainless Steel
<b>Piston</b>	
<b>In Brass Housing</b>	Polysulfone for water; Brass for oil or air
<b>Stainless Steel Housing</b>	316 Stainless Steel
<b>Low Flow Piston (FS-926)</b>	Same as Housing
<b>Spring</b>	316 Stainless Steel
<b>O-Ring</b>	Viton®
<b>Other Wetted Parts</b>	Epoxy
<b>Pressure Rating</b>	
<b>Operating, Maximum</b>	1000 PSIG (69 bar)
<b>Proof</b>	2500 PSIG (172 bar)
<b>Burst</b>	5000 PSIG (345 bar)
<b>Operating Temperature</b>	
<b>With Brass or S.S. Piston</b>	-20°F to +300°F (-29°C to +148.9°C)
<b>With Polysulfone Piston</b>	-20°F to +225°F (-29°C to +107.2°C)
<b>Repeatability</b>	1% Maximum Deviation
<b>Set Point Accuracy</b>	±10%
<b>Set Point Differential</b>	15% Maximum
<b>Switch*</b>	SPDT, 20 VA
<b>Inlet/Outlet Ports</b>	1/4" NPT
<b>Electrical Termination</b>	No. 18 AWG, 24" L., Polymeric Lead Wires

\*See "Electrical Data" on Page X-5 for more information.

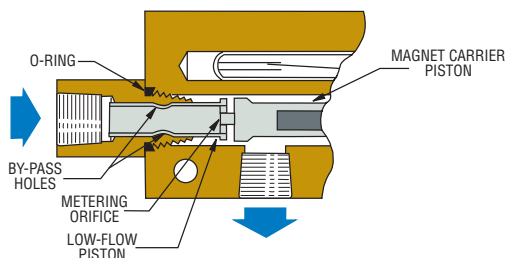


Both the FS-925 and FS-926 use a spring-loaded piston to detect positive flow with great precision. They act upon direct fluid flow and will not show "false-positive" flow indication as can happen with sensors using indirect sensing methods such as pressure measurement. The FS-926 incorporates an additional lap-fitted piston for very low flows; see below.

### Dimensions



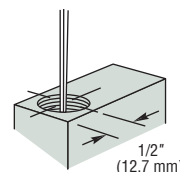
### Double Piston Detects Minute Flow – FS-926



An additional, lap-fitted piston is used in Gems FS-926 Series to accurately detect low-flow rates. Calibration is determined by one or more metering holes in the end of the low-flow piston, which regulate bypass flow, and therefore the actuation setting.

When metered bypass flow is exceeded, the resultant pressure differential displaces the low-flow piston, moving the magnet carrier piston to actuate the reed switch. Two large bypass holes in the piston skirt are exposed after actuation to maintain low pressure drop.

### Electrical Connection, 1/2" NPT Conduit



### Flow Settings, Air (Typical)

Dependent on operating line pressure. Examples of set point ranges at a given line pressure are shown below.

Line Pressure	Actuation Point			
	FS-925		FS-926	
	Min.	Max.	Min.	Max.
5 PSIG (Minimum)	0.5 SCFM	10 SCFM	2 SCFH	15 SCFH
100 PSIG	1.5 SCFM	25 SCFM	7 SCFH	50 SCFH

Minimum 5 PSI line pressure required.

### Gas Calibration

Water flow units should not be used for air/gas applications: Gas flow units have a special dash-pot piston for reliable operation. Gas calibration is dependent upon line pressure, switch orientation, and the specific type of gas. The calibrated flow set point is subject to change with fluctuations in line pressure.

### How To Order – Standard Models – Water Calibration

Specify Part Number based on desired housing material and flow setting.

**Liquids other than water:** Special calibration is available from GEMS for media other than water. Please consult factory with your requirements, including housing material (brass or stainless steel), flow media, operating pressure, flow set point and liquid viscosity (SSU). A lot charge will be applied for special calibrations.

**Gas flow:** Consult factory for available calibrations. Specify: Housing material (brass or stainless steel), gas type, mounting orientation, operating pressure and actuation setting (SCFM or SCFH) and normal flow rate. A lot charge will be applied for special calibrations.

### FS-925 Series – General Purpose

Flow Settings GPM, ±10%	Part Numbers	
	Brass	316 S.S.
0.10	26914 ⚡	26926 ⚡
0.25	26915 ⚡	26927 ⚡
0.50	26916 ⚡	26928
0.75	26917 ⚡	26929
1.00	26918 ⚡	26930
1.50	26919 ⚡	26931

### FS-926 Series – Low Flow

Flow Setting		Part Numbers	
cc/Min. ±10%	Equiv. GPM	Brass Material	316 S.S. Material
50	.013	26938 ⚡	26951 ⚡
100	.025	26939 ⚡	26952
150	.045	26941 ⚡	26953
200	.055	26942	26954
250	.065	26943	26955
300	.075	26944	26956

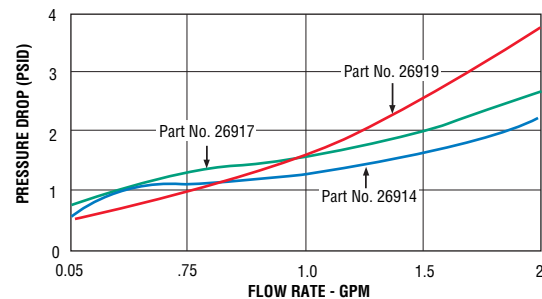
Notes:

- Flow settings are calibrated using water @ +70°F on increasing flow, with units in a vertical position (lead wires up). Consult factory regarding special flow setting calibration.
- Temperature changes will slightly affect the standard water or gas flow settings listed. Oil flow settings will vary with viscosity.
- Use of 50 micron filtration is recommended.

⚡ – Stock Items.

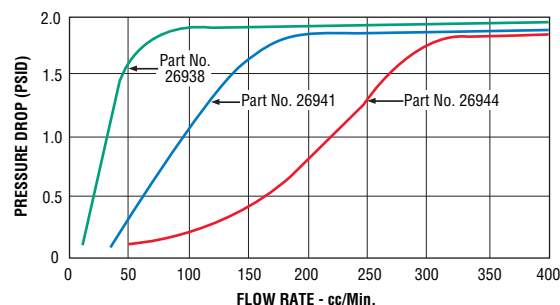
### Pressure Drop - Typical

#### FS-925 Series



Tests conducted with units in vertical position (lead wires up) with water at +70°F (21°C).

#### FS-926 Series



Tests conducted with units in vertical position (lead wires up) with water at +70°F (21°C).

**FS-925 and FS-926 switches are U.L. Approved for Class I, Division 2, Groups A, B, C, D hazardous locations.**

They are also available with FM-approved, explosion-proof junction box for Class I, Division 1, Group D hazardous locations. Units must be assembled completely at GEMS.

U.L. Approved — File No. E183854

### Standard Wiring Color Code

Wire Color	Terminal
Orange	N.O.
Black	Common
Red	N.C.

# FS-10798 Series – Externally Adjustable for Water, Oils and Gases

**Flow Rate Settings:** Liquids: Infinite Adjustment between 0.5 GPM and 20.0 GPM

Air/Gases: See Gas Flow Adjustment Ranges below

**Port Size:** 1/2" NPT

**Primary Construction Material:** Brass or Stainless Steel

**Setting Type:** Adjustable

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 1000 PSIG, 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

Wetted Materials	
<b>Housing</b>	Brass or 316 Stainless Steel
<b>Piston</b>	
<b>In Brass Housing</b>	Polysulfone for water; Brass for oil or air
<b>In Stainless Steel Housing</b>	316 Stainless Steel Only
<b>Spring</b>	316 Stainless Steel
<b>O-Ring</b>	Viton®
<b>Other Wetted Parts</b>	Epoxy
Pressure Rating	
<b>Operating</b>	1000 PSIG (69 bar)
<b>Proof</b>	2500 PSIG (172 bar)
<b>Burst</b>	5000 PSIG (345 bar)
Operating Temperature	
<b>With Brass or S.S. Piston</b>	-20°F to +300°F (-29°C to +148.9°C)
<b>With Polysulfone Piston</b>	-20°F to +225°F (-29°C to +107.2°C)
<b>Repeatability</b>	1% Maximum Deviation
<b>Set Point Accuracy</b>	±10% Maximum
<b>Set Point Differential</b>	15% Maximum
<b>Switch*</b>	SPDT, 20 VA
<b>Inlet/Outlet Ports</b>	1/2" NPT
<b>Electrical Termination</b>	No. 18 AWG, 24" L., Polymeric Lead Wires

\*See "Electrical Data" on Page X-5 for more information.

## Air/Gas Flow Adjustment Ranges

Water or oil flow units should not be utilized for air/gas applications. The FS-10798 Gas Flow configuration utilizes a special dash-pot piston for reliability. The flow adjustment ranges are typical for air service. For other gases, the flow range will vary with the density of the gas. Please consult factory for more information.

<b>For 5 PSIG Line*</b>	1 to 75 SCFM Approx.
<b>For 100 PSIG Line</b>	3 to 160 SCFM Approx.

\* Minimum 5 PSI line pressure required.



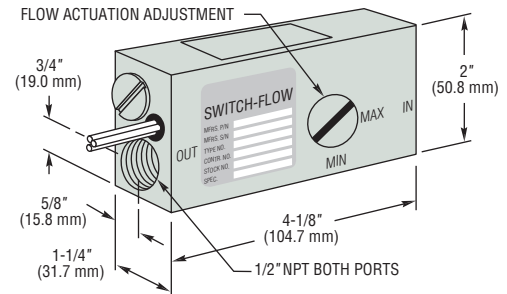
Shown with optional 1/2" conduit connector.



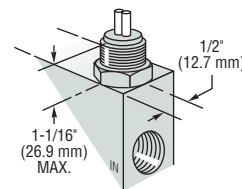
U.L. Recognized — File No. E31926  
 CSA Listed — File No. LR30200

## Dimensions

### With Wire Leads and Strain Relief



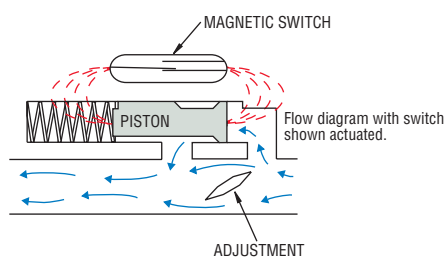
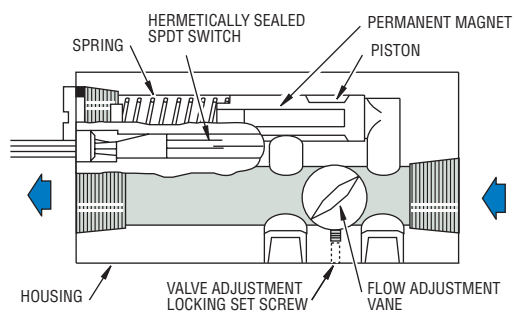
### With 1/2" NPT Conduit Connector



FLOW SWITCHES



**How It Works**



An externally rotatable vane is positioned in the main flow path within the unit. The magnet carrier piston is located in a bypass flow chamber. Pressure differential, caused by flow around the adjusting vane, displaces the spring-biased piston which actuates a hermetically sealed SPDT reed switch within the unit.

**How To Order – Standard Models**

Specify Part Number based on desired media, piston material and electrical termination.

Media	Materials		Part Numbers	
	Housing	Piston	With Lead Wires	With 1/2" Conduit Connector
Liquids	Brass	Brass (for Oils)	61205 ⚡	49073 ⚡
		Polysulfone (for Water)	25357 ⚡	25363 ⚡
		316 Stainless Steel	25358 ⚡	25364 ⚡
Gases		Brass	25359 ⚡	25365 ⚡
		316 Stainless Steel	25360 ⚡	25366 ⚡

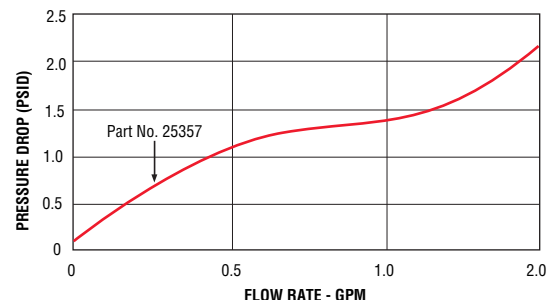
**Notes:**

1. Temperature changes will slightly affect the standard water or gas flow settings listed. Oil flow settings will vary with temperature and viscosity.
2. Use of 50 micron filtration is recommended.

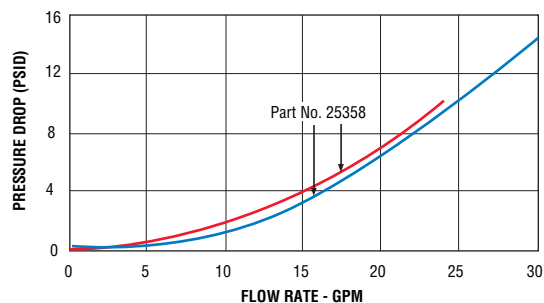
⚡ – Stock Items.

**Pressure Drop - Typical**

0.5 GPM



10 GPM and 20 GPM



Tests conducted with units in horizontal position with water at +70°F (21°C). Data will vary slightly for vertically mounted units.

**FS-10798 switches are U.L. Approved for Class I, Division 2, Groups A, B, C, D hazardous locations. U.L. Approved — File No. E183854**

**Standard Wiring Color Code**

Wire Color	Terminal
Orange	N.O.
Black	Common
Red	N.C.

# FS-930 Series – Oil Flow Switch, Compensates For Viscosity Change In Fluids

**Flow Rate Settings:** 0.1 GPM to 1.0 GPM  
**Port Size:** 1/4" NPT  
**Primary Construction Material:** Brass  
**Setting Type:** Fixed



A unique, patented piston design assures accuracy within 20% over a full range of viscosities—from 40 to 1000 SSU. Ideal for use in applications where liquids of different viscosities are blended; or for use in lubrication systems where oil flow monitoring is critical at start-ups. Switch compensates for viscosity changes automatically. Each unit is factory preset, using 300 SSU oil, for actuation at specified flow rates.

## Specifications

<b>Wetted Materials</b>	
Housing	Brass
Piston	Brass
Spring	316 Stainless Steel
O-Ring	Viton®
Other Wetted Parts	Epoxy
<b>Pressure Rating</b>	
Operating, Maximum	1000 PSIG (69 bar)
Proof	2500 PSIG (172 bar)
Burst	5000 PSIG (345 bar)
Operating Temperature	-20°F to + 300°F (-29°C to +148.9°C)
Repeatability	1% Maximum Deviation**
Set Point Accuracy	±10%
Set Point Differential	15% Maximum
Switch*	SPDT, 20 VA
Inlet/Outlet Ports	1/4" NPT
Electrical Termination	No. 18 AWG, 24" L., Polymeric Lead Wires
Explosion-Proof Approvals	U.L. Approved for Class I, Division 2, Groups A, B, C, D. Also available with FM approved, explosion proof junction box for Class I, Division 1, Group D hazardous locations. U.L. Approved — File No. E183854

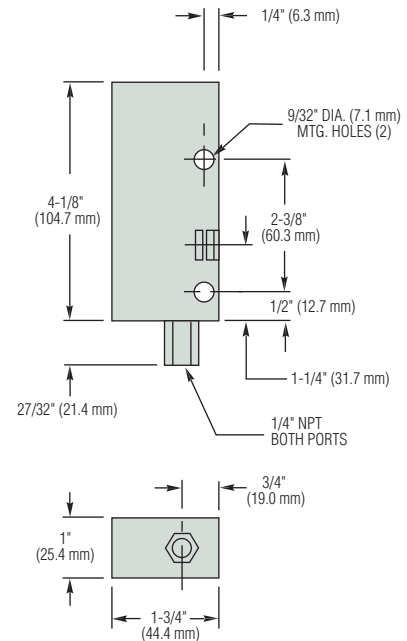
\* See "Electrical Data" on Page X-5 for more information  
 \*\* Reference at 300 SSU set point.



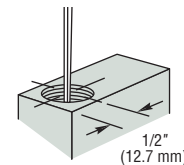
U.L. Recognized —  
File No. E31926



## Dimensions



## Electrical Connection, 1/2" NPT Conduit



### How To Order – Standard Models

Specify Part Number based on flow setting.

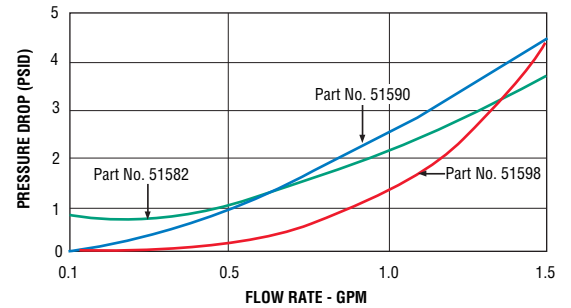
Flow Setting GPM, ±10%	Part Numbers
0.10	<b>51582</b> ⚡
0.25	<b>51586</b> ⚡
0.50	<b>51590</b>
0.75	<b>51594</b>
1.00	<b>51598</b>

**Notes:**

1. Flow settings are calibrated in a vertical position (lead wires up) with 300 SSU oil. Set points will be maintained within 20% of settings in a liquid viscosity range of 40 to 1,000 SSU.
2. Use of 50 micron filtration is recommended.

⚡ – Stock Items.

### Pressure Drop – Typical



Tests conducted with units in vertical position (lead wires up) with water at +70°F (21°C).

# Shuttle Type Switches – For Moderate to High Liquid Flow Rates

- ▶ Models for flow rate settings from .5 GPM to 100.0 GPM
- ▶ Rugged housings with port sizes ranging from 3/4" NPT to 3" NPT
- ▶ Efficient flow paths assure low line pressure drop at full flow

## Typical Applications

Protect bearings or gears from loss of lubricant flow. Can reduce maintenance costs on...

- Oil separators • Fuel Systems • Pumps • Compressors • Presses

Provide instant, automatic shutdown if coolant flow falls off in electronics or machinery, such as...

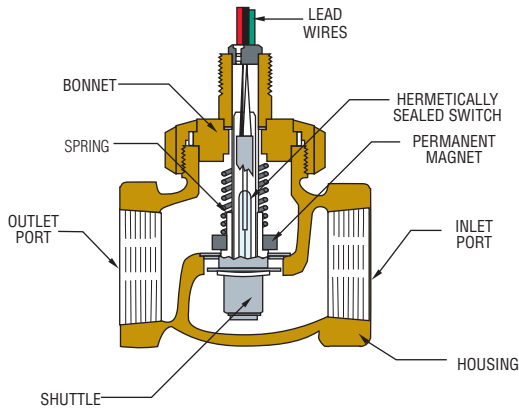
- Heat Exchangers • Semiconductor Manufacturing Equipment
- Induction Furnaces • Radio Transmitters

Assure efficient operation of process systems, including...

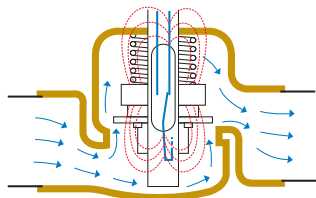
- Water Filtration and Reverse Osmosis • Chlorinators • De-icers
- Sterilizers • Evaporators

## Design Data

### General Operating Principle (FS-200 Series Shown)



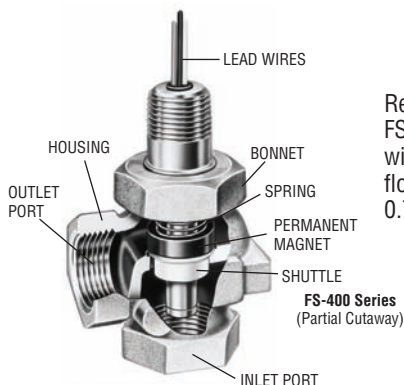
As liquid flow increases to the actuation setting, a magnet-equipped shuttle is displaced. When displaced by fluid flow, this shuttle actuates a hermetically sealed, SPDT or SPST reed switch within the unit stem. A compression spring or gravity provides shuttle return when flow decreases.



This reed switch, when actuated, can be used to operate remote alarms or indicators, or may be integrated into automatic system controls.

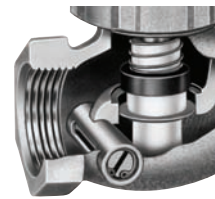
Typical flow diagram showing switch actuated.

### 90° Flow Path Versions

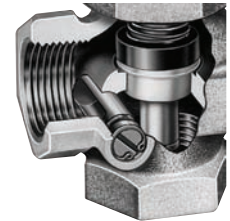


Replace an ordinary 90° pipe joint with an FS-400 Series switch to monitor liquid flow with 1% repeatability. A choice of seven flow rate actuation settings ranging from 0.75 GPM to 10.0 GPM are offered.

### Adjustable Versions



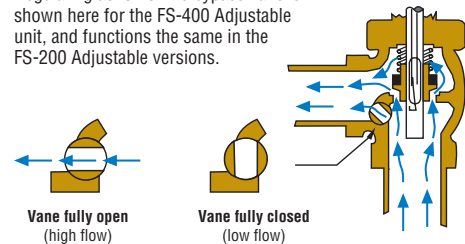
**FS-200 Adjustable**  
(Partial view)



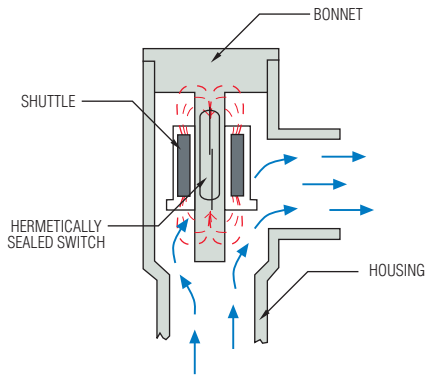
**FS-400 Adjustable**  
(Partial view)

Adjustable versions of the FS-200 and FS-400 Flow Switches incorporate an internal adjustable bypass vane which is controlled externally using an ordinary, flat-blade screwdriver. As the bypass vane is rotated to its open position, an increasing amount of liquid is allowed to bypass the shuttle assembly, resulting in the need for a higher rate of flow to actuate the switch; closing the adjustable bypass vane results in switch actuation at lower flow rates. Switch actuation can be set from 0.75 GPM to 15 GPM.

Regulating action of the bypass vane is shown here for the FS-400 Adjustable unit, and functions the same in the FS-200 Adjustable versions.



All Plastic, Transparent Versions

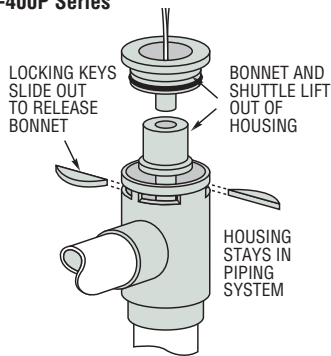


The FS-400P Series is an inexpensive alternative for plastic piping systems. Units are available in clear PVC housings. The clear version, with a bright red shuttle, provides highly visible affirmation of flow status. Low-cost, all PVC versions are for use in systems where liquid pressures are below 120 PSIG and temperatures do not exceed 120°F. An easily removed, one-piece bonnet and shuttle assembly for quick clean-out is featured.

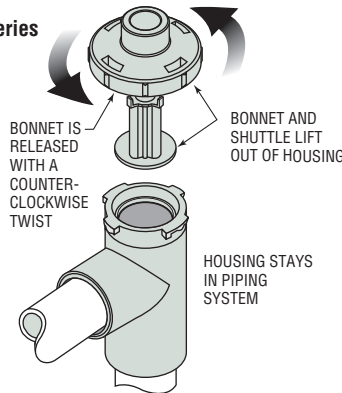
Typical Bonnet and Shuttle Removal

While a slight accumulation of foreign material within shuttle type units will not affect operation, 150 micron filtration is suggested. Any sizable amount of contamination should be removed. Removing the bonnet nut on FS-200, and FS-400 Series units allows the shuttle assembly to be removed for cleaning without disturbing the installation. Sliding keys on the FS-400P are removed, or the bonnet is twisted on the FS-500, for the one-piece bonnet/shuttle to be lifted out of its housing. Consult the factory for replacement parts. Damaged electrical components must be replaced at the factory.

FS-400P Series



FS-500 Series



Contents	Page Start
FS-200 Series	
General Purpose, Straight-Through Flow Path .....	G-18
FS-200 Series Adjustable	
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General Purpose, 90° Flow Path .....	G-20
FS-400 Series Adjustable	
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Actuation Set Point .....	G-20
FS-400P Series	
Low-Cost, All PVC .....	G-21
FS-500 Series	
Low-Cost, All Polypropylene .....	G-22



# FS-200 Series – General Purpose, Straight-Through Flow Path



**Flow Rate Settings:** Fixed: 0.5 GPM to 100.0 GPM  
Adjustable: 1.0 GPM to 15.0 GPM

**Port Size:** 1" NPT to 2" NPT

**Primary Construction Material:** Bronze or Stainless Steel

**Setting Type:** Fixed or Adjustable

The FS-200 Series offers accurate flow detection, with 1% repeatability, over a broad range of flow settings and port sizes. Its durable construction delivers long-life reliability in either water or oil. Generous flow paths keep pressure drop low. These switches are ideal for detection of improper flow rates in high volume lubrication, cooling or process systems.

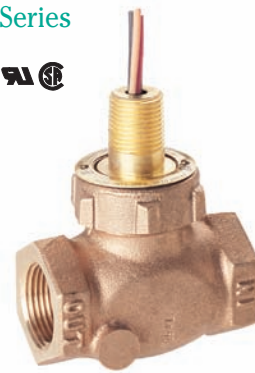
FS-200 Adjustable Series switches offer the same accuracy and are as rugged as those with fixed settings, but provide one additional feature: external adjustability. With these versatile switches your choice of flow settings is diverse within a given range. An ordinary, flat-blade screwdriver is all that's required for the actuation adjustment.

## Specifications

Wetted Materials	
<b>Housing</b>	
FS-200	Bronze or 316 Stainless Steel
FS-200 Adjustable	Bronze
<b>Shuttle</b>	
	Teflon®
<b>Bonnet</b>	
	Bronze or Stainless Steel
<b>Spring</b>	
	316 Stainless Steel
<b>Other Wetted Parts</b>	
	Viton®, Ceramic
<b>Pressure Rating</b>	
Operating	400 PSIG (27.6 bar) @ 100°F (37.8°C)
Proof	800 PSIG (55.2 bar) @ 100°F (37.8°C)
<b>Operating Temperature</b>	
FS-200	-20°F to +300°F (-29°C to +148.9°C)
FS-200 Adjustable	-20°F to +200°F (-29°C to +93.3°C)
<b>Repeatability</b>	
	1% Maximum Deviation
<b>Set Point Accuracy</b>	
	±10%
<b>Set Point Differential</b>	
	15% Maximum
<b>Switch*</b>	
	SPDT, 20 VA
<b>Electrical Termination</b>	
	No. 18 AWG, 24" L., Polymeric Lead Wires Red NC, Black Common, Orange NO

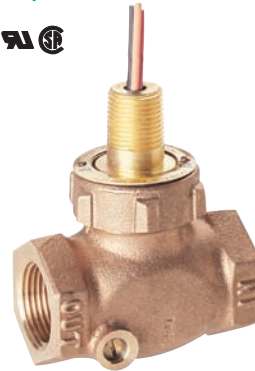
\*See "Electrical Data" on Page X-5 for more information.

## FS-200 Series



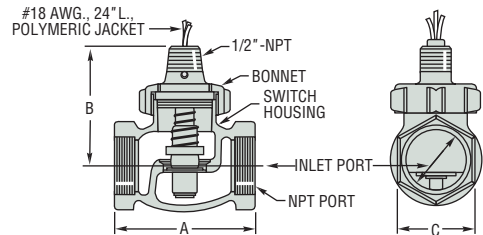
U.L. Recognized  
File No. E31926  
CSA Listed —  
File No. LR30200  
and LR22666  
FM Approved —  
File No. 0A8A3.AE  
and 1H3A2.AX

## FS-200 Adjustable



U.L. Recognized  
File No. E31926  
CSA Listed —  
File No. LR22666  
FM Approved —  
File No. 0Q2A8.AE

## Dimensions



Model	Port Size NPT	A inch (mm)	B inch (mm)	C Hex inch (mm)
FS-200 and FS-200 Adjustable	1"	3-1/4 (82.6)	3 (76.2)	1-25/32 (45.2)
	1-1/4"	4 (101.6)	3-3/16 (80.9)	2-3/16 (55.5)
	1-1/4" ss	4-1/2 (114.3)	3-3/16 (80.9)	2-3/16 (55.5)
	1-1/2"	4-1/2 (114.3)	3-1/2 (88.9)	2-1/2 (63.5)
	2"	5-3/8 (136.5)	4 (101.6)	3-3/32 (78.5)

### Notes:

- Adjustable versions available in 1 inch port sizes only.
- Standard calibration is in water with units in a horizontal position.
- Viscosity changes will affect setpoints. Typically, as viscosity increases setpoints will decrease.
- Consult Gems for special applications.

How To Order – Standard Models

Specify Part Number for the FS-200 Series based on desired housing material, port size and flow setting, or based on flow setting range for FS-200 Adjustable versions.

FS-200 Series

Port Size NPT	Flow Setting GPM	Part Numbers	
		Bronze	Stainless Steel
1"	0.5	27051 ⚡	27059 ⚡
	1	27052 ⚡	27060
	2	27053 ⚡	27061
	3	27054 ⚡	27062
	4	27055 ⚡	27063
	5	27056 ⚡	27064
	6	27057 ⚡	27065
	8	27058 ⚡	27066
1-1/4"	1	27067 ⚡	27076
	2	27068	27077
	4	27069	27078
	6	27070	27079
	8	27071	27080
	10	27072	27081
	12	27073	27082
	16	27074	27083
20	27075	27084	

Port Size NPT	Flow Setting GPM	Part Numbers	
		Bronze	Stainless Steel
1-1/2"	1.5	27085 ⚡	27093
	3	27086	27094
	5	27087	27095
	7.5	27088	27096
	10	27089	27097
	15	27090	27098
	20	27091	27099
	30	27092	27100
2"	2	27101 ⚡	27109
	4	27102	27110
	5	27103	27111
	10	27104	27112
	15	27105	27113
	25	27106	27114
	35	27107	27115
	50	27108	27116

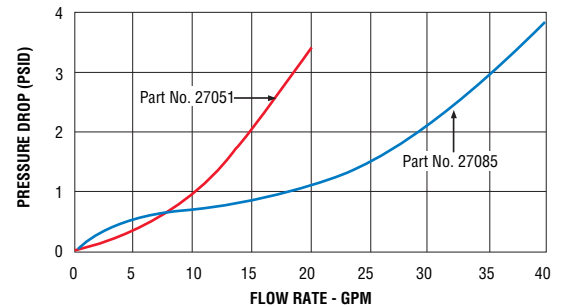
FS-200 Adjustable

Port Size NPT	Flow Setting Adjustment Range GPM	Part Numbers
1"	1.0-6.0	26615 ⚡
	5.0-15.0	26616 ⚡
	2.0-8.0	26838 ⚡

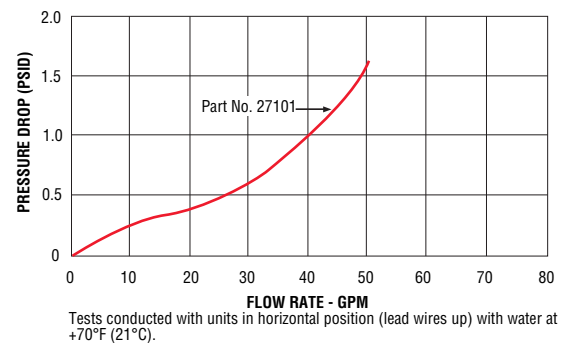
- Notes:
- Flow settings for fixed versions are calibrated using water at +70°F on increasing flow, with units in a horizontal position (lead wires up). Consult factory regarding special flow setting calibration, or liquids other than water. Temperature changes will slightly affect the flow settings listed. Oil flow settings will vary with viscosity.
  - Adjustable units that are set to customer specification are subject to GEMS test stand accuracy.
  - Use of 150 micron filtration is recommended.
  - Minimum 5 PSI line pressure required.
- ⚡ – Stock Items.

Pressure Drop - Typical

1" NPT and 1-1/2" NPT Ports



2" NPT Ports



Tests conducted with units in horizontal position (lead wires up) with water at +70°F (21°C).

FS-200 Series Flow Switches are U.L. Approved for Class I, Division 2, Groups A, B, C, D hazardous areas.



They are also available with FM-approved, explosion-proof junction box for Class I, Division 1, Group D hazardous locations. Units must be completely assembled at GEMS. U.L. Approved — File No. E183854

For Remote Alarms – See Page E-30

- Adjustable Volume
- Indoor Outdoor
- Solid-State



# FS-400 Series – General Purpose, 90° Flow Path

**Flow Rate Settings:** Fixed Version: 0.75 GPM to 10.0 GPM  
Adjustable Version: 0.75 GPM to 14.0 GPM

**Port Size:** 3/4"

**Primary Construction Material:** Bronze

**Setting Type:** Fixed or Adjustable

Provides accurate flow detection in water and oil with 1% repeatability. Flow settings on the adjustable version can be easily changed without disassembly. A shuttle by-pass vane inside the housing is controlled externally using an ordinary flat-blade screwdriver. These switches are ruggedly constructed of non-corrosive materials and resist shock and vibration. Suitable for triggering alarms on interlocking shutdown circuitry when flow rate is improper to protect bearings, gears and cooling systems.

## Specification

<b>Wetted Materials</b>	
Housing	Bronze
Shuttle	Delrin®
Spring	316 Stainless Steel
O-Ring	Viton®
Other Wetted Parts	Ceramic
<b>Pressure Rating, Maximum</b>	
Operating	400 PSI (27.6 bar) @ 100°F (+37.8°C)
Proof	800 PSI (55.2 bar) @ 100°F (+37.8°C)
<b>Operating Temperature</b>	
	-20°F to +180°F (-29°C to +82.2°C)
<b>Repeatability</b>	
	1% Maximum Deviation
<b>Set Point Accuracy</b>	
	±10%
<b>Set Point Differential</b>	
	15% Maximum
<b>Switch*</b>	
	SPDT, 20 VA
<b>Inlet/Outlet Ports</b>	
	3/4" NPT
<b>Electrical Termination</b>	
	No. 18 AWG, 24" L., Polymeric Lead Wires

\*See "Electrical Data" on Page X-5 for more information.

## How To Order – Standard Models

Specify Part Number based on flow settings for the FS-400 Series, based on flow setting range for the FS-400 Adjustable version.

### FS-400 Series

NPT	Flow Setting GPM	Part Numbers
3/4"	0.75	26440 ⚡
	1.5	26441 ⚡
	2.0	26442
	2.5	26443 ⚡
	5.0	26444
	7.5	26445
	10.0	26446

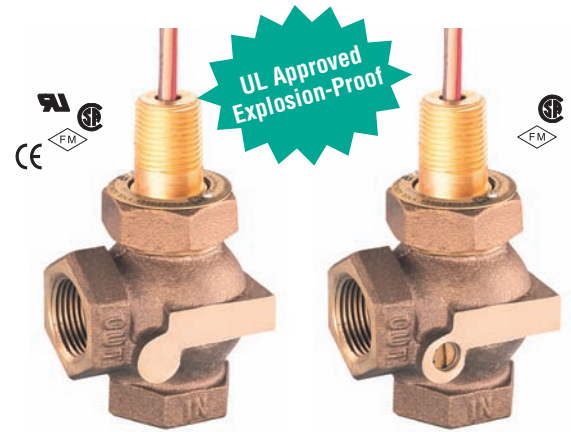
### FS-400 Adjustable

NPT	Flow Setting GPM	Part Numbers
3/4"	0.75-4.0	26600 ⚡
	2.0-8.0	26601 ⚡
	7.0-14.0	26602 ⚡

#### Notes:

- Flow settings for Fixed Version are calibrated using water at +70°F on increasing flow, with units in a vertical position (lead wires up). Temperature changes will slightly affect the flow settings listed.
- Adjustable units that are set to customer specifications are subject to GEMS test stand accuracy.
- Use of 150 micron filtration is recommended.
- Minimum 5 PSI line pressure required.

⚡ – Stock Items.



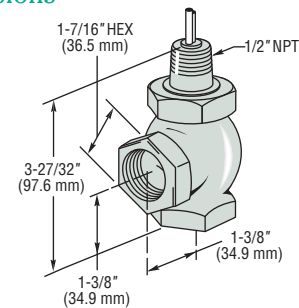
**FS-400 Series**

U.L. Recognized —  
File No. E31926  
CSA Listed —  
LR30200 and LR22666  
FM Approved —  
File No. 0A8A3.AE and  
1H3A2.AX

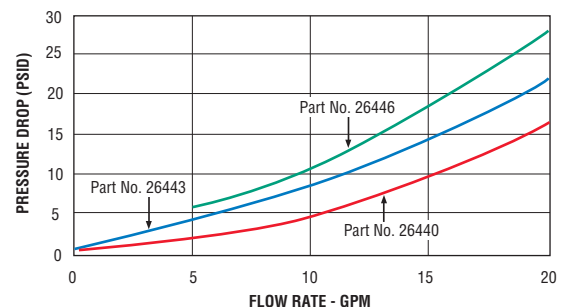
**FS-400 Adjustable**

CSA Listed —  
File No. LR22666  
FM Approved —  
File No. 0A8A3.AE

## Dimensions



## Pressure Drop - Typical



Tests conducted with units in vertical position (lead wires up) with water at +70°F (21°C).

**FS-400 switches are U.L. Approved for Class I, Division 2, Groups A, B, C, D hazardous areas.**

Available with FM-approved, explosion-proof junction box for Class I, Division 1, Group D hazardous locations. Units must be assembled completely at GEMS.

U.L. Approved — File No. E183854

# FS-400P Series – Low Cost Units for Plastic Piping

**Flow Rate Settings:** 0.5 GPM or 2.0 GPM  
**Port Size:** 3/4" or 1" IPS  
**Primary Construction Material:** Clear PVC  
**Setting Type:** Fixed

Designed for low cost flow/no-flow monitoring. This series is available with a clear transparent PVC housing which is ideal for use where visual flow confirmation is desirable. These corrosion-resistant switches offer broad chemical compatibility. With only one moving part, their rugged construction offers long life with minimum maintenance. Ideal for water heating or purification, equipment cooling and general chemical processing use.

## Specifications

<b>Materials</b>	
Housing, Shuttle and Bonnet	PVC
O-Ring	Buna N
Other Wetted Parts	Epoxy
<b>Operating Pressure, Maximum</b>	
	120 PSIG (8.3 bar) @ +70°F to +100°F @ +21°C to +37.8°C
	50 PSIG (3.4 bar) @ +101°F to +120°F @ +38.3°C to +48.9°C
<b>Operating Temperature, Maximum Clear Version</b>	
	+120°F (+48.9°C)
<b>Set Point Accuracy</b>	± 20%
<b>Set Point Differential</b>	20% Maximum
<b>Switch*</b>	SPST, 20 VA N.O. @ No Flow
<b>Inlet/Outlet Ports</b>	3/4" or 1" IPS and 1/2" NPT
<b>Mounting Attitude</b>	Vertical, Inlet Down
<b>Electric Termination</b>	No. 22 AWG, 24" L., PVC Lead Wires

\*See "Electrical Data" on Page X-5 for more information.

## How To Order – Standard Models

Specify Part Number based on material and port size.

PVC Material	Port Size	Actuation on Increasing Flow	Part Numbers
Clear	1/2" NPT*	0.5 GPM ±20%	135805 ⚡
	3/4" IPS	0.5 GPM ±20%	135810 ⚡
	1" IPS	2.0 GPM ±20%	135815 ⚡

\*3/4" IPS model with 1/2" NPT port adapter installed.

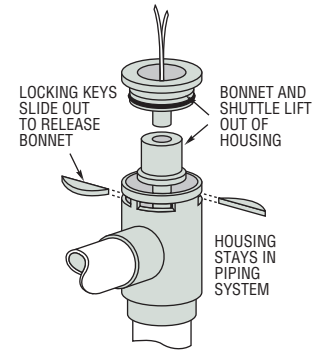
Notes:

- Care should be taken by specifiers to ensure fluid compatibility with the above listed wetted materials.
- Use of 150 micron filtration is recommended.

⚡ – Stock Items.



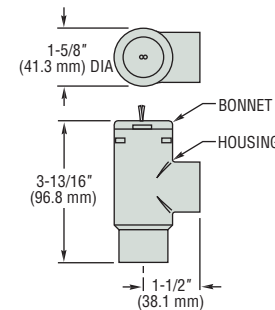
U.L. Recognized —  
 File No. E31926  
 CSA Listed —  
 File No. LR30200



Cleanout is quick and easy. Two locking keys slide out to allow removal of a one-piece bonnet and shuttle assembly. Housing and piping are left undisturbed.

## Dimensions

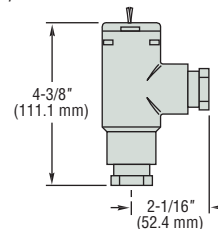
3/4" IPS Size (Both Ports)



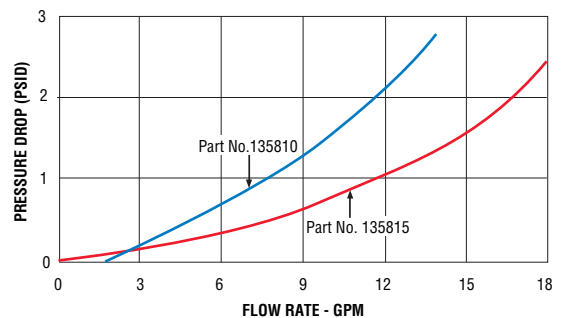
1" IPS Size (Both Ports)  
 (All other dimensions are the same as 3/4" size)



1/2" NPT



## Pressure Drop - Typical



Tests conducted with units in vertical position (lead wires up) with water at +70°F (21°C).

# FS-500 Series – Low Cost Units for Threaded Plastic Piping

**Flow Rate Settings:** 0.25 GPM to 5.0 GPM  
**Port Size:** 3/4" NPT  
**Primary Construction Material:** Polypropylene  
**Setting Type:** Fixed

The FS-500 offers low cost flow monitoring with a variety of switch actuation points and low pressure drop. All wetted parts are polypropylene or stainless steel, making this switch ideal for a wide range of chemical and temperature requirements. The materials are also NSF or FDA approved for potable water treatment applications including chlorinators, purifiers and heaters. The FS-500 is ideal for equipment cooling including welders, lasers, etc. A J-box version with a 5 amp relay is also available for direct control of higher electrical loads, such as chlorinator pumps.

## Specifications

<b>Wetted Materials*</b>	
<b>Housing, Bonnet, Shuttle, Shuttle Cap</b>	Polypropylene, Hydrolytically Stable
<b>O-Ring</b>	Viton® or Buna N
<b>Spring</b>	316 Stainless Steel
<b>Retaining Clip</b>	PH 15-7 Mo Stainless Steel
<b>Operating Pressure, Maximum</b>	100 PSIG (6.9 bar) @ +70°F (21°C) 50 PSIG (3.4 bar) @ +180°F (82°C) 40 PSIG (2.8 bar) @ +212°F (100°C)
<b>Operating Temperature, Maximum</b>	0° to 212°F (100°C)
<b>Set Point Accuracy</b>	± 20%
<b>Set Point Differential</b>	± 20% Maximum
<b>Switch**</b>	SPST, N.O. Pilot Duty 20 VA, 120-240 VAC or VDC
<b>J-Box with 5A Relay</b>	
<b>Coil</b>	120 VAC 50/60 Hz
<b>Contacts SPDT</b>	5A – 240 VAC Res 1/3 HP – 120 VAC 5A – 28 VDC Res.
<b>Inlet/Outlet Ports</b>	3/4" Female NPT
<b>Electric Termination Pilot</b>	No. 22 AWG, 24" Zip Cord Lead Wires
<b>J-Box</b>	6' PVC Cable

\* Materials of Construction are available for FDA or NSF Compliance.  
 \*\* See "Electrical Data" on Page X-5 for more information.

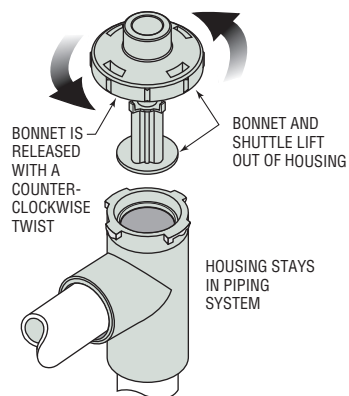
## How To Order – Standard Models

Specify Part Number based on switch actuation set point. Set points other than those listed are available as special order; contact GEMS with your requirements. Normally closed switch logic units available as special orders.

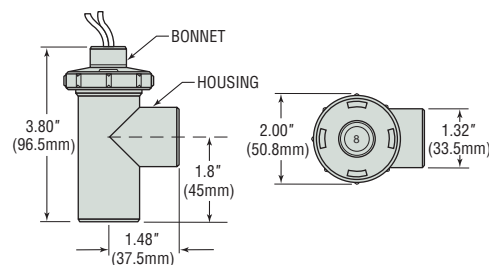
Switch Actuation Set Point GPM	Part Numbers	
	Pilot Duty	J-Box w/5A Relay
0.25	170231 ⚡	175901 ⚡
0.50	170232 ⚡	175902 ⚡
1.00	170233 ⚡	—
2.00	175117 ⚡	—
2.50	170234 ⚡	—
5.00	170235 ⚡	—

Note: Use of 100 micron filtration is recommended.

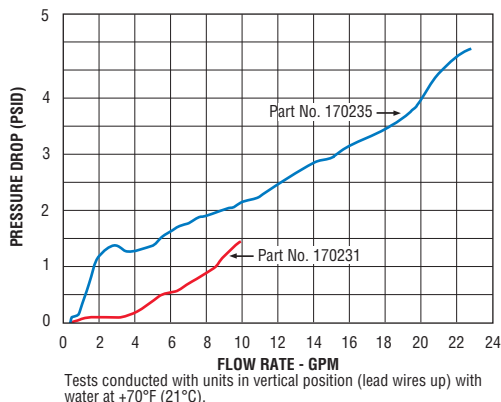
⚡ – Stock Items.



## Dimensions



## Pressure Drop - Typical





# Paddle Type Flow Switches – For Flow/No-Flow Detection in Large Line Sizes

- ▶ Engineered for positive liquid flow detection at pressures to 2000 PSIG (138 bar)
- ▶ Unique, patented cam design assures low pressure drop and does not require bellows, seals, or mechanical linkages
- ▶ Minimum in-line restriction; paddle pivots to move out of liquid path with increasing flow

## Typical Applications

Assure flow and/or leak detection in large, high pressure in...

- Compressors • Heat Exchangers • Turbines • Engines • Boilers • Chillers

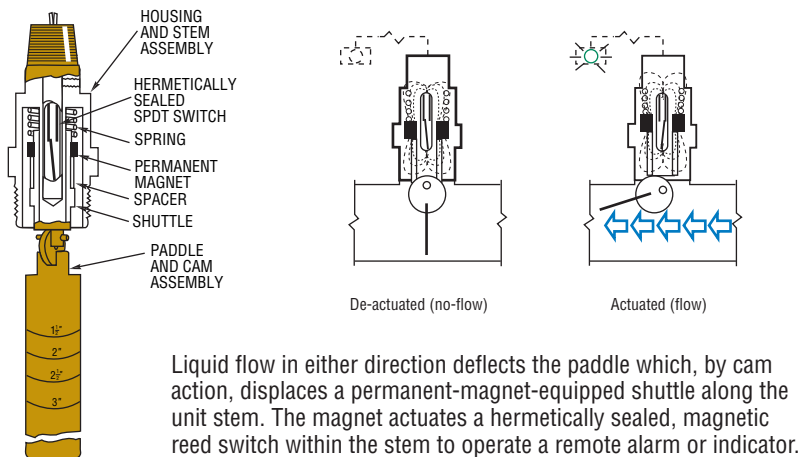
Protect high or low pressure pumps from cavitation, sense critical, reverse flow and protect...

- Valves • Pumps • Regulators

Contents	Page Start
FS-550 Series	
High Pressure, Metal Version .....	G-24

## Design Data

### General Operating Principle



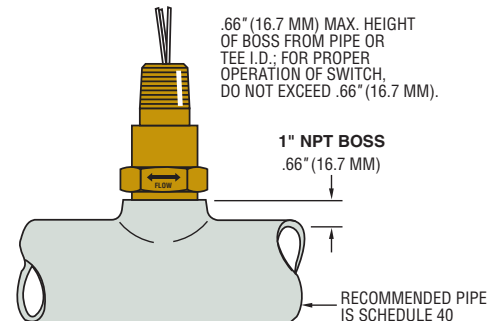
Liquid flow in either direction deflects the paddle which, by cam action, displaces a permanent-magnet-equipped shuttle along the unit stem. The magnet actuates a hermetically sealed, magnetic reed switch within the stem to operate a remote alarm or indicator.

## Simple Installation and Easy Maintenance

Installs in a standard pipe tee or reducing fitting. If excessive particle build-up necessitates occasional cleaning, simply remove the unit and manually remove particles actuate paddle for free movement.

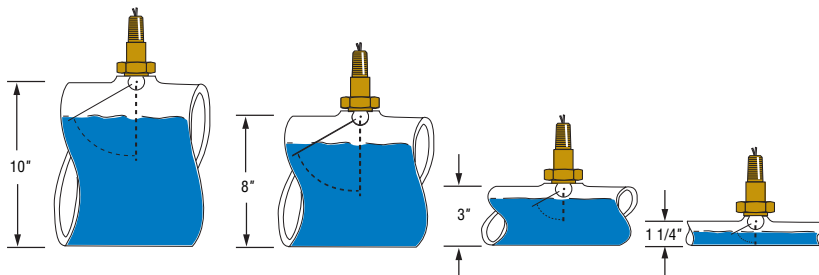
### Easy Installation

Installs in a standard pipe tee or reducing fitting.



## Paddles Cut-to-Length For Broad Range of Pipe Sizes

Cutting the paddle to length selects a standard flow rate as shown on the tables on the following pages. Approximate pipe sizes are marked on the paddle. These units can be used in pipe with diameters greater than the 5" paddle length. They provide flow/no-flow detection where there is a velocity of 0.5 ft. per second.



# FS-550 Series – High Pressure, Metal Paddle Switch

**Pipe Line Size:** 1-1/4" and Up  
**Primary Construction Material:** Stainless Steel or Brass  
**Setting Type:** Fixed

Standard FS-550 switches sense liquid flow in either direction to monitor flow/no-flow conditions. They are supplied in two paddle lengths. 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 3 PSIG of pressure drop regardless of pipe size.

## Specifications

<b>Wetted Materials</b>	
<b>Housing</b>	Brass or 316 Stainless Steel
<b>Paddle</b>	302 Stainless Steel
<b>Spring</b>	316 Stainless Steel
<b>Other Wetted Parts</b>	Ceramic and Teflon®
<b>Operating Pressure, Maximum</b>	2000 PSIG (138 bar)
<b>Pressure Drop</b>	3 PSIG (0.2 bar) Maximum
<b>Operating Temperature</b>	-30°F to + 300°F (-34.4°C to + 148.9°C)
<b>Set Point Accuracy</b>	± 25%
<b>Switch*</b>	SPDT, 20 VA
<b>Repeatability</b>	± 5%
<b>Electrical Termination</b>	No. 18 AWG, 24" L., Polymeric Lead Wires

\* See "Electrical Data" on Page X-5 for more information.

## Standard Actuation and De-actuation Set Points

The Table below indicates paddle lengths which achieve switch actuation for specific flow rates. Approximate pipe line sizes are marked on paddle.

	Pipe Size Marked at Paddle Cut-Off Point	Pipe Line Sizes					
		1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
		Approximate Actuation and (De-Actuation) Flow Rates GPM Water					
<b>Short Paddle Unit</b>	1-1/4"	5 (3)	13 (8)	22 (15)	29 (22)	—	—
<b>Long Paddle Unit</b>	1-1/2"	—	15 (11)	28 (21)	38 (30)	—	—
	2"	—	—	22 (15)	27 (20)	48 (38)	—
	2-1/2"	—	—	—	21 (14)	40 (26)	52 (39)
	3"	—	—	—	—	31 (20)	45 (32)
	4"	—	—	—	—	—	39 (25)

All flow rate tests for the above table were conducted with the switch installed in a standard "T" fitting. For calculation of flow rates in pipe sizes larger than 5", a flow velocity of approximately 0.5 ft. per sec. actuates the switch with a full length (5") paddle. The paddle can be trimmed to achieve different actuation points.

## How To Order – Standard Models

Select switch type, paddle length and housing material, then specify adjacent part number.

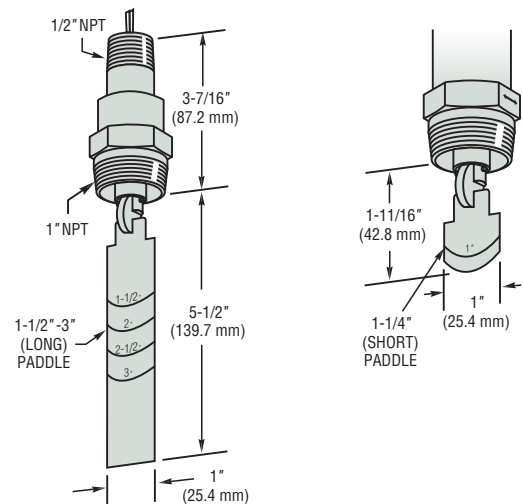
Switch Type	Paddle Length	Housing Material	Switch Operation	Part Numbers	
				Standard	3-Pin J-Box
SPDT Standard Unit	Long	Brass	N.O. or N.C.	29609	56730
		316 S.S.		29608	56729
	Short	Brass		30641	66914
		316 S.S.		30640	61189

Note: The FS-550 Switch is not recommended for use with 1" plastic tees.

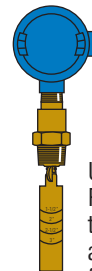


U.L. Recognized  
 File No. E31926  
 CSA Listed —  
 File No. LR30200  
 and LR22666  
 FM Approved —  
 File No. 0A8A3.AE  
 and 1H3A2.AX

## Dimensions



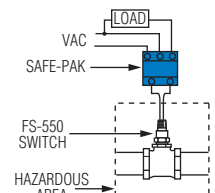
## FS-550 switches are U.L. Approved for Class I, Division 2, Groups A, B, C, D hazardous areas.



They are also available as FM-approved when used with GEMS Junction Boxes which are explosion-proof for Class I, Division 1, Groups B, C, D, E, F, G hazardous locations.

Using GEMS SAFE-PAK Relays and barriers, these switches provide automatic flow/no flow interlock and are intrinsically-safe without explosion-proof housing and piping.

U.L. Approved — File No. E183854



# Gems Transducers Deliver Top Performance and Value Under Pressure!

- ▶ Excellent Repeatability, Reliability
- ▶ Sensing Ranges from Vacuum to 10,000 psi (-1 to 689 bar)
- ▶ Broad Range of Sensing Technologies:
  - Chemical Vapor Deposition
  - Sputtered Thin Film
  - Capacitance
  - MMS

When your applications require exceptional pressure sensing performance and long-life reliability, look to Gems to deliver. From vacuum to 10,000 psig (-1 to 689 bar), we've got you covered with industry's largest selection and best choice of technologies. Our capacitance type sensors are ideal for high volume use; sputtered thin film types are the most precise pressure sensors you can buy, and our other types satisfy all requirements in between.

## Typical Applications

- **Off Highway Vehicles** — Load Weighing Systems and Load Moment Indicating
- **Natural Gas Equipment** — Compressors and Dispensing Equipment
- **Semiconductor Processing** — Wafer Manufacturing
- **Power Plants** — Piping Steam Pressures
- **Refrigeration** — Compressors and Lube Oil Pressure Equipment
- **Robotics** — Factory Automated Equipment
- **Test & Measurement** — Dynamometers, Medical Instrumentation, Wind Tunnels
- **Barometrics** — Altimeter Certification, Weather Stations
- **HVAC** — Compressors, Filter Monitoring, Energy Management
- **Transportation** — Breaking, Compressors, Lifts, Air Conditioning

## Psibar® CVD Type

Chemical Vapor Deposition manufacturing methods bond a polysilicon layer to a stainless steel diaphragm at the molecular level to produce a sensor with superior long term drift performance. Common batch processing semiconductor manufacturing methods are used to create a polysilicon strain gauge bridge with terrific performance at a very reasonable price. CVD construction offers excellent price/performance and is the most popular sensor for OEM applications.

## Sputtered Thin Film Type

Sputtered film deposition creates transducers with maximum combined linearity, hysteresis and repeatability. Accuracy is as high as 0.08% full scale with long term drift as low as 0.06% full scale per year. Phenomenal performance for critical instruments — Gems sputtered thin film transducers are the jewels of the pressure sensing industry.

## Capacitance Type

Gems manufactures capacitance type pressure sensors for a wide range of high volume OEM and specialty applications. Detecting the capacitance change between two surfaces allows Gems transducers to sense extremely low pressure and vacuum levels. Robust construction allows these units to be used in a wide variety of applications. Coupled with an ASIC, these units provide good price/performance in a host of packaging styles.

## MMS Type

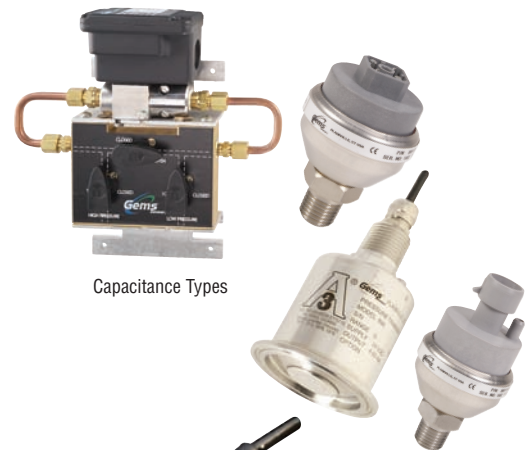
These transducers employ a micromachined silicon (MMS) diaphragm to detect pressure changes. The silicon diaphragm is protected from the media by an oil-filled 316SS isolation diaphragm; they react in tandem to process fluid pressure. MMS sensors utilize common semiconductor manufacturing techniques that allow for high proof pressure, good linearity, great thermal shock performance and stability in a thin sensor package.



Psibar® CVD Types



Sputtered Thin Film Types



Capacitance Types



MMS Type

PRESSURE TRANSDUCERS

Contents	Page Start
Psibar® CVD Types .....	H-3
Sputtered Thin Film Types .....	H-12
Capacitance Types .....	H-25
MMS Types .....	H-42

## Selection Guide

Purpose	Pressure Range	Accuracy (Full Scale, Typ.)	Long Term Drift (Full Scale/Year)	Thermal Error per °F relative to Room Temperature (Full Scale Typ.)	Operating Temperatures*											Sensor Technology Type	Gems Series Number	
						Ratiometric	Millivolt	Voltage Output	Current Output	Gauge	Absolute	Vacuum	Diff. Pressure	Submersible	Sanitary			Semiconductor
General/ OEM	Vacuum to 6000 psig (-1 to 414 bar)	0.25% (0.15% optional)	0.20%	0.015%	-40°F to +260°F (-40°C to +125°C)	•	•	•	•	•	•	•	•			Strain Gauge (CVD)	2200/2600	
		0.50%	0.20%	0.020%				•	•	•	•					Strain Gauge (CVD)	1200/1600	
	Vacuum to 10,000 psig (-1 to 690 bar)	0.25%	0.50%	±0.035%	-40°F to +185°F (-40°C to +85°C)			•	•	•	•					Capacitance	809	
	2 to 10,000 psig (0 to 690 bar)	<25psi: 0.25% >25psi: 0.13%	0.50%	<25psi: 0.035% >25psi: 0.025%	-40°F to +260°F (-40°C to +125°C)			•	•	•						Capacitance	856	
	10 in. WC to 150 in. WC (25 to 350 mbar)	0.20%	0.25%	0.028%	-40°F to +212°F (-40°C to +100°C)			•	•	•			•			Capacitance	5000	
High Accuracy	500 to 10,000 psig (0 to 690 bar)	0.15%	0.06%	0.010%	-67°F to +248°F (-55°C to +120°C)			•	•	•						Strain Gauge (Sputtered)	3000	
	2 to 6,000 psi (0.5 to 400 bar)	0.15%	0.15%	0.010%	-22°F to +212°F (-30°C to +100°C)				•	•	•		•			Strain Gauge (CVD)	6700	
	2 to 10,000 psig (0.2 to 690 bar)	0.10%	0.10%	0.008%	-22°F to +212°F (-30°C to +100°C)				•	•	•		•			Strain Gauge (Sputtered)	4700	
	15 to 10,000 psig (1 to 690 bar)	0.08%	0.06%	0.006%	-65°F to +275°F (-54°C to +135°C)	•		•		•	•	•		•		Strain Gauge (Sputtered)	4000	
	0 to 30,000 psig (0 to 2,200 bar)	0.25%	0.2%	0.83%	-40°F to +257°F (-40°C to +125°C)	•		•	•	•						Strain Gauge (Sputtered)	3100/3200	
High Temperature & Accuracy	15 to 6,000 psig (1 to 400 bar)	0.10%	0.06%	0.006%	-65°F to +450°F (-54°C to +230°C)		•			•	•					Strain Gauge (Sputtered)	4000 High Temp	
Specialty	10 to 1,000 Torr (10 to 1,000 mbar)	0.50%	0.5%	0.025%	-4°F to +176°F (-20°C to +80°C)			•			•				•	Capacitance	820	
	600 to 1,100 hPa/mb 800 to 1,100 hPa/mb 0 to 20 psia	0.25%	0.25%/6 mos.	0.033%	0°F to +175°F (-18°C to +80°C)				•		•		•		•	Capacitance	876	
	0.25 to 100 in. WC (Unidirectional) 0.1 to 50 in. WC (Bidirectional)	1.00%	0.50%	0.066%	0°F to +150°F (-18°C to +65°C)			•	•	•			•		•	Capacitance	865	
	1 to 100 psid (0.0 to 7 bar)	0.25%	0.50%	0.040%	0°F to +175°F (-18°C to +80°C)			•	•	•			•			Capacitance	830	
	Vacuum to 1,000 (-1 to 69 bar)	0.20%	0.50%	0.040%	-40°F to +260°F (-40°C to +125°C)				•	•		•			•	Capacitance	890	
	5 to 260 psig (0.35 to 18 bar)	0.25%	0.20%	0.012%	-40°F to +180°F (-40°C to +80°C)	•	•	•	•					•		Strain Gauge (MMS)	2400	
	500 to 10,000 psig (0 to 690 bar)	0.10%	0.05%	0.20%	-40°F to +185°F (-40°C to +85°C)											•	Strain Gauge (Sputtered)	9000

\* Specific temperature capability depends on electrical connection selected. See specifications on respective product pages

**PRESSURE TRANSDUCERS**

## 2200 Series / 2600 Series – General Purpose Industrial Pressure Transducers

- ▶ Gauge, Absolute, Vacuum and Compound Pressure Models Available
- ▶ Submersible, General Purpose and Wash Down Enclosures
- ▶ High Stability Achieved by CVD Sensing Element
- ▶ Millivolt, Voltage and Current Output Models

The 2200 series features stability and accuracy in a variety of enclosure options. The 2600 series extends the packaging options via an all welded stainless steel back end for demanding submersible and industrial applications. The 2200 and the 2600 feature proven CVD sensing technology, an ASIC (amplified units), and modular packaging to provide a sensor line that can easily accommodate specials while not sacrificing high performance.

### Specifications

<b>Input</b>	
<b>Pressure Range</b>	Vacuum to 6000 psi (400 bar)
<b>Proof Pressure</b>	2 x Full Scale (FS) (1.5 x Fs for 400 bar, ≥ 5000 psi)
<b>Burst Pressure</b>	>35 x FS ≤ 100 psi (6 bar); >20 x FS ≥ 1000 psi (60 bar); >5 x FS ≤ 6000 psi (400 bar)
<b>Fatigue Life</b>	Designed for more than 100 million FS cycles
<b>Performance</b>	
<b>Long Term Drift</b>	0.2% FS/year (non-cumulative)
<b>Accuracy</b>	0.25 % FS typical (optional 0.15% FS)
<b>Thermal Error</b>	1.5% FS typical (optional 1% FS)
<b>Compensated Temperatures</b>	-5°F to +180°F (-20°C to +80°C)
<b>Operating Temperatures</b>	-40°F to +260°F (-40°C to +125°C) for elec. codes A, B, C, 1 -5°F to +180°F (-20°C to +80°C) for elec. codes 2, D, G, 3 -5°F to +125°F (-20°C to +50°C) for elec. codes F, M, P Amplified units >100°C maximum 24 VDC supply
<b>Zero Tolerance</b>	1% of span
<b>Span Tolerance</b>	1% of span
<b>Response Time</b>	0.5 ms
<b>Mechanical Configuration</b>	
<b>Pressure Port</b>	See ordering chart
<b>Wetted Parts</b>	17-4 PH Stainless Steel
<b>Electrical Connection</b>	See ordering chart
<b>Enclosure</b>	316 ss, 17-4 PH ss IP65 NEMA 4 for elec. codes A, B, C, D, G, 1, 2, 3 IP67 for elec. code "F" IP68 for elec. codes M, (max depth 200 meters H <sub>2</sub> O) IP30 for elec. code "3" with flying leads
<b>Vibration</b>	70g, peak to peak sinusoidal, 5 to 2000 Hz (Random Vibration: 20 to 2000 Hz @ ≈20g Peak per MIL-STD.-810E Method 514.4)
<b>Acceleration</b>	100g steady acceleration in any direction 0.032% FS/g for 15 psi (1 bar) range decreasing logarithmically to 0.0007% FS/g for 6000 psi (400 bar) range.
<b>Shock</b>	20g, 11 ms, per MIL-STD.-810E Method 516.4 Procedure I
<b>Approvals</b>	CE, UR (22ET, 26ET Intrinsically Safe)
<b>Weight</b>	Approx. 100 grams (additional cable; 75 g/m)

Series 2200



Series 2600





## Individual Specifications

<b>Millivolt Output units</b>	
Output	100 mV (10 mv/v)
Supply Voltage (Vs)	10 VDC (15 VDC max.) Regulated
Bridge resistance	2600-6000 ohms
<b>Voltage Output units</b>	
Output	see ordering chart
Supply Voltage (Vs)	1.5 VDC above span to 35 VDC @ 6 mA
Supply Voltage Sensitivity	0.01% FS/Volt
Min. Load Resistance	(FS output / 2) Kohms
Current Consumption	approx 6 mA at 7.5V output
<b>Current Output units</b>	
Output	4-20 mA (2 wire)
Supply Voltage (Vs)	24 VDC, (7-35 VDC)
Supply Voltage Sensitivity	0.01% FS/Volt
Max. Loop Resistance	(Vs-7) x 50 ohms

## Electromagnetic Capability

Meets the requirement for CE marking of EN50081-2 for emissions and EN50082-2 for susceptibility.

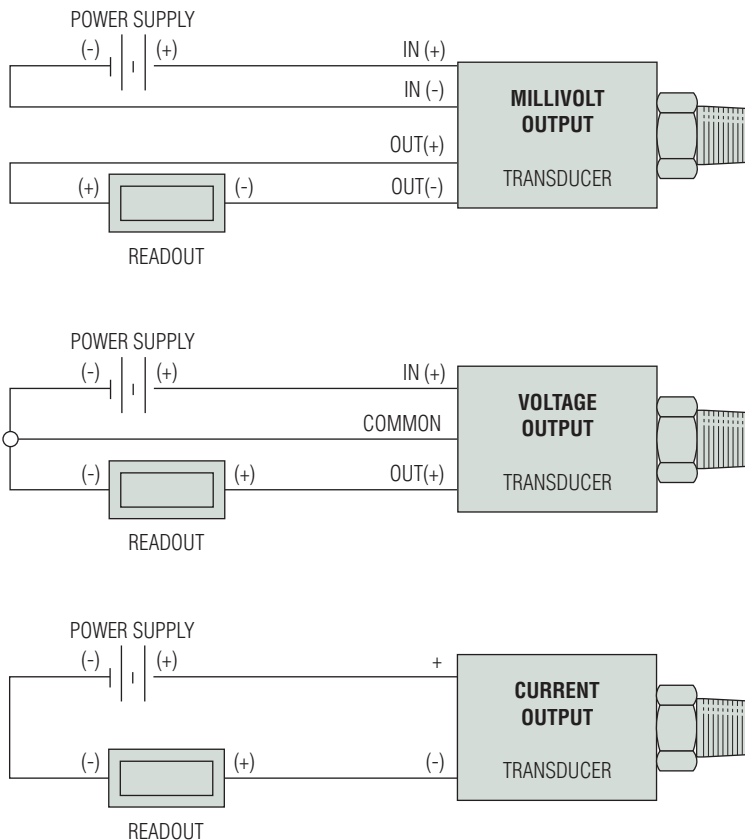
### Test Data:

- EN61000-4-2 Electrostatic Discharge. 8kV air discharge, 4kV contact discharge. Unit survived.
- ENV50140 Radiated RF Susceptibility. 10V/m, 80MHz-1GHz, 1kHz mod. Maximum recorded output error was  $<\pm 1\%$
- ENV50204 Radiated RF Susceptibility to Mobile Telephones. 10V/m, 900MHz. Maximum recorded output error was  $<\pm 1\%$ .
- EN61000-4-4 Fast Burst Transient. 2kV, 5/50ns, 5kHz for 1 minute. Unit survived.
- ENV50141 Conducted RF Susceptibility. 10Vms, 1kHz mod, 150kHz - 80MHz. Maximum recorded output error was  $<\pm 1\%$

Connection Code		mV units				Voltage units				Current units (4-20mA)		
		IN+	OUT+	OUT-	IN-	IN+	COM	OUT+	EARTH	(+)	(-)	EARTH
A, B, G	"DIN" PIN	1	2	3	E	1	2	3	4	1	2	4
C	"10-6 Bayonet" PIN	A	B	C	D	A	C	B	E	A	B	E
D	"cable"	R	Y	BL	G	R	BK	W	DRAIN	R	BK	DRAIN
F	"IP 67 cable"	R	W	G	BK	R	BK	W	DRAIN	R	BK	DRAIN
M	"Immersible"	R	Y	BL	W	R	W	Y	DRAIN	R	BL	DRAIN
1	"8-4 Bayonet" PIN	A	B	C	D	A	C	B	D	A	B	D
2	"cable"	R	W	G	BK	R	BK	W	DRAIN	R	BK	DRAIN
3	"conduit & cable"	R	W	G	BK	R	BK	W	DRAIN	R	BK	DRAIN


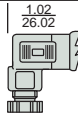
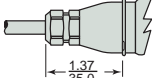
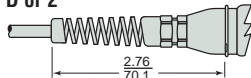
### Cable Legend:

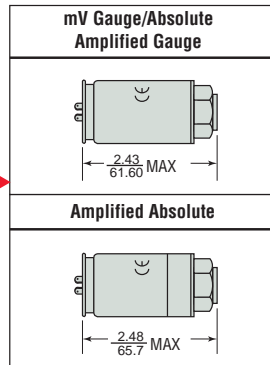
R = Red  
 BL = Blue  
 BK = Black  
 W = White  
 Y = Yellow













## Dimensions

### 2200 Series


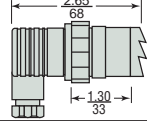

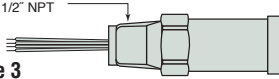
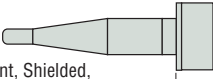
<b>Mini 4 Pin - No Connector</b>
<b>Code B</b> 
<b>Mini 4 Pin - With Connector</b>
<b>Code A</b>  1.02 26.02
<b>IP67 Cable (Waterproof)</b>
<b>Code F</b>  1.37 35.0
24 AWG Shielded PVC
<b>IP65 or NEMA4 Cable</b>
<b>Code D or 2</b>  2.76 70.1
24 AWG Shielded PVC

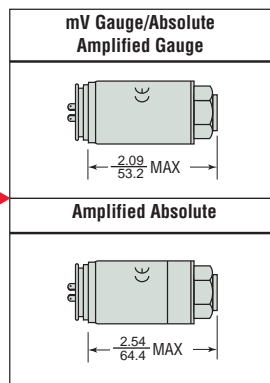


Maximum diameter 1.07" (27.3 mm)



<b>1/8-27 NPT</b>
<b>Code 08</b>  0.59 15
<b>1/4 - 18 NPT</b>
<b>Code 02 with snubber</b>  0.79 20
<b>Code OJ with snubber</b> 
<b>1/4-18 NPT Internal</b>
<b>Code 0E</b>  0.95 24
<b>1/2-14 NPT</b>
<b>Code 0H</b>  1.02 26.0
<b>7/16-20 UNF-2A</b>
<b>Code 04</b>  0.75 19
<b>9/16-18 UNF-2A</b>
<b>Code 1P</b>  0.67 17
<b>G 1/8 Internal</b>
<b>Code 09</b> 
<b>G 1/4 External</b>
<b>Code 01</b>  0.67 17
<b>R 1/4</b>
<b>Code 0A</b>  0.79 20

### 2600 Series

<b>10-6 or 8-4 Mil-C Connector</b>
<b>10-6 Code C</b>  0.87 22
<b>8-4 Code 1</b>
<b>Large DIN 43650 Plug</b>
<b>Code G</b>  2.65 68 1.30 33
<b>Conduit Connector with Cable</b>
<b>Code 3</b> 1/2" NPT  43 1.70
24 AWG Shielded PVC
<b>Conduit Connector with Flying Leads</b>
<b>Code 3</b> 1/2" NPT with length "U"  1.70/43
<b>Moulded, Immersible Cable</b>
<b>Code M</b> 24 AWG, Vent, Shielded, Polyurethane  0.90 23



Maximum diameter 1.07" (27.3 mm)

<b>Nose Cone - Black Acetal</b>
<b>Code 19</b>  0.75 19
<b>Nose Cone Sink Weight</b>
<b>Code 29</b>  4.67/121 Ø 10.0 Through hole Ø 10.0

inch  
mm

## How to Order

Use the **bold** characters from the chart below to construct a product code

**2200 B G A60 01 A 3 U A**

**Series**  
**2200**      **2600**      **22 ET<sup>4</sup>**      **26 ET<sup>4</sup>**

**Output**  
**A** - 100 mV    **C** - 1-6V      **J** - 0.5-5.5V    **G** - 0.2-10.2V  
**B** - 4-20mA    **D** - 1-11V     **R** - 0-5V       **F** - 0.1-5.1V  
                  **H** - 1-5V      **S** - 0-10V

**Pressure Datum**  
**A\*** - Absolute    **G** - Gauge  
\*Max absolute range is 25 bar. (≤ 300 psi)

**Pressure Range<sup>3</sup> – psi**

<b>F07</b> - 0-7.5	<b>G60</b> - 0-600	<b>Vac</b> = -15 psi
<b>F15</b> - 0-15	<b>H10</b> - 0-1,000	<b>1F5</b> - Vac-0
<b>F30</b> - 0-30	<b>H15</b> - 0-1,500	<b>3F0</b> - Vac-15
<b>F60</b> - 0-60	<b>H20</b> - 0-2,000	<b>6F0</b> - Vac-45
<b>G10</b> - 0-100	<b>H30</b> - 0-3,000	<b>1G0</b> - Vac-85
<b>G15</b> - 0-150	<b>H40</b> - 0-4,000	<b>1G5</b> - Vac-135
<b>G20</b> - 0-200	<b>H50</b> - 0-5,000	<b>2G0</b> - Vac-185
<b>G30</b> - 0-300	<b>H60</b> - 0-6,000	<b>3G0</b> - Vac-285
<b>G50</b> - 0-500		

**Pressure Range - bar**

<b>A10</b> - 0-1	<b>B25</b> - 0-25	<b>Vac</b> = -1 bar
<b>A16</b> - 0-1.6	<b>B40</b> - 0-40	<b>1A0</b> - Vac-0
<b>A25</b> - 0-2.5	<b>B60</b> - 0-60	<b>1A6</b> - Vac-0.6
<b>A40</b> - 0-4	<b>C10</b> - 0-100	<b>2A5</b> - Vac-1.5
<b>A60</b> - 0-6	<b>C16</b> - 0-160	<b>4A0</b> - Vac-3
<b>B10</b> - 0-10	<b>C25</b> - 0-250	<b>6A0</b> - Vac-5
<b>B16</b> - 0-16	<b>C40</b> - 0-400	<b>1B0</b> - Vac-9
		<b>1B6</b> - Vac-15
		<b>2B5</b> - Vac-24
		<b>4B0</b> - Vac-39

**Pressure Port**

<b>08</b> - 1/8-27 NPT External	<b>09</b> - G1/8 Internal
<b>02</b> - 1/4-18 NPT External	<b>01</b> - G1/4 External
<b>0J</b> - 1/4 NPT External w/snubber	<b>0A</b> - R1/4 External
<b>0E</b> - 1/4 NPT Internal	Submersible (2600 only)
<b>0H</b> - 1/2-14 NPT External	<b>19</b> - Plastic Nose Cone
<b>04</b> - 7/16-20 External (SAE #4, J514)	<b>29</b> - Sink Weight Nose Cone
<b>1P</b> - 9/16-18 External (SAE #6, J1926-2)	
<b>1J</b> - 7/16-20 External (SAE #4, J1926-2)	

**Performance Code**  
**A** - .25%/1.5%  
**B** - .15%/1.0%

**Cable Length<sup>1</sup>**  
**U** - No Cable Fitted<sup>1 2</sup>  
**D** - 1 Metre (3 feet)  
**E** - 3 Metres (9 feet)  
**F** - 5 Metres (16 feet)  
**G** - 10 Metres (32 feet)

**Apparatus Protection**  
**2** - mV Only Transient Protection CE Mark, UR  
**3** - Amplified Only RFI Protected CE Mark, UR  
**E** - Amplified only IS mark (Div. 1 only)<sup>4</sup>  
**T** - Amplified only IS mark (Div. 1 and 2)<sup>4 5</sup>

**Electrical Connection (See Notes)**  
**2200 Series**  
**A** - 4 PIN DIN (Micro) Mating Connector Supplied  
**B** - 4 PIN DIN (Micro) Mating Connector Not Supplied  
**2** - Cable Nema 4 USA  
**D** - Cable European Color Code  
**F** - Cable Gland Metal IP67

**2600 Series**  
**C** - Fixed Plug Size 10-6 Mating Plug Not Supplied  
**G** - Fixed Plug To DIN 43650 Mating Plug Supplied  
**M** - Moulded Cable Immersible  
**1** - Fixed Plug Size 8-4 Mating Plug Not Supplied  
**3** - Conduit Connector 1/2NPT Ext. 1M Cable<sup>2</sup>

**Notes:**

- When electrical connection is cable please select a cable length from Table 1 below. When electrical connection is DIN or plug style "U" must be specified.
- Where electrical connection -3 and cable length -U occur in part number, the unit will be supplied with flying leads (4-1/2" IP30). Additional Pressure Ranges are available. Please consult factory.
- Intrinsically safe transducers are available with amplified outputs only. (ETL, entity approved for Class I, Division 1, Groups C & D, hazardous areas; Class I, Divisions 1 and 2, Groups C & D for Electrical Connection Codes -A, -B, -G or -3 only.
- Apparatus Protection Code -T is available for Electrical Connection Codes -A, -B, -G or -3 only.

### Table 1 - Cable Length

(2600 Series) (2200 Series select "U" through "G")

Code	Length (M)	Code	Length (M)
<b>U</b>	No Cable Fitted	<b>M</b>	40
<b>D</b>	1	<b>N</b>	50
<b>E</b>	3	<b>P</b>	75
<b>F</b>	5	<b>Q</b>	100
<b>G</b>	10	<b>R</b>	125
<b>H</b>	15	<b>S</b>	150
<b>J</b>	20	<b>4</b>	170
<b>K</b>	25	<b>5</b>	200
<b>L</b>	30	<b>6</b>	225



## 1200 Series / 1600 Series – OEM Transducers Featuring Exceptional Proof Pressure and Stability Specifications

- ▶ Gauge, Vacuum, and Compound Pressure Models
- ▶ General Purpose and Wash down Enclosures
- ▶ High Proof Pressure Achieved by Thicker Diaphragm Construction
- ▶ Voltage and Current Output Models

The 1200 Series features stability and toughness via its CVD and ASIC design coupled with a thicker diaphragm. The thicker diaphragm enables these sensors to survive most pressure spikes caused by pump ripple, solenoid valves, etc. The 1600 Series extends the packaging options by providing an all welded stainless steel back end for demanding industrial applications. A modular design allows special ordering of fittings, electrical cables, etc. for OEM applications. The ASIC and CVD technology enables Gems to offer almost any output over any pressure range.

### Specifications

<b>Input</b>	
<b>Pressure Range</b>	Vacuum to 6000 psi (400 bar)
<b>Proof Pressure</b>	4 x Full Scale (FS) (<1% FS Zero Shift)
<b>Burst Pressure</b>	>35 x FS <= 60 psi (4 bar); >20 x FS <= 600 psi (40 bar); >5 x FS <= 6000 psi (400 bar)
<b>Fatigue Life</b>	Designed for more than 100 million FS cycles
<b>Performance</b>	
<b>Supply Voltage Sensitivity</b>	0.01% FS/Volt
<b>Long Term Drift</b>	0.2% FS/year (non-cumulative)
<b>Accuracy</b>	0.5% FS typical
<b>Thermal Error</b>	2.0% FS typical
<b>Compensated Temperatures</b>	-5°F to +180°F (-20°C to +80°C)
<b>Operating Temperatures</b>	-40°F to +260°F (-40°C to +125°C) for elec. codes A, B, C, 1 -5°F to +180°F (-20°C to +80°C) for elec. codes 2, D, G, 3 -5°F to +125°F (-20°C to +50°C) for elec. code F temperatures >100°C supply is limited to 24 VDC
<b>Zero Tolerance</b>	1% of span
<b>Span Tolerance</b>	1% of span
<b>Response Time</b>	0.5 ms
<b>Mechanical Configuration</b>	
<b>Pressure Port</b>	see ordering chart
<b>Wetted Parts</b>	17-4 PH Stainless Steel
<b>Electrical Connection</b>	see ordering chart
<b>Enclosure</b>	316 SS, 17-4 PH ss IP65 NEMA 4 for elec. codes A,B,C,D,G,1,2,3 IP67 for elec. codes F IP30 for elec. code "3" with flying leads
<b>Vibration</b>	70g, peak to peak sinusoidal, 5 to 2000 Hz (Random Vibration: 20 to 200 Hz @ ≈20g Peak per MIL-STD.-810E Method 514.4)
<b>Acceleration</b>	100g steady acceleration in any direction 0.032% FS/g for 15 psi (1 bar) range decreasing logarithmically to 0.0007% FS/g for 6000 psi (400 bar) range.
<b>Shock</b>	20g, 11 ms, per MIL-STD.-810E Method 516.4 Procedure I
<b>Approvals</b>	CE, UR (12 ET, 16 ET Intrinsically safe)
<b>Weight</b>	approx. 100 grams (additional; cable 75 g/m)



Along with the superiority of the CVD strain gauge, Psibar® transducers incorporate components to leverage the sensing element's strength. The output is a product with a unique balance of performance and value unmatched in today's pressure sensing market.



## Individual Specifications

<b>Voltage Output units</b>	
Output	See ordering chart
Supply Voltage (Vs)	1.5 VDC above span to 35 VDC
Min. Load Resistance	(FS output / 2) Kohms
<b>Current Output units</b>	
Output	4-20 mA (2 wire)
Supply Voltage (Vs)	24 VDC, (7-35 VDC)
Max. Loop Resistance	(Vs-7) x 50 ohms

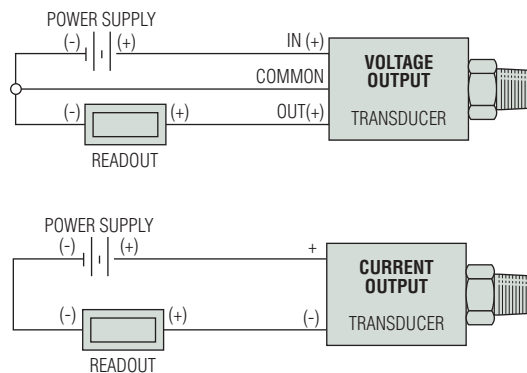
Electrical Connection Cable		Voltage Units				Current Units (4-20 mA)		
		IN+	COM	OUT+	EARTH	(+)	(-)	EARTH
A, B, G "DIN"	PIN	1	2	3	4	1	2	4
C "10-6 Bayonet"	PIN	A	C	B	E	A	B	E
D "cable"		R	BK	W	DRAIN	R	BK	DRAIN
F "IP 67 cable"		R	BK	W	DRAIN	R	BK	DRAIN
1 "8-4 Bayonet"	PIN	A	C	B	D	A	B	D
2 "cable"		R	BK	W	DRAIN	R	BK	DRAIN
3 "conduit & cable"		R	BK	W	DRAIN	R	BK	DRAIN

## Electromagnetic Capability

Meets the requirement for CE marking of EN50081-2 for emissions and EN50082-2 for susceptibility.

Test Data:

- EN61000-4-2 Electrostatic Discharge. 8kV air discharge, 4kV contact discharge. Unit survived.
- ENV50140 Radiated RF Susceptibility. 10V/m, 80MHz-1GHz, 1kHz mod. Maximum recorded output error was  $\leq \pm 1\%$
- ENV50204 Radiated RF Susceptibility to Mobile Telephones. 10V/m, 900MHz. Maximum recorded output error was  $\leq \pm 1\%$ .
- EN61000-4-4 Fast Burst Transient. 2kV, 5/50ns, 5kHz for 1 minute. Unit survived.
- ENV50141 Conducted RF Susceptibility. 10Vms, 1kHz mod, 150kHz - 80MHz. Maximum recorded output error was  $\leq \pm 1\%$



### Cable Legend:

- R = Red
- BL = Blue
- BK = Black
- W = White
- Y = Yellow

Table 1 - Cable Length

Code	Length (M)	Code	Length (M)
U	No Cable Fitted	M	40
D	1	N	50
E	3	P	75
F	5	Q	100
G	10	R	125
H	15	S	150
J	20	4	170
K	25	5	200
L	30	6	225

## Monitor Liquid Level with Gems Psibar® Pressure Transducers

- Continuously Monitor Liquid Levels
- Stainless Steel Wetted Parts are Compatible With Most Fluids
- Mount Through Top or Side of Tanks

Gems Psibar® pressure transducers provide a great, cost-effective method for measuring liquid levels. From measuring inventories in process storage tanks to monitoring hot water feed tanks, our design flexibility promotes easy installation, with mounting either through the tank top or from the side.

### Getting Started...

Tank content is determined from the pressure exerted on the sensor, so you need to know the depth **and** the specific gravity of the liquid being measured. When these two factors are known, the following equation can be used to determine the pressure range needed to specify an applicable pressure transducer:

$$\text{Pressure in PSI} = \text{Liquid Level (in feet)} \times (\text{Specific Gravity} \times 0.433)$$

### Example:

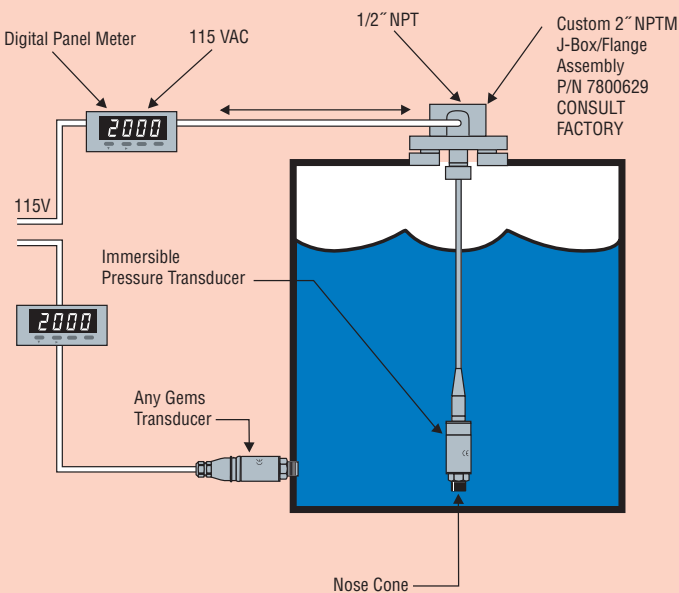
Tank Level:

$$\text{Pressure in PSI} = \text{Liquid Level (in feet)} \times (\text{Specific Gravity} \times 0.433)$$

$$\text{Pressure in PSI} = 30 \times (1.0 \times 0.433)$$

$$\text{Pressure in PSI} = 12.99 \text{ PSI}$$

Using a Psibar Series 1200, 1600, 2200 or 2600 transducer, specify Pressure Range code **F15** (0-15 PSI).

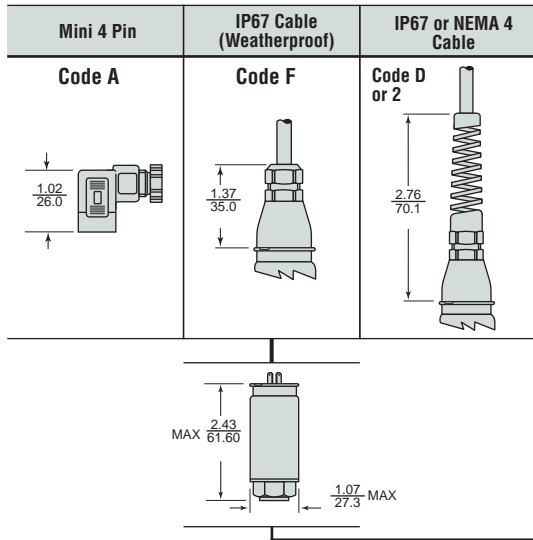




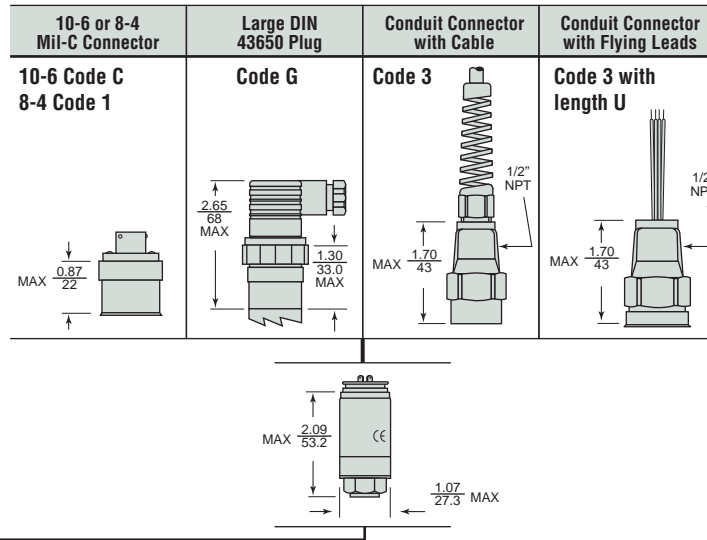


Dimensions

1200 Series



1600 Series



1/8 NPT	1/4-18 NPT	1/4-18 NPT Internal	1/2-14 NPT	7/16 - 20 UNF-2A (SAE J514)	9/16-18 UNF-2A	G 1/8	G1/4 External	R 1/4
Code 08	Code 02 (0J with snubber)	Code 0E	Code 0H	Code 04	Code IP	Code 09	Code 01	Code 0A

How to Order

Use the **bold** characters from the chart below to construct a product code

Series: **1600** B G A60 01 D 3 D A

Output: B - 4-20mA, C - 1-6V, D - 1-11V, H - 1-5V; J - 0.5-5.5V, R - 0-5V, S - 0-10V

Datum: G - Gauge

Pressure Range<sup>3</sup> - psi: F15 - 0-15, F30 - 0-30, F60 - 0-60, G10 - 0-100, G15 - 0-150, G20 - 0-200, G30 - 0-300, G50 - 0-500; G60 - 0-600, H10 - 0-1.000, H15 - 0-1.500, H20 - 0-2.000, H30 - 0-3.000, H40 - 0-4.000, H50 - 0-5.000, H60 - 0-6.000; Vac = -15 psi, 1F5 - Vac-0, 3F0 - Vac-15, 6F0 - Vac-45, 1G0 - Vac-135, 1G5 - Vac-135, 2G0 - Vac-185, 3G0 - Vac-285

Pressure Range<sup>3</sup> - bar: A10 - 0-1, A16 - 0-1.6, A25 - 0-2.5, A40 - 0-4, A60 - 0-6, B10 - 0-10, B16 - 0-16; B25 - 0-25, B40 - 0-40, B60 - 0-60, C10 - 0-100, C16 - 0-160, C25 - 0-250, C40 - 0-400; Vac = -1 bar, 1A0 - Vac-0, 1A6 - Vac-0.6, 2A5 - Vac-1.5, 4A0 - Vac-3, 6A0 - Vac-5, 1B0 - Vac-9, 1B6 - Vac-15, 2B5 - Vac-24, 4B0 - Vac-39

Electrical Connection: 1200 Series (A, B, F, 2), 1600 Series (C, 1, G, 3)

Apparatus Protection: 3, E, T

Performance Code: A

Cable Length<sup>1</sup>: U, D

Pressure Port: 08, 02, 0J, 0E, 0H, 04, 1P, 1J

European Threads: 09, 01, 0A

- Notes:
- When electrical connection is cable please select a cable length from Table 1 (opposite page). When electrical connection is DIN or plug style "U" must be specified.
  - Electrical Connections "F" and "2" are 24AWG, Shielded, PVC Cable.
  - Additional Pressure Ranges are available. Please consult factory.
  - Intrinsically safe transducers are available with amplified outputs only. (ETL, entity approved for Class I, Division 1, Groups C & D, hazardous areas; Class I, Divisions 1 and 2, Groups C & D for Electrical Connection Codes -A, -B, -G or -3 only.)
  - Apparatus Protection Code -T is available for Electrical Connection Codes -A, -B, -G or -3 only.

## 3300 Series

### Compact Low Pressure OEM Pressure Transmitters

- ▶ 0 - 250 psi pressure ranges (0 to 16 bar)
- ▶ Choice of outputs, electrical connections and pressure ports
- ▶ Operating temperature up to 257°F (125°C)

For OEMs that need consistent high levels of performance, reliability and stability the 3300 Series units offer a small package size with all stainless steel wetted parts at an unbeatable price performance ratio. A wide choice of electrical outputs as well as both electrical and pressure connections means the unit is suitable for most applications without modification. The compact construction of the 3300 series makes it ideal for installation where space is at a premium.

#### Specifications

Performance	
Long Term Drift	0.2% FS/YR (non-cumulative)
Accuracy	0.25% FS
Thermal Error	±1% max./176°F (80°C)
Compensated Temperatures	-4°F to +212°F (-20°C to +100°C)
Operating Temperatures	-40°F to +257°F (-40°C to +125°C)
Zero Tolerance	±0.5% of span, max.
Span Tolerance	±1% of span, max.
Fatigue Life	Designed for more than 100 M cycles
Mechanical Configuration	
Pressure Port	See under "How to Order," last page
Wetted Parts	17-4 PH Stainless Steel
Electrical Connection	See under "How to Order," last page
Enclosure	IP67 (IP65 for electrical codes B and K)
Vibration	BSEN 60068-2-6 (FC) BSEN 60068-2-64 (FH)
Shock	BSEN 60068-2-2n (Ea)
Approvals	CE, PED, RoHS
Weight	1.23 to 1.9 ounce (35 to 53 grams). Configuration dependant

#### Individual Specifications

<b>Voltage Output Units</b>	
Output	0 V min. to 10 V max. See under "How to Order," last page
Supply Voltage (Vs)	3 Volts above full scale to 30 Vdc (24 Vdc, max. above 230°F (110°C) applications). Source and Sinks 8mA
<b>Current Output Units</b>	
Output	4-20 mA
Supply Voltage (Vs)	10-30 Vdc (24 Vdc, max. above 230°F (110°C) applications)
<b>Ratiometric Output Units</b>	
Output	0.5 to 4.5 Vdc
Supply Voltage (Vs)	5 Vdc ±10%
Max Load Resistance	(Supply Voltage - 7.5) x 50 ohms



#### EMC Specifications

**Emissions Tests:** EN61326-1:2006 and EN61326-2-3:2006

Test Standard	Test
EN55011:2007	Conducted Emissions
EN55011:2007	Radiated Emissions

**Immunity Tests:** EN61326-1:2006 and EN61326-2-3:2006

Test Standard	Test
EN61000-4-2:1995 + A1 + A2	Electrostatic Discharge
EN61000-4-3:2006	Radiated Immunity
EN61000-4-4:2004	Fast Burst Transients
EN61000-4-6:2006	Conducted RF Immunity

Pressure Capability

PSI

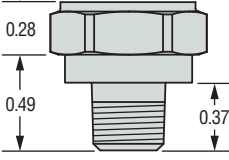
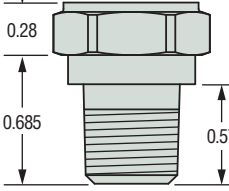
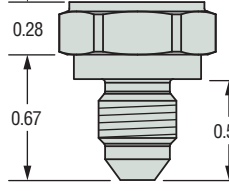
Pressure Range (PSI)	Burst Pressure (x Full Scale)	Proof Pressure
0-15	150	3x Proof Pressure
0-30	200	
0-50	125	
0-100	85	
0-150	50	
0-200	30	
0-250	30	

Bar

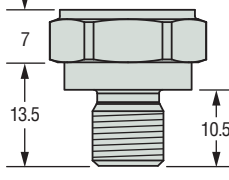
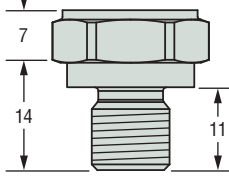
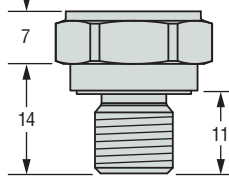
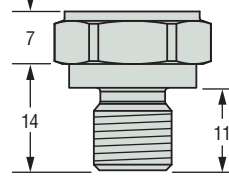
Pressure Range (Bar)	Burst Pressure (x Full Scale)	Proof Pressure
0-1	15	3x Proof Pressure
0-1.6	100	
0-2.5	200	
0-4	125	
0-6	85	
0-10	50	
0-16	30	

Pressure Ports

SAE

	1/8"-27 NPT	1/4"-18 NPT	7/16"-20 UNF with 37° Flare
Dimensions in Inches			
Fitting Code	08	02	04
Torque	2-3 TFFT*	2-3 TFFT*	15-16 NM

Metric

	G1/8"-27 External	G1/4" External	G1/4" A Integral Face Seal	M12 x 1.5 - 6g
Dimensions in MM				
Fitting Code	0S	01	05	0L
Torque	22-25 NM	30-35 NM	30-35 NM	28-30 NM

\*NPT Threads 2-3 turns from finger tight. Wrench tighten 2-3 turns.

General Notes:

1. The diameter of all cans is 19 mm (0.748")
2. Hex is 22 mm (0.866") Across Flats (A/F) for deep socket mounting

## Electrical Connector

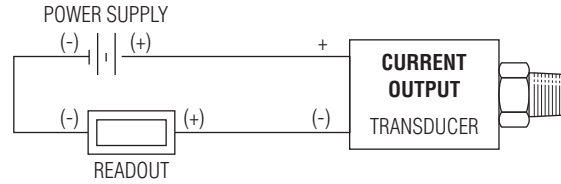
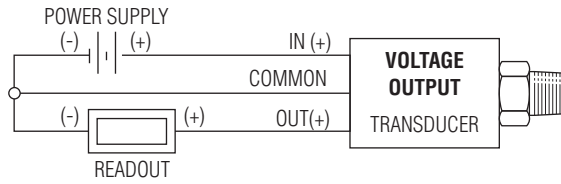
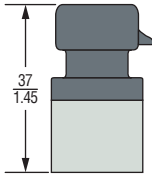
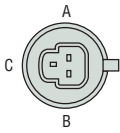
DIN 9.4 mm			M12 x 1P			Deutsch DT04-4P			Amp Superseal 1.5	
Code B		Code K		Code E		Code 8		Code 6		
Pin #	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Note
1	$V_{out}$ (pressure)	No Connect	$V_{supply}$	Supply	$V_{supply}$	Supply	Ground	Return	$V_{out}$ (pressure)	Amp Superseal connectors may be used with 0.5-4.5V Ratiometric Output only.
2	$V_{supply}$	Supply	Ground	Return	$V_{out}$ (pressure)	No Connect	$V_{supply}$	Supply	Ground	
3	No Connect	No Connect	$V_{out}$ (pressure)	No Connect	Ground	Return	No Connect	No Connect	$V_{supply}$	
4	Ground	Return	No Connect	No Connect	No Connect	No Connect	$V_{out}$ (pressure)	No Connect	—	

## Mating Connectors

Part Number	Description	For Use on Elect. Code #
557230	MINI DIN Connector, Strain Relief (with drive screw & gasket)	B and K
557703-01M0	M12 Cord Set – 1 Meter (Red 1, Green 2, Blue 3, Yellow 4)	E
557703-03M0	M12 Cord Set – 3 Meters (Red 1, Green 2, Blue 3, Yellow 4)	E
557703-04M0	M12 Cord Set – 4 Meters (Red 1, Green 2, Blue 3, Yellow 4)	E
557703-05M0	M12 Cord Set – 5 Meters (Red 1, Green 2, Blue 3, Yellow 4)	E
	Recommended Mating Parts (AMP p/n: Housing 282087-1; Contacts 3X 183025-1; Seal 281934-1; Boot 880811-2)	6
557701	AMP Superseal Mate Kit	6
210729	AMP 3.5' Cable Cord Set – Clear Pos 1, Black Pos 2, Red Pos 3	6
210730	AMP 12" Flying Leads Cord Set – White Pos 1, Black, Red Pos 3	6
	Recommended Mating Parts (Deutsch p/n: Housing Plug DT064S-P012; Wedge W4S-P012; Sockets 4X 0462-201-1631)	8
224153	Deutsch Cord Set 3' Long (18 AWG PVC Cable – Black 1, Red 2, Green 3, White 4)	8
	Recommended Mating Parts (Delphi Packard MetriPack p/n: Body 12065286; Seal 12052893. Consult Delphi for Contacts)	9
218760	Packard Mate Kit	9
223974	Packard Cord Set 3' Long (24 AWG PVC Cable – White 1, Black 2, Red 3)	9
223975	Packard Cord Set 6' Long (24 AWG PVC Cable – White 1, Black 2, Red 3)	9
227987	Packard Cord Set 14.75' Long (22 AWG PVC Cable - White 1, Black 2, Red 3)	9
220492	Packard Mate - 12" Flying Leads – 3 Conductor PVC 18 AWG	9
222976	Packard Mate - 18" Flying Leads – 3 Conductor PVC 18 AWG	9
220797	Packard Mate - 24" Flying Leads – 3 Conductor PVC 18 AWG	9

Wiring Diagram

Packard MetriPack

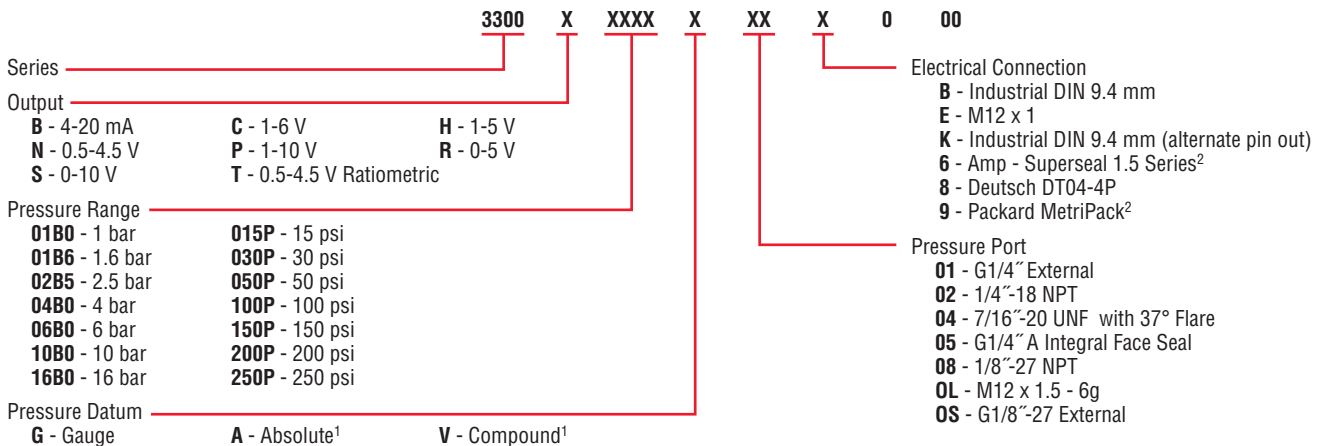


Code 9

Pin ID	Voltage Mode	Note
C	V <sub>out</sub> (pressure)	MetriPack connectors may be used with 0.5-4.5V Ratiometric Output only.
A	Ground	
B	V <sub>supply</sub>	
—	—	—

How to Order

Use the **bold** characters from the chart below to construct a product code



Notes:

- Contact Gems for availability
- Compatible with Ratiometric Output Only; Code T

PRESSURE TRANSDUCERS



# 6700 Series-Stable Industrial Transmitters with Turndown Capabilities

- ▶ Gauge and Absolute Pressure Models
- ▶ Submersible, General Purpose and Wash down Enclosures
- ▶ High Stability Achieved by Sputtered Sensing Element

The 6700 series features customer accessible 5:1 turndown from nominal range via a switch and potentiometer. Down ranging whether factory or user adjusted is ideal for applications requiring high overpressure. The 6700 are housed in a rugged enclosure for harsh conditions and features superb stability by incorporating Gems CVD sensing element.

## Specifications

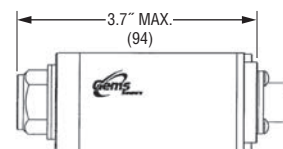
Input	
<b>Pressure Range</b>	0.5 to 400 bar; (7.5 to 6000 psi) Gauge and Absolute
<b>Proof Pressure</b>	2 x Full Scale (FS) (1.5 x FS for 400 bar, ≥ 5000 psi)
<b>Burst Pressure</b>	>35 x FS ≤ 100 psi (6 bar); >20 x FS ≤ 1000 psi (60 bar); >5 x FS ≤ 6000 psi (400 bar)
<b>Fatigue Life</b>	Designed for more than 100 million FS cycles
Performance	
<b>Output</b>	4-20 mA (2 wire)
<b>Supply Voltage (Vs)</b>	9.5 to 40 VDC (ExII 1G 9.5 to 28 Vdc)
<b>Supply Voltage Sensitivity</b>	0.005% of max span/Volt
<b>Long Term Drift</b>	0.15% of max span/year (non-cumulative)
<b>Accuracy</b>	0.15% FS typical
<b>Thermal Error Typical</b>	15°F to 120°F (-10°C to +50°C) 0.5% of max span -4°F to +176°F (-20°C to +80°C) 1% of max span
<b>Operating Temperatures</b>	-4°F to +185°F (-20°C to +85°C) elec. conn. code C G & L -4°F to +122°F (-20°C to +50°C) elec. conn. code M, 3 -22°F to +212°F (-30°C to +100°C) process/media
<b>Zero Tolerance</b>	0.15 % span, typical
<b>Span Tolerance</b>	0.15% span, typical
<b>Zero Adjustment</b>	±10% (100% at factory) by potentiometer
<b>Span Adjustment</b>	17% to 100% of span by potentiometer/switches
<b>Max. Loop Resistance</b>	(Vs-9.5) x 50 ohms
Mechanical Configuration	
<b>Pressure Port</b>	see ordering chart
<b>Wetted Parts</b>	17-4 PH Stainless Steel (1 & 1.6b 17-4 PH and 15-7 MO)
<b>Electrical Connection</b>	see ordering chart
<b>Enclosure</b>	318 Duplex SS, 17-4 PH SS IP40 for gauge datum elec code C, L IP65 for absolute datum elec code C, L IP65 for elec. code G, 3 IP68 for elec. code M
<b>Vibration</b>	35g peak sinusoidal, 5 to 2000 Hz
<b>Acceleration</b>	100g steady acceleration in any direction 0.036% FS/g for 10 psi (0.75 bar) range decreasing logarithmically to 0.0007% FS/g for 6000 psi (400 bar) range.
<b>Shock</b>	Withstands free fall to IEC 68-2-32 procedure 1
<b>Approvals</b>	CE, Lloyds Register, optimal EXII 1G; E Exia II CT4 (-40°C < T amb < 75°C) Cert BASEEFA 02ATEX00040X
<b>Weight</b>	approx. 250 grams (additional; cable 75 g/m)



## Dimensions in. (mm)

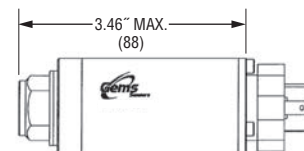
Max diameter 39mm, all models

### Code C



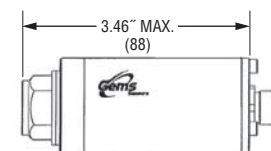
Six Pin Fixed Plug (10-6)

### Code G



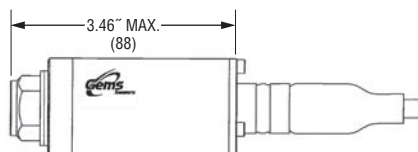
Fixed Plug to DIN 43650 Mating Connector Supplied

### Code L



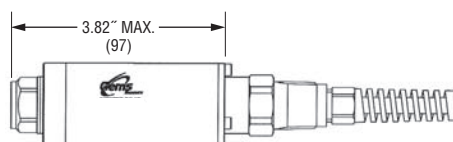
Electrical Connector M12 x 1 (5 Pin)

### Code M



Immersible to 200mWG

### Code 3



1/2 - 14 NPT conduit

## How to Order

Use the **bold** characters from the chart below to construct a product code

**SELECT:** **6700 B G B10 00 G 3 000 B**

- 6700** series for bar ranges, **6710** series for psi ranges
- Output Response: **B** 4-20 mA Undamped;
- Pressure Datum: **G** gauge and compound; **A** absolute
- Insert pressure range code from table below
- Pressure Port see chart
- Electrical Connection  
**C** Fixed plug size 10-6, mate sold separately part # 499532-0006  
**M** IP68 immersible cable; **G** Fixed plug to DIN 43650, mate supplied  
**L** M12 x 1 (5 pin); **3** 1/2-14 NPT conduit
- Approvals/Protection  
**3** CE;  
**G** ATEX approved intrinsically safe EExia IIC T4, galvanic isolation gauge and absolute
- Cable Length in meters (requires electrical connection code M)  
**000** no cable; **001** 1 meter cable; **999** 999 meters
- Static/Thermal performance  
**B** 0.15%/5%

**Note:** For 500mb use range code A 0.25%/3%

## Electrical Connections

Electrical Connection Code	Wiring		
	(+)	(-)	EARTH
<b>G</b> "DIN"	1	2	4
<b>C</b> "10-6 Bayonet"	A	B	E
<b>M</b> "IP 68 Immersible Cable"	R	BL	DRAIN

**Cable Legend:**

R = Red      BL = Blue

## Pressure Range Code

6700 Model Bar Ranges	Range Code	Gauge (G) Absolute (A)
0 to 500mb	<b>N50</b>	G, A
0 to 1	<b>A10</b>	G, A
0 to 1.6	<b>A16</b>	G, A
0 to 2.5	<b>A25</b>	G, A
0 to 4	<b>A40</b>	G, A
0 to 6	<b>A60</b>	G, A
0 to 10	<b>B10</b>	G, A
0 to 16	<b>B16</b>	G, A
0 to 25	<b>B25</b>	G, A
0 to 40	<b>B40</b>	G
0 to 60	<b>B60</b>	G
0 to 100	<b>C10</b>	G
0 to 160	<b>C16</b>	G
0 to 250	<b>C25</b>	G
0 to 400	<b>C40</b>	G

6710 Model PSI Ranges	Range Code	Gauge (G) Absolute (A)
0 to 15	<b>F15</b>	G, A
0 to 30z	<b>F30</b>	G, A
0 to 60	<b>F60</b>	G, A
0 to 100	<b>G10</b>	G, A
0 to 150	<b>G15</b>	G, A
0 to 200	<b>G20</b>	G, A
0 to 300	<b>G30</b>	G, A
0 to 500	<b>G50</b>	G
0 to 600	<b>G60</b>	G
0 to 1000	<b>H10</b>	G
0 to 1500	<b>H15</b>	G
0 to 3000	<b>H30</b>	G
0 to 5000	<b>H50</b>	G
0 to 6000	<b>H60</b>	G

## Pressure Ports – See Page H-24 for Dimensions

Code	Description of Stainless Steel Fittings
<b>OO</b>	G 1/4 internal
<b>AO</b>	G 1/4 external
<b>KO</b>	7/16-20 UNF-3A external
<b>MO</b>	M14 x 1.5 external
<b>PO</b>	G 1/2 manometer
<b>BO</b>	1/4-18 NPT external
<b>GO</b>	1/2-14 NPT external
<b>SO</b>	7/16-20 UNJF-3A, MS 33656E4

### Immersible Sensors

<b>10</b>	Plastic Nose cone
<b>20</b>	Nose cone with restrictor
<b>30</b>	Nose cone w/ steel sink weight

## 3100 Series and 3200 Heavy Duty Series Compact OEM Pressure Transmitters

- ▶ 0–50 psi to 0-30,000 psi ranges (0-3.5 bar to 0-2,200 bar)
- ▶ High Proof Pressures
- ▶ Broad Choice of Outputs
- ▶ RoHS Compliant

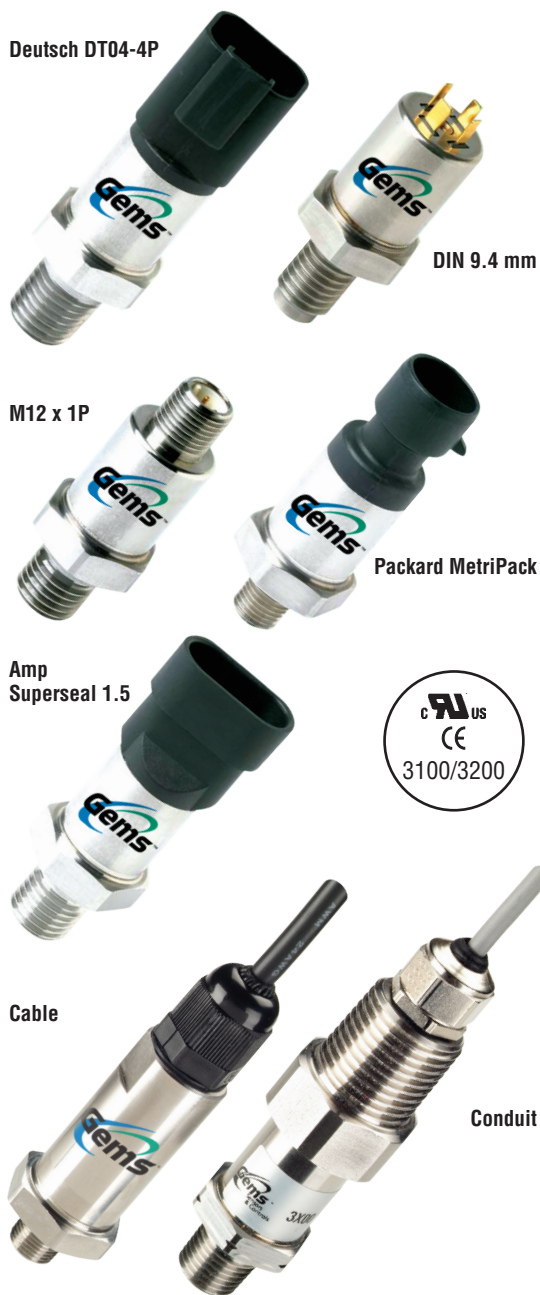
For OEMs that need consistent high levels of performance, reliability and stability the 3100 and 3200 Series sputtered thin film units offer unbeatable price performance ratio in a small package size. They feature all-stainless steel wetted parts, a broad selection of electrical and pressure connections, and wide choice of electrical outputs to allow stock configurations suitable for most applications without modification. At the heart of both these series is a sputter element that also provides exceptional temperature specifications. Plus, our manufacturing process for the 3100 and 3200 Series include the latest automated equipment, producing the most consistent and best price to performance sensor on the market today.

Additionally, 3200 Series transmitters feature thicker diaphragms and a pressure restrictor to withstand the rigors of cavitations or extreme pressure spikes, delivering years of reliable and stable performance in pulsating applications.

The compact construction of both these series makes them ideal for installation where space is at a premium. And they are fully RoHS compliant.

### Specifications

Performance	
<b>Long Term Drift</b>	0.2% FS/YR (non-cumulative)
<b>Accuracy</b>	
3100	0.25% FS
3200	0.5% FS for <1000 psi (60 bar)
<b>Thermal Error</b>	
3100	0.83% FS/100°F (1.5% FS/100°C)
3200	2% FS/100°C for <1000 psi (60 bar)
<b>Compensated Temperatures</b>	-40°F to +257°F (-40°C to +125°C)
<b>Operating Temperatures</b>	-40°F to +257°F (-40°C to +125°C)
<b>Zero Tolerance</b>	
3100	0.5% of span
3200	1% FS for <1000 psi (60 bar)
<b>Span Tolerance</b>	
3100	0.5% of span
3200	1% FS for <1000 psi (60 bar)
<b>Response Time</b>	1 ms
<b>Fatigue Life</b>	Designed for more than 100 M cycles
<b>Mechanical Configuration</b>	
<b>Pressure Port</b>	See under "How to Order," last page
<b>Wetted Parts</b>	17-4 PH Stainless Steel
<b>Electrical Connection</b>	See under "How to Order," last page
<b>Enclosure</b>	IP67 (IP65 for electrical codes B and R)
<b>Vibration</b>	40G peak to peak sinusoidal, (Random Vibration: 20 to 1000 Hz @ approx. 40G peak per MIL-STD-810E)
<b>Shock</b>	Withstands free fall to IEC 68-2-32 procedure 1
<b>EMC (Radiated Immunity)</b>	100 V/m
<b>Approvals</b>	CE, conforms to European Pressure Directive, Fully RoHS compliant, UL recognized files # E219842 & E174228
<b>Weight</b>	35 grams



### Individual Specifications

<b>Voltage Output (3-wire)</b>	0 V min. to 10 V max. See under "How to Order," last page
<b>Supply Voltage</b>	2 Volts above full scale to 30 Vdc max @ 4.5 mA (6.5 mA on dual output version)
<b>Source and Sinks</b>	2 mA
<b>Current Output (2-wire)</b>	4-20 mA
<b>Supply Voltage</b>	8-30 Vdc
<b>Maximum Loop Resistance</b>	(Supply Voltage-8) x 50 ohms
<b>Ratiometric Output</b>	0.5 to 4.5 Vdc @ 4 mA (6.5 mA on dual output version)
<b>Supply Voltage</b>	5 Vdc ±10%

**Pressure Capability**

Pressure Range PSI (Bar)	Proof Pressure (x Full Scale)		Burst Pressure (x Full Scale)	
	3100	3200	3100	3200
50-300 (3.5-25)	3.00 x FS	3.00 x FS	40 x FS	
500-1,500 (40-100)			20 x FS	
2,000-6,000 (160-400)			10 x FS	
7,500-9,000 (600)			10 x FS	
10,000 (700)	2.00 x FS	3.00 x FS	4 x FS	>60,000 PSI (4,000 bar)
15,000 (1,000)				
25,000 (1,800)				
30,000 (2,200)	1.40 x FS	—	1.5 x FS	—

**Pressure Ports**

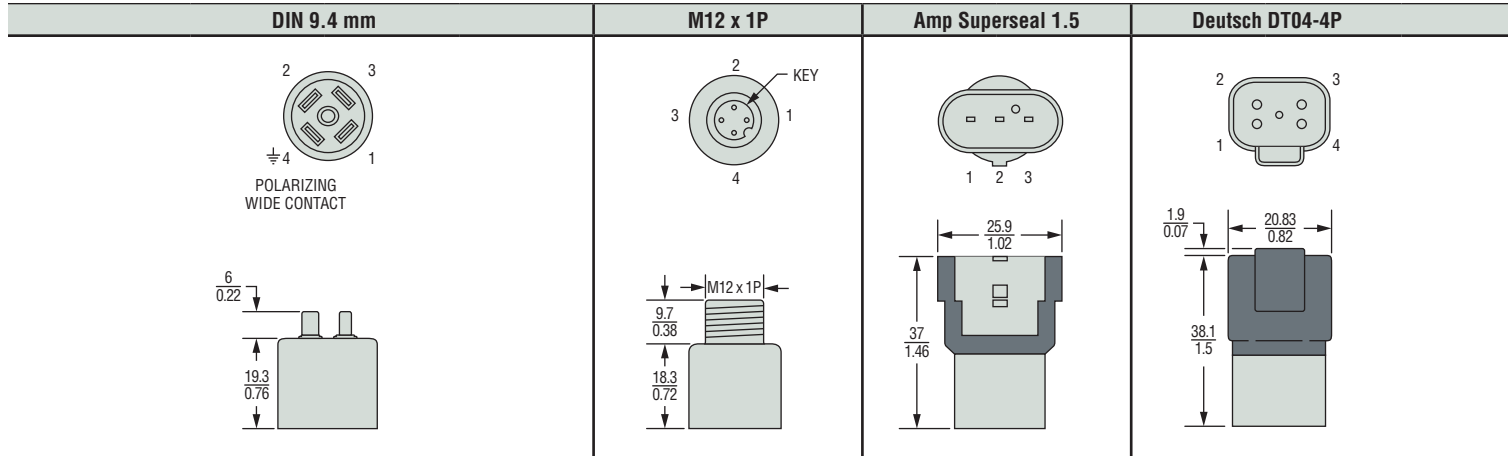
SAE Dimensions in Inches				
	<b>Fitting Code</b> <b>Torque</b>	<b>08 = 1/8"-27 NPT</b> 2-3 TFFT*	<b>4D = 1/8"-27 NPTF Dryseal</b> 2-3 TFFT*	<b>02 = 1/4"-18 NPT</b> 2-3 TFFT*
<b>Fitting Code</b> <b>Torque</b>	<b>4C = 1/4"-18 NPTF Dryseal</b> 2-3 TFFT*	<b>4N = SAE J1926:2/3/8-24</b> 18-20 NM	<b>1J = 7/16"-20 UNF with O-Ring</b> 18-20 NM	<b>04 = 7/16"-20 UNF with 37° Flare</b> 15-16 NM
			Metric Dimensions in MM →	
<b>Fitting Code</b> <b>Torque</b>	<b>1G = SAE 4 Female 7/16" Schraeder</b> 18-20 NM	<b>1P = 9/16-18 "Heavy Duty"</b> 18-20 NM		<b>01 = G1/4"-27 External</b> 30-35NM
<b>Fitting Code</b> <b>Torque</b>	<b>05 = G1/4" A Integral Face Seal</b> 30-35 NM	<b>0L = M12 x 1.5</b> 28-30 NM	<b>2T = M12x1.5 HP Metal Washer Seal</b> 30-35 NM	<b>0K = M14 x 1.5</b> 2-3 TFFT*

\*NPT Threads 2-3 turns from finger tight. Wrench tighten 2-3 turns.

General Notes:

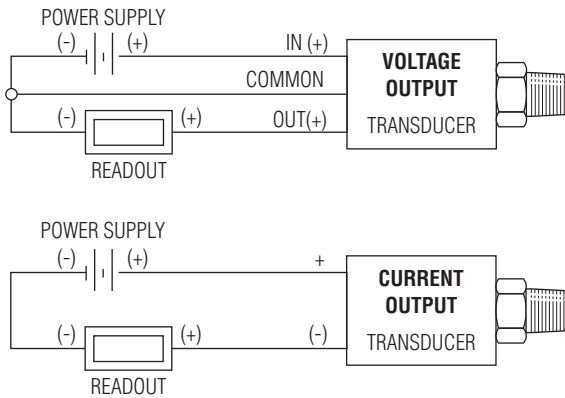
1. The diameter of all cans is 19 mm (0.748")
2. Hex is 22 mm (0.866") Across Flats (A/F) for deep socket mounting
3. O-Ring material, where applicable, is Nitrile<sup>®</sup> unless otherwise specified.

## Electrical Connector

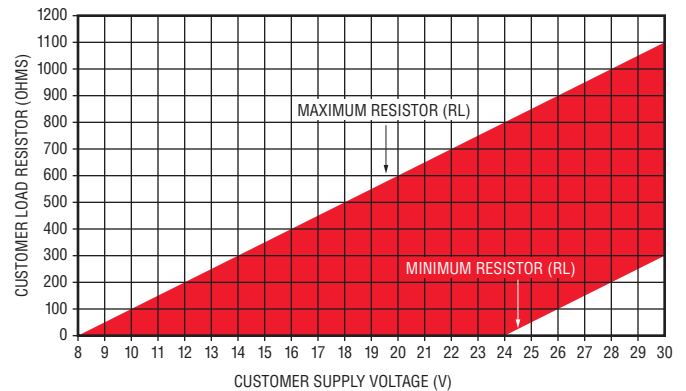


Code B			Code R		Code E		Code 6		Code 8	
Pin #	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode
1	$V_{out1}$ (pressure)	No Connect	$V_{supply}$	Supply	$V_{supply}$	Supply	$V_{out1}$ (pressure)	No Connect	Ground	Return
2	$V_{supply}$	Supply	Ground	Return	$V_{out1}$ (pressure)	No Connect	Ground	Return	$V_{supply}$	Supply
3	$V_{out2}$ (temp)	No Connect	$V_{out}$ (pressure)	No Connect	Ground	Return	$V_{supply}$	Supply	$V_{out2}$ (temp)	No Connect
4	Ground	Return	$V_{out2}$ (temp)	No Connect	$V_{out2}$ (temp)	No Connect	—	—	$V_{out1}$ (pressure)	No Connect

## Wiring Diagram



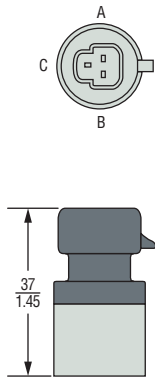
## Current Output Mode (Load Resistor Range)



Minimum Resistor Value =  $50 \cdot (+V - 24)$  for  $+V > 24V$   
 Maximum Resistor Value =  $50 \cdot (+V - 8)$  for  $+V > 8V$

**Cable-Out Types**

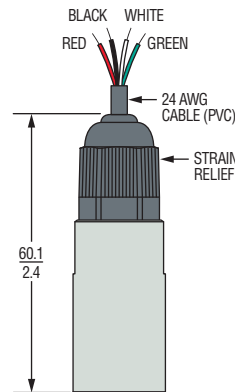
**Packard MetriPack**



**Code 9**

Pin ID	Voltage Mode	Current Mode
C	$V_{out1}$ (pressure)	No Connect
A	Ground	Return
B	$V_{supply}$	Supply
—	—	—

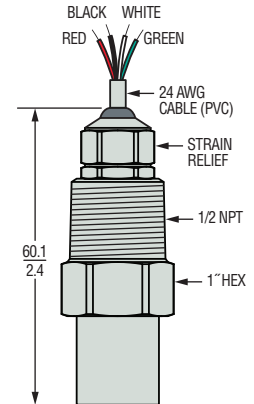
**Cable**



**Code F**

Wire Color	Voltage Mode	Current Mode
Red	Supply	Supply
Black	Ground	Return
White	$V_{out1}$ (pressure)	No Connect
Green	$V_{out2}$ (temp)	No Connect

**1/2" Conduit Connection**



**Code 3**

Voltage Mode	Current Mode
Supply	Supply
Ground	Return
$V_{out1}$ (pressure)	No Connect
$V_{out2}$ (temp)	No Connect

**Mating Connectors**

Part Number	Description	For Use on Elect. Code #
557230	MINI DIN Connector, Strain Relief (with drive screw & gasket)	B and R
557703-01M0	M12 Cord Set – 1 Meter (Red 1, Green 2, Blue 3, Yellow 4)	E
557703-03M0	M12 Cord Set – 3 Meters (Red 1, Green 2, Blue 3, Yellow 4)	E
557703-04M0	M12 Cord Set – 4 Meters (Red 1, Green 2, Blue 3, Yellow 4)	E
557703-05M0	M12 Cord Set – 5 Meters (Red 1, Green 2, Blue 3, Yellow 4)	E
	Recommended Mating Parts (AMP p/n: Housing 282087-1; Contacts 3X 183025-1; Seal 281934-1; Boot 880811-2)	6
557701	AMP Superseal Mate Kit	6
210729	AMP 3.5' Cable Cord Set – Clear Pos 1, Black Pos 2, Red Pos 3	6
210730	AMP 12" Flying Leads Cord Set – White Pos 1, Black, Red Pos 3	6
	Recommended Mating Parts (AMP p/n: Socket Conn 1-967325-1. Consult AMP for Contacts, Wire Seal and Strain Relief options)	7
557702	DIN 72585 Twist Lock Mate Kit	7
	Recommended Mating Parts (Deutsch p/n: Housing Plug DT064S-P012; Wedge W4S-P012; Sockets 4X 0462-201-1631)	8
224153	Deutsch Cord Set 3' Long (18 AWG PVC Cable – Black 1, Red 2, Green 3, White 4)	8
	Recommended Mating Parts (Delphi Packard MetriPack p/n: Body 12065286; Seal 12052893. Consult Delphi for Contacts)	9
218760	Packard Mate Kit	9
223974	Packard Cord Set 3' Long (24 AWG PVC Cable – White 1, Black 2, Red 3)	9
223975	Packard Cord Set 6' Long (24 AWG PVC Cable – White 1, Black 2, Red 3)	9
227987	Packard Cord Set 14.75' Long (22 AWG PVC Cable - White 1, Black 2, Red 3)	9
220492	Packard Mate - 12" Flying Leads – 3 Conductor PVC 18 AWG	9
222976	Packard Mate - 18" Flying Leads – 3 Conductor PVC 18 AWG	9
220797	Packard Mate - 24" Flying Leads – 3 Conductor PVC 18 AWG	9

**PRESSURE TRANSDUCERS**



## How to Order

Use the **bold** characters from the chart below to construct a product code

			<b>3100</b>	<b>B</b>	<b>200PG</b>	<b>02</b>	<b>B</b>	<b>R</b>	<b>01</b>	
Series	_____									Cable Length (For electrical connections F& 3 only)
	<b>3100 / 3200</b> - Pressure Transducer – Combination Pressure and Temperature <sup>1</sup> <b>3101 / 3201</b> - Temp. Output Range -40°C to 125°C <b>3102 / 3202</b> - Temp. Output Range 0°C to 100°C <b>3103 / 3203</b> - Temp. Output Range 0°C to 80°C									<b>00</b> - No Cable <b>01</b> - 1 meter <b>02</b> - 2 meters <b>03</b> - 3 meters <b>04</b> - 4 meters <b>05</b> - 5 meters
Output	_____									Optional Restrictor (3200 only)
	<b>B</b> - 4-20 mA <b>C</b> - 1-6 V <b>H</b> - 1-5 V <b>N</b> - 0.5-4.5 V <b>R</b> - 0-5 V <b>S</b> - 0-10 V <b>T</b> - 0.5-4.5 V Ratiometric									<b>R</b> - Restrictor <b>0</b> - No Restrictor
Pressure Range – psi	_____									Electrical Connection
	<b>050PG</b> - 0-50 psiG <sup>5</sup> <b>10CPG</b> - 0-1,000 psiG <b>10KPS</b> = 0-10,000 psiS <b>075PG</b> - 0-75 psiG <b>15CPG</b> - 0-1,500 psiG <b>15KPS</b> - 0-15,000 psiS <sup>2</sup> <b>100PG</b> - 0-100 psiG <b>20CPS</b> - 0-2,000 psiS <b>20KPS</b> - 0-20,000 psiS <sup>2</sup> <b>150PG</b> - 0-150 psiG <b>25CPS</b> - 0-2,500 psiS <b>25KPS</b> - 0-25,000 psiS <sup>2</sup> <b>200PG</b> - 0-200 psiG <b>30CPS</b> - 0-3,000 psiS <b>300PG</b> - 0-300 psiG <b>35CPS</b> - 0-3,500 psiS <b>500PG</b> - 0-500 psiG <b>40CPS</b> - 0-4,000 psiS <b>600PG</b> - 0-600 psiG <b>50CPS</b> - 0-5,000 psiS <b>750PG</b> - 0-750 psiG <b>60CPS</b> - 0-6,000 psiS <b>75CPS</b> - 0-7,500 psiS									<b>B</b> - Industrial DIN 9.4 mm (mating connector not supplied) <b>E</b> - M12 x 1P (4-Pin) <b>F</b> - Cable version <sup>6</sup> <b>G</b> - Large DIN <b>R</b> - Industrial DIN 9.4 mm (alternate pin out) <b>3</b> - 1/2" NPT Male Conduit <sup>6</sup> <b>6</b> - Amp - Superseal 1.5 Series <b>8</b> - Deutsch DT04-4P <b>9</b> - Packard MetriPack
Pressure Range - bar	_____									Pressure Port <sup>4</sup>
	<b>0004G</b> - 0-4 barG <sup>5</sup> <b>0160S</b> - 0-160 barS <b>1000S</b> - 1,000 barS <sup>2</sup> <b>0005G</b> - 0-5 barG <b>0250S</b> - 0-250 barS <b>1600S</b> - 1,600 barS <sup>2</sup> <b>0010G</b> - 0-10 barG <b>0400S</b> - 0-400 barS <b>0016G</b> - 0-16 barG <b>0600S</b> - 0-600 barS <b>0025G</b> - 0-25 barG <b>0040G</b> - 0-40 barG <b>0060G</b> - 0-60 barG <b>0100G</b> - 0-100 barG									<b>08</b> - 1/8-27 NPT External <b>02</b> - 1/4-18 NPT External <b>04</b> - 7/16-20 External (SAE #4, J514) <b>1J</b> - 7/16-20 External (SAE #4, J1926-2) <b>0E</b> - 1/4"-18 NPT Internal <b>0K</b> - M14 x 1.5 Straight <b>1G</b> - Schrader SAE #4, 7/16" Internal <b>1P</b> - SAE 6 (9/16"-18 UNF 2A) <b>4C</b> - 1/4-18 NPTF External (Dryseal) <b>4D</b> - 1/8-27 NPTF External (Dryseal) <b>4N</b> - SAE 3 (3/8-24 UNF External)

### Notes:

- Temperature outputs are for voltage output pressure sensors only (applies to codes **-C**, **-H**, **-N**, and **-T** only) and limited to connections that have 4 pins (Electrical codes **-B**, **-E**, **-7**, and **-8**). Accuracy is 3.5% of temperature span. Requires additional 2mA of power.
- Ranges 15,000 psi (1,000 bar) and above available with **-2T** pressure port only.
- For use with pull-up or pull-down resistors, contact factory.
- Pressure ports **0E** and **1G** are NOT available with the Restrictor option.
- 0-50 PSI (4 bar) – **NOT** available with 4-20 mA or 0-10 Vdc outputs.
- For electrical codes **F** & **3**, specify cable length in meters.



**How to Order**

Use the **bold** characters from the chart below to construct a product code

- SELECT:** **4700 B G B10 00 G 3 000 E**
- 4700** bar units, **4710** psi units
  - Output Response: **B** 4-20 mA Undamped
  - Pressure Datum: **G** gauge; **A** absolute  
(For differential models and compound ranges consult sales)
  - Insert pressure range code from table below
  - Pressure Port see chart
  - Electrical Connection  
**C** Fixed plug size 10-6, mate sold separately part # 499532-0006  
**G** Fixed plug to DIN 43650 mating plug supplied; **L** M12 x 1 (5 pin)  
**M** IP68 immersible cable; **3** 1/2-14 NPT Conduit
  - Approvals/Protection (For flame proof units see next page)  
**3** CE; **G** ATEX approved intrinsically safe EEIa IIC T4, Galvanic, isolators
  - Cable Length in meters (requires electrical connection code F)  
**000** No Cable; **001** 1 meter; **999** 999 meters
  - Static/Thermal Performance  
**E** 0.2%/1.6%; **F** 0.2%/1.0%. 500mbar range performance code **E** only

**Electrical Connections**

Electrical Connection Code	Wiring		
	(+)	(-)	EARTH
<b>G</b> "DIN"	1	2	4
<b>C</b> "10-6 Bayonet"	A	B	E
<b>F</b> "IP 68 Cable"	R	BL	DRAIN

**Cable Legend:**

R = Red      BL = Blue

4700 Model Bar Ranges	Range Code	Gauge (G)* Absolute (A)
0 to 500mb	<b>N50</b>	G, A
0 to 1	<b>A10</b>	G, A
0 to 1.6	<b>A16</b>	G, A
0 to 2.5	<b>A25</b>	G, A
0 to 4	<b>A40</b>	G, A
0 to 6	<b>A60</b>	G, A
0 to 10	<b>B10</b>	G, A
0 to 16	<b>B16</b>	G, A
0 to 25	<b>B25</b>	G, A
0 to 40	<b>B40</b>	G, A
0 to 60	<b>B60</b>	G, A
0 to 100	<b>C10</b>	G, A
0 to 160	<b>C16</b>	G, A
0 to 250	<b>C25</b>	G, A
0 to 400	<b>C40</b>	G, A
0 to 600	<b>C60</b>	G, A**
0 to 690	<b>C69</b>	G, A**

4710 Model PSI Ranges	Range Code	Gauge (G)* Absolute (A)
0 to 10	<b>F10</b>	G
0 to 15	<b>F15</b>	G, A
0 to 30	<b>F30</b>	G, A
0 to 60	<b>F60</b>	G, A
0 to 100	<b>G10</b>	G, A
0 to 150	<b>G15</b>	G, A
0 to 200	<b>G20</b>	G, A
0 to 300	<b>G30</b>	G, A
0 to 500	<b>G50</b>	G, A
0 to 1000	<b>H10</b>	G, A
0 to 1500	<b>H15</b>	G, A
0 to 3000	<b>H30</b>	G, A
0 to 5000	<b>H50</b>	G, A
0 to 6000	<b>H60</b>	G, A
0 to 10000	<b>J60</b>	G, A**

\* For compound ranges please consult factory  
\*\* Inconel pressure port required.

**Pressure Ports - See Page H-24 for Dimensions**

Codes		Description
SS	Inconel	
<b>OO</b>	<b>OK</b>	G 1/4 internal
<b>AO</b>	<b>AK</b>	G 1/4 AT external
<b>KO</b>	<b>KK</b>	7/16-20 UNF 3A external
<b>MO</b>	<b>MK</b>	M14 x 1.5 external
<b>PO</b>	<b>PK</b>	G 1/2 AT external
<b>BO</b>	<b>BK</b>	1/4-18 NPT external
<b>GO</b>	<b>GK</b>	1/2-14 NPT external
<b>SO</b>	<b>SK</b>	7/16-20 UNJF external, MS 33656E4
<b>Immersible</b>		
<b>10</b>		Plastic nose cone
<b>20</b>		Nose cone with restrictor
<b>30</b>		Nose cone w/ss Sink Weight

# 9000 Series CANbus Digital Output Pressure Transducer



- ▶ High accuracy over wide operating temperature range  
T.E.B.  $\pm 0.2\%$  Span,  $-40^{\circ}\text{F}$  to  $+185^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ )
- ▶ Excellent Long Term Stability  
 $<0.05\%$  per year, non-cumulative
- ▶ Small size: 25mm diameter, 120mm length
- ▶ Isolated high speed CAN interface - ISO11898
- ▶ Programmable update rate
- ▶ Standard application interface - CANopen DS301 & DSP404
- ▶ In system programmable
- ▶ Self diagnostics - bridge fault detection, hours in service, watchdog, last calibration date, next calibration date
- ▶ Unsurpassed customer support - Rapid Development Kit

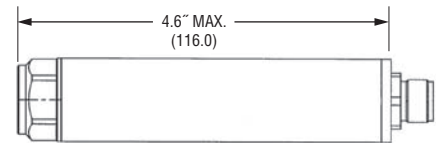


The 9000 CANBUS pressure transducer meets the demands of the test and measurement industry, including automotive and marine applications, with high levels of accuracy over a wide temperature range. The digital output in engineering units eliminates the need for user system calibration.

Designed to have a wide input voltage range, input to output isolation, immunity to noise and self-diagnostics the 9000 is ideal for electrically noisy environments or applications where earthing or grounding can be a problem.

Through the standard CANopen protocol multiple devices can be used on a single bus reducing user cabling.

## Dimensions in. (mm)

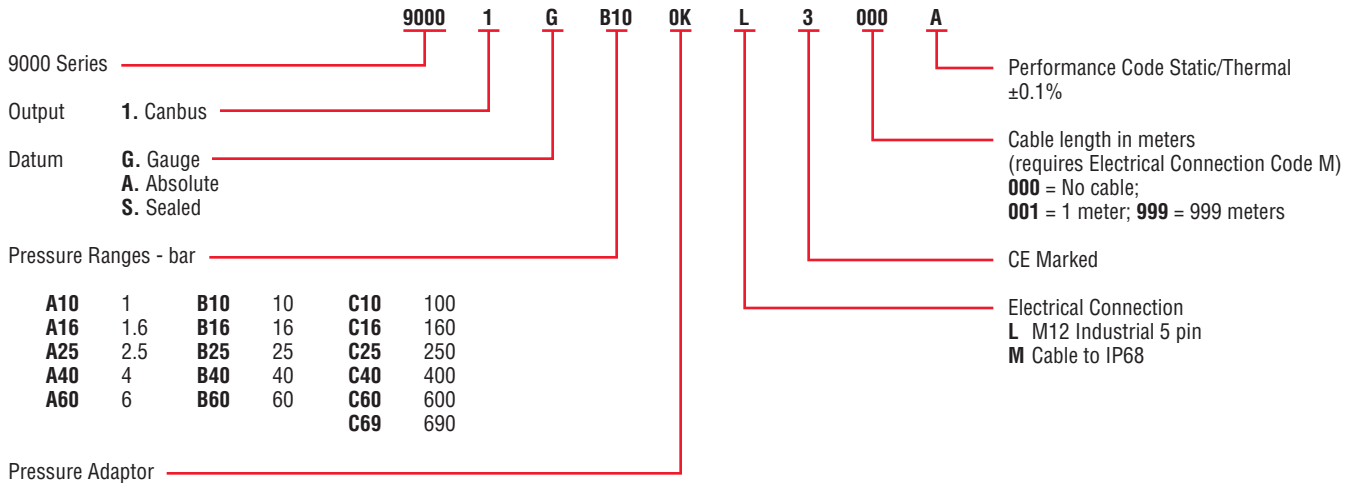


## Specification

Input	
<b>Pressure Range</b>	0 to 1 - 0 to 690 bar
<b>Proof Pressure</b>	2 x FS (Inconel 1.5 x F.S.)
<b>Burst Pressure</b>	>35 x FS for ranges / 87 psi (6 bar) >15 x FS for ranges $\geq 1450$ psi (100 bar) >4 x FS for ranges $\leq 10007$ psi (690 bar)
<b>Supply Voltage</b>	7-30 VDC
Performance	
<b>Long Term Stability</b>	Zero drift $<0.05\%$ Full range output non cumulative
<b>Accuracy</b>	$\pm 0.1\%$ Full Scale
<b>Total Error Band</b>	$\pm 0.2\%$ Full Scale
<b>Compensated Temperature</b>	$-40^{\circ}\text{F}$ to $+185^{\circ}\text{F}$ ( $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ )
<b>Operating Temperature</b>	$-40^{\circ}\text{F}$ to $+185^{\circ}\text{F}$ ( $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ )
Mechanical Configuration	
<b>Pressure Port</b>	(see table on next page)
<b>Wetted Parts</b>	17-4 PH or Inconel
<b>Electrical Connection</b>	5 pin M12 x 1, cable to IP68, others on request
<b>Enclosure</b>	SS
<b>Vibration</b>	$<0.08\%$ FRO/g 20Hz to 2000Hz, 35g
<b>Shock</b>	Withstands free fall to IEC 68-2-32 procedure 1
<b>Approvals</b>	CE Emissions EN 61000-6-4, Immunity EN 61000-6-2
<b>Weight</b>	$<180$ grams

**How to Order**

Use the **bold** characters from the chart below to construct a product code



Stainless Steel	Inconel	Description
<b>00</b>	<b>0K</b>	G1/4 internal
<b>AO</b>	<b>AK</b>	G1/4 AT external
<b>KO</b>	<b>KK</b>	7/16-20 UNF-3A external
<b>MO</b>	<b>MK</b>	M14 x 1.5 external
<b>PO</b>	<b>PK</b>	G1/2 AT external
<b>BO</b>	<b>BK</b>	1/4-18 NPT external
<b>GO</b>	<b>GK</b>	1/2-14 NPT external
<b>SO</b>	<b>SK</b>	7/16-20 UNJF-3A, MS 33656F4

**Accessories**

Order Code	Description
557002	Restrictor Kit
499877-1000	Saddle Mounting Kit
562320-02M0	2m, unshielded, 5core, cable - Terminated to M12 male connector
562320-05M0	5m, unshielded, 5core, cable - Terminated to M12 male connector
562321	Rapid Development Kit - including 9V battery, M12 to 9 way D type cable terminated assembly, USB to CAN Interface, Gems start up CD ROM
562293	User manual

# Accessories, Adaptors

These adaptors can be factory fitted or supplied separately and thread into the 6700, 4000 and 4700 series. When factory fitted, they are electron-beam welded to the transducers providing additional strength and a guaranteed hermetic seal. For 1200/1600 and 2200/2600 series refer to their respective sections.

Description	Code SS	Code Inconel	Description	Code SS	Code Inconel
G 1/4 External 	A0	AK	M 1/4 x 1.5 (DIN) External 	M0	MK
1/4" 18 NPT External 	B0	BK	G 1/2 AT External 	P0	PK
1/2" -14NPT External 	G0	GK	7/16 - 20 UNF External 	S0	SK
Plastic Nosecone 	10	1K	Nose cone with restrictor 	20	N/A
Sink weight nose cone 	30	N/A			

Dimensions expressed: inch (mm)

PRESSURE TRANSDUCERS

# Gems Capacitance Transducers —Functional Simplicity with Structural Sophistication

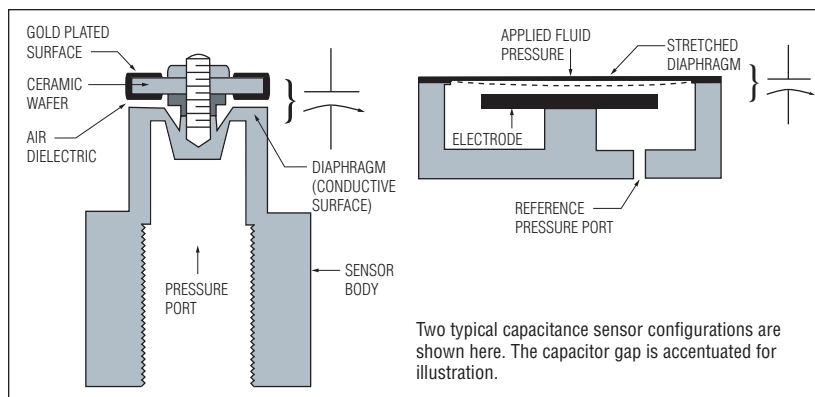
- ▶ High Accuracies
- ▶ Minimal Mechanical Motion
- ▶ Broad Range Capabilities
- ▶ Long Term Stability
- ▶ High Level Output
- ▶ Broad Media Compatibility
- ▶ High Electromagnetic Compatibility
- ▶ Resistant to Harsh Environments

Gems' capacitive pressure transducers are expertly designed adaptations of a simple, durable and fundamentally stable device... the electrical capacitor.

## Principle of Operation

In a typical Gems configuration, a compact housing contains two closely-spaced, parallel, electrically isolated metallic surfaces, one of which is essentially a diaphragm capable of slight flexibility under applied pressure. The diaphragm is constructed of a low-hysteresis material such as 17-4 PH stainless steel or a proprietary compound of fused glass and ceramic. These firmly secured surfaces (or plates) are mounted so that a slight mechanical flexing of the assembly, caused by a minute change in applied pressure, alters the gap between them. This creates, in effect, a variable capacitor.

The resulting change in capacitance is detected by a sensitive linear comparator circuit (employing proprietary, custom-designed ASICs), which amplifies and outputs a proportional, high-level signal.



The inherent simplicity and ruggedness of this physical configuration, the fact that all wettable parts are of stainless steel or low-hysteresis ceramic, and a careful marriage of the mechanical assembly to the electronic circuitry, all combine to create a transducer that exhibits uniformly superior performance.

Contents	Page Start
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865 Series.....	H-34
876 Series.....	H-36
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5000 Series.....	H-40
2400 Series.....	H-42



PRESSURE TRANSDUCERS



# 809 Series – Industrial OEM Pressure Transducer

- ▶ Sensing Ranges from Vacuum to 10,000 psi (-1 to 690 bar)
- ▶ Rugged Stainless Steel & Valox® Housings
- ▶ Ideal for High Shock & Vibration Applications

The 809 Series pressure transducers are designed specifically for industrial applications with demanding price and performance requirements. They offer exceptional reliability in typical industrial grade environments. 809 Series transducers operate on low-cost, unregulated DC power, and over a wide temperature band with both liquids and gases. Designed for harsh environments, they are suitable for use in high shock and vibration applications. Stainless steel and Valox® housings are small and lightweight for easy integration into compact systems. The standard feature set of the 809 Series delivers exceptional performance in extreme environmental conditions at a price that OEMs will appreciate.

## Common Specifications

<b>Input</b>	
<b>Pressure Range</b>	-14.7 to 10,000 psi (-1 to 690 bar)
<b>Proof Pressure</b>	See ordering chart
<b>Burst Pressure</b>	See ordering chart
<b>Fatigue Life</b>	>1 million cycles
<b>Performance</b>	
<b>Supply Voltage (Vs)</b>	9-30 VDC (5 VDC on 0.5-4.5 VDC units)
<b>Long Term Drift</b>	0.5% FS/year
<b>Accuracy</b>	±0.25% FS
<b>Thermal Error Zero</b>	±0.02% FS/°F (±0.036% FS/°C)
<b>Thermal Error Span</b>	±0.015% FS/°F (±0.030% FS/°C)
<b>Compensated Temperatures</b>	-4°F to +176°F (-20°C to +80°C)
<b>Operating Temperatures</b>	-40°F to +185°F (-40°C to +85°C)
<b>Storage Temperatures</b>	-40°F to +185°F (-40°C to +85°C)
<b>Zero Tolerance</b>	1% of span
<b>Span Tolerance</b>	1% of span
<b>Response Time</b>	5 ms
<b>Mechanical Configuration</b>	
<b>Pressure Port</b>	See ordering chart
<b>Wetted Parts</b>	17-4 PH Stainless Steel
<b>Electrical Connection</b>	See Dimensions chart, next page
<b>Enclosure</b>	Weather-Resistant (Stainless Steel and Valox®)
<b>Vibration</b>	20g (MIL STD 202, Method 204, Condition C)
<b>Shock</b>	200g (MIL STD 202, Method 213B, Condition C)
<b>Weight</b>	2.3 oz

## Individual Specifications

<b>Voltage Output Units</b>	
<b>Output</b>	3 Wire, see ordering chart
<b>Current Consumption</b>	8 mA
<b>Min. Load Resistance</b>	5000 ohms
<b>Current Output Units</b>	
<b>Output</b>	4-20 mA (2 wire)
<b>Max. Loop Resistance</b>	(Vs-9) x 50 ohms



1/2" Conduit/Terminal Block



Cable



3-Pin Packard Connector



Hirschmann Connector

## Applications

- Hydraulic Systems
- Compressor Control
- HVAC/R Equipment
- Industrial Engines
- Process and Containerized Refrigeration Systems
- Industrial OEM Equipment

## How They Operate

809 Series transducers utilize a proven center mount electrode configuration combined with a durable 17-4 PH stainless steel pressure sensing element to form a variable capacitor. As pressure (or vacuum) increases or decreases, the capacitance changes. Self-contained high-level output IC-circuitry converts the change in capacitance to a fully conditioned linear voltage or current output signal.

**Dimensions**

Electrical Termination Style	Cable Anchor	1/2" Conduit/Terminal Block	Hirschmann Connector	3-Pin Packard Connector
<b>Terminal Specifications</b>	Standard: 2 ft. multiconductor cable. Longer lengths options. See ordering chart.	1/2" conduit connection with 3-screw terminal block. (T1 version is same without conduit connection.)	Mating connector is Hirschmann G4WIF. May be ordered separately from Gems— Option 590.	Mating connector is comprised of Packard P/Ns 12065287 & 12103881. May be ordered separately from Gems— Option 581/582.
<b>Ordering Code</b>	<b>XX</b> (cable length in feet)	<b>A1</b> - Conduit / <b>T1</b> - Terminal Block	<b>H2</b>	<b>P1</b> (3-Pin)

**How to Order**

Use the **bold** characters from the chart below to construct a product code.

**SELECT**

**8091 - 001P - G - 2M - 11 - 02 - XXX**

Series **8091** - 809 Series

Pressure Range Code

**Pressures – psi**

Code	Range	Proof	Burst	Code	Range	Proof	Burst
<b>Z01</b>	0 to -14.7	10	15	<b>150P</b>	0 to 150	300	1000
<b>001P</b>	0 to 1	2	250	<b>200P*</b>	0 to 200	400	2000
<b>002P</b>	0 to 2	4	250	<b>250P*</b>	0 to 250	500	2000
<b>005P*</b>	0 to 5	10	250	<b>500P*</b>	0 to 500	1000	3000
<b>010P*</b>	0 to 10	20	500	<b>600P</b>	0 to 600	1200	3000
<b>015P</b>	0 to 15	30	500	<b>10CP*</b>	0 to 1000	2000	5000
<b>025P*</b>	0 to 25	50	500	<b>20CP</b>	0 to 2000	3000	6500
<b>030P</b>	0 to 30	50	500	<b>30CP</b>	0 to 3000	4500	7500
<b>050P*</b>	0 to 50	100	750	<b>50CP</b>	0 to 5000	7500	10000
<b>100P*</b>	0 to 100	200	1000	<b>10KP</b>	0 to 10000	12500	20000

Options

- 590** - Hirschmann Mating Connector (for H2 Termination)
- 581** - Packard Mating Connector, 3 ft. (for P1 Termination)
- 582** - Packard Mating Connector, 6 ft. (for P1 Termination)

Electrical Termination

- XX** - Cable length in feet (e.g., 02 = 2 ft.)\*
- P1** - Packard (3-Pin)
- H2** - Hirschmann ("Mini")
- T1** - Terminal Block
- A1** - 7/8" Hole for 1/2" Conduit\*

Output

- 11** - 4-20 mA\*
- 24** - 0.5-5.5 Vdc\*
- 28** - 1-6 Vdc
- 45** - 0.5-4.5 VDC (5 VDC supply voltage)

Pressure Port

- 2M** - 1/4" NPT Male\*
- J7** - 7/16" SAE Male (J1926-2)
- 1M** - 1/8" NPT Male

Datum

- G** - Gauge
- C** - Compound (030PC = -14.7 to 30 psi)
- S** - Sealed (available in 200 psi ranges and above)
- V** - Vacuum (**Z01** range code only)

\* Standard configuration. Minimum 25 pieces apply for all other configurations.

## 820G Series – Absolute

- ▶ Standard Torr, kPa and mbar Vacuum Ranges
- ▶ Wide Compensated Operating Temperature
- ▶ Protected Against Miswiring

The 820G Series sensor is an accurate, low-cost absolute sensor for even the most demanding vacuum applications. An all-welded construction eliminates stability issues inherent in other designs caused by frictional contact between dissimilar metals. 820G Series manometers are offered with a variety of vacuum pressure fittings, and a rugged design provides a high overpressure capability over a wide temperature range.

### Common Specifications

Input	
Pressure Range	0 to 1000 Torr or 0 to 100 kPa
Proof Pressure	See ordering chart
Burst Pressure	See ordering chart
Fatigue Life	>1 million cycles
Performance	
Output	0-5 VDC or 0-10 VDC @ 6mA (3 wire)
Supply Voltage (Vs)	9-30 VDC (14-30 VDC for 10 VDC output)
Long Term Drift	±0.5% FS/year
Accuracy	±0.5% RDG
Thermal Error Zero	±0.01% FS/°F (±0.018% FS/°C)
Thermal Error Span	±0.015% RDG/°F (±0.027% RDG/°C)
Compensated Temperatures	32°F to +122°F (0°C to 50°C)
Operating Temperatures	-4°F to +176°F (-20°C to +80°C)
Storage Temperatures	-4°F to +185°F (-20°C to +85°C)
Zero Tolerance	.5% FS
Span Tolerance	.5% FS
Minimum Load Resistance	5000 ohms
Response Time	20 ms
Mechanical Configuration	
Pressure Port	See ordering chart
Wetted Parts	Inconel® with Stainless Steel (4T fitting—All Inconel)
Electrical Connection	9-Pin D-Sub
Enclosure	All-Welded Stainless Steel
Shock	50g
Approvals	CE – 89/336/EEC for Heavy Industrial, fully RoHS compliant
Weight	5 oz



### Applications

- Semiconductor Manufacturing
- Absorption Chillers
- Lasers
- Autoclaves
- Freeze Drying
- Vacuum Distillation

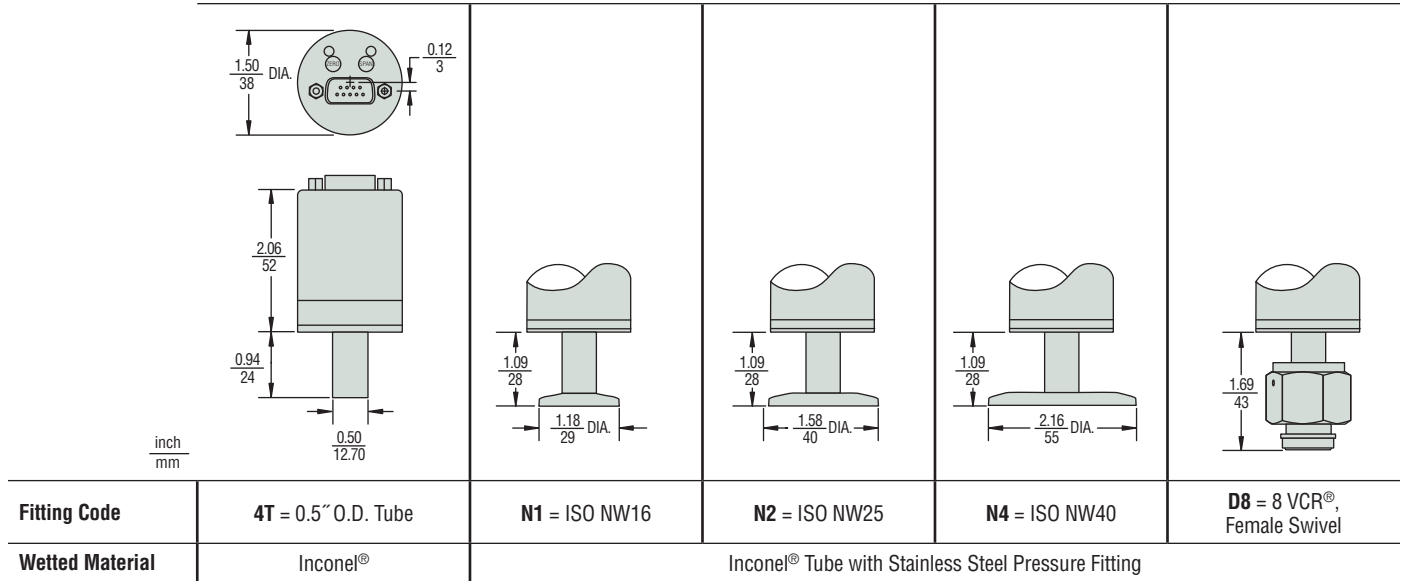
### How They Operate

820G Series manometers feature an Inconel® diaphragm and insulated electrode, which forms a variable capacitor. As pressure (vacuum) increases or decreases, the capacitance changes. This capacitance is detected and converted to a fully-conditioned linear voltage output signal.

### Conversion Chart

Torr	x	1.333	=	mbar
Torr	x	0.1333	=	kPa
Torr	x	0.0193	=	psi
kPa	x	10.0	=	mbar
kPa	x	7.501	=	Torr
kPa	x	0.145	=	psi
mbar	x	0.10	=	kPa
mbar	x	0.7501	=	Torr
mbar	x	0.0145	=	psi

**Dimensions**



**How to Order**

Use the **bold** characters from the chart below to construct a product code.

**SELECT**

Series **820** - 820G Series

Pressure Range Code

Torr			kPa			Millibar		
Code	Range (Torr)	Proof (psia)	Code	Range (kPa)	Proof (kPa)	Code	Range (mbar)	Proof (mbar)
<b>010T</b>	0-10	45	<b>001K</b>	0-1	300	<b>010M</b>	0-10	3000
<b>020T</b>	0-20	45	<b>002K</b>	0-2	300	<b>020M</b>	0-20	3000
<b>100T</b>	0-100	45	<b>010K</b>	0-10	300	<b>100M</b>	0-100	3000
<b>10CT</b>	0-1000	45	<b>100K</b>	0-100	300	<b>10CM</b>	0-1000	3000

Datum **A** - Absolute

Pressure Port **4T** - 0.5" O.D. Tube  
**N1** - ISO NW16  
**N2** - ISO NW25  
**N4** - ISO NW40  
**D8** - 8 VCR®, Female Swivel

**820 - 020T - A - 4T - 2B - D9 - K**

Accuracy  
**K** - ±0.5% of Reading (Standard)  
**A** - ±0.25% of Reading (Optional)

Electrical Connection  
**D9** - 9 Pin D-Sub  
**T1** - 5 Pin Terminal Strip

Output  
**2B** - 0-5 VDC  
**2C** - 0-10 VDC

VCR® is a registered trademark of Swagelok Marketing Co.  
 Tri-Clover® is a registered trademark of Tri-Clover, Inc.  
 Inconel® is a registered trademark of Special Metals Corp.

# 830 Series – Wet/Wet Differential Pressure Transducer



- ▶ Liquid Media on Both Ports
- ▶ Bleed Screws for Accurate Results
- ▶ Optional Manifold for Easy Installation

The 830 Series is designed for wet-to-wet differential pressure measurements of liquids or gases. They feature fast-response capacitance sensors that respond approximately 20x faster than conventional fluid-filled transducers! Sensors are coupled to signal conditioned electronic circuitry for highly accurate, linear analog output proportional to pressure. Both unidirectional and bidirectional models are available for line pressures up to 250 psi (17 bar). These units feature bleed ports that allow for total elimination of air in the line and pressure cavities.

## Common Specifications

<b>Input</b>	
Pressure Range	0 to 100 psid (0 to 6.9 bar)
Proof Pressure	see ordering chart
Burst Pressure	see ordering chart
Common Line Pressure	<250 psia (17 bar)
Fatigue Life	>1 Million Cycles
<b>Performance</b>	
Supply Voltage (Vs)	9-30 VDC (13-30 VDC for 10 VDC output)
Long Term Drift	0.5% FS/year
Accuracy	0.25% FS
Thermal Error Zero	0.02% FS/°F (0.036% FS/°C)
Thermal Error Span	0.02% FS/°F (0.036% FS/°C)
Compensated Temperatures	30°F to 150°F (-1°C to +65°C)
Operating Temperatures	0°F to 175°F (-18°C to +80°C)
Storage Temperatures	-65°F to +250°F (-54°C to +121°C)
Zero Tolerance	0.5% FS
Span Tolerance	0.5% FS
<b>Mechanical Configuration</b>	
Pressure Port	see ordering chart
Wetted Parts	17-4 PH Stainless Steel, 300 Series SS, Viton and Silicone
Electrical Connection	7/8" Knock Out for 1/2" Conduit, Screw Terminal Strip
Enclosure	Stainless Steel, Aluminum
Vibration	5g Peak Sinusoidal, 5 to 500 Hz
Acceleration	10g
Shock	50g
Approvals	CE
Weight	15 oz

## Individual Specifications

<b>Voltage Output Units</b>	
Output	0-5 VDC or 0-10 VDC (3 wire)
Min. Load Resistance	5000K ohms
<b>Current Output Units</b>	
Output	4-20 mA (2 wire)
Max. Loop Resistance	(Vs-9) x 50 ohms



3-Valve Manifold Assembly



Gems optional 3-valve manifold assembly eases installation and maintenance.

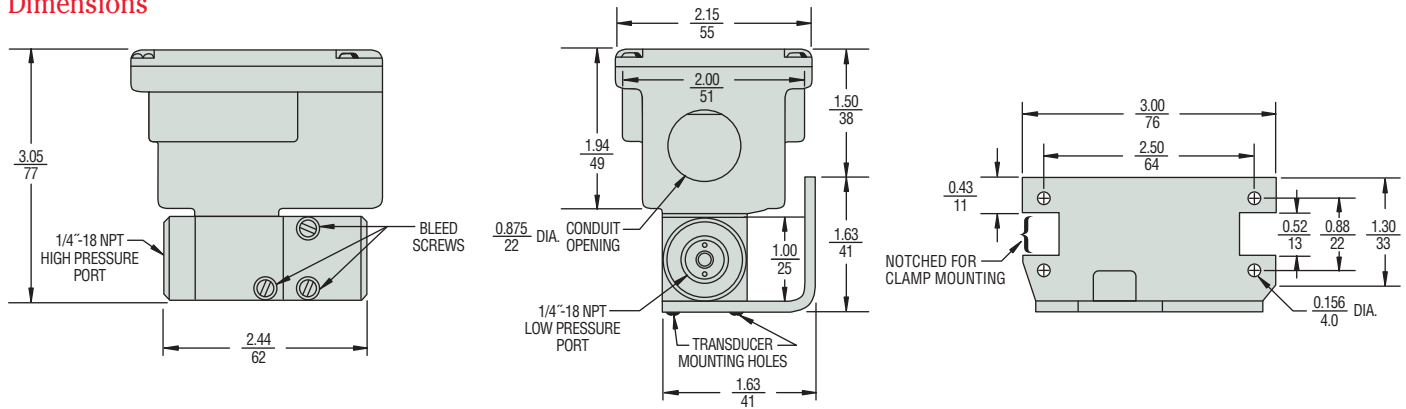
## Applications

- Energy Management Systems
- Process Control Systems
- Liquid & Gas Flow Measurement
- Filter Monitoring
- Liquid Level Measurement

## How They Operate

A unique isolation system transmits the motion of the differential pressure sensing diaphragm from the high line pressure environment to the dry enclosure where it moves one of a pair of capacitance plates proportionally to the diaphragm movement. Electronic circuitry linearizes output vs. pressure and compensates for thermal effects of the sensor.

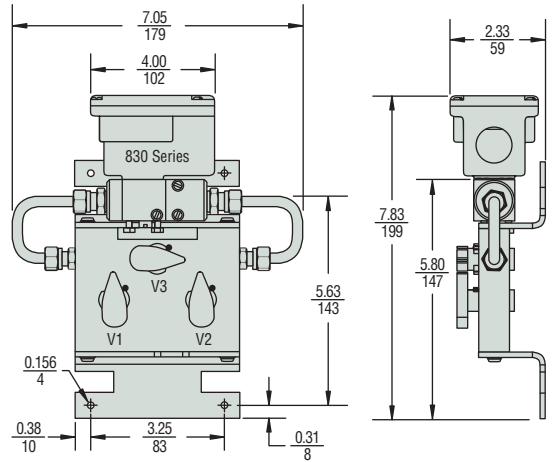
Dimensions



3-Valve Manifold

Gems optional 3-valve manifold assembly eases installation and maintenance. Machined of brass, it eliminates internal pipe connections and the associated chance of internal leaks. When manifold and 830 Series transducer are ordered together, they are assembled at the factory and shipped ready for mounting. Specify the **3V** Pressure Port code when ordering.

<b>Wetted Parts</b>	360 Brass, Copper 122, Acetal plug valves, and Nitrile O-rings
<b>Valve Type</b>	90-degree on/off
<b>Process Connections</b>	1/4" NPTF
<b>Dimensions</b>	7.05" x 6.25" x 2.16" D (179 mm x 159 mm x 55mm)
<b>Weight</b>	2.5 lbs



How to Order

Use the **bold** characters from the chart below to construct a product code

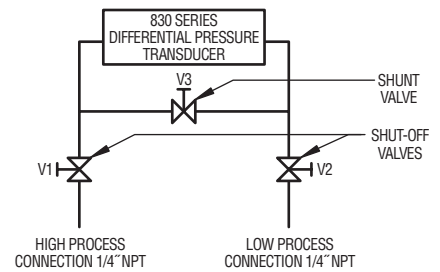
SELECT

**8301 025PD 2F 11 B X**

- Series **8301** - 830 Series
- Pressure Range Code **025PD**

Unidirectional psid Ranges	Proof Pressure – psi			Bidirectional psid Ranges	Proof Pressure – psi		
	High Side	Low Side	Burst		High Side	Low Side	Burst
<b>001PD</b> - 0-1	20	2.5	200	<b>0R5PB</b> - ±0.5	20	1.25	200
<b>002PD</b> - 0-2	40	5.0	200	<b>001PB</b> - ±1	40	2.50	200
<b>005PD</b> - 0-5	100	12.5	600	<b>2R5PB</b> - ±2.5	100	6.25	600
<b>010PD</b> - 0-10	100	25.0	1000	<b>005PB</b> - ±5	100	12.50	1000
<b>025PD</b> - 0-25	250	62.5	1000	<b>010PB</b> - ±10	200	25.00	1000
<b>030PD</b> - 0-30	250	62.5	1000	<b>025PB</b> - ±25	250	62.50	1000
<b>050PD</b> - 0-50	250	125.0	1000	<b>050PB</b> - ±50	250	125.00	1000
<b>100PD</b> - 0-100	250	250.0	1000				
- Pressure Port **2F** - 1/4" NPTF  
**3V** - 3-Valve Manifold Assembly Installed
- Output **11** - 4-20 mA  
**2D** - 0-5 Vdc  
**2E** - 0-10 Vdc
- Bleed Screw Seals **B** - Viton/Silicon Standard  
**A** - Buna-N Optional
- Optional **C** - Calibration Certificate

Valve Schematic



PRESSURE TRANSDUCERS



## 856 Series – Industrial Pressure Transducers

- ▶ 0-2 to 0-10,000 psi (0 to 700 bar) Pressure Ranges
- ▶ Voltage or Current Output
- ▶ NEMA 4/IP65 with Zero and Span Adjustments

The 856 Series is specifically designed for NEMA4/IP65 service and features a die-cast aluminum enclosure. Their robust capacitive design is resistant to environmental effects, such as shock, vibration, temperature and EMI/RFI. A 17-4 PH stainless steel sensing element does not require isolation from corrosive media. A 1/2" threaded conduit is provided for electrical termination and a removable cover provides easy access to the internal wiring terminal strip.

### Common Specifications

<b>Input</b>	
<b>Pressure Range</b>	0 to 10,000 psig (0 to 700 bar)
<b>Proof Pressure</b>	See ordering chart
<b>Burst Pressure</b>	See ordering chart
<b>Fatigue Life</b>	>1 million cycles
<b>Performance</b>	
<b>Supply Voltage (Vs)</b>	9-30 VDC
<b>Long Term Drift</b>	0.5% FS/year
<b>Accuracy</b>	
<25 psi	±0.25% FS
≥25 psi	±0.13% FS
<b>Thermal Error Zero</b>	
<25 psi	±0.02% FS/°F (±0.036% FS/°C)
≥25 psi	±0.01% FS/°F (±0.018% FS/°C)
<b>Thermal Error Span</b>	
	±0.015% FS/°F (±0.027% FS/°C)
<b>Compensated Temperatures</b>	
	-4°F to +176°F (-20°C to +80°C)
<b>Operating Temperatures</b>	
	-40°F to +260°F (-40°C to +125°C)
<b>Storage Temperatures</b>	
	-40°F to +260°F (-40°C to +125°C)
<b>Zero Tolerance</b>	
	0.5% of span (adjustable)
<b>Span Tolerance</b>	
	1% of span (adjustable)
<b>Mechanical Configuration</b>	
<b>Pressure Port</b>	see ordering chart
<b>Wetted Parts</b>	17-4 PH Stainless Steel
<b>Electrical Connection</b>	Two 1/2" Internal Threaded Ports, Screw Terminal Strip
<b>Enclosure</b>	Die-Cast Aluminum, NEMA 4/IP65
<b>Vibration</b>	20g (MIL STD 202, Method 204, Condition C)
<b>Shock</b>	200g (MIL STD 202, Method 213B, Condition C)
<b>Approvals</b>	CE
<b>Weight</b>	13.4 oz

### Individual Specifications

<b>Voltage Output Units</b>	
<b>Output</b>	0.1-5.1 VDC (3 wire)
<b>Current Consumption</b>	6 mA
<b>Min. Load Resistance</b>	5000 ohms
<b>Current Output Units</b>	
<b>Output</b>	4-20 mA (2 wire)
<b>Max. Loop Resistance</b>	(Vs-9) x 50 ohms



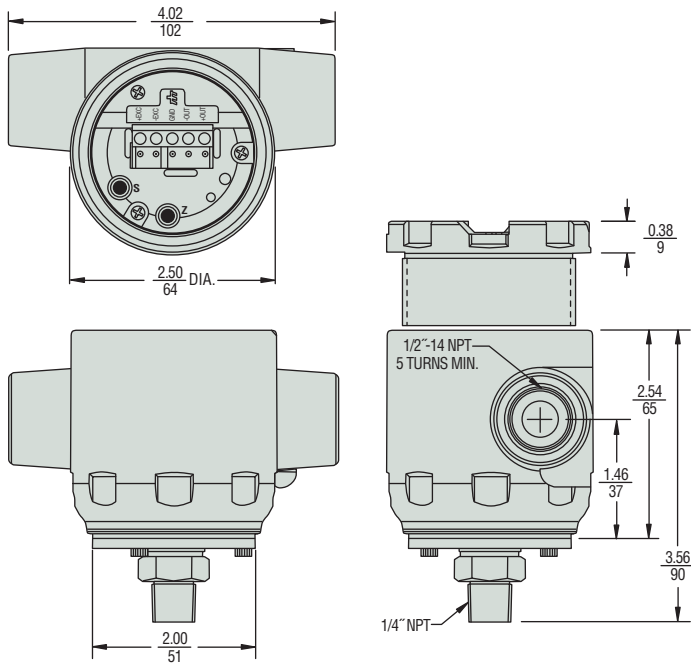
### Applications

- Process Control
- Chemical Processing
- Agricultural Irrigation
- Natural Gas Pipeline
- Grain Processing
- Industrial Pressure Monitoring

### How They Operate

Gems' patented variable capacitance sensor features an insulated electrode plate fastened to the center of the sensor diaphragm, which forms a variable capacitor. As pressure increases or decreases, the capacitance changes. This change in capacitance is detected and converted to a linear analog signal by Gems' custom ASIC-based circuit, producing an output signal proportional to applied pressure.

Dimensions



How to Order

Use the **bold** characters from the chart below to construct a product code.

SELECT

1. Series **8561** - 856 Series

2. Pressure Range Code

Pressures – psi			
Code	Range	Proof	Burst
<b>002P</b>	0 - 2	4	250
<b>005P</b>	0 - 5	10	250
<b>010P</b>	0 - 10	20	500
<b>015P</b>	0 - 15	30	500
<b>025P</b>	0 - 25	100	500
<b>050P</b>	0 - 50	150	750
<b>100P</b>	0 - 100	300	1000
<b>150P</b>	0 - 150	300	1000
<b>200P</b>	0 - 200	450	2000
<b>250P</b>	0 - 250	500	2000
<b>500P</b>	0 - 500	1000	3000
<b>600P</b>	0 - 600	1200	3000
<b>10CP</b>	0 - 1000	2000	5000
<b>30CP</b>	0 - 3000	4500	7500
<b>50CP</b>	0 - 5000	7500	10000
<b>10KP</b>	0 - 10000	12000	12500

Pressures – bar			
Code	Range	Proof	Burst
<b>1R6B</b>	0 - 1.6	6	40
<b>004B</b>	0 - 4	10	50
<b>006B</b>	0 - 6	18	60
<b>010B</b>	0 - 10	30	80
<b>016B</b>	0 - 16	32	130
<b>025B</b>	0 - 25	50	170
<b>040B</b>	0 - 40	80	240
<b>060B</b>	0 - 60	120	300
<b>100B</b>	0 - 100	200	400
<b>160B</b>	0 - 160	320	500
<b>250B</b>	0 - 250	380	550
<b>400B</b>	0 - 400	600	800
<b>700B</b>	0 - 700	800	1350

**8561 - 025P - G - 4M - 11 - C**

- 6. Optional **C** - Calibration Certificate
- 5. Output **11** - 4-20 mA  
**22** - 0.1-5.1 Vdc (≥25 psi ranges)
- 4. Pressure Port **2M** - 1/4" NPT (M)  
**4M** - 1/2" NPT (M) (≥25 psi ranges)  
**2F** - 1/4" NPTF (≥25 psi ranges)  
**1M** - 1/8" NPTM (<25 psi ranges)
- 3. Pressure Datum **G** - Gauge (standard)

## 865 Series – Very Low Differential Pressure Transducers

- ▶ For Air or Non-Conductive Gas
- ▶ 0.25 to 100 Inches in W.C.(differential)/  
±0.1 to ±50 Inches in W.C. (bidirectional)
- ▶ High Proof Pressure

The 865 Series are very low-pressure transducers for ranges as low 0.25" W.C. and feature ±1% full scale static accuracy. Primarily used in Building Energy Management, these transducers are capable of measuring pressures and flows with the accuracy necessary for proper building pressurization and air flow control. 865 Series transducers utilize an all-stainless steel micro-tig welded sensor that allows up to 10 psi overpressure (in either direction) with no damage to the unit. All sensor components have thermally matched coefficients, which promote improved temperature performance and excellent long-term stability.

### Common Specifications

Input	
Pressure Range	0.25" to 100" WC
Proof Pressure	10 psi (700 mbar)
Fatigue Life	10 psi, max. (700 mbar)
Performance	
Supply Voltage (Vs)	9-30 VDC
Accuracy	±1.0% FS (Standard); .4% & .25% versions available
Thermal Error Zero	±0.033% FS/°F (±0.06% FS/°C)
Thermal Error Span	±0.033% FS/°F (±0.06% FS/°C)
Compensated Temperatures	0°F to +150°F (-18°C to +65°C)
Operating Temperatures	0°F to +150°F (-18°C to +65°C)
Storage Temperatures	-40°F to +185°F (-40°C to +85°C)
Zero Tolerance	1% (.5% for high accuracy option)
Span Tolerance	1% (.5% for high accuracy option)
Mechanical Configuration	
Pressure Port	1/4" Fitting
Wetted Parts	Stainless Steel and Glass-Filled Polyester
Electrical Connection	Screw Terminal Strip
Enclosure	Fire Retardant Glass-Filled Polyester; Option A1 Conduit Enclosure Available
Approvals	CE
Weight	3 oz

### Individual Specifications

Voltage Output Units	
Output	0-5 VDC (see ordering chart)
Min. Load Resistance	5000 kohms
Current Output Units	
Output	4-20 mA (2 wire)
Max. Loop Resistance	(Vs-9) x 50 ohms



### Applications

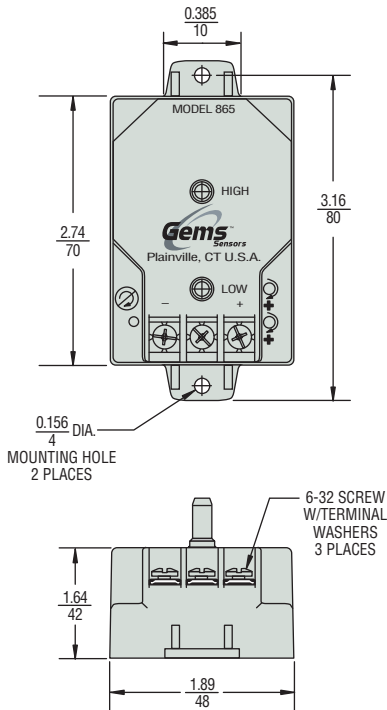
- HVAC
- Energy Management Systems
- Variable Air Volume and Fan Control (VAV)
- Environmental Pollution Control
- Static Duct and Clean Room Pressures
- Oven Pressurization and Furnace Draft Controls

### How They Operate

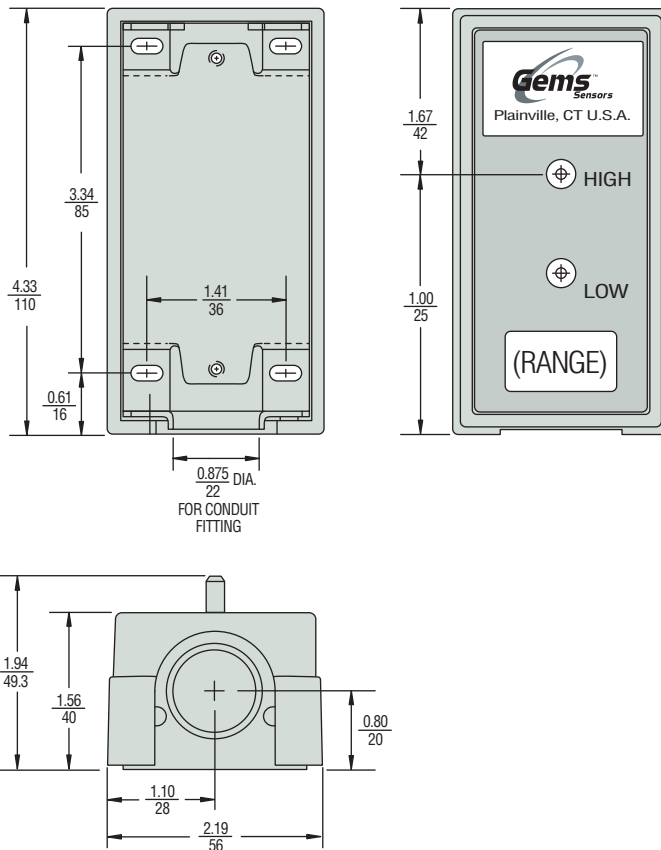
A tensioned stainless steel diaphragm and insulated stainless steel electrode, positioned close to the diaphragm, form a variable capacitor. Positive pressure moves the diaphragm toward the electrode, increasing the capacitance. A decrease in pressure moves the diaphragm away from the electrode, decreasing the capacitance. The change in capacitance is detected and converted to a linear DC electrical signal by Gems' unique electronic circuitry.

**Dimensions**

Standard 865 Series



Optional Conduit Enclosure – Code A1



**How to Order**

Use the **bold** characters from the chart below to construct a product code.

**SELECT**

Series **8651** - 865 Series

Pressure Range Code

<b>Unidirectional</b>		<b>Bidirectional</b>	
Code	Range (Inches W.C.)	Code	Range (Inches W.C.)
<b>R25WD</b>	0 to 0.25	<b>OR1WB</b>	±0.1
<b>OR5WD</b>	0 to 0.5	<b>R25WB</b>	±0.25
<b>001WD</b>	0 to 1.0	<b>OR5WB</b>	±0.5
<b>2R5WD</b>	0 to 2.5	<b>001WB</b>	±1.0
<b>005WD</b>	0 to 5.0	<b>2R5WB</b>	±2.5
<b>010WD</b>	0 to 10.0	<b>005WB</b>	±5.0
<b>025WD</b>	0 to 25.0	<b>010WB</b>	±10.0
<b>050WD</b>	0 to 50.0	<b>025WB</b>	±25.0
<b>100WD</b>	0 to 100.0	<b>050WB</b>	±50.0

Output **11** - 4-20 mA (9-30 VDC excitation)  
**2B** - 0-5 VDC (9-30 VDC excitation)

**8651 - OR5WD - 2B - T1 - C**

Accuracy  
**C** - ±1% FS (Standard)  
 Options:  
**E** - ±0.4% FS – Calibration Certificate supplied  
**F** - ±0.25% FS – Calibration Certificate supplied  
**G** - ±1% FS – Calibration Certificate supplied

Electrical Connection  
**T1** - Terminal Strip  
**A1** - Supplied with Optional 7/8" Knock-Out Hole for 1/2" Conduit Enclosure

**PRESSURE TRANSDUCERS**

## 876 Series – Barometric Pressure Transducers

- ▶ Instant Warm-Up
- ▶ Barometric Pressure: 600 to 1100 or 800 to 1100 hPa/mb
- ▶ Low Power Consumption (for Battery or Solar Power)

The 876 Series features an extremely accurate and stable ceramic sensor to deliver a great value in environmental pressure measurement. Gems' glass-fused ceramic capacitive sensing capsule offers inherent thermal stability and low hysteresis in a proven, simple design. A custom ASIC used in the 876 Series achieves long-term stability and high accuracy, and its low power requirements (as low as 5 VDC) allow the sensor to operate in remote battery or solar powered applications. An integrated mounting bracket and 1/8" tube pressure connection ease installation.

### Common Specifications

Input	
<b>Pressure Range</b>	See ordering chart
<b>Proof Pressure</b>	20 psia (30 psia for 20 psia range)
<b>Fatigue Life</b>	>1 million cycles
Performance	
<b>Long Term Drift</b>	0.25% FS/6 months
<b>Accuracy</b>	±0.25% FS
<b>Thermal Error Zero</b>	1% FS
<b>Thermal Error Span</b>	1% FS
<b>Compensated Temperatures</b>	30°F to +130°F (0°C to +55°C)
<b>Operating Temperatures</b>	0°F to +175°F (-18°C to +79°C)
<b>Storage Temperatures</b>	-65°F to +250°F (-55°C to +121°C)
<b>Zero Tolerance</b>	±25 mV
<b>Span Tolerance</b>	±50 mV
Mechanical Configuration	
<b>Pressure Port</b>	1/8" Tube Fitting
<b>Wetted Parts</b>	Stainless Steel, Alumina Ceramics, Gold, Elastomer
<b>Electrical Connection</b>	2 ft. Multiconductor Cable
<b>Enclosure</b>	Stainless Steel with Mounting Bracket
<b>Vibration</b>	2g from 5 Hz to 400 Hz
<b>Acceleration</b>	10g
<b>Shock</b>	50g (operating, 1/2 sine 10mg)
<b>Approvals</b>	CE
<b>Weight</b>	3.5 oz.

### Individual Specifications

Supply Voltage (Vs)	Excitation	Output (3-wire)
9.0-14.5 VDC	12 VDC	0.1-5.1 VDC
21.6-26.0 VDC	24 VDC	0.1-5.1 VDC
4.9-7.1 VDC	5 VDC	0.5-4.5 VDC



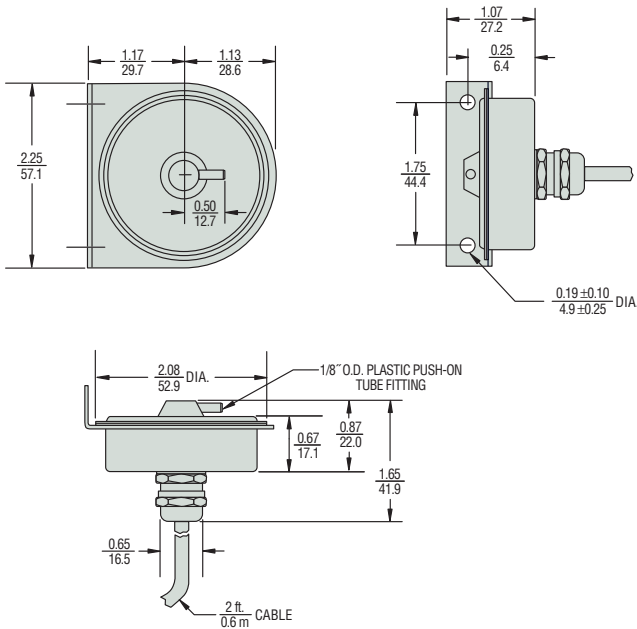
### Applications

- Environmental Monitoring Systems
- Weather Measurement Systems
- Weather and Environmental Data Logging
- Barometric Pressure Compensation for Internal Combustion Engine Performance
- Cleanroom Barometric Pressure Compensation
- Automotive Emissions Test Equipment

### How They Operate

A glass-fused ceramic sensing capsule detects changes in barometric pressure. As pressure increases or decreases, the capacitance changes. This change in capacitance is detected and converted to a linear analog signal by Gems' custom ASIC-based circuit, producing an output signal proportional to applied pressure.

Dimensions



How to Order

Use the **bold** characters from the chart below to construct a product code.

**SELECT** **876** - **6-11mb** - **12 V** - \* - \* - \* - \*

1. Series **876** - 876 Series

2. Pressure Range Code  
 Barometric:  
**6-11mb** - 600 to 1100 mb  
**8-11mb** - 800 to 1100 mb  
**0-20P** - 0 to 20 psia

3. Excitation/Output

Code	Excitation	Output
12 V	12 VDC	0.1-5.1 VDC
24 V	24 VDC	0.1-5.1 VDC
5 V	5 VDC	0.5-4.5 VDC

4. Options (\*Add as suffix to base part code as needed)  
**715** - 0.1% FS accuracy.  
**839** - 1/8" NPT pressure port.  
 Cable Length:  
**803-810** - For cable length of 3 to 10 feet (2 ft. is standard).  
 Please specify cable length by code (e.g., 810 for 10 ft. cable).  
 Consult factory for cable longer than 10 ft.  
 Calibration Certification:  
**901** - 11-point calibration certificate.

PRESSURE TRANSDUCERS



# 890 Series – 3A Sanitary Pressure Transducer

- ▶ For Clean-In-Place (CIP) and Sterilize-In-Place (SIP)
- ▶ 0.20% Full Scale Accuracy
- ▶ No Liquid Fill Diaphragms

The 890 Series meets 3A sanitary design standards and is fully sealed to withstand external high pressure washdowns. These units are packaged in rugged welded stainless steel housings and are exceptionally insensitive to vibration, shock and environmental extremes. A small size and tri-clover sanitary pressure fitting allow direct mounting in most CIP and SIP installations. Other features include IC-based circuitry, a 1/2" NPT conduit fitting and shielded cable with vent tube. Sealed screws provide access to zero and span adjustments.

## Specifications

Input	
Pressure Range	Vacuum to 1000 psig
Proof Pressure	see ordering chart
Burst Pressure	see ordering chart
Fatigue Life	>1 million cycles
Performance	
Output	4-20 mA (2 Wire)
Supply Voltage (Vs)	18-38 VDC
Accuracy	0.20% FS
Thermal Error Zero	0.02% FS/°F (0.036%FS/°C)
Thermal Error Span	0.02% FS/°F (0.036%FS/°C)
Compensated Temperatures	20°F to 180°F (-7°C to +80°C)
Operating Temperatures	-40°F to +260°F (-40°C to +125°C)
Storage Temperatures	-65°F to +260°F (-54°C to +127°C)
Zero Tolerance	1% FS (±0.5 mA adjustable)
Span Tolerance	1% FS (±0.5 mA adjustable)
Maximum Loop Resistance	(Vs-18) x 50
Response Time	10 ms
Mounting Effects	0.15% FS (.25% FS for 1.5" Tri-Clover)
Mechanical Configuration	
Pressure Port	1.5" or 2" Tri-Clover Sanitary Fitting
Wetted Parts	316 Stainless Steel
Electrical Connection	1/2" NPT Conduit Fitting and Strain Relief with 15 ft. Cable
Enclosure	Stainless Steel
Vibration	10g Peak Sinusoidal, 50 to 1000 Hz
Acceleration	10g
Shock	50g
Approvals	Meets 3-A Sanitary Standards
Weight	8 oz



## Applications

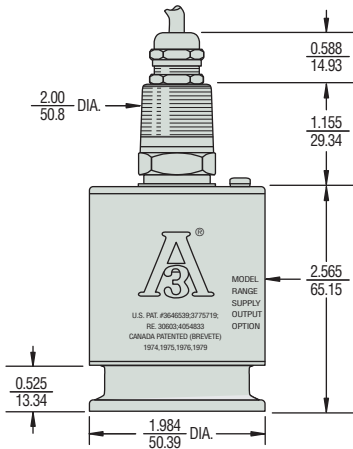
- Food Processing
- Dairy & Beverage Processing
- Pharmaceutical Processing
- Sanitary Pipelines

## How They Operate

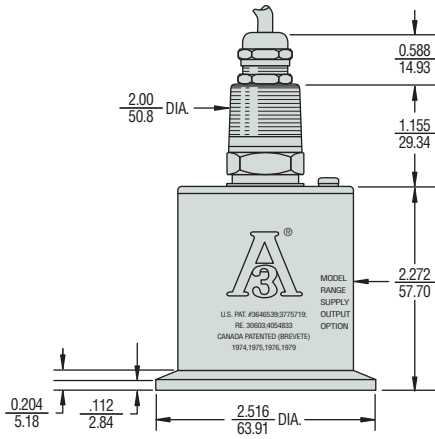
A stainless steel diaphragm and an insulated electrode form a variable capacitor. Pressure on the diaphragm alters the sensor's capacitance, which is then detected and converted to a highly accurate linear 4-20 mA signal by electronic circuitry featuring Gems' patented charge-balance principle. Low hysteresis, very stable operation and negligible clamping effect are inherent.

**Dimensions**

1.5" Fitting



2" Fitting



Gems adheres to strict quality standards including MIL-1-45208A and ANSI-2540-1.

**How to Order**

Order as 890 Series Sanitary Pressure Transmitters. Specify Pressure Range (tabulated below), Fitting Size and any Options. Use **bold** characters to construct a product code.

**SELECT**

**C890 - 10 - 1.5 - \* - \* - \* - \***

1. Series **C890** - 890 Series

2. Pressure Ranges

2" Tri-Clover Sanitary Fittings				1.5" Tri-Clover Sanitary Fittings		
Operating Range psig	in. H <sub>2</sub> O	Proof psig	Burst psig	Operating Range psig	Proof psig	Burst psig
<b>1</b>	22.7	50	100	<b>30</b>	1000	1200
<b>2</b>	55.4	100	150	<b>60</b>	1000	1200
<b>5</b>	138.4	150	200	<b>100</b>	1000	1200
<b>10</b>	276.8	150	200	<b>300</b>	1000	1200
<b>15</b>	415.2	150	200	<b>500</b>	1000	1500
<b>30</b>	830.4	150	300	<b>1000</b>	1250	2400
<b>60</b>	1160.8	180	400	<b>-14.7 to 15</b>	1000	1200
<b>100</b>	2768.0	200	400	<b>-14.7 to 45</b>	1000	1200
<b>150</b>	4152.0	225	400			
<b>-14.7 to 15</b>	-407 to 415	150	300			

3. Pressure Port  
**1.5** - 1.5" Tri-Clover Sanitary Fitting  
**2.0** - 2" Tri-Clover Sanitary Fitting

4. Options (\*Add as suffix to base part code as needed)  
**715** - ±0.1% FS accuracy  
**884** - 20 Ra finish  
**911** - Etched metal stainless steel tag  
 Cable Length:  
**816-825** - For cable lengths of 16 to 25 feet (15 ft. is standard).  
 Please specify cable length by code (e.g., 820 for 20 ft. cable).  
 Consult factory for cable longer than 25 feet.  
 Calibration Certificate:  
**901** - 11-point calibration certificate.

**PRESSURE TRANSDUCERS**

# 5000 Series Low Pressure Transducer

- ▶ Submersible and General Purpose Models
- ▶ Stainless Steel Case Construction
- ▶ High Proof Pressures

The 5000 Series features a sturdy ceramic diaphragm that detects minute pressure variations, while withstanding large pressure spikes. The tough ceramic sensor is housed in a duplex stainless steel case to ensure performance in the most demanding applications, such as sea water.

## Specifications

<b>Input</b>	
<b>Pressure Range</b>	0 to 415" wc (0 to 15psi)
<b>Proof Pressure</b>	30psi (≤ 80"wc) 60psi (≤ 150"wc); 100psi (>150"wc)
<b>Burst Pressure</b>	45psi (≤ 28"wc) 60psi (>28"wc to 80"wc) 90psi (≤ 150"wc); 145psi (>150"wc)
<b>Fatigue Life</b>	10 million FS cycles
<b>Performance</b>	
<b>Long Term Stability</b>	0.25% span/annum
<b>Accuracy</b>	0.2% span max
<b>Thermal Error</b>	2% span max
<b>Compensated Temperatures</b>	-4°F to +140°F (-20°C to +60°C)
<b>Operating Temperatures</b>	
<b>Process media</b>	-40°F to +212°F (-40°C to +100°C)
<b>Electrical code G &amp; L</b>	-15°F to +185°F (-25°C to +85°C)
<b>Electrical code M &amp; 3</b>	-5°F to +120°F (-20°C to +50°C)
<b>Zero Tolerance</b>	1% span
<b>Span Tolerance</b>	1% span
<b>Mounting Effects</b>	0.25% span max
<b>Response Time</b>	5ms
<b>Supply Voltage Sensitivity</b>	0.01% span/volt
<b>Mechanical Configuration</b>	
<b>Inconel Pressure Ports</b>	(See Ordering Guide)
<b>Wetted Parts</b>	318 Duplex SS, Ceramic, Viton (Nitrile Optional)
<b>Electrical Connection</b>	(See Ordering Guide)
<b>Enclosure</b>	Code M IP68 Submersible Code G IP65
<b>Vibration</b>	35g peak 5-2000 Hz, MIL STD 810, Method 514.2, Procedure I
<b>Acceleration</b>	100g, MIL STD 810C, Method 513.2, Procedure II
<b>Approvals</b>	CE, Lloyds Register, optional intrinsically safe EXII 1G; E Exia II BT4 (-20°C < T amb < 75°C)
<b>Weight</b>	330gms (excluding cable) (12oz)

## Individual Specifications

<b>Voltage Output units</b>	
<b>Output</b>	(See Ordering Guide) (3-wire)
<b>Supply Voltage (Vs)</b>	9 to 35 VDC (8-35 VDC, 1-6 VDC Output)
<b>Current Output Unit</b>	
<b>Output</b>	4-20 mA (2 wire)
<b>Supply Voltage (Vs)</b>	9 to 35 VDC (ExII 1G 9-28 Vdc)
<b>Max. Loop Resistance</b>	(Vs-9)* 50 ohms

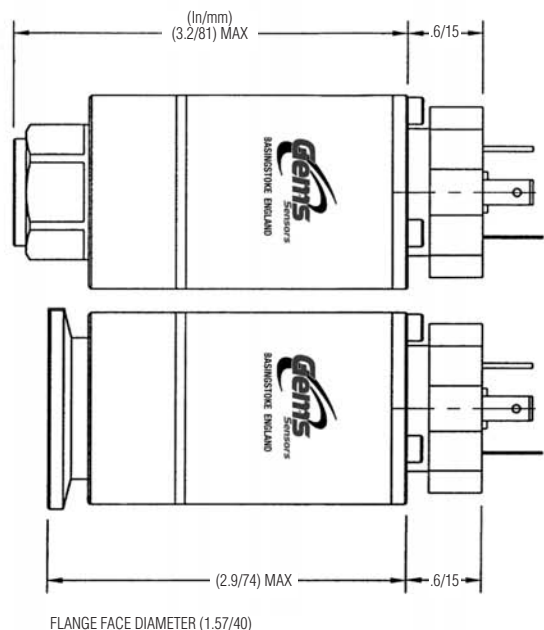
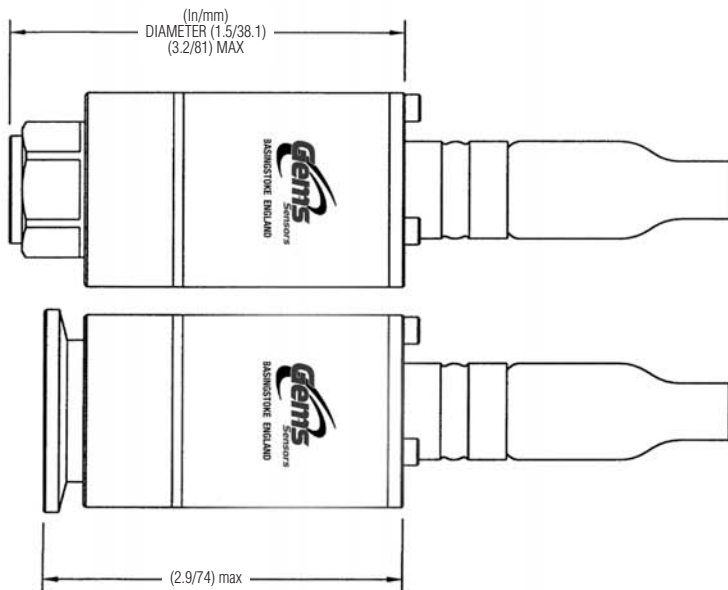


**How to Order**

Use the **bold** characters from the chart below to construct a product code.

**SELECT**

<p>1. <b>5000</b> series</p> <p>2. Output:  <b>B</b> 4–20 mA    <b>C</b> 1–6 VDC    <b>F</b> 0.1–5.1 VDC    <b>H</b> 1–5 VDC  <b>J</b> 0.5–5.5 VDC    <b>R</b> 0–5 VDC</p> <p>3. Pressure Datum: <b>G</b> gauge</p> <p>4. Pressure range code*  <b>M70</b> 10 to 28" wc, 25 to 70 mbar, 0.36 - 1 psi  <b>N20</b> 29 to 80" wc, 71 to 200 mbar, 1 - 3 psi  <b>N35</b> 81 to 150" wc, 201 to 350 mbar, 3 - 5 psi  <b>A10</b> 151 to 415" wc, 351 to 1000 mbar, 5 - 15 psi</p> <p>* specify range required at time of order  eg. 5000BGM700FM3001a@15"wc</p>	<p><b>5000 B G N20 OF M 3 001 A @XXX</b></p>	<p>10. Specify Calibration (i.e @70" wc)</p> <p>9. Static/Thermal Error Band <b>A</b> 0.25%/2%</p> <p>8. Cable Length <b>000</b> = No Cable <b>001</b> = 1 meter <b>999</b> = 999 meters</p> <p>7. Approvals <b>3</b> CE Marked <b>B</b> Zenier <b>G</b> Galvanic Intrinsically Safe</p> <p>6. Electrical Connection <b>G</b> Fixed Plug to DIN 43650, Mating Connector Supplied <b>L</b> M12 x 1 (5 pin) <b>M</b> Immersible Cable Assembly, IP68 <b>3</b> 1/2-14 NPT Conduit</p> <p>5. <b>Pressure Connection</b>  <b>OK</b> G1/4 Internal  <b>AK</b> G 1/4 external  <b>MK</b> M14x1.5 external  <b>BK</b> 1/4 - 18 NPT external  <b>KK</b> 7/16 - 20unf - 3A external  <b>OF</b> Open Face, KF25 Flange</p> <p>Submersible Nose Cones {  <b>19</b> Plastic Nose Cone  <b>29</b> Stainless Steel Nose Cone</p>
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## 2400 Slimline Borehole Transducer/Transmitters

- ▶ Triple sealed to ensure immersible integrity
- ▶ <10ms switch on/settling period
- ▶ 19mm diameter

Gems Sensors 2400 Series immersible pressure transducer has been specifically designed to meet the rigors of long term immersibility. A custom designed hermetic header guarantees that water cannot enter the transducer even if the cable sheath is damaged during use. The large bore vent tube is connected directly to the back of the sensor which provides rapid venting, even on the longest cable run. The sensor itself is impervious to the effects of water guaranteeing long service life even in areas of high humidity, which can cause condensation. The all welded electronics enclosure is completely segregated from all other areas with the electronics themselves designed to provide fast switch on and settling to ensure maximum battery life and ease of calibration.

### Specifications

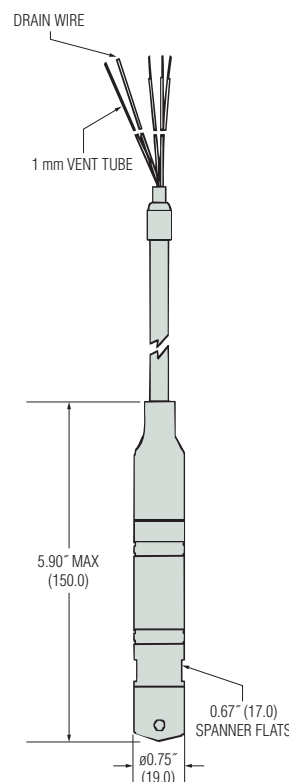
<b>Input</b>	
<b>Pressure Range</b>	0 to 4 to 0 to 200mWg (mA & V) 0 to 10, 20, 50,100, 200mWg (mV)
<b>Proof Pressure</b>	1.5 x Fs nominal range
<b>Burst Pressure</b>	3 x Fs
<b>Fatigue Life</b>	Designed for more than 100 million FS cycles
<b>Performance</b>	
<b>Long Term Drift</b>	0.2% FS/year (non-cumulative)
<b>Accuracy</b>	0.25% FS typical
<b>Thermal Error</b>	0.5% Typical 30°F to 120°F (0°C to 50°C)
<b>Compensated Temperatures</b>	15°F to 120°F (-10°C to +50°C)
<b>Operating Temperatures</b>	-40°F to +180°F (-40°C to +80°C)
<b>Zero Tolerance</b>	1% of span
<b>Mechanical Configuration</b>	
<b>Pressure Port</b>	G1/4" AT external fitted with nosecone
<b>Wetted Parts</b>	316 Stainless Steel, Polyurethane, Acetal
<b>Electrical Connection</b>	Polyurethane Cable
<b>Enclosure</b>	IP68 to 650ft (200mWG)
<b>Vibration</b>	35g peak sinusoidal, 5 to 2000 Hz
<b>Shock</b>	Withstands free fall to IEC 68-2-32 procedure 1
<b>Approvals</b>	CE
<b>Weight</b>	Approx. 100 grams (additional; cable 75 g/m)

### Individual Specifications

<b>Voltage Output units</b>	
<b>Output</b>	0 to 10V
<b>Supply Voltage (Vs)</b>	13 to 28 VDC
<b>Supply Voltage Sensitivity</b>	0.026% span/V
<b>Min. Load Resistance</b>	(FS output / 2) Kohms
<b>Current Consumption</b>	Approx 6 mA @ 8 VDC
<b>Current Output units</b>	
<b>Output</b>	4-20 mA (2 wire)
<b>Supply Voltage (Vs)</b>	24 VDC, (8-28 VDC)
<b>Supply Voltage Sensitivity</b>	0.026% span/V
<b>Max. Loop Resistance</b>	(Vs-7) x 50 ohms
<b>Millivolt units</b>	
<b>Output</b>	100mV ±1mV
<b>Supply Voltage</b>	10 VDC regulated (15 VDC max)
<b>Bridge Resistance</b>	3.5KOHM ± 20% @ 77°F (25°C)
<b>Sink Weight</b>	P/N 198700



Dimensions in. (mm)



2400 B 1 010 @ 7 psi

For electrical output codes B&S specify in 1psi increments the full scale calibration required.

**Cable Length**

001 = 1 metre, 999 = 999 metres etc

**Code**

- 1 10mWG
- 2 20mWG
- 3 50mWG
- 4 100mWG
- 5 200mWG

**Code**

- 1 6 to 14psi (4 to 10mWG)
- 2 15 to 28psi (11 to 20mWG)
- 3 29 to 57psi (21 to 40mWG)
- 4 58 to 142psi (41 to 100mWG)
- 5 143 to 284psi (101 to 200mWG)

**Code Electrical Output**

- A 100 mV Not Rangeable
- B 4-20 mA
- S 0-10 VDC

NOTES

A large grid of red dashed lines for taking notes, consisting of 20 columns and 30 rows.



# 899 Series – Pressure Transducer Termination Enclosure

- ▶ Visible Desiccant Status Indicator
- ▶ Easily Replaceable Desiccating Covers
- ▶ Surge Suppression

Gems rugged NEMA 4X rated 899 Series pressure transducer termination enclosure is designed for field termination of pressure transducers.

Desiccant material contained within the cover, captures and condenses moisture through surface adsorption, providing an effective barrier against the ingress of humidity into the pressure transducer's sensor. When replacement is necessary, the user is alerted through the clearly visible desiccant status window, which changes from blue (dry) to pink (saturated).

With a life expectancy of approximately 6 months, the desiccant can be regenerated by removing the cover and baking it in a 200°F (93°C) oven for 3 to 4 hours or until it returns to its dry status (blue). To ensure uninterrupted system operation, replacement desiccating covers are available.

The case is constructed of sturdy plastic glass-filled polycarbonate (UL94AB-0), and is designed with easy access to terminal connections. NEMA 4X (IP65) rated for indoor and outdoor installations, the 899 Series includes integral surge protection to protect the circuit board from a voltage surge up to 2000 volts.

An optional low cost, replaceable, terminal interface circuit board is offered to change the unit from a voltage to current, or current to voltage output unit. For pipe mounting installations, a pipe mounting kit is also available.

## Specifications

<b>Electrical (Current) Input/Excitation</b>	4 to 20 mA / 5 to 33 VDC
<b>Electrical (Voltage) Input/Excitation</b>	DC Volts / 0 to 6 VDC DC Volts / 5 to 33 VDC
<b>Electrical Termination</b>	PG9 Strain Relief
<b>Surge Suppression</b>	Up to 2000 Volts

## How to Order

Order as 899 Series Pressure Transducer Termination Enclosure. Specify Electrical Termination, Input / Excitation and any Options. Use **bold** characters to construct a product code.

- SELECT** **899 - G2 - 45 - \***
1. Series 899 - 899 Series
  2. Electrical Termination **G2** - PG9 Strain Relief
  3. Input / Excitation **11** - 4 to 20mA / 5 to 33 VDC  
**45** - DC Volts / 0 to 6 VDC  
**24** - DC Volts / 5 to 33 VDC
  4. Options (\*Add as suffix to base part code as needed) **M1** - Pipe Mount Kit

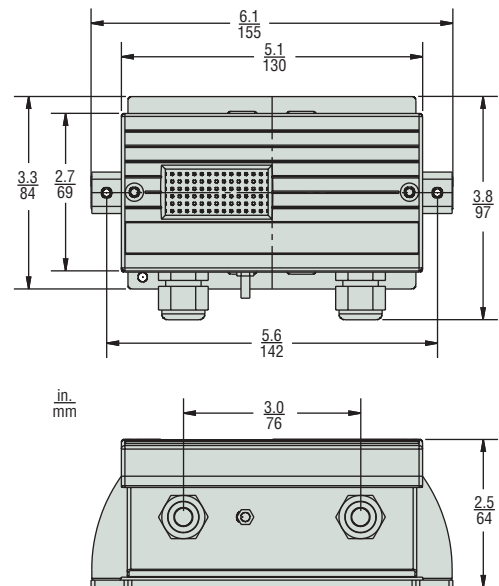


## Applications

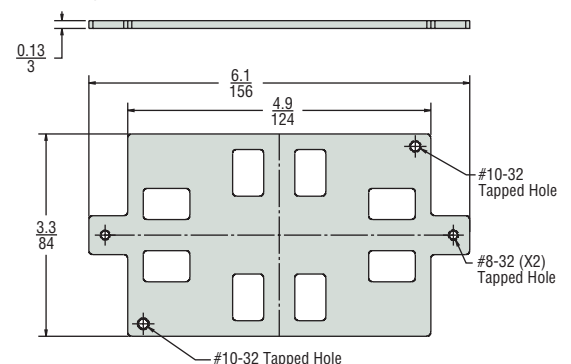
- Field Termination of Pressure Transducers
- Submersible
- Sanitary
- Underground
- Chillers

## Dimensions

Front and Side View



## Mounting Bracket



## From 2 to 6000 PSI (40 mbar to 400 bar), GEMS Pressure Switches Cover A Wide Range of Applications

- ▶ General, Vacuum, Differential, Specialty
- ▶ Field-Adjustable or Factory Set Switches
- ▶ High Proof Pressure
- ▶ Rugged and Dependable

GEMS offers a choice of pressure switches, from compact cylindrical models for OEM use, to larger, enclosed units for rugged process applications. These switches are ideal for the filtering process of coolants in the machine tool industry, use in transmissions of off-highway vehicles and as redundant systems with existing monitors such as transducers.

### Unique Piston/Diaphragm Design

A piston/diaphragm design, incorporating the high proof pressure of piston technology allows these switches to operate with the sensitivity and accuracy of a diaphragm design. Repeatability ranges from 0.25 percent to 5 percent of the set point.

### Many Materials To Choose From

Enclosures include aluminum, stainless steel, brass, reinforced plastic and zinc-plated steel. Wetted parts include a diaphragm available in Buna-n, Teflon® coated Kapton®, stainless steel, PTFE, EPDM or Viton® and a pressure port available in stainless steel, brass, zinc or aluminum.



### Pressure Switch Option Descriptions

**G:** Gold contacts are usually required for low DC current loads (<12 VDC @ 12 mA) associated with TTL input devices. They provide decreased contact resistance, which results in more reliable switching especially in the presence of an oxidizing atmosphere.

**OXY:** Wetted Materials are ultrasonically cleaned per the Compressed Gas Association's Method G-4.1.

**10A:** 10A option is provided by a microswitch rated 10 Amperes at 250 VAC. This microswitch has a wide movement differential, which results in a larger deadband than listed in the standard catalog pages.

**IP:** Ingress Protection is provided by either an epoxy sealed cap (IP65) or silicon wire seals (IP66). On some models, this option is only available with FS option.

**RB:** Rubber Boot is designed to be cut out for the proper wire or cable size by the customer and sealed with an appropriate sealant in the field.

**WF:** Weatherpack female termination consists of the following Delphi P/N's:(12045793 Conn "C" Circuit), 12089188 Female Pins and 12015323 Wire Seals.

**WM:** Weatherpack male termination consists of the following Delphi P/N's: 12010973 Connector, (12010717 Conn "C" Circuit), 12089040 Male Pins and 12015323 Wire Seals.

**DE:** Deutsch male termination consists of the following Deutsch P/N's: DT04-2P Connector, (DT04-3P "C" Circuit) 1060-16-0122 Male Pins and W(2 or 3)P Wedgelok.

**FS:** Gems will preset switches to the indicated set point within repeatability limits listed on the specific product catalog page.

**R:** The restrictor option is recommended for hydraulic systems that need a small reduction in pressure pulsations to increase pressure switch life. It is a pressed in part that has an orifice size of 0.045" (1.4 mm)

**SR:** The spiral restrictor option heavily dampens pressure pulsations in any hydraulic system, which prevents false signaling and premature wear. It is not recommended for pressure settings below 1500 psig (103 bar) because it slows the response time of the pressure switch.

## Selection Guide

	Pressure Range	Proof Pressure	Switch	Notes	Series	Page
Subminiature Pressure Switches	0.75 to 15 psi (52 to 1034 mbar)	150 psi (10 bar)	SPST, SPDT	—	PS11	I-3
	5 to 150 psi (0.35 to 10 bar)	500 psi (35 bar)	SPST	Kapton® Diaphragm	PS31	I-5
	5 to 100 psi (0.35 to 7 bar)	500 psi (35 bar)		Elastomer Diaphragm	PS32	I-7
	50 to 300 psi (3.45 to 20 bar)	500 psi (35 bar)	SPST	Kapton® Diaphragm	PS51	I-5
				Elastomer Diaphragm	PS52	I-7
	15 to 3000 psi (1.03 to 207 bar)	6000 psi (414 bar)	SPST	—	PS61	I-11
				PS62	I-13	
	5 to 6000 psi (0.35 to 414 bar)	7500 psi (517 bar)	SPST, SPDT, DPST, DPDT	—	PS75	I-19
Miniature Pressure Switches	3.5 to 100 psi (0.24 to 7 bar)	350 psi (24 bar)	SPST, SPDT	—	PS41	I-9
	10 to 5000 psi (0.7 to 344 bar)	6000 psi (414 bar)	SPST, SPDT	—	PS71	I-15
	10 to 750 psi (0.7 to 52 bar)	3000 psi (207 bar)	SPST, SPDT	—	PS72	I-17
	15 to 1750 psi (1 to 121 bar)	4500 psi (517 bar)	SPST, DPDT	—	PS76	I-21
Vacuum Switches	1.5" to 15" Hg (51 to 508 mbar)	150 psi (10 bar)	SPST, SPDT	—	PS81	I-23
	5" to 28" Hg (169 to 948 mbar)	350 psi (24 bar)	SPST, SPDT	—	PS82	I-25
Solid-State Switches	0 to 6000psi (0 to 400 bar)	See Specs	SPST, Relay or Transistor	Solid-State	PS98	I-27

## Plastic Diaphragms

Option K or Standard Teflon® Coated Kapton® (Polyimide) Diaphragm

Teflon® is compatible with almost every liquid and gaseous media. Kapton® has very stable physical properties over a wide temperature range (-100°F to +400°F). This results in pressure switches that exhibit very little set point shift due to temperature extremes. Kapton® possesses exceptional fatigue strength but is very stiff which results in wider but more stable deadbands than most elastomers.

## Elastomer Diaphragms

Elastomers offer incredible sensitivity coupled with extremely long life. This results in stable set points over the life of the pressure switch as well as tight deadbands. Their biggest weakness is the increase in modulus (stiffening) that occurs at lower temperatures. This results in pressure switch set points to shift higher and deadbands to increase with decreasing temperature. They also exhibit more hysteresis than Kapton® diaphragms.

**Standard:** Nitrile (Buna-N).

Typically specified on water and petroleum based hydraulic oils. Temperature range: 32°F to 250°F (0°C to 121°C)

**Option V:** Viton®

(Fluoroelastomer) Diaphragm. Typically used with alcohols, diesters, solvents, acids and synthetic oils. Also used for high vacuum service. Temperature range: 32°F to 400°F (0°C to 204°C)

**Option E:** EPDM (Ethylene

Propylene) Diaphragm. Typically used with phosphate ester based hydraulic fluids, brake fluids, ketones, steam and hot water. Temperature range: -65°F to +212°F (-54°C to +100°C)

**Option N:** Neoprene

(Chloroprene) Diaphragm. Typically specified for refrigerant systems. Temperature range: -65°F to +275°F (-54°C to +135°C)

# PS11 – Ultra-Long Life OEM Pressure Switches

- ▶ 0.75 to 15 psi (52 to 1034 mbar)
- ▶ 1,000,000 Cycle Life Typical
- ▶ Factory Set or Adjustable Set Points

For low pressure applications, the longevity of our PS11 Series is hard to beat. A life expectancy of 1 million cycles means long-term reliability. Their snap-action microswitch resets automatically and meets or exceeds industry standards. The brass housing offers chemical resistance at an affordable price.

## Specifications

<b>Switch*</b>	5 Amp @ 24 VDC and 250 VAC 1.0 Amp resistive 0.5 Amp inductive @ 24 VDC (-G option)
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Diaphragm</b>	Nitrile (optional Viton®, EPDM or Kapton®)
<b>Fitting</b>	Brass
<b>Housing</b>	Brass
<b>O-Ring</b>	Nitrile (optional Viton® or EPDM)
<b>Electrical Termination**</b>	DIN 43650A IP00; Terminals IP00; Flying Leads IP00
<b>Proof Pressure</b>	0 psia to 150 psi (-1 bar to 10.3 bar)
<b>Burst Pressure</b>	300 psi (20.7 bar)
<b>Approvals</b>	CE, UL Approved units available
<b>Weight, Approximate</b>	0.31 lbs. (0.14 kg)

\* Gold contacts (option G) may be required for less than 12 VDC and 20 mA.  
\*\* Plastic housing is vented to atmosphere. Consult factory for non-vented version.

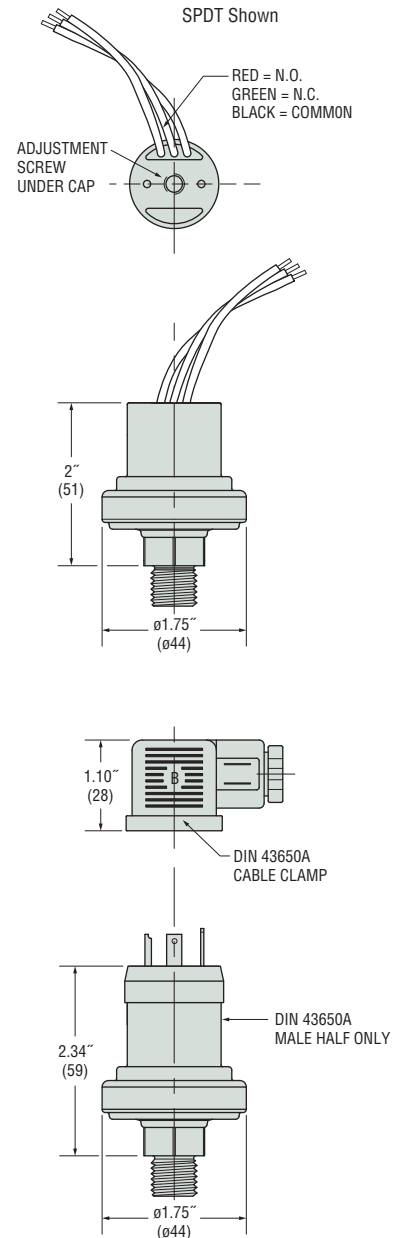
## Recommended Operating Temperature Limits

Diaphragm Material	Range
Nitrile	15°F to 250°F (-9°C to +121°C)
Viton®	0°F to 250°F (-18°C to +121°C)
EPDM	-40°F to +250°F (-40°C to +121°C)
Kapton®	-40°F to +250°F (-40°C to +121°C)

Note: Switches may function below the cold temperature limit but the set point and deadband will increase. Consult factory for details.

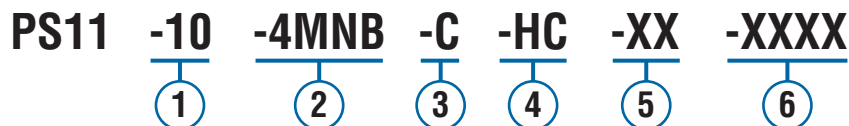


## Dimensions



## How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



### 1 Pressure Range Code

Insert Pressure Range Code from Table 1, below.

### 2 Pressure Fitting<sup>1</sup>

- 2MNB = 1/8" NPTM Brass
- 4MNB = 1/4" NPTM Brass
- 2FNB = 1/8" NPTF Brass
- 4MGB = 1/4" BSPM Brass (G type)
- 4MSB = 7/16"-20 SAE Male, Brass
- 6MSB = 9/16"-18 SAE Male, Brass

### 3 Circuit

- A = SPST/N.O.
- B = SPST/N.C.
- C = SPDT

### 4 Electrical Termination<sup>2</sup>

- FLXX = Flying Leads<sup>3</sup>
- ELXX = 1/2" Male NPT Conduit w/Flying Leads<sup>3</sup>
- H = DIN 43650A Male Half Only
- HC = DIN 43650A 9mm Cable Clamp
- HN = DIN 43650A 1/2" NPT Female Conduit

### 5 Options

- V = Viton® Diaphragm
- E = EPDM Diaphragm
- K = Kapton® Diaphragm
- IP = Ingress Protection<sup>4</sup>
- G = Gold Contacts  
(for loads less than 12 mA @ 12 VDC)
- OXY = Oxygen Cleaned
- WF = Weather Pack Connector, Female
- WM = Weather Pack Connector, Male
- DE = Deutsch Connector, Male, DT04 Series

### 6 Fixed Set Point (optional)

- A. Specify set point **-FS** (in PSI or mBAR, see example)<sup>5</sup>
  - B. Set Point Actuation  
    - R** on Rising Pressure
    - F** on Falling Pressure
- Example: **-FS200MBARF** for 200 mBAR Falling  
 or **-FS3PSIR** for 3 PSI Rising

#### Notes:

1. Other fittings available. Consult factory.
2. DIN units are available with **-C** SPDT circuit only.
3. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-FL18** or **-EL30**.
4. Ingress Protection requires Fixed Set Point **-FS**.
5. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>10</b>	0.75-4 psig (51-276 mbar)	±0.15 psi (10 mbar) +4% of setting	0.2 psi (14 mbar) +9% of setting
<b>20</b>	3.5-15 psig (241-1034 mbar)	±0.25 psi (17 mbar) +5% of setting	0.4 psig (26 mbar) +11% of setting

\* Repeatability and set point of units may change due to the effects of temperature.

\*\* In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

# PS31/PS51 – Kapton® Diaphragm OEM Subminiature Pressure Switch

- ▶ 5 to 300 psi (0.345 to 20 bar)
- ▶ Ideal for Low Temperature Pneumatic Applications
- ▶ Adjustable or Factory Set

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

The PS31 and PS51 share identical construction and envelope dimensions, with the PS51 Series providing higher pressure ranges.

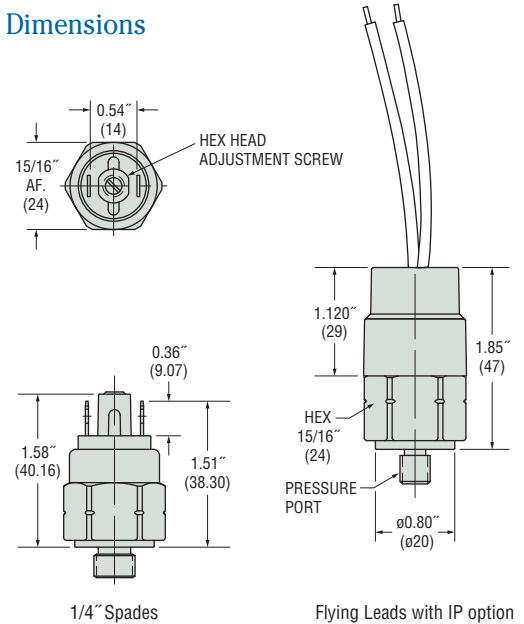
## Specifications

<b>Operating Temperature</b>	-40°F to +230°F (-40°C to +110°C)
<b>Switch*</b>	100 VA Max.
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Diaphragm</b>	Teflon® Coated Kapton® (Solid Teflon® Available)
<b>O-Ring</b>	Nitrile (Std.) Consult factory for other materials
<b>Fitting</b>	Brass (optional 316 Stainless Steel)
<b>Electrical Termination</b>	Exposed Terminals IP00; IP option IP66
<b>Deadband</b>	See Table 1
<b>Proof Pressure</b>	500 psi (35 bar)
<b>Burst Pressure</b>	1000 psi (69 bar)
<b>Approvals</b>	CE (limits switch voltage to 42 VDC)
<b>Weight, Approximate</b>	Brass: 0.14 lbs. (0.06 kg)

\* Gold contacts (option G) may be required for less than 12 VDC and 20 mA.



## Dimensions





## How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



**1 Series**

**PS31** or **PS51**

**2 Pressure Range Code**

Insert Pressure Range Code from Table 1, below.

**3 Pressure Fitting<sup>1</sup>**

Brass

- 2MNB** = 1/8" NPTM
- 4MNB** = 1/4" NPTM
- 2MGB** = 1/8" BSPM (G type)
- 4MGB** = 1/4" BSPM (G type)
- 8MGB** = 1/2" BSPM (G type)
- M10B** = M10 x 1.0, Straight
- M12B** = M12 x 1.5, Straight
- 4MSB** = 7/16"-20 SAE Male
- 6MSB** = 9/16"-18 SAE Male

316 Stainless Steel

- 2MNS** = 1/8" NPTM
- 4MNS** = 1/4" NPTM
- 2MGS** = 1/8" BSPM (G type)
- 4MGS** = 1/4" BSPM (G type)
- 4MSS** = 7/16"-20 SAE Male
- 6MSS** = 9/16"-18 SAE Male

**4 Circuit**

- A** = SPST/N.O.
- B** = SPST/N.C.

**5 Electrical Termination**

- SP** = Spade Terminals (standard)
- TS** = Terminal Screws
- FLXX** = Flying Leads<sup>2</sup>
- FLSXX** = Flying Leads w/PVC Shrink Tubing<sup>2</sup>
- CABXX** = 18 AWG PVC Cable<sup>3</sup>

**6 Options**

- G** = Gold Contacts  
(for loads less than 12 mA @ 12 VDC)
- IP** = Ingress Protection<sup>4</sup>
- OXY** = Oxygen Cleaned
- RB** = Rubber Boot (shipped loose)
- WF** = Weather Pack Connector, Female
- WM** = Weather Pack Connector, Male
- DE** = Deutsch Connector, Male, DT04 Series

**7 Fixed Set Point (optional)**

- A. Specify set point -**FS**  
(in PSI or BAR, see example)<sup>5</sup>
- B. Set Point Actuation  
**R** on Rising Pressure  
**F** on Falling Pressure  
Example: -**FS0.6BARF** for 0.6 BAR Falling  
or -**FS10PSIR** for 10 PSI Rising

Notes:

1. Other fittings available. Consult factory.
2. 18" is standard. Specify lead length in inches (max. 48"). e.g. -**FL18** or -**FLS30**.
3. 36" is minimum. Specify cable length in inches. e.g. -**CAB36** or -**CAB120**.
4. Ingress Protection is available only with -**FL**, -**FLS** or -**CAB** Electrical Termination choices.
5. Set Point must be within Pressure Range selected in Step 2.

Table 1 — Pressure Range Codes

PS31

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>20</b>	5-25 psi (0.3-1.7 bar)	±1 psi (0.07 bar) +3% of setting	2 psi (0.14 bar) +4% of setting
<b>30</b>	20-60 psi (1.4-4.1 bar)	±1.5 psi (0.10 bar) +3% of setting	3 psi (0.21 bar) +4% of setting
<b>40</b>	50-150 psi (3.4-10.3 bar)	±2.5 psi (0.17 bar) +3% of setting	4 psi (0.28 bar) +4% of setting

PS51

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>15</b>	50-150 psi (3.4-10.3 bar)	±3.0 psi (0.21 bar) +4% of setting	5 psi (0.14 bar) +5% of setting
<b>20</b>	150-300 psi (10.3-20.7 bar)	±4 psi (0.28 bar) +4% of setting	8 psi (0.21 bar) +5% of setting

\* Repeatability and set point of units may change due to the effects of temperature.

\*\* In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

# PS32/PS52 – Elastomer Diaphragm OEM Subminiature Pressure Switch

- ▶ 5 to 300 psi (0.345 to 20 bar)
- ▶ Ideal for Pneumatic and Low Pressure Hydraulic Applications
- ▶ Adjustable or Factory Set

These compact pressure switches are designed for OEM applications. Made economical by using metal blade contacts in lieu of microswitches, the series features long-lasting Elastomer diaphragms in three materials. Elastomer diaphragms offer increased sensitivity and life for applications without temperature extremes.

The PS32 and PS52 share identical construction and envelope dimensions, with the PS52 Series providing higher pressure ranges.

## Specifications

<b>Switch*</b>	100 VA Max.
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Diaphragm</b>	Elastomer (Nitrile standard) (Viton®, EPDM optional)
<b>Fitting</b>	Brass standard (optional 316 SS)
<b>Electrical Termination</b>	Exposed Terminals IP00; IP option IP66
<b>Deadband</b>	See Table 1
<b>Proof Pressure</b>	500 psi (35 bar)
<b>Burst Pressure</b>	1000 psi (69 bar)
<b>Approvals</b>	CE (limits switch voltage to 42 VDC)
<b>Weight, Approximate</b>	Brass: 0.14 lbs. (0.06 kg)

\* Gold contacts (option G) may be required for less than 12 VDC and 20 mA.

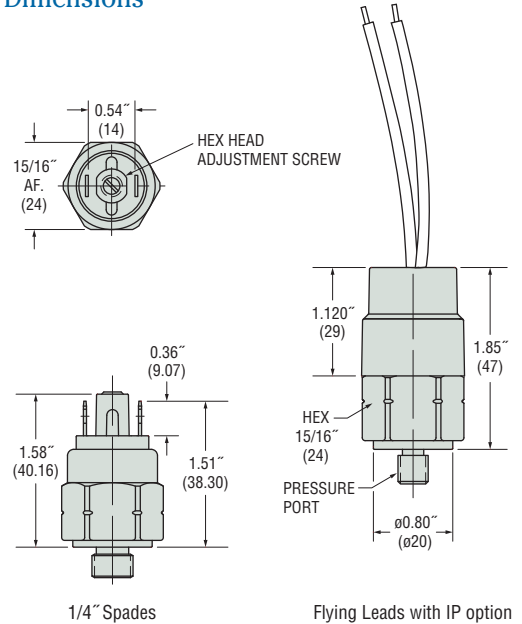
## Recommended Operating Temperature Limits

Diaphragm Material	Range
Nitrile	15°F to 230°F (-9°C to 110°C)
Viton®	0°F to 230°F (-18°C to 110°C)
EPDM	-40°F to 230°F (-40°C to 110°C)

Note: Switches may function below the cold temperature limit but the set points and deadband will increase. Consult factory for details.



## Dimensions



How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



1 Series

**PS32** or **PS52**

2 Pressure Range Code

Insert Pressure Range Code from Tables 1, below.

3 Pressure Fitting<sup>1</sup>

Brass

- 2MNB = 1/8" NPTM
- 4MNB = 1/4" NPTM
- 2MGB = 1/8" BSPM (G type)
- 4MGB = 1/4" BSPM (G type)
- 4MSB = 7/16"-20 SAE Male

316 Stainless Steel

- 2MNS = 1/8" NPTM
- 4MNS = 1/4" NPTM
- 2MGS = 1/8" BSPM (G type)
- 4MGS = 1/4" BSPM (G type)
- 4MSS = 7/16"-20 SAE Male

4 Circuit

- A = SPST/N.O.
- B = SPST/N.C.

5 Electrical Termination

- SP = Spade Terminals (standard)
- TS = Terminal Screws
- FLXX = Flying Leads<sup>2</sup>
- FLSXX = Flying Leads w/PVC Shrink Tubing<sup>2</sup>
- CABXX = 18 AWG PVC Cable<sup>3</sup>

6 Options

- V = Viton® Diaphragm
- E = EPDM Diaphragm
- H = ECOH Diaphragm
- G = Gold Contacts  
(for loads less than 12 mA @ 12 VDC)
- IP = Ingress Protection<sup>4</sup>
- OXY = Oxygen Cleaned
- RB = Rubber Boot (shipped loose)
- WF = Weather Pack Connector, Female
- WM = Weather Pack Connector, Male
- DE = Deutsch Connector, Male, DT04 Series

7 Fixed Set Point (optional)

- A. Specify set point **-FS**  
(in PSI or BAR, see example)<sup>5</sup>
- B. Set Point Actuation  
**R** on Rising Pressure  
**F** on Falling Pressure  
Example: **-FS0.6BARF** for 0.6 BAR Falling  
or **-FS10PSIR** for 10 PSI Rising

Notes:

1. Other fittings available. Consult factory.
2. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-FL18** or **-FLS30**.
3. 36" is minimum. Specify cable length in inches. e.g. **-CAB36** or **-CAB120**.
4. Ingress Protection is available only with **-FL**, **-FLS** or **-CAB** Electrical Termination choices.
5. Set Point must be within Pressure Range selected in Step 2.

Table 1 — Pressure Range Codes

PS32

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>20</b>	5-25 psi (0.3-1.7 bar)	±1 psi (0.07 bar) +3% of setting	2 psi (0.14 bar) +4% of setting
<b>30</b>	20-60 psi (1.4-4.1 bar)	±1.5 psi (0.10 bar) +3% of setting	3 psi (0.21 bar) +4% of setting
<b>40</b>	50-150 psi (3.4-10.3 bar)	±2.5 psi (0.17 bar) +3% of setting	4 psig (0.28 bar) +4% of setting

PS52

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>15</b>	50-150 psi (3.4-10.3 bar)	±3.0 psi (0.21 bar) +4% of setting	5 psi (0.14 bar) +5% of setting
<b>20</b>	150-300 psi (10.3-20.7 bar)	±4 psi (0.28 bar) +4% of setting	8 psi (0.21 bar) +5% of setting

\* Repeatability and set point of units may change due to the effects of temperature.

\*\* In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

# PS41 – Economical Miniature Pressure Switches

▶ 3.5 to 100 psi (0.24 to 7 bar)

These miniature pressure switches are designed for demanding applications where space and/or price are strong concerns. The switches utilize a piston/diaphragm design, which incorporates the high proof pressure of piston technology with the sensitivity of diaphragm designs. Switches are field adjustable via an Allen head screw that is hidden to protect against unauthorized tampering.

## Specifications

<b>Switch</b>	SPST; SPDT
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Diaphragm Material</b>	Nitrile (optional EPDM, Viton® or Neoprene)
<b>Fitting</b>	Brass (optional 316 Stainless Steel)
<b>Electrical Termination</b>	DIN 43650A IP65; Terminals IP00; Flying Leads IP65; Option IP: IP66; Conduit with Flying Leads IP65
<b>Proof Pressure</b>	350 psi (24 bar)
<b>Burst Pressure</b>	700 psi (48 bar)
<b>Approvals</b>	CE, UL Approved units available
<b>Weight, Approximate</b>	Brass: 0.3 lbs. (0.14 kg)

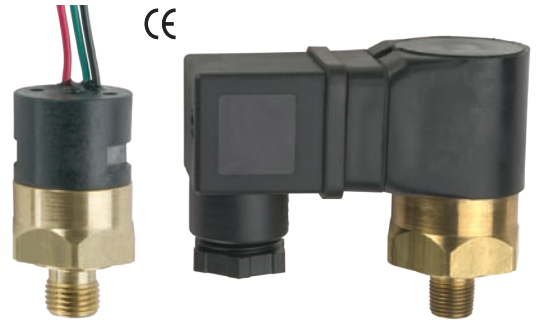
## Recommended Operating Temperature Limits

Diaphragm Material	Options Selected		
	No option, -10A, -SP or -RD	-RD or -RD and -G	-SP or -10A
<b>Nitrile</b>	15°F to 185°F (-9°C to +85°C)	15°F to 250°F (-9°C to +121°C)	15°F to 212°F (-9°C to +100°C)
<b>Viton®</b>	0°F to 185°F (-18°C to +85°C)	0°F to 250°F (-18°C to +121°C)	0°F to 212°F (-18°C to +100°C)
<b>EPDM</b>	-10°F to +185°F (-23°C to +85°C)	-10°F to +250°F (-23°C to +121°C)	-10°F to +212°F (-23°C to +100°C)
<b>Neoprene</b>	-10°F to +185°F (-23°C to +85°C)	-10°F to +250°F (-23°C to +121°C)	-10°F to +212°F (-23°C to +100°C)

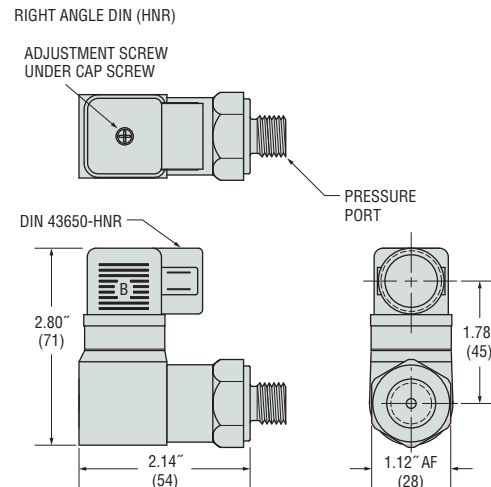
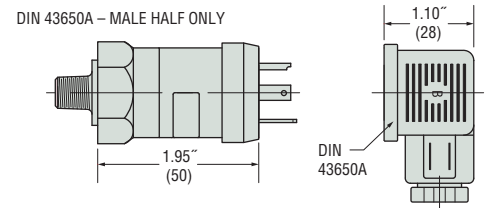
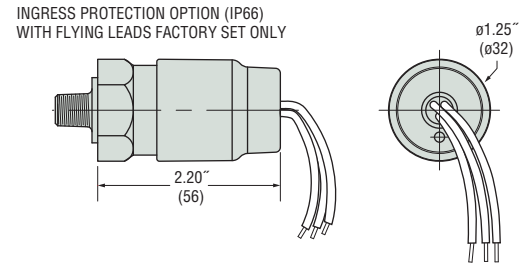
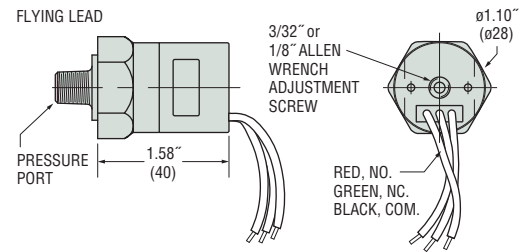
Note: Switches may function below the cold temperature limit but the set points and deadband will increase. Consult factory for details.

## Electrical Switch Ratings

Options Selected	AC	DC
No option or -RD	5 amps @ 125/250 Volts	5 amps resistive, 3 amps inductive @ 28 Volts
-G or -RD with -G	1 amp @ 125 Volts	1 amp resistive, 0.5 amp inductive @ 28 Volts
-SP without -G	10.1 amps @ 125/250 Volts	—
-SP with -G	2 amps @ 125/250 Volts	—

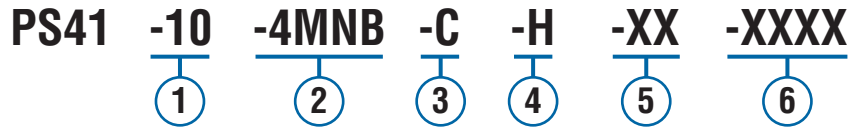


## Dimensions



How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



1 Pressure Range Code

Insert Pressure Range Code from Table 1, below.

2 Pressure Fitting<sup>1</sup>

Brass

- 2MNB = 1/8" NPTM
- 4MNB = 1/4" NPTM
- 2MGB = 1/8" BSPM (G type)
- 4MGB = 1/4" BSPM (G type)
- 4MSB = 7/16"-20 SAE Male
- 6MSB = 9/16"-18 SAE Male

316 Stainless Steel

- 2MNS = 1/8" NPTM
- 4MNS = 1/4" NPTM
- 4MGS = 1/4" BSPM (G type)
- 4MSS = 7/16"-20 SAE Male

3 Circuit

- A = SPST/N.O.
- B = SPST/N.C.
- C = SPDT

4 Electrical Termination

- SP = Spade Terminals<sup>2</sup>
- FLXX = Flying Leads<sup>3</sup>
- FLSXX = Flying Leads w/PVC Shrink Tubing<sup>3</sup>
- ELXX = 1/2" NPT Male Conduit w/Flying Leads<sup>4</sup>
- CABXX = 18 AWG PVC Cable<sup>5</sup>
  - H = DIN 43650A Male Half Only<sup>6</sup>
  - HR = Right Angle DIN 43650A Male Half Only<sup>6</sup>
  - HC = DIN 43650A 9mm Cable Clamp<sup>6</sup>
  - HCR = Right Angle DIN 43650A 9mm Cable Clamp<sup>6</sup>
  - HN = DIN 43650A with 1/2" Female NPT Conduit<sup>6</sup>
  - HNR = Right Angle DIN 43650A with 1/2" Female NPT Conduit<sup>6</sup>

5 Options<sup>7</sup>

- V = Viton<sup>®</sup> Diaphragm
- N = Neoprene Diaphragm
- E = EPDM Diaphragm
- 10A = 10A @ 125/250 VAC Max. Rating
- G = Gold Contacts  
(for loads less than 12 mA @ 12 VDC)
- RD = Reduced Differential  
(25% reduction typical)
- IP = Ingress Protection<sup>8</sup>
- OXY = Oxygen Cleaned
- WF = Weather Pack Connector, Female
- WM = Weather Pack Connector, Male
- DE = Deutsch Connector, Male, DT04 Series

6 Fixed Set Point (optional)

- A. Specify set point **-FS**  
(in PSI or BAR, see example)<sup>9</sup>
- B. Set Point Actuation  
**R** on Rising Pressure  
**F** on Falling Pressure  
Example: **-FS0.5BARF** for 0.5 BAR Falling  
or **-FS5PSIR** for 5 PSI Rising

Notes:

1. Other fittings available. Consult factory.
2. Requires **-10A** or **-G** option. (20% increase in deadband typical)
3. 1/8" is standard. Specify lead length in inches (max. 48"). e.g. **-FL18** or **-FLS30**.
4. 1/2" is standard. Specify lead length in inches (max. 48"). e.g. **-EL18** or **-EL30**.
5. 36" is minimum. Specify cable length in inches. e.g. **-CAB36** or **-CAB120**.
6. DIN connectors require **-C** SPDT circuit.
7. Options **-10A**, **-G** or **-RD** cannot be combined.
8. Ingress Protection is available only with **-FL**, **-FLS** or **-CAB** Electrical Termination choices. Ingress Protection requires Fixed Set Point **-FS**.
9. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>10</b>	3.5-8 psi (0.24-0.55 bar)	±0.35 psi (0.024 bar) +2% of setting	1.50 psi (0.14 bar) +7% of setting
<b>20</b>	7-30 psi (0.48-2.07 bar)	±0.8 psi (0.055 bar) +2% of setting	3 psi (0.21 bar) +8% of setting
<b>30</b>	25-100 psi (1.7-6.9 bar)	±2.0 psi (0.138 bar) +2% of setting	5 psig (0.28 bar) +10% of setting

\* Repeatability and set point of units may change due to the effects of temperature.

\*\* These numbers are for the standard microswitch. With either the **-SP** or **-10A** option, the values are typically 20% greater than those listed. With the **-RD** option, the values will be typically 25% less than those listed. In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

# PS61 – OEM Subminiature Pressure Switch

- ▶ 15 to 3000 psi (1 to 207 bar)
- ▶ Exceptional Size-to-Pressure-Range Ratio
- ▶ Adjustable or Factory Set

These compact pressure switches are designed for OEM applications. They are equipped with high proof pressure capabilities for demanding hydraulic applications such as forklifts, scissor lifts, and off road equipment.

## Specifications

<b>Switch*</b>	100 VA Max.
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Diaphragm</b>	Nitrile (optional Neoprene, EPDM or Viton®)
<b>Fitting</b>	Zinc-Plated Steel (optional 316 Stainless Steel)
<b>Electrical Termination</b>	Exposed Terminals IP00; IP option IP66
<b>Deadband</b>	See Table 1
<b>Proof Pressure</b>	6000 psi (414 bar)
<b>Burst Pressure</b>	9000 psi (600 bar)
<b>Approvals</b>	CE (limits switch voltage to 42 VDC)
<b>Weight, Approximate</b>	Steel: 0.14 lbs. (0.06 kg)

\* Gold contacts (option G) may be required for less than 12 VDC and 20 mA.

## Recommended Operating Temperature Limits

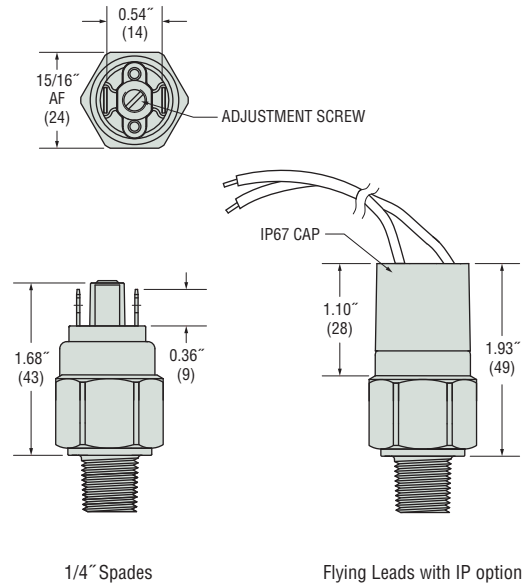
Diaphragm Material	Range
Nitrile	15°F to 230°F (-9°C to +110°C)
Viton®	0°F to 230°F (-18°C to +110°C)
EPDM	-40°F to +230°F (-40°C to +110°C)

Note: Switches may function below the cold temperature limit but the set points and deadband will increase. Consult factory for details.



CE

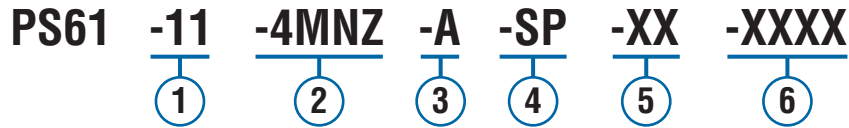
## Dimensions





How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



**1 Pressure Range Code**

Insert Pressure Range Code from Table 1, below.

**2 Pressure Fitting<sup>1</sup>**

12L14 Zinc-Plated Steel

- 2MNZ = 1/8" NPTM 12L14
- 4MNZ = 1/4" NPTM 12L14
- 2MGZ = 1/8" BSPM 12L14 (G type)
- 4MGZ = 1/4" BSPM 12L14 (G type)
- 4MSZ = 7/16"-20 SAE Male
- 6MSZ = 9/16"-18 SAE Male
- 8MSZ = 3/4"-16 SAE Male
- M10Z = M10 x 1.0, Straight
- M12Z = M12 x 1.5, Straight

316 Stainless Steel

- 2MNS = 1/8" NPTM
- 4MNS = 1/4" NPTM
- 2MGS = 1/8" BSPM (G type)
- 4MGS = 1/4" BSPM (G type)
- 4MSS = 7/16"-20 SAE Male
- 6MSS = 9/16"-18 SAE Male

**3 Circuit**

- A = SPST/N.O.
- B = SPST/N.C.

**4 Electrical Termination**

- SP = Spade Terminals (standard)
- TS = Terminal Screws
- FLXX = Flying Leads<sup>2</sup>
- FLSXX = Flying Leads w/PVC Shrink Tubing<sup>2</sup>
- CABXX = 18 AWG PVC Cable<sup>3</sup>

**5 Options**

- V = Viton® Diaphragm
- E = EPDM Diaphragm
- N = Neoprene Diaphragm
- H = ECOH Diaphragm
- G = Gold Contacts  
(for loads less than 12 mA @ 12 VDC)
- IP = Ingress Protection<sup>4</sup>
- R = Restrictor (low damping coefficient) Brass
- SR = Spiral Restrictor (high damping coefficient)  
12L14 Steel w/Black Oxide Finish<sup>5</sup>
- OXY = Oxygen Cleaned (requires SS housing)
- RB = Rubber Boot (shipped loose)
- WF = Weather Pack Connector, Female
- WM = Weather Pack Connector, Male
- DE = Deutsch Connector, Male, DT04 Series

**6 Fixed Set Point (optional)**

- A. Specify set point **-FS**  
(in PSI or BAR, see example)<sup>6</sup>
- B. Set Point Actuation  
**R** on Rising Pressure  
**F** on Falling Pressure  
Example: **-FS3BARF** for 3 BAR Falling  
or **-FS60PSIR** for 60 PSI Rising

Notes:

1. Other fittings available. Consult factory.
2. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-FL18** or **-FLS30**.
3. 36" is minimum. Specify cable length in inches. e.g. **-CAB36** or **-CAB120**.
4. Ingress Protection is available only with **-FL**, **-FLS** or **-CAB** Electrical Termination choices.
5. **-SR** will result in wider deadbands and slower response times.
6. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>11</b>	15-60 psi (1-4 bar)	±1.5 psi (0.10 bar) +3% of setting	3 psi (0.21 bar) +5% of setting
<b>15</b>	40-150 psi (3-10 bar)	±2.5 psi (0.17 bar) +3% of setting	5 psig (0.34 bar) +6% of setting
<b>19</b>	75-275 psi (5.2-18.9 bar)	±3.75 psi (0.26 bar) +3% of setting	7 psig (0.48 bar) +8% of setting
<b>25</b>	150-500 psi (10.3-34.5 bar)	±5 psi (0.34 bar) +3% of setting	10 psi (0.69 bar) +10% of setting
<b>29</b>	275-800 psi (19.0-55.2 bar)	±8 psi (0.55 bar) +3% of setting	15 psi (1.03 bar) +11% of setting
<b>35</b>	400-1100 psi (27.6-76 bar)	±13 psi (0.90 bar) +3% of setting	30 psi (2.07 bar) +12% of setting
<b>50</b>	1000-3000 psi (69-207 bar)	±35 psi (2.41 bar) +3% of setting	70 psi (4.83 bar) +14% of setting

\* Repeatability and set point of units may change due to the effects of temperature.

\*\* In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

## PS62 – OEM Subminiature Pressure Switch

- ▶ 15 to 600 psi (1 to 41 bar)
- ▶ Exceptional Size-to-Pressure-Range Ratio
- ▶ Adjustable or Factory Set
- ▶ Minimal Set Point Change at Low Temperature Extremes

These compact pressure switches are designed for medium pressure OEM applications. They offer all the performance of our proven PS61 model with the low temperature capability of Kapton®.

### Specifications

<b>Operating Temperature</b>	-40°F to +230°F (-40°C to +110°C)
<b>Switch*</b>	100 VA Max.
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Housing</b>	Zinc-Plated Steel (optional 316L Stainless Steel)
<b>Diaphragm</b>	Kapton® (polyimide)
<b>O-Ring</b>	Nitrile (other materials available)
<b>Electrical Termination</b>	Exposed Terminals IP00; IP option IP66
<b>Deadband</b>	See Table 1
<b>Proof Pressure</b>	3000 psi (207 bar)
<b>Burst Pressure</b>	6000 psi (414 bar)
<b>Approvals</b>	CE (limits switch voltage to 42 VDC)
<b>Weight, Approximate</b>	Steel: 0.14 lbs. (0.06 kg)

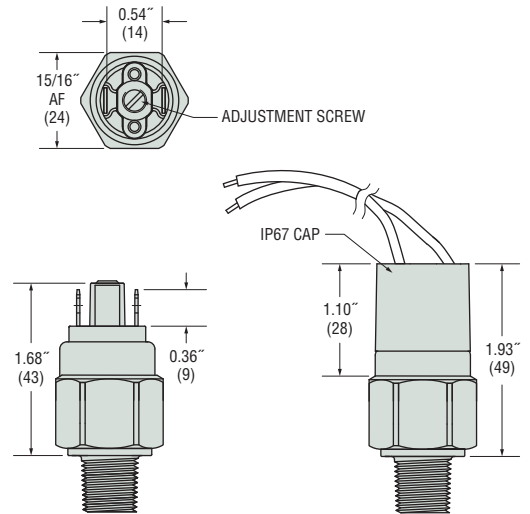
\* Gold contacts (option G) may be required for less than 12 VDC and 20 mA.

**New!**



CE

### Dimensions



1/4" Spades

Flying Leads with IP option

How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



1 Pressure Range Code

Insert Pressure Range Code from Table 1, below.

2 Pressure Fitting<sup>1</sup>

12L14 Zinc-Plated Steel

- 2MNZ = 1/8" NPTM 12L14
- 4MNZ = 1/4" NPTM 12L14
- 2MGZ = 1/8" BSPM 12L14 (G type)
- 4MGZ = 1/4" BSPM 12L14 (G type)
- 4MSZ = 7/16"-20 SAE Male
- 6MSZ = 9/16"-18 SAE Male

316L Stainless Steel

- 2MNS = 1/8" NPTM
- 4MNS = 1/4" NPTM
- 2MGS = 1/8" BSPM (G type)
- 4MGS = 1/4" BSPM (G type)
- 4MSS = 7/16"-20 SAE Male
- 6MSS = 9/16"-18 SAE Male

3 Circuit

- A = SPST/N.O.
- B = SPST/N.C.

4 Electrical Termination

- SP = Spade Terminals (standard)
- TS = Terminal Screws
- FLXX = Flying Leads<sup>2</sup>
- FLSXX = Flying Leads w/PVC Shrink Tubing<sup>2</sup>
- CABXX = 18 AWG PVC Cable<sup>3</sup>

5 Options

- N = Neoprene Diaphragm
- G = Gold Contacts  
(for loads less than 12 mA @ 12 VDC)
- IP = Ingress Protection<sup>4</sup>
- R = Restrictor (low damping coefficient) Brass
- SR = Spiral Restrictor (high damping coefficient)  
12L14 Steel w/Black Oxide Finish<sup>5</sup>
- OXY = Oxygen Cleaned
- RB = Rubber Boot (shipped loose)
- WF = Weather Pack Connector, Female
- WM = Weather Pack Connector, Male
- DE = Deutsch Connector, Male, DT04 Series

6 Fixed Set Point (optional)

- A. Specify set point -FS  
(in PSI or BAR, see example)<sup>6</sup>
- B. Set Point Actuation  
R on Rising Pressure  
F on Falling Pressure  
Example: -FS3BARF for 3 BAR Falling  
or -FS60PSIR for 60 PSI Rising

Notes:

1. Other fittings available. Consult factory.
2. 18" is standard. Specify lead length in inches (max. 48"). e.g. -FL18 or -FLS30.
3. 36" is minimum. Specify cable length in inches. e.g. -CAB36 or -CAB120.
4. Ingress Protection is available only with -FL, -FLS or -CAB Electrical Termination choices.
5. -SR will result in wider deadbands and lower response time.
6. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>10</b>	15-60 psi (1-4 bar)	±1.5 psi (0.10 bar) +4% of setting	3 psi (0.21 bar) +6% of setting
<b>20</b>	40-150 psi (3-10 bar)	±2.5 psi (0.17 bar) +4% of setting	5 psig (0.34 bar) +7% of setting
<b>30</b>	75-275 psi (5.2-18.9 bar)	±3.75 psi (0.26 bar) +4% of setting	7 psig (0.48 bar) +9% of setting
<b>40</b>	150-600 psi (10.3-41.4 bar)	±5 psi (0.34 bar) +4% of setting	10 psi (0.69 bar) +11% of setting

\* Repeatability and set point of units may change due to the effects of temperature.

\*\* In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

# PS71 – General Purpose Mini Pressure Switches

► 10 to 5000 psi (0.7 to 344 bar)

These versatile general purpose switches with snap action microswitches can be used in a wide range of hydraulic and pneumatic applications. Their proven piston/diaphragm design offers outstanding accuracy over a very wide pressure range with an outstanding 6000 psi proof pressure. Their modular construction allows Gems to offer a large number of standard pressure fittings in two materials as well as numerous electrical ratings and terminations. Users can easily configure this model to meet their needs.

## Specifications

<b>Switch</b>	SPST; SPDT
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Diaphragm</b>	Nitrile (optional EPDM, Viton® or Neoprene)
<b>Fitting</b>	Zinc-Plated Steel (Optional 316 SS)
<b>Electrical Termination</b>	DIN 43650A IP65; Spade Terminals IP00; Flying Leads IP65; Conduit with Flying Leads IP65; IP option IP66
<b>Proof Pressure</b>	6000 psi (414 bar)
<b>Burst Pressure</b>	9000 psi (600 bar)
<b>Approvals</b>	CE, UL Approved units available
<b>Weight, Approximate</b>	0.4 lbs. (0.15 kg)

## Recommended Operating Temperature Limits

Diaphragm Material	Options Selected		
	No option, -10A, -SP or -RD	-RD or -RD and -G	-SP or -10A
<b>Nitrile</b>	15°F to 185°F (-9°C to +85°C)	15°F to 250°F (-9°C to +121°C)	15°F to 212°F (-9°C to +100°C)
<b>Viton®</b>	0°F to 185°F (-18°C to +85°C)	0°F to 250°F (-18°C to +121°C)	0°F to 212°F (-18°C to +100°C)
<b>EPDM</b>	-10°F to +185°F (-23°C to +85°C)	-10°F to +250°F (-23°C to +121°C)	-10°F to +212°F (-23°C to +100°C)
<b>Neoprene</b>	-10°F to +185°F (-23°C to +85°C)	-10°F to +250°F (-23°C to +121°C)	-10°F to +212°F (-23°C to +100°C)

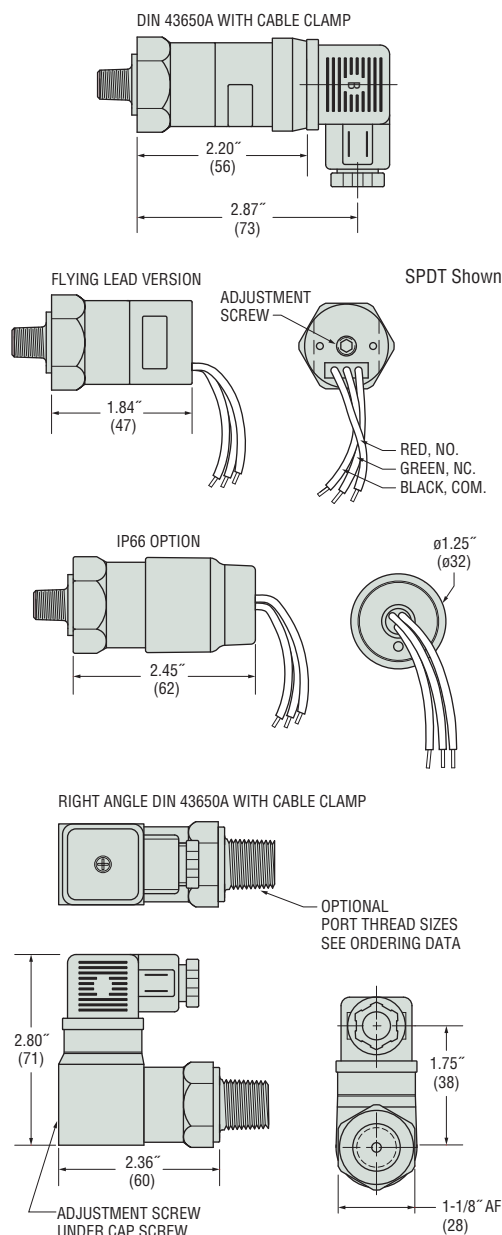
Note: Switches may function below the cold temperature limit but the set points and deadband will increase. Consult factory for details.

## Electrical Switch Ratings

Options Selected	AC	DC
No option or -RD	5 amps @ 125/250 Volts	5 amps resistive, 3 amps inductive @ 28 Volts
-G only or -RD with -G	1 amp @ 125 Volts	1 amp resistive, 0.5 amp inductive @ 28 Volts
-10A only or -SP without -G	10.1 amps @ 125/250 Volts	—
-SP with -G	2 amps @ 125/250 Volts	—

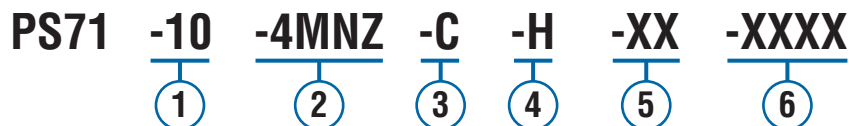


## Dimensions



## How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



### 1 Pressure Range Code

Insert Pressure Range Code from Table 1, below.

### 2 Pressure Fitting<sup>1</sup>

12L14 Zinc-Plated Steel

- 2MNZ = 1/8" NPTM
- 4MNZ = 1/4" NPTM
- 2MGZ = 1/8" BSPM (G type)
- 4MGZ = 1/4" BSPM (G type)
- 4MSZ = 7/16"-20 SAE Male
- 6MSZ = 9/16"-18 SAE Male

316 Stainless Steel

- 2MGS = 1/8" BSPM (G type)
- 4MNS = 1/4" NPTM
- 4MGS = 1/4" BSPM (G type)

### 3 Circuit

- A = SPST/N.O.
- B = SPST/N.C.
- C = SPDT

### 4 Electrical Termination

- SP = Spade Terminals<sup>2</sup>
- FLXX = Flying Leads<sup>3</sup>
- FLSXX = Flying Leads w/PVC Shrink Tubing<sup>3</sup>
- ELXX = 1/2" NPT Male Conduit w/Flying Leads<sup>4</sup>
- CABXX = 18 AWG PVC Cable<sup>5</sup>
  - H = DIN 43650A Male Half Only<sup>6</sup>
  - HR = Right Angle DIN 43650A Male Half Only<sup>6</sup>
  - HC = DIN 43650A 9mm Cable Clamp<sup>6</sup>
  - HCR = Right Angle DIN 43650A 9mm Cable Clamp<sup>6</sup>
  - HN = DIN 43650A with 1/2" Female NPT Conduit<sup>6</sup>
  - HNR = Right Angle DIN 43650A with 1/2" Female NPT Conduit<sup>6</sup>

### 5 Options<sup>7</sup>

- V = Viton<sup>®</sup> Diaphragm
- E = EPDM Diaphragm
- N = Neoprene Diaphragm
- 10A = 10A @ 125/250 VAC Max. Rating
- G = Gold Contacts  
(for loads less than 12 mA @ 12 VDC)
- RD = Reduced Differential  
(25% reduction typical)
- IP = Ingress Protection<sup>8</sup>
- OXY = Oxygen Cleaned<sup>9</sup>
  - R = Restrictor (low damping coefficient) Brass
  - SR = Spiral Restrictor (high damping coefficient)  
300 Series Stainless Steel<sup>10</sup>
- WF = Weather Pack Connector, Female
- WM = Weather Pack Connector, Male
- DE = Deutsch Connector, Male, DT04 Series

### 6 Fixed Set Point (optional)

- A. Specify set point **-FS**  
(in PSI or BAR, see example)<sup>11</sup>
- B. Set Point Actuation  
**R** on Rising Pressure  
**F** on Falling Pressure  
Example: **-FS2BARF** for 2 BAR Falling  
or **-FS20PSIR** for 20 PSI Rising

Notes:

1. Other fittings available. Consult factory.
2. 20% increase in deadband typical.
3. 1/8" is standard. Specify lead length in inches (max. 48"). e.g. **-FL18** or **-FLS30**.
4. 1/8" is standard. Specify lead length in inches (max. 48"). e.g. **-EL18** or **-EL30**.
5. 36" is minimum. Specify cable length in inches. e.g. **-CAB36** or **-CAB120**.
6. DIN connectors require **-C** SPDT circuit.
7. Options **-10A**, **-G** or **-RD** cannot be combined.
8. Ingress Protection is available only with **-FL**, **-FLS** or **-CAB** Electrical Termination choices. Ingress Protection requires Fixed Set Point **-FS**.
9. Requires stainless steel housing.
10. **-SR** will result in wider deadbands and slower response time.
11. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>10</b>	10-30 psi (0.7-2.1 bar)	±1.5 psi (0.103 bar) +2% of setting	3.5 psi (0.28 bar) +11% of setting
<b>20</b>	25-75 psi (1.7-5.2 bar)	±2.5 psi (0.172 bar) +2% of setting	3.5 psi (0.28 bar) +11% of setting
<b>30</b>	65-300 psi (4.5-20.7 bar)	±5.0 psi (0.345 bar) +2% of setting	20 psig (1.38 bar) +11% of setting
<b>40</b>	250-1000 psi (17.2-69.0 bar)	±15 psi (1.03 bar) +2% of setting	45 psig (3.10 bar) +12% of setting
<b>50</b>	1000-3000 psi (69-206.8 bar)	±30 psi (2.06 bar) +3% of setting	70 psig (4.83 bar) +12% of setting
<b>60</b>	2500-5000 psi (172.4-344.7 bar)	±50 psi (3.45 bar) +4% of setting	140 psi (9.65 bar) +13% of setting

\* Repeatability and set point of units may change due to the effects of temperature.

\*\* These numbers are for the standard microswitch. With either the **-SP** or **-10A** option, the values are typically 20% greater than those listed. With the **-RD** option, the values will be typically 25% less than those listed. In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

# PS72 – General Purpose Mini Pressure Switches

**New!**

- ▶ 10 to 750 psi (0.7 to 51.7 bar)
- ▶ Adjustable or Factory Set
- ▶ Minimal Set Point Change at Low Temperature Extremes

These versatile microswitch based pressure switches are designed for medium pressure OEM applications. They offer all the performance of our proven PS71 model with the low temperature capability of Kapton®.



## Specifications

<b>Switch</b>	SPST; SPDT
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Housing</b>	Zinc-Plated Steel (316L stainless steel and brass available)
<b>Diaphragm</b>	Kapton® (polyimide)
<b>O-Ring</b>	Nitrile (other materials available)
<b>Electrical Termination</b>	DIN 43650A IP65; Spade Terminals IP00; Flying Leads IP65; Conduit with Flying Leads IP65; IP option IP66
<b>Proof Pressure</b>	3000 psi (207 bar)
<b>Burst Pressure</b>	6000 psi (414 bar)
<b>Approvals</b>	CE, UL Approved units available
<b>Weight, Approximate</b>	Steel: 0.4 lbs. (0.15 kg)

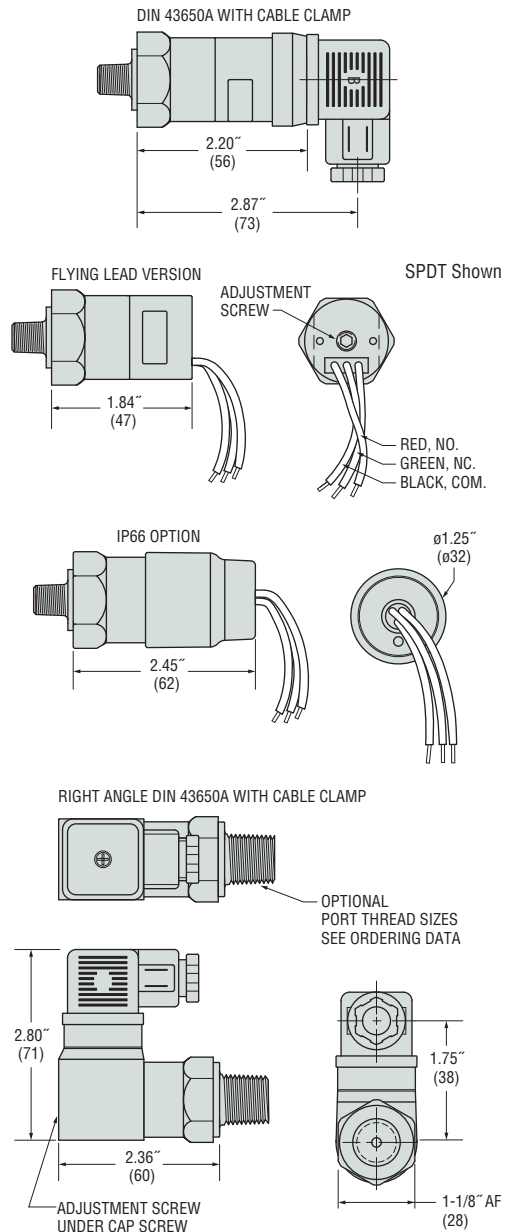
## Recommended Operating Temperature Limits

Options Selected	Temperature
<b>-RD</b>	-40°F to +250°F (-40°C to +121°C)
<b>No Options</b>	-40°F to +185°F (-40°C to +85°C)
<b>-SP or -10A</b>	-40°F to +212°F (-40°C to +100°C)

## Electrical Switch Ratings

Options Selected	AC	DC
No option or <b>-RD</b>	5 amps @ 125/250 Volts	5 amps resistive, 3 amps inductive @ 28 Volts
<b>-G</b> only or <b>-RD</b> with <b>-G</b>	1 amp @ 125 Volts	1 amp resistive, 0.5 amp inductive @ 28 Volts
<b>-10A</b> only or <b>-SP</b> without <b>-G</b>	10.1 amps @ 125/250 Volts	—
<b>-SP</b> with <b>-G</b>	2 amps @ 125/250 Volts	—

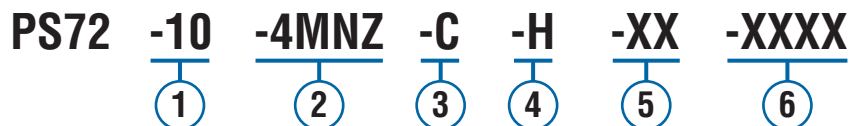
## Dimensions





## How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



### 1 Pressure Range Code

Insert Pressure Range Code from Table 1, below.

### 2 Pressure Fitting<sup>1</sup>

12L14 Zinc-Plated Steel

- 2MNZ = 1/8" NPTM
- 4MNZ = 1/4" NPTM
- 2MGZ = 1/8" BSPM (G type)
- 4MGZ = 1/4" BSPM (G type)
- 4MSZ = 7/16"-20 SAE Male
- 6MSZ = 9/16"-18 SAE Male

316 Stainless Steel

- 2MGS = 1/8" BSPM (G type)
- 4MNS = 1/4" NPTM
- 4MGS = 1/4" BSPM (G type)

### 3 Circuit

- A = SPST/N.O.
- B = SPST/N.C.
- C = SPDT

### 4 Electrical Termination

- SP = Spade Terminals<sup>2</sup>
- FLXX = Flying Leads<sup>3</sup>
- FLSXX = Flying Leads w/PVC Shrink Tubing<sup>3</sup>
- ELXX = 1/2" NPT Male Conduit w/Flying Leads<sup>4</sup>
- CABXX = 18 AWG PVC Cable<sup>5</sup>
  - H = DIN 43650A Male Half Only<sup>6</sup>
  - HR = Right Angle DIN 43650A Male Half Only<sup>6</sup>
  - HC = DIN 43650A 9mm Cable Clamp<sup>6</sup>
  - HCR = Right Angle DIN 43650A 9mm Cable Clamp<sup>6</sup>
  - HN = DIN 43650A with 1/2" Female NPT Conduit<sup>6</sup>
  - HNR = Right Angle DIN 43650A with 1/2" Female NPT Conduit<sup>6</sup>

### 5 Options<sup>7</sup>

- 10A = 10A @ 125/250 VAC Max. Rating
- G = Gold Contacts (for loads less than 12 mA @ 12 VDC)
- RD = Reduced Differential (25% reduction typical)
- IP = Ingress Protection<sup>8</sup>
- OXY = Oxygen Cleaned<sup>9</sup>
- R = Restrictor (low damping coefficient) Brass
- SR = Spiral Restrictor (high damping coefficient) 300 Series Stainless Steel<sup>10</sup>
- WF = Weather Pack Connector, Female
- WM = Weather Pack Connector, Male
- DE = Deutsch Connector, Male, DT04 Series

### 6 Fixed Set Point (optional)

- A. Specify set point **-FS** (in PSI or BAR, see example)<sup>11</sup>
  - B. Set Point Actuation
    - R** on Rising Pressure
    - F** on Falling Pressure
- Example: **-FS2BARF** for 2 BAR Falling or **-FS20PSIR** for 20 PSI Rising

Notes:

1. Other fittings available. Consult factory.
2. Requires **-10A** or **-G** option. (20% increase in deadband typical)
3. 1/8" is standard. Specify lead length in inches (max. 48"). e.g. **-FL18** or **-FLS30**.
4. 1/8" is standard. Specify lead length in inches (max. 48"). e.g. **-EL18** or **-EL30**.
5. 36" is minimum. Specify cable length in inches. e.g. **-CAB36** or **-CAB120**.
6. DIN connectors require **-C** SPDT circuit.
7. Options **-10A**, **-G** or **-RD** cannot be combined.
8. Ingress Protection is available only with **-FL**, **-FLS** or **-CAB** Electrical Termination choices. Ingress Protection requires Fixed Set Point **-FS**.
9. Requires stainless steel housing.
10. **-SR** will result in wider deadbands and slower response times.
11. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

Pressure Range Code	Pressure Range	Repeatability	Average Deadband*
<b>10</b>	10-30 psi (0.7-2.1 bar)	±1.5 psi (0.103 bar) +3% of setting	3.5 psi (0.28 bar) +12% of setting
<b>20</b>	25-75 psi (1.7-5.2 bar)	±2.5 psi (0.172 bar) +3% of setting	3.5 psi (0.28 bar) +12% of setting
<b>30</b>	65-300 psi (4.5-20.7 bar)	±5.0 psi (0.345 bar) +3% of setting	20 psig (1.38 bar) +12% of setting
<b>40</b>	250-750 psi (17.2-51.7 bar)	±15 psi (1.03 bar) +3% of setting	45 psig (3.10 bar) +13% of setting

\* These numbers are for the standard microswitch. With either the **-SP** or **-10A** option, the values are typically 20% greater than those listed. With the **-RD** option, the values will be typically 25% less than those listed. In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

# PS75 – Rugged Cylindrical Pressure Switch

- ▶ Side Mounted DIN Connection
- ▶ Top Mounted Electrical Connection
- ▶ 5 to 6000 psi (0.35 to 414 bar)
- ▶ Wear Disc Design for Longer Life
- ▶ DPDT Models Available

Gems PS75 Series have all metal surfaces for overload stops and deliver reliable operation under extremely high pressure surges. They are designed with a wear disc and cushioning ring for increased life. The switches use a piston/diaphragm design, which combine the high proof pressure of piston technology with the sensitivity of a diaphragm design. They can be field or factory adjusted.

## Specifications

<b>Switch</b>	SPST; SPDT; DPST; DPDT
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Diaphragm</b>	Nitrile (optional Viton®, Neoprene or EPDM)
<b>Fitting</b>	Zinc-Plated Steel (optional 316 Stainless Steel)
<b>Housing</b>	Brass or Zinc-Plated Steel (optional 316 Stainless Steel)
<b>Electrical Termination</b>	DIN 43650A IP65; Conduit with Flying Leads IP65; Flying Leads IP65
<b>Proof Pressure</b>	7500 psi (517 bar) except range 10: 500 psi (35 bar)
<b>Burst Pressure</b>	9000 psi (600 bar)
<b>Approvals</b>	CE, UL Approved units available
<b>Weight, Approximate</b>	Steel: 0.6 lbs. (0.27 kg)

## Recommended Operating Temperature Limits

Diaphragm Material	Circuit Codes	
	-A, -B, -C	-AA, -BB, -CC (or -A, -B, -C with -RD option)
<b>Nitrile (Std)</b>	15°F to 185°F (-9°C to +85°C)	15°F to 250°F (-9°C to +121°C)
<b>Viton®</b>	0°F to 185°F (-18°C to +85°C)	0°F to 250°F (-18°C to +121°C)
<b>EPDM</b>	-10°F to +185°F (-23°C to +85°C)	-10°F to +250°F (-23°C to +121°C)
<b>Neoprene</b>	-10°F to +185°F (-23°C to +85°C)	-10°F to +250°F (-23°C to +121°C)

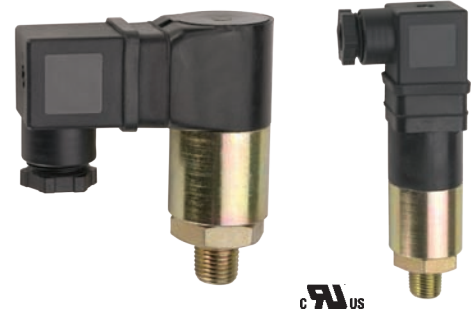
Note: Switches may function below the cold temperature limit but the set points and deadband will increase. Consult factory for details.

## Electrical Switch Ratings

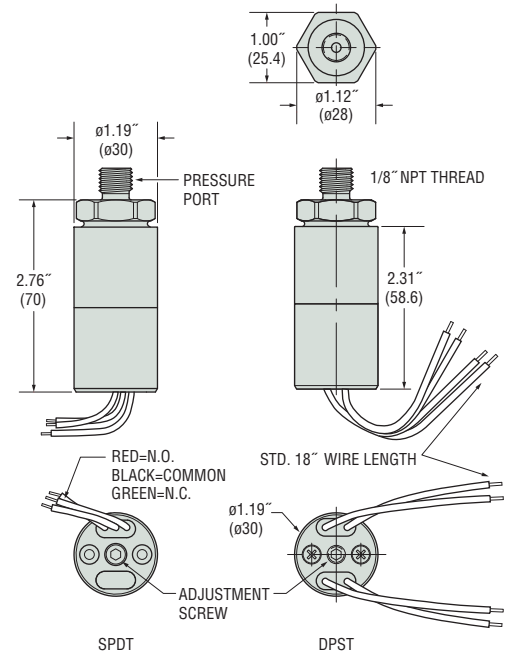
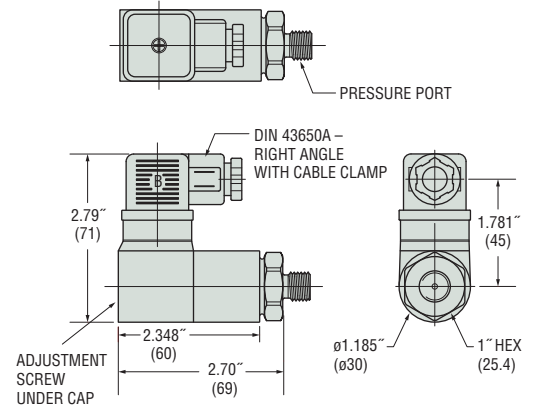
Circuit Code	AC	DC
<b>-A, -B, -C<sup>1</sup></b>	5 amps @ 125/250 Volts	5 amps resistive, 3 amps inductive @ 28 Volts
<b>-A, -B, -C<sup>2</sup></b>	1 amp @ 125 Volts	1 amp resistive, 0.5 amp inductive @ 28 Volts
<b>-AA, -BB, -CC<sup>1</sup></b>	2 switches rated 5 amps @ 125/250 Volts	2 switches rated 5 amps resistive, 3 amps inductive @ 28 Volts
<b>-AA, -BB, -CC<sup>2</sup></b>	2 switches rated 1 amp @ 125/250 Volts	2 switches rated 1 amp resistive, 0.5 amp inductive @ 28 Volts

Notes:

1. Without Gold Contacts Option (-G).
2. With Gold Contacts Option (-G).



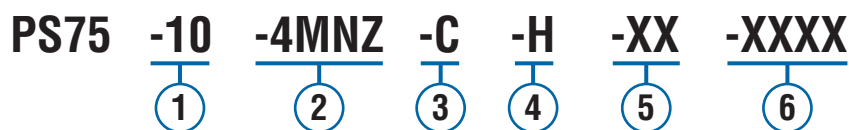
## Dimensions



PRESSURE SWITCHES

## How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



### 1 Pressure Range Code

Insert Pressure Range Code from Table 1, below.

### 2 Pressure Fitting<sup>1</sup>

12L14 Zinc-Plated Steel

- 2MNZ = 1/8" NPTM
- 4MNZ = 1/4" NPTM
- 4FNZ = 1/4" NPTF
- 4MGZ = 1/4" BSPM (G type)
- 4FGZ = 1/4" BSPF (G type)
- 4MSZ = 7/16"-20 SAE Male
- 6MSZ = 9/16"-18 SAE Male
- 4SSZ = 7/16"-20 SAE Male Swivel

316 Stainless Steel

- 4MNS = 1/4" NPTM
- 4MGS = 1/4" BSPM (G type)
- 4FGS = 1/4" BSPF (G type)
- 6MSS = 9/16"-18 SAE Male

### 3 Circuit

- A = SPST/N.O.
- B = SPST/N.C.
- C = SPDT
- AA = DPST/N.O.<sup>2</sup>
- BB = DPST/N.C.<sup>2</sup>
- CC = DPDT<sup>2</sup>

### 4 Electrical Termination

- FLXX = Flying Leads<sup>3</sup>
- ELXX = 1/2" NPT Male Conduit w/Flying Leads<sup>4</sup>
- H = DIN 43650A Male Half Only<sup>5</sup>
- HR = Right Angle DIN 43650A Male Half Only<sup>5</sup>
- HC = DIN 43650A 9mm Cable Clamp<sup>5</sup>
- HCR = Right Angle DIN 43650A 9mm Cable Clamp<sup>5</sup>
- HN = DIN 43650A with 1/2" Female NPT Conduit<sup>5</sup>
- HNR = Right Angle DIN 43650A with 1/2" Female NPT Conduit<sup>5</sup>

### 5 Options

- V = Viton<sup>®</sup> Diaphragm
- N = Neoprene Diaphragm
- E = EPDM Diaphragm
- G = Gold Contacts  
(for loads less than 12 mA @ 12 VDC)
- RD = Reduced Differential (25% reduction typical)
- OXY = Oxygen Cleaned<sup>6</sup>
- R = Restrictor (low damping coefficient) Brass
- SR = Spiral Restrictor (high damping coefficient)  
300 Series Stainless Steel<sup>7</sup>
- WF = Weather Pack Connector, Female
- WM = Weather Pack Connector, Male
- DE = Deutsch Connector, Male, DT04 Series

### 6 Fixed Set Point (optional)

- A. Specify set point -FS (in PSI or BAR, see example)<sup>8</sup>
- B. Set Point Actuation
- R on Rising Pressure
- F on Falling Pressure
- Example: -FS1BARF for 1 BAR Falling
- or -FS20PSIR for 20 PSI Rising

Notes:

1. Manifold mounts available. Consult factory.
2. Requires -FL or -EL electrical termination.
3. 18" is standard. Specify lead length in inches (max. 48"). e.g. -FL18 or -FL30.
4. 18" is standard. Specify lead length in inches (max. 48"). e.g. -EL18 or -EL30.
5. DIN connectors require -C SPDT circuit.
6. Requires stainless steel pressure fitting.
7. -SR will result in wider deadbands and slower response times.
8. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

For Circuit Codes -A, -B and -C

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>10</b>	5-25 psi (0.35-1.7 bar)	±1.0 psi (0.07 bar) +2% of setting	3 psi (0.21 bar) +5% of setting
<b>20</b>	15-75 psi (1.0-5.2 bar)	±2.5 psi (0.17 bar) +2% of setting	5 psig (0.34 bar) +10% of setting
<b>30</b>	50-150 psi (3.5-10.3 bar)	±6 psi (0.41 bar) +2% of setting	15 psig (1.03 bar) +13% of setting
<b>40</b>	150-650 psi (10.3-44.8 bar)	±15 psi (1.03 bar) +2% of setting	25 psi (1.72 bar) +14% of setting
<b>50</b>	500-1750 psi (34.5-121 bar)	±25 psi (1.72 bar) +2% of setting	55 psi (3.79 bar) +15% of setting
<b>60</b>	1000-3500 psi (69-241 bar)	±45 psi (3.10 bar) +3% of setting	100 psi (6.89 bar) +16% of setting
<b>70</b>	2500-6000 psi (172-414 bar)	±80 psi (5.51 bar) +4% of setting	200 psi (13.8 bar) +17% of setting

For Circuit Codes -AA, -BB and -CC\*\*\*

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>10</b>	5-25 psi (0.35-1.7 bar)	±1.5 psi (0.10 bar) +3% of setting	2 psi (0.14 bar) +5% of setting
<b>20</b>	15-75 psi (1.0-5.2 bar)	±3.5 psi (0.24 bar) +3% of setting	4 psig (0.28 bar) +8% of setting
<b>30</b>	50-150 psi (3.5-10.3 bar)	±9 psi (0.62 bar) +3% of setting	13 psig (0.90 bar) +10% of setting
<b>40</b>	150-650 psi (10.3-44.8 bar)	±22 psi (1.51 bar) +3% of setting	21 psi (1.45 bar) +11% of setting
<b>50</b>	500-1750 psi (34.5-121 bar)	±35 psi (2.41 bar) +3% of setting	45 psi (3.10 bar) +12% of setting
<b>60</b>	1000-3500 psi (69-241 bar)	±60 psi (4.14 bar) +4% of setting	80 psi (5.52 bar) +13% of setting
<b>70</b>	2500-6000 psi (172-414 bar)	±100 psi (6.89 bar) +5% of setting	160 psi (11.0 bar) +14% of setting

\* Repeatability and set point of units may change due to the effects of temperature.

\*\* In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

\*\*\* Operation of both switches in most cases will not be simultaneous but will occur within the specifications listed. Deadband figures already reflect the improvement from the -RD option which is automatically included in the -AA, -BB and -CC circuits.

# PS76 – Rugged Cylindrical Pressure Switch

**New!**

- ▶ Side Mounted DIN Connection
- ▶ Top Mounted Electrical Connection
- ▶ 15 to 1750 psi (1 to 121 bar)
- ▶ Minimal Set Point Change at Low Temperature Extremes
- ▶ DPDT Models Available

These versatile microswitch based pressure switches are designed for high pressure OEM applications. They offer all the performance of our proven PS75 model with the low temperature capability of Kapton®.

## Specifications

<b>Switch</b>	SPST; SPDT; DPST; DPDT
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Port Fitting</b>	Zinc-Plated Steel (316L Stainless Steel available)
<b>Diaphragm</b>	Kapton® (polyimide)
<b>O-Ring</b>	Nitrile (other materials available)
<b>Electrical Termination</b>	DIN 43650A IP65; Conduit with Flying Leads IP65; Flying Leads IP65
<b>Proof Pressure</b>	4500 psi (517 bar) except Range 10: 500 psi (35 bar)
<b>Burst Pressure</b>	6000 psi (414 bar)
<b>Approvals</b>	CE, UL Approved units available
<b>Weight, Approximate</b>	Steel: 0.6 lbs. (0.27 kg)

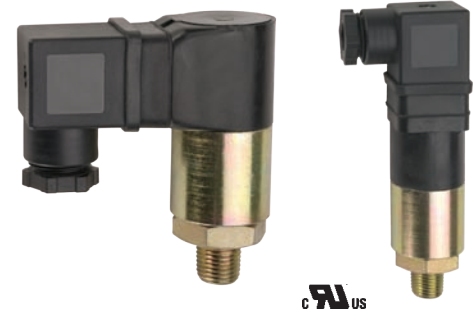
## Recommended Operating Temperature Limits

Diaphragm Material	Circuit Codes	
	-A, -B, -C	-AA, -BB, -CC (or -A, -B, -C with -RD option)
Teflon® Coated Kapton®	-40°F to +185°F (-40°C to +85°C)	-40°F to +250°F (-40°C to +121°C)

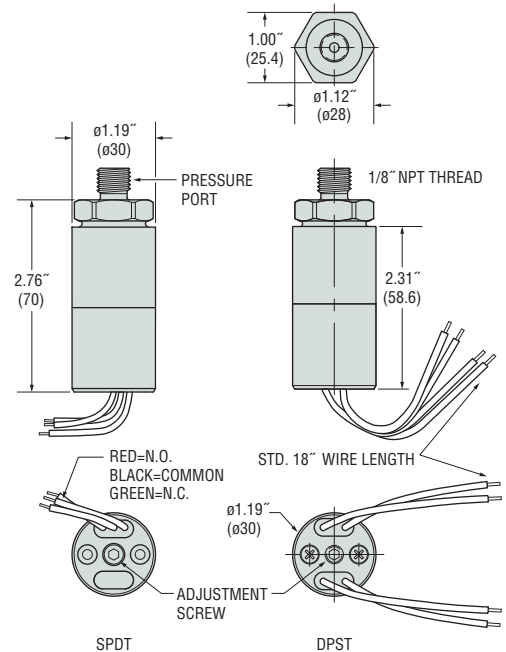
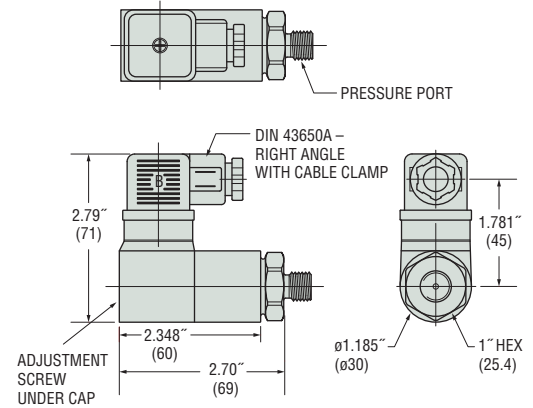
## Electrical Switch Ratings

Circuit Code	AC	DC
-A, -B, -C <sup>1</sup>	5 amps @ 125/250 Volts	5 amps resistive, 3 amps inductive @ 28 Volts
-A, -B, -C <sup>2</sup>	1 amp @ 125 Volts	1 amp resistive, 0.5 amp inductive @ 28 Volts
-AA, -BB, -CC <sup>1</sup>	2 switches rated 5 amps @ 125/250 Volts	2 switches rated 5 amps resistive, 3 amps inductive @ 28 Volts
-AA, -BB, -CC <sup>2</sup>	2 switches rated 1 amp @ 125/250 Volts	2 switches rated 1 amp resistive, 0.5 amp inductive @ 28 Volts

Notes:  
1. Without Gold Contacts Option (-G).  
2. With Gold Contacts Option (-G).

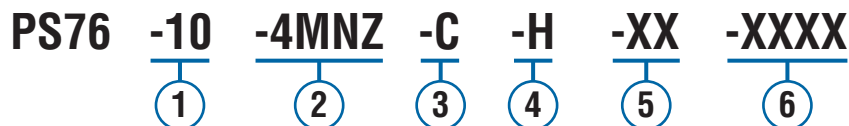


## Dimensions



How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



1 Pressure Range Code

Insert Pressure Range Code from Table 1, below.

2 Pressure Fitting<sup>1</sup>

12L14 Zinc-Plated Steel

- 2MNZ = 1/8" NPTM
- 4MNZ = 1/4" NPTM
- 4FNZ = 1/4" NPTF
- 4MGZ = 1/4" BSPM (G type)
- 4FGZ = 1/4" BSPF (G type)
- 4MSZ = 7/16"-20 SAE Male
- 6MSZ = 9/16"-18 SAE Male
- 4SSZ = 7/16"-20 SAE Male Swivel

316L Stainless Steel

- 4MNS = 1/4" NPTM
- 4MGS = 1/4" BSPM (G type)
- 4FGS = 1/4" BSPF (G type)
- 6MSS = 9/16"-18 SAE Male

3 Circuit

- A = SPST/N.O.
- B = SPST/N.C.
- C = SPDT
- AA = DPST/N.O.<sup>2</sup>
- BB = DPST/N.C.<sup>2</sup>
- CC = DPDT<sup>2</sup>

4 Electrical Termination

- FLXX = Flying Leads<sup>3</sup>
- ELXX = 1/2" NPT Male Conduit w/Flying Leads<sup>4</sup>
- H = DIN 43650A Male Half Only<sup>5</sup>
- HR = Right Angle DIN 43650A Male Half Only<sup>5</sup>
- HC = DIN 43650A 9mm Cable Clamp<sup>5</sup>
- HCR = Right Angle DIN 43650A 9mm Cable Clamp<sup>5</sup>
- HN = DIN 43650A with 1/2" Female NPT Conduit<sup>5</sup>
- HNR = Right Angle DIN 43650A with 1/2" Female NPT Conduit<sup>5</sup>

5 Options

- G = Gold Contacts (for loads less than 12 mA @ 12 VDC)
- RD = Reduced Differential (25% reduction typical)
- OXY = Oxygen Cleaned<sup>6</sup>
- R = Restrictor (low damping coefficient) Brass
- SR = Spiral Restrictor (high damping coefficient) 300 Series Stainless Steel<sup>7</sup>
- WF = Weather Pack Connector, Female
- WM = Weather Pack Connector, Male
- DE = Deutsch Connector, Male, DT04 Series

6 Fixed Set Point (optional)

- A. Specify set point -FS (in PSI or BAR, see example)<sup>8</sup>
  - B. Set Point Actuation
    - R on Rising Pressure
    - F on Falling Pressure
- Example: -FS1BARF for 1 BAR Falling or -FS20PSIR for 20 PSI Rising

Notes:

1. Manifold mounts available. Consult factory.
2. Requires -FL or -EL electrical termination.
3. 18" is standard. Specify lead length in inches (max. 48"). e.g. -FL18 or -FL30.
4. 18" is standard. Specify lead length in inches (max. 48"). e.g. -EL18 or -EL30.
5. DIN connectors require -C SPDT circuit.
6. Requires stainless steel pressure fitting.
7. -SR will result in wider deadbands and slower response times.
8. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

For Circuit Codes -A, -B and -C

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>10</b>	15-75 psi (1.0-5.2 bar)	±2.5 psi (0.17 bar) +3% of setting	5 psig (0.34 bar) +11% of setting
<b>20</b>	50-150 psi (3.5-10.3 bar)	±6 psi (0.41 bar) +3% of setting	15 psig (1.03 bar) +14% of setting
<b>30</b>	150-650 psi (10.3-44.8 bar)	±15 psi (1.03 bar) +3% of setting	25 psi (1.72 bar) +15% of setting
<b>40</b>	500-1750 psi (34.5-121 bar)	±25 psi (1.72 bar) +3% of setting	55 psi (3.79 bar) +16% of setting

For Circuit Codes -AA, -BB and -CC\*\*\*

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>10</b>	15-75 psi (1.0-5.2 bar)	±3.5 psi (0.24 bar) +4% of setting	4 psig (0.28 bar) +9% of setting
<b>20</b>	50-150 psi (3.5-10.3 bar)	±9 psi (0.62 bar) +4% of setting	13 psig (0.90 bar) +11% of setting
<b>30</b>	150-650 psi (10.3-44.8 bar)	±22 psi (1.51 bar) +4% of setting	21 psi (1.45 bar) +12% of setting
<b>40</b>	500-1750 psi (34.5-121 bar)	±35 psi (2.41 bar) +4% of setting	45 psi (3.10 bar) +13% of setting

\* Repeatability and set point of units may change due to the effects of temperature.

\*\* In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

\*\*\* Operation of both switches in most cases will not be simultaneous but will occur within the specifications listed. Deadband figures already reflect the improvement from the -RD option which is automatically included in the -AA, -BB and -CC circuits.

# PS81 – Ultra-Long Life Vacuum Switches

- ▶ 1.5" to 15" Hg (51 to 508 mbar)
- ▶ Sensitive Diaphragm for Lower Set Points
- ▶ Factory Fixed or Adjustable Set Points

For low vacuum applications, the longevity of our PS81 Series is hard to beat. A life expectancy of 1 million cycles means long-term reliability. Their brass housing and choice of four diaphragm materials ensures chemical compatibility with your system. PS81 series switches have a field adjustable set point or can be factory set.

## Specifications

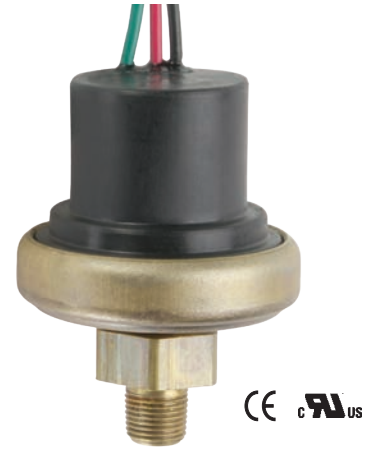
<b>Switch*</b>	5A @ 125/250 VAC, 3 Amp inductive @ 24 VDC (Std)
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Diaphragm and O-Ring</b>	Nitrile standard (optional EPDM, Viton® or Kapton® with o-ring)
<b>Fitting</b>	Brass
<b>Housing</b>	Brass
<b>Spring</b>	300 Series SS
<b>Spring Guide</b>	Delrin®
<b>Electrical Termination**</b>	DIN 43650A IP00; Terminals IP00; Flying Leads IP00; IP option IP00
<b>Proof Pressure</b>	0 psia to 150 psig (-1 bar to 10.3 bar)
<b>Burst Pressure</b>	500 psi (34.5 bar)
<b>Approvals</b>	CE, UL Approved units available
<b>Weight, Approximate</b>	0.31 lbs. (0.14 kg)

\* Gold contacts (option G) may be required for less than 12 VDC and 20 mA.  
\*\* Plastic housing is vented to atmosphere. Consult factory for sealed versions.

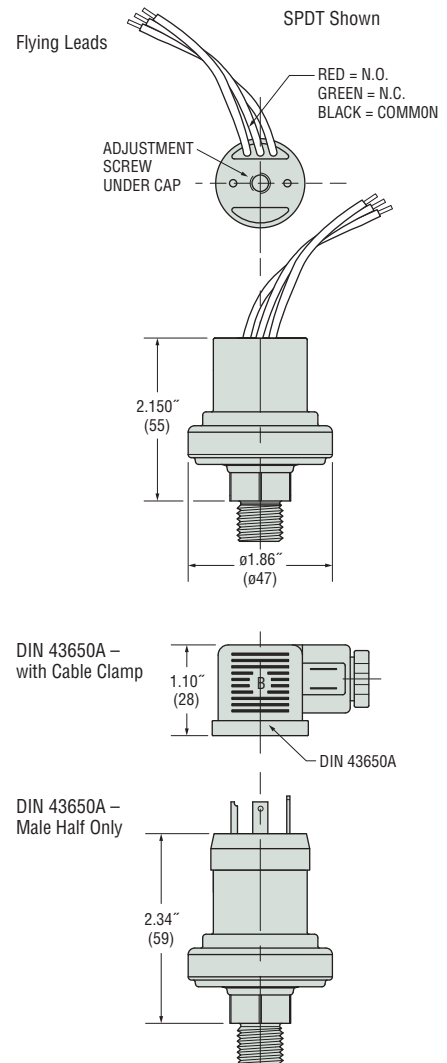
## Recommended Operating Temperature Limits

Diaphragm Material	Range
Nitrile	15°F to 250°F (-9°C to +121°C)
Viton®	0°F to 250°F (-18°C to +121°C)
EPDM	-40°F to +250°F (-40°C to +121°C)
Kapton®	-40°F to +250°F (-40°C to +121°C)

Note: Switches may function below the cold temperature limit but the set points and deadband will increase. Consult factory for details.



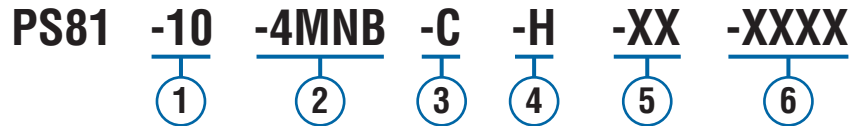
## Dimensions





How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



**① Pressure Range Code**

Insert Pressure Range Code from Table 1, below.

**② Pressure Fitting**

- 2MNB= 1/8" NPTM Brass
- 4MNB= 1/4" NPTM Brass
- 2FNB= 1/8" NPTF Brass
- 4MGB= 1/4" BSPM Brass (G type)
- 4MSB= 7/16"-20 SAE Male, Brass
- 6MSB= 9/16"-18 SAE Male, Brass

**③ Circuit**

- A= SPST/N.O.
- B= SPST/N.C.
- C= SPDT

**④ Electrical Termination**

- FLXX= Flying Leads<sup>1</sup>
- ELXX= 1/2" NPT Male Conduit w/Flying Leads<sup>2</sup>
- H= DIN 43650A Male Half Only<sup>3</sup>
- HC= DIN 43650A 9mm Cable Clamp<sup>3</sup>
- HN= DIN 43650A with 1/2" Female NPT Conduit<sup>3</sup>

**⑤ Options**

- V= Viton® Diaphragm
- E= EPDM Diaphragm
- K= Kapton® Diaphragm (Nitrile O-ring)
- G= Gold Contacts  
(for loads less than 12 mA @ 12 VDC)
- OXY= Oxygen Cleaned
- IP= Ingress Protection<sup>4</sup>

**⑥ Fixed Set Point (optional)**

- A. Specify set point **-FS**  
(in Inches Hg or mBAR, see example)<sup>5</sup>
- B. Set Point Actuation  
**R** on Rising Vacuum  
**F** on Falling Vacuum  
Example: **-FS100MBARF** for 100 mBAR Falling  
or **-FS2INHGR** for 2" Hg Rising

Notes:

1. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-FL18** or **-FL30**.
2. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-EL18** or **-EL30**.
3. DIN connectors require **-C** SPDT circuit.
4. Ingress Protection is available only with **-FL** or **-EL** Electrical Termination and requires Fixed Set Point **-FS**.
5. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
<b>10</b>	1.5-5" Hg (51-169 mbar)	±0.2" Hg (7 mbar) +3% of setting	0.3" Hg (10 mbar) +9% of setting
<b>20</b>	4-15" Hg (136-508 mbar)	±0.35" Hg (12 mbar) +4% of setting	0.6" Hg (20 mbar) +11% of setting

\* Repeatability and set point of units may change due to the effects of temperature.

\*\* In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

# PS82 – Economical Miniature Vacuum Switches

► 5" to 28" Hg (169 to 948 mbar)

These miniature vacuum switches, based on our proven PS71 series, are designed for demanding applications where space and/or price are strong concerns.

## Specifications

<b>Switch</b>	SPST; SPDT
<b>Repeatability</b>	See Table 1
<b>Wetted Parts</b>	
<b>Diaphragm Material</b>	Nitrile standard (optional EPDM, Viton® and Neoprene)
<b>Fitting</b>	Brass (optional 316 Stainless Steel)
<b>Spring</b>	316 Stainless Steel
<b>Electrical Termination</b>	DIN 43650A IP65; Male Conduit with Flying Leads IP65; Flying Leads IP00; IP option IP66
<b>Proof Pressure</b>	0 psia to 350 psig (-1 bar to 24 bar)
<b>Burst Pressure</b>	700 psi (48 bar)
<b>Approvals</b>	CE
<b>Weight, Approximate</b>	Brass: 0.4 lbs. (0.18 kg)

## Recommended Operating Temperature Limits

Diaphragm Material	Options Selected		
	No option, -10A, -SP or -RD	-RD or -RD and -G	-SP or -10A
<b>Nitrile</b>	15°F to 185°F (-9°C to +85°C)	15°F to 250°F (-9°C to +121°C)	15°F to 212°F (-9°C to +100°C)
<b>Viton®</b>	0°F to 185°F (-18°C to +85°C)	0°F to 250°F (-18°C to +121°C)	0°F to 212°F (-18°C to +100°C)
<b>EPDM</b>	-10°F to +185°F (-23°C to +85°C)	-10°F to +250°F (-23°C to +121°C)	-10°F to +212°F (-23°C to +100°C)
<b>Neoprene</b>	-10°F to +185°F (-23°C to +85°C)	-10°F to +250°F (-23°C to +121°C)	-10°F to +212°F (-23°C to +100°C)

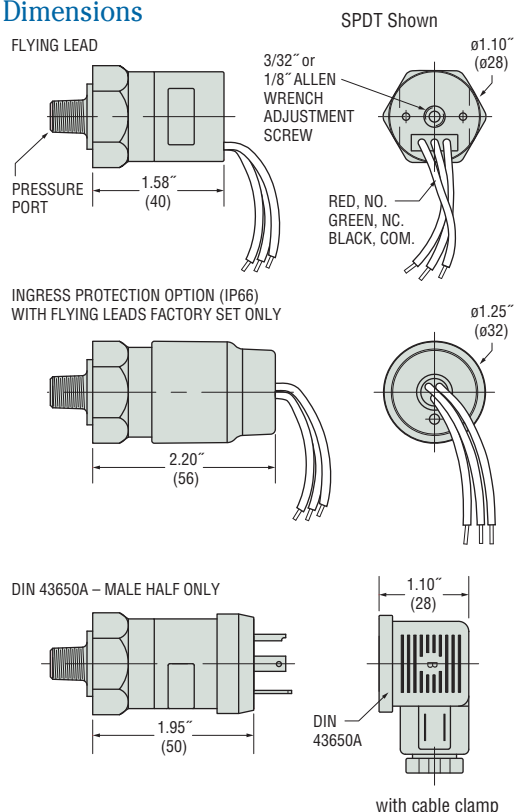
Note: Switches may function below the cold temperature limit but the set points and deadband will increase. Consult factory for details.

## Electrical Switch Ratings

Options Selected	AC	DC
No option or -RD	5 amps @ 125/250 Volts	5 amps resistive, 3 amps inductive @ 28 Volts
-G only or -RD with -G	1 amp @ 125 Volts	1 amp resistive, 0.5 amp inductive @ 28 Volts
-10A only or -SP without -G	10.1 amps @ 125/250 Volts	—
-SP with -G	2 amps @ 125/250 Volts	—

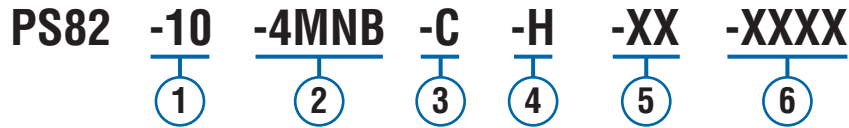


## Dimensions



How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



1 Pressure Range Code

Insert Pressure Range Code from Table 1, below.

2 Pressure Fitting<sup>1</sup>

Brass

- 2MNB = 1/8" NPTM
- 4MNB = 1/4" NPTM
- 2MGB = 1/8" BSPM (G type)
- 4MGB = 1/4" BSPM (G type)
- 4MSB = 7/16"-20 SAE Male
- 6MSB = 9/16"-18 SAE Male

316 Stainless Steel

- 2MNS = 1/8" NPTM
- 4MNS = 1/4" NPTM
- 4MGS = 1/4" BSPM (G type)

3 Circuit

- A = SPST/N.O.
- B = SPST/N.C.
- C = SPDT

4 Electrical Termination

- FLXX = Flying Leads<sup>2</sup>
- FLSXX = Flying Leads w/PVC Shrink Tubing<sup>2</sup>
- ELXX = 1/2" NPT Male Conduit w/Flying Leads<sup>3</sup>
- CABXX = 18 AWG PVC Cable<sup>4</sup>
  - H = DIN 43650A Male Half Only<sup>5</sup>
  - HR = Right Angle DIN 43650A Male Half Only<sup>5</sup>
  - HC = DIN 43650A 9mm Cable Clamp<sup>5</sup>
  - HCR = Right Angle DIN 43650A 9mm Cable Clamp<sup>5</sup>
  - HN = DIN 43650A with 1/2" Female NPT Conduit<sup>5</sup>
  - HNR = Right Angle DIN 43650A with 1/2" Female NPT Conduit<sup>5</sup>
  - HM = Micro (9.4mm Spacing) DIN Style Male Half Only<sup>5</sup>
  - SP = Spade Terminals<sup>6</sup>

5 Options

- 10A = 10A @ 125/250 VAC Max. Rating<sup>7</sup>
- V = Viton<sup>®</sup> Diaphragm
- N = Neoprene Diaphragm
- E = EPDM Diaphragm
- G = Gold Contacts (for loads less than 12 mA @ 12 VDC)
- RD = Reduced Differential (25% reduction typical)
- IP = Ingress Protection<sup>8</sup>
- OXY = Oxygen Cleaned
- WF = Weather Pack Connector, Female
- WM = Weather Pack Connector, Male
- DE = Deutsch Connector, Male, DT04 Series

6 Fixed Set Point (optional)

- A. Specify set point **-FS** (in Inches Hg or mBAR, see example)<sup>9</sup>
  - B. Set Point Actuation
    - R** on Rising Vacuum
    - F** on Falling Vacuum
- Example: **-FS300MBARF** for 300 mBAR Falling or **-FS10INHGR** for 10" Hg Rising

Notes:

1. Other fittings available. Consult factory.
2. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-FL18** or **-FLS30**.
3. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-EL18** or **-EL30**.
4. 36" is minimum. Specify cable length in inches. e.g. **-CAB36** or **-CAB120**.
5. DIN connectors require **-C** SPDT circuit.
6. Requires **-10A**, **-G** options (50% increase in deadband typical).
7. Options **-10A**, **-G** or **-RD** cannot be combined.
8. Ingress Protection is available only with **-FL**, **-FLS**, **-ELS** or **-CAB** Electrical Termination choices. Ingress Protection requires Fixed Set Point **-FS**.
9. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Vacuum Range Codes

The deadband values tabulated are for the standard microswitch. With either the -SP or -10A option, the deadband values are typically 50% greater than those listed. With the -RD option, the values will be typically 25% less than those listed. In certain applications deadband can be tailored and controlled to customer specifications. Consult factory for details.

Vacuum Range Code	Vacuum Range	Repeatability	Average Deadband*
<b>10</b>	5-15" Hg (169-508 mbar)	±0.71" Hg (24 mbar) +2% of setting	3.05" Hg (103 mbar) +7% of setting
<b>20</b>	12-28" Hg (406-948mbar)	±1.63" Hg (55 mbar) +2% of setting	6.1" Hg (207 mbar) +8% of setting

\* -IP and -EL options are approximate gauge switches. Altitude and temperature changes will result in set point shifts.

# PS98 - Solid-State Pressure Switch

- ▶ 0 to 6000 psi and 0 to 400 bar
- ▶ No Moving Parts—Highly Resistant to Shock and Vibration
- ▶ Ideal for Off-Highway, Mobile, Demanding Applications
- ▶ Long Cycle Life

Answering the demand for solid-state switches, Gems proudly offers the PS98. Built from our proven CVD and ASIC design, the PS98 Solid-State pressure switch offers greater accuracy in rough environments. This switch is an ideal alternative to electromechanical types when cycles exceed 50 cycles/minute and broad frequency response is needed. In addition to a modular design, a host of pressure ports and electrical connections are available. Switch and switch-back points are factory set per customer specification.

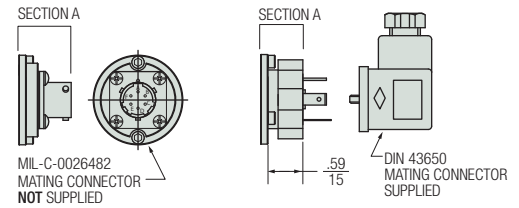
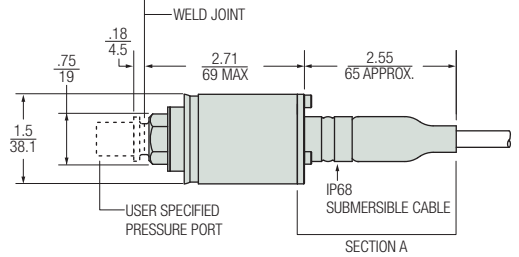
### Specifications:

<b>Operating Temperature</b>	-40°F to +260°F (-40°C to +127°C)
<b>Switch</b>	Relay or Transistor
<b>Repeatability*</b>	.25% of Full Set point range @ 70°F (20°C)
<b>Fatigue Life</b>	Designed for more than 100 million FS cycles
<b>Wetted Parts</b>	
<b>Diaphragm</b>	17-4PH Stainless Steel
<b>Fitting</b>	316 Stainless Steel
<b>Electrical Termination</b>	DIN "G" IP65 10-6 MIL CONN "C" IP65 Submersible Cable "M" IP68
<b>Supply Voltage (Vs)</b>	24-72 VDC
<b>Vibration</b>	70g, peak to peak sinusoidal, 5 to 2000 Hz (Random Vibration: 20 to 2000 Hz @ approx. 20g Peak per MIL-STD-810E Method 514.4)
<b>Acceleration</b>	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.
<b>Shock</b>	20g, 11 ms, per MIL-STD-810E Method 516.4 Procedure 1
<b>Proof Pressure</b>	2X Full Scale
<b>Approvals</b>	CE (limits switch voltage to 42 VDC)
<b>Weight, Approximate</b>	1.0 lbs. (0.45 kg)

\* Repeatability and set point of units may change due to the effects of temperature.

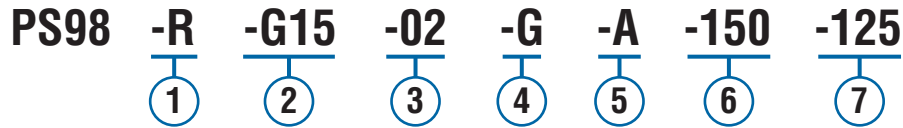


### Dimensions



How To Order

Use the **Bold** characters from the chart below to construct a product code. Please reference Notes.



1 Output

- R=Relay
- T=Transistor

2 Pressure Range

Insert Pressure Range Code from Tables 1, below.

3 Pressure Port

- 08=1/8"-27 NPT External
- 02=1/4"-18 NPT External
- 0J=1/4" NPT External w/snubber
- 0E=1/4" NPT Internal
- 0H=1/2"-14 NPT External
- 04=7/16"-20 External (SAE #4, J514)
- 1P=9/16"-18 External (SAE #6, J1926-2)
- 1J=7/16"-20 External (SAE #4, J1926-2)
- 09=G1/8" Internal
- 01=G1/4" External
- 0A=R1/4" External

4 Electrical Termination

- G=Large DIN
- MXXX=IP68 Cable  
(Specify length in meters; e.g. -M012)
- C=6-Pin Connector

5 Circuit

- A=N.O.
- B=N.C.

6 Factory Set Point<sup>1</sup>

7 Re-Set Point<sup>1</sup>

Note:

1. Set Points must be within Pressure Range selected in Step 2.

Tables 1 — Pressure Range Codes

PSI Measurement

Pressure Range Code	Pressure Range (psi)
<b>F15</b>	0-15
<b>F30</b>	0-30
<b>F60</b>	0-60
<b>G10</b>	0-100
<b>G15</b>	0-150
<b>G20</b>	0-200
<b>G30</b>	0-300
<b>G50</b>	0-500
<b>G60</b>	0-600
<b>H10</b>	0-1000
<b>H15</b>	0-1500
<b>H20</b>	0-2000
<b>H30</b>	0-3000
<b>H40</b>	0-4000
<b>H50</b>	0-5000
<b>H60</b>	0-6000

Bar Measurement

Pressure Range Code	Pressure Range (bar)
<b>A10</b>	0-1
<b>A16</b>	0-1.6
<b>A25</b>	0-2.5
<b>A40</b>	0-4
<b>A60</b>	0-6
<b>B10</b>	0-10
<b>B16</b>	0-16
<b>B25</b>	0-25
<b>B40</b>	0-40
<b>B60</b>	0-60
<b>C10</b>	0-100
<b>C16</b>	0-160
<b>C25</b>	0-250
<b>C40</b>	0-400
—	—
—	—

# Miniature and Subminiature Solenoid Valves

Gems specializes in made-to-order fluidic systems, and a major segment of that activity includes the integration of miniature solenoid valves and manifold assemblies. Our miniature and subminiature solenoid valves are utilized in solutions that serve industries ranging from medical and biotech to automotive and industrial equipment.

Gems solenoid valves are designed to your specifications for each unique application. Each series offers a broad range of construction/performance options to build an endless array of configurations—too many to list in this catalog. From custom coils and manifolds to exotic materials and flow characteristics, there is very little that we cannot accomplish. Whether pneumatic or liquid, cryogenic or high temperature, vacuum or high-pressure, we partner with you to identify, create, and produce the best possible fluidic solution.

If at any time, you have a question or simply want to give us your requirements and have Gems Sensor and Controls design your valve or system, please contact us by phone at 800-378-1600 or email us at [info@gemssensors.com](mailto:info@gemssensors.com).

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Isolation.....	J-19
Inert Isolation.....	J-23
Cryogenic .....	J-35

## Get Help Quick

An application data sheet (ADS), located on page J-40, will help you select performance criteria and options. Fax it directly to a Gems Valve Engineer at 860-747-4244 or configure your valve online for RFQ at [www.gemssensors.com](http://www.gemssensors.com).

### General Purpose Valves

A broad range of 2- and 3-way solenoid valves in both miniature and subminiature sizes. A wide selection of configuration options allows easy customization to match specific application requirements.



### Isolation Valves

Isolation diaphragms protect media and moving parts alike. Ideal for high-purity and aggressive media applications.



### Cryogenic Valves

These valves provide reliable service to media temperatures as low as -320°F (-196°C). Ideal for liquid Nitrogen and Carbon Dioxide use.



SOLENOID VALVES



## 4 Steps to Valve Selection

The steps described in this section will help you identify the performance criteria needed to meet your application requirements and select the right valve.

### Step 1 – Calculating $C_v$

Begin by calculating the valve flow coefficient ( $C_v$ ) using: operating pressure differential; flow rate for your application; Specific Gravity; and in some circumstances, temperature. If you already know your  $C_v$  please go directly to Step 2.

$C_v$  combines the effects of all flow restrictions in the valve into a single number.  $C_v$  represents the quantity of water, at 68°F and in gallons per minute (GPM) that will flow through your valve with a 1 psi pressure differential.  $C_v$  can also be calculated for gases.

Specific Gravity (SG) for liquid is the ratio of the density, or specific weight of the liquid, relative to that of water. Similarly, the SG for gas is the ratio of the density, or specific weight of the gas, relative to that of air. The SG of your media is important in calculating  $C_v$  because it directly correlates to the flow rate through your valve.

### Liquid Flow

Because liquids are incompressible, their flow rate depends only on the difference between the inlet and outlet pressures ( $P_1 - P_2$  or  $\Delta P$ , pressure differential. Figure 1).

The  $C_v$  of any valve flowing liquid media can be determined with the equation shown to the right.

**Example:** Using Water at 68°F:

V = 3.08 GPM  
P1 = 100 PSI  
P2 = 40 PSI  
SG = 1

$$C_v = \frac{3.08}{\sqrt{\frac{100-40}{1}}} = .398$$

**Fig. 1: Press Differential**



Pressure differential is the difference between the inlet and outlet pressures.

### Temperature and $C_v$

Temperature is not included in the  $C_v$  calculation for non-compressible fluids (liquids) and is only used in determining SG. Conversely, because gases are compressible, temperature (T) has a greater effect on volume and therefore is included as a separate variable in gas  $C_v$  calculations. flow rate through your valve.

#### Liquid Flow Formula

$$C_v = \frac{V}{\sqrt{\frac{\Delta P}{SG}}}$$

**Where:**

**CV** = Valve flow coefficient  
**V** = Flow rate in GPM  
**ΔP** = Pressure differential (PSID)  
**SG** = Specific Gravity

### Gas Flow

Since gases are compressible fluids there are two separate equations for high and low-pressure differential flow.

**Example:** Using Air:

V = 10 SCFM  
P1 = 20 PSIG = 34.7 PSIA (20 + 14.7)  
P2 = 0 PSIG = 14.7 PSIA (0 + 14.7)  
SG = 1  
T = 72° F = 532° Rankine (72 + 460)

Since this is high-pressure differential flow ( $14.7 \leq 34.7 / 2$ ), we use the following equation:

$$C_v = \frac{10}{13.61 \cdot 34.7 \sqrt{\frac{1}{(1) 532}}} = .49$$

#### Gas Flow $C_v$ Formula

- Low-pressure differential flow is when  $P_2 > \frac{P_1}{2}$  and the following equation is used:

$$C_v = \frac{V}{16.05 \sqrt{\frac{(P_1^2 - P_2^2)}{(SG) T}}}$$

- High-pressure differential flow is when  $P_2 \leq \frac{P_1}{2}$  and the following equation is used:

$$C_v = \frac{V}{13.61 P_1 \sqrt{\frac{1}{(SG) T}}}$$

**Where:**

**CV** = Valve flow coefficient  
**V** = Flow rate in SCFM  
**P1** = Inlet pressure in PSIA  
**P2** = Outlet pressure in PSIA  
**SG** = Specific Gravity  
**T** = Temperature of gas in Degree Rankine

16.05 and 13.61 are constants used in gas flow equations

For help calculating your  $C_v$ , please contact a Gems valve engineer at 800-378-1600 or info@gemssensors.com.

## Step 2 – Valve Function

Identify how your valve will function in your application. Pick from the choices below.

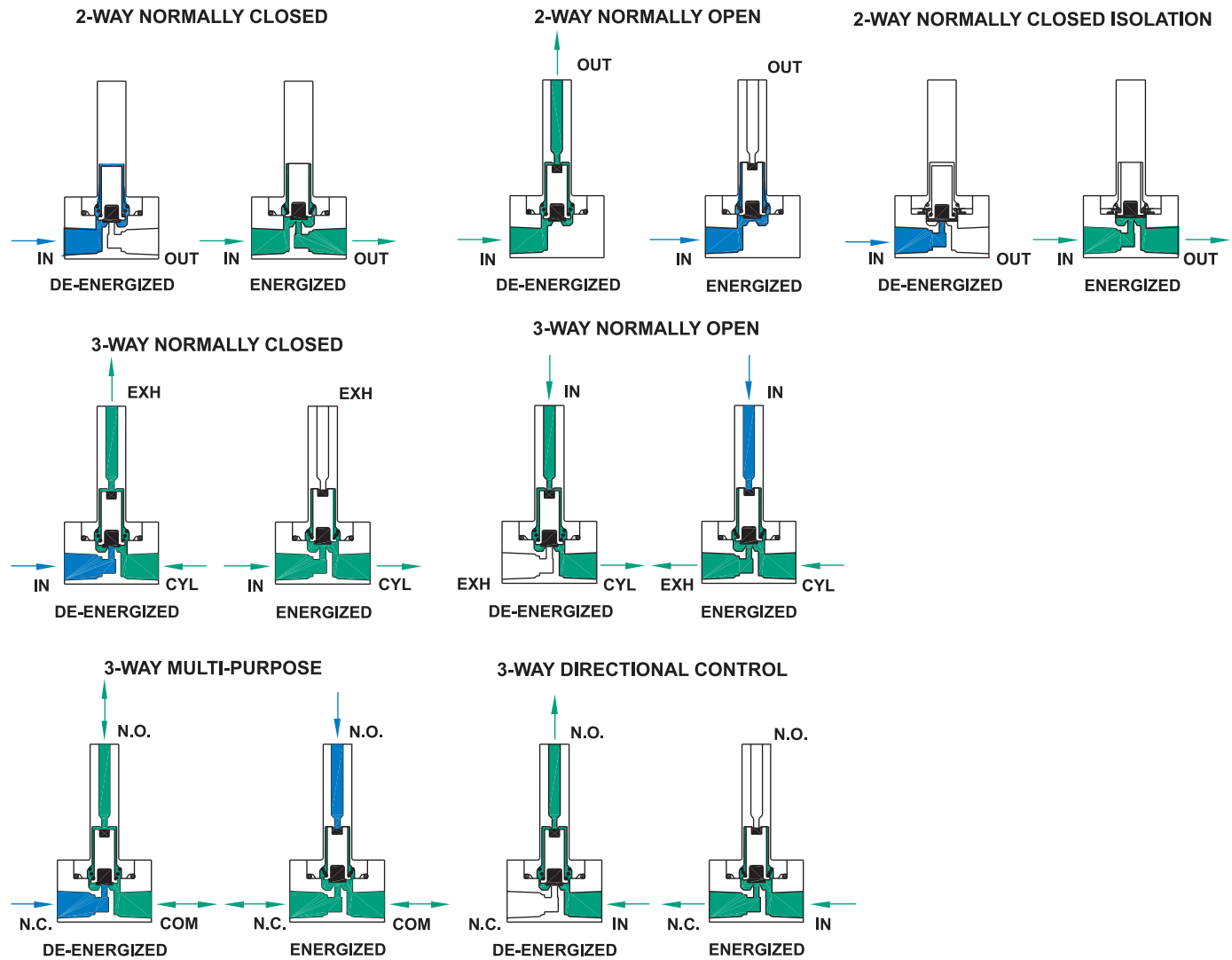
### An important note regarding $C_v$ and valve function:

The  $C_v$  calculated will apply to either the Body Orifice or the Stop Orifice depending on the valve's function.

For example, the Stop Orifice for a 3-way normally closed valve, when de-energized, is the exhaust port. In other words,  $C_v$  is calculated using the specific Inlet Pressure (P1) and Outlet Pressure (P2) for the flow paths described below.

#### Flow Key

- Blocked Flow
- Free Flow



Gems specializes in the design and manufacturing of custom solenoid valves and fluidic systems. If you don't see what you're looking for, or have a question, contact us at 800-378-1600 or [info@gemssensors.com](mailto:info@gemssensors.com).

### Step 3 – Identify Your Valve Series

Select possible valve series candidate using the overview charts below. Begin by choosing the category for your application:

- General Purpose
- Isolation
- Cryogenic

Using the charts, select maximum operating pressure differential (MOPD), the  $C_v$ , function, and additional specifications needed for your application to select possible valve series. The detailed performance specs for each series are located on the corresponding pages listed on the chart.

If you would like assistance with your selection, want to modify a valve, or simply want a sounding board please contact a Gems™ valve engineer at 800-378-1600 or info@gemssensors.com.

General Purpose							
Function	2- & 3-Way						
Media	Gas Only		Gas & Liquid				
Size	Sub-Miniature			Miniature			
$C_v$ Range	0.018 - 0.070			0.019 - 0.430		0.045 - 0.880	
Port Configuration	#10-32 Manifold Mount		Barb (1/16, 5/64, 1/8), Manifold or Face-Mount		#10-32, 1/8, 1/4 NPT, Manifold Mount		1/8, 1/4, 3/8 NPT, Manifold Mount
Orifice Dia (in)	0.032 - 0.078		0.031 - 0.052	0.032 - 0.156	0.062 - 0.210		0.047 - 0.375
Power (watt)	0.65, 2		0.5, 1, 2	6	7		10
MOPD (psi)	175	250	100	1000	400		900
Valve Series	E, EH	G, GH	M	A	B	C	D
Pages	J-7, J-8	J-9, J-10	J-5, J-6	J-11, J-12	J-13, J-14	J-15, J-16	J-17, J-18

Cryogenic			Isolation		Inert Isolation
Function	2-Way, Normally Closed Only		2-Way, Normally Closed Only		
Media	Liquid		Gas & Liquid		
Size	Miniature		Miniature		
$C_v$ Range	0.045 - 0.440	0.040 - 0.770	0.020 - 0.300		
Port Configuration	1/8, 1/4 NPT	1/8, 1/4, 3/8 NPT	#10-32, 1/8 NPT, 1/4 NPT, Manifold Mount		
Orifice Dia (in)	0.046 - 0.188	0.046 - 0.250	0.032 - 0.156		
Power (watt)	9	15	4.5, 7		
MOPD (psi)	900	1000*	50 (Plastic Body), 150		
Valve Series	B-Cryo	D-Cryo	AS	BS	
Pages	J-35, J-36	J-37, J-38	J-19, J-20	J-21, J-22	

See page J-24

\*Consult factory for higher MOPD.

### Step 4 – Make Your Selection and Configure Your Valve

Complete your valve design by selecting the additional design parameters to build the best possible valve. For example:

- Materials needed for your media (stainless steel, brass, fluoroelastomer, EPDM, etc.)
- Coil construction (lead wire, quick connect spade, grommet, conduit, yoke, etc.)
- Port configuration
- Manifold assembly
- Voltage

For help selecting the additional options for your valve or if you want to confirm that your selection is the best choice or work with an engineer on integrating a fluidic system into your application, contact us at 800-378-1600 or info@gemssensors.com. We are happy to assist. You can also place orders through these same channels.

We specialize in application specific valves. Our modular valve designs, coupled with our cutting edge 3D modeling and innovative CNC manufacturing capabilities, result in fluidic systems that are truly adaptable to any originally manufactured equipment.



Part Prefix Table ①

Power Rating	Orifice	MOPD (psig)	C <sub>v</sub>	① Primary Prefix
			Body	
0.5 Watt	0.031	25	0.020	MA
	0.052	10	0.038	MA
1 Watt	0.031	50	0.020	MB
	0.052	25	0.038	MB
2 Watts	0.031	100	0.020	MC
	0.052	50	0.038	MC

② Valve Type

- 20 = 2-Way normally closed
- 22 = 2-Way normally open
- 30 = 3-Way normally closed (free vent)
- 31 = 3-Way normally closed (line connection)
- 32 = 3-Way normally open
- 33 = 3-Way multi-purpose
- 34 = 3-Way directional control

③ Orifice Size

- 2 = 0.031"
- 5 = 0.052"

④ Plunger Seal / O-Ring Material

- V = Viton®
- N = Nitrile
- E = EPDM

⑤ Body Material

- B = Brass
- A = Aluminum

⑥ Body Port Configuration

- 0 = Face mount
- 1 = 1/16" barb
- 2 = 5/64" or 3/32" barb
- 3 = 1/8" barb
- 4 = Manifold mount, #10-32 UNF-2A stud†
- 5 = #10-32 UNF-2B female thread (180° apart only)
- 6 = 1/8"-27 NPT ports (180° apart only)

⑦ Stop Port Configuration

- 0 = No barb (Standard for 2-way NC & 3-way free vent)
- 1 = 1/16" barb (.031" orifice only)
- 2 = 5/64" or 3/32" barb
- 3 = 1/8" barb

⑧ Coil Construction

- U = P.C. board solderable (2-pin)
- P = P.C. board mount (4-pin)
- Q = Quick connect 0.110 spade
- L = Lead-wires, #26 AWG, 18" long
- W\_\_ = Lead-wires (Specify length in inches)

⑨ Voltage

- 200 = 3 VDC
- 201 = 5 VDC
- 203 = 12 VDC
- 204 = 24 VDC
- \_\_VDC = DC (specify voltage)
- \_\_VAC = AC Rectified 2-watt coil only (specify voltage, lead-wires only)

⑩ Additional Options

- OC = Cleaned for oxygen use
- VAC = Vacuum application (0 to 27" Hg)

† Teflon® o-ring not suitable for manifold mount.

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## E & EH Series – Subminiature Gas

- ▶ MOPD: 175 PSI
- ▶  $C_v$  Range: 0.018 to 0.070
- ▶ 0.65 Watts or 2 Watts

A 2- or 3-way sub-miniature solenoid valve that delivers faster response times—and higher flow rates, the E & EH Series is specifically engineered for air and dry gas applications. A nickel-plated body and coil housing construction produces a highly durable, corrosion resistant valve. With a wattage range of 0.65–2 the E & EH Series provides versatility for power conserving, high pressure, and high flow applications.

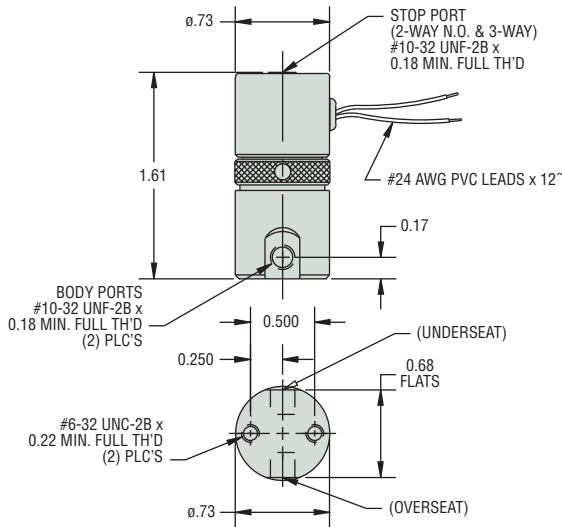


### Typical Applications

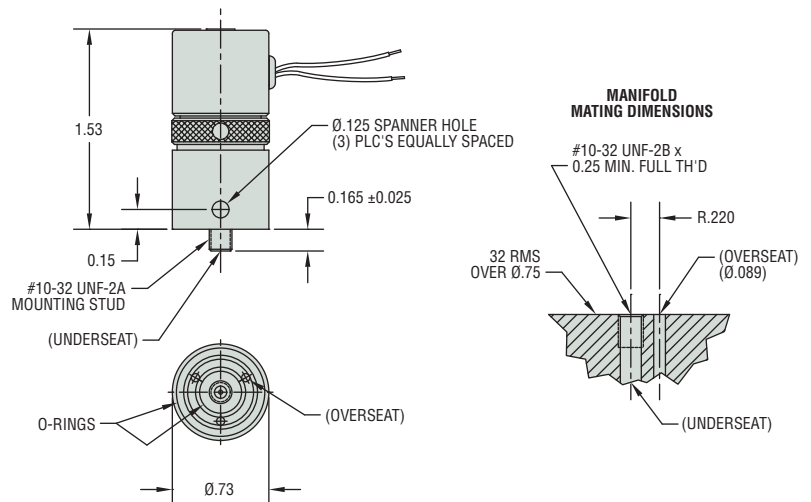
- Medical and Respiratory Healthcare
- Printing Machinery and Sorting Equipment
- Automated Packaging Equipment
- Air Monitoring Systems

### Dimensions

#### Threaded Port Body

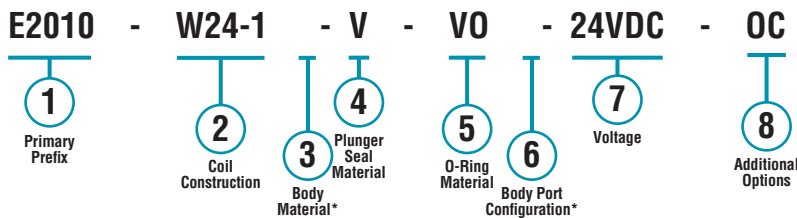


#### Manifold Mount Body



### How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.



\* Blank entry indicates a "Standard" selection (#10-32 straight thread ports, in this case).

#### Example:

E2010-W24-1-V-VO-24VDC-OC

E-Series 2-Way N.C. solenoid valve, with 24" lead-wires from an encapsulated coil, nickel-plated brass body, Viton® plunger seal, Viton® o-ring, #10-32 straight thread ports, operating at 24 VDC, and is cleaned for oxygen use.



Part Prefix Table ①

	Power Rating	Orifice		MOPD (psig)	C <sub>v</sub>		① Primary Prefix
		Body	Stop		Body	Stop	
2-WAY N.C.	0.65W	1/32	—	125	0.018	—	E2010
		3/64	—	70	0.023	—	E2011
		1/16	—	40	0.036	—	E2012
		5/64	—	20	0.070	—	E2013
	2W	1/32	—	175	0.018	—	EH2010
		3/64	—	150	0.023	—	EH2011
		1/16	—	100	0.036	—	EH2012
		5/64	—	50	0.070	—	EH2013
2-WAY N.O.	0.65W	—	1/32	125	—	0.018	E2210
		—	3/64	70	—	0.023	E2211
		—	1/16	40	—	0.032	E2212
	2W	—	1/32	175	—	0.018	EH2210
		—	3/64	150	—	0.023	EH2211
		—	1/16	100	—	0.032	EH2212
3-WAY N.C.	0.65W	1/32	1/32	125	0.018	0.018	E3010
		3/64	3/64	70	0.023	0.023	E3011
		1/16	1/16	40	0.036	0.032	E3012
	2W	1/32	1/32	175	0.018	0.018	EH3010
		3/64	3/64	150	0.023	0.023	EH3011
		1/16	1/16	100	0.036	0.032	EH3012
3-WAY N.O.	0.65W	1/32	1/32	125	0.018	0.018	E3210
		3/64	3/64	70	0.023	0.023	E3211
		1/16	1/16	40	0.036	0.032	E3212
	2W	1/32	1/32	175	0.018	0.018	EH3210
		3/64	3/64	150	0.023	0.023	EH3211
		1/16	1/16	100	0.036	0.032	EH3212
3-WAY Multi Purpose	0.65W	1/32	1/32	80	0.018	0.018	E3310
		3/64	3/64	40	0.023	0.023	E3311
		1/16	1/16	20	0.036	0.032	E3312
	2W	1/32	1/32	150	0.018	0.018	EH3310
		3/64	3/64	100	0.023	0.023	EH3311
		1/16	1/16	50	0.036	0.032	EH3312
3-WAY Directional Control	0.65W	1/32	1/32	135	0.018	0.018	E3410
		3/64	3/64	80	0.023	0.023	E3411
		1/16	1/16	45	0.036	0.032	E3412
	2W	1/32	1/32	190	0.018	0.018	EH3410
		3/64	3/64	165	0.023	0.023	EH3411
		1/16	1/16	80	0.036	0.032	EH3412

② Coil Construction

(blank) = Tape-wrapped, Class-B, with lead-wires (12" long)\*  
 W\_\_ = Lead-wires, non-standard length (specify in inches)  
 1 = Encapsulated coil  
 5 = Encapsulated coil with 0.110 spade terminals  
 10 = Rectified coil for AC voltage (2 watt only)

③ Body Material

(blank) = Nickel-plated brass\*

④ Plunger Seal Material

(blank) = Nitrile\*  
 V = Viton®  
 E = EPR  
 MQ = Silicone

⑤ O-Ring Material

(blank) = Nitrile\*  
 VO = Viton®  
 EO = EPR  
 MQO = Silicone

⑥ Body Port Configuration

(blank) = #10-32 straight thread ports\*  
 BM = M5 x 0.8 ports  
 MM = Manifold mount with #10-32 threaded stud†  
 MM2 = Manifold mount with M5 x 0.8 threaded stud†  
 BO = Bottom under-seat port (max orifice = 1/16")

⑦ Voltage

\_\_VDC = DC (specify voltage)  
 \_\_VAC = AC rectified 2-watt only (specify voltage)

⑧ Additional Options

OC = Cleaned for oxygen use  
 QQ = Quiet operation (2-way N.C.)  
 VAC = Vacuum application (0 to 29.5" Hg)

\* Standard selection; will be used unless otherwise specified.  
 Standard selections are not referenced in final part number.

† Teflon® o-ring not suitable for manifold mount.

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## G & GH Series – Subminiature

- ▶ MOPD: 250 PSI
- ▶  $C_v$  Range: 0.018 to 0.070
- ▶ 0.65 Watts or 2 Watts

This extremely versatile 2- or 3-way sub-miniature valve gives you the option of choosing the highly durable stainless steel or the lightweight corrosion resistant acetal body, to meet your overall design parameters. Select stainless steel or Delrin®, and other materials available to resist corrosion in most acids and alkaline solutions, or pick acetal for a tough and heat resistant metal substitute to meet your weight and chemical inert requirements.



### Typical Applications

Stainless Steel Bodies:

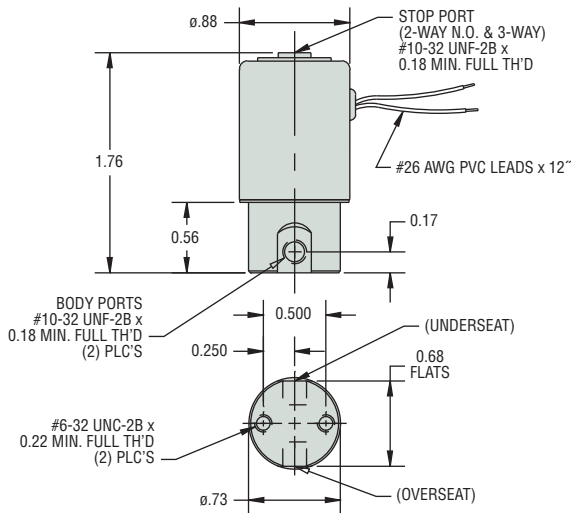
- Hospital Equipment
- Laboratory Equipment
- Air Sampling Systems

Acetal Bodies:

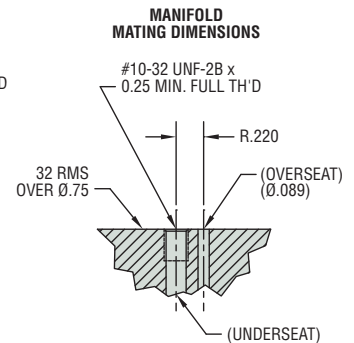
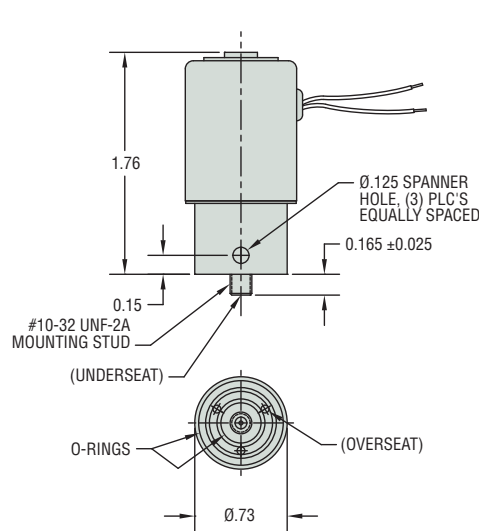
- Water Purification Systems
- Analytical Equipment

### Dimensions

#### Threaded Port Body

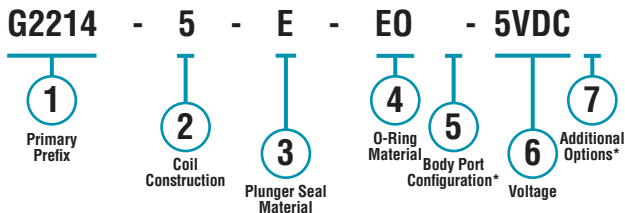


#### Manifold Mount Body



### How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.



\* Blank entry indicates a "Standard" selection  
(#10-32 straight thread ports, in this case).

#### Example:

G2214-5-E-EO-5VDC

G-Series 303 Stainless Steel 2-Way N.O. solenoid valve, with tape-wrapped, Class-B, with lead-wires (12" long), encapsulated coil with 0.110 spade terminals, EPR plunger seal, EPR o-ring, #10-32 straight thread ports, operating at 5 VDC.

Part Prefix Table ①

	Power Rating	Orifice		MOPD (psig)	C <sub>v</sub>		① Primary Prefix	
		Body	Stop		Body	Stop	303 Stainless Steel <sup>†</sup>	Acetal (#10-32 port only)
2-WAY N.C.	0.65W	0.030	—	125	0.018	—	G2012	G2032
		0.040	—	70	0.023	—	G2013	G2033
		0.055	—	40	0.038	—	G2014	G2034
		0.078	—	20	0.063	—	G2015	G2035
	2W	0.030	—	250	0.018	—	GH2012	GH2032
		0.040	—	175	0.023	—	GH2013	GH2033
		0.055	—	100	0.038	—	GH2014	GH2034
		0.078	—	50	0.063	—	GH2015	GH2035
2-WAY N.O.	0.65W	—	0.030	125	—	0.018	G2212	G2232
		—	0.040	70	—	0.023	G2213	G2233
		—	0.055	40	—	0.038	G2214	G2234
		—	0.078	20	—	0.057	G2215	G2235
	2W	—	0.030	200	—	0.018	GH2212	GH2232
		—	0.040	150	—	0.023	GH2213	GH2233
		—	0.055	100	—	0.038	GH2214	GH2234
		—	0.078	50	—	0.057	GH2215	GH2235
3-WAY N.C.	0.65W	0.030	0.030	125	0.018	0.018	G3012	G3032
		0.040	0.040	70	0.023	0.023	G3013	G3033
		0.055	0.055	40	0.038	0.038	G3014	G3034
		0.078	0.078	20	0.063	0.057	G3015	G3035
	2W	0.032	0.030	200	0.018	0.018	GH3012	GH3032
		0.040	0.040	150	0.023	0.023	GH3013	GH3033
		0.055	0.055	100	0.038	0.038	GH3014	GH3034
		0.078	0.078	50	0.063	0.057	GH3015	GH3035
3-WAY N.O.	0.65W	0.030	0.030	125	0.018	0.018	G3212	G3232
		0.040	0.040	70	0.023	0.023	G3213	G3233
		0.055	0.055	40	0.038	0.038	G3214	G3234
		0.078	0.078	20	0.057	0.057	G3215	G3235
	2W	0.030	0.030	175	0.018	0.018	GH3212	GH3232
		0.040	0.040	150	0.023	0.023	GH3213	GH3233
		0.055	0.055	80	0.038	0.038	GH3214	GH3234
		0.078	0.078	40	0.057	0.057	GH3215	GH3235
3-WAY Multi Purpose	0.65W	0.030	0.030	80	0.018	0.018	G3312	G3332
		0.040	0.040	40	0.023	0.023	G3313	G3333
		0.055	0.055	20	0.036	0.029	G3314	G3334
		0.078	0.078	10	0.063	0.053	G3315	G3335
	2W	0.030	0.030	110	0.018	0.018	GH3312	GH3332
		0.040	0.040	85	0.023	0.023	GH3313	GH3333
		0.055	0.055	50	0.036	0.029	GH3314	GH3334
		0.078	0.078	25	0.063	0.057	GH3315	GH3335
3-WAY Directional Control	0.65W	0.030	0.030	135	0.018	0.018	G3412	G3432
		0.040	0.040	80	0.023	0.023	G3413	G3433
		0.055	0.055	45	0.029	0.029	G3414	G3434
		0.078	0.078	20	0.063	0.055	G3415	G3435
	2W	0.030	0.030	190	0.018	0.018	GH3412	GH3432
		0.040	0.040	165	0.023	0.020	GH3413	GH3433
		0.055	0.055	80	0.038	0.038	GH3414	GH3434
		0.078	0.078	40	0.063	0.063	GH3415	GH3435

② Coil Construction

(blank) = Tape-wrapped, Class-B, with lead-wires (12" long)\*  
 W\_ = Lead-wires, non-standard length (specify in inches)  
 1 = Encapsulated coil  
 5 = Encapsulated coil with 0.110 spade terminals  
 10 = Rectified coil for AC voltage (2-watt only)

③ Plunger Seal Material

(blank) = Viton®\*  
 NB = Nitrile  
 E = EPR  
 N = Neoprene

④ O-Ring Material

(blank) = Viton®\*  
 NBO = Nitrile  
 EO = EPR  
 NO = Neoprene

⑤ Body Port Configuration

(blank) = #10-32 straight thread ports\*  
 LC = 1/8"-27 NPT ports (2-way valves only)<sup>2</sup>  
 BM = M5 x 0.8 ports<sup>2</sup>  
 MM = Manifold mount with #10-32 threaded stud<sup>2†</sup>  
 MM2 = Manifold mount with M5 x 0.8 threaded stud<sup>2†</sup>

⑥ Voltage

\_\_VDC = DC (specify voltage)  
 \_\_VAC = AC Rectified 2-watt only (specify voltage)

⑦ Additional Options

OC = Cleaned for oxygen use  
 TP = PTFE coated plunger  
 VAC = Vacuum application (0 to 29.5" Hg)

\* Standard selection; will be used unless otherwise specified. Standard selections are not referenced in final part number.

Notes

1. Use prefixes from this column if you plan to select a Body Port Configuration other than the #10-32 straight thread ports.
2. Not available on Acetal bodies.

<sup>†</sup> Teflon® o-ring not suitable for manifold mount.

Gems specializes in the design and manufacturing of custom solenoid valves and fluidic systems. If you don't see what you're looking for, or have a question, contact us at 800-378-1600 or info@gemssensors.com.

# A Series

- ▶ MOPD: 1000 PSI
- ▶ C<sub>v</sub> Range: 0.019 to 0.3
- ▶ 6 Watts

The A Series gives you a highly adaptable design for practically all applications requiring flow between C<sub>v</sub> 0.019 and 0.300. This robust 2- or 3-way miniature solenoid utilizes a stainless steel body to resist corrosion for most acids, alkaline solutions, and harsh environments. Also available in plastic—from polypropylene to Delrin®—when specific inert or demanding requirements are needed. Available in numerous port configurations, orifice sizes, and material combinations, the A Series is a highly flexible valve that fulfills the requirements for most applications.



## Typical Applications

Stainless Steel Bodies:

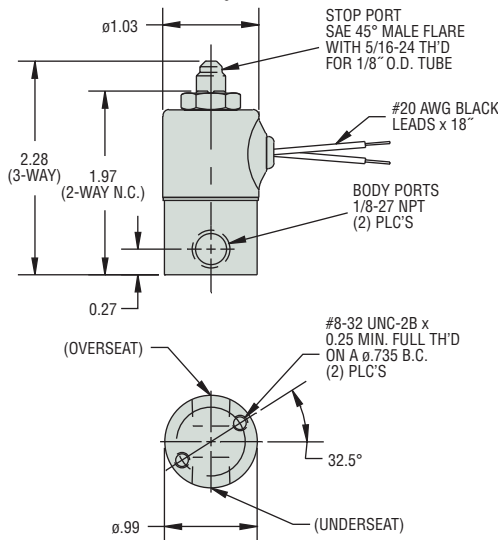
- Medical Equipment
- Laboratory Equipment
- Food Processing Equipment

Brass Bodies:

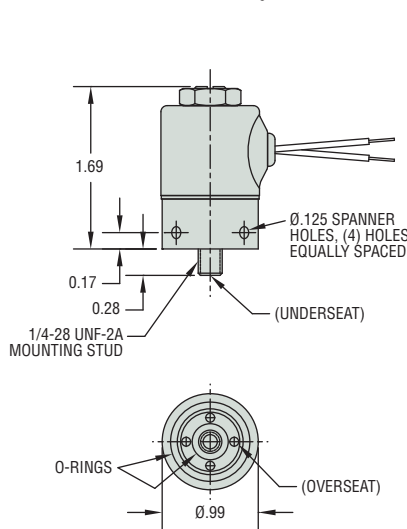
- Industrial Applications
- Automotive
- Water Transfer Systems

## Dimensions

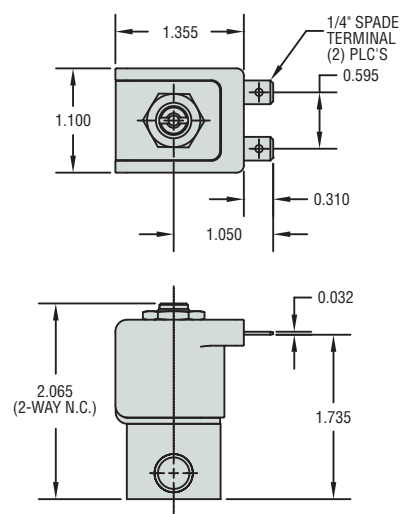
### Threaded Port Body



### Manifold Mount Body



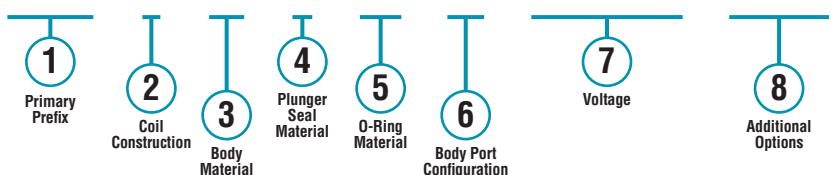
### Molded Coil



## How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.

**A2213 - 3 - BB - N - NO - LB - 110/60VAC - WM-TP**



Note: After the Primary Prefix, any "-Code" may be blank when standard (blank) selections are specified.

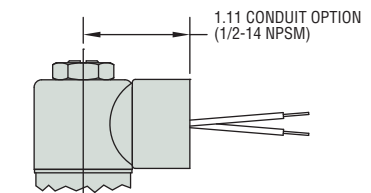
### Example:

A2213-3-BB-N-NO-LB-110/60VAC-WM-TP

2-Way N.O. (with 1/8"-27 NPT stop port adaptor) solenoid valve, with brass body, neoprene plunger seal, neoprene O-ring, 1/4"-18 FNPT body ports, operating at 110/60 VAC/Hz, and includes the mounting bracket and PTFE coated plunger options.

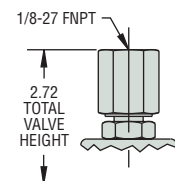
### Alternate 1/2" Conduit Housing

Available on all body configurations



### Stop Port

Standard on 2-way N.O.; Option "AD" on 3-Way.



Part Prefix Table ①

	Orifice		MOPD (psig)	C <sub>v</sub>		① Primary Prefix	
	Body	Stop		Body	Stop	Grommet Housing	Conduit Housing
2-WAY N.C.	1/32	—	1000	0.020	—	A2011	A2021
	3/64	—	500	0.035	—	A2012	A2022
	1/16	—	300	0.065	—	A2013	A2023
	5/64	—	200	0.090	—	A2014	A2024
	3/32	—	175	0.155	—	A2015	A2025
	1/8	—	100	0.240	—	A2016	A2026
	5/32	—	50	0.300	—	A2017	A2027
2-WAY N.O. (option AD standard)	—	1/32	200	—	0.019	A2211	A2221
	—	3/64	150	—	0.040	A2212	A2222
	—	1/16	100	—	0.075	A2213	A2223
3-WAY N.C. Free Vent	1/32	1/32	200	0.019	0.019	A3011	A3021
	3/64	3/64	150	0.040	0.040	A3012	A3022
	1/16	3/64	100	0.070	0.040	A3013	A3023
	1/16	1/16	75	0.070	0.070	A3014	A3024
	3/32	3/64	50	0.170	0.040	A3015	A3025
3-WAY N.C. Line Connection	1/32	1/32	200	0.019	0.019	A3111	A3121
	3/64	3/64	150	0.040	0.040	A3112	A3122
	1/16	3/64	100	0.070	0.040	A3113	A3123
	1/16	1/16	75	0.070	0.070	A3114	A3124
	3/32	3/64	50	0.170	0.040	A3115	A3125
3-WAY N.O.	1/32	1/32	150	0.019	0.019	A3211	A3221
	3/64	3/64	100	0.040	0.040	A3212	A3222
	1/16	3/64	90	0.070	0.040	A3213	A3223
	1/16	1/16	75	0.070	0.070	A3214	A3224
	3/32	3/64	50	0.170	0.040	A3215	A3225
3-WAY Multi Purpose	1/32	1/32	125	0.019	0.019	A3311	A3321
	3/64	3/64	100	0.040	0.040	A3312	A3322
	1/16	3/64	90	0.070	0.040	A3313	A3323
	1/16	1/16	75	0.070	0.070	A3314	A3324
	3/32	3/64	25	0.170	0.040	A3315	A3325
3-WAY Directional Control	1/32	1/32	225	0.019	0.019	A3411	A3421
	3/64	3/64	150	0.040	0.040	A3412	A3422
	1/16	3/64	100	0.070	0.040	A3413	A3423
	1/16	1/16	75	0.070	0.070	A3414	A3424
	3/32	3/64	50	0.155	0.040	A3415	A3425

② Coil Construction

- (blank) = Tape-wrapped, Class-B, with 18" lead wires\*
- W \_\_\_ = Tape-wrapped coil, lead-wires, non-standard length (specify length)
- 1M = Over molded coil, Class-B, lead-wires
- 2M = Over molded coil, Class-F, lead-wires
- 3M = Over molded coil, Class-H, lead-wires
- 4M = Over molded coil, Class-B, 1/4" spade terminals
- 5M = Over molded coil, Class F, 1/4" spade terminals
- 6M = Over molded coil Class H, 1/4" spade terminals
- 4 = Encapsulated coil, Class-B, 3/16" spade terminals
- 5 = Encapsulated coil, Class-B, 0.110" spade terminals
- 8 = Encapsulated coil, Class F, 3/16" spade terminals
- 10 = Externally rectified coil (lead wires only)
- 11 = Tape-wrapped coil, Class H, lead wires
- HC = molded coil, Class F, EN175301-803 Form B DIN, Industrial, 11mm, 2+1 poles
- HC2 = Encapsulated coil, Class B, EN175301-803 Form C DIN, Industrial, 9.4mm, 2+1 poles

③ Body Material

- (blank) = 303 Stainless Steel\*
- BB = Brass
- SB = 304 Stainless Steel
- SB5 = 316 Stainless Steel
- SBF = 430F Stainless Steel

④ Plunger Seal Material

- (blank) = Nitrile\*
- E = EPR
- GV = Gasoline Viton® (2-way valves only)
- N = Neoprene
- NS = Nitrile (NSF/FDA, 2-way valves only)
- PF = Perfluoroelastomer
- R = Rulon® (2-way valves only)
- T = PTFE
- V = Viton®

⑤ O-Ring Material

- (blank) = Nitrile\*
- EO = EPR
- NO = Neoprene
- NSO = Nitrile (NSF/FDA, 2-way valves only)
- PFO = Perfluoroelastomer
- TO = PTFE
- VO = Viton®

⑥ Body Port Configuration

- (blank) = 1/8-27 NPT female thread\*
- LB = 1/4-18 NPT female thread
- BD = #10-32 female straight thread (max. orifice = 1/8")
- LT = 1/8-28 BSPT female thread (2-way valves only)
- LU = 1/4-19 BSPT female thread (2-way valves only)
- MM = Manifold mount (1/4-28 UNF-2A mounting stud)†††
- MM3 = Manifold mount (5/16-24 UNF-2A mounting stud)†††
- OB = Omit body (operator style)
- MB = Bottom metering (max. orifice = 3/32")
- BI = Bottom over-seat port, female thread (max. orifice = 1/8")
- BIM = Bottom over-seat port, 1/8-27 NPT male thread (max orifice = 5/64") brass body only
- BO = Bottom under-seat port, female thread
- BOM = Bottom under-seat port, 1/8-27 NPT male thread (max orifice = 1/8") brass body only
- RL = 90° porting - left hand
- RR = 90° porting - right hand
- BS = Stop port, #10-32 female straight thread†

⑦ Voltage†† (see note below)

- \_\_\_ VDC = DC (specify DC voltage)
- \_\_\_ VAC = AC (specify AC voltage; includes copper shading ring)

⑧ Additional Options

- Y = Yoke
- WM = Mounting bracket
- TP = PTFE coated plunger
- AD = 1/8 - 27 NPT stop port adapter (3-way valves only)
- QO = Quiet operation (2-way valves only)
- S = Silver shading ring
- OC = Cleaned for oxygen use
- VAC = Vacuum application (0 to 29.5" Hg)
- G1 = One-piece 303 Stainless Steel guide assembly
- G5 = One piece 316 Stainless Steel guide assembly

\* Standard selection; will be used unless otherwise specified. Standard selections are not referenced in final part number.

† Plastic body available, contact Gems.  
 †† Can be AC rectified without shading ring. Use coil construction Code 10.  
 ††† Teflon® o-ring not suitable for manifold mount.

Gems specializes in the design and manufacturing of custom solenoid valves and fluidic systems. If you don't see what you're looking for, or have a question, contact us at 800-378-1600 or info@gemssensors.com.



## B Series – Modular

- ▶ MOPD: 400 PSI
- ▶  $C_v$  Range: 0.018 to 0.430
- ▶ 7 Watts

The B Series is a direct acting solenoid valve, available in 2- or 3-way functionality. Like all of our valves, the B Series has bubble tight plunger construction and is designed to last for millions of cycles in general purpose liquid, gas, and vacuum applications. The B Series is available in various orifice sizes, a variety of body materials, wattages, and coil constructions for the utmost adaptability to your application requirements. The B Series is an excellent choice for most general-purpose application requiring a  $C_v$  of 0.018 to 0.430.

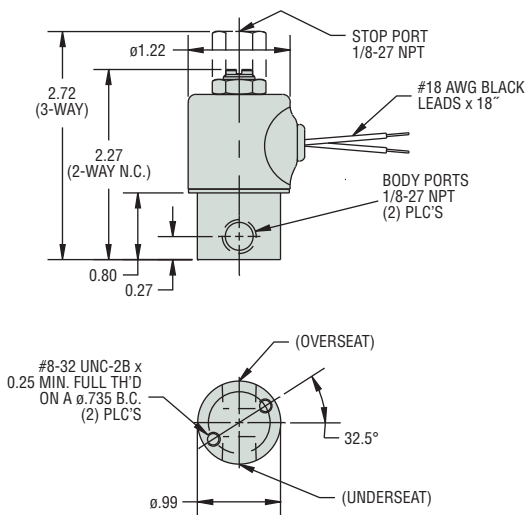


### Typical Applications

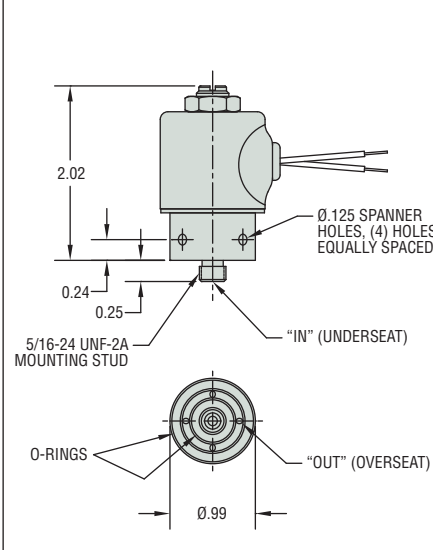
- Printing
- HVAC
- Semiconductor Equipment
- Medical Equipment

### Dimensions

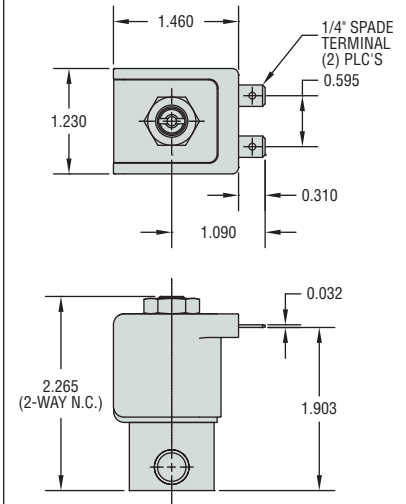
#### Threaded Port Body



#### Manifold Mount Body

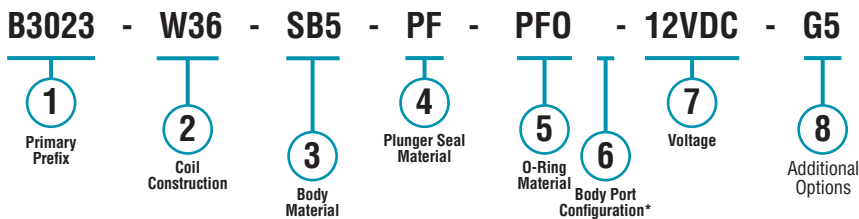


#### Molded Coil



### How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.



\* Blank entry indicates a "Standard" selection (1/8-27 NPT female thread, in this case).

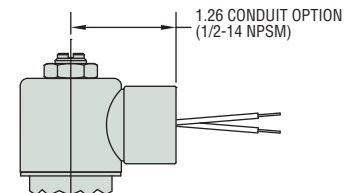
#### Example:

B3023-W36-SB5-PF-PFO-12VDC-G5

2-Way N.C. Free Vent (with 1.26 Conduit Option) solenoid valve, with 36" tape-wrapped coil, lead-wired, non-standard length, 316 stainless steel body, perfluoroelastomer plunger seal, perfluoroelastomer o-ring, 1/8-27 NPT female thread, operating at 12 VDC, and includes a one piece 316 stainless steel guide assembly option.

#### Alternate 1/2" Conduit Housing

Available on all body configurations





Part Prefix Table ①

	Orifice		MOPD (psig)	C <sub>v</sub>		① Primary Prefix	
	Body	Stop		Body	Stop	Grommet Housing	Conduit Housing
2-WAY N.C.	1/16	—	400	0.065	—	B2011	B2021
	5/64	—	300	0.090	—	B2012	B2022
	3/32	—	250	0.155	—	B2013	B2023
	7/64	—	200	0.200	—	B2014	B2024
	1/8	—	150	0.240	—	B2015	B2025
	5/32	—	100	0.300	—	B2016	B2026
	3/16	—	50	0.430	—	B2017	B2027
2-WAY N.O.	—	1/32	400	—	0.019	B2211	B2221
	—	3/64	300	—	0.040	B2212	B2222
	—	1/16	200	—	0.075	B2213	B2223
	—	5/64	150	—	0.090	B2214	B2224
3-WAY N.C. Free Vent	1/32	1/32	250	0.018	0.018	B3011	B3021
	3/64	3/64	175	0.040	0.040	B3012	B3022
	1/16	1/16	125	0.065	0.070	B3013	B3023
	5/64	5/64	100	0.090	0.090	B3014	B3024
	3/32	5/64	75	0.155	0.090	B3015	B3025
	1/8	5/64	50	0.240	0.090	B3016	B3026
	5/32	5/64	15	0.300	0.090	B3017	B3027
3-WAY N.C. Line Connection	1/32	1/32	250	0.018	0.018	B3111	B3121
	3/64	3/64	175	0.040	0.040	B3112	B3122
	1/16	1/16	125	0.065	0.070	B3113	B3123
	5/64	5/64	100	0.090	0.090	B3114	B3124
	3/32	5/64	75	0.155	0.090	B3115	B3125
	1/8	5/64	50	0.240	0.090	B3116	B3126
3-WAY N.O.	1/32	1/32	200	0.018	0.018	B3211	B3221
	3/64	3/64	150	0.040	0.040	B3212	B3222
	1/16	1/16	125	0.065	0.070	B3213	B3223
	5/64	5/64	100	0.090	0.090	B3214	B3224
	3/32	5/64	75	0.155	0.090	B3215	B3225
	1/8	5/64	50	0.240	0.090	B3216	B3226
3-WAY Multi Purpose	5/32	5/64	15	0.300	0.090	B3217	B3227
	1/32	1/32	175	0.018	0.018	B3311	B3321
	3/64	3/64	125	0.040	0.040	B3312	B3322
	1/16	1/16	100	0.065	0.070	B3313	B3323
	5/64	5/64	75	0.090	0.090	B3314	B3324
	3/32	5/64	50	0.155	0.090	B3315	B3325
3-WAY Directional Control	1/8	5/64	25	0.240	0.090	B3316	B3326
	5/32	5/64	15	0.300	0.090	B3317	B3327
	1/32	1/32	275	0.018	0.018	B3411	B3421
	3/64	3/64	200	0.040	0.040	B3412	B3422
	1/16	1/16	150	0.065	0.070	B3413	B3423
	5/64	5/64	100	0.090	0.090	B3414	B3424
	3/32	5/64	75	0.155	0.090	B3415	B3425
	1/8	5/64	50	0.240	0.090	B3416	B3426
	5/32	5/64	25	0.300	0.090	B3417	B3427

② Coil Construction

- (blank) = Tape-wrapped, Class-B, with 18" lead wires\*
- W\_\_\_ = Tape-wrapped coil, lead-wires, non-standard length (specify length)
- 1M = Over molded coil, Class-B, lead-wires
- 2M = Over molded coil, Class-F, lead-wires
- 3M = Over molded coil, Class-H, lead-wires
- 4M = Over molded coil, Class-B, 1/4" spade terminals
- 5M = Over molded coil, Class F, 1/4" spade terminals
- 6M = Over molded coil Class H, 1/4" spade terminals
- 4 = Encapsulated coil, Class-B, 3/16" spade terminals
- 5 = Encapsulated coil, Class-B, 0.110" spade terminals
- 8 = Encapsulated coil, Class F, 3/16" spade terminals
- 10 = Externally rectified coil (lead wires only)
- 11 = Tape-wrapped coil, Class H, lead wires

② Coil Construction, continued

- HC = molded coil, Class F, EN175301-803 Form B DIN, Industrial, 11mm, 2+1 poles
- HC2 = Encapsulated coil, Class B, EN175301-803 Form C DIN, Industrial, 9.4mm, 2+1 poles
- TK = Higher efficiency coil (2-way N.C. only)

③ Body Material

- (blank) = 303 Stainless Steel\*
- BB = Brass
- SB = 304 Stainless Steel
- SB5 = 316 Stainless Steel
- SBF = 430F Stainless Steel

④ Plunger Seal Material

- (blank) = Nitrile\*
- E = EPR
- GV = Gasoline Viton® (2-way N.C. only)
- N = Neoprene
- NS = Nitrile (NSF/FDA material)
- PF = Perfluoroelastomer
- R = Rulon® (2-way N.C. only)
- T = PTFE
- V = Viton®

⑤ O-Ring Material

- (blank) = Nitrile\*
- EO = EPR
- NO = Neoprene (NSF/FDA material)
- NSO = Nitrile (NSF/FDA material)
- PFO = Perfluoroelastomer
- TO = PTFE
- VO = Viton®

⑥ Body Port Configuration

- (blank) = 1/8-27 NPT female thread\*
- LB = 1/4-18 NPT female thread
- BD = #10-32 female straight thread (max. orifice = 1/8")
- LT = 1/8-28 BSPT female thread
- LU = 1/4-19 BSPT female thread (2-way N.C. only)
- MM = Manifold mount (1/4-28 UNF-2A mounting stud)†††
- MM3 = Manifold mount (5/16-24 UNF-2A mounting stud)†††
- OB = Omit body (operator style)
- MB = Bottom metering (2-way N.C. only)
- BI = Bottom over-seat port, female thread (max. orifice = 1/8")
- BIM = Bottom over-seat port, 1/8-27 NPT male thread (max. orifice = 5/64", brass body only)
- BO = Bottom under-seat port, female thread
- BOM = Bottom under-seat port, 1/8-27 NPT male thread (max. orifice = 1/8", brass body only)
- RL = 90° porting - left hand
- RR = 90° porting - right hand
- BS = Stop port, #10-32 female straight thread

⑦ Voltage†† (see note below)

- \_\_\_VDC = DC (specify DC voltage)
- \_\_\_VAC = AC (specify AC voltage; includes copper shading ring)

⑧ Additional Options

- Y = Yoke (2-way N.C. only)
- WM = Mounting bracket
- TP = PTFE coated plunger
- QO = Quiet operation (2-way N.C. only)
- S = Silver shading ring
- OC = Cleaned for oxygen use
- VAC = Vacuum application (0 to 29.5" Hg)
- G1 = One-piece 303 Stainless Steel guide assembly (standard on 2-way normally open and all 3-way valves)
- G5 = One piece 316 Stainless Steel guide assembly
- SH = 1" Diameter housing, grommet
- SC = 1" Diameter housing, conduit

\* Standard selection; will be used unless otherwise specified. Standard selections are not referenced in final part number.

† Internal rectified available. Consult factory.

†† Can be AC rectified without shading ring. Use coil construction Code 10.

††† Teflon® o-ring not suitable for manifold mount.

# C Series – High Flow

- ▶ MOPD: 400 PSI
- ▶  $C_v$  Range: 0.019 to 0.420
- ▶ 7 Watts

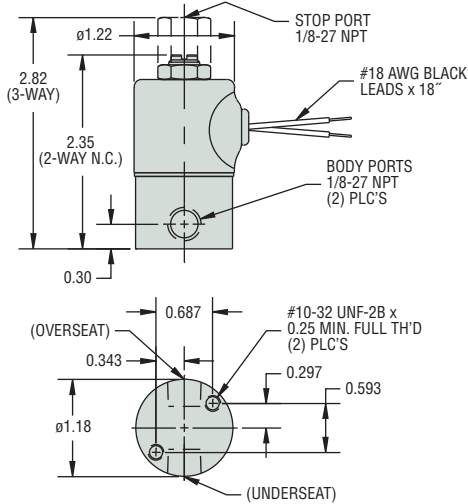
The C Series, available only in brass, is a highly durable miniature 2- or 3-way direct acting valve for applications that require a higher flow control. The C Series also utilizes a larger diameter body and larger port connections for higher  $C_v$  valves rates. The free machining brass body allows for fast and precise machining, translating into lower product costs as compared to stainless steel. Design engineers appreciate the quality inherent in solid brass components.

## Typical Applications

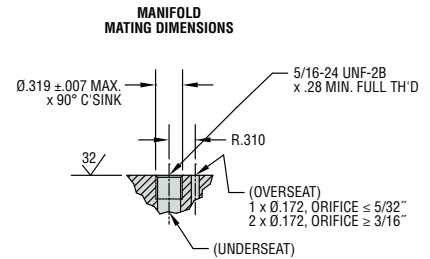
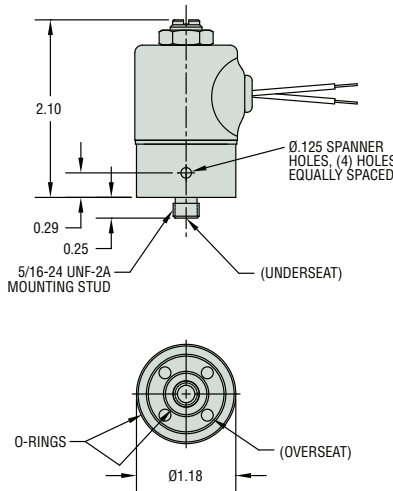
- Therapeutic Beds
- Automotive Applications
- Packaging Equipment

## Dimensions

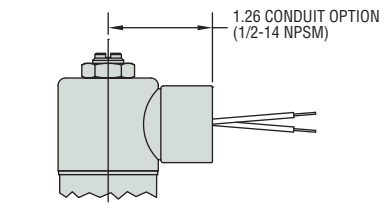
### Threaded Port Body



### Manifold Mount Body



### Alternate 1/2" Conduit Housing Available on all body configurations



## How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.

<b>C2016</b>	-	<b>11</b>	-	<b>E</b>	-	<b>EO</b>	-	<b>LB</b>	-	<b>48VDC</b>	-	<b>VAC</b>		
<b>1</b>		<b>2</b>		<b>3</b>		<b>4</b>		<b>5</b>		<b>6</b>		<b>7</b>		<b>8</b>
Primary Prefix		Coil Construction		Body Material*		Plunger Seal Material		O-Ring Material		Body Port Configuration		Voltage		Additional Options

\* Blank entry indicates a "Standard" selection (Brass, in this case).

### Example:

C2016-11-E-EO-LB-48VDC-VAC

2-Way N.C. solenoid valve, with tape-wrapped coil, Class-H, lead-wires, brass body, EPR plunger seal, EPR o-ring, 1/4-18 NPT female thread, operating at 48 VDC, and includes a vacuum application (0 to 29.5" Hg) option.



Part Prefix Table ①

	Orifice		MOPD (psig)	C <sub>v</sub>		① Primary Prefix	
	Body	Stop		Body	Stop	Grommet Housing	Conduit Housing
2-WAY N.C.	1/16	—	400	0.080	—	C2011	C2021
	7/64	—	200	0.180	—	C2012	C2022
	1/18	—	150	0.240	—	C2013	C2023
	5/32	—	100	0.300	—	C2014	C2024
	3/16	—	75	0.360	—	C2015	C2025
	7/32	—	40	0.420	—	C2016	C2026
2-WAY N.O.	—	1/32	400	—	0.019	C2211	C2221
	—	3/64	300	—	0.040	C2212	C2222
	—	1/16	200	—	0.075	C2213	C2223
	—	5/64	150	—	0.105	C2214	C2224
3-WAY N.C. Free Vent	1/16	1/16	125	0.080	0.075	C3011	C3021
	5/64	5/64	100	0.105	0.105	C3012	C3022
	1/8	5/64	50	0.240	0.105	C3013	C3023
	3/16	5/64	25	0.360	0.105	C3014	C3024
	7/32	5/64	VAC	0.420	0.105	C3015	C3025
3-WAY N.C. Line Connection	1/16	1/16	125	0.080	0.075	C3111	C3121
	5/64	5/64	100	0.105	0.105	C3112	C3122
	1/8	5/64	50	0.240	0.105	C3113	C3123
	3/16	5/64	25	0.360	0.105	C3114	C3124
	7/32	5/64	VAC	0.420	0.105	C3115	C3125
3-WAY N.O.	1/16	1/16	125	0.080	0.075	C3211	C3221
	5/64	5/64	100	0.105	0.105	C3212	C3222
	1/8	5/64	75	0.240	0.105	C3213	C3223
	3/16	5/64	40	0.360	0.105	C3214	C3224
	7/32	5/64	VAC	0.420	0.105	C3215	C3225
3-WAY Multi Purpose	1/16	1/16	100	0.080	0.075	C3311	C3321
	5/64	5/64	75	0.105	0.105	C3312	C3322
	1/8	5/64	25	0.240	0.105	C3313	C3323
	3/16	5/64	10	0.360	0.105	C3314	C3324
	7/32	5/64	5	0.420	0.105	C3315	C3325
3-WAY Directional Control	1/16	1/16	150	0.080	0.075	C3411	C3421
	5/64	5/64	100	0.105	0.105	C3412	C3422
	1/8	5/64	50	0.240	0.105	C3413	C3423
	3/16	5/64	25	0.360	0.105	C3414	C3424
	7/32	5/64	5	0.420	0.105	C3415	C3425

② Coil Construction

- (blank) = Tape-wrapped, Class-B, with 18" lead-wires\*
- W\_\_ = Tape-wrapped coil, lead-wires, non-standard length (specify in inches)
- 1 = Encapsulated coil, Class-B, lead-wires
- 3 = Encapsulated coil, Class-H, lead-wires
- 4 = Encapsulated coil, Class-B, 1/4" spade terminals (3/16" spade optional)
- 10 = Externally rectified coil (lead-wires only)
- 11 = Tape-wrapped coil, Class-H, lead-wires
- HC2 = Encapsulated coil, Class-B, EN175301-803 Style C, Industrial, 9.4mm, 2+1 poles

③ Body Material

- (blank) = Brass\*
- SB = 304 Stainless Steel
- SB1 = 303 Stainless Steel
- SB5 = 316 Stainless Steel
- SBF = 430F Stainless Steel

④ Plunger Seal Material

- (blank) = Nitrile\*
- E = EPR
- GV = Gasoline Viton® (2-way N.C. only)
- N = Neoprene
- NS = Nitrile (NSF/FDA material)
- PF = Perfluoroelastomer
- R = Rulon® (2-way N.C. only)
- T = PTFE
- V = Viton®

⑤ O-Ring Material

- (blank) = Nitrile\*
- EO = EPR
- NO = Neoprene
- NSO = Nitrile (NSF/FDA material)
- PFO = Perfluoroelastomer
- TO = PTFE
- VO = Viton®

⑥ Body Port Configuration

- (blank) = 1/8-27 NPT female thread\*
- LB = 1/4-18 NPT female thread
- BD = #10-32 female straight thread (2-way N.C. only, max. orifice = 1/8")
- LU = 1/4-19 BSPT female thread (2-way N.C. only)
- OB = Omit body (operator style)
- BO = Bottom under-seat port, female thread
- RL = 90° porting - left hand
- RR = 90° porting - right hand
- MM4 = Manifold mount (5/16-24 UNF-2A mounting stud)††
- BS = Stop port, #10-32 female straight thread

⑦ Voltage<sup>†</sup> (see note below)

- \_\_VDC = DC (specify voltage)
- \_\_VAC = AC (specify voltage; includes copper shading ring)

⑧ Additional Options

- WM = Mounting bracket
- TP = PTFE coated plunger
- QO = Quiet operation (2-way normally closed valves only)
- S = Silver shading ring
- OC = Cleaned for oxygen use
- VAC = Vacuum application (0 to 29.5" Hg)
- GT = One-piece 303 Stainless Steel guide assembly (standard on 2-way normally open and all 3-way valves)
- G5 = One piece 316 Stainless Steel guide assembly

\* Standard selection; will be used unless otherwise specified. Standard selections are not referenced in final part number.

<sup>†</sup> Can be AC rectified without shading ring. Use coil construction Code 10.  
<sup>††</sup> Teflon® o-ring not suitable for manifold mount.

Gems specializes in the design and manufacturing of custom solenoid valves and fluidic systems. If you don't see what you're looking for, or have a question, contact us at 800-378-1600 or info@gemssensors.com.

# D Series – High Flow

- ▶ MOPD: 900 PSI
- ▶  $C_v$  Range: 0.045 to 0.880
- ▶ 10 Watts

For maximum flow in a miniature solenoid valve the D Series valves delivers a wide range of  $C_v$  values and maximum operating pressures. The D Series is also available in multiple body materials, seal materials, coil constructions, voltages, and wattages. Proven to perform for millions of cycles without failure, the D valve—as with the entire valve series—is ideal for manifold configurations, sub-assemblies, and complete fluidic systems. The D Series is the largest in a progression—A Series, B Series, and C Series—of the highly flexible, modular design, (general purpose) valves.

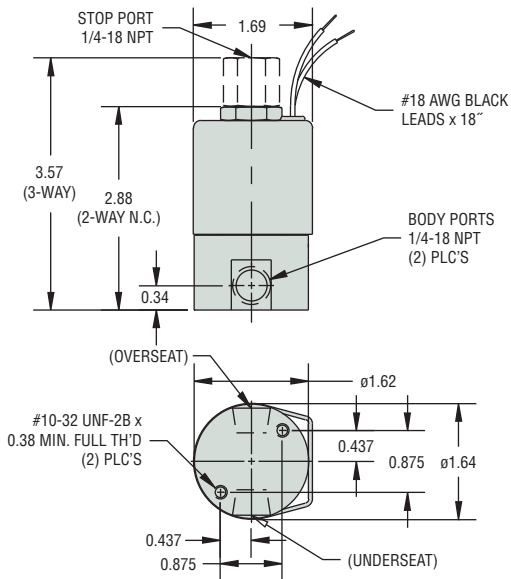


## Typical Applications

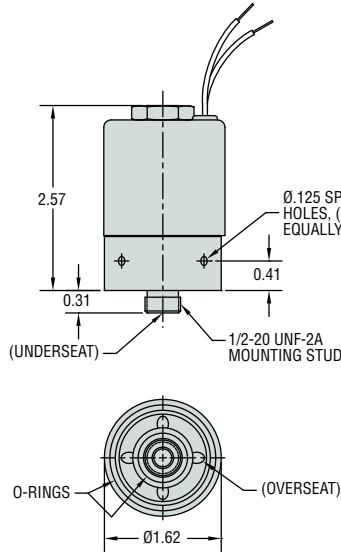
- Agriculture
- Defense
- Sterilization Equipment
- Industrial Automation

## Dimensions

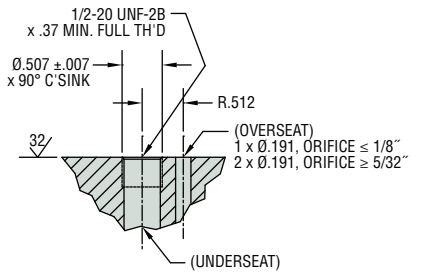
### Threaded Port Body



### Manifold Mount Body

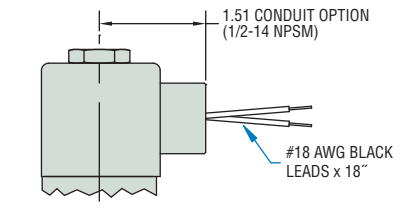


### MANIFOLD MATING DIMENSIONS



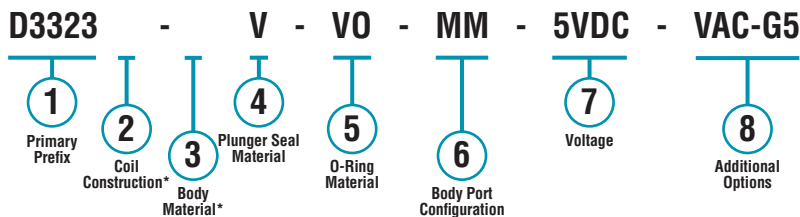
### Alternate 1/2" Conduit Housing

Available on all body configurations



## How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.



\* Blank entry indicates a "Standard" selection (Tape-wrapped, Class-B, with 18" lead-wires and 430F Stainless Steel, in this case).

### Example:

D3323-V-VO-MM-5VDC-VAC-G5

3-Way Multi Purpose (with 1.26 Conduit Option) solenoid valve, with tape-wrapped, Class-B, with 18" lead-wires, 430F stainless steel body, Viton® plunger seal, Viton® o-ring, manifold mount (1/2-20 UNF-2A mounting stud, max. orifice = 14"), operating at 5 VDC, and includes vacuum application (0 to 29.5" Hg) and one piece 316 stainless steel guide assembly options.

Part Prefix Table ①

	Orifice		MOPD (psig)	C <sub>v</sub>		① Primary Prefix	
	Body	Stop		Body	Stop	Grommet Housing	Conduit Housing
2-WAY N.C.	3/64	—	900	0.045	—	D2011	D2021
	1/16	—	650	0.080	—	D2012	D2022
	3/32	—	350	0.150	—	D2013	D2023
	1/8	—	225	0.210	—	D2014	D2024
	5/32	—	130	0.380	—	D2015	D2025
	3/16	—	85	0.430	—	D2016	D2026
	1/4	—	50	0.700	—	D2017	D2027
	5/16	—	20	0.850	—	D2018	D2028
2-WAY N.O.	3/8	—	10	0.880	—	D2019	D2029
	—	3/64	900	—	0.045	D2211	D2221
	—	1/16	550	—	0.080	D2212	D2222
	—	5/64	300	—	0.110	D2213	D2223
	—	3/32	175	—	0.150	D2214	D2224
3-WAY N.C. Free Vent	—	1/8	110**	—	0.210	D2215	D2225
	—	5/32	60**	—	0.380	D2216	D2226
	1/16	1/16	175	0.080	0.080	D3011	D3021
	5/64	5/64	150	0.110	0.110	D3012	D3022
	3/32	3/32	125	0.150	0.150	D3013	D3023
	1/8	1/8	85**	0.210	0.210	D3014	D3024
3-WAY N.C. Line Connection	5/32	5/32	45**	0.380	0.380	D3015	D3025
	3/16	5/32	30**	0.430	0.380	D3016	D3026
	1/4	5/32	10**	0.700	0.380	D3017	D3027
	1/16	1/16	175	0.080	0.080	D3111	D3121
	5/64	5/64	150	0.110	0.110	D3112	D3122
	3/32	3/32	125	0.150	0.150	D3113	D3123
	1/8	1/8	85**	0.210	0.210	D3114	D3124
3-WAY N.O.	5/32	5/32	45**	0.380	0.380	D3115	D3125
	3/16	5/32	30**	0.430	0.380	D3116	D3126
	1/4	5/32	10**	0.700	0.380	D3117	D3127
	1/16	1/16	200	0.080	0.080	D3211	D3221
	5/64	5/64	175	0.110	0.110	D3212	D3222
	3/32	3/32	150	0.150	0.150	D3213	D3223
3-WAY Multi Purpose	1/8	1/8	100**	0.210	0.210	D3214	D3224
	5/32	5/32	50**	0.380	0.380	D3215	D3225
	3/16	5/32	35**	0.430	0.380	D3216	D3226
	1/4	5/32	15**	0.700	0.380	D3217	D3227
	1/16	1/16	160	0.080	0.080	D3311	D3321
	5/64	5/64	130	0.110	0.110	D3312	D3322
3-WAY Directional Control	3/32	3/32	110	0.150	0.150	D3313	D3323
	1/8	1/8	75**	0.210	0.210	D3314	D3324
	5/32	5/32	40**	0.380	0.380	D3315	D3325
	3/16	5/32	25**	0.430	0.380	D3316	D3326
	1/4	5/32	10**	0.700	0.380	D3317	D3327
3-WAY Directional Control	1/16	1/16	225	0.080	0.080	D3411	D3421
	5/64	5/64	185	0.110	0.110	D3412	D3422
	3/32	3/32	150	0.150	0.150	D3413	D3423
	1/8	1/8	110**	0.210	0.210	D3414	D3424
	5/32	5/32	60**	0.380	0.380	D3415	D3425
	3/16	5/32	40**	0.430	0.380	D3416	D3426
	1/4	5/32	20**	0.700	0.380	D3417	D3427

\*\* DC or rectified coil only

② Coil Construction

(blank) = Tape-wrapped, Class-B, with 18" lead-wires\*

W\_\_ = Tape-wrapped coil, lead-wires, non-standard length (specify in inches)

1 = Encapsulated coil, Class-B, lead-wires

2 = Molded coil, Class-F, lead-wires

3 = Encapsulated coil, Class-H, lead-wires

4 = Encapsulated coil, Class-B, 1/4" spade terminals

10 = Externally rectified coil (lead-wires only)

11 = Tape-wrapped coil, Class-H, lead-wires

HC = Encapsulated coil, Class-B, EN175301-803 Style A, Industrial, 18mm, 2+1 poles

HC2 = Encapsulated coil, Class-B, EN175301-803 Style C, Industrial, 9.4mm, 2+1 poles

③ Body Material

(blank) = 430F Stainless Steel\*

BB = Brass

SB1 = 303 Stainless Steel

SB5 = 316 Stainless Steel

④ Plunger Seal Material

(blank) = Nitrile\*

E = EPR

GV = Gasoline Viton® (2-way normally open and 3-way valves max. orifice = 3/32")

N = Neoprene (2-way normally closed valves only, max. orifice = 1/4")

NS = Nitrile (NSF/FDA, max. orifice = 1/4")

PF = Perfluoroelastomer (max. orifice = 1/4")

R = Rulon® (2-way normally closed valves only, max. orifice = 1/4")

T = PTFE (max. orifice = 1/4")

V = Viton®

⑤ O-Ring Material

(blank) = Nitrile\*

EO = EPR

NO = Neoprene

NSO = Nitrile (NSF/FDA, 2-way valves only)

PFO = Perfluoroelastomer

TO = PTFE

VO = Viton®

⑥ Body Port Configuration

(blank) = 1/4-18 NPT female thread\*

LC = 1/8-27 NPT female thread (max. orifice = 5/16")

LD = 3/8-18 NPT female thread

LT = 1/8-28 BSPT female thread (max. orifice = 5/16")

LU = 1/4-19 BSPT female thread

MM = Manifold mount (1/2-20 UNF-2A mounting stud, max. orifice = 1/4")††

OB = Omit body (operator style)

BI = Bottom over-seat port, female thread (max. orifice = 1/4")

BO = Bottom under-seat port, female thread

⑦ Voltage† (see note below)

\_\_VDC = DC (specify voltage)

\_\_VAC = AC (specify voltage; includes copper shading ring)

⑧ Additional Options

WM = Mounting bracket on the coil housing

TP = PTFE coated plunger

CP = Chamfered plunger

QO = Quiet operation (2-way valves only)

S = Silver shading ring

OC = Cleaned for oxygen use

VAC = Vacuum application (0 to 29.5" Hg)

G5 = One piece 316 Stainless Steel guide assembly

\* Standard selection; will be used unless otherwise specified. Standard selections are not referenced in final part number.

† Can be AC rectified without shading ring. Use coil construction Code 10.

†† Teflon® o-ring not suitable for manifold mount.



## AS Series

- ▶ MOPD: 110 PSI (Plastic Body) or 150 PSI (Metal Body)
- ▶  $C_v$  Range: 0.020 to 0.300
- ▶ 4.5 Watts (Plastic Body) or 7 Watts (Metal Body)

The AS Series is a 2-way isolation valve, designed to control the flow of various aggressive liquids and gases with several body and diaphragm materials. With a modular design, the AS offers performance flexibility and the protection your media needs from the solenoid's internal components. Numerous port configurations, voltage options, and coil constructions enable the AS Series to be a truly versatile miniature inert isolation valve, easily integrated into any complex or demanding system.

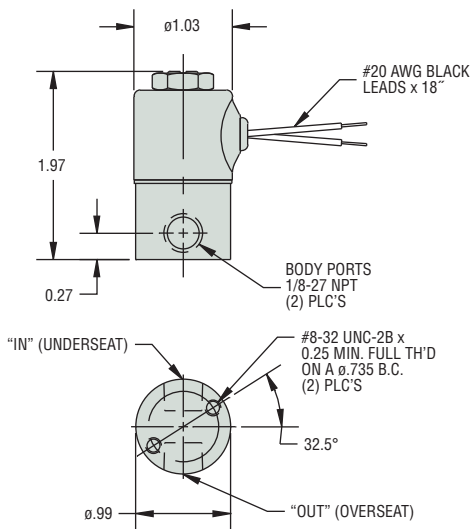
### Typical Applications

- Analytical Instruments
- Clinical Diagnostic Analyzers
- Bio-Instrumentation

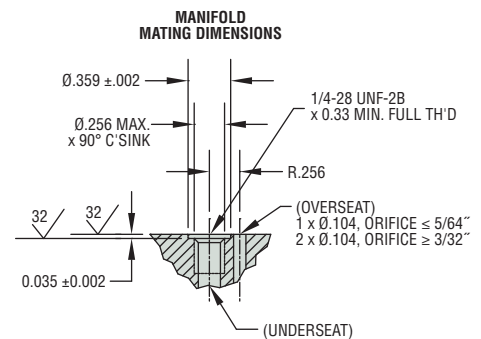
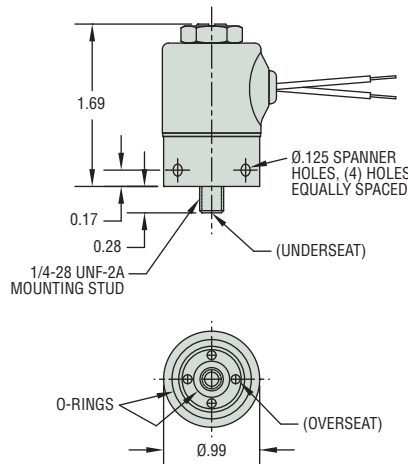


### Dimensions

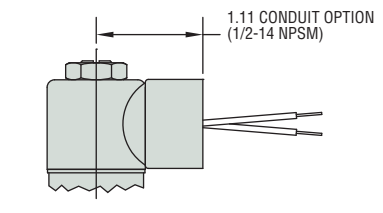
#### Threaded Port Body



#### Manifold Mount Body

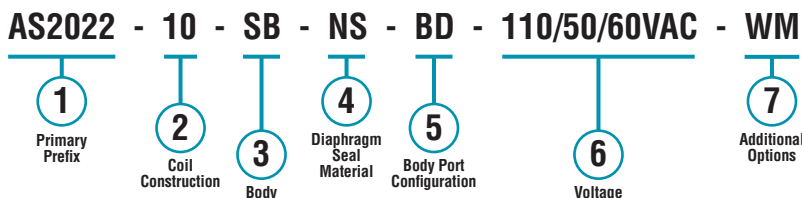


#### Alternate 1/2" Conduit Housing Available on all body configurations



### How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.



#### Example:

AS2022-10-SB-NS-BD-110/50/60VAC-WM

2-Way N.C. (1/2" conduit housing) solenoid valve, with externally rectified coil (lead-wires only), 304 stainless steel body, nitrile (NSF/FDA) diaphragm seal, #10-32 female straight thread, operating at 110/50/60 Volt AC with rectified coil and mounting bracket.

#### Notes

1. After the Primary Prefix, any "-Code" may be blank when standard (blank) selections are specified.
2. The Body Material option code, when specified, supercedes the standard body material indicated by the Primary Prefix.



Part Prefix Table ①

Body Material	Orifice	MOPD (psig)	Max Back Pressure	C <sub>v</sub>	① Primary Prefix	
	Body				BODY	Grommet Housing
303 Stainless Steel <sup>1</sup>	1/32	150	10	0.020	AS2011	AS2021
	3/64	110	10	0.035	AS2012	AS2022
	1/16	90	10	0.065	AS2013	AS2023
	5/64	70	10	0.090	AS2014	AS2024
	3/32	45	10	0.155	AS2015	AS2025
	1/8	15	5	0.240	AS2016	AS2026
	5/32	5	5	0.300	AS2017	AS2027
Polypropylene (1/8-27 NPT Female Thread body port only)	3/64	110	10	0.035	AS2032	AS2042
	1/8	15	10	0.240	AS2036	AS2046

\* Other body orifice sizes may be available, consult factory.

### ② Coil Construction

(blank) = Tape-wrapped, Class-B, with 18" lead-wires\*

W\_\_ = Tape-wrapped coil, lead-wires, non-standard length (specify in inches)

1 = Encapsulated coil, Class-B, lead-wires

2 = Molded coil, Class-F, lead-wires

3 = Encapsulated coil, Class-H, lead-wires

4 = Encapsulated coil, Class-B, 3/16" spade terminals (1/4" spade optional)

10 = Externally rectified coil (lead-wires only)

11 = Tape-wrapped coil, Class-H, lead-wires

HC2 = Encapsulated coil, Class-B, EN175301-803 Style C, Industrial, 9.4mm, 2+1 poles

### ③ Body Material (Replaces Standard 303 SS)

BB = Brass

SB = 304 Stainless Steel

SB5 = 316 Stainless Steel

### ④ Diaphragm Seal Material

(blank) = Viton® diaphragm\*

E = EPR diaphragm

NS = Nitrile (NSF/FDA) diaphragm

PF = Perfluoroelastomer diaphragm

### ⑤ Body Port Configuration

(blank) = 1/8-27 NPT female thread\*

LB = 1/4-18 NPT female thread<sup>2</sup>

BD = #10-32 female straight thread (max. orifice = 1/8")<sup>2</sup>

LT = 1/8-28 BSPT female thread<sup>2</sup>

LU = 1/4-19 BSPT female thread<sup>2</sup>

MM = Manifold mount (1/4-28 UNF-2A mounting stud)<sup>2†</sup>

MM3 = Manifold mount (5/16-24 UNF-2A mounting stud)<sup>2†</sup>

OB = Omit body (operator style)<sup>2</sup>

BI = Bottom over-seat port, female thread (max. orifice = 1/8")<sup>2</sup>

BIM = Bottom over-seat port, 1/8-27 NPT male thread

(max. orifice = 5/64", brass body only)<sup>2</sup>

BO = Bottom under-seat port, female thread<sup>2</sup>

BOM = Bottom under-seat port, 1/8-27 NPT male thread

(max. orifice = 1/8", brass body only)<sup>2</sup>

RL = 90° porting - left hand<sup>2</sup>

RR = 90° porting - right hand<sup>2</sup>

### ⑥ Voltage

\_\_\_ VDC = DC (specify voltage)

\_\_\_ VAC = AC Rectified only (specify voltage)

### ⑦ Additional Options

Y = Yoke

WM = Mounting bracket

OC = Cleaned for oxygen use

\* Standard selection; will be used unless otherwise specified. Standard selections are not referenced in final part number.

#### Notes

1. Use Prefixes from these rows if you want to use any of the other Body Materials listed under selection ③. Simply add the respective material code in the 3rd part number position (See Example).
2. Not available with Polypropylene bodies.

† Teflon® o-ring not suitable for manifold mount.

Gems specializes in the design and manufacturing of custom solenoid valves and fluidic systems. If you don't see what you're looking for, or have a question, contact us at 800-378-1600 or info@gemssensors.com.

## BS Series – Higher Flow

- ▶ MOPD: 150 PSI (Plastic Body) or 150 PSI (Metal Body)
- ▶  $C_v$  Range: 0.035 to 0.300
- ▶ 4.5 Watts (Plastic Body) or 7 Watts (Metal Body)

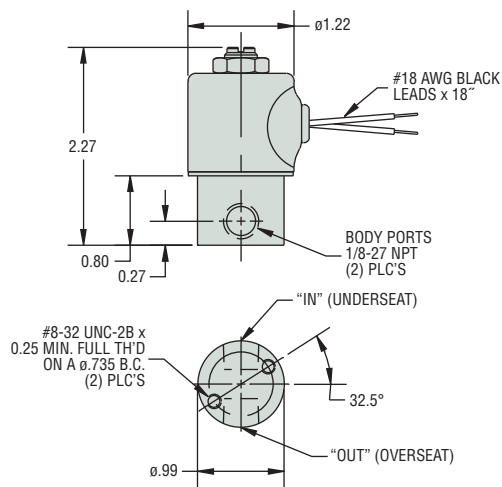
The BS Series is a 2-way, high flow, isolation valve that is designed to be virtually impervious to chemical attack and to protect high purity media. When your media cannot come in contact with any metallic materials, this highly versatile, modular valve delivers the protection you need for accurate and reliable flow control for millions of cycles. With a variety of body, and diaphragm materials, plus numerous port configurations, voltage options, and coil constructions, the BS Series is truly a miniature inert isolation valve that can be built to your exact applications requirements.

### Typical Applications

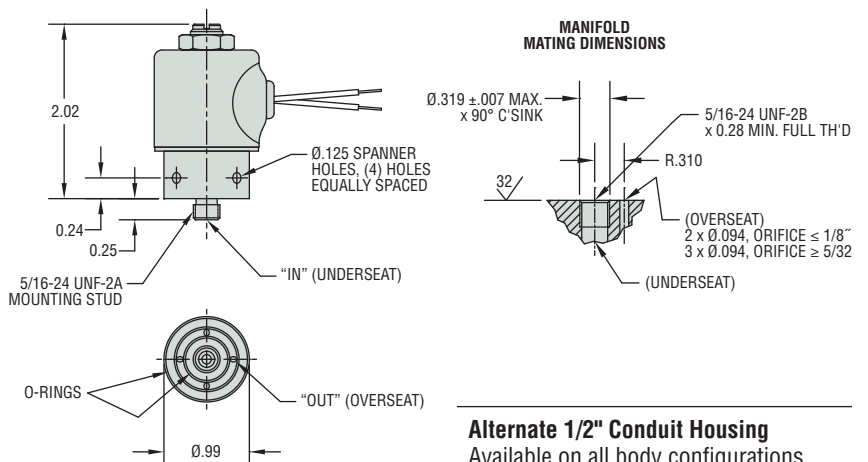
- Remediation Equipment
- Clinical Chemistry Equipment
- Analytical Instrumentation

### Dimensions

#### Threaded Port Body

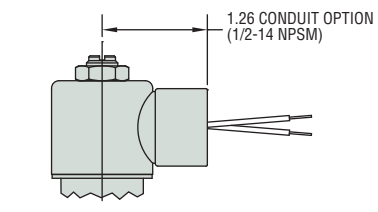


#### Manifold Mount Body



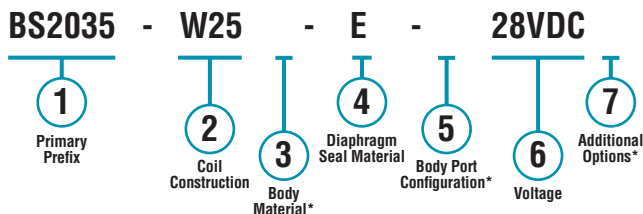
#### Alternate 1/2" Conduit Housing

Available on all body configurations



### How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.



\* Blank entry indicates a "Standard" selection (1/8-27NPT female thread, in this case).

#### Example:

BS2035-W25-E-28VDC

2-Way N.C. Polypropylene (grommet housing, 1/8-27 NPT female thread only) solenoid valve, with 25" tape-wrapped coil, lead-wires, non-standard length, EPR diaphragm seal, 1/8-27 NPT female thread, operating at 28 VDC.



Part Prefix Table ①

Body Material	Orifice	MOPD (psig)	Max Back Pressure	C <sub>v</sub>	① Primary Prefix	
	Body				Grommet Housing	Conduit Housing
303 Stainless Steel <sup>1</sup>	3/64	150	15	0.035	BS2010	BS2020
	1/16	110	10	0.065	BS2011	BS2021
	5/64	85	10	0.090	BS2012	BS2022
	3/32	70	10	0.155	BS2013	BS2023
	7/64	25	10	0.200	BS2014	BS2024
	1/8	10	5	0.240	BS2015	BS2025
	5/32	5	5	0.300	BS2016	BS2026
Polypropylene (1/8-27 NPT Female Thread body port only)	3/64	150	15	0.035	BS2030	BS2040
	1/8	10	5	0.240	BS2035	BS2045

\* Other body orifice sizes may be available, consult factory.

### ② Coil Construction

(blank) = Tape-wrapped, Class-B, with 18" lead-wires\*

W\_\_ = Tape-wrapped coil, lead-wires, non-standard length (specify in inches)

1 = Encapsulated coil, Class-B, lead-wires

3 = Encapsulated coil, Class-H, lead-wires

4 = Encapsulated coil, Class-B, 1/4" spade terminals (3/16" spade optional)

10 = Externally rectified coil (lead-wires only)

11 = Tape-wrapped coil, Class-H, lead-wires

HC2 = Encapsulated coil, Class-B, EN175301-803 Style C, Industrial, 9.4mm, 2+1 poles

### ③ Body Material (Replaces Standard 303 SS)

BB = Brass

SB = 304 Stainless Steel

SB5 = 316 Stainless Steel

### ④ Diaphragm Seal Material

(blank) = Viton® diaphragm\*

E = EPR diaphragm

NS = Nitrile (NSF/FDA) diaphragm

PF = Perfluoroelastomer diaphragm

### ⑤ Body Port Configuration

(blank) = 1/8-27 NPT female thread\*

LB = 1/4-18 NPT female thread<sup>2</sup>

BD = #10-32 female straight thread (max. orifice = 1/8")<sup>2</sup>

LT = 1/8-28 BSPT female thread<sup>2</sup>

LU = 1/4-19 BSPT female thread<sup>2</sup>

MM = Manifold mount (1/4-28 UNF-2A mounting stud)<sup>12</sup>

MM3 = Manifold mount (5/16-24 UNF-2A mounting stud)<sup>12</sup>

OB = Omit body (operator style)<sup>2</sup>

BI = Bottom over-seat port, female thread (max. orifice = 1/8")<sup>2</sup>

BIM = Bottom over-seat port, 1/8-27 NPT male thread

(max. orifice = 5/64", brass body only)<sup>2</sup>

BO = Bottom under-seat port, female thread<sup>2</sup>

BOM = Bottom under-seat port, 1/8-27 NPT male thread

(max. orifice = 1/8", brass body only)<sup>2</sup>

RL = 90° porting - left hand<sup>2</sup>

RR = 90° porting - right hand<sup>2</sup>

### ⑥ Voltage

\_\_\_ VDC = DC (specify voltage)

\_\_\_ VAC = AC Rectified only (specify voltage)

### ⑦ Additional Options

WM = Mounting bracket

OC = Cleaned for oxygen use

\* Standard selection; will be used unless otherwise specified. Standard selections are not referenced in final part number.

#### Notes

- Use Prefixes from these rows if you want to use any of the other Body Materials listed under selection ③. Simply add the respective material code in the 3rd part number position (See Example).
- Not available with Polypropylene bodies.

<sup>†</sup> Teflon® o-ring not suitable for manifold mount.

Gems specializes in the design and manufacturing of custom solenoid valves and fluidic systems. If you don't see what you're looking for, or have a question, contact us at 800-378-1600 or info@gemssensors.com.

# 4 Steps to Valve Selection

The steps described in this section will help you identify the performance criteria needed to meet your application requirements and select the right valve.

## Step 1 – Calculating $C_v$

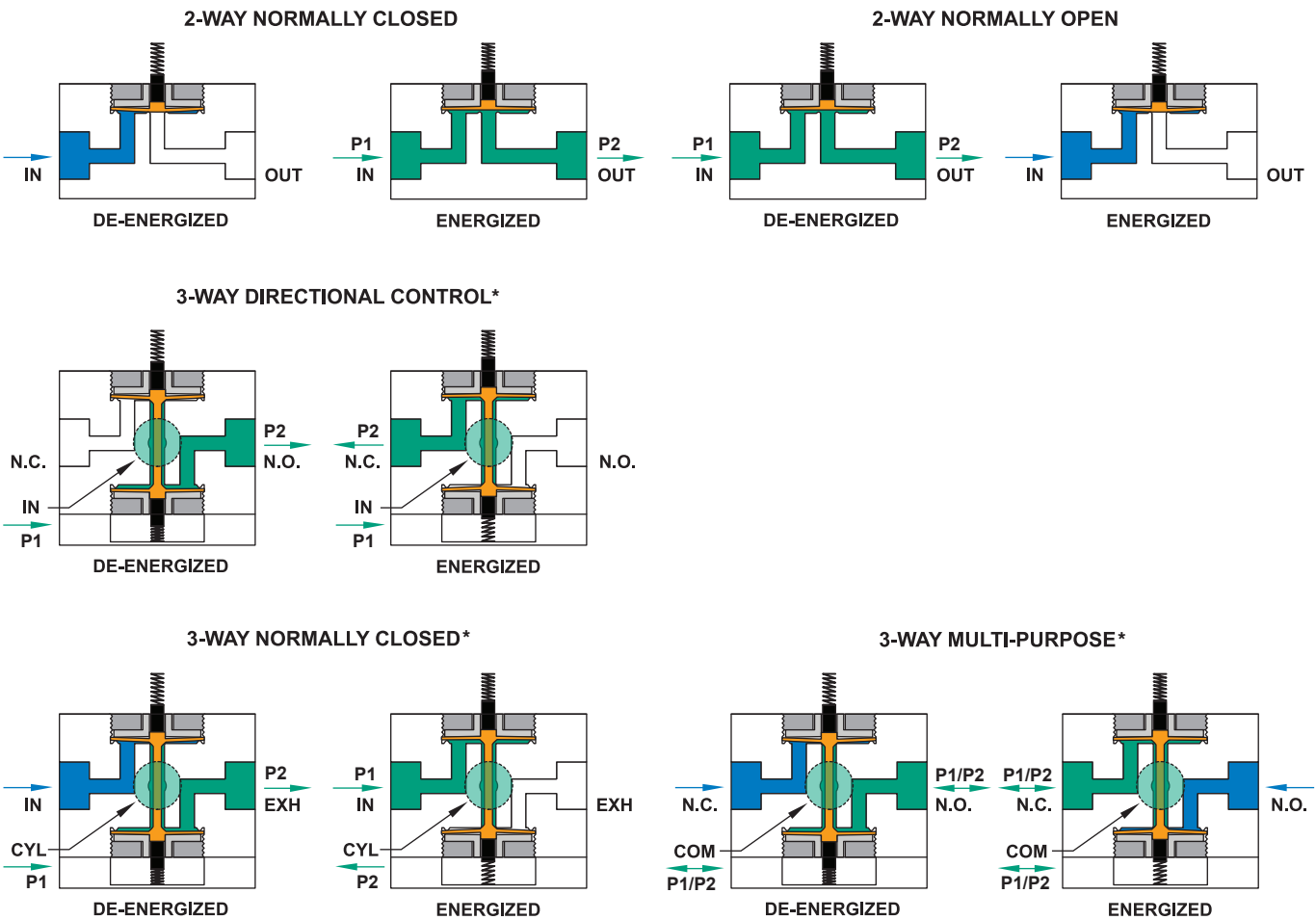
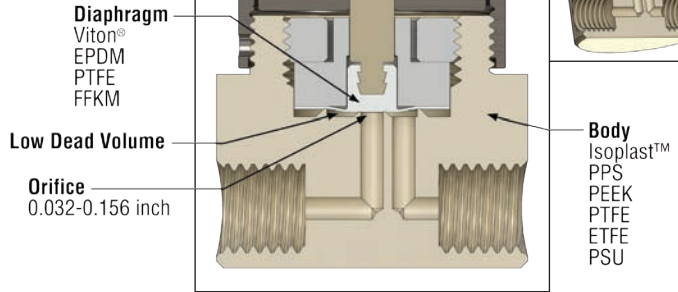
Review Step 1 – Calculating  $C_v$  on Page J-2.

## Step 2 – Valve Function

Identify how your valve will function in your application. Pick from the choices below.

### Flow Key

- Blocked Flow
- Free Flow
- Dual Diaphragm/Poppet



\*K-Series 3-way valves are classified as directional control. For alternate uses contact Gems.

Gems specializes in the design and manufacturing of custom solenoid valves and fluidic systems. If you don't see what you're looking for, or have a question, contact us at 800-378-1600 or info@gemssensors.com.

SOLENOID VALVES

## Step 3 – Identify Your Valve Series

Select possible valve series candidate using the overview chart below.

Select maximum operating pressure differential (MOPD), the  $C_v$ , function, and additional specifications needed for your application to select possible valve series. The detailed performance specs for each series are located on the corresponding pages listed on the chart.

If you would like assistance with your selection, want to modify a valve, or simply want a sounding board please contact a Gems™ valve engineer at 800-378-1600 or info@gemssensors.com.

Inert Isolation						
<b>Function</b>	2-Way, Normally Closed		2- & 3-Way		2-Way, Normally Closed	2- & 3-Way
<b>Media</b>	Liquid	Gas & Liquid	Liquid			
<b>Size</b>	Sub-Miniature		Miniature			
<b><math>C_v</math> Range</b>	0.008 - 0.015	0.016 - 0.040	0.011 - 0.105		0.055 - 0.14	
<b>Port Configuration</b>	1/4"-28 UNF flat bottom, #10-32, 5/16"-24, 1/8" NPT, M6 X 1.0, Manifold Mount	1/8 Barb, Face-Mount, #10-32 Threaded Flat Bottom	1/4"-28 UNF flat bottom, #10-32, 5/16"-24, 1/8" NPT, M6 X 1.0, Tube Mount, Syringe, Manifold Mount		1/4"-28 UNF flat bottom, #10-32, 5/16"-24, 1/8" NPT, M6 X 1.0	
<b>Orifice Dia (in)</b>	0.032 - 0.054	0.032 & 0.052	0.032 - 0.125		0.092	0.156
<b>Power (watt)</b>	1.8	2	2.6, 2.8	4.8	5.1	8
<b>MOPD (psig)</b>	20	70	15 - 50	10 - 60	20	15
<b>Valve Series</b>	<b>KS</b>	<b>Chem-S™</b>	<b>KM</b>	<b>KL</b>	<b>KV</b>	<b>KW</b>
<b>Pages</b>	<b>J-27, J-28</b>	<b>J-25, J-26</b>	<b>J-29, J-30, J-31, J-32</b>	<b>J-29, J-30, J-31, J-32</b>	<b>J-33, J-34</b>	<b>J-33, J-34</b>

## Step 4 – Make Your Selection and Configure Your Valve

Complete your valve design by selecting the additional design parameters to build the best possible valve. For example:

- Materials needed for your media (bodies and diaphragms, fluoroelastomer, EPDM, etc.)
- Coil voltage
- Port configuration

For help selecting the additional options for your valve or if you want to confirm that your selection is the best choice or work with an engineer on integrating a fluidic system into your application, contact us at 800-378-1600 or info@gemssensors.com. We are happy to assist. You can also place orders through these same channels.

We specialize in application specific valves. Our modular valve designs, coupled with our cutting edge 3D modeling and innovative CNC manufacturing capabilities, result in fluidic systems that are truly adaptable to any originally manufactured equipment.

## Chem-S™ Series – Subminiature

- ▶ MOPD: 70 PSI
- ▶  $C_v$  Range: 0.016 to 0.040
- ▶ 2 Watts

The Chem-S™ utilizes revolutionary diaphragm technology in a liquid compatible, sub-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.

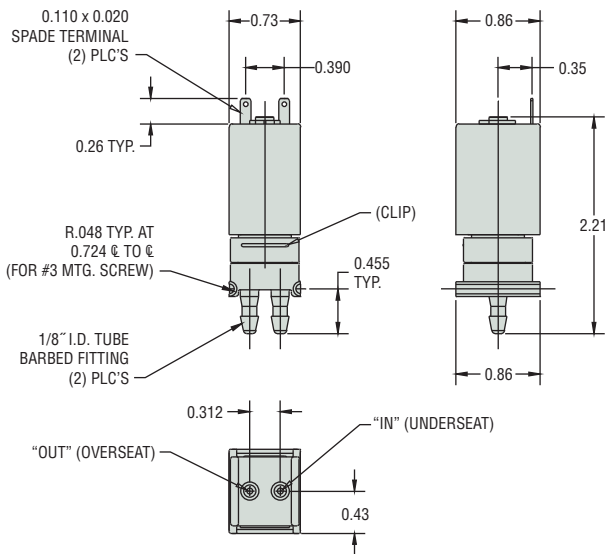
### Typical Applications

- Analytical Instrumentation
- Clinical Chemistry Equipment
- Medical Diagnostic and Testing Machinery

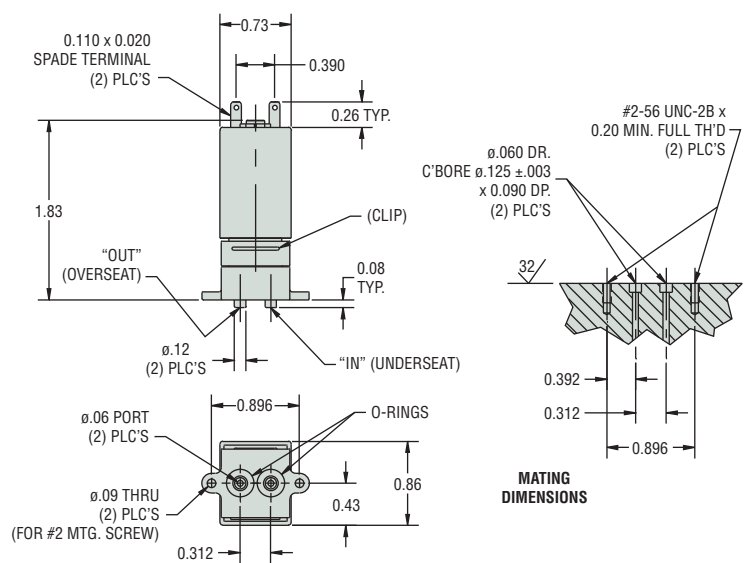


### Dimensions

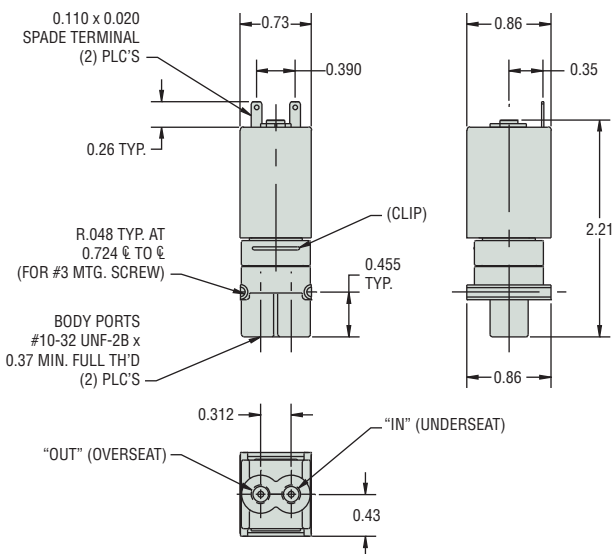
#### Barb Port Body



#### Manifold Mount Body



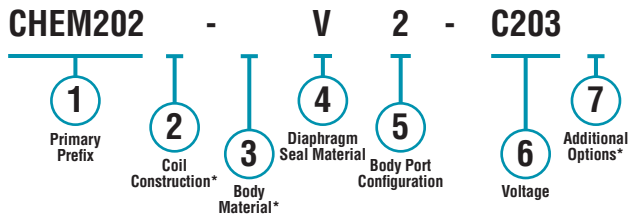
#### Threaded Port Body





How To Order

Use the **Bold** characters from the choices listed below to construct a product code.



\* Blank entry indicates a "Standard" selection (Quick connect 0.110 spade and Polyurethane (Isoplast™), in this case).

Example:

CHEM202-V2-C203

2-Way N.C. solenoid valve, with quick connect 0.110 spade, polyurethane (Isoplast™) body, Viton® diaphragm seal, manifold mount, operating at 12 VDC.

Part Prefix Table ①

Orifice	MOPD (psig)	C <sub>v</sub>	① Primary Prefix
		Body	
0.031	70	0.016	<b>CHEM202</b>
0.052	25	0.040	<b>CHEM205</b>

- ② **Coil Construction**  
(blank) = Quick connect 0.110 spade\*
- ③ **Body Material**  
(blank) = Polyurethane (Isoplast™)\*
- ④ **Diaphragm Seal Material**  
V = Viton®  
E = EPDM
- ⑤ **Body Port Configuration**  
1 = 1/8" barb  
2 = Manifold mount†  
3 = #10-32 flat bottom straight thread ports
- ⑥ **Voltage**  
C201 = 5 VDC  
C203 = 12 VDC  
C204 = 24 VDC  
\_\_ VDC = DC (specify voltage)

Please Note: Usable for vacuum applications (0-27" Hg). When using for vacuum applications apply vacuum to "IN" port.

\* Standard selection; will be used unless otherwise specified. Standard selections are not referenced in final part number.

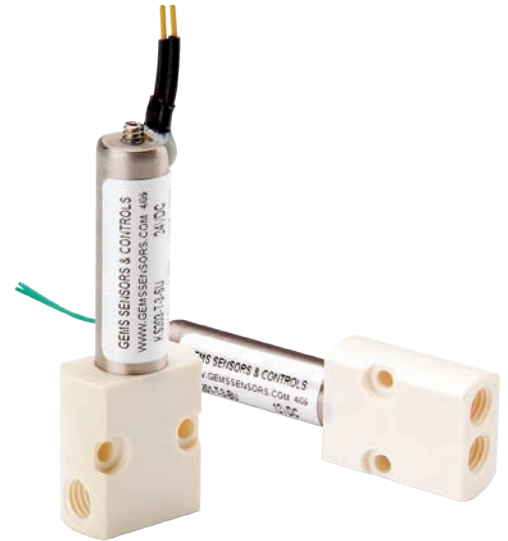
† Teflon® o-ring not suitable for manifold mount.

Gems specializes in the design and manufacturing of custom solenoid valves and fluidic systems. If you don't see what you're looking for, or have a question, contact us at 800-378-1600 or info@gemssensors.com.

# KS Series – 3/8” (9.53 mm) Solenoids

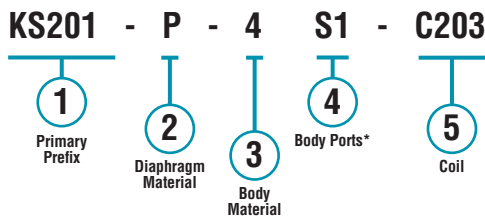
- ▶ 2-Way, Normally Closed
- ▶ MOPD: 20 PSIG (1.38 bar)
- ▶ C<sub>v</sub> Range: 0.008 to 0.015
- ▶ 1.8 Watts

KS Series isolation valves are 2-way, Normally Closed (NC) valves featuring 0.38” (10 mm) solenoid shell diameters. The isolation valve design ensures that the only wetted parts are the valve diaphragm and the valve body. For exceptional chemical compatibility the KS Series utilizes PEEK or PPS bodies, with a choice of diaphragm materials to meet your specific needs.



## How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.



\* Combination of Body Port Configuration and Port Thread; Manifold Mount (BM) does **not** use the Thread Size designator

### Example:

KS201-P-4 S1-C203

Small 2-Way N.C. Perfluoroelastomer solenoid valve, with a Polyaryletheretherketone body and 1/4”-28 UNF flat bottom threaded side ports, operating at 12 VDC.

## Part Prefix Table ①

	Orifice (inch)	MOPD*		C <sub>v</sub>	Internal Volume (μl)			① Primary Prefix
		psig	bar		Side Ports	Bottom Ports	Manifold Mount	
<b>2-WAY</b>	0.032	20	1.38	0.008	20	18	13	<b>KS201</b>
<b>N.C.</b>	0.054	20	1.38	0.015	42	35	21	<b>KS203</b>

\* Maximum Operational Pressure Differential

### ② Diaphragm Material

- T = PTFE Polytetrafluoroethylene
- E = EPDM Ethylene Propylene Diene (M)
- P = FFKM Perfluoroelastomer

### ③ Body Material

- 3 = PPS Polyphenylene Sulfide
- 4 = PEEK Polyaryletheretherketone

### ④ Body Port Configuration

- BM = Manifold mount
- S\_ = Threaded side port
- B\_ = Threaded bottom port

Port Thread (Used in conjunction with Threaded Port Configurations)

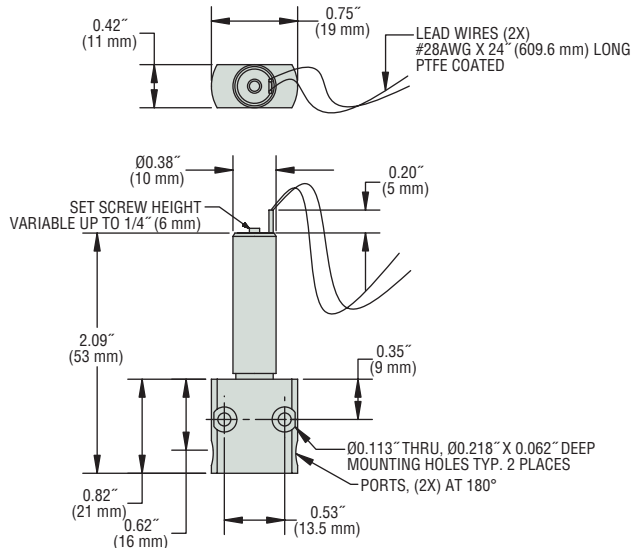
- 1 = 1/4”-28 UNF flat bottom (Standard)
- 2 = 10-32
- 3 = 5/16”-24
- 4 = 1/8” NPT
- 5 = M6 X 1,0

### ⑤ Coil

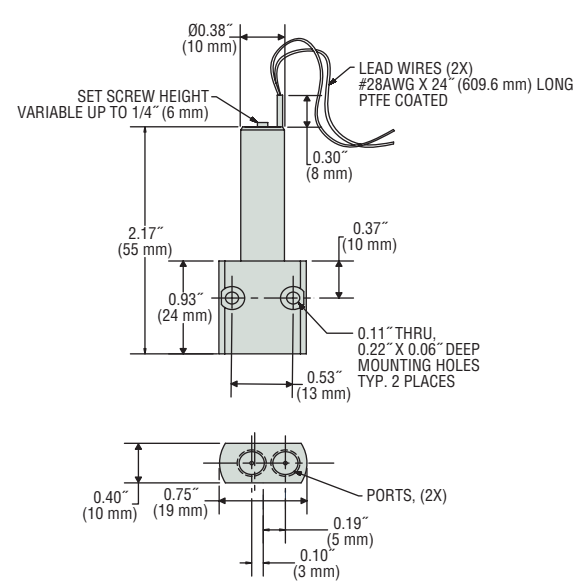
- C203 = 12 VDC
- C204 = 24 VDC

Dimensions – Threaded Port Body

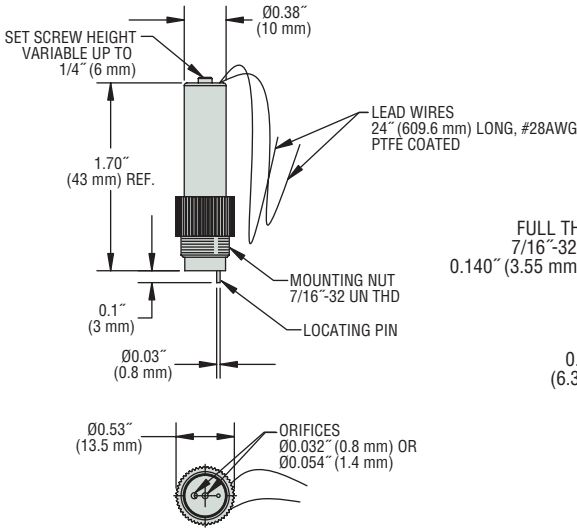
Side Port



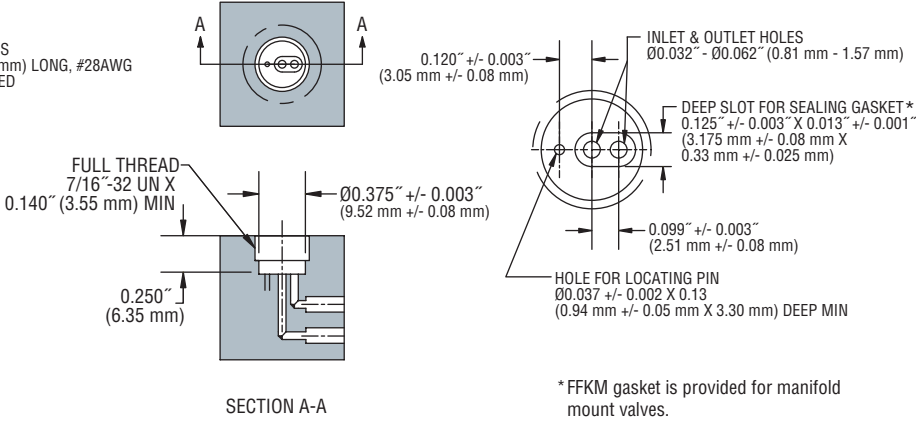
Bottom Port



Dimensions – Manifold Mount Body



Manifold Preparation



\* FFKM gasket is provided for manifold mount valves.

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## KM/KL Series – 0.75" (19.05 mm) and 1.0" (25.4 mm) Solenoids

- ▶ 2-Way Normally Open/Closed; 3-Way Directional
- ▶ MOPD: 10 PSIG to 30 PSIG (0.69 bar to 2.07 bar); to 60 PSIG (4.17 bar) on 3-Way
- ▶  $C_v$  Range: 0.011 to 0.105
- ▶ As Low as 2.8 Watts

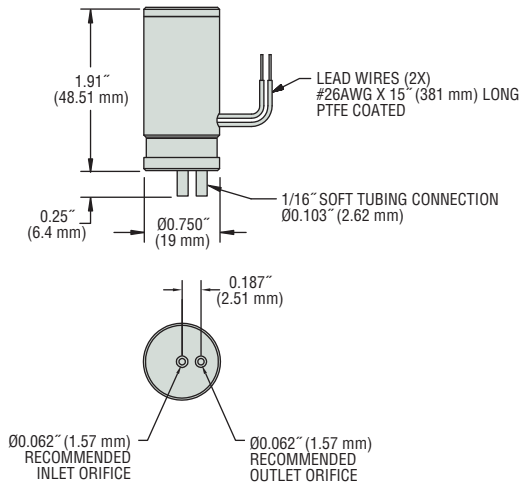
These isolation valves offer 2-way Normally Open (NO) and Closed (NC), or 3-way Directional Control operation. While sharing similar configurations with the KM Series, the KL Series features larger orifice sizes with greater  $C_v$  values. Their design ensures that the only wetted parts are the valve diaphragm and body.

Find Ordering Information on Page J-32.

### Dimensions – Tube Mount Body

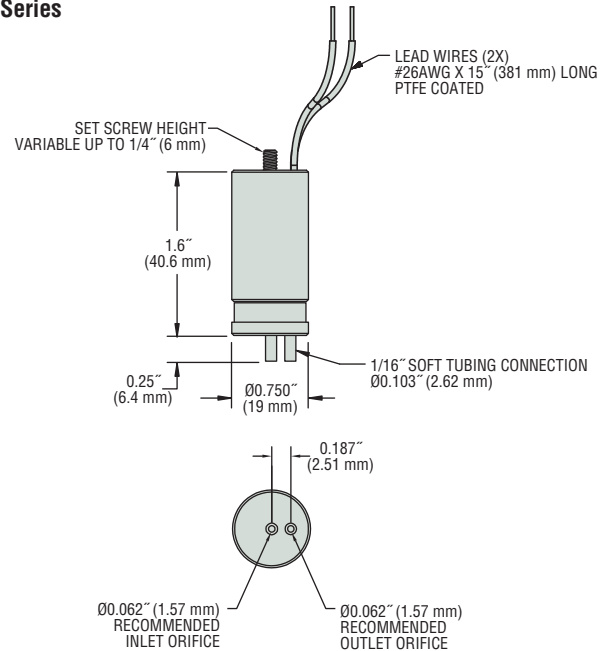
2-Way, Normally Open (N.O.)

#### KM Series



2-Way, Normally Closed (N.C.)

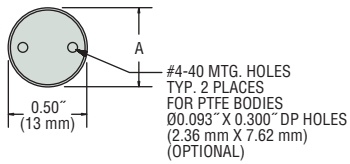
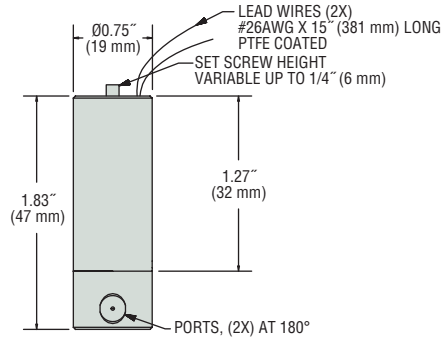
#### KM Series



Dimensions – Side Port Body

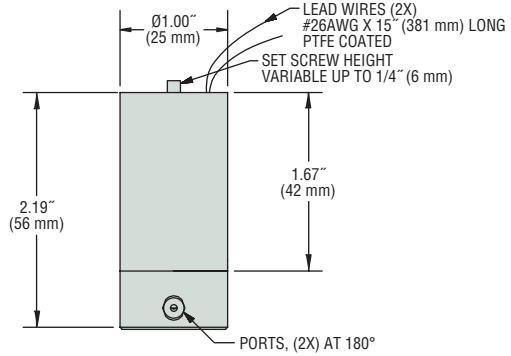
2-Way, Normally Closed (N.C.)

KM Series



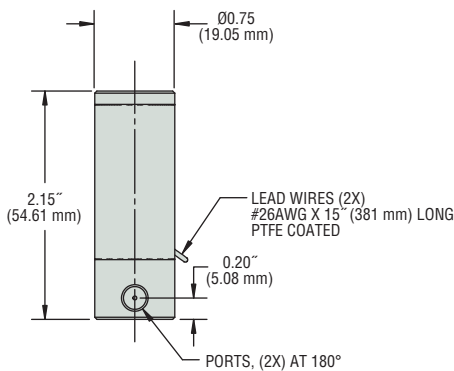
Orifice Size (inch)	Dim A	
	inch	mm
0.032	0.75	19.05
0.054	0.75	19.05
0.062	0.875	22.23

KL Series

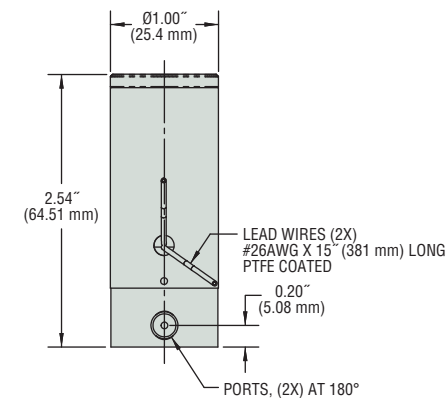


2-Way, Normally Open (N.O.)

KM Series

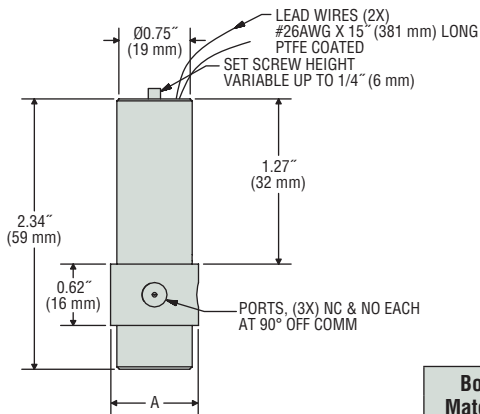


KL Series



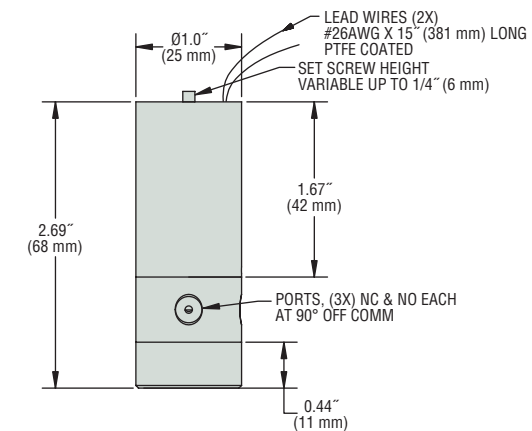
3-Way, Normally Closed (N.C.), Multi-Purpose, Directional Control

KM Series



Body Material	Dim A	
	inch	mm
PTFE	0.875	22.225
All Others	0.75	19.05

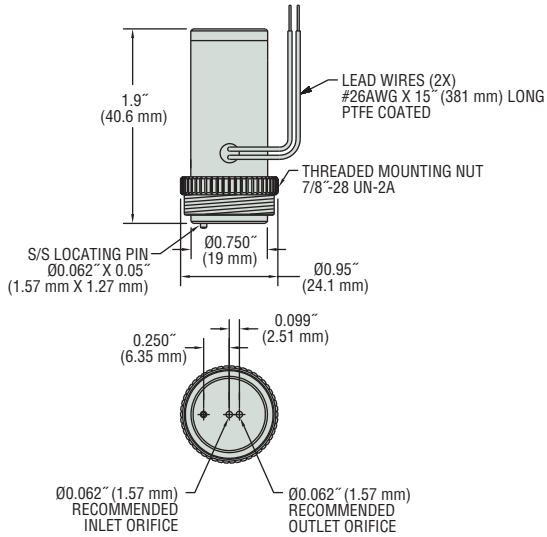
KL Series



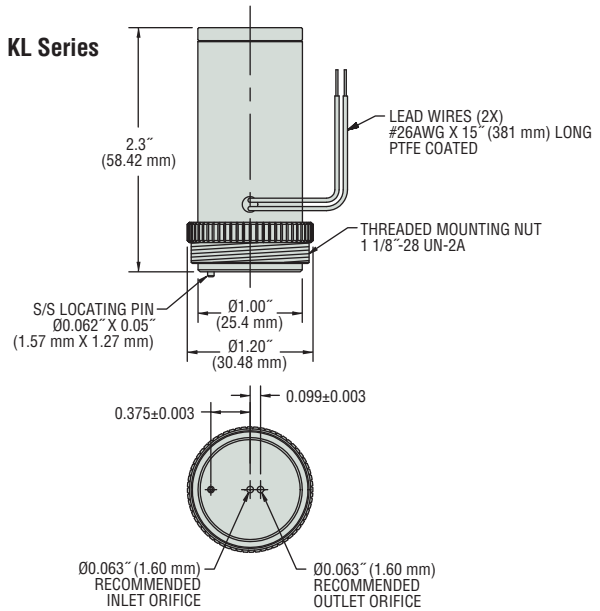
## Dimensions – Manifold Mount Body

### 2-Way, Normally Open (N.O.)

#### KM Series

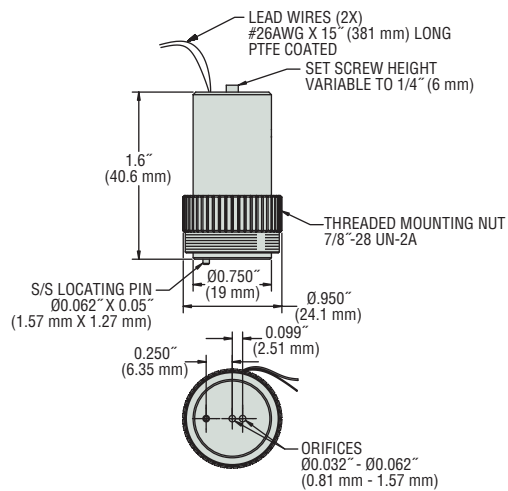


#### KL Series

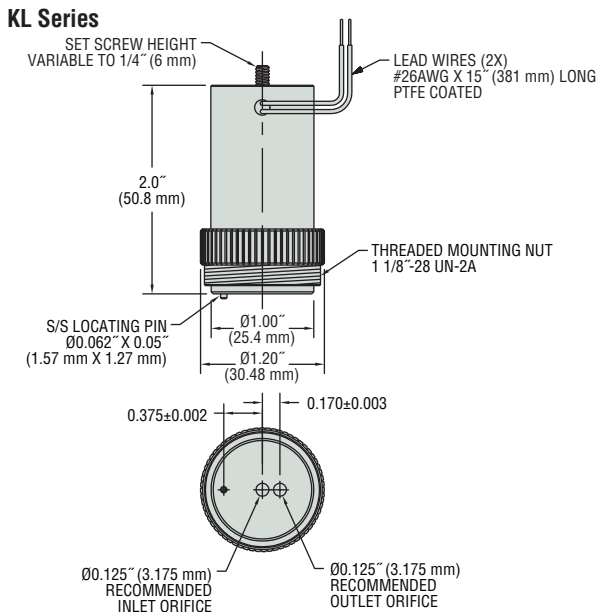


### 2-Way, Normall Closed (N.C.)

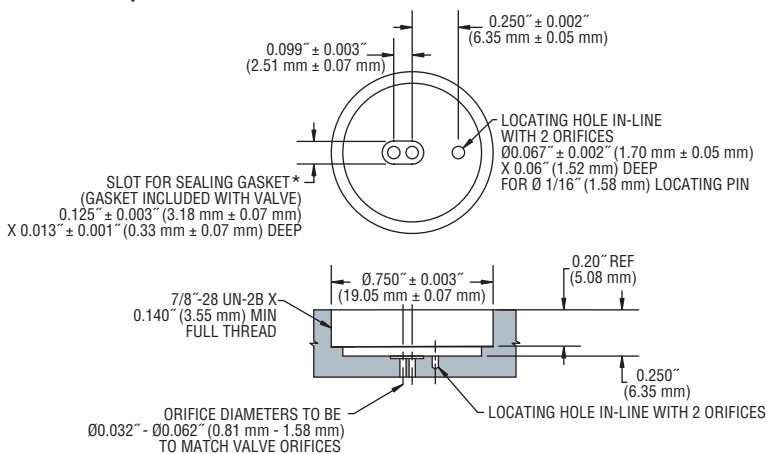
#### KM Series



#### KL Series



### Manifold Preparation – KM Series

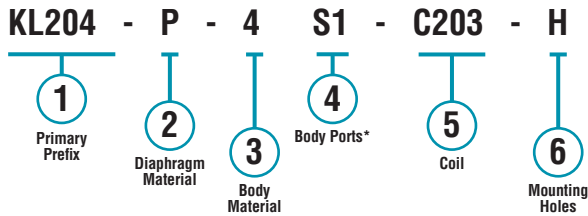


Note: Valve spacing to be 1.00" (25.4 mm) min. center to center  
\* FFKM gasket is provided for manifold mount valves.



## How To Order

Use the **Bold** characters from the choices listed to construct a product code.



\* Combination of Body Port Configuration and Port Thread; BM, BT, SL and SU do **not** use the Thread Size designator

**Example:** KL204-P-4 S1-C203-H

2-Way N.C. solenoid valve with a PEEK body and FFKM diaphragm configured with 1/4"-28 UNF threaded Side Ports, optional mounting holes, and operating at 12 VDC.

## Part Prefix Table ①

	Orifice (inch)	MOPD*		C <sub>v</sub>	Internal Volume (μl)			① Primary Prefix
		psig	bar		Side Mount	Manifold Mount	Tube Mount	
<b>2-WAY N.C.</b>	0.032	20	1.38	0.011	19	33	—	<b>KM201</b>
	0.054	20	1.38	0.027	39	N/A	—	<b>KM203</b>
	0.062	20	1.38	0.03	54	52	106	<b>KM204</b>
	0.062	30	2.07	0.042	55	55	—	<b>KL204</b>
	0.092	15	1.03	0.08	133	N/A	—	<b>KL205</b>
	0.125	10	0.69	0.105	296	223	—	<b>KL206</b>
<b>2-WAY N.O.</b>	0.032	20	1.38	0.011	19	33	—	<b>KM221</b>
	0.054	20	1.38	0.027	39	N/A	—	<b>KM223</b>
	0.062	20	1.38	0.03	54	52	106	<b>KM224</b>
	0.062	30	2.07	0.042	55	55	—	<b>KL224</b>
	0.092	10	0.69	0.08	133	N/A	—	<b>KL225</b>
	0.125	10	0.69	0.105	296	223	—	<b>KL226</b>
<b>3-WAY Directional Controls</b>	0.032	15 (NC/O) 20 (Com)	1.03 (NC/O) 1.38 (Com)	0.01	45	N/A	—	<b>KM341</b>
	0.046	15 (NC/O) 20 (Com)	1.03 (NC/O) 1.38 (Com)	0.023	52	N/A	—	<b>KM342</b>
	0.032	30 (NC/O) 60 (Com)	2.07 (NC/O) 4.14 (Com)	0.01	47	N/A	—	<b>KL341</b>
	0.062	30 (NC/O) 60 (Com)	2.07 (NC/O) 4.14 (Com)	0.028	87	N/A	—	<b>KL344</b>

\* Maximum Operational Pressure Differential

### ② Diaphragm Material

2-Way

**T** = PTFE Polytetrafluoroethylene  
**E** = EPDM Ethylene Propylene Diene (M)  
**V** = FKM Fluoroelastomers<sup>1</sup>  
**P** = FFKM Perfluoroelastomer

3-Way KM

**T** = PTFE Polytetrafluoroethylene  
**E** = EPDM Ethylene Propylene Diene (M)  
**P** = FFKM Perfluoroelastomer

3-Way KL

**T** = PTFE Polytetrafluoroethylene

### ③ Body Material

**1** = PTFE Polytetrafluoroethylene  
**2** = ETFE Ethylene Tetrafluoroethylene  
**3** = PPS Polyphenylene Sulfide  
**4** = PEEK Polyaryletheretherketone  
**5** = PSU Polysulfone<sup>2</sup>

### ④ Body Port Configuration

**BM** = Manifold mount<sup>3</sup>

**BT** = Tube mount - accomodates 1/16" ID soft tubing<sup>3,4</sup>

**SL** = Syringe - luer common port & 1/4"-28 UNF NC/O ports<sup>5</sup>

**SU** = Syringe - 1/4"-28 UNF ports<sup>5</sup>

**S** = Threaded side port

**B** = Threaded bottom port

Port Thread (Used in conjunction with Threaded Port Configurations)

**1** = 1/4"-28 UNF flat bottom (Standard)

**2** = 10-32<sup>6</sup>

**3** = 5/16"-24

**4** = 1/8" NPT

**5** = M6 X 1,0

### ⑤ Coil

**C203** = 12 VDC

**C204** = 24 VDC

**C109** = 115 VAC

**C116** = 220 VAC

### ⑥ Mounting Holes

**(blank)** = Holes not required

**H** = Mounting Holes in body

Notes

1. Not available in KL2X5 or KL2X6.

2. Available in KM2X4, E/V diaphragms, BM/BT port configurations.

3. See internal volume chart for available orifices.

4. PSU body only.

5. Available in KM3XX, PEEK body, PTFE diaphragm.

6. Not available in KL2X5 or KL2X6.

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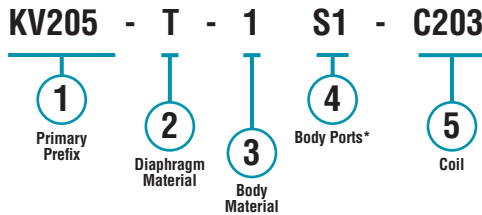
# KV/KW Series – 1.25” (31.75 mm) and 1.5” (38.1 mm) Solenoids

- ▶ 2-Way Normally Closed and 3-Way Directional Control
- ▶ MOPD: 15 PSI to 20 PSI
- ▶ C<sub>v</sub> Range: 0.055 to 0.14
- ▶ PTFE Bodies and Diaphragms

Our largest orifice sizes for the highest flow rates, with a reduced component height. They feature all-PTFE wetted parts for extreme chemical compatibility.

## How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.



\* Combination of Body Port Configuration and Port Thread; Manifold Mount (BM) does **not** use the Thread Size designator

### Example:

KV205-T-1 S1-C203-H

2-Way N.C. PTFE solenoid valve, with a PTFE body, 1/4”-28 UNF flat bottom threaded side ports and mounting holes, operating at 12 VDC.

## Part Prefix Table ①

	Orifice (inch)	MOPD* (psig)	C <sub>v</sub>	Internal Volume (μl)	① Primary Prefix
<b>2-WAY N.C.</b>	0.092	20	0.055	108	<b>KV205</b>
	0.156	15	0.11	239	<b>KW207</b>
<b>3-WAY Directional Controls</b>	0.156	15 (NC/O)	0.14	462	<b>KW347</b>

\* Maximum Operational Pressure Differential

### ② Diaphragm Material

T = PTFE Polytetrafluoroethylene

### ③ Body Material

1 = PTFE Polytetrafluoroethylene

### ④ Body Port Configuration

S\_ = Threaded side port

Port Thread (Used in conjunction with Threaded Port Configurations)

1 = 1/4”-28 UNF flat bottom<sup>1</sup> (Standard for KV)

2 = 10-32<sup>1</sup>

3 = 5/16”-24

4 = 1/8” NPT (Standard for KW)

5 = M6 X 1,0<sup>1</sup>

### ⑤ Coil

**C203** = 12 VDC

**C204** = 24 VDC

**C109** = 115 VAC

**C116** = 220 VAC

\* Standard selection; will be used unless otherwise specified. Standard selections are not referenced in final part number.

Note

1. Not available with KW Series.

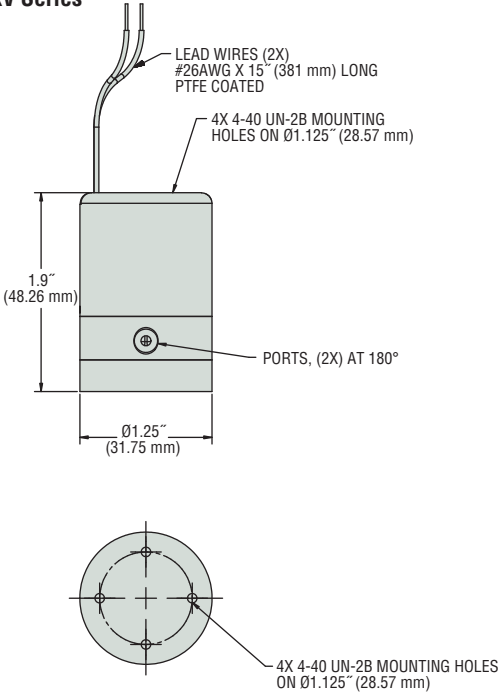


SOLENOID VALVES

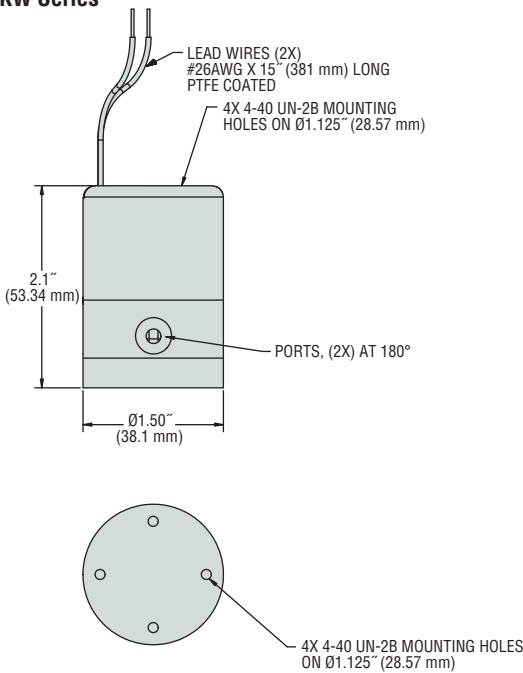
Dimensions – Side Port Body

2-Way, Normally Closed (N.C.)

KV Series

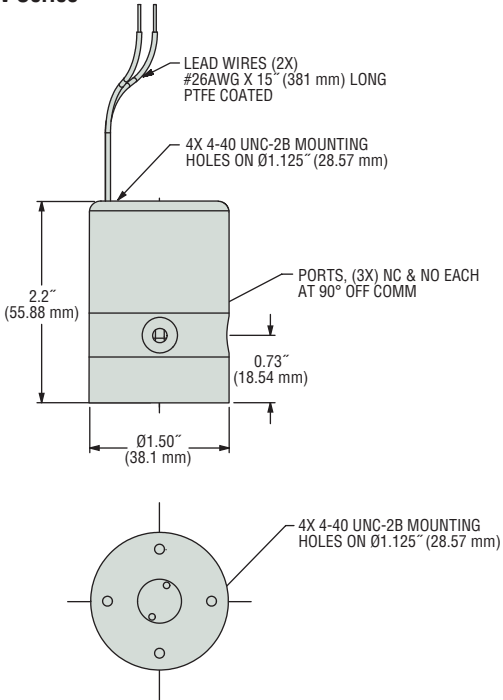


KW Series



3-Way, Normally Closed (N.C.), Multi-Purpose, Directional Control

KW Series



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## B-Cryo Series

- ▶ MOPD: 900 PSI
- ▶  $C_v$  Range: 0.045 to 0.440
- ▶ 9 Watts

The B-Cryo Series is a 2-way miniature Cryogenic valve designed and built for service down to -320°F (-196°C) in applications needing a  $C_v$  between 0.045 and 0.440. Depending on your temperature requirements, the B-Cryo Series can be configured for liquid nitrogen (LN2), liquid carbon dioxide (LCO2), and other extreme temperature media. PTFE coated plungers, 316 Stainless Steel guide tubes and plunger springs, encapsulated coils, and PTFE or Rulon® seat seals produce a truly robust Cryogenic valve for applications requiring high cycle life and media temperature control.

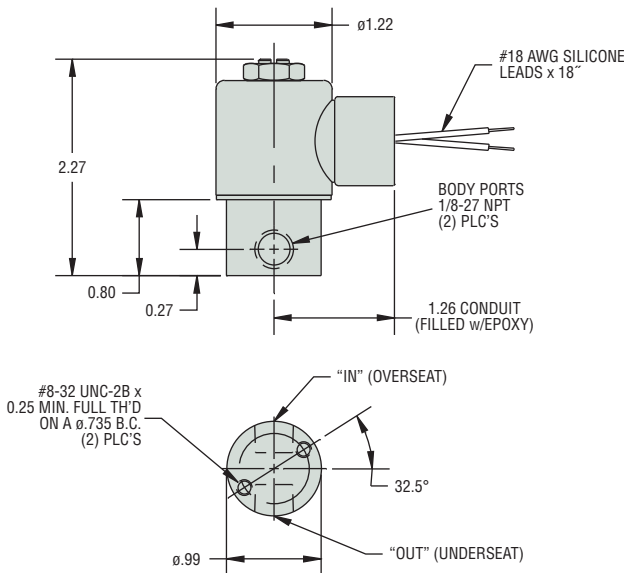


### Typical Applications

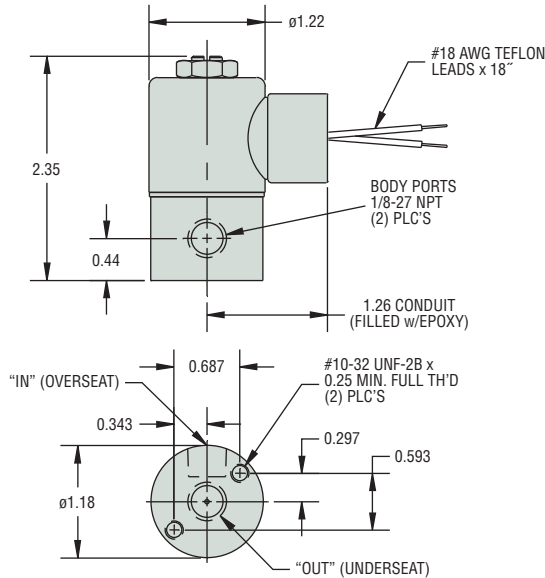
- Environmental Chambers
- Food Processing
- Laser Surgical Equipment
- Semiconductor Manufacturing

### Dimensions

#### LN2-Liquid Nitrogen



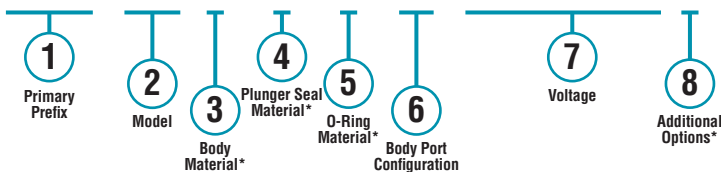
#### LCO2-Liquid Carbon Dioxide



### How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.

#### **B2062 - LN2** - **LB - 120/50/60VAC**



\* Blank entry indicates a "Standard" selection (430F Stainless Steel, Rulon® and Variseal®, in this case).

#### Example:

B2062-LN2-LB-120/50/60VAC

2-Way N.C. Liquid Nitrogen Class-H Encapsulated Coil with lead-wires, conduit filled housing solenoid valve, with 430F stainless steel body, Rulon® plunger seal, Variseal® o-ring, 1/4-18 NPT female thread, operating at 120/50/60 Volt AC.

Part Prefix Table ①

		① Primary Prefix			
Orifice Body	MOPD (psig)	C <sub>v</sub> Body	Class H, Encapsulated Coils		
			Lead Wires—Filled Conduit Housing	Lead Wires—Unfilled Conduit Housing	Lead Wires— Grommet Housing
3/64	900	0.045	B2060	B2020	B2010
1/16	405	0.075	B2061	B2021	B2011
5/64	270	0.105	B2062	B2022	B2012
3/32	160	0.160	B2063	B2023	B2013
7/64	110	0.190	B2064	B2024	B2014
1/8	80	0.255	B2065	B2025	B2015
5/32	65	0.365	B2066	B2026	B2016
3/16	30	0.440	B2067	B2027	B2017

② Model

- LN2 = Liquid Nitrogen model
- LCO2 = Liquid Carbon Dioxide model

③ Body Material

LN2 Only

(blank) = 430F Stainless Steel\*

LCO2 Only

(blank) = 303 Stainless Steel\*

BB = Brass

SB = 304 Stainless Steel

SB5 = 316 Stainless Steel

④ Plunger Seal Material

LN2 Only

(blank) = Rulon®\*

LCO2 Only

(blank) = PTFE\*

MQ = Silicone (consult factory)

⑤ O-Ring Material

LN2 Only

(blank) = Variseal® (PTFE material with internal spring)\*

TO = PTFE (consult factory)

LCO2 Only

(blank) = Variseal® (PTFE material with internal spring)\*

TO = PTFE (consult factory)

⑥ Body Port Configuration

LN2 Only

(blank) = 1/8-27 NPT female thread\*

LB = 1/4-18 NPT female thread

LT = 1/8-28 BSPT female thread

LU = 1/4-19 BSPT female thread

BI = Bottom over-seat port, female thread (max. orifice = 1/8")

BO = Bottom under-seat port, female thread

RL = 90° porting - left hand

RR = 90° porting - right hand

LCO2 Only

(blank) = 1/8-27 NPT, bottom under-seat port, female thread\*

LB = 1/4-18 NPT female thread (in-line porting only)

LT = 1/8-28 BSPT female thread

LU = 1/4-19 BSPT female thread (in-line porting only)

BOM = Bottom under-seat port, male thread

(max. orifice = 1/8", brass body only)

IL = Inline porting, 180° apart

⑦ Voltage

LN2 Only

\_\_\_ VDC = DC (specify voltage)

\_\_\_ VAC = AC Rectified (specify voltage)

LCO2 Only

\_\_\_ VDC = DC (specify voltage)

\_\_\_ VAC = AC Rectified (specify voltage)

⑧ Additional Options

LN2 Only

(blank) = Chamfered and PTFE coated plunger\*

(blank) = 316 Stainless Steel 1-piece guide assembly\*

(blank) = 316 Stainless Steel spring\*

LCO2 Only

(blank) = Chamfered and PTFE coated plunger\*

(blank) = 316 Stainless Steel 1-piece guide assembly\*

(blank) = 316 Stainless Steel spring\*

\* Standard selection; will be used unless otherwise specified. Standard selections are not referenced in final part number.

## D-Cryo Series

- ▶ MOPD: 1000 PSI
- ▶  $C_v$  Range: 0.040 to 0.770
- ▶ 15 Watts

The D-Cryo Series is a 2-way, high flow, miniature Cryogenic valve designed and built for service down to  $-320^{\circ}\text{F}$  ( $-196^{\circ}\text{C}$ ). Depending on your temperature requirements, the D-Cryo Series can be configured for liquid nitrogen (LN2), liquid carbon dioxide (LCO2), and other extreme temperature media. PTFE coated plungers, 316 Stainless Steel guide tubes and plunger springs, encapsulated coils, and PTFE or Rulon® seat seals produce a truly robust Cryogenic valve for applications requiring high cycle life and media temperature control.

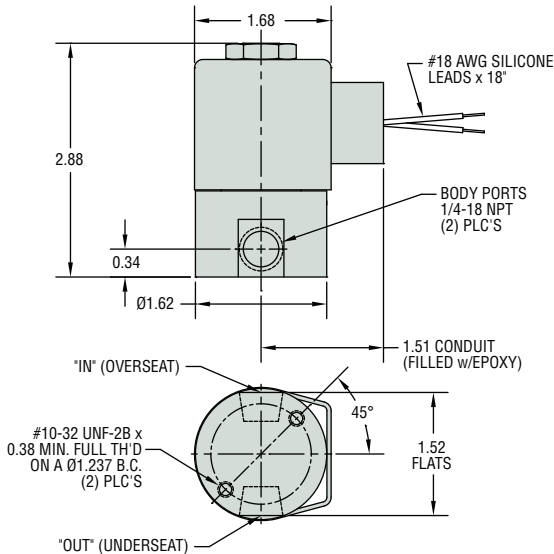


### Typical Applications

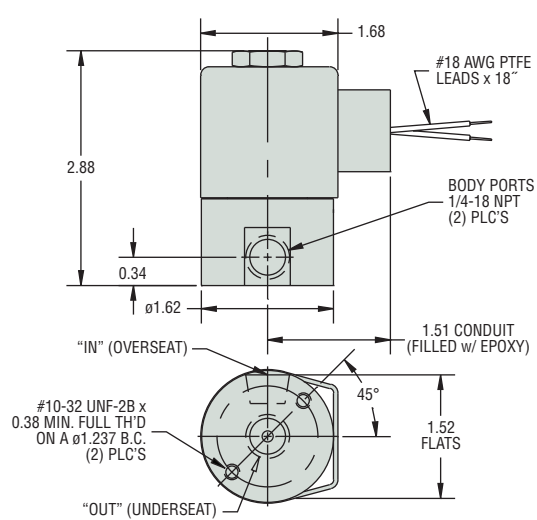
- Environmental Chambers
- Food Processing
- Laser Surgical Equipment
- Semiconductor Manufacturing

### Dimensions

#### LN2-Liquid Nitrogen



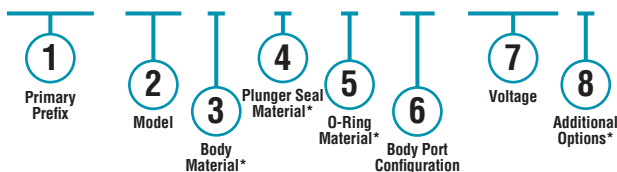
#### LCO2-Liquid Carbon Dioxide



### How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.

#### D2062 - LN2 - LT - 12VDC



\* Blank entry indicates a "Standard" selection (430F Stainless Steel, Rulon® and Variseal®, in this case).

#### Example:

D2062-LN2-LT-12VDC

2-Way N.C. Liquid Nitrogen Class-H Encapsulated Coil with lead-wires, conduit filled housing solenoid valve, with 430F stainless steel body, Rulon® plunger seal, Variseal® o-ring, 1/8-28 BSPT female thread, operating at 12 DC with rectified coil.



Part Prefix Table ①

		① Primary Prefix			
Orifice Body	MOPD (psig)	C <sub>v</sub> Body	Class H, Encapsulated Coils		
			Lead Wires—Filled Conduit Housing	Lead Wires—Unfilled Conduit Housing	Lead Wires— Grommet Housing
3/64	1000*	0.040	D2061	D2021	D2011
1/16	1000*	0.070	D2062	D2022	D2012
3/32	640	0.165	D2063	D2023	D2013
1/8	375	0.305	D2064	D2024	D2014
5/32	185	0.365	D2065	D2025	D2015
3/16	130	0.470	D2066	D2026	D2016
1/4	40	0.770	D2067	D2027	D2017

\* For higher pressure, consult factory.

② Model

- LN2 = Liquid Nitrogen model
- LCO2 = Liquid Carbon Dioxide model

③ Body Material

LN2 Only

(blank) = 430F Stainless Steel\*

LCO2 Only

(blank) = 430F Stainless Steel\*  
BB = Brass

④ Plunger Seal Material

LN2 Only

(blank) = Rulon®\*

LCO2 Only

(blank) = PTFE\*  
MQ = Silicone (consult factory)

⑤ O-Ring Material

LN2 Only

(blank) = Variseal® (PTFE material with internal spring)\*

LCO2 Only

(blank) = Fluorosilicone\*  
TO = PTFE

⑥ Body Port Configuration

LN2 Only

(blank) = 1/4-18 NPT female thread\*  
LC = 1/8-27 NPT female thread  
LD = 3/8-18 NPT female thread  
LT = 1/8-28 BSPT female thread  
LU = 1/4-19 BSPT female thread  
BI = Bottom over-seat port, female thread  
BO = Bottom under-seat port, female thread

LCO2 Only

(blank) = 1/4-18 NPT, bottom under-seat port, female thread\*  
LC = 1/8-27 NPT female thread  
LD = 3/8-18 NPT female thread (in-line porting only)  
LT = 1/8-28 BSPT female thread  
LU = 1/4-19 BSPT female thread  
IL = Inline porting, 180° apart

⑦ Voltage

LN2 Only

\_\_\_ VDC = DC (specify voltage)  
\_\_\_ VAC = AC Rectified (specify voltage)

LCO2 Only

\_\_\_ VDC = DC (specify voltage)  
\_\_\_ VAC = AC Rectified (specify voltage)

⑧ Additional Options

LN2 Only

(blank) = Chamfered and PTFE coated plunger\*  
(blank) = 316 Stainless Steel 1-piece guide assembly\*  
(blank) = 316 Stainless Steel spring\*

LCO2 Only

(blank) = Chamfered and PTFE coated plunger\*  
(blank) = 316 Stainless Steel 1-piece guide assembly\*  
(blank) = 316 Stainless Steel spring\*

\* Standard selection; will be used unless otherwise specified.  
Standard selections are not referenced in final part number.

## Manifold Assemblies

Gems Valve Engineers specialize in working with OEMs to design and manufacture integrated valve and manifold assemblies to meet most any fluidic system requirements. Our expert team of field and in-house engineers can deliver AutoCAD® or SolidWorks drawings in days for easy integration into OEM equipment. Whether it is a single or multiple position manifold—made from plastic, aluminum, brass or stainless steel—final systems are delivered completely assembled, tested, and ready for installation into your equipment.

Gems Manifold Assemblies offer features you require, in a compact package, at a competitive price. Integrated manifold assemblies provide:

- Simplified fluidic systems
- Decreased number of potential leak paths
- Reduction in the amount of mounting hardware
- Reduced quantity of fittings and tubing via common passages
- Compact package
- Design opportunity for multiple valve configurations to handle complex and precise flow control
- Reduced labor content required by OEMs
- Easy valve maintenance or replacement

All Gems valve families can be integrated into a manifold system. Contact your Gems Valve Engineer for a manifold assembly that will fulfill all of your application requirements. Contact us at 800-378-1600 or [info@gemssensors.com](mailto:info@gemssensors.com).

## Fluidic Systems

Purchasing a complete fluidic system through Gems eliminates the time and effort of multiple purchase orders and reduces receiving, inspection, and coordination of different parts down to a single assembly. Plus, buying from a single source gives OEMs one contact point for design changes, expediting, and warranty questions.

Gems valve engineers and manufacturing have a 50-year history of working with OEMs to develop, design, and manufacture their complex fluidic systems; from simple wiring harnesses and connectors to plug and play sub-assemblies and additional integrated fluidic components.

Designing and purchasing a complete turnkey fluidic system from Gems Sensors & Controls has many advantages.

- Receiving a complete 100% tested system that can be installed directly into your end product
- Reducing the number of suppliers required
- Decreasing the assembly of numerous third-party parts
- Minimizing the number of potential leak-points by eliminating tubing and fittings
- Reducing multiple components into a smaller and simplified final system

Our team of experts can integrate:

- Multiple valve types, including 3rd party manufacturers, into one assembly
- Numerous tube and pipe fittings
- Various electrical terminations
- Sensors/Switches/Gauges:
  - Pressure switch, transducer or gauge
  - Fluid flow sensor
  - Fluid level sensor
  - Temperature switch or transducer
- Inline media filters
- Heaters and thermistors

Contact your Gems Valve Engineer for a fluidic system that will fulfill all of your application requirements. Contact us at 800-378-1600 or [info@gemssensors.com](mailto:info@gemssensors.com).





Send your ADS directly to a Gems Engineer!  
 Fax#: 860-747-4244 • This form may also be completed online at [gemssensors.com](http://gemssensors.com) for RFQ.

One Cowles Road  
 Plainville, CT 06062  
 Toll Free: 888.840.1230

Name	Title	Email	
Company	Phone	Fax	
Address		Address 2	
City	State	Zip	Date / /

Please describe your application:  Liquid  Pneumatic  Vacuum Service  Oxygen Service  Liquid CO2 Cryogenic  Liquid N2 Cryogenic

Immediate quantity required \_\_\_\_\_ Estimated annual quantity \_\_\_\_\_

**Valve Configuration or Function**

**DE-ENERGIZED STATE**

- 2-Way Normally Closed
- 2-Way Normally Open
- 2-Way Normally Closed (Diaphragm)
- 2-Way Normally Closed Dual Purpose
- 3-Way Normally Closed Free Vent
- 3-Way Normally Closed Line Connect
- 3-Way Normally Open
- 3-Way Multi-Purpose
- 3-Way Directional Control

**FLOW REQUIREMENTS**

C<sub>v</sub>: Body \_\_\_\_\_, Stop \_\_\_\_\_ Orifice Diameter: Body \_\_\_\_\_, Stop \_\_\_\_\_  
 Flow at the Body Orifice \_\_\_\_\_ (GPMO or SCFM) with a \_\_\_\_\_ psig at the Inlet, and \_\_\_\_\_ psig at the outlet  
 Flow at the Stop Orifice \_\_\_\_\_ (GPMO or SCFM) with a \_\_\_\_\_ psig at the Inlet, and \_\_\_\_\_ psig at the outlet

**PRESSURE**

Operating Pressure \_\_\_\_\_  
 Max. Pressure \_\_\_\_\_  
 Min. Pressure \_\_\_\_\_  
 Max. Back Pressure \_\_\_\_\_

**TEMPERATURE**

Media Temp. \_\_\_\_\_  
 Max. Media Temp. \_\_\_\_\_  
 Min. Media Temp. \_\_\_\_\_  
 Ambient Temp. \_\_\_\_\_  
 Max. Ambient Temp. \_\_\_\_\_  
 Min Ambient Temp. \_\_\_\_\_

MEDIA(S) \_\_\_\_\_

**BODY MATERIAL**

- Brass
- Stainless Steel
- Aluminum
- Polypropylene
- Other \_\_\_\_\_

**PLUNGER SEAL MATERIAL**

- Nitrile
- Viton®
- Ethylene Propylene
- Neoprene
- Silicone
- Perfluoroelastomer
- Other \_\_\_\_\_

**O-RING MATERIAL**

- Nitrile
- Viton®
- Ethylene Propylene
- Neoprene
- Silicone
- Perfluoroelastomer
- Other \_\_\_\_\_

**ELECTRICAL REQUIREMENTS**

- AC  DC
- Max. Voltage \_\_\_\_\_
- Min. Voltage \_\_\_\_\_

Operating Voltage \_\_\_\_\_, ( \_\_\_\_\_ Hz)  
 Continuous Duty Max. Time ON \_\_\_\_\_  
 Intermittent Duty Min. Time OFF \_\_\_\_\_

Max. Wattage \_\_\_\_\_  
 Max. Cycle Rate \_\_\_\_\_  
 Life Cycle Expectancy \_\_\_\_\_

**COIL REQUIREMENTS**

- Class B
- Class F
- Class H
- Tape Wound
- Encapsulated
- Molded
- Lead Wire (Specify Length If required) \_\_\_\_\_)
- 3/16" Spades
- 1/4" Spades
- 0.110" Spades
- 18 mm DIN
- 11 mm DIN
- 9.4 mm DIN

- Rectified
- Arc Suppression Diode
- Special Connectors  
(Please Specify) \_\_\_\_\_

**HOUSE STYLE**

- Grommet
- Conduit, 1/2-14 NPS
- Grommet with Bracket
- Conduit with Bracket
- Other \_\_\_\_\_

**BODY CONFIGURATION**

- |  |  |   |  |  |  |
|--|--|---|--|--|--|
| <input type="checkbox"/> Single Valve Body       | <input type="checkbox"/> Body Port<br>1/8" NPT | <input type="checkbox"/> Stop Port (If Different)<br>1/8" NPT | <input type="checkbox"/> Body Port Orientation<br>180° | <input type="checkbox"/> Female Bottom Port<br>Specify Port Size _____ | <input type="checkbox"/> Male Bottom Porting<br>1/8" NPT (Brass) |
| <input type="checkbox"/> Manifold Mount          | <input type="checkbox"/> 1/4" NPT              | <input type="checkbox"/> 1/4" NPT                             | <input type="checkbox"/> 1/4" NPT                      | <input type="checkbox"/> 90° Right                                     | <input type="checkbox"/> Pressure Over-Seat                      |
| <input type="checkbox"/> Operator Only (No Body) | <input type="checkbox"/> 3/8" NPT              | <input type="checkbox"/> #10-32                               | <input type="checkbox"/> 3/8" NPT                      | <input type="checkbox"/> 90° Left                                      | <input type="checkbox"/> Pressure Under Seat                     |
| <input type="checkbox"/> Metering                | <input type="checkbox"/> #10-32                | <input type="checkbox"/> #10-32                               |  |  |  |
|  | <input type="checkbox"/> 1/8" BSPT             | <input type="checkbox"/> 1/8" BSPT                            |  |  |  |
|  | <input type="checkbox"/> M5 x 0.8              | <input type="checkbox"/> M5 x 0.8                             |  |  |  |

**What will be the Valves Environment?**

Will the valve be exposed to moisture?  Yes  No Will the valve be exposed to external contamination?  Yes  No

Will the valve be in close proximity to a heat-generating source (e.g. Transformer, pump, motor)?  Yes  No

Will the valve be subject to vibration or shock?  No  Yes If yes: Vibration \_\_\_\_\_ CPS at \_\_\_\_\_ Gs, Shock \_\_\_\_\_ GS duration for \_\_\_\_\_ ms.

# PRX Series – Compact Switches

## PRX-10, PRX-20, PRX-30, PRX-40, PRX-50, PRX-70

- Easy to install
- No standby power requirements
- Reliable for over 1 million cycles
- Interchangeable with existing sensors
- Hermetically sealed for longer performance

The PRX series from Gems offers a versatile line of low cost, general purpose proximity sensors designed for dry applications. Constructed out of ABS and UL approved material, the PRX series has no standby power requirements and no moving parts. Proximity sensors are hermetically sealed for long lasting performance and are easy to install for a variety of applications.

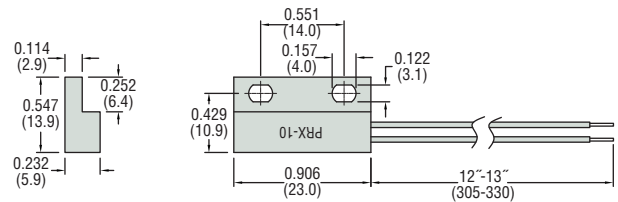
### Specifications

<b>Housing Material</b>	ABS
<b>Operating Temperature</b>	32°F to 212°F (0°C to 100°C)
<b>Switch</b>	SPST, N.O.
<b>Voltage, Max.</b>	160 Vdc
<b>Current, Max.</b>	0.5 Amps
<b>Vibration Resistance</b>	10 to 55 Hz

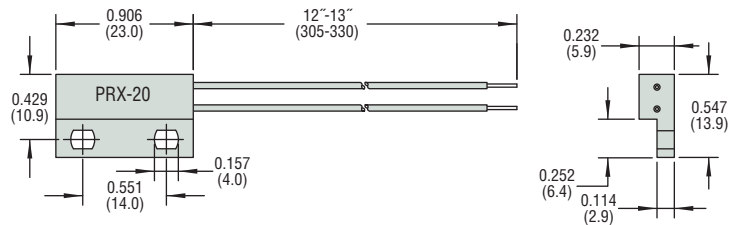
### Typical Applications

- General purpose
- Household appliances
- Security systems
- Door interlocks
- Safety interlocks
- Position indication
- Equipment automation

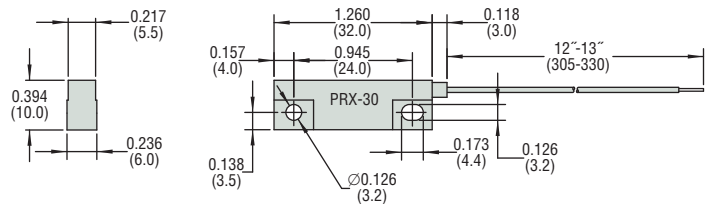
### PRX-10



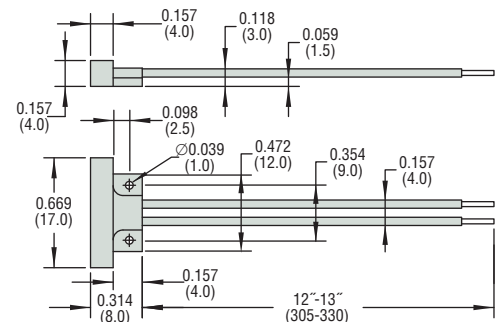
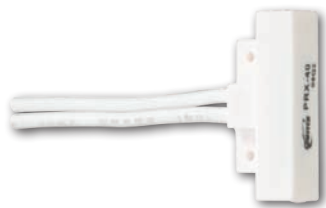
### PRX-20



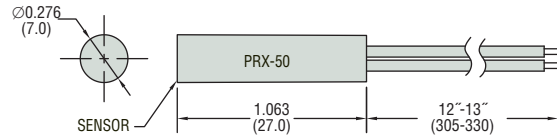
### PRX-30



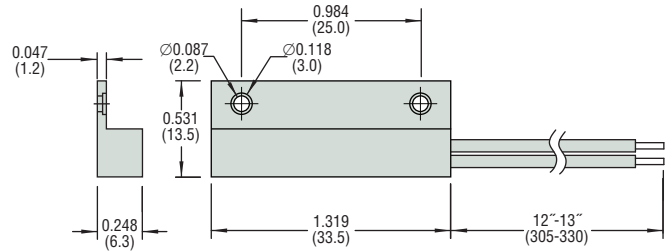
### PRX-40



PRX-50



PRX-70



How To Order – Switches

Select by Part Number based on operational requirements. All proximity switches below come with matching magnets included.

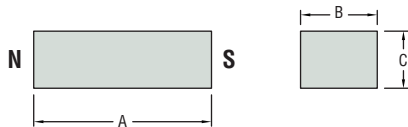
Series	Operating Temperature	Contact Rating	Switch Open Distance, Min.	Switch Close Distance, Min.	Part Number
PRX-10	14°F to 176°F (-10°C to +80°C)	10 VA	1.02 inch (26 mm)	0.63 inch (16 mm)	225951
PRX-20	14°F to 176°F (-10°C to +80°C)	10 VA	1.30 inch (33 mm)	0.79 inch (20 mm)	225952
PRX-30	14°F to 176°F (-10°C to +80°C)	10 VA	1.02 inch (26 mm)	0.63 inch (16 mm)	225953
PRX-40	14°F to 176°F (-10°C to +80°C)	10 VA	1.30 inch (33 mm)	0.35 inch (9 mm)	225954
PRX-50	14°F to 140°F (-10°C to +60°C)	10 VA	1.57 inch (40 mm)	0.67 inch (17 mm)	225955
PRX-70	14°F to 140°F (-10°C to +60°C)	50 VA	1.97 inch (50 mm)	0.71 inch (16 mm)	225956

Notes:

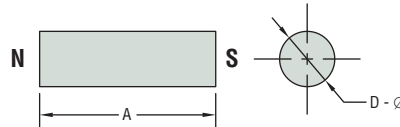
- Product options include: Lead length, Activation Magnet and 22 Gage Wire. Please contact Gems for these options.
- Lead time 2 weeks. A minimum piece order is required; please contact factory .

Actuating Magnets

Ferrite



Neo



How To Order – Magnets

Magnets for the above Proximity Switch series can be ordered separately.

Specify Part Number based on series switch with which the magnet is to be paired.

Switch Series	Magnet Type	Dimensions – inch (mm)				Part Number
		A	B	C	D – Ø	
PRX-10 PRX-20 PRX-30	Ferrite	1 (25.5)	0.43 (11)	0.35 (9)	—	226618
PRX-40	Neo	0.62 (15.8)	—	—	0.11 (2.8)	226621
PRX-50	Neo	0.79 (20.1)	—	—	0.25 (6.3)	226622
PRX-70	Neo	1.13 (28.6)	—	—	0.18 (4.7)	226623

# PRX-100 Series

## Heavy Duty, General Purpose

- Easy to install
- No standby power requirements
- Reliable for over 1 million cycles
- Interchangeable with existing sensors
- Hermetically sealed for longer performance

### Specifications

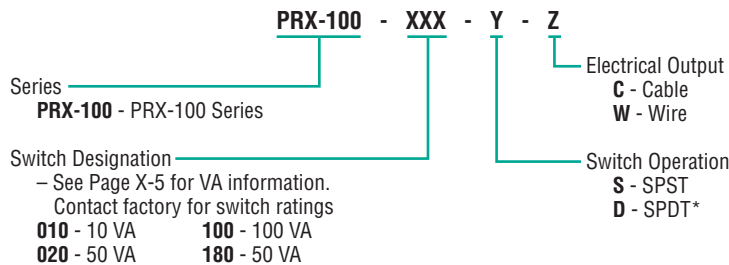
<b>Housing Material</b>	Norel (Polyphenylene Oxide - Styrene)
<b>Operating Temperature</b>	-40°F to +194°F (-20°C to +90°C)
<b>Pressure</b>	Atmospheric
<b>Approvals</b>	cULus File # E305671

### Typical Applications

- General Purpose
- Household Appliances
- Security systems
- Door interlocks
- Safety interlocks
- Position indication
- Equipment automation

### How To Order – Two Steps: Select Switch and Magnet

**Step 1:** Configure Switch Part Number from options below.



**Example:** PRX-100-020-D-W

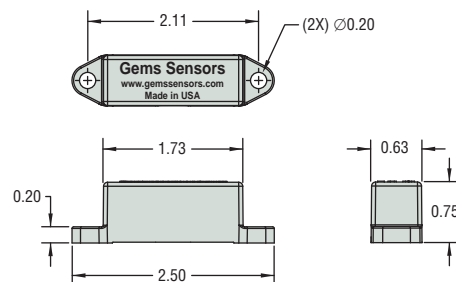
\* Requires Switch Designation "100".

**Step 2:** Select an Actuating Magnet to pair with Switch.

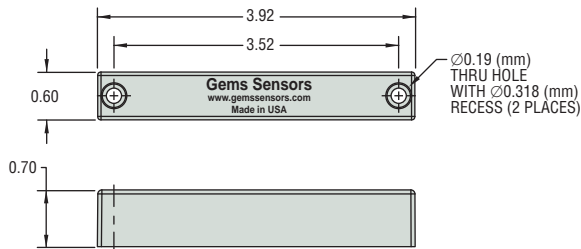
PRX-100 Series actuating magnets are available in both housed assemblies and as bare magnets (See Page K-5).

### Configuration

#### Type 1 Assembly



#### Type 2 Assembly



### How to Order

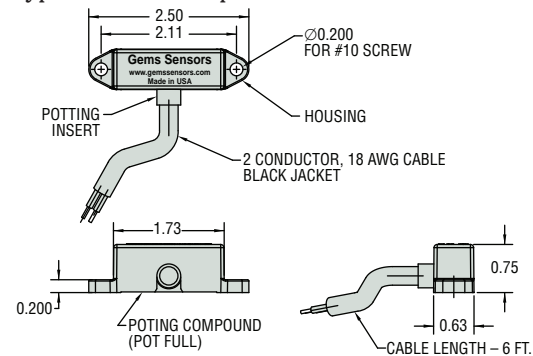
**Magnets for the above Proximity Switches are ordered separately.** Select by Configuration, Magnet Type and Size.

Configuration	Magnet Type	Magnet Size		Part Number
		A – Length	B – Diameter	
Type 1 Assembly	Alnico 5	1.5" (38.1 mm)	3/8" (9.5 mm)	<b>217302</b>
	Neo N35H	1.5" (38.1 mm)	3/8" (9.5 mm)	<b>217310</b>
Type 2 Assembly	Alnico 5	2.5" (63.5 mm)	3/8" (9.5 mm)	<b>217301</b>
	Alnico 5	1.5" (38.1 mm)	3/8" (9.5 mm)	<b>222055</b>
	Neo N35H	1.5" (38.1 mm)	3/8" (9.5 mm)	<b>222056</b>

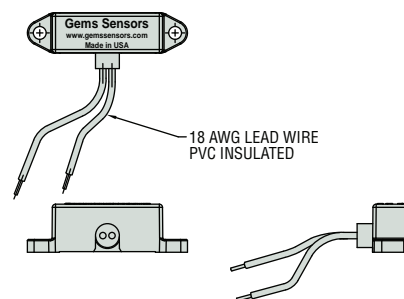


### Dimensions

#### Type C – Cable Output



#### Type W – Wire Output





## PRX-300 Series Mid Range General Purpose

- Stress relief technology for reed switch protection
- Easy to install
- No standby power requirements
- Reliable for over 1 million cycles
- Interchangeable with existing sensors
- Hermetically sealed for longer performance
- Normally Open (No magnetic field)

The compact size of the PRX-300 series offers a variety of low cost, high performance proximity switches. Constructed out of robust 33% glass filled nylon the PRX-300 series has no standby power requirements and no moving parts. Proximity switches are hermetically sealed for long lasting performance and are easy to install and adjust for a variety of customer applications.

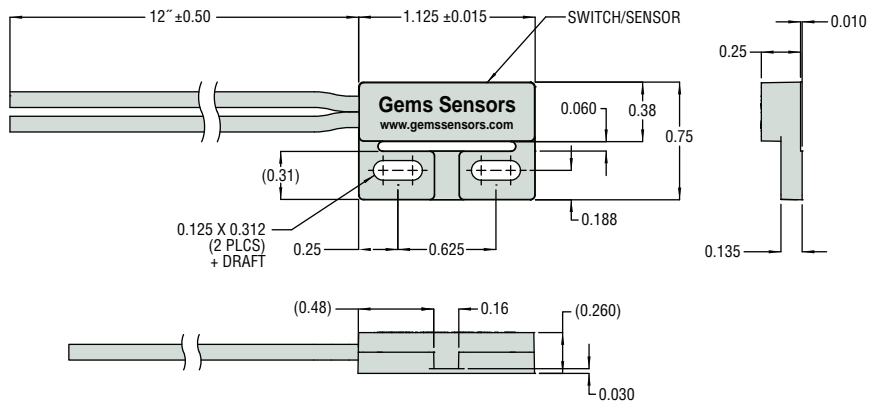
### Specifications

<b>Housing Material</b>	Nylon 33% GF
<b>Operating Temperature</b>	32°F to 212°F (0°C to 100°C)
<b>Pressure</b>	Atmospheric
<b>Switch</b>	SPST, N.O.
<b>Voltage, Max.</b>	250 Vdc
<b>Current, Max.</b>	1.0 A
<b>Approval</b>	cUL Recognized

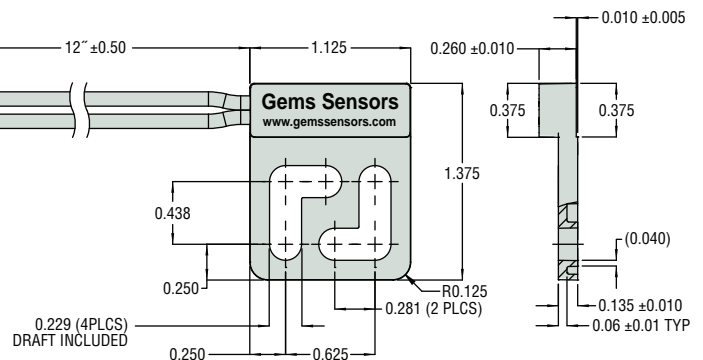
### Typical Applications

- General Purpose
- Household Appliances
- Security systems
- Door interlocks
- Safety interlocks
- Position indication
- Equipment automation

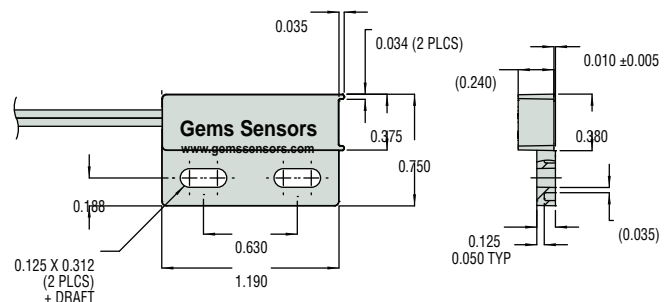
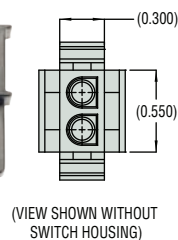
### PRX-300



### PRX-310



### PRX-320



## How To Order – Switches

Select by Part Number based on operational requirements.

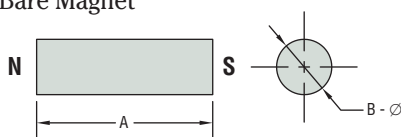
Series	Housing Material	Operating Temperature	Contact Rating	Switch Actuation Distance	Part Number
PRX-300	Nylon 33% GF	32°F to 212°F (0°C to 100°C)	50 VA	0.75 inch (19 mm)	<b>225815</b>
PRX-310	Nylon 33% GF	32°F to 212°F (0°C to 100°C)	50 VA	0.70 inch (17.8 mm)	<b>225820</b>
PRX-320	Nylon 33% GF	32°F to 212°F (0°C to 100°C)	50 VA	0.5 inch (12.7 mm)	<b>225830</b>

Notes:

1. Product options include: Lead length, Activation Magnet and 22 Gage Wire. Please contact Gems for these options  
Lead time 2 weeks.

## Actuating Magnets

Bare Magnet



## How to Order

**Magnets for the above Proximity Switches series are ordered separately.**

Select by Configuration, Magnet Type and Size.

Configuration	Magnet Type	Magnet Size		Part Number
		A – Length	B – Diameter	
Bare Magnet	Alnico 5	1" (25.4 mm)	3/16" (4.8 mm)	<b>217311</b>
		1.5" (38.1 mm)	3/8" (9.5 mm)	<b>217303</b>
		2.5" (63.5mm)	3/8" (9.5 mm)	<b>217909</b>
		3" (76.2mm)	1/2" (12.7 mm)	<b>220551</b>
	Neo N35H	1" (25.4 mm)	3/16" (4.8 mm)	<b>217304</b>
				<b>217309</b>
		1" (25.4 mm)	3/8" (9.5 mm)	<b>220753</b>
		1.5" (38.1 mm)	3/8" (9.5 mm)	<b>220999</b>

## GEMS Relays and Barriers Render Any Non-Voltage Producing Sensor or Switch Intrinsically Safe

- ▶ Provide method of eliminating explosive conditions
- ▶ Rapid, arc-free response provides positive, non-mechanical operation
- ▶ Solid-state reliability assures consistent performance
- ▶ Low-power switching; a few milliamps of current controls high-power loads
- ▶ Completely encapsulated construction  
Units are impervious to dust, moisture or foreign material  
They are tamper-proof and shock- and vibration-resistant
- ▶ Modular housings for easier installation
- ▶ Exceptionally long, trouble-free service life

### Intrinsic Safety and its Advantages.

#### Instrument Society of American Specification ISA-RP12.2 Defining Intrinsically Safe Equipment:

“Intrinsically safe equipment and wiring is equipment and wiring which is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most ignited concentration. Intrinsically safe terminations and wiring may be brought into any hazardous location of any Group classification for which it is accepted without requiring explosion-proof housing or other means of protection.”

To be certified “intrinsically safe,” a device or circuit must be so designed that no two simultaneous failures can cause an explosion. Intrinsically safe systems are more dependable. The I.S. circuit must function reliably per specifications, with no explosions, during and after cycling through a number of operations.

The units can also be installed more conveniently. Since no explosion is possible, no explosion-proof conduit or enclosures of any kind are needed in the hazardous area. Maintenance can be performed immediately as needed. And, intrinsically safe systems are more economical. Costly enclosures with their mounting requirements are unnecessary. No purging is required, thereby eliminating blowers, pressure switches, timers and relays.

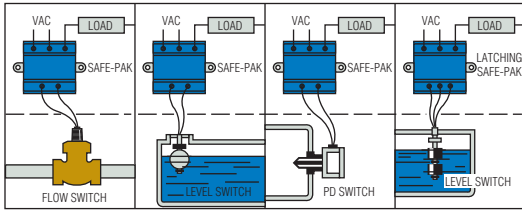
**SAFE-PAK® RELAYS:** These intrinsically safe units amplify sensor load-handling capabilities in a wide diversity of AC and DC control switching applications.

**Zener Barriers:** These passive, energy-limiting devices, provide intrinsically safe DC outputs for a variety of sensors such as level and flow switches...level indicating transducers and transmitters...and many others. The maximum energy possible at the switch terminals of the SAFE-PAK and Zener Barriers is far below the explosive point of the most volatile surrounding gas conditions. The type of non-voltage-producing switch or sensor best suited for the application can be utilized, since the entire switching circuit is rendered intrinsically safe by the SAFE-PAK or Zener Barrier. As the switching circuit is low voltage, there is no shock hazard to operating or maintenance personnel.



## Typical Applications

### Switches Located in Hazardous Areas



### Important points to remember when selecting Zener Barriers and Safe Pak® :

- The maximum input voltage rating of the barrier must be higher than your power supply. (i.e., a 24 VDC supply would require a 30 V barrier.)
- Make sure the barrier is rated for your hazardous area class, division, and group.

## Intrinsic Safety Approvals – Safe-Pak® Relays and Zener Barriers

Model	Part Number	Approvals			Hazardous Locations							Page Number		
		UL	FM	CSA	Class	Division	Group							
							A	B	C	D	E		F	G
SAFE-PAK®	22445	•	•	•	I, II	1, 2	•	•	•	•	•	•	•	L-4 and L-5
	25872	•	•	•			•	•	•	•	•	•	•	
	25873	•	•	•			•	•	•	•	•	•	•	
	64101	•	•	•			•	•	•	•	•	•	•	
	144600	•	•	•			•	•	•	•	•	•	•	
Programmable SAFE-PAK®	54820	•	•	•	I, II	1, 2	•	•	•	•	•	•	L-6 and L-7	
	54825	•	•	•			•	•	•	•	•	•		
	54845	•	•	•			•	•	•	•	•	•		
	54801	•	•	•	I, II	1, 2				•			L-10 and L-11	
	54803	•	•	•			•	•						
	54805	•	•	•			•	•						
	54806	•	•	•			•	•			•			
Zener Barriers <sup>2</sup>	111950	•	•	•	I, II	1, 2	•	•	•	•	•	•	L-8 and L-9	
	111952	•	•	•			•	•	•	•	•	•		•
	111954	•	•	•			•	•	•	•	•	•		•
	111956	•	•	•			•	•	•	•	•	•		•
	113000	•	•	•			•	•	•	•	•	•		•
	114072	•	•	•			•	•	•	•	•	•		•
	114074	•	•	•			•	•	•	•	•	•		•
	114166	•	•	•			•	•	•	•	•	•		•
114175	•	•	•	•	•	•	•	•	•	•				

#### Notes:

1. Certified intrinsically safe under MSHA certification No. 1662 for use on permissible equipment. For Group D use only.
2. Zener Barrier models, Part Numbers 54801, 54803, 54805, 54806; Programmable SAFE-PAK models, Part Numbers 54820, 54825, 54845 are certified by CSA for mounting inside a suitable enclosure in Division 2 or non-hazardous locations and must be connected by means of the two studs provided to grounded copper busbar or equivalent.

For information on non-intrinsically safe holding relays and switching units, see Pages L-12 and L-13.

MSHA — Bureau of Mines



UL — Underwriter's Laboratories, Inc.



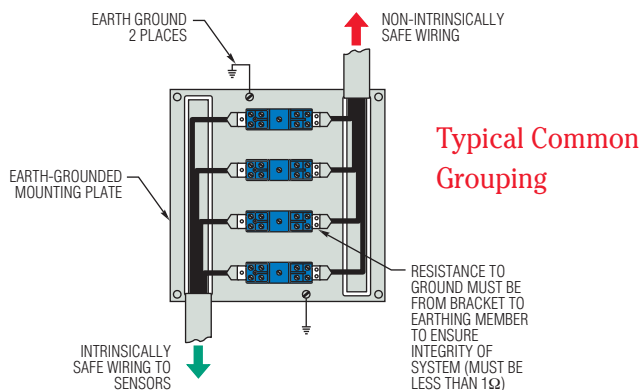
FM — Factory Mutual



CSA — Canadian Standards Association

## Installation and Maintenance

SAFE-PAK and Zener Barrier units are installed in a safe area and connected to the sensor in a hazardous location...no explosion-proof or protective housings of any kind are needed. Units install singly, in any position...or can be grouped on a common, earth-grounded plate with mounting tabs to provide electrical grounding. No. 6-32 threaded electrical terminals are conveniently placed atop the unit housings. Barriers and relays may be grouped on a common, earth-grounded mounting plate. Intrinsically safe sensor wiring must be separated from non-intrinsically-safe input wiring in separate conduits or raceways to prevent by-pass during testing or servicing.



The only maintenance normally required is routine inspection approximately every two years or less to check integrity of earth-grounding and electrical connections, and to make sure the unit is clean.

GEMS SAFE-PAKS and Zener Barriers must be installed in conformance with the National Electrical Code and the INSTRUCTION, INSTALLATION AND SERVICE Bulletin supplied with all units. Periodic checks of ground bonding and cleanliness of units and terminals constitute the only maintenance required.

### Warning

Misapplication of intrinsically safe products may result in injuries or damages. The circuit diagrams presented in this catalog are typical and may not represent your application.

## Hazardous Locations as defined by the National Electrical Code Handbook. . .

The degree of hazard is normally indicated by a three-part designation: "Class-, Division, and Group-." Class I, Division 1, Group A denotes the most severely and continually hazardous condition.

**Class I Locations** — Are those in which flammable bases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

**Class II Locations** — Are those which are hazardous because of the presence of combustible dust.

**Class III Locations** — Are those which are hazardous because of the presence of easily ignitable fibers or flyings, but in which such fibers or flyings are not likely to be in suspension in air quantities sufficient to produce ignitable mixtures.

**Division 1** — Locations in which hazardous concentrations in the air exist continuously, intermittently, or periodically under normal operating conditions.

**Division 2** — Locations in which hazardous concentrations are handled, processed, or used, but are normally confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown.

**Group A** — Atmospheres containing acetylene.

**Group B** — Atmospheres containing hydrogen, or gases or vapors of equivalent hazard, such as manufactured gas.

**Group C** — Atmospheres containing ethyl-ether vapors, ethylene or cyclopropane.

**Group D** — Atmospheres containing gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, lacquer solvent vapors or natural gas.

**Group E** — Atmospheres containing metal dust, including aluminum, magnesium, and their commercial alloys and other metals of similarly hazardous characteristics.

**Group F** — Atmospheres containing carbon black, coal or coke dust.

**Group G** — Atmospheres containing flour, starch, or grain dusts.

# Intrinsically SAFE-PAK® Relays Amplify Sensor Load-Handling Capabilities

Costly explosion-proof enclosures with their mounting requirements are unnecessary. No purging is required.

**SAFE-PAK:** Less than 100 microamps at 9 VDC actuates the unit to control loads to 5A at 120 VAC. Resistive (up to 100,000Ω) or short-circuiting sensors operate the unit. 120 VAC and 240 VAC model.

**Low Sensitivity SAFE-PAK:** Sensor closures up to 1000Ω resistance control resistive loads to 5A at 120 VAC. 120 VAC, N.O. model.

See table on Page L-2 for specific approval information.



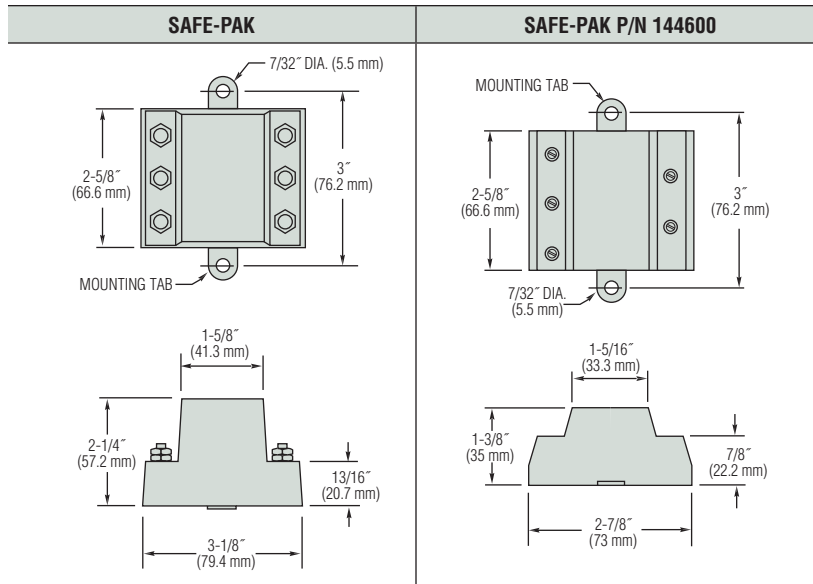
P/N  
22445  
25872  
25873  
64101



P/N  
144600



## Dimensions



## How To Order

Select Part Number based on Relay Style, Operating Voltage and Switch Operation required.

Relay Style	Operating & Load Voltage Range	Load Current Maximum	Turn-On Sensitivity (Typical) <sup>1</sup>	Turn-Off Sensitivity (Typical) <sup>1</sup>	Voltage Loss	Operating Temperature Range	Output Leakage Current Maximum	Switching Operation	Part Number
SAFE-PAK®	95 to 135 VAC	5A	400 K	1 M	2 VAC	0°F to +120°F (-17.8°C to +48.9°C)	6 mA @ 120 VAC	SPST N.O.	22445 <sup>5</sup> ⚡
	100 to 135 VAC						6 mA @ 120 VAC	SPST N.C.	25872 <sup>5</sup> ⚡
	200 to 250 VAC						12 mA @ 250 VAC	SPST N.O.	25873 ⚡
Low Sensitivity SAFE-PAK®	110 to 130 VAC	.5A @ 20 VAC <sup>2</sup> .05A @ 200 VAC <sup>2</sup>	300	1000	—	-10°F to +140°F (-23.3°C to +60°C)	0	SPST N.O.	64101 ⚡
	105 to 125 VAC	5A	500	2000	2 VAC	-40°F to +120°F (-40°C to +48.9°C)	6 mA @ 120 VAC	SPST N.O.	144600 ⚡

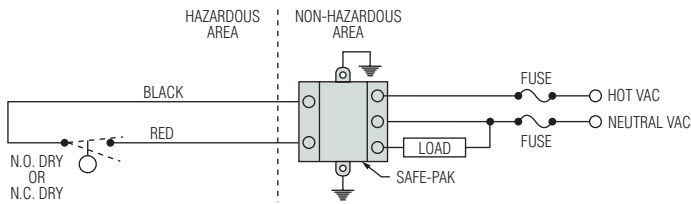
Notes:

- Temperature Dependent.
- 50-60 Hz
- All AC voltage and current specifications are RMS values unless otherwise stated.
- Housing material is Polysulfone.
- Certified intrinsically safe under MSHA certification No. 1662 for use on permissible equipment. For Group D use only.

⚡ – Stock Items.

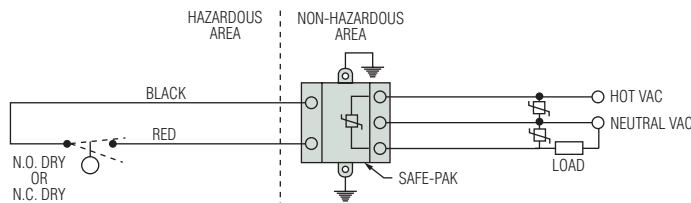


**Typical Wiring Diagrams**



SAFE-PAK, Part Numbers 25872, 25873, 64101 or 144600 with sensor switch in hazardous location.

Transient Protection for SAFE-PAK (AC Loads) Use a properly sized metal oxide varistor (MOV) as shown below.



Installation and maintenance must be in accordance with the National Electrical Code and the applicable GEMS INSTRUCTION, INSTALLATION and SERVICE bulletin available at [www.gemssensors.com](http://www.gemssensors.com)

# Define Switching Mode Anytime With Programmable SAFE-PAK® Relays

Provide normally open (N.O.), normally closed (N.C.) or latching output with variable time delays

- ▶ Designed for use with switches or sensors monitoring flow, pressure, level, etc
- ▶ They render non-voltage-producing sensors intrinsically safe for operation in potentially hazardous areas
- ▶ Streamlined housing suited for group-mounting on a common earth-grounded plate for multiple installation
- ▶ UL recognized, FM, CSA and evaluated by MSHA

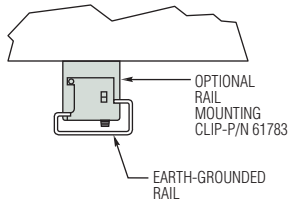
Operations such as normally open, normally closed or latching are programmed into these versatile SAFE-PAK units by the user during installation. Selection is made by simply connecting sensor wiring (and jumper wire when required) to the proper terminals on the unit as diagrammed on opposite page. All units are programmable, except where otherwise indicated.

See table on Page L-2 for specific approval information.

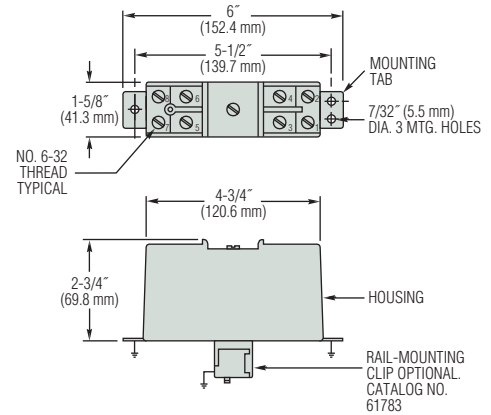
## Options

SAFE-PAK Relays can be supplied with any of the following options on special order. Please consult factory.

- With optically isolated operation
- With zero-crossover load switching
- Longer time delays
- Rail-mounting clip (in addition to standard mounting tabs)

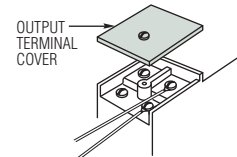


## Dimensions



## Protective Cover

Assures intrinsic safety integrity of sensor terminals and wiring.



## Specifications

Part Number	Operating Voltage <sup>4</sup>	Load Current Maximum	Load Voltage Range	Turn-On Sensitivity (Typical) <sup>1</sup>	Turn-Off Sensitivity (Typical) <sup>1</sup>	Leakage Current "Off" State, Maximum	Voltage Loss, Maximum	Transient Current <sup>3</sup>	Operating Temperature Range
54820 ⚡	95 to 125 VAC, 50-60 Hz	2A	25-250 VAC 50-60 Hz	≤400 K	1 M	3 mA	2 V	20A	+32°F to +140°F (0°C to 60°C)
54825 ⚡		.05A @ 20 V .05A @ 200 V AC or DC	0-250 VAC 50-400 Hz 0-200 VDC	≤30 K	60 K	—	—	—	

Notes:

1. Temperature Dependent.
2. Housing material is blue Lexan®.
3. Repetitive surge currents caused by transient voltage/current pulses may eventually cause permanent damage to triac-type switches if adequate transient suppression is not utilized.
4. All AC voltage and current specifications are RMS values unless otherwise stated.

⚡ – Stock Items.

## How To Order

Specify Part Number based on output.

Description – Hybrid Relay	Switching Mode	Part Number
Triac Output, AC Operation	Programmable, N.O., N.C., or latching	54820 ⚡
Reed Switch Output, AC/DC Operation		54825 ⚡
Optional Rail Mounting Clip		61783

⚡ – Stock Items.

## Programming the GEMS Programmable SAFE-PAK

**Normally Open Load Operation:** Switch closure to terminals 5 and 7 turns Programmable Relay “on” and energizes load. Same switch opening will turn “off” Programmable Relay and de-energize load. Terminals 6 and 8 are not used.

**Normally Closed Load Operation:** Switch closure to terminals 6 and 7 turns Programmable Relay “off” and de-energizes load. Same switch opening will turn “on” Programmable Relay and energize load. Jumper must be connected between terminals 5 and 7...terminal 8 is not used.

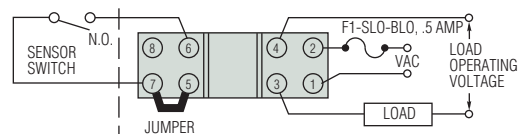
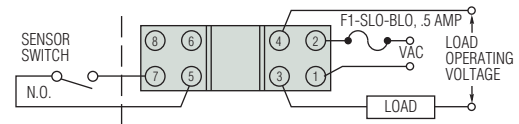
**Latching “A” Operation:** For refill control, momentary switch closure to terminals 5 and 7 turns Programmable Relay “on” and energizes load. Load remains “on” until the Programmable Relay turns “off” with a momentary switch closure at terminals 6 and 7. The load is then de-energized. Jumper must be connected between terminals 7 and 5 and 6.

Note: Latching function should be accomplished on sensor input side of the Programmable SAFE-PAK. No latching function is advised on the output power circuit side.

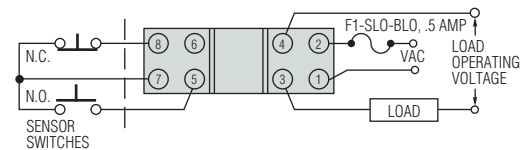
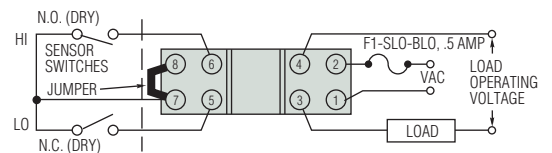
**Latching “B” Operation:** Momentary switch closure to terminals 5 and 7 turns Programmable Relay “on” and energizes load. Load remains “on” until the N.C. switch terminals 7 and 8 opens. The Programmable Relay turns “off” and load is de-energized. Terminal 6 and jumper are not used.

Note: Latching function should be accomplished on sensor input side of the Programmable SAFE-PAK. No latching function is advised on the output power circuit side.

## Typical Wiring

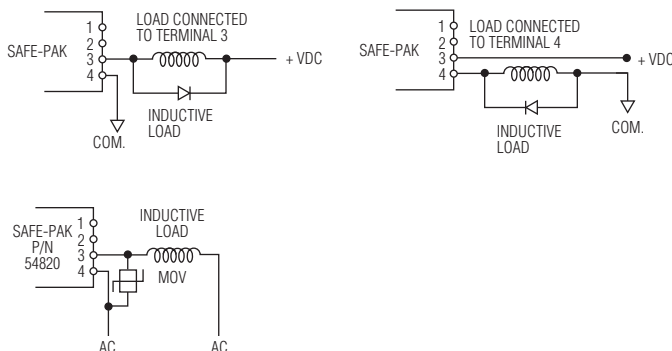


## Refill Operation Shown

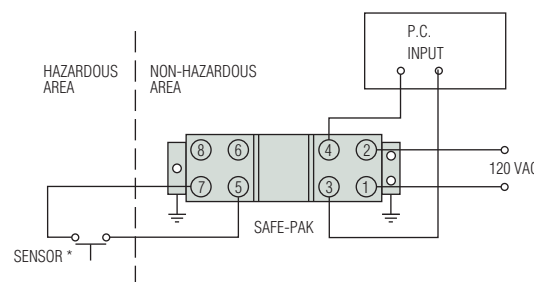


## Load Consideration

When these units are used in high-noise electrical systems, connection of a varistor (General Electrical G-MOV or equivalent diode) across terminals 3 and 4 is recommended. Consult factory for recommended varistor protection.



## Connecting to Programmable Controllers



Programmable SAFE-PAK, P/N 54825, providing simple on-off functions for hazardous location, and interfacing with TTL or AC logic input of programmable controller. \*Temperature, pressure, position, flow or level.

Installation and maintenance must be in accordance with the National Electrical Code and the applicable GEMS INSTRUCTION, INSTALLATION and SERVICE Bulletin available at [www.gemssensors.com](http://www.gemssensors.com)

# 65800 Series Single Channel Zener Barriers Render Switches or Signal Conditioners Intrinsically Safe

Limits D.C. voltage and current to the hazardous area and provides a path for fault current

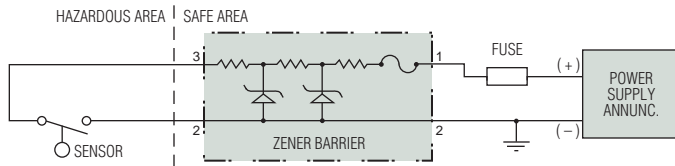
- ▶ Intrinsic safety with solid-state reliability
- ▶ Compact size streamlines installation
- ▶ Space-saving in multiples
- ▶ Encapsulated construction is impervious to dust and moisture

The exceptionally compact design of GEMS 65800 Series units saves space and simplifies installation; especially in multiples on a common mounting plate. They provide great economy as well since no explosion-proof enclosures are needed for sensor wiring. Encapsulated construction is impervious to dust and moisture. Single-screw mounting is standard, but units can be supplied with an optional clip for rail mounting. The single through-mounting screw also provides electrical connection to ground through the earth-grounded mounting surface.

Any non-voltage-producing sensor or switch is rendered intrinsically safe for hazardous locations when properly connected to the output of these Zener Barriers.

See table on Page L-2 for specific approval information.

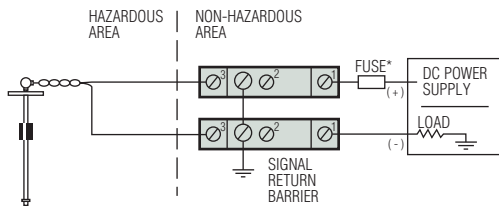
## Typical Wiring Diagram



## Positive single-channel Zener Barrier with negative ground.

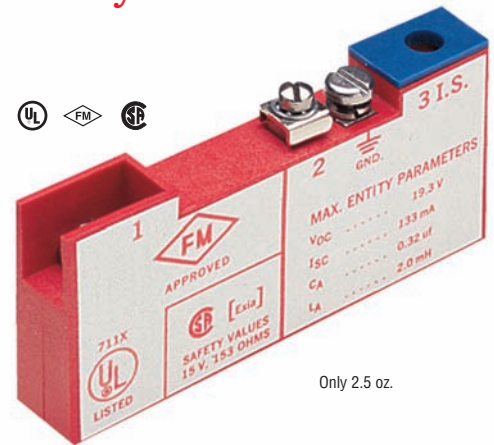
For most non-voltage-producing devices located in a hazardous area, a single Zener Barrier that is negative-earth-ground can be used for intrinsic safety. Instrumentation that produces an output (signal conditioners) usually requires two barriers, one for each "floating" lead. In this case, a dual channel barrier can be provided (see L-10 and L-11).

Or, for applications where the instrument signal return level cannot be reduced, a supply barrier and a low resistance return barrier can be supplied (shown below).

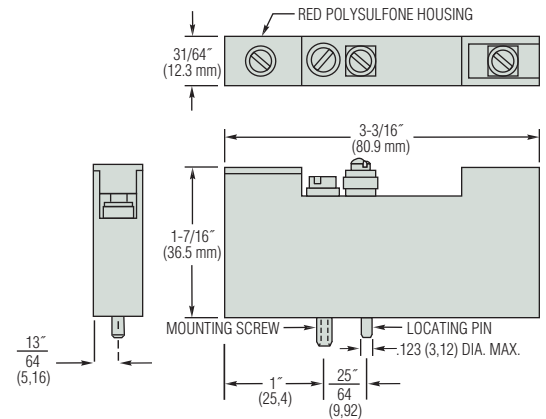


For floating leads: 65800 Series supply and return barriers for signal conditioners.

Installation and maintenance must be in accordance with the National Electrical Code and the applicable Gems INSTRUCTION, INSTALLATION and SERVICE bulletin available at [www.gemssensors.com](http://www.gemssensors.com)

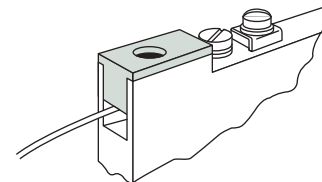


## Dimensions



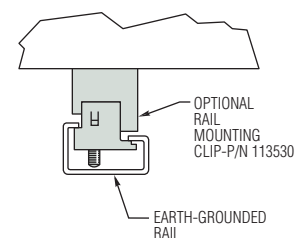
## Protective Cover

Protective cover over the output terminal (3) assures intrinsic safety of sensor wiring.



## Optional Rail Mounting

Gems Single Channel Zener Barriers can be supplied on special order with a clip for rail mounting. Clip attaches to barrier with standard mounting screw.



## How To Order

Specify Part Number based on Barrier Type and Input Power requirements.

Zener Barrier Type	DC Input to Barrier, Max.		Signal Polarity	Series Resistance ohms	Application Group	Reactive Limits		Part Number
	Voltage	Current				Capacitance $\mu$ f	Inductance mh	
Supply	+15	250 mA	Positive	183	A, B, C, D, E, G	0.32	2.0	<b>111950</b> ⚡
	+20	125 mA		303		0.18	4.1	<b>111952</b>
	+24	62 mA		390		0.12	3.0	<b>111954</b> ⚡
	+30	62 mA		750		0.07	1.8	<b>111956</b> ⚡
	+18	125 mA		183	C, D, E, G	0.72	3.6	<b>114074</b>
	+24	62 mA		234		0.33	3.1	<b>114072</b>
	+27	62 mA		276		0.24	3.3	<b>114175</b>
	+30	250 mA		303		0.20	3.0	<b>113000</b> ⚡
Signal Return	+30	250 mA		33.9	A, B, C, D, E, G	0.07	.35	<b>114166</b> ⚡
Optional Rail Clip								<b>113530</b> ⚡

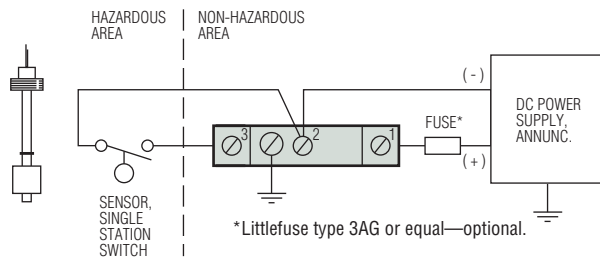
### Notes:

- All models shown are for Class I and II, Division 1 and 2. Specific Application Groups are tabulated.
- Ambient operating temperatures for all models shown is -40°F to +140°F (-40°C to +60°C).

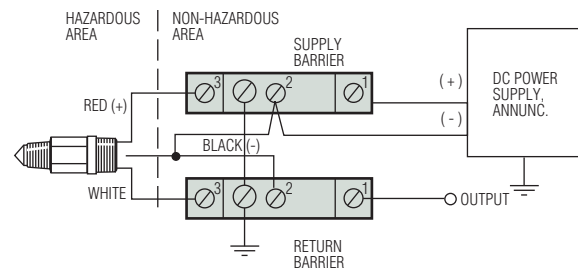
⚡ – Stock Items.

## Typical Application Examples

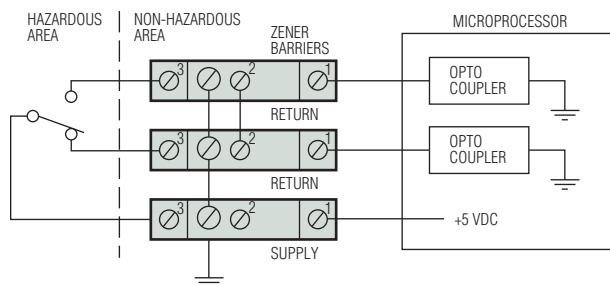
Sensors or Switches may be any non-voltage-producing device. Typical are: flow and level switches, temperature switches (thermostats), pressure switches or passive resistive transducers or transmitters. Below are typical examples.



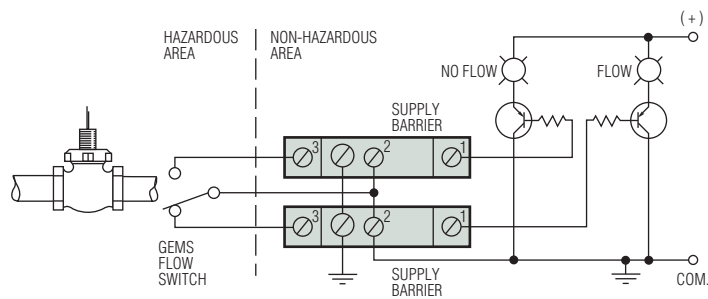
With GEMS level switch or any other non-voltage-producing device located in a hazardous area.



Supply and Return Zener Barriers used with GEMS EL-1100 Series electro-optical level switch.



For optically coupled microprocessor. 65800 Series supply with two return barriers for SPDT switch.



Used with GEMS flow switch located in a hazardous area for flow/no flow indication.

# 54800 Series Dual Channel Zener Barriers Provide Intrinsic Safety to Signal Producing Sensors

- ▶ Intrinsic safety with solid-state reliability
- ▶ Since no explosion-proof enclosures are needed for sensor wiring, these units further provide economical installation
- ▶ With encapsulated construction, 54800 Series Barriers are impervious to dust and moisture
- ▶ Optional clip available for rail mounting

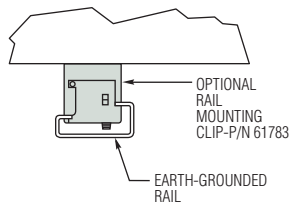
For most non-voltage-producing devices located in a hazardous area, a single zener barrier that is negative-earth-grounded (see preceding two pages) can be used for intrinsic safety.

Instrumentation that produces an output (signal conditioners) usually requires two barriers, one for each "floating" lead. In this case, select one of the 54800 Series dual channel barriers shown here.

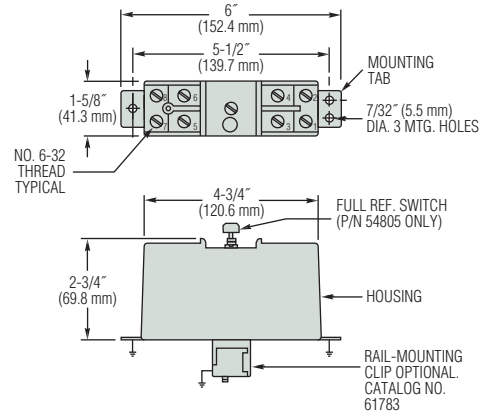
Any non-voltage-producing sensor or switch is rendered intrinsically safe for hazardous locations when properly connected to the output of these Zener Barriers. See table on Page L-2 for specific approval information.

### Optional Rail Mounting

Gems SAFE-PAK Relays can be supplied on special order with a clip for rail mounting. Clip is in addition to standard mounting tabs.

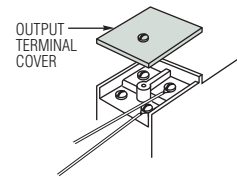


### Dimensions



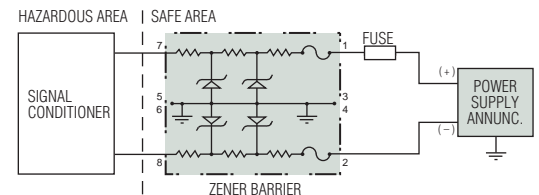
### Protective Cover

Assures intrinsic safety integrity of sensor terminals and wiring.



### Typical Wiring Diagram

Positive dual-channel Zener Barrier with floating leads.





## How To Order

Specify Part Number based on the specifications tabulated below.

DC Input to Barrier, Max.	Signal Polarity	Total Series Resistance Per Channel	Application Group	Reactive Limits		Part Numbers
				Capacitance $\mu\text{f}$	Inductance mh	
15 VDC, 200 mA	Positive	65	D	5.6	0.7	<b>54801</b> ⚡
20 VDC, 100 mA	Positive	270	A, B	0.4	0.9	<b>54803</b> ⚡
			C	1.2	5.0	
			D	3.2	10.0	
20 VDC, 100 mA (Full Ref. Sw.)	Positive	270	A, B	0.4	0.9	<b>54805</b> ⚡
			C	1.2	5.0	
			D	3.2	10.0	
30 VDC, 60 mA	Positive	275	D	2.4	6.0	<b>54806</b> ⚡
Optional Rail Mounting Clip						<b>61783</b>

### Notes:

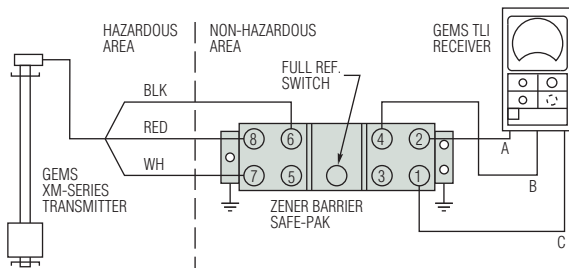
- These barriers are internally fused. If a "fault" or abnormal signal level continues for a sustained period of time, the internal fusing within the barrier will open, disconnecting the barrier. External fuses (Littlefuse Type 3AG or equal) are recommended to protect the Barrier from incorrect wiring at start-up, or from other equipment fault.
- Housing material is blue Lexan®.
- All models shown are for Class I and II, Division 1 and 2. Specific Application Groups are tabulated.
- Ambient operating temperature for all models shown is -40°F to +140°F (-40°C to +60°C).
- Terminals 3, 4, 5 and 6 are common and are bonded to the mounting tabs for positive redundant grounding.

⚡ – Stock Items.

Installation and maintenance must be in accordance with the National Electrical Code and the applicable GEMS INSTRUCTION, INSTALLATION and SERVICE Bulletin available at [www.gemssensors.com](http://www.gemssensors.com)

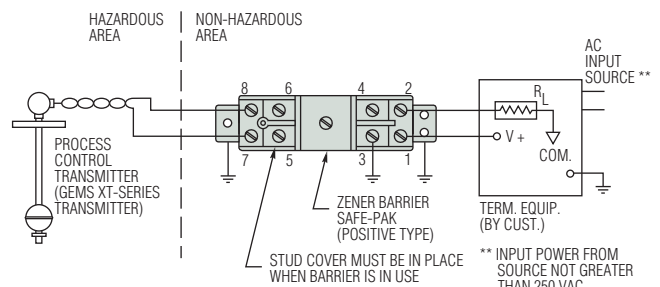
## Typical Application Examples

Sensor switch may be any non-voltage-producing device. Typical are: flow and level switches, temperature switches (thermostats), pressure switches or passive, resistive transducers or transmitters. Below are typical examples.



P/N 54805 in a continuous liquid level monitoring system.

Note: Terminals 3, 4, 5 and 6 are common and are bonded to the mounting tabs for positive redundant grounding.



P/N 54806 in process control system.

### To Determine Loop Resistance:

$$R_{\text{Loop}} = \frac{V_A^* - 10}{.02}; R_{\text{Loop}} = R_{\text{SUPPLY BARRIER}} + R_{\text{RETURN BARRIER}} + R_{\text{MONITORING EQUIPMENT}}$$

\* $V_A$  must be less than 28 VDC (30 Volt Barriers)

# Non-Intrinsically Safe Relays

## Boost Your Sensor's Load Handling Ability

- ▶ SPST, N.O. Operation
- ▶ AC or DC models
- ▶ Amplify current handling capability of sensors for controlling high power loads
- ▶ Compact, polysulfone bodies are totally encapsulated
- ▶ Impervious to shock or vibration
- ▶ Solid-state reliability

GEMS solid-state switching units perform the functions of electro-mechanical relays, with the added reliability and advantages inherent in solid-state. Compact, totally encapsulated, and impervious to shock or vibration, these units mount anywhere... even directly on working machinery.

**LOAD-PAKS:** integrated, solid-state switches that amplify current handling capabilities of sensors for controlling high power loads. SPST, N.O. operation, AC and DC models.

**SPDT-PAKS:** enable one low-current sensor to control two independent loads up to 5 amps each. Switching is N.O. for one load and N.C. for the other.

**FLIP-PAKS:** provide low-current, "Start-stop" or "on-off" switching for industrial motor, liquid level and other control systems. Units hold operational state up to 1/2 second during momentary power loss to cut nuisance shutdowns; low voltage protection is inherent. 120 VAC and 240 VAC models handle loads to 5 amps.

### Dimensions

LOAD-PAK, 5 Amp. A.C.	LOAD-PAK, 10 Amp, A.C. LOAD-PAK, 2 Amp, D.C. SPDT-PAK, FLIP-PAK

### Electrical Information

**DC LOAD-PAK:** Switching is by means of B+ closure. . .the DC LOAD-PAK must be wired to the polarity shown. REVERSING POLARITY WILL DESTROY THIS UNIT.

**SPDT-PAK:** This unit is designed to operate with a load connected to each of the two outputs. These loads must be 10 watts, minimum, for correct SPDT switching. One load used alone must be connected to the N.O. terminal. With this load, which may be less than 10 watts, the unit will operate the same as an SPST unit.

**Line Transients:** While random line transients will not normally harm LOAD-PAKS, they may pass current to some loads for up to 1/2 cycle duration\*. AC LOAD-PAKS and the DC LOAD-PAK include transient protection. . .the SPDT-PAK does not. If load transients are a problem, the external protective circuit, a properly-sized metal oxide varistor, may be used.

\* Mechanical holding or latching contacts (contactors) may cause some loads to latch under transient conditions.

LOAD-PAK®,  
5 AMP, AC



LOAD-PAK®,  
10 AMP, AC



### Intrinsically Safe

LOAD-PAK®,  
2 AMP, DC

Certified intrinsically safe under MSHA Certification No. 1951 for use on permissible equipment, for Group D use only.



FLIP-PAK



SPDT-PAK



**Surge Current Ratings of LOAD-PAKS.**

Non-repetitive.

LOAD-PAK Rating	Overload Time		
	.010 Sec.	1.0 Sec.	10 Sec.
	Overload, Amps		
5 Amps, AC	30	20	10
10 Amps, AC	50	30	15

\*Mechanical holding or latching contacts (contactors) may be cause some loads to latch under transient conditions.

**Switch or Sensor Wiring:** Wires connecting external sensor switches to LOAD-PAKS should not be placed in raceways or conduits containing high voltage lines. Voltages induced from these lines trigger the low-power, solid-state triac, causing it to turn “on” momentarily.

**How To Order**

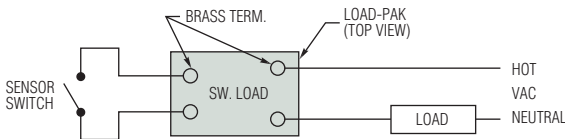
Specify Part Number based on the specifications tabulated below.

	LOAD-PAK 5 AMP, AC	LOAD-PAK 10 AMP, AC	LOAD-PAK 2 AMP, DC	SPDT-PAK 5 AMP, AC	FLIP-PAK 5 AMP, AC
<b>Part Number</b>	20173 ⚡	26392 ⚡	25763 ⚡	22155 ⚡	28196 ⚡ 28244 ⚡
<b>Operating &amp; Load Voltage Range</b>	24 to 260 VAC		6 to 48 VDC	100 to 130 VAC	100 to 130 VAC 200 to 250 VAC
<b>Voltage Loss</b>	2 VAC		2 VDC	3 VAC	2 VAC
<b>Sensor Current, Max.</b>	20 mA		35 mA	20 mA	20 mA
<b>Allowable Resistance in Sensor Circuit to Turn “ON” (Max.)</b>	4 k at Nom. Volt.		0 to 4 k	4 k at Nom. Volt.	—
<b>Leakage Current Thru Load Term.</b>	12 mA @ 240 VAC		2 mA	20 mA	12 mA @ 240 VAC
<b>Switching Mode</b>	SPST, N.O.			SPST, N.O. & N.C.	SPST, N.O.
<b>Operating Temperature</b>	0°F to 120°F (-17.8°C to 48.9°C)		32°F to 120°F (0°C to 48.9°C)	0°F to 120°F (-17.8°C to 48.9°C)	

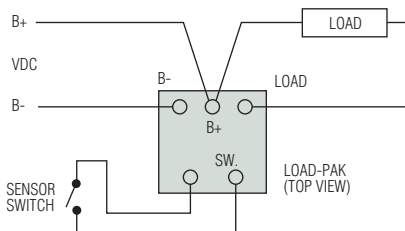
Note: All AC voltage and current specifications are RMS values unless otherwise stated.

⚡ – Stock Items

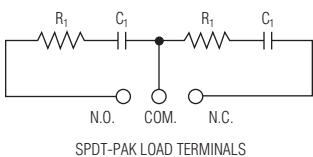
**Typical Wiring**



**LOAD-PAK**, Part Numbers 20173 and 26392 actuated by dry contact sensor to control load up to 10 amps, AC.



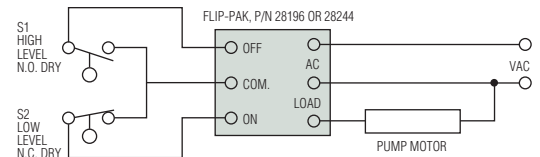
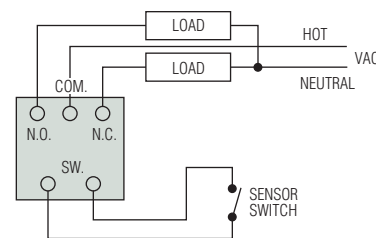
**LOAD-PAK**, Part Number 25763, actuated by dry contact sensor to control load up to 2 amps, DC.



R = 100 OHM,  
1/4 WATT  
RESISTOR  
C = .05 MICROFARAD,  
500 V, CAPACITOR

**TRANSIENT PROTECTION FOR THE SPDT-PAK**, The circuit shown or a properly-sized metal oxide varistor may be used.

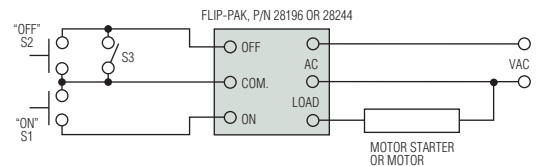
**SPDT-PAK**, actuated by a single sensor to control two separate loads.



**FLIP-PAK**, providing pump up/down control.

**Refill:** Low level permits S2 to close, starting refill pump. Rising level allows S2 to open, and eventually closes S1 to actuate the FLIP-PAK “OFF” circuit and stop the pump motor. The FLIP-PAK “OFF” override assures pump shut-down even if S2 failed to open.

**Pump-Down:** With “ON” and “OFF” connections of S1 and S2 transposed at the FLIP-PAK, the pump is started by S1 and stopped by S2 at low level. The same “OFF” override prevails.



With two normally open, momentary contact push buttons (S1 and S2), the **FLIP-PAK** provides solid-state control of the motor starter or the motor itself... if load requirements are within FLIP-PAK ratings. S3 provides a safety shut-down. With S3 closed, the “ON” push button (S1) is rendered ineffective by the “OFF” override feature of the FLIP-PAK.

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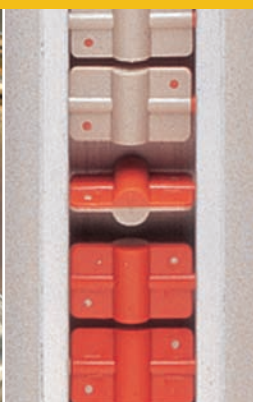
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